

Report

Emission factor programme Task 3 – Emissions Of New Persistent Organic Pollutants

Report to the Department for Environment
Food and Rural Affairs; the National Assembly
of Wales; the Scottish Executive; and the
Department of Environment in Northern Ireland

Report

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Address for Correspondence netcen
 Culham Science Park
 Abingdon
 Oxon
 OX14 3ED
 Telephone 01235 463391
 Facsimile 01235 463005

Kate.Haigh@aeat.co.uk

netcen is a operating division of AEA Technology plc

netcen is certificated to ISO9001 & ISO 14001

| | Name | Signature | Date |
|--------------------|----------------|------------------|-------------|
| Author | Kate Haigh | | 27/01/03 |
| Reviewed by | Robert Stewart | | |
| Approved by | Mike Woodfield | | |

Executive Summary

This report has been prepared for the Department for the Environment, Food and Rural Affairs; the National Assembly of Wales; the Scottish Executive; and the Department of Environment in Northern Ireland by **netcen** (an operating division of AEA Technology plc) under the contract EPG 1/3/195 - Emission factors for air pollutants.

The Department for Environment Food and Rural Affairs (DEFRA) Air and Environment Quality (AEQ) Division is responsible for maintaining the UK National Atmospheric Emissions Inventory (NAEI). The NAEI is maintained by **netcen** on behalf of DEFRA. As part of the ongoing quality control of the NAEI the quantitative uncertainty in the national emission total of each component pollutant in NAEI is reviewed annually. Based on the findings of this review project EPG 1/3/195 aims to characterise and minimise uncertainty in the emission factors used in the compilation of the NAEI and by association that of other UK inventories. The project has objectives (Tasks) that are set and reviewed annually; these comprise data collection and evaluation via literature review, personal contact with industrial representatives, direct source measurement and other means as appropriate.

The purpose of this study was to improve the National Atmospheric Emissions Inventory (NAEI) estimates of selected Persistent Organic Pollutants (POPs). The Persistent Organic Pollutants addressed in this study are;

- Polychlorinated Terphenyls (PCTs)
- Ugilec
- Hexachlorobutadiene
- Pentabromodiphenyl ether (PentaBDE)
- Pentachlorobenzene
- Short Chain Chlorinated Paraffins (SCCPs)

A range of organisations with experience of either the use or production of these pollutants were contacted. Data on consumption and emissions of these Persistent Organic Pollutants was gathered from contacts in industry, Trade Associations and the producers and information was also collated from existing research.

The information obtained in the study has improved the completeness of the NAEI. The more detailed and accurate information on production and use in the UK collected on several of these POPs has made it possible to exclude them from the inventory as they have never been, or are no longer, used/allowed in the UK (Ugilec, Polychlorinated Terphenyls and Pentachlorobenzene). The data has enabled a more consistent emissions estimate to be proposed for the time series covered by the NAEI for SCCPs. A review of Pentabromodiphenyl ether emission data is recommended once proposed legislation covering use of this material is introduced. A further review of Hexachlorobutadiene emissions is recommended to determine whether migration from a landfill facility is a significant source.

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1 Introduction

1.1 NATIONAL ATMOSPHERIC EMISSIONS INVENTORY AND EMISSION FACTORS

This report has been prepared for the Department for the Environment, Food and Rural Affairs; the National Assembly of Wales; the Scottish Executive; and the Department of Environment in Northern Ireland by **netcen** (an operating division of AEA Technology plc) under the contract EPG 1/3/195 - Emission factors for air pollutants.

The Department for Environment Food and Rural Affairs (DEFRA) Air and Environment Quality (AEQ) Division is responsible for maintaining the UK National Atmospheric Emissions Inventory (NAEI). The NAEI is maintained by **netcen** on behalf of DEFRA. As part of the ongoing quality control of the NAEI the quantitative uncertainty in the national emission total of each component pollutant in NAEI is reviewed annually. Based on the findings of this review project EPG 1/3/195 aims to characterise and minimise uncertainty in the emission factors used in the compilation of the NAEI and by association that of other UK inventories. The project has objectives (Tasks) that are set and reviewed annually; these comprise data collection and evaluation via literature review, personal contact with industrial representatives, direct source measurement and other means as appropriate.

This report provides a summary of work undertaken to improve the NAEI emission estimates of selected Persistent Organic Pollutants (POPs).

1.2 PERSISTENT ORGANIC POLLUTANTS

Persistent Organic Pollutants are found in trace quantities in all areas of the environment. They accumulate in humans and plants, and have differing degrees of toxicity. Although POPs may be transformed both physically and chemically over long periods, they do not readily break down in the environment with half-lives in soils in the order of years.

There has been a growing interest in these pollutants and in particular their potential chronic toxicity and impacts on human health. This is reflected by the recent international agreement to reduce releases of these chemicals under the United Nations Economic Commission for Europe (UNECE) POPs Protocol and their consideration for air quality standards by the Expert Panel on Air Quality Standards (EPAQS).

This report examines a number of POPs not included in the NAEI and considers their inclusion in the inventory:

- Polychlorinated Terphenyls (PCTs)
- Ugilec
- Hexachlorobutadiene
- Pentabromodiphenyl (PentaBDE)
- Pentachlorobenzene (PeCB)

In addition, emissions of Short Chain Chlorinated Paraffins (SCCPs) are reviewed to improve the inventory. The POPs are described in further detail in the following section.

2 Study POPs

2.1 POLYCHLORINATED TERPHENYLS

Polychlorinated Terphenyls (PCTs) are physically and chemically close to Polychlorinated biphenyls (PCBs). The yellow resin PCT made it useful for industrial purposes and also as a replacement for PCBs. Polychlorinated Terphenyls (PCTs) have been used in Electrical capacitors and transformers. They have been produced in the UK historically but are no longer produced or used in the UK. They may however be present in old electrical equipment. There is regulation in place controlling the identification and destruction of PCTs.

2.2 UGILEC

Ugilec is a product formerly used in capacitors, transformers and hydraulic fluid in mining. It is no longer produced in the UK. Ugilec 121 and 21 are monomethyl-dichloro-diphenyl methane. Ugilec 141 is monomethyl-tetrachloro-diphenyl methane. Marketing and use of Ugilec 121, 21, 141 were banned in the UK from June 1994 (except for research, development and analysis use).

2.3 HEXACHLOROBUTADIENE

Hexachlorobutadiene was formerly produced as an unintentionally released by-product of chlorinated solvent production but the material is now incinerated. There is no evidence to suggest it is used in the UK.

2.4 PENTABROMODIPHENYL ETHER

Pentabromodiphenyl ether (PentaBDE) has been used as a flame retardant in polyurethane foam applications. It is not produced in the UK but is used in polyurethane applications (PUR) which are in turn used for foam in furniture and upholstery. There are regulations pending on this product.

2.5 PENTACHLOROBENZENE

Pentachlorobenzene (PeCB) is used in fungicide, flame-retardants and dielectric fluids. It was produced in the UK as an impurity of the fungicide quintozone (pentachloronitrobenzene), which is used in the UK. However, quintozone is now produced differently to prevent Pentachlorobenzene production.

2.6 SHORT CHAIN CHLORINATED PARAFFINS

Short Chain Chlorinated Paraffins (SCCPs) are currently used in the following sectors:

- Metal working
- Leather
- Rubber
- Paints
- Sealants
- Textiles

SCCPs are used and are also produced in the UK. However, regulation is expected to be in place soon to limit the use of SCCPs in the UK.

3 Methods of Study

3.1 EMISSION INVENTORIES

Emission inventories play an important role in assessing the effects of anthropogenic (man made) activity on atmospheric pollution. The principal human demands for energy, transportation, materials and food may be regarded as the “drivers” for the production of air pollutants. In order for an economy to continue to develop in a sustainable way these sources of pollution must be managed. To do this we must understand the “impacts”- i.e. what types of pollution affect which parts of the environment or human health, and to what extent. To decide whether action is necessary we also need to know the “state” of the environment- i.e. to evaluate whether the levels in the environment exceed those which will cause environmental harm.

In taking appropriate action we must be able to respond in a focused way to control and reduce pollution while avoiding larger-scale damage to economic development. Emission inventories provide policy makers and the public with an understanding of the key polluting sources or the “pressures”, how these sources have developed with economic growth and how they are likely to contribute to pollution in the future. This understanding is essential for a focused “response” to the problems associated with air pollution and to meet the demands of sustainable development.

3.2 THE UK NATIONAL ATMOSPHERIC EMISSIONS INVENTORY

The UK National Atmospheric Emission Inventory (NAEI) is compiled for the Department for Environment, Food and Rural Affairs (DEFRA) Air and Environment Quality (AEQ) Division and the devolved administrations. Related work on greenhouse gas emissions is also conducted for the Global Atmosphere Division of the Department. The NAEI is the reference air emissions inventory for the UK and includes emission estimates for a wide range of important pollutants. These include: greenhouse gases, regional pollutants leading to acid deposition and photochemical pollution, persistent organic pollutants and other toxic pollutants such as heavy metals.

The NAEI is compiled on an annual basis, each year the latest set of data are added to the inventory and the full time series are updated to take account of improved data and any advances in the methodology used to estimate the emissions. Updating the full time series is an important process as it ensures that the entire dataset uses the methodology that is the most current, and hence considered to give the most accurate results and the most accurate indication of emission trends.

3.3 CONTINUOUS IMPROVEMENT AND BASIC METHODOLOGY

Throughout the compilation of the NAEI, considerable effort has been made to ensure both comparability and consistency with other national statistics and that all available

data sources are considered. Hence, the source data are drawn from a wide range of sources. Where specific point source emission data are unavailable, emissions are estimated from other activity data such as fuel consumption, distance travelled, production or some other statistical data that is directly related to the emissions.

During 2001, particular emphasis has been placed on improving several areas of the emission inventory. At a more general level there is also a continued drive to use data which most accurately represents the source. Emission factors and activity data are assessed each year to identify whether more appropriate information has become available.

3.4 STUDY STRATEGY

Standard methods from the NAEI have been used to gather information on the pollutants relevant to this study. A desk based study was undertaken and a wide range of sources have been contacted including trade Associations, producers, suppliers and end users. For each product contact was attempted with the users of the product and the suppliers/producers in order to investigate what sort of quantities of products were being used in what processes. It was also established whether or not the withdrawal of such a product would be a cause of concern for any of the product users. The data gathering process has produced a number of contacts with experience of these products and data on production and consumption. The study made every effort to check that comparable means of estimating production/consumption were used throughout.

4 Results

4.1 POLYCHLORINATED TERPHENYLS

4.1.1 Sources

Polychlorinated Terphenyls (PCTs) were not produced in the UK although it is likely that PCTs and equipment containing PCTs were imported. Production of PCTs ceased in the early 1980s and they are no longer used in the UK.

4.1.2 Processes

Polychlorinated Terphenyls (PCTs) in the past were used in electrical capacitors and transformers and also other processes where they were used as plasticisers, fire retardants, vapour suppressers and impregnants (Filyk, 2002). PCTs are no longer used in the production of such electrical equipment but they may however be present in old electrical equipment. There are regulations in place intended to control the existing material and subsequently identify its destruction route (EU Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls).

4.1.3 Quantities

There are currently regulations in place incorporated in the UK Environmental Protection Regulations (May 2000) which require any product/appliance containing PCTs concentrations greater than 0.005% to be identified by the end of July 2000 and a destruction route be defined by the end of December 2000. EU Directive 96/59/EC prescribes that all identifiable PCTs are eliminated by 2010. The Environment Agency is the responsible body for registration of stocks of PCT in equipment (and PCB) in England and Wales. However, registration does not currently distinguish between PCBs and PCTs,

It is estimated that global production during the years 1955-1980 was approximately 60,000t, it is not known how much material entered the UK.

4.2 UGILEC

4.2.1 Sources

Ugilec is monomethyl-dichloro-diphenyl methane (Ugilec 121 and 21) or monomethyl-tetrachloro-diphenyl methane (Ugilec 141). Ugilec was supplied in the UK but not produced. Ugilec 141 had been produced in the EU since 1981, Ugilec 121 and 21 were introduced in 1984 and all were banned from 1994.

4.2.2 Processes

Ugilec is a product formerly used in capacitors, transformers and hydraulic fluid in mining.

4.2.3 Quantities

There are UK regulations in place preventing the use of Ugilec (implementing EU Council Directive 91/339/EEC of 18 June 1991 amending Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations).

In June 1994 the use of Ugilec 21, 121, 141 and products and preparations containing it was prohibited within EU (except for limited uses e.g. where machinery is already in service and when it is maintained). In 1996 regulation required any appliance containing Ugilec to be identified and registered with the Environment Agency where concentration was >0.005% (EU Council Directive 96/59/EC, detailed as for PCTs). Note that registration does not distinguish between Ugilec, PCBs and PCTs. The quantities of historical production of this product have not been determined but there are now no suppliers of Ugilec in the UK.

4.3 HEXACHLOROBUTADIENE

4.3.1 Sources

Hexachlorobutadiene (HCBd) was historically produced as an unintentionally released by-product of chlorinated solvent production. It is no longer a by-product of chlorinated solvent production (it is incinerated) and there is no evidence to suggest it is still used.

4.3.2 Processes

An unintentional by-product of chlorinated solvent production, hexachlorobutadiene was also used as a fumigant and for some other minor uses including manufacture of rubber compounds, solvent, heat transfer liquid, fluid for gyroscopes hydraulic fluid, laboratory reagent, and a chemical intermediate in the production of chlorofluorocarbons and lubricants (Ministry of VROM/DGM, 2002).

4.3.3 Quantities

Although there is still production of Chlorinated solvents in the UK, Hexachlorobutadiene is no longer a by product of the process and therefore there is no indication that it is still produced/used in the EC (BUA 91).

In 1982 there were an estimated 10,000 tonnes world wide, There are emissions estimates available of 2 kg emission to air in Europe in 1997, a 95% decline from 1985 to 1997 (Ministry of VROM/DGM, 2002).

Through contacting former suppliers it was found that hexachlorobutadiene is a by product of Perchloroethylene/Trichloroethylene & Vinyl Chloride production. The quantities of this product produced are low, but concentrate up in heavies streams, none of which are sold, but are consumed by incineration. Hexachlorobutadiene may be present in chlorinated solvents at a trace level. Hexachlorobutadiene is also produced in

Perchloroethylene/CTC manufacture however, UK CTC production ceased in 1993, although there are a number still operating in Europe (Ineos Chlor 2002).

Waste streams containing hexachlorobutadiene from manufacturing plant in Runcorn was disposed to a landfill facility prior to the 1950's. ICI, the owners of the Weston site, have found HCBd in boreholes and indoor air samples at residential properties adjacent to the site (a former quarry). Action by ICI to address migration of HCBd has included demolition of affected properties. Risk-based management of the site will inform action or remediation plans to resolve any issues identified by monitoring but is unlikely to involve full remediation of the site. Informal contact suggests that air quality measurements around the site indicate HCBd but that this may be attributed in part due to trace emissions from on-going industrial activity adjacent to the site.

netcen considers that insufficient information are available at present to determine that HCBd should be excluded from the NAEI or include an emission estimate. As emissions from the site are likely to continue for several years, it is recommended that HCBd is reviewed again next year and ICI and the Environment Agency (the regulatory authority) are approached for further information.

4.4 PENTABROMODIPHENYL ETHER

4.4.1 Sources

Pentabromodiphenyl ether (PentaBDE) has been used as a flame retardant in polyurethane foam applications.

4.4.2 Processes

Pentabromodiphenyl ether is not produced in the UK but is widely used solely in polyurethane applications (PUR) which are in turn used for foam in furniture and upholstery.

4.4.3 Quantities

There are regulations pending on PentaBDE. On 15 January 2001, the European Commission proposed a ban on the marketing and use of Penta-BDPE, including a ban upon articles that contain the substance (COM (2001) 12 final).

A good deal more research has been conducted for PentaBDE than some other products covered in this report and the following emission factors have been estimated.

An emission factor for release to air of PentaBDE from PUR applications has been estimated (COM 2000) and is

- 0.5kg/tonne used.

This emission factor was used to estimate an EU annual release to air of 150kg assuming an EU use of 300 tonne/year PentaBDE used solely in polyurethane applications (PUR) which is higher than other market estimates (see below),

Other emission data suggests that :

- 3.9% of pentaBDE in a product is released over the typical 10 year product life due to volatilisation.
- the destination of PentaBDE in the environment is 75% soil, 24% water, 1% air.

the major routes being filter waste and rejected material to landfill (Peltola, 2000). The partitioning between water and air is inconsistent with other application data.

PentaBDE is not produced in the European Union but was imported for sale by two companies until recently. There is a relatively small European market, 210 tonne/year in 1999 (compared to 8,290 tonnes in the US). Imports into the EU amount to 125 tonne/year in 2000 (0.1% of the quantity of all flame retardant used in the UK) with a further 125 tonnes in PentaBDE-treated articles. Use in the UK is estimated to be 20-40 tonne/year. This suggests a declining demand although, the range of figures for import tonnages into the EU also suggests considerable uncertainty for UK use.

On 15 January 2001, the European Commission proposed a ban on the marketing and use of Penta-BDPE, including a ban upon articles that contain the substance (COM (2001) 12 final).

4.5 PENTACHLOROBENZENE

4.5.1 Sources

Pentachlorobenzene (PeCB) is used in fungicide, flame-retardants and dielectric fluids.

4.5.2 Processes

Pentachlorobenzene (PeCB) was produced in the UK as an impurity of quintozone, which is used in the UK. However, quintozone is now produced differently to prevent PeCB production.

4.5.3 Quantities

Pentachlorobenzene (PeCB) is no longer a metabolite of quintozone so this is no longer a source of PeCB occurrence in the environment (Ministry of VROM/DGM, 2002). Council Directive 90/533/EEC (amending Directive 79/117/EEC) banned the use of quintozone with more than 10g/kg pentachlorobenzene (and 1g/kg hexachlorobenzene) after 1991. As there is no production or use of Pentachlorobenzene it is unlikely that PeCB enters the environment from the sources listed above but it is possibly still released during municipal waste incineration (although **netcen** considers that this is unlikely to be a significant source in the UK).

4.6 SHORT CHAIN CHLORINATED PARAFFINS

4.6.1 Sources

Short Chain Chlorinated Paraffins (SCCPs) are used and produced in the UK.

4.6.2 Processes

Short Chain Chlorinated Paraffins (SCCPs) are used in the following processes:

- Metal working
- Leather
- Rubber
- Paints
- Sealants
- Textiles

SCCPs are traditionally used mostly for metal working fluids, but the use has been reduced and replaced by other materials.

4.6.3 Quantities

Regulation is expected to be in place soon to limit the use of SCCPs in the UK.

Figures available for SCCP production are

- Europe production: 13,000t 1994
13,208t 1995
4,000t 1998.

There are several sources of information as to the quantities of SCCPs produced/used, some slightly conflicting, so the best estimates have been collected and combined to produce a best estimate of a time series of SCCP production/consumption in the UK.

The 2000 database version of the NAEI calculated the emission factor for SCCPs from a population weighted EU total. The European Chemicals Bureau (ECB) risk assessment for SCCPs release to air indicates a total EU release of 393.9 kg. This provided an annual UK emission of about 62 kg/year which was incorporated into the NAEI with an assumed constant emission for all years, 1990 - 2000.

Figures 1 and 2 show the additional information provided from this study, derived annual emission estimates for SCCPs are provided in table 1. The proposed emission estimates provide a much reduced and improved inventory for SCCPs with a reduced uncertainty.

Figure 1 - Estimated consumption of all Chlorinated Paraffins in the UK

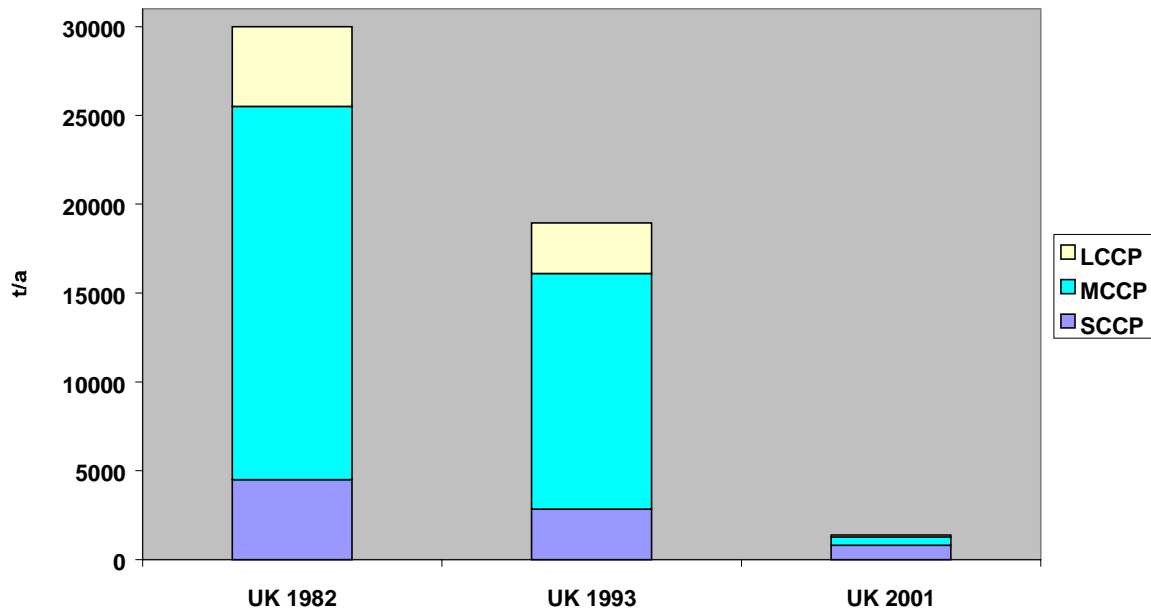
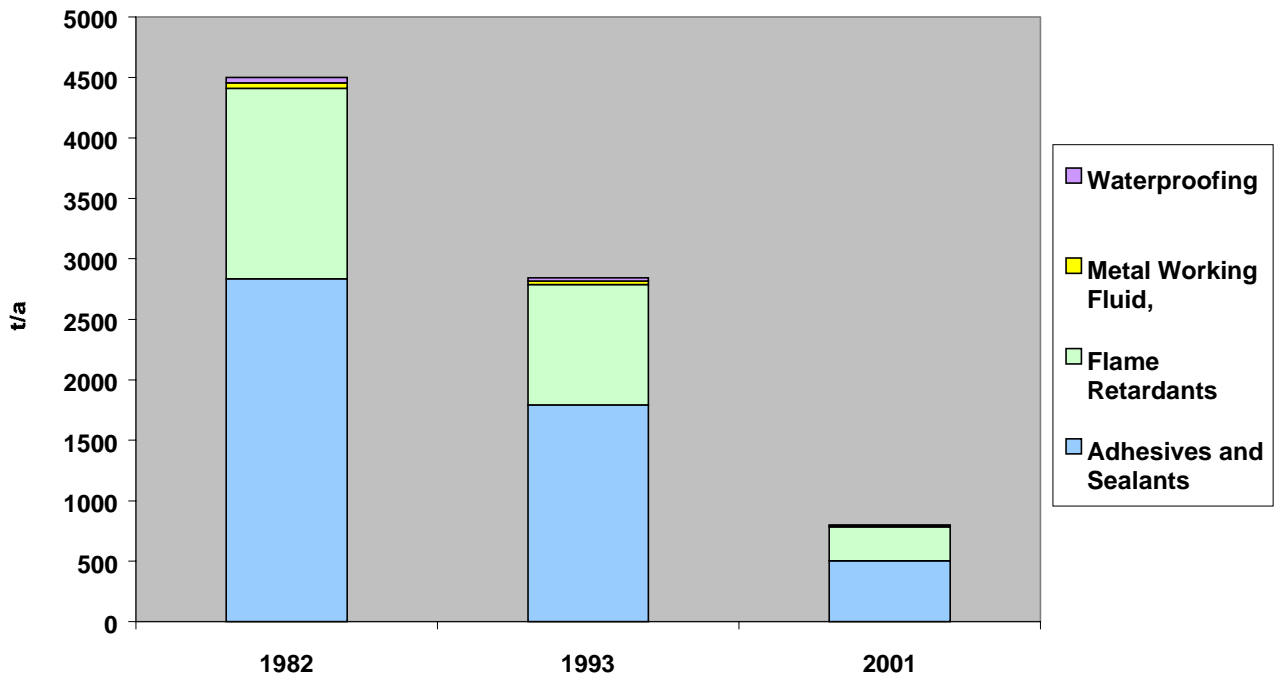


Figure 2 - Estimated UK SCCP Consumption



Information has been provided by manufacturers of these products but is commercially sensitive and therefore the details shall remain confidential in this written report.

There are alternatives available for most uses except paints and sealants. For example the leather industry does not envisage any significant difficulty with the withdrawal of the

use of SCCPs. The coatings sector use of SCCPs has generally been replaced by the use of medium chain chlorinated paraffins and therefore it is unlikely there would be a major issue with the phasing out of SCCPs.

5 Recommendations

5.1 POPS IN THE NATIONAL ATMOSPHERIC EMISSIONS INVENTORY

Currently the following pollutants are not included in the National Atmospheric Emissions Inventory:

- Polychlorinated Terphenyls (PCTs)
- Ugilec
- Hexachlorobutadiene
- Pentabromodiphenyl ether (PentaBDE)
- Pentachlorobenzene

Short Chain Chlorinated Paraffins (SCCPs) are included within the NAEI emissions estimates. The 2000 inventory (1970 - 1999) included estimates for this pollutant but there is a high degree of uncertainty associated with the estimates.

Based on the results of this study the National Atmospheric Emissions Inventory POPs estimates have been reviewed and the following recommendations prepared for the 2001 inventory (1970 - 2000).

5.2 POLYCHLORINATED TERPHENYLS

As PCTs are no longer produced or used in the UK and there are regulations in place to control identification and destruction (EU Council Directive 96/59/EC) it is not considered necessary to add this pollutant into the NAEI. Retrospective inclusion of PCTs prior to 2000 is not recommended as it would require substantial effort to obtain data and such data is likely to have a high uncertainty.

5.3 UGILEC

As Ugilec is no longer produced or used in the UK and there is regulation in place preventing the use of Ugilec (EU Council Directives 91/339/EEC and 96/59/EC) it is not considered necessary to add this pollutant into the NAEI. Retrospective inclusion of Ugilec prior to 2000 is not recommended as it would require substantial effort to obtain data and such data is likely to have a high uncertainty.

5.4 HEXACHLOROBUTADIENE

Hexachlorobutadiene is no longer produced but **netcen** considers that there are insufficient information available at present to determine that HCBd should be excluded

from the NAEI or include an emission estimate. It is recommended that HCBd is reviewed again next year.

5.5 PENTABROMODIPHENYL ETHER

Emission factors and some emission statistics have already been estimated for PentaBDE. Estimates can be made for UK emissions based on EU figures split by population and there are also some estimates available in literature.

The worst case EU annual release is estimated to be 150kg to air (assuming 300tonne/year PentaBDE used solely in polyurethane applications (PUR)) from this the UK emission can be estimated:

$$\text{UK emission} = ((150 \text{ kg}/376455000) * 59832000)$$

$$\text{UK emission} = 24 \text{ kg/year.}$$

| |
|--|
| $\begin{aligned} & (\text{EU emission}/\text{EU population}) \\ & * \text{UK population} \\ \text{EU 15 population 2000} &= 376455000 \\ \text{UK population 2000} &= 59832000 \\ & \text{Source: Eurostat} \end{aligned}$ |
|--|

However there is a high uncertainty associated with this sort of estimate. As there is a high uncertainty and there are regulations pending for PentaBDE it is likely that more information will become available on this pollutant.

Consequently this pollutant has not been included in the 2001 NAEI but **netcen** recommends that a further review is undertaken after introduction of regulation when more information should be available .

5.6 PENTACHLOROBENZENE

As Pentachlorobenzene (PeCB) is no longer produced or used in the UK it is not considered necessary to add this pollutant into the NAEI. Retrospective inclusion of PeCB prior to 2000 is not recommended as it would require substantial effort to obtain data and such data is likely to have a high uncertainty.

5.7 SHORT CHAIN CHLORINATED PARAFFINS

The 2000 database version of the NAEI provided a UK annual emission of about 62 kg/year with was incorporated into the NAEI with an assumed level emission for all years, 1990 - 2000. Table 1 shows the revised annual emission estimates for SCCPs recommended for inclusion in the 2001 NAEI. The proposed emission estimates provide a much reduced and improved inventory for SCCPs.

Table 1 - Proposed Emission estimates for SCCPs in the 2001 NAEI

| Year | SCCPs emissions kg/year | |
|-------------|--------------------------------|---------------------------|
| | NAEI 2000 | Proposed NAEI 2001 |
| 1990 | 62 | 47.6 |
| 1991 | 62 | 45.4 |
| 1992 | 62 | 43.3 |
| 1993 | 62 | 41.1 |
| 1994 | 62 | 30.1 |
| 1995 | 62 | 24.0 |
| 1996 | 62 | 18.2 |
| 1997 | 62 | 12.7 |
| 1998 | 62 | 7.7 |
| 1999 | 62 | 5.8 |
| 2000 | 62 | 3.4 |
| 2001 | 62 | 0.6 |

6 Impact of Research on Inventory Quality

The research documented in this report has had the following impacts on the quality of the NAEI:

- emission estimates for short-chain chlorinated paraffins have been reduced for all years covered by the NAEI. For 2001, the new estimate is 0.6 kg which is less than 1% of the estimate (62kg) that would have been included had this research not been undertaken. The accuracy of the NAEI has been substantially improved as a result.
- the research has confirmed that polychlorinated terphenyls, ugilec, and pentachlorobenzene are no longer produced or used in the UK. While this will not result in a change in the NAEI, nonetheless, the NAEI can be said to be more complete and accurate in the sense that emissions of these pollutants have been shown to be zero.
- the research has confirmed that, although it is no longer produced, there is a potential for emissions of hexachlorobenzene and that further work should be carried out. The work has improved the quantity of information available to the NAEI and has helped to prioritise further work.
- the research has produced an estimate of emissions of pentabromodiphenyl ether of 24 kg per year, which compares with an emission estimate of 13.8 tonnes for all polybrominated diphenyl ethers in the NAEI. The estimate for pentabromodiphenyl ether is subject to high uncertainty and has not been included in the 2001 version of the NAEI. Nevertheless, the research has gone some way towards improving the completeness and accuracy of this aspect of the NAEI.

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Appendices

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Contacts List

POPs Contact list

British Leather Confederation
Cofederation of British Metalforming
British Rubber Manufacturers Association
Ineos Chlor
British Coating Association
British Adhesives and Sealants Organisation
Furniture Industry Research Association
British Coating Association
ICI Runcorn
Environment Agency, Warrington