National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants (draft)

United Kingdom of Great Britain and Northern Ireland

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Executive Summary

The Stockholm Convention is a global treaty to protect human health and the environment from Persistent Organic Pollutants (POPs). POPs are a group of chemicals which persist in the environment, may bioaccumulate in food and human tissues and are toxic. These chemicals also have the potential to be transported long distances and deposited far away from their place of release including in pristine environments such as the Arctic. The Convention requires that Parties adopt and introduce measures to reduce releases of POPs into the environment with the aim of reducing human and wildlife exposure.

There are 22 POP chemicals listed in the Convention. These fall into three broad categories: pesticides (such as aldrin, chlordecone and lindane), industrial chemicals (such as penta-bromodiphenyl ether) and unintentionally produced by-products of combustion and some industrial and non-industrial processes (such as dioxins, furans). The pesticides and industrial chemicals listed in the Convention have been banned in the UK for many years, with some limited exemptions.

As a Party to the Stockholm Convention, the UK developed a National Implementation Plan (NIP)[1] in 2007. This has been revised to provide an account of how the Convention is being implemented in the UK and to outline next steps for the management of POPs, particularly those which have been more recently listed. The evidence for the more recent POPs has been obtained through a review of existing inventories for emissions to air, land and water, a periodical review of scientific journals for emission factor data and communication with industry and national and international experts.

Since 2007, a UK POPs multi-vector inventory has been developed to evaluate those POPs which are released unintentionally from anthropogenic sources (listed in Annex C of the Convention). This has been built on the existing UK National Atmospheric Emissions Inventory (NAEI) and now reflects better knowledge of emissions from a selection of sources. These include PCBs in sewage sludge, waste incineration, non-ferrous metal smelting, hexachlorobenzene (HCB) emissions from the pesticide chlorothalonil and household burning of garden waste.

The multi-vector inventory provides detailed information on sources of POPs and is a key part of the UK's assessment capability for further emissions and emission minimisation. It shows that emission estimates to air, land and water for all Stockholm Convention Annex C substances (including the recently listed pentachlorobenzene) declined significantly in the UK between 1990 and 2010.

In particular, there is evidence that levels of dioxins and furans are levelling off with background levels being maintained by domestic combustion activities. In 2010 most dioxin emissions came from diffuse sources such as the small scale combustion of waste and accidental fires. Key sources of emissions to water are linked to waste water treatment works.

For polychlorinated biphenyls (PCBs), emissions to air and land are dominated by leaks of di-electric fluid from older equipment in which PCBs were used as heat transfer fluids (e.g. capacitors, transformers, electrical switching gear). However, these emissions have declined significantly over the last twenty years. Emissions of HCB to air, land and water have also declined significantly over this period, with the current key sources being the combustion of fuels in the power industry and its presence as a trace contaminant in the pesticide chlorothalonil.

1 http://archive.defra.gov.uk/environment/quality/chemicals/documents/pop-nationalplan.pdf

The major route of potential human exposure to POPs is through the food chain. The Food Standards Agency monitors the UK food supply and animal feeds for a selection of the listed POPs. The levels found have raised no concerns for human health.

As the contribution of larger industrial sources has reduced, a range of smaller, more diffuse sources have come to dominate emissions of unintentionally produced POPs in the UK. Although backyard burning remains a key diffuse source of some POPs, publicity has helped to raise public awareness about good practice. The Government will continue to build on this work.

Emissions of the unintentionally produced POPs, PCBs and polybrominated di-phenyl ether flame retardants will continue to be monitored through the Toxic Organic Micro-Pollutants (TOMPS) air monitoring programme. Where available, current emission trends data will be compared with data collected in 2016 in order to review the success of UK policies and input into the next review of the Plan.

Overall the UK has made good progress against the actions outlined in the 2007 NIP. In terms of future activity, the priority is to gain a better understanding of the potential scale and level of emissions from past (legacy) uses and in-use items containing POPs, particularly when these enter the waste stream. Where relevant, the existing multi-vector inventories will be expanded to include emission data on the ten substances which were added to the Convention in 2009 and 2011. Work will be carried out to disaggregate the emission data for Annex C substances to the full five vectors required by the Stockholm Convention. These are air, land, water, residue (contamination of wastes and by-products (recycled/ landfill)) and product (POP contaminated products sold to market (e.g. PCP compounds)). The UK Government will also continue to support research on POPs, which will help to inform future measures needed to achieve further emission reductions.

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Introduction

1.1 Purpose of the UK National Implementation Plan

The Stockholm Convention on Persistent Organic Pollutants (POPs) entered into force on 17 May 2004. It is a global treaty signed by 151 States and regional economic integration organisations with the objective to protect human health and the environment from persistent organic pollutants. The Convention web address may be found at: http://www.pops.int/

Parties to the Convention are required to develop and endeavour to put into practice a National Implementation Plan (NIP) setting out how they will implement their obligations under the Convention. This plan should be submitted within two years of the date on which the Convention entered into force for that Party. The UK ratified the Stockholm Convention on 17 April 2005 and consequently submitted its first NIP in 2007.

The UK NIP is subject to periodic updating and revision in response to the dynamic nature of the Convention, for example, in its identification and inclusion of additional POPs.

1.2 Development of the updated UK National Implementation Plan

The updated UK NIP has been developed by the Department for Environment, Food and Rural Affairs (Defra) in close collaboration with the Scottish Government, the Welsh Government, the Department of Environment, Northern Ireland and other relevant Government Departments and Agencies.

1.3 What are Persistent Organic Pollutants?

POPs are a group of chemicals that are toxic, persist in the environment, bioaccumulate in fatty tissues and biomagnify through the food chain. In addition, POPs have the potential to be transported long distances and deposited far from their place of release, including in pristine environments such as the Arctic and Antarctic. POPs have been identified as priority chemicals for many years in the UK and the international community has called for actions to reduce and eliminate their production, use and release.

1.4 Overview of the listed Persistent Organic Pollutants

The Stockholm Convention currently focuses on reducing and eliminating releases of 22 POPs (Table 1). These include those POPS added to the Convention in 2009 and 2011. Descriptions of each of the 22 POPs are provided at Annex 2.

Table 1: The 22 POPS listed in the Stockholm Convention			
Chemical	**Pesticide**	**Industrial chemical**	**Unintentional – by-product**
Aldrin	X		
Chlordane	X		
Dieldrin	X		
Endrin	X		
Heptachlor	X		
Hexachlorobenzene	X	X	X
Mirex	X		
Toxaphene (camphechlor)	X		
Polychlorinated biphenyls (PCBs)		X	X
DDT	X		
Dioxins			X
Furans			X
Chlordecone*	X		
Hexabromobiphenyl*		X	
Hexa- and hepta- bromodiphenyl ether*		X	
Alpha hexachlorocyclohexane*	X		X
Beta hexachlorocyclohexane*	X		X
Lindane (gamma hexachlorocyclohexane)	X		
Pentachlorobenzene (PeCB)*	X	X	X
Perfluorooctanesulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F)*		X	
Tetra- and penta- bromodiphenyl ether*		X	
Endosulfan**	X		

* Listed in 2009

**Listed in 2011

1.5 Provisions of the Stockholm Convention

The Stockholm Convention establishes a strong international framework for promoting global action on POPs, which are divided into three groups according to their mechanism of production and level of restriction.

Nineteen of the intentionally produced chemicals are subject to a ban on production and use except where there are generic or specific exemptions (aldrin, poly-bromodiphenyl ether (hexa-, hepta-, tetra-, penta-), chlordane, chlordecone, dieldrin, endosulfan, endrin, heptachlor, hexabromobiphenyl, hexachlorobenzene (HCB), alpha and beta hexachlorocyclohexane (HCH), lindane (gamma hexachlorocyclohexane), mirex, pentachlorobenzene, perfluorooctanesulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F), polychlorinated biphenyls (PCBs), toxaphene (also known as camphechlor)). In addition, the production and use of DDT is severely restricted.

Parties are required to take measures to reduce releases from the unintentional production of dioxins, PCBs, HCB and pentachlorobenzene (PeCB) with the goal of their continuing minimisation and, where feasible, ultimate elimination. The main tool for this is the development of source inventories and release estimates as well as plans for release reductions. The use of Best Available Techniques to limit releases of unintentionally produced POPs from the major sources, as categorised in the Convention, is also required.

There are special provisions for those Parties with regulatory assessment schemes to both review existing chemicals for POP characteristics and to take regulatory measures to prevent the development, production and marketing of new substances with POP characteristics.

The Convention also makes provision for the identification and safe management of stockpiles containing or consisting of POPs. Waste containing, consisting of or contaminated with POPs should be disposed of in such a way that the POP content is destroyed or irreversibly transformed. Where this does not represent the environmentally preferable option or where the POP content is low, waste shall be otherwise disposed of in an environmentally sound manner. Disposal operations that may lead to the recovery or re-use of POPs are forbidden.

The Convention recognises the particular needs of developing countries and specific provisions on technical assistance and financial resources and mechanisms are included in the general obligations.

Section 2

The UK's Legislative and Policy framework on Persistent Organic Pollutants

Action on Persistent Organic Pollutants is delivered at the international, EU and national levels.

2.1 International level

Owing to the long range transportation of POPs, a global approach is necessary to agree the control of these substances. In addition to the Stockholm Convention, the UK has the following commitments at the international and regional level.

2.1.1 The United Nations Economic Cooperation for Europe (UNECE) Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Persistent Organic Pollutants

The UNECE Executive Body adopted the Protocol on Persistent Organic Pollutants on 24 June 1998 in Aarhus, Denmark. This aimed to eliminate discharges, emissions and losses of 16 pesticides, industrial chemicals and by-products/contaminants. The Protocol bans or severely restricts the production and use of specified products and includes provisions for dealing with their wastes. Seven new substances were added to the Protocol in 2009, although these changes have not yet entered into force.

In its Long-Term Strategy, adopted in December 2010, the Convention stated that the main focus of global action on POPs should be through the Stockholm Convention, with further changes to the POPs Protocol focusing on unintentionally released POPs and where it is agreed that the implementation of stricter measures in the UNECE region is needed. Further information may be found at: http://www.unece.org/env/lrtap/pops_h1.html

2.1.2 The Rotterdam Convention on the Prior Informed Consent for certain hazardous chemicals and pesticides in international trade

The Rotterdam Convention is a global agreement which seeks to promote shared responsibility and cooperative efforts among Parties in the international trade of certain hazardous chemicals, in order to protect human health and the environment. It establishes a Prior Informed Consent (PIC) procedure, which seeks agreement from importing countries to accept shipments of certain hazardous chemicals. Most of the POPs listed in the Stockholm Convention are included in the Rotterdam Convention. The UK ratified in 2004. In the UK, the Prior Informed Consent procedure is operated by the Health and Safety Executive which has been appointed as the Designated National Authority. Further information may be found at: http://www.pic.int/

2.1.3 The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal

The Basel Convention is a global agreement which addresses the problems and challenges posed by the movement and management of hazardous wastes, including those consisting of, containing or contaminated with POPs. The Basel Convention uses a Prior Informed Consent (PIC) procedure to control transboundary movements of waste whereby hazardous waste cannot be shipped from one country to another without the consent of those countries involved, including countries of transit.

The Basel Convention was amended in 1995. The amendment prohibits the export of all hazardous waste from Parties that are members of the EU, OECD and Liechtenstein to all other Parties to the Convention. While the ban is not yet in force in its own right, it is implemented in the EU through the Waste Shipment Regulation. The UK ratified in 1994. Further information may be found at http://www.basel.int/.

2.1.4 The World Summit on Sustainable Development

The World Summit on Sustainable Development (WSSD), held in September 2002 in Johannesburg, agreed an Intergovernmental Plan of Implementation setting out what needs to be done to achieve global sustainable development. The plan of implementation included a number of chemicals related targets, including the implementation of existing chemicals conventions and the development of a Strategic Approach to International Chemicals Management (SAICM).

2.1.5 The Strategic Approach to International Chemicals Management

The International Conference on Chemicals Management held in February 2006 finalised and adopted the Strategic Approach to International Chemicals Management.

SAICM is a global framework to improve chemicals management. It is a voluntary agreement supported by a high-level declaration and contains a toolkit of policies and activities aimed at raising the standards of chemicals management, particularly in developing countries. SAICM pulls together international bodies with responsibility for chemicals management and supports and enhances the global treaties that cover chemicals and hazardous waste. Further details can be found at http://www.chem.unep.ch/saicm/ .

2.2 European Union

As a Member State of the European Union, there is close co-operation between the EU and the UK on policy and legislation on chemicals. Most UK legislation concerning the control of chemicals arises from European Community legislation.

2.2.1 European Union legislation on Persistent Organic Pollutants

The Community Implementation Plan includes a full list of relevant European Legislation. Further details can be found at: http://ec.europa.eu/environment/pops/index_en.htm

The key instruments are outlined below.

Regulation (EC) 850/2004 on POPs is directly applicable in UK law and implements the most important obligations of both the Stockholm Convention and the UNECE POPs Protocol. It prohibits the production, use and marketing of the POPs listed in the Annexes of both instruments and contains provisions on stockpiles and wastes, which are stricter than those stipulated in the Stockholm Convention.

In 2010, a number of amendments of the EU Regulation, to implement the international agreement reached at the 4th Conference of the Parties (COP) to the Stockholm Convention in 2009, entered into force. The new chemicals added to the EU Regulation on POPs have already been subject to prohibition or severe restrictions in the EU. However, certain restrictions go further than previously was the case in order to comply with the new international commitments.

The new chemicals are: four types of polybromodiphenyl ether (PBDEs), alpha and beta hexachlorocyclohexane (HCH), lindane (gamma HCH), perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride and pentachlorobenzene. The original POPs were mainly pesticides but some of the new substances have been widely used in consumer and industrial products.

Council Directive 96/59/EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls aims at disposing PCBs and equipment containing PCBs[2] as soon as possible, and for five litre equipment before the end of 2010. Until such time as they are decontaminated, taken out of service and/or disposed of, the maintenance of transformers containing PCBs may continue only if the objective is to ensure that the PCBs they contain comply with technical standards or specifications regarding dielectric quality and provided that the transformers are in good working order and do not leak. Directive 96/59/EC also sets requirements for the environmentally sound disposal of PCBs.

With regard to unintentionally produced POPs, there are several instruments that have an impact, either directly or indirectly, on the reduction of releases of these substances. The main release control measures are set out in Directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC).

In 2010 the Directive on industrial emissions 2010/75/EU (IED) was adopted. The IED will replace the IPPC Directive and the sectoral directives as of 7 January 2014, with the exception of the Large Combustion Plants Directive, which will be repealed with effect from 1 January 2016.

Regulation (EC) No 1907/2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) inter alia provides provisions to ensure that industrial chemicals having POP characteristics are identified and prevented from being produced or imported in the EU.

Although there are tonnage triggers for registration below which the data submitted to the authorities will not necessarily be sufficient for POP assessment within the REACH framework, the Regulation also has provisions to address substances of very high concern which exhibit the criteria of being persistent, bioaccumulative or toxic. These provisions apply regardless of tonnage. Furthermore, the European Chemicals Agency has a right to request further information from companies if it suspects that a substance might exhibit POP characteristics.

Regulation (EC) No 689/2008 concerning the export and import of certain dangerous chemicals (known as the PIC Regulation) prohibits, in accordance with the provisions of the Stockholm Convention, the export from the European Union of POPs listed in Annexes A and B of the Convention.

Directive 2008/105/EC on environmental quality standards in the field of water policy sets out environmental quality standards relating to the presence in surface water of two groups of priority substances. The substances are selected on account of the risk they pose to, or via, the aquatic environment. Annex I of this Directive currently lists 33 substances broken into two groups:

- Priority substances – required for reduction of discharges and losses;
- Priority hazardous substances – required for the cessation or phase out of discharges, emissions and losses.

Substances addressed by Annex I include POPs, which are classified as priority hazardous substances. Annex I is periodically reviewed and updated and a further 15 substances are currently proposed to be added to the Annex, including dioxins and dioxin-like PCBs.

2 transformers can be used until the end of their useful life provided their PCB level is less than 500ppm.

The Directive places a requirement on member states to establish, for each River Basin District, an inventory of emissions, discharges and losses for substances listed under Annex I. The aim of these inventories is to help provide an evidence base to inform policy decisions and plans to reduce these emissions, discharges and losses and thus help maintain, or achieve, compliance with the environmental quality standards.

2.3 National level

The UK has arrangements in place to ensure that independent expert scientific advice is available to inform policy through the Hazardous Substances Advisory Committee (HSAC). We also have a dedicated body for engagement with stakeholders on chemicals matters, through the UK Chemicals Stakeholder Forum.

2.3.1 UK Regulation on Persistent Organic Pollutants

In the UK, the Persistent Organic Pollutants Regulations 2007 supplements the Community Regulation EC 850/2004. Following the addition of nine new substances to the Stockholm Convention at the Fourth Conference of the Parties (COP4) in May 2009, the UK POPs Regulations were amended in August 2010 to list the additional substances in its annexes. The Regulations designate the Environment Agency[3] as the Competent Authority and enforcement agency for the EC POPs Regulation in England and Wales; the Department of the Environment in Northern Ireland; and the Scottish Environment Protection Agency (SEPA) in Scotland. The Regulation also specifies the duties of the Competent Authority and the Member State.

2.3.2 UK roles and responsibilities

UK Government Departments and Agencies with an implementation and/or enforcement role for the Stockholm Convention include the following:

- *Department for Environment, Food and Rural Affairs (Defra)* – Defra leads for the UK in consultation with the devolved Administrations, other Government Departments and other stakeholders on the further development and implementation of the Stockholm Convention. Defra's work aims to promote and protect the quality of life and natural resources, both at home and internationally. Underlying this are a number of objectives including: to protect and improve the rural, urban, marine and global environment and to lead integration of these goals with other policies across Government and internationally; and to protect the public's interest in relation to environmental impacts.

In the UK environmental responsibilities have been devolved to the following bodies:

- *the Scottish Government* – the Environment and Forestry Directorate (EFD) of the Scottish Government aims to help improve the sustainable exploitation of land, sea and freshwater resources and rural development, while safeguarding the interests of consumers, and protecting and enhancing the environment. The EFD encourages action to reduce pollution and other measures to safeguard the environment. Specifically, it develops and oversees the implementation of policy on, for example, integrated pollution prevention and control, the water environment, waste management and air quality. The EFD also sponsors the Scottish Environment Protection Agency (the regulatory and enforcement authority for environmental protection and pollution control in Scotland, covering discharges to air, land and water);

3 From 1 April 2013, the Environment Agency will cease to be an England and Wales body and there will be a new Natural Resources Body for Wales replacing Environment Agency Wales, the Countryside Council for Wales and Forestry Commission Wales. The role of Competent Authority for POPs in Wales will pass from the Environment Agency to the new body.

- *Welsh Government* – the Welsh Government is committed to sustainable development as its central organising principle. Its responsibilities include: environmental water quality, waste management, contaminated land and land quality, air quality, and industrial pollution controls. The Welsh Government is of the view that the regulation of industrial chemicals and nanotechnologies is best carried out through strong legislation applied consistently across Europe and, where possible, reinforced through global treaties. The Welsh Government supports a consistent UK-wide approach to policy and regulation in this area. The Welsh Government sponsors the Environment Agency in Wales; and
- *Northern Ireland Department of the Environment* (DOE NI) – part of Northern Ireland DOE's objectives are to protect and improve the environment. DOE takes the lead in advising on and implementing environmental policy and strategy in Northern Ireland. The Northern Ireland Environment Agency (NIEA) as an executive agency within the Department of the Environment has a wide range of responsibilities for the environment and supports the Department's mission to make Northern Ireland a better place to live, work and invest.

One Department with a particular interest in promoting the success of multilateral environmental agreements such as the Stockholm Convention in developing countries is:

- *Department for International Development* (DFID) – The Department for International Development is the UK Government Department responsible for promoting sustainable development and reducing poverty. The central focus of Government policy is a commitment to the internationally agreed Millennium Development Goals which include aims such as the eradication of extreme poverty and hunger, the reduction of child mortality and the improvement of maternal health, but also to ensure environmental sustainability. DFID's assistance is concentrated in the poorest countries of sub-Saharan Africa and Asia, but also contributes to poverty reduction and sustainable development in middle-income countries, including those in Latin America and Eastern Europe. It works in partnership with Governments committed to the Millennium Development Goals, with civil society, the private sector and the research community. It also works with multilateral institutions including the World Bank, the Global Environment Facility, United Nations agencies and the European Commission.

In England, Wales and Scotland the responsibility for enforcing environmental and chemicals legislation rests with the following bodies:

- *the Environment Agency* (EA) – the EA is the main environmental regulator in England and Wales. It was set up as a non-departmental public body (NDPB) sponsored largely by Defra and the Welsh Government. The Agency issues various permits, licences, consents and registrations, including permits under Integrated Pollution Prevention and Control to reduce unintentional release of POPs. Before users carry out an activity that may need a licence it can offer advice on ways of reducing that activity's effect on the environment. Part of its role is to regularly inspect and monitor licence-holders to ensure that the standards that have been set are being met. The Agency can take legal action against those committing environmental crime and is the designated enforcer of the Stockholm Convention in England and Wales. However, from 1 April 2013 the EA will cease to be an England and Wales body, and there will be a new Natural Resources Body for Wales replacing the current Environment Agency Wales, Countryside Council for Wales and Forestry Commission Wales. This new Welsh body will take responsibility for regulating POPs in Wales;

- *the Scottish Environment Protection Agency* (SEPA) – SEPA is the main environmental regulator for Scotland, an NDPB sponsored by the Scottish Government, with the main aim of providing an efficient and integrated environmental protection system that will improve the environment. In broad terms it regulates activities that may pollute water and air, the storage, transport and disposal of waste, and the keeping and disposal of radioactive materials. SEPA is the designated enforcer of the Stockholm Convention in Scotland.
- *the Northern Ireland Environment Agency* (NIEA) – NIEA is the main environmental regulator for Northern Ireland. NIEA aims to protect, conserve and promote the natural environment and built heritage of Northern Ireland for the benefit of present and future generations. The NIEA provides education and advice and undertakes the regulation of activities which have the potential to pose a risk to human health or damage the natural or built environment. The NIEA is responsible for implementing a wide range of legislation covering water quality, pollution prevention and control, waste management, the protection of historic monuments and buildings, and nature conservation and the countryside.

In summary the three environment agency organisations have similar roles and responsibilities except that in England and Wales the IPPC processes with less potential to release dioxins (i.e. Pollution Prevention and Control Part B and Part A(2) processes are regulated by Local Authorities while in Scotland they are regulated by SEPA). In Northern Ireland, those processes corresponding to Part A and Part A2 are regulated by NIEA, while the regulation of those processes corresponding to Part B are split between NIEA and local authorities.

There are also a number of other Departments with specific responsibilities for the management of chemicals. These include:

- *Health and Safety Executive* (HSE) – HSE's mission is the prevention of death, injury and ill health to those at work and those affected by work activities. HSE deals with a range of health risks, including noise, vibration, pathogens, radiation and the risks posed by chemicals specifically. Within its enforcement responsibilities HSE enforces a range of chemical related legislation;
- *Health and Safety Executive Northern Ireland* (HSE NI) – HSE NI is the lead body responsible for the promotion and enforcement of health and safety at work standards in Northern Ireland. Its mission is to ensure that risks to people's health and safety arising from work activities are effectively controlled; and
- *The Chemicals Regulation Directorate* (CRD) – CRD is a directorate of the Health and Safety Executive (HSE) and is the UK Competent Authority for the regulation of biocides, pesticides, detergents and chemicals as they are regulated by REACH, and duties under the Classification and Labelling regime. The primary aim of CRD is to ensure the safe use of biocides, industrial chemicals, pesticides and detergents to protect the health of people and the environment.

And there are other bodies with responsibilities for human health and the environment, including:

- *Health Departments* – The aim of the UK's health departments is to improve the health and wellbeing of people. The Department of Health for England sets the direction on promoting and protecting people's health, taking the lead on issues such as environmental hazards to health, infectious diseases, health promotion and education and the safety of medicines. The Environmental Hazards Branch, within the Department, plays a role providing policy advice relating to possible impacts on human health of chemicals in the environment. The Department works closely on environmental chemical issues with other Government departments and international organisations such as the European Union, World Health Organisation and OECD. It obtains expert scientific and medical advice from the Health Protection Agency (HPA). The HPA is assisted in formulating expert advice by a number of independent advisory committees. The HPA also provides a dedicated field service and an integrated approach to protecting the public to chemical hazards, radiation and microbiological hazards. At a national level, it is proposed that a new dedicated public health service, Public Health England, will be set up in April 2013, incorporating the functions of, among other public health bodies, the HPA;
- *Food Standards Agency* – the Food Standards Agency is an independent food safety watchdog set up to protect the public's health and consumer interests in relation to food. Its Food Safety Group is responsible for the development of policy and provision of advice on chemical contaminants in food, and represents the UK during negotiations with the European Commission and other Member States regarding regulatory limits for chemicals in food;
- *Local Authorities* – in England and Wales Local Authorities enforce local air pollution controls. Under this, conditions are included in authorisations for prescribed processes to ensure that the process is operated using the best available techniques not entailing excessive cost. Local Authorities are also responsible for the enforcement of food safety regulations, including contaminant limits; and
- *Her Majesty's Revenue and Customs* (HMRC) – have enforcement responsibility at the frontier against imports and exports of regulated chemicals under the Stockholm Convention.

Section 3

Implementation of action on Persistent Organic Pollutants

This section considers the current situation regarding POPs in the UK, outlining their production, use, release pathways and relevant regulatory controls. Where relevant, details of present stocks and marketing of the substances, and measures undertaken to meet compliance requirements is also provided. Details of POPs emissions are provided in Section 4.

Details regarding the 12 existing POPs were provided in the UK 2007 National Implementation Plan. This NIP provides an update on that information and should be read in conjunction with the 2007 Plan. Those POPs listed in 2009 and 2011 are covered in detail in the present 2012 Plan. However, more background about the existing POPs and those listed in 2009 is provided in the Defra reports, 'Review and update of the UK Source Inventories of Dioxins, Dioxin-Like Polychlorinated Biphenyls and Hexachlorobenzene for Emissions to Air, Water and Land (Report[4] and Annex)' and 'A further update of the UK source inventories for emissions to air, land and water of dioxins, dioxin-like PCBs, PCBs and HCB, incorporating multi-media emission inventories for nine new POPs under the Stockholm Convention'. These reports are available at http://randd.defra.gov.uk/.

3.1 Overview of regulatory control

The requirements of the Stockholm Convention are implemented in UK principally by the the UK Persistent Organic Pollutants Regulations 2007. The Regulations contain provisions regarding production, placing on the market and use of chemicals, management of stockpiles and wastes and measures to reduce unintentional releases of POPs. Other chemical and environmental legislation complements the Regulation in implementing the requirements of the Stockholm Convention. In addition there are controls in place to reduce releases of unintentionally produced POPs and human exposure to these. These are outlined at the end of this section.

The Environment Agency's Chemical Compliance Team undertakes proactive, cost-effective monitoring and enforcement of compliance with certain chemical marketing and use regulations, including the requirements relating to Persistent Organic Pollutants. Intelligence-led, risk-based targeting is used to deliver sector-focused compliance campaigns which employ a combination of advice and guidance to raise awareness across the broader industry audience, and proportionate direct enforcement action where necessary.

3.2 Update for POPs regulated before 2009 ('existing POPs')

The term 'existing POPs' covers the substances listed in the Stockholm Convention or the POPs Protocol and regulated by the POPs Regulation at EU level before 2008, i.e. before the new POP substances were listed in the Stockholm Convention or the POPs Protocol in 2009 and 2011 (referred to at Section 3.2). This section provides an update to the more detailed information contained in the UK 2007 NIP.

4 http://archive.defra.gov.uk/environment/quality/chemicals/documents/dioxins-report100630.pdf

3.2.1 Pesticides

The Stockholm Convention originally listed the pesticides aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene, mirex and toxaphene (also known as camphechlor). All have been banned in the UK for many years. As outlined in the 2007 NIP, monitoring data between 1999 and 2004 showed that concentrations of these chemicals in water were below detectable limits, although trace amounts were still present.

3.2.2 Hexachlorobenzene (HCB)

Hexachlorobenzene is an industrial chemical as well as a pesticide and its use, including in imported articles is banned under Regulation (EC) 850/2004, which is implemented through the UK POPs Regulations 2007. The key current source of emissions to air in the UK (66% in 2010) is associated with the use of imported chlorothalonil in which HCB is an impurity. Historically the single most significant source of HCB to any vector was the use of hexachloroethane (HCE) as a cover gas for secondary aluminium manufacture. HCB was present as a contaminant in HCE and the HCE used in this industry was vented to air at the end of its life with no capture or treatment. The use of HCE for this application was banned in the UK before 2000, resulting in a dramatic drop in emissions.

In 2010 the Environment Agency (EA), working alongside the Health and Safety Executive (HSE), served two enforcement notices on companies importing fireworks containing HCB. A total of 32,150 fireworks were destroyed in accordance with the waste management requirements of the regulations.

3.2.3 Polychlorinated Biphenyls (PCBs)

Prior to the mid-1970s PCBs were used in both ‘closed’ (electrical equipment such as capacitors, transistors and electrical switching gear) and ‘open’ applications. Although the open use of PCBs ceased in the 1970s, it is possible that building sealants containing PCBs may still be present in older properties. A significant amount of PCBs found in the environment will have arisen from past use of such products.

The manufacture of PCB containing equipment was banned in 1985. However, due to their high persistence and the residual bank of equipment still being used, emissions of PCBs have continued long after the ban was introduced. As required under Council Directive 96/59/EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (the PCB Directive), the Environment Agencies hold registers of all identifiable PCB holdings (including any transformer, capacitor or receptacle containing residual stocks) in the UK. These are available on request from local Agency offices. The UK submits annual returns of holdings to the European Commission.

The method used to estimate the current number and size of PCB-containing items of equipment is complex and due to the difficulty in identifying PCB-containing equipment, the uncertainty in estimates will be high. The UK Environment Agencies are working with companies on their PCB registers to establish more accurate records and to arrange for the disposal of 133 items of PCB-containing equipment that are not transformers, where they have been found.

On 17 October 2011, 77 companies registered their equipment in England and Wales, five of which had holdings in Wales. There are a total of 45,047 items of registered equipment, 380 of which are held by companies in Wales.

3.2.4 Dioxins and furans

Emissions of dioxins and furans have declined significantly following measures taken to control industrial releases. However, unintentional releases from diffuse sources, such as backyard burning, continue to present a challenge in achieving further reductions.

Since 2007, the UK has been affected by one major incident relating to dioxins in food. This originated in the Republic of Ireland and was associated with highly contaminated feed which was supplied mainly to pig farms in the Republic of Ireland. Some potentially contaminated pork and pork products were exported to other Member States, including the UK, and were withdrawn from the food chain as a precaution. However, some of the highly contaminated feed was also supplied to a small number of beef and dairy farms in Northern Ireland. As a consequence, hundreds of thousand litres of milk were discarded, several hundred tonnes of meat were withdrawn and destroyed and about 5,000 contaminated cattle were culled in order to prevent the further entry of contaminated meat into the food chain.

Although further product withdrawals have been instigated as a result of contamination incidents in other Member States, there have been no other significant incidents originating in the UK.

3.3 POPs regulated from 2009 ('new POPs')

The new POPs are the substances that were listed in the Stockholm Convention at the 4th and 5th Conference of the Parties (COP) to the Stockholm Convention held in May 2009 and in April 2011, respectively, and in the POP Protocol at the 27th meeting of the Executive Body of LRTAP Convention held in December 2009 and that were not listed in any of these instruments before.

Thus, the new POPs are chlordecone; alpha and beta hexachlorocyclohexane (HCH); endosulfan; lindane (gamma HCH); pentachlorobenzene (PeCB); perfluorooctanesulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F); tetra-, penta-, hexa-, and hepta-BDE (Polybrominated diphenylethers, PBDEs).

3.3.1 Annex A substances, Pesticides (chlordecone, alpha and beta hexachlorocyclohexane (HCH), endosulfan and lindane (gamma HCH))

3.3.1.1 Current production, marketing, use and control

These pesticides are not produced in the UK and have been banned for many years. The effective date of each ban is set out in Table 2.

Table 2: Date of ban or expiry date of last approved use in UK for new Annex A pesticides			
Substance	**Effective date of ban or last approved use in UK**	**EU legislation**	**UK implementing measure**
Chlordecone	1977		Banned under Recommendation RECS1260 issued 25/05/1977
Alpha hexachlorocyclohexane (HCH)	1982	Council Directive 79/117/EEC	Implemented administratively as no pesticide legislation in place at the time.
Beta hexachlorocyclohexane (HCH)	1982		
Lindane (gamma hexachlorocyclohexane (HCH)	Plant protection uses: 2002, with provision for granting temporary permission in emergency situations Biocidal uses: 'Non-agricultural' pesticide uses, e.g wood preservative products and insecticides: between 2000 and 2003 under the UK Control of Pesticides Regulations 1986.	Plant protection: Non-inclusion in Annex I of Council Directive 91/414/ EEC (via Commission Decision 2000/801/EC) Biocidal uses: Non-inclusion in Annex I of Directive 98/8/EC (via Commission Regulations (EC) No 2032/2003 and 1048/2005) requiring any existing products to be removed from the market by 1st September 2006.	Plant protection uses: Implemented administratively under the Plant Protection Product Regulations 1995 by revoking products containing lindane. Biocidal uses: could have been implemented administratively under the Biocidal Products Regulations 2001 but products had already been revoked under the Control of Pesticides Regulations so no action required.
Endosulfan	2007	Non-inclusion in Annex I of Council Directive 91/414/ EEC (via Commission Decision 2005/863/EC)	Implemented administratively under the Plant Protection Product Regulations 2005 by revoking products containing endosulfan.

EU legislation (particularly Council Directive 79/117/EEC) prohibited the placing on the market and use of plant protection products containing certain active substances which, even if applied in an approved manner, could give rise to harmful effects on human health or the environment.

Council Directive 79/117/EEC was repealed on 14 June 2011, since when the marketing of plant protection products in the EU has been governed by Regulation (EC) No 1107/2009. This prohibits the use of any active substances in plant protection products unless approved for that purpose.

The wider production, use, import and export of alpha and beta hexachlorcyclohexane (HCH) and lindane (gamma HCH) have been banned under Regulation (EC) 850/2004.

Endosulfan is also classified as a priority hazardous substance under the Water Framework Directive 2000/60/EC which requires environmental quality standards to be set for concentrations in water and sediments.

3.3.1.2 Historical use and release pathways

Chlordecone

Chlordecone is a synthetic chlorinated compound, which was mainly used as an agricultural pesticide. It was first produced in 1951 and introduced commercially in 1958. Chlordecone was sold under the trade name 'Kepone'. In the UK, all Kepone and Kepone derivatives had their licence for sale revoked in July 1977.

Chlordecone may not have been used in the UK prior to its ban in 1977. Releases of the substance to the environment are therefore unlikely.

Alpha and beta hexachlorocyclohexane (HCH)

Alpha and beta hexachlorocyclohexane (HCH) were previously important components of the pesticide Technical HCH, which was banned in the UK in 1982. Lindane (99% by weight gamma HCH), which replaced Technical HCH, contains only trace amounts of alpha and beta HCH. As significant quantities of waste were generated in the production of lindane, this may have contained the alpha and beta HCH isomers.

In the UK, the main release pathway for these substances is emissions to air from the past production and use of the pesticide lindane. Plant protection uses were withdrawn from the UK market in 2002. Other release pathways include:

- emissions to air of HCH from contaminated soils (particularly the case for beta HCH); and
- emissions to water from sewage treatment works which are reported through the UK Pollution Release and Transfer Register (PRTR).

Lindane (gamma hexachlorocyclohexane (HCH))

Lindane has been used globally as a broad-spectrum insecticide for seed and soil treatment, foliar applications on crops, tree and wood treatment and against ectoparasites in both veterinary and human applications. The estimated worldwide use in 1990 was 8,400 tonnes. The production of lindane has decreased rapidly in recent years and it is now only produced in a few countries.

In the UK, lindane was used as an insecticide to treat crops and timber. To a lesser degree, it was a constituent of specialist shampoos for the treatment of head lice. The use of lindane was at its peak in the 1970s, after which its use declined. until its ban in 2002.

The main release pathways in the UK for lindane are:

- emissions to air from historic lindane production and use; and
- emissions to land from historic lindane application, notably as a legacy of treated stockpiles of wood (e.g. used in construction, fencing, etc.) with an estimated lifespan of 50 years.

Releases to the environment may also occur to:

- air from contaminated soils,
- land and possibly groundwater from waste materials consigned to landfill.

There remains the potential for ongoing releases of lindane from the legacy of previously treated wood products that have not yet been disposed. Although estimates of remaining stockpiles of treated wood and their lindane content have been made, these come with a high level of uncertainty.

Endosulfan

Endosulfan is an insecticide which occurs as two isomers, alpha and beta endosulfan, both of which are biologically active. It has been used since the 1950s to control crop pests, tsetse flies and ectoparasites of cattle. It has also been used as a wood preservative. Several countries that used to produce endosulfan in Europe have stopped production. There has been no known manufacture of endosulfan in the UK.

Endosulfan is used as a broad spectrum insecticide to control a wide range of pests on a variety of crops including coffee, cotton, rice, sorghum and soy. It was used in the UK until 2006 when it was withdrawn from the market for plant protection uses, as a result of non-inclusion in Council Directive 91/414/EEC.

The main release pathways for endosulfan would be from past use to water and soil sediments. Endosulfan may also be present in trace amounts in agricultural products imported from other countries.

3.3.1.3 Stockpiles and compliance activity

In 2011/2012 the Environment Agency (England and Wales) instigated the destruction of 315kg of redundant lindane products, equating to 88.5kg of lindane.

3.3.2 Annex A substances, Industrial chemicals (Hexabromobiphenyl and polybrominated diphenyl ether (tetra, penta, hexa and hepta BDE))

3.3.2.1 Current production, use, control and release pathways

Hexabromobiphenyl

Hexabromobiphenyl (HBB) was used as a flame retardant within a number of plastic applications, mainly in the 1970s. The production of HBB ceased in the UK when it was banned in 1977.

During production the key emissions would have been to air and water, with further residual emissions to air from goods during use (e.g. due to abrasion resulting in dusts containing HBB). Emissions to air, land and water would therefore have occurred throughout the lifecycle of the product including after final disposal to landfill.

Plastic products treated with HBB are expected to have a lifespan ranging from five to ten years. It is therefore unlikely that there have been any significant HBB emissions to the environment after 1990.

Polybrominated diphenyl ether (tetra, penta, hexa and hepta BDE)

The four POPs in this category are substances which have either been used as flame retardants or been present in commercial grade flame retardant products. They are not produced in the UK. They have been banned in the UK as indicated in Table 3.

Table 3: Date of ban for new Annex A flame retardants	
Substance	**Effective date of the ban in the UK**
Hexa- and hepta- bromodiphenyl ether	2004 (commercial octabromodiphenyl ether)
Tetra- and penta- bromodiphenyl ether	2003 (commercial pentabromodiphenyl ether)

Council Directive 2003/11/EC on pentabromodiphenyl ether and octabromodiphenyl ether is implemented through the UK Controls on Pentabromodiphenyl Ether and Octabromodiphenyl Ether Regulations 2004 and bans the use and placing on the market of Commercial Penta and OctaBDE. The ban applies to goods marketed and manufactured in the UK.

Additional controls on the use and placing on the market of these substances are provided through the EU Chemicals Regulation (REACH, 1906/2007) and the EU Restriction of certain Hazardous Substances (ROHS) Directive (2011/65/EC).

Since 2007, the EU Waste Electrical and Electronic Equipment (WEEE) Regulation has regulated the disposal and recycling of electrical and electronic equipment containing tetra, penta, hexa and heptaBDE. This legislation is implemented in the UK through the Waste Electrical and Electronic Equipment Regulations 2006.

3.3.2.2 Historical use and release pathways

Polybrominated diphenyl ether (tetra, penta, hexa and hepta BDE)

Tetra and pentaBDE are the two main polyBDE congeners found within commercial pentaBDE. The hexaBDE congener may also be found in low concentrations in commercial pentaBDE. Hexa and heptaBDE are congeners found within commercial octaBDE.

Historically commercial octaBDE had more limited applications than pentaBDE in the UK, as it was primarily used as an additive flame retardant in plastic housings for electrical goods. Commercial pentaBDE was used as an additive flame retardant in a number of plastic applications, as well as being widely used in soft furnishings to meet strict UK fire resistance targets.

Although both commercial penta and octaBDE have been banned in the UK since 2003 and 2004 respectively, low levels of brominated chemicals could continue to be present in unlabelled recycled plastics. Both commercial penta and octaBDE were manufactured and used in the UK until 2000.

Emissions of tetra and pentaBDE from in-use items and in waste streams are estimated to be more significant than those arising from past manufacturing or use. This is because carpets, textiles, furnishings and other items which may have been treated with pentaBDE prior to the 2003 ban remain in use and will continue to enter waste streams for some time. It is estimated that tetra and pentaBDE may be emitted to air, land and water during use and following disposal of these goods.

In recent years, the main release pathways for hexa and heptaBDE are believed to have been emissions to air and land in the form of contaminated dusts arising from the disposal of products manufactured prior to the ban. It is reported that these substances are present in many articles still in use and that releases from this source will diminish over time as these items are removed from the UK stock of electrical goods.

3.3.3 Annex B substances, Industrial chemicals (perfluorooctanesulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F)

3.3.3.1 Current production, marketing, use and control

Perfluorooctane sulfonic acid (PFOS) is not produced in the UK. It was banned under the terms of the Controls on Dangerous Substances and Preparations Regulations 2007. However there are exemptions for its use in the chrome plating, semi-conductor and photographic industries. Exemptions for PFOS under the EU POPs Regulation are as follows:

(a) until 26 August 2015, wetting agents for use in controlled electroplating systems;

(b) photoresists or anti reflective coatings for photolithography processes;

(c) photographic coatings applied to films, papers, or printing plates;

(d) mist suppressants for non- decorative hard chromium (VI) plating in closed loop systems;

(e) hydraulic fluids for aviation.

Exemptions for use of unused stocks of fire fighting foams containing PFOS ceased in 2011.

3.3.3.2 Emission sources and release pathways

Perfluorooctane sulfonic acid (PFOS) is both intentionally produced and an unintended degradation product of related anthropogenic chemicals. PFOS was manufactured by the 3M Company in Europe as a surfactant for a range of applications until 2001. It is understood that some small scale manufacture of PFOS might have continued outside Europe after 3M ceased production.

In the UK, current use of PFOS includes metal plating activities in the chrome industry, the use of small quantities in semi-conductor manufacture and limited applications in the photographic industry.

In the past PFOS has also been used as a surfactant in a number of fire fighting foams. It is estimated that approximately 0.5 tonnes of PFOS in industrial fire fighting foam was used at the Buncefield fuel storage terminal fire in 2005.

Previous use of PFOS was dominated by the domestic market, particularly as a stain repellent in furniture and other furnishing items. These items, which are still being used, are likely to remain a source of PFOS emissions for an extended period.

In the UK, the main environmental release pathways are believed to be to water, where concerns have been raised about further de novo[5] formation of PFOS within waste water treatment works. However, no substantiated data exists to verify current emission estimates.

5 Synthesis of PFOS from simple molecules

3.3.3.3 Stockpiles, compliance activity and alternatives

In the UK, PFOS-containing stockpiles have been notified to the UK authorities for use as a wetting agent and mist suppressant in non-decorative hard chrome plating. In 2011, a total 3,654kg of PFOS-containing material equating to 88kg of PFOS were notified by four companies. Information from the manufacturer suggests that these quantities will diminish as alternatives are now being used and products reformulated.

Following a 2006 targeted campaign by the Environment Agency (EA), the Fire Rescue Service (FRS) voluntarily phased out the use of remaining stocks of PFOS-containing foam in 2011. A further campaign in 2011 identified that other industry (mainly non-FRS) continued to hold stocks of PFOS-containing fire fighting foam up until the ban of its use in mid-2011. A communications exercise to raise awareness of the need to dispose of these foams was undertaken. Approximately 20,000 litres of PFOS-containing foam, firewater and system flushings have been disposed of following this campaign.

3.3.4 Annex A and C substance, Pesticide, Industrial chemical, Unintentional by-product (Pentachlorobenzene (PeCB))

3.3.4.1 Production, marketing, use and control

Pentachlorobenzene (PeCB) is not produced in the UK and has no current commercial uses. It is present as a contaminant in the pesticide quintozene. The UK set maximum limits for PeCB contamination in quintozene in the early 1990s (10mg/g active substance). Following a review, quintozene was not included as an active substance under Council Directive 91/414/EEC and quintozene-containing products already on the market were withdrawn on 27 June 2001 with existing stocks to be exhausted by 27 June 2002. From 28 June 2002 it has been illegal to market, use or store plant protection products containing quintozene.

3.3.4.2 Historical use and release pathways

Emissions of pentachlorobenzene (PeCB) from a wide range of sources have been estimated for the period 1990 to 2010. Emissions in 1990 were dominated by industrial sources and from the legacy of earlier industrial processes. The significance of these industrial sources has declined since 1990, leading to more recent emission estimates being dominated by diffuse sources.

In the past PeCB was present in the following as:

- an elastomer in PCB di-electric fluids
- a contaminant of HCE (hexachloroethane) de-gassing agents used in aluminium manufacture
- a contaminant of the pesticide quintozene
- a contaminant of the pesticide PCP (pentachlorophenol)
- a contaminant of tetrachloroethene (also known as perchloroethylene or PERC) used in dry cleaning
- a by-product of the production of carbon tetrachloride

Pentachlorobenzene is also produced as an unintentional by-product in combustion processes, in the following diffuse activities:

- uncontrolled combustion of waste
- accidental fires
- incineration of hazardous and clinical wastes
- combustion of solid fuels – principally coal in domestic grates trace residues from emissions of waste water treatment works

3.4 Controls on unintentionally produced POPs

3.4.1 Current legislation on unintentionally produced POPs

The UK's legislation on unintentionally produced POPs is delivered through a combination of action at the national, European Union and international level. In the UK, control measures via legislation and abatement technologies have led to a significant reduction in dioxin, PCB and PeCB emissions. These measures include a combination of pollution control equipment or substitute process technologies. For major industrial sources these measures are listed in this section of the NIP. Full details of existing Community legislation are available in the Community Implementation Plan, which can be found at http://ec.europa.eu/environment/pops/index_en.htm. A summary of the controls applied in the UK including the application of Best Available Techniques and Best Environmental Practices, is appended at Annex 3. Details about the source categories to which these apply were outlined in the 2007 NIP[6] (Annex 5A and 5B).

3.4.2 Control on industrial processes

Unintentionally produced persistent organic pollutants, including dioxins and dioxin-like PCBs, are covered under several instruments in Community legislation that have an impact, either directly or indirectly, on the reduction of releases of these substances. The main release control measures are set out in the Integrated Pollution Prevention and Control Directive (Directive 2008/1/EC) which will be replaced from 7 January 2014 by somewhat strengthened provisions in Chapter II of the industrial emissions Directive (2010/75/EU).

The IPPC Directive lays down the legal framework for the control of releases of dioxins and dioxin-like PCBs from industrial installations. Installations covered by Annex I of the Directive are required to obtain a permit from the Member States' authorities. The permits must be based on the concept of best available techniques (BAT) and must include emission limit values for any pollutants likely to be emitted in significant quantities. Therefore, emission limit values are not included for processes that do not release significant amounts of dioxins. The Directive also has provisions relating to monitoring and enforcement, public participation and exchange of information.

6 http://archive.defra.gov.uk/environment/quality/chemicals/documents/pop-nationalplan.pdf

In the UK the enforcement authorities are the Environment Agencies and Local Authorities. In England and Wales, the Environment Agency regulates industrial processes such as municipal waste incinerators, cement works, chemical manufacturing plants, oil refineries and steel works; Local Authorities regulate some combustion/incineration and metal processes and crematoria. The Scottish Environment Protection Agency (SEPA) and the Northern Ireland Environment Agency regulate releases in their respective territories.

The implementation of IPPC resulted in significant reductions in dioxins emissions, particularly from municipal solid waste (MSW) incineration plants. Although reductions have been achieved for sinter plants, there remain significant emissions from this sector owing more to large gas volumes emitted than to high concentrations.

3.4.3 Other key legislation for dioxins, PCBs and HCB

Directive 2000/76/EC on waste incineration regulates all waste incineration facilities and introduced a strict emission limit for dioxins of 0.1 nanogram I-TEQ[7] per cubic metre of gaseous releases (A summary of how TEQ measurements are derived and the equivalent measures for dioxins and furans are attached at Annex 4, 4A and 4D). This has led to further reductions in dioxins emissions from these sources in the UK. This Directive also will be replaced from 7 January 2014 by the industrial emissions Directive (Chapter IV).

The European Pollutant Release and Transfer Register (E-PRTR), a Community-wide inventory of the principal emissions and responsible sources, was established by EU Regulation 166/2006. The register includes unintentionally produced POPs, with the exception of PCBs.

3.4.4 Controls on open agricultural burning

Since May 2006 agricultural waste has been included in national waste management controls. The unregulated open burning of agricultural waste has been banned since May 2007, with the exception of the open burning of small quantities of plant tissue which continues to be allowed under the Environmental Permitting (England and Wales) Regulations 2010. Schedule 3 of these Regulations provides an exemption from the need for an environmental permit, subject to certain conditions. However, it is an offence for a farmer to dispose of agricultural waste in a manner likely to cause pollution of the environment or harm to human health.

3.5 Marketing and use controls

Controls on the marketing and use of certain chemicals found to be contaminated with dioxins have been put in place. These include PCB-containing oils, the herbicide trichlorophenoxyacetic acid (2, 4, 5-T) and the wood preservative pentachlorophenol (PCP).

7 TEQ (Toxic Equivalent Quotient) is a scheme which enables levels of individual dioxins, furans and PCBs to be reported as a single value based on the toxicity of each congener (see Annex 4 for more information)

3.6 Controls on diffuse sources

Industrial sources are now tightly regulated; however, some diffuse sources of dioxin, PCB, HCB and PeCB releases continue to make a significant contribution to emissions and may require further consideration. There is legislation restricting the lighting of domestic garden waste bonfires and open burning on domestic premises. Section 33 of the Environment Protection Act 1990 (as amended by the Waste Management Regulations 2006 (England and Wales) provides that a person who disposes of controlled waste in a manner likely to cause environmental pollution or harm to human health commits an offence.

3.7 Occupational exposure to dioxins, PCBs and HCB

Health and Safety legislation lays down a series of requirements on employers which will apply to situations at work where exposure to polychlorinated biphenyls (PCBs) and dioxins may occur. This includes the Control of Major Accident Hazard Regulations 1999 (COMAH) and the Control of Substances Hazardous to Health Regulations (COSHH) 2002 (as amended).

There is no specific occupational exposure limit set for dioxins but the 17 biologically active dioxin congeners are listed in Schedule 1 of the COSHH Regulations 2002 (as amended). Schedule 1 includes a list of substances and processes to which the definition of carcinogen relates and therefore there is a requirement for employers to reduce exposure to these dioxins to as low as is reasonably practicable. The Health and Safety Executive (HSE) has also issued specific guidance on how to reduce exposure to dioxins in the aluminium recycling industry (http://www.hse.gov.uk/pubns/indg377.pdf).

Employers must ensure that exposure of their employees to PCBs is either prevented or, where this is not reasonably practicable, ensure that the concentration of PCBs in workplace air, averaged over an eight-hour period, does not exceed the Workplace Exposure Limit (WEL) of 0.1 mg/m^3. PCBs also carry the 'Sk' notation indicating they can be absorbed through the skin which will lead to systemic toxicity.

There is no occupational exposure limit for hexachlorobenzene (HCB). HCB has a 'harmonised classification' in the European Union as a Category 1B carcinogen. This means that it is regarded as a potential human carcinogen and if it is present in the workplace either intentionally or as a process by-product the employer has an obligation under the COSHH Regulations 2002 (as amended) to reduce exposures to as low as is reasonably practicable.

In addition, the COSHH Regulations apply to any substance which is listed in Table 3.2 of part 3 of Annex VI of the CLP Regulation and for which an indication of danger specified for the substance is very toxic, toxic, harmful, corrosive or irritant. They also apply to:

- Any preparation (mixture) that is dangerous for supply, as above.
- Any substance which has a Workplace Exposure Limit (WEL).
- Any biological agents used at work.
- Any dust other than one with a WEL at a concentration in air above 10mg/m^3 averaged over eight hours, or any such respirable dust above 4mg/m^3 over eight hours.
- Any other substance that creates a risk to health because of its properties and the way it is used or is present in the workplace.

3.8 Food legislation on dioxins and dioxin-like polychlorinated biphenyls

Regulation (EC) 1881/2006 on setting maximum levels for certain contaminants in food as amended by Regulation (EC) 1259/2011 establishes maximum acceptable levels for dioxins, dioxin-like PCBs and non-dioxin-like PCBs in food. Limits are set in meat, liver (including fish liver), fish, marine oils, milk and dairy products, hen eggs and egg products, animal fats, vegetable oil and foods for infants and young children. Regulation 252/2012 sets conditions to ensure that samples are representative and that analysis is carried out to an acceptable standard. Recommendation 2011/516 establishes separate action levels for dioxins and dioxin-like PCBs at which an investigation should be considered, if possible, to identify and eliminate any significant local sources.

3.9 Controls on dioxins and polychlorinated biphenyls in animal feed

Measures to help protect consumers from carryover from animal feed into meat, milk and eggs, etc. are in place. Maximum permitted limits for dioxins, dioxin-like PCBs and non-dioxin-like PCBs have been set under the scope of Directive 2002/32/EC on undesirable substances in animal feed. In addition, action thresholds for dioxins and dioxin-like PCBs have been set under Directive 2002/32/EC. The limits and thresholds have been set via Commission Regulations, hence these controls do not need to be implemented into domestic legislation.

Section 4

Evaluation of the current releases of the POPs

This section considers the current releases of the POPs to the environment, data on emission trends in different environmental vectors (where available) and uptake through the food chain. It also outlines measures that are in place to control emissions of unintentionally produced POPs and to what extent these have assisted in reducing emissions from regulated sources. More detailed background about the existing POPs and those listed in 2009 is provided in the Defra reports, 'Review and update of the UK Source Inventories of Dioxins, Dioxin-Like Polychlorinated Biphenyls and Hexachlorobenzene for Emissions to Air, Water and Land (Report[8] and Annex)' and 'A further update of the UK source inventories for emissions to air, land and water of dioxins, dioxin-like PCBs, PCBs and HCB, incorporating multi-media emission inventories for nine new POPs under the Stockholm Convention'. These reports are available at http://randd.defra.gov.uk/.

A review of the UK's 2007 Dioxin Action Plan, which summarises the actions taken to secure further reductions in dioxins and furans, as well as HCB and PCBs, may be found in Annex 6.

4.1 Monitoring

4.1.1 Toxic Organic Micro-Pollutants (TOMPS) monitoring network (air)

The objective of the Toxic Organic Micro-Pollutant network is to continuously measure concentrations of a range of pollutants, including dioxins, PCBs and PBDEs in air at rural and urban locations in the UK. The network was set up in 1990, with Lancaster University becoming the main contractor in 2004. The university is responsible for the analysis of samples from all six of the sites. These include two urban and four rural locations respectively; London, Manchester, High Muffles (North Yorkshire), Hazelrigg (Lancashire), Weybourne (Norfolk) and Auchencorth (Midlothian).

4.1.2 Monitoring of POPs in food

The Food Standard Agency (FSA) does not have an ongoing programme of monitoring POPs in food and animal feed. Resources are instead allocated on a risk basis, in line with Regulation 882/2004 on official controls. FSA provides additional funding to Local Authorities for the testing of imported and locally-produced food and feed, which may include dioxin testing. FSA also carried out its own targeted surveys and investigations into the occurrence of dioxins, PCBs and other POPs in food and feed.

The Health and Saftery Executive (HSE) is responsible for delivering the programme of monitoring pesticide residues in the UK food supply as required under EU Regulation 396/2005. Some of the pesticides included in this monitoring are POPs. The Defra Expert Committee on Pesticides Residues in Food (PRiF) oversees this work and publishes quarterly results which can be found at: http://www.pesticides.gov.uk/guidance/industries/pesticides/advisory-groups/PRiF/PRiF_Results_and_Reports/index-to-results-by-food-pesticide-residues.htm

8 http://archive.defra.gov.uk/environment/quality/chemicals/documents/dioxins-report100630.pdf

4.1.2.1 Polybrominated Diphenyl Ethers (PBDEs)

FSA has been investigating levels of PBDEs in food since 2003. Further to the work reported in the 2007 National Implementation Plan, which included trout and eels, farmed and wild fish and shellfish and a Total Diet Study, FSA has investigated levels in other foods. The work was carried out between 2008 and 2010. The results were supplied to EFSA for inclusion in their review of data as part of their opinion on PBDEs in food and are available at: http://www.foodbase.org.uk/results.php?f_report_id=747. Levels found were similar to or lower than those found in the earlier fish and shellfish survey, the results of which had been reviewed by the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT). COT concluded that the levels found in the latter survey were not a concern for health and therefore the later investigation raised no new concerns. PBDEs have been included in another Total Diet Study, using samples collected between November 2011 and March 2012. The results will be available early in 2013. PBDEs will also be included in a new BFR investigation by FSA, planned to begin in early 2013.

4.1.2.2 Perfluorooctane sulfonate (PFOS)

FSA conducted a survey for PFOS and related compounds in foods (PFAS) between 2007 and 2009. Levels were generally found to be low and no concerns were raised about human health. A summary of the work is available at http://www.food.gov.uk/multimedia/pdfs/fsis0509.pdf. PFAS are also included in the ongoing Total Diet Study (publication early 2013).

4.1.2.3 FSA work on POPs not currently listed under the Stockholm Convention

The investigation of BFRs in foods included hexabromocyclododecanes (HBCDDs), which have been considered for inclusion in the Stockholm Convention. These are also included in the ongoing Total Diet Study. An investigation was also carried out into levels of polychlorinated naphthalenes (PCNs) in food. PCNs, some of which have been reported to have dioxin-like properties, were identified as a possible emerging risk, although their use is historical rather than current. A full report of the investigation is available at: http://www.foodbase.org.uk//admintools/reportdocuments/733-1-1245_C01039_PCN-CP_Final_Report.pdf. The UK COT reviewed the results and concluded that PCNs were not a priority for future work. Nevertheless, they will also be included in the Total Diet Study since the additional analytical work required is minimal. The COT statement is available at: http://cot.food.gov.uk/pdfs/cotstatementpcns200905.pdf. The investigation also included short and medium-chain chlorinated paraffins (SCCP/MCCP), which were detected occasionally but with insufficient data to allow a reliable interpretation.

Finally, FSA has investigated mixed halogenated dioxins, furans and biphenyls (PXDD/Fs, PXBs) i.e. congeners that contain both chlorine and bromine. This work was prompted by an increasing number of reports of dioxin-like activity in environmental samples, in particular those collected near e-waste handling sites, which could not be attributed to pure chlorinated or brominated congeners. PXDD/Fs are thought to be formed during combustion when both chlorine and bromine are present, a circumstance that has become increasingly common with the widespread use of BFRs. The mixed halogenated congeners are of potential importance as there have been some reports that they exhibit higher potency than TCDD. Due to the much larger number of possible congeners and the limited availability of suitable reference standards, the work is very challenging. However, it was possible to show that PXDD/Fs and PXBss were detectable in a wide range of foods. Most notably, a mono-brominated analogue of PCB 126 was detected in 95% of samples and the di- and even tri-bromo analogues were also regularly found. A full report of the work is available at: http://www.foodbase.org.uk//admintools/reportdocuments/656-1-1109_C01050.pdf. Work on PXDD/Fs and PXBs will continue with the Total Diet Study.

4.1.3 Monitoring of POPs in the marine environment

The Centre for Environment, Fisheries and Aquaculture Science (Cefas) undertake monitoring for some POPs in the marine environment. A range of organic contaminants have been determined in marine mammal tissues alongside the Cetacean Strandings Investigation Programme, funded by Defra. These have included PCBs, a range of organochlorine pesticides (DDT and its breakdown products, HCHs, hexachlorobenzene and dieldrin), polycyclic aromatic hydrocarbons, butyltin compounds, the flame retardants PBDEs and HBCD, PFOS and PFOA. Within the UK Clean Seas Environment Monitoring Programme, Cefas also undertakes contaminant analyses (PCBs, PBDEs, PAHs) in surface sediments and biota from offshore regions around England and Wales.

4.2 UK source inventories

Parties to the Stockholm Convention are required to evaluate current releases and develop and maintain source inventories and release estimates for substances listed under Annex C (unintentional releases arising from anthropogenic sources) of the Convention. Evaluation of the inventories enables the assessment of progress made towards the goal of continuing minimisation and to identify where further control measures are required.

The UK has established a range of inventories to monitor emissions including (i) the National Atmospheric Emissions Inventory (NAEI) which provides a standard reference inventory for data on a wide range of POPs and other pollutants to air; and (ii) pollution inventories of releases to air, water and land for large industrial processes which are regulated under the EU Integrated Pollution Prevention and Control Directive (IPPC). These are compiled annually.

The data provided by the UK pollution inventories is consolidated with data from other sources in the UK Pollutant Release and Transfer Register (PRTR). The PRTR enables the UK to meet the obligations of the UNECE Aarhus Convention on public access to information and participation in decision-making and can be found at http://www.unece.org/env/pp/introduction.html.

Action undertaken as part of the UK's 2007 Dioxin Action Plan led to the development of multi-vector inventories for emissions to air, water and land for the unintentionally produced POPs dioxins and furans, HCBs and PCBs. The emissions estimates to water and land were not available for these substances in 2007. The emission estimates provided in the multi-vector inventories have been revised to reflect improved quality of POPs source data gained through further work undertaken to establish a better understanding of emission factors for these POPs. The time trend estimates of emissions to air provided in the 2007 NIP were based on the best available data at the time and have been superseded by those estimated for the air-vector in the more recent multi-vector inventories. This reflects the change in methodology used to calculate the estimates based on improved knowledge about emission sources and factors.

An initial multi-media inventory has also been developed for pentachlorobenzene and work is currently underway (expected to be completed by May 2013) to further disaggregate the multi-vector inventory to the full five vectors (air, land, water, residue and product) required by the Stockholm Convention.

The UK will develop a set of regularly updated emission inventories to satisfy the requirements of Directive 2008/105/EC on environmental quality standards in the field of water policy. The inventories will include priority and priority hazardous substances listed in table 1 of the Directive, updated in accordance with four-yearly reviews.

4.2.1 UK POPs emission inventory infrastructure

Table 4 provides an overview of the scope of POPs information that is available from the UK data reporting mechanisms, including data for the new POPs.

Table 4 – Summary of UK POPs emission inventory infrastructure

Substance	NAEI	IPPC/EPR Pollution Inventories	UK PRTR
Chlordecone			
Dioxins and furans			
Hexabromobiphenyl (HBB)			
Hexachlorobenzene (HCB)			
α- and β- Hexachlorocyclohexane (HCH)			
Lindane			
Polycyclic Aromatic Hydrocarbons (PAHs)			
Polybrominated diphenylethers (PBDEs)			
Polychlorinated biphenyls (PCBs)			
Pentachlorobenzene (PeCB)			
Perfluoro octane sulphonates (PFOS)			
MEDIA			
Air			
Land			
Water			
Waste transfer			
SOURCE TYPES			
Point source			
Diffuse Source			
Inventory start date	**1990**	**1995**	**2007**

Key

NAEI – National Atmospheric Emissions Inventory

IPPC/EPR Pollution Inventories – EU Integrated Pollution Prevention and Control Directive/Environmental Permitting Regulations Pollution Inventories

UK PRTR – United Kingdom Pollutant Release and Transfer Register

NO DATA IN INVENTORY
DATA IN INVENTORY

4.3 Current releases of dioxins, PCBs and HCB in UK

The POPs multi-vector inventories provide estimates of emissions to air, land and water spanning the years from 1990-2010. The inventories show that emission rates of dioxins, PCBs and HCB in the UK have declined significantly over this period. These reductions are detailed in Table 5 below.

Table 5: Emission reductions in dioxins, PCBs and HCB for the UK between 1990 and 2010

	% reduction between 1990 and 2010	
	All vectors	**Air**
Dioxin	65	80
PCBs	95	88
HCB	98	99

The levels of dioxin and dioxin-like PCBs in food have reduced by approximately 70% between 1997 and 2007.

4.3.1. Dioxins and Furans

Inventories of dioxins are reported as a total of dioxins and furans as a measure of toxic equivalency factors. A summary of how TEQ measurements are derived and the equivalent measures for dioxins and furans are attached at Annexes 4, 4A and 4B. There are two systems in current use for presenting toxic equivalency factors for dioxins: the International TEQ (I-TEQ) and the more recent World Health Organisation the TEQ (WHO TEQ).

The annual releases of dioxins[9] in 2010 were estimated to be:

- 189 g I-TEQ/year to air
- 501 g I-TEQ/year to land (includes all releases to land including waste to landfill); and
- 26 g I-TEQ to water

The 2010 release estimates for different sectors indicate that diffuse sources, such as the small scale combustion of waste and accidental fires, remain major contributors of dioxin emissions (Annexes 5A1 and 5A2). The iron and steel industry is still the main industrial emission source. Emissions to land/landfill are dominated by diffuse sources, but are supplemented by Air Pollution Control (APC)[10] residues and granulated slag generated through combustion processes largely within the incineration, power generation and metal industries. The review of the Dioxin Action Plan (Annex 6) highlights the importance of waste recycling in reducing quantities consigned to landfill.

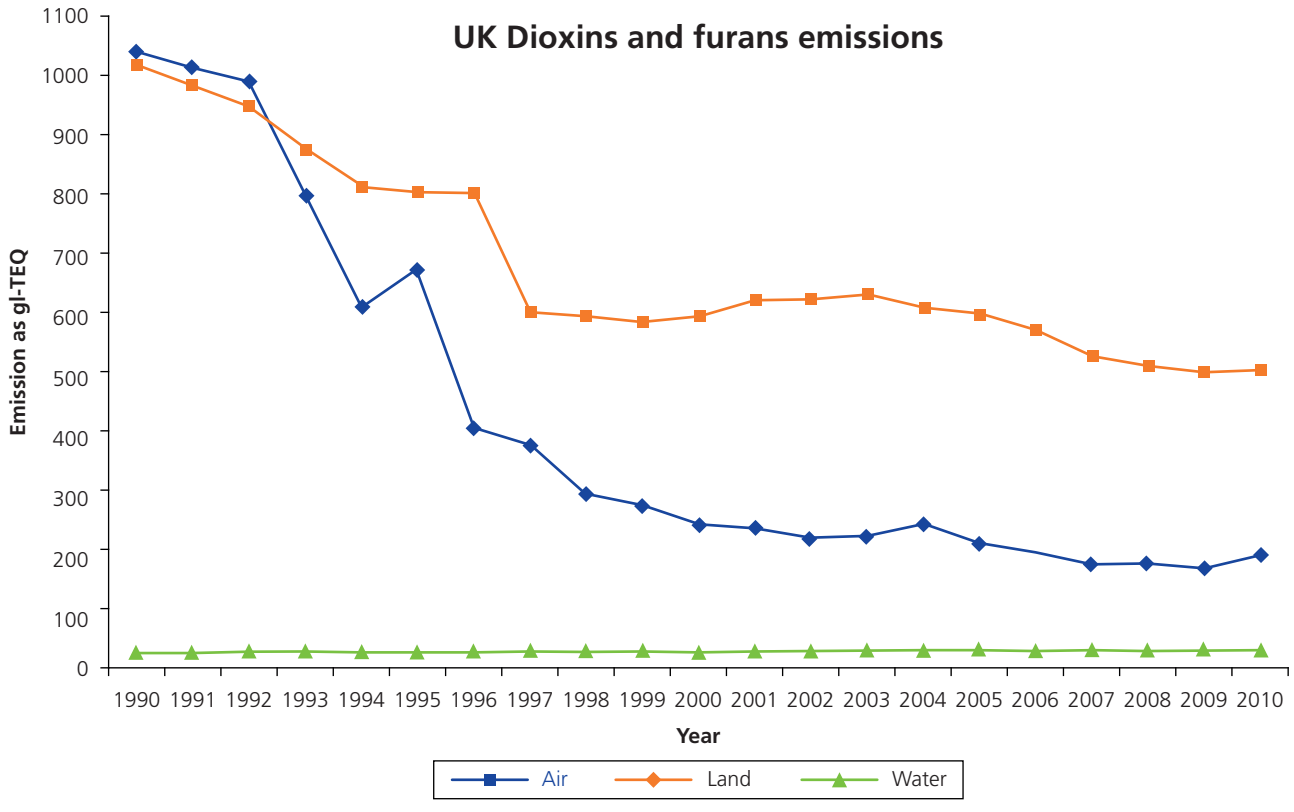
9 The term dioxin includes dioxins (polychlorinated dibenzo-p-dioxins (PCDD)) and furans (polychlorinated dibenzofurans (PCDF))
10 Mainly fly ash (fine particles arising from flue gases caught in flue gas cleaning systems) plus activated carbon and lime (gas scrubbing materials)

Waste water treatment works are the main source of dioxin and furan emissions to water, with figures ranging between 24.1 and 26.2g I-TEQ over the period 1990 to 2010. Because these discharges have not been reported consistently year on year, in order to derive data for a full time-series an emission factor was derived from a period when discharges were reported consistently. The emission factor has used in year reported values dividing against UK population to produce a per capita factor. Subsequent years have been calculated by multiplication of human population figures, reflecting the fact that this source is determined by population density.

4.3.1.1 Emission trends for dioxins and furans

Figure 1 shows the decline in emissions of dioxins and furans between 1990 and 2010, as stricter controls on industrial sources have taken effect. The emissions have started to level off suggesting that it is likely to become increasingly difficult to achieve further significant reductions.

Figure 1: Dioxin and furan emissions for the UK 1990-2010



4.3.2 Polychlorinated Biphenyls

Polychlorinated Biphenyls (PCBs) are a family of chemicals made up of different chemical congeners which exhibit different toxicities. Releases of PCBs into the environment will contain complex mixtures of these congeners which would require full sampling and analysis to better understand the ratios of the different congeners. In many cases this information is unavailable and can be difficult to derive for individual congener level therefore internationally the convention is to quote emissions as total PCB, with the potential for including the 'dioxin-like PCB' fraction as a sub-total where possible. The inventory reports estimates of the total weight of PCBs released.

The 2007 NIP reported that releases of PCBs to air were estimated to be 1,330kg in 2004. Owing to recent improvements in the estimation methods this figure has now been revised to 1,119kg.

Annual releases of PCBs in 2010 were estimated to be 799kg/year, which represents a 320kg (29%) reduction on the revised 2004 estimates. Polychlorinated Biphenyls have not been manufactured and used in the UK for many decades but old PCB-containing equipment continues to exist and still accounts for the majority of all air emissions at 59% (see Table 6).

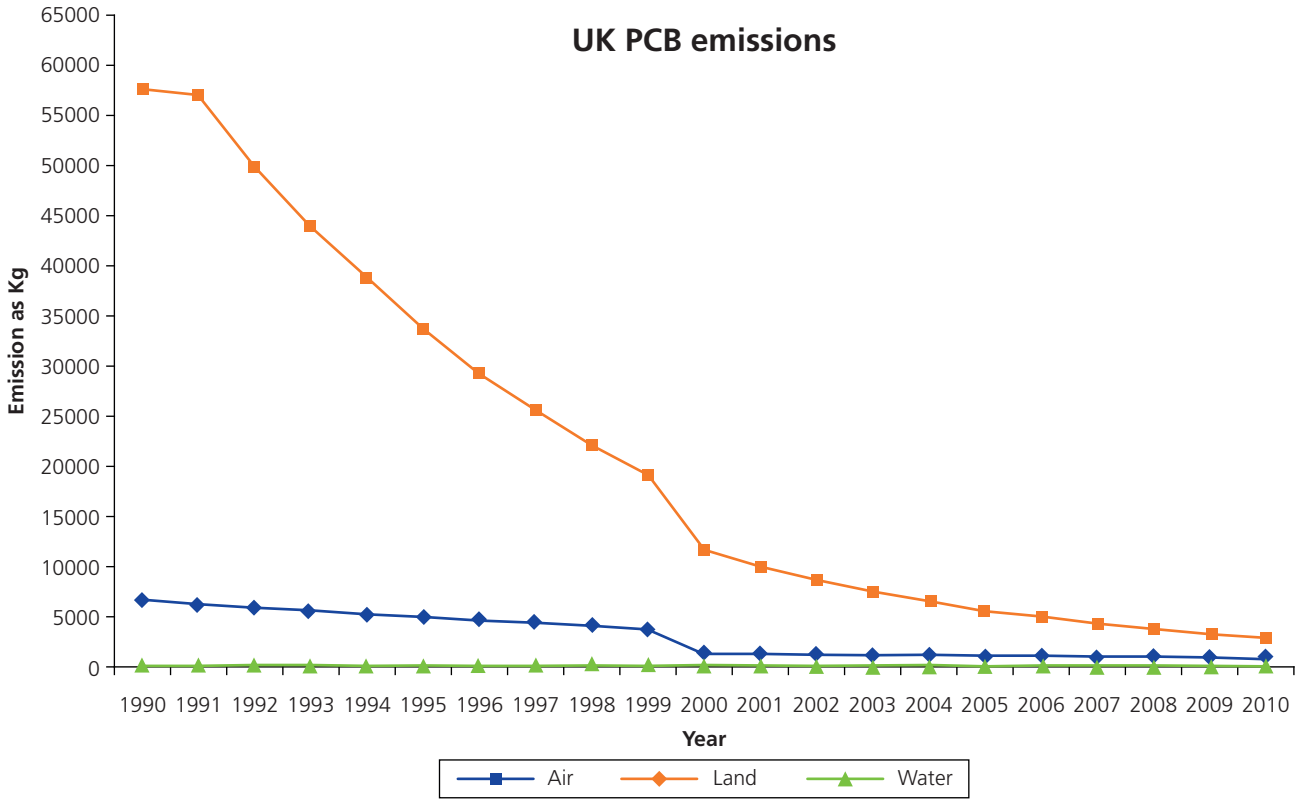
Table 6: Key Sources of PCB emissions to air in 2010

Source of PCB emissions	Releases of PCB to air (kg/year)	Percentage of total PCB emissions to air (%)
Di-electric equipment	471	59
Electric Arc Furnaces	111	14
Backyard burning	80	10
Accidental fires vehicles and buildings	40	5
Power station combustion of coal	32	4
Basic Oxygen Furnaces (Iron production)	16	2
Iron and steel sintering	16	2
Other sources	4	4

Releases to land, including waste to landfill, are reported for the first time and were estimated at 2938kg/year in 2010. Compared to data modelled over the last twenty years this represents a highly significant reduction since 1990 (Figure 3). Figure 3 also demonstrates that levels of PCB releases to both air and land significantly reduced following an awareness campaign in 2000 that resulted in the identification and removal of large PCB containing equipment from the environment.

Emissions of PCB to water have been reported to the Environment Agency since 2007, in a range between 0.6 to 2kg per annum.

Figure 3: UK PCB emissions for 1990-2010



4.3.3 Hexachlorobenzene

The annual releases for HCB in 2010 indicate a continuing decline in emissions to air and land since 1990 with negligible releases to water over the last twenty years.

Table 7: UK HCB emissions for 1990, 2000 and 2010

Emissions in Kg	1990	2000	2010
Air	3170	80	33
Land*	54	12	9
Water	3.1	1.7	1.7

*Land emissions include all releases to land including waste to landfill

Since the ban on the use of hexachloroethane (HCE) in secondary aluminium manufacture the dominant source of emissions to the environment in the UK has been through the use of pesticides.

The previous emission estimates quoted in the UK National Implementation Plan (2007) were based on UK agricultural statistics and literature emission factors assuming 100% release to air at the maximum allowable concentrations under UK and European law. As part of the POPs multi-media inventory development carried out in 2009 the model for emissions was revised based on the work of Yu Fong

(2008)[11] to account for spray drift. This apportioned the pesticide used based on air, land and water compartments more suitably. The further update of the UK POPs inventories carried out in 2010 included a sampling and analysis regime for chlorothalonil, the main pesticide related to HCB emissions. This work was used to review the emission factor used for HCB emission from chlorothalonil to provide the best 'working concentration' estimates. The previous estimates were based on work by Bailey RE (2001)[12], which was based on the 40 ppm regulatory threshold. The 2010 sampling and analysis regime took 30 samples (23 from chlorothalonil products and seven from a related product as exploratory work) at point of usage and analysed for both chlorothalonil and HCB. Based on market share this gives a new weighted average of 8ppm. The estimates assume that the 1998 (and before) factors are correct and extrapolated between 1998-2009. Assuming that 1998 will be 40ppm and 2009 will be 8ppm.

The other key source for HCB emissions is the combustion of fuels within the power industry, which accounted for 9kg (27%) of HCB emissions to air in 2010 (Annex 5 (B1)).

4.4 Overview of the emission data for the new POPs

All of the ten new POPs added to the Stockholm Convention in 2009 and 2011 had either already been banned in the UK and/or had their use restricted under other reporting protocols, in particular the UNECE's convention on long range transboundary air pollution (CLR-TAP). International and UK-specific data on the source activities and environmental releases of the new POPs is scarce and associated release estimates are subject to high levels of uncertainty.

4.4.1 Annex A substances, Pesticides (chlordecone, endosulfan, alpha and beta hexachlorocyclohexane (HCH) and lindane (gamma HCH)

The 2008 emission estimates for those pesticides for which data exists are provided in the following table.

Table 8: UK emission estimates in 2008 for the new pesticides

POP	Emission to air, land and water in total (2008)
Chlordecone	Negligible
Alpha HCH	7.4 tonnes to all media
Beta HCH	2.7 tonnes to all media
Lindane (gamma HCH)	26 tonnes to all media

Pollution inventory data compiled by the Environment Agency for Hexachlorocyclohexane (HCH) (all isomers) shows reported releases to water and waste water of less than 0.2kg in 2010. These releases are attributable to the energy, sewage treatment and textiles and fibre processing industries. There is no data to suggest that this has led to a breach of environmental quality standards under the Water Framework Directive.

Chlordecone has not been used in the UK for many years and estimates are considered to be negligible. Estimates for endosulfan are not available.

11 Yongfu Xu (2008) 'Review and update of the HCB inventory emissions to air, land and water', paper published by AEA.
12 Bailey RE (2001) Global HCB emission, published in Chemosphere 43, pp 167-182

4.4.1.1 Monitoring information in water for some of the pesticides

The Environment Agency carries out water monitoring for some pesticides listed in the Stockholm Convention. Analysis conducted concerning compliance with the environmental quality standards for Hexachlorocyclohexane (HCH, alpha, beta and gamma (Lindane) isomers) shows a limited number of exceedences for HCH at a limited number of specific sites. Further analysis of this data will be carried out in order to assess the overall significance of these emission and to determine if further action is required to eliminate them.

4.4.2 POPs listed in 2009 – Annex A substances, Industrial chemicals (hexabromobiphenyl and polybrominated diphenyl ether (tetra, penta, hexa and hepta BDE))

The emission estimates for 2008 for these substances are provided in the table below.

Table 9: UK Emission estimates in 2008 for the new Annex A chemicals

POP	Emission to air (2008)	Emission to land (2008)	Emission to water (2008)
Hexabromobiphenyl (HBB)	1.8kg	no data	<1 gram
Tetra and PentaBDE	2500kg	2000kg	700kg
Hexa and HeptaBDE	0.77kg	no data	no data

4.4.2.1 Hexabromobiphenyl

A separate inventory study found that no HBB emissions were expected for Europe in 2007. Despite a low residual risk of releases from use and disposal of imported plastic goods, environmental releases of HBB in the UK in recent years are estimated to be very low (50kg to landfill; 1kg to air).

4.4.2.2 Polybrominated diphenylethers (hexa-, hepta-, tetra- and penta- PBDE)

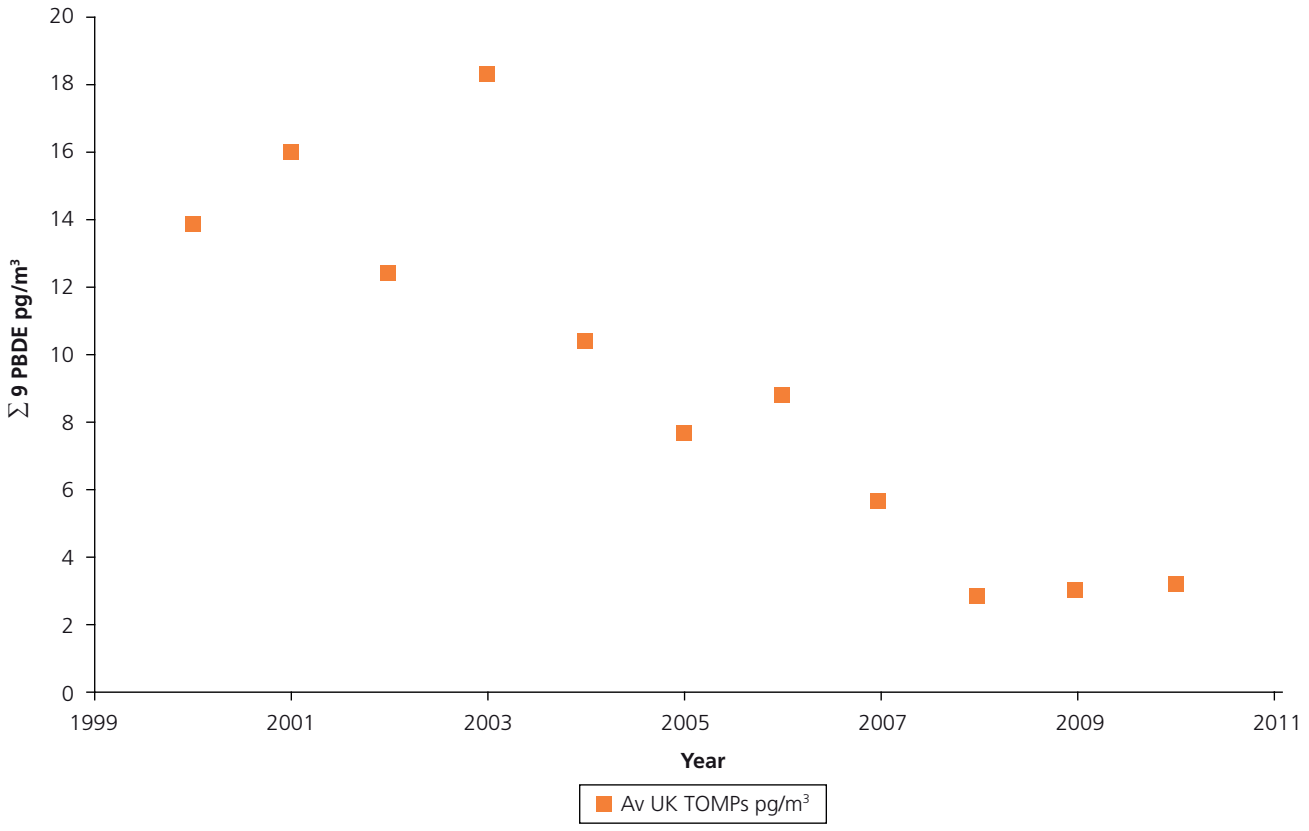
A recent re-analysis of the TOMPs air sample archive to determine concentrations of polybrominated diphenylethers (PBDEs) in the UK atmosphere showed consistent decreases in concentrations over recent years with the observed decline starting during the period 2001-2003[13]. This is illustrated in Figure 5 for the sum of nine PBDE congeners using average data for four sites. Of the individual congeners detected in the air samples, BDE-47 (tetra) was the most abundant at all sites and in almost all samples, followed by BDE-99 (penta), with both congeners dominating all calculated profiles. Given that these two congeners are the main components of the penta-BDE (PeBDE) technical mixture, with BDE-47 accounting for 38-42% and BDE-99 accounting for 45-49% of the total, these results likely reflect the extensive use of that specific technical mixture.

The European emission data from Prevedouros *et. al*. (2004)[14] have been recently updated to provide emission estimates for the UK. These estimates are based on a dynamic model of historical estimates of PBDE manufacture, incorporation into products (e.g. polyurethane foams) and subsequent emission from each product type using specific emission factors over their respective life cycles. A strong correlation between the estimated emissions and the measured concentrations from the TOMPs network (R^2=0.79, p=0.0084) suggests that on-going releases from articles containing PeBDE products is likely to be controlling the long-term trends in the UK atmosphere.

13 Birgul, A., Katsoyiannis, A., Gioia, R., Crosse, J., Earnshaw, E., Ratola, N., Jones, K.C., and Sweetman, A.J. (2012) Polybrominated diphenyl ethers (PBDEs) in the United Kingdom atmosphere. Environmental Pollution, 169, 105-111

14 Prevedouros, K., Jones, K.C., and Sweetman, A.J. (2004) Production, Consumption and Emission Estimates for Pentabrominated Diphenyl Ether (PeBDE) in Europe (1970 to 2000). Environmental Science and Technology, 38(12), 3224-3231

Figure 5: Trends for PBDEs ambient air concentrations over time at TOMPs sites (data represents an average of four sites)



4.4.3 Annex B substance, Industrial chemical (perfluorooctanesulphonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F)

POP	Emission to air (2010)	Emission to land (2010)	Emission to water (2010)
Perfluorooctanesulfonic acid (PFOS)	0kg	5kg	820kg

The UK environmental releases of PFOS in 2008 were estimated to be around 0 kg to air, 5kg to land and 600kg to water. However, a limited sampling and analysis programme was carried out in 2010 to verify the modelling methods used to estimate emissions from sewage works which are reported to the Environment Agency's Pollution Inventory. These findings, which related to the Calder and Aire rivers, were used to revise UK estimates for annual emissions to water and land from agricultural applications of sewage sludge. The resulting new annual estimates are around 820kg PFOS to water, with emissions to land and air remaining at 5kg and 0kg respectively.

4.4.4 Annex A and C substance, Pesticide, Industrial chemical, Unintentional by-product (pentachlorobenzene)

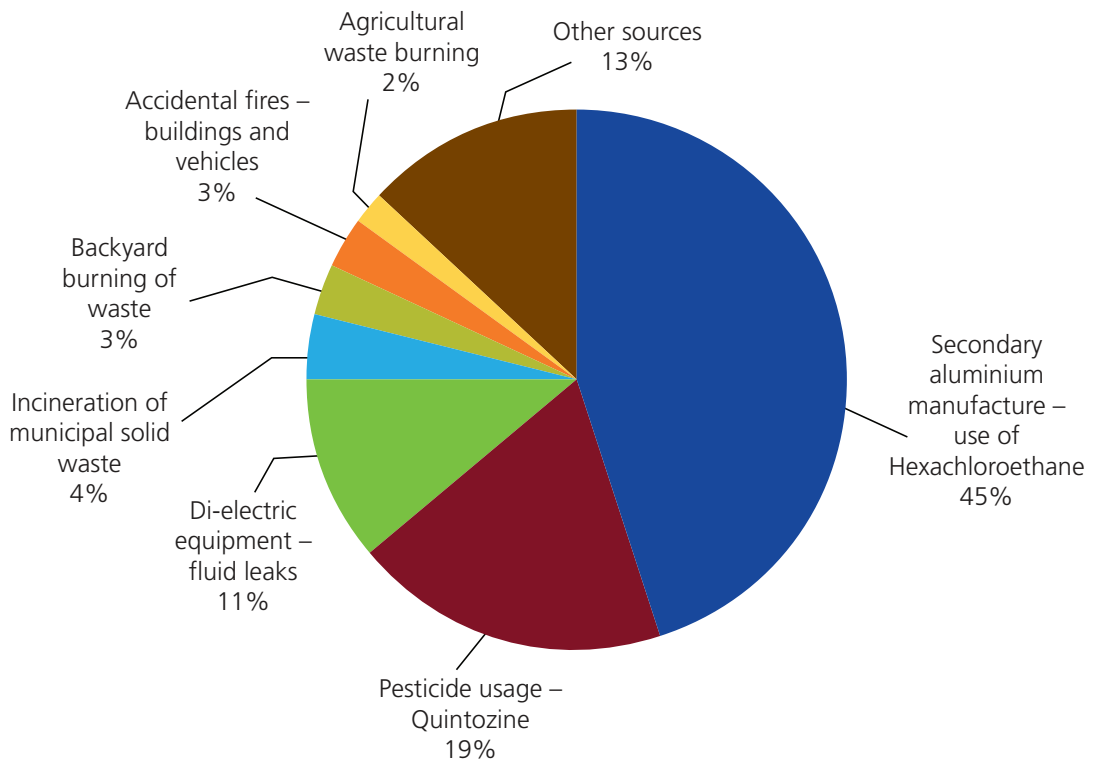
POP	Emission to air (2010)	Emission to land (2010)	Emission to water (2010)
Pentachlorobenzene (PeCB)	35kg	233kg	3kg

PeCB is included in the PRTR[15] as its emissions are above the threshold of 1kg to all vectors.

Estimated PeCB emissions to air have declined significantly in 2010 to only 9% of the 1990 estimate of 386kg. This has been due to legislative control measures on industrial sources and the development of effective abatement technologies. The comparatively low 2010 PeCB emissions data to air are now dominated by sources such as the backyard burning of waste (33%) and accidental fires (21% (see Figure 5 and 6).

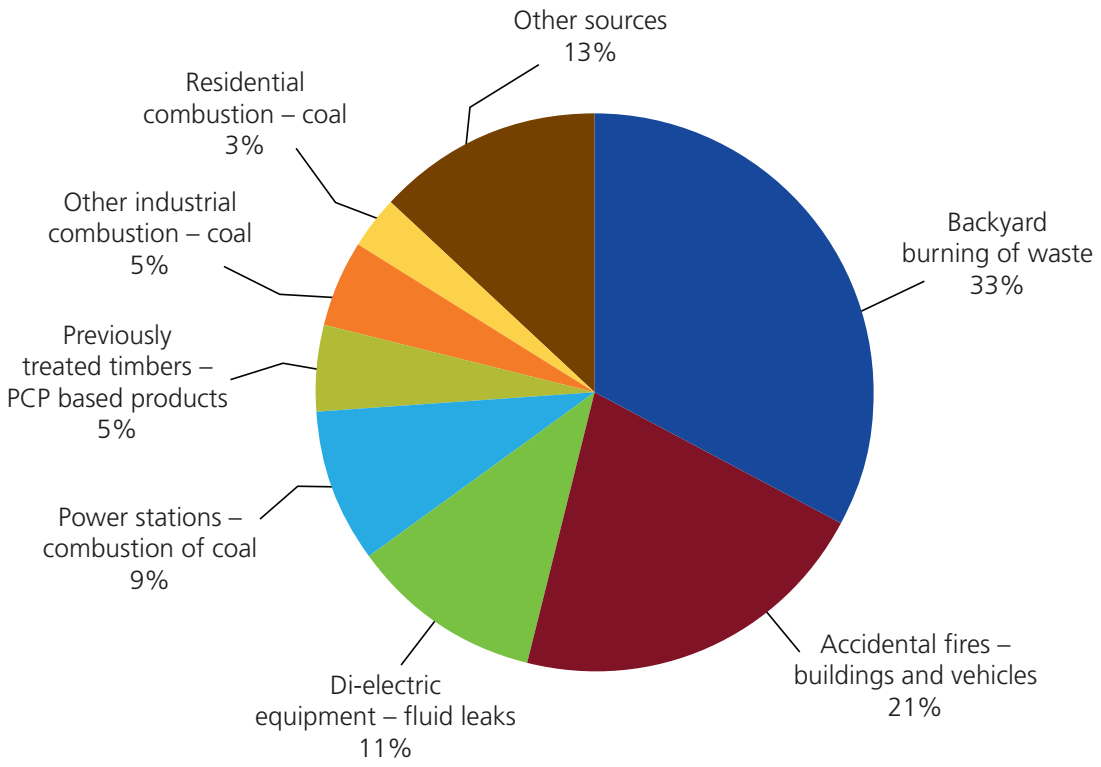
Estimated PeCB releases to land remained moderately high at 233kg in 2010 and were primarily due to the disposal of contaminated ash, notably from diffuse waste combustion sources. Water emissions were dominated by waste water treatment works and reflect the residue emissions from the food chain.

Figure 6: UK pentachlorobenzene emissions to air 1990 (386kg total emission)



15 The UK PRTR will include all emissions of POPs from industrial sources at IPPC part A2 and greater, provided they exceed a pre-set annual emission threshold.

Figure 7: UK Pentachlorobenzene emissions to air 2010 (35kg total emission)



4.5 Human exposure to POPs

Human exposure to POPs can be through air, water, soil, food, dermal contact and occupational exposure. Studies have indicated that in contemporary industrialised settings more than 90% exposure of the general population to these compounds is through food. In the UK, the decline in industrial emissions of POPs has resulted in a reduction in food-borne exposure. It is now recognised that other exposure routes such as inhalation could play a role.

4.5.1 Evaluation of concentrations in food

4.5.1.1 Polybrominated Diphenyl Ethers (PBDEs)

FSA has been investigating levels of PBDEs in food since 2003. Further to the work reported in the 2007 National Implementation Plan, which included trout and eels, farmed and wild fish and shellfish and a Total Diet Study, FSA has investigated levels in other foods. The work was carried out between 2008 and 2010. The results were supplied to EFSA for inclusion in their review of data as part of their opinion on PBDEs in food and are available at: http://www.foodbase.org.uk/results.php?f_report_id=747. Levels found were similar to or lower than those found in the earlier fish and shellfish survey, the results of which had been reviewed by the Committee on Toxicity of Chemicals in Food, Consumer Products and

the Environment (COT). COT concluded that the levels found in the latter survey were not a concern for health and therefore the later investigation raised no new concerns. PBDEs have been included in another Total Diet Study, using samples collected between November 2011 and March 2012. The results will be available early in 2013. PBDEs will also be included in a new BFR investigation by FSA, planned to begin in early 2013.

4.5.1.2 Perfluorooctane sulfonate (PFOS)

FSA conducted a survey for PFOS and related compounds in foods (PFAS) between 2007 and 2009. Levels were generally found to be low and no concerns were raised about human health. A summary of the work is available at http://www.food.gov.uk/multimedia/pdfs/fsis0509.pdf. PFAS will also be included in the ongoing Total Diet Study, which is due for publication in early 2013.

4.6 Evaluation of concentrations in the marine environment

The Centre for Environment, Fisheries and Aquaculture Science (Cefas) undertake monitoring for some POPs in the marine environment. Their monitoring using harbour porpoises has shown concentrations of:

- PBDEs (summed tetra to hexa congeners) in the range from not detected to 15.7 mg/kg lipid weight between 1992-2008, with the peak concentration observed in a porpoise stranded in 1993. Monitoring has shown concentrations declining significantly since 1998.
- HCHs (alpha and gamma) declining over time with concentrations over the period 1992-2008 ranging from 0 to 2.0mg/kg lipid weight and the peak concentration occurring in a porpoise stranded in 1992.

4.7 Effectiveness evaluation of current legislation on emissions

Without exception, monitoring surveys in the UK have demonstrated a decline in emissions of dioxin, PCBs, HCB and PeCB (see Annexes 5A to 5D for data on time series to air, land and water).

Section 5

Strategies and measures to further reduce the emissions of POPs

The UK Government's continuing goal is to protect human health and the environment from the risks posed by POPs and to reduce the total releases derived from anthropogenic sources of each of them. Over the past two decades, the UK Government has taken steps to identify, quantify and manage the major sources of unintentional releases of dioxins, PCBs and HCB listed in the Stockholm Convention. Previous major sources such as waste incinerators and industrial processes have now been controlled via legislation and abatement techniques and continue to be closely regulated.

Current emissions of dioxins, PCBs, HCB and PeCB are dominated by a wide range of smaller diffuse sources. There is now better knowledge about burning habits which has enabled improvements to be made in deriving data on burning activities, and reducing levels of uncertainty in the emissions for these diffuse sources. Overall the UK has seen a significant decline in emissions for these POPs since 1990; between 1990 and 2010, emissions to air, water and land have reduced by approximately 65%.

Data on emissions of the new POPs is limited. Additionally, there are gaps in the UK Government's knowledge of potential sources and emissions from previous legacy applications for the new POPs. Similarly, knowledge is not yet fully developed on the likely emissions of POPs contained in in-use items through to these entering the waste stream. Current evidence suggests that the most pressing task is to improve knowledge in these areas, with priority being given to lindane, polybrominated diphenyl ethers (PBDE) and PFOS. The UK Government also recognises that managing reductions of emissions from in-use items entering the waste stream will require particular consideration. To this extent, the UK Government has already started investigating the likely impact of PBDE-containing electrical and electronic equipment and end-of-life vehicles in waste streams.

Multi-media source inventories have been established to provide a more comprehensive assessment of dioxin, PCB and HCB emissions to air, water and land. These have been expanded to capture emissions for PeCB and work is underway to bring the new POPs into scope of the inventories. Due to the declining trend in the emissions of the original POPs, the UK Government is proposing to reduce the frequency of monitoring for these to allow for this additional work.

Defra will continue to secure reductions in emissions from processes and activities regulated by Local Authorities. The UK Government and devolved administrations will also work with the Local Authorities to explore opportunities to build on existing efforts to improve public awareness of the current regulatory regime on burning of domestic and garden waste to reduce emissions of dioxins, PCBs, HCB and PeCB.

5.1 Assessment of the potential emissions from legacy lindane production and application

The use of the pesticide lindane for industrial treatment of wood used in construction, fencing, railway sleepers and other similar applications declined from 1980. It was withdrawn for use from the market in 2002. The treated wood has an estimated lifespan of 50 years. The emissions to air from this historic use were estimated to be 58 tonnes in 1990 declining to 7.6 tonnes in 2010. Additionally, there may be legacy emissions of lindane to land from unused treated stockpiles of wood.

5.1.1 Identifying and quantifying potential stockpiles of unused treated wood

A consultation with the timber and construction sector will be undertaken to quantify potential stockpiles of unused treated wood as emission sources for lindane.

5.1.2 Identifying and assessing emissions from potential waste piles from historical lindane production

A review of historical lindane producers will be undertaken to establish the disposal routes for the waste generated by the industry. The information will be used to assess the potential for ongoing emissions from any identified waste sites.

5.2 Emission from consumer products and domestic activity

5.2.1 Uncontrolled emission to the environment

POPs emissions to the environment are regulated for certain consumer appliances and goods. For example, the disposal of waste generated from electronic equipment containing flame retardant POPs is regulated whereas items such as fabrics and furniture containing POPs are not. These remain a potential source of POPs emissions to the environment.

A study will be undertaken to assess levels of emissions of polybrominated diphenyl ethers and PFOS from consumer products. Depending on the results of this work consideration will be given to potential methods for controlling emissions.

5.3 Food chain pathway, mechanisms and livestock uptake

5.3.1 Pharmaceuticals, veterinary medicines and personal care products

The Food Standards Agency has recently begun investigating the uptake of pharmaceuticals, veterinary medicines and personal care products from the environment into food. Although none of the chemicals under investigation are currently designated as POPs, some may meet the necessary criteria. It is anticipated that the results of this work will be published in the first half of 2013, after which a decision will be made on what further investigative work may be required.

5.3.2 Contaminant levels in fish and shellfish in UK waters

In late 2012, the FSA will be commissioning a two-year, geographically-based investigation of contaminant levels in fish and shellfish taken from UK waters. The investigation will include existing and emerging POPs and will target higher-risk species and areas of potential pollution (heavy shipping, onshore industrial activity, major estuary outflows, etc). As well as supporting the FSA objective of ensuring that food produced in the UK is safe to eat, this work will provide baseline data for Descriptor 9 of Good Environmental Status (food produced from the marine environment must be safe for consumption) within the scope of the Marine Strategy Framework Directive (MSFD).

5.3.3 Use of former waste materials in agricultural applications

The FSA is also intending to commission an investigation into the use of former waste materials in agricultural applications. Significant quantities of ash from the incineration of paper sludge, poultry litter and meat and bone meal are being considered for use as, for example, soil improvers, animal bedding desiccants or fertilisers. Similarly, chipped waste wood is being considered for animal bedding. All of these materials may contain significant quantities of dioxins and other POPs and it is important to ensure that the proposed uses do not lead to an unacceptable uptake into crops or exposure of grazing animals.

5.3.4 Occurrence of brominated flame retardants (BFRs) in food

The European Food Safety Authority has published a series of opinions on brominated flame retardants (BFRs), including PBDEs and hexabromocyclododecane (HBCDDs). Based on the various recommendations in these opinions, the FSA will be commissioning further investigations into the occurrence of BFRs in food.

5.4 Implementation schedule for measures to reduce the emissions of POPs

The following table summarises the identified actions and measures to be taken together with an implementation schedule:

Table 10: Implementation schedule for improvements to the UK POPs inventories and related activities

Activity	Actors	Timing
POPs monitoring		
Development and maintenance of multimedia emissions inventory for new and existing POPs	Defra	Ongoing
TOMPS Monitoring network (Air)	Defra	Ongoing
Assessment of the potential emissions from legacy lindane production and application		
Investigative study to quantify potential stockpiles of unused treated wood as emission sources for lindane	Environment Agency	2013/2014
A review of the historical lindane producers to establish the disposal routes for the waste generated by the industry and identify potential sources of emissions	Environment Agency	2013/2014
Emission from consumer products and domestic activity		
Investigative study to explore levels of emissions of polybrominated diphenyl ethers and PFOS from consumer products	Defra/ Environment Agency	2013/2014
Food chain pathway, mechanisms and livestock uptake		
Testing of food and animal feed	FSA	Ongoing
Pharmaceuticals, veterinary medicines and personal care products	FSA	Current, due to publish in 2013
Investigation of contaminant levels in fish and shellfish in UK waters	FSA	Commencing late 2012
Investigation of use of former waste materials in agricultural applications	FSA	Commencing 2013
Occurence of brominated flame retardants (BFRs) in food, in line with recommendations of European Food Safety Authority (EFSA) opinions	FSA	Subject to timing of EFSA publication of opinions

Reduction or elimination of releases from stockpiles and wastes

Article 6 of the Stockholm Convention requires that appropriate strategies should be developed to identify stockpiles and wastes consisting of or containing or contaminated with POP substances. Stockpiles identified by these strategies should be managed in a safe, efficient and environmentally sound manner.

The Stockholm Convention defines which stockpiles are deemed as waste and requires that they are handled, collected and transported in an environmentally sound manner. The Convention requires wastes to be disposed of in such a way that the POPs content is destroyed or irreversibly transformed. However, waste can be otherwise disposed of in an environmentally sound manner when destruction or irreversible transformation does not represent the environmentally preferable option, or where the POP content is low. The Stockholm Convention and the Basel Convention are working together to agree low POP content levels for the banned substances.

Regulation (EC) 850/2004 on POPs contains provisions that go beyond those required by the Stockholm Convention. Under Article 7, the Regulation requires that waste consisting of, containing or contaminated by POPs shall be disposed of or recovered in such a way as to ensure that the POPs content is destroyed or irreversibly transformed by physico-chemical treatment, incineration on land or use as secondary fuel.

Council Regulation (EC) No 1195/2006 adopted low POPs concentration limit values for annex IV of the POPs Regulation. Values for low POP content limits (concentration limits) in annex IV of the Regulation provide the trigger level above which all POPs in wastes have to be destroyed or irreversibly transformed. Derogations from this requirement are allowed, in Article 7(4)(b), where destruction or irreversible transformation is not the environmentally preferable option. The wastes to which this exemption may apply, and the maximum concentration limits up to which the exemption can apply, are listed in annex V. However, the derogations are only to be used by Member States in exceptional cases. It is UK Government policy that no waste should be exported from the UK for disposal.

In addition, those dealing with waste consisting of, containing or contaminated with POPs will be subject to the other waste controls, as appropriate, such as duty of care and controls for hazardous waste.

The concentration limits in the POPs regulation are listed in the Table below:

Table 11: Persistent organic pollutants concentration limits in waste
Annex IV – Low POPs concentration limits

Substance	Concentration Limit
Dioxins/Furans	15µg/kg
PCBs	50mg/kg
Other Persistent organic pollutants	50mg/kg

At the time of writing this updated National Implementation Plan, low POPs concentration limits for tetra-, penta-, hexa- and hepta- bromodiphenyl ether, perfluorooctane sulfonic acid and its derivatives, and endosulfan had not been set.

Other obligations of the Stockholm Convention

The principal obligations of the Convention require that Parties adopt and implement measures aimed at reducing or eliminating the release of POPs into the environment. This section considers a range of other obligations listed in the Convention and what the UK is doing to implement them.

7.1 Information exchange, awareness and education

Article 10 includes obligations for Parties to facilitate 'Public information, awareness and education' on POPs. Specifically, it requires that 'each Party shall, within its capabilities promote and facilitate *inter alia* 'training of workers, scientists and educators, policy and decision makers'. In the UK it is standard practice when developing decision making on environmental policy to consult stakeholders and make information publicly available through a range of media including publications of consultation documents, research reports and the internet.

Making information about the environment publicly available is essential in achieving sustainable development. By providing access to environmental information the public is able to take decisions in the full knowledge of the likely environmental implications and to participate more effectively in decision-making processes that affect the environment. Openness also promotes transparent decision-making and greater public accountability of how authorities undertake their duties and responsibilities in the UK.

Since 1992, the public has had a statutory right of access to environmental information held by public authorities and certain other bodies. This stems from the European Community Directive 90/313/EEC on the freedom of access to information on the environment. In 2003, the 1990 Directive was replaced by EC Directive 2003/4/EC on public access to environmental information, which takes account of advances in technology, reflects international developments in access rights and also learns from the experience of the earlier regime.

The Defra website www.defra.gov.uk contains a wide range of information on what the Government is doing to protect the environment in a range of areas such as chemicals, air quality, soil and contamination and water quality. It includes news on national, EU and international chemicals policy, Government position statements, advisory committee papers and reports, and developments in research.

The National Air Quality Information Archive is the UK's national archive of air quality information and reports, including detailed air quality monitoring data and statistics, plus major sections on local air quality management and air quality research. This may be found at:
www.airquality.co.uk/archive/index.php

Information on emissions is also included in the UK's National Atmospheric Emissions Inventory, which compiles estimates of emissions from UK sources including road transport, power stations and industrial plants. This may be found at: www.naei.org.uk

The Environment Agency's Pollution Inventory is an annual record of pollution in England and Wales from activities that it regulates. One of its main objectives is to provide the public with easily accessible information about pollution from industrial and other sources in their local area and nationally. It records pollution that is released into air, discharged into rivers or the sewerage network, or is transferred off site as waste. This feeds in to the Agency's *'Greener Business Report'* which highlights the areas of success and failure in achieving pollution reductions. It also feeds into the National Atmospheric Emissions Inventory, and both the UK and European Pollutant Release and Transfer Register (PRTR). The pollution

inventory home page can be found at: http://www.environment-agency.gov.uk/

Likewise, the Scottish Environment Protection Agency provides a wide variety of environmental information in reports and on its website, which also contains an education homepage: http://www.sepa.org.uk/default.aspx

The Scottish Environment Protection Agency's 'Scottish Pollutant Release Inventory (SPRI)' is an annual record of pollution in Scotland and can be found at: http://www.sepa.org.uk/air/process_industry_regulation/pollutant_release_inventory.aspx

The Northern Ireland Environment Agency also compiles emission data for Northern Ireland and submits this to the UK Pollutant Release and Transfer Register (PRTR).

The data provided by the UK pollution inventories is consolidated with data from other sources and can be found at: http://prtr.defra.gov.uk/

For some persistent organic pollutants, such as dioxins, the major route of human exposure is through diet. It is therefore important that the public has access to information on food. In the UK this information is provided by the Foods Standards Agency which, along with every other public authority, has a legal duty under Section 19 of the Freedom of Information Act 2000 to adopt and maintain a scheme which relates to the publication of information and to have the scheme approved by the Information Commissioner, to publish information in accordance with that scheme, and to review the scheme from time to time. The Agency's publication scheme brings together in one place the many differing types of information that are issued by the Agency in the discharge of its public functions and it categorises the information type and provides details on how to obtain it.

The Agency produces a wide range of publications for the public and the food industry, many of which are available free of charge and some of which can be downloaded from its website: www.food.gov.uk

In addition, Defra will provide and exchange information with Parties to Convention via the Convention Secretariat.

7.2 Research, development and monitoring

Article 11 requires that Parties facilitate and encourage research, development and monitoring of POPs on their sources, releases, transport levels and trends and effects in humans and environment and support international obligations aimed at research, data collection and monitoring.

The UK Government continues to support a substantial amount of scientific research to underpin policy development on POPs. Government funded monitoring is commissioned and carried out by a range of organisations for a variety of purposes. These include compliance monitoring for international, European and national legislation, trend monitoring and plugging knowledge gaps about particular chemicals including POPs. Details about past and ongoing research can be found in Defra can be found at the following website: http://randd.defra.gov.uk/

A number of other Government Departments and agencies, including Department of Health (e.g. Environmental Health, Air Pollution), Environment Agency (e.g. Air Quality, Human Health Effects, Diffuse Pollution), Food Standards Agency (e.g. chemical contaminants in food) and the Scotland and Northern Ireland Forum for Environmental Research, have significant research portfolios on chemicals including POPs and information on these can be found at the following:
http://www.dh.gov.uk/health/category/research/
http://www.environment-agency.gov.uk/research/
http://food.gov.uk/science/
www.sniffer.org.uk

Defra has supported air monitoring for different pollutants over the years including POPs. Environmental monitoring and modelling of air pollution is essential to provide reliable information on air quality and to satisfy statutory requirements.

Defra has undertaken multimedia fate modelling to support development and negotiation of international instruments to control POPs, involving consideration of restrictions on POPs already covered by the United Nations Economic Commission for Europe (UNECE) POPs Protocol and Stockholm Convention, as well as new candidate POPs for inclusion.

Details of mandatory monitoring of food and animal feed undertaken by the Food Standards Agency can be found at the following website: www.food.gov.uk

7.3 New and emerging issues

Article 8 of the Stockholm Convention sets out process and criteria by which new POPs are processed, assessed and listed in the Annexes of the Convention. The UK Government will continue to respond to new and emerging issues addressing both requirements under the Stockholm Convention and the UNECE POPs Protocol.

The UK continues to participate in international assessments of POPs and plays an active role to input into the work of technical committees under both the Stockholm Convention and the UNECE POPs Protocol to assess substances that meet the criteria of a POP. The UK, in partnership with the European Community and its Member States has nominated substances to be added to the Stockholm Convention.

In addition the UK continues to survey the environment and food for existing and emerging POPs substances. Details of previous and ongoing studies may be found at the Food Standards Agency (FSA) and Centre for Environment, Fisheries and Aquaculture Science (Cefas) web pages below:
http://www.food.gov.uk/science/research/contaminantsresearch/env-cont/organic-cont/
http://www.cefas.defra.gov.uk/publications-and-data/scientific-series/aquatic-environment-reports.aspx

7.4 Effectiveness evaluation

Article 16 requires that Parties in accordance to their technical and financial capabilities and using existing monitoring programmes and mechanisms (where possible) co-operate on a regional basis, when appropriate and contribute to a global monitoring programme for the Convention. In addition, Parties shall periodically evaluate the effectiveness of the Convention, beginning four years after coming into force (i.e. 2008).

The UK has, in the past, submitted information gained from its POP monitoring programme in food and air to the European Food Safety Authority and the Secretariat, respectively. The UK will continue to maintain liaison and collaboration with the Convention Secretariat in contributing towards a global monitoring plan and consideration of inclusion of new POPs in future research and monitoring programmes.

7.5 Provision of technical assistance

Article 12 requires Parties to recognise that rendering timely and appropriate technical assistance in response to requests from developing country Parties and Parties with economies in transition is essential to the successful implementation of the Convention. Provision of technical assistance includes taking into account the particular needs of developing countries and countries with economies in transition to develop and strengthen their capacity to implement their obligations under the Convention. Much of the UK's regional and bilateral development assistance is focused on helping developing countries to mainstream sound management of chemicals including POPs in poverty reduction strategies and development assistance. The principal routes for providing assistance to developing countries and countries with economies in transition are listed below:

(i) The Global Environment Facility (GEF)

The Global Environment Facility was created in 1991 to channel multilateral funds into projects that create global environmental benefits, initiated by people in developing countries. It brings together 182 member Governments, leading development institutions, the scientific community and a wide spectrum of private sector and non-Governmental organisations. It has allocated US$10.5 billion in grants and an additional US$51 billion in co-financing from other sources to support more than 2700 projects in 165 countries. These projects are implemented by the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP) and the World Bank. More information on the GEF can be found at: www.gefweb.org

In 2002 persistent organic pollutants became a GEF focal area. In 2010 the GEF-5 replenishment allocated an envelope of US$420 million for chemicals – and US$375 million specifically for persistent organic pollutants projects, providing financial and technical assistance to countries in meeting their Stockholm convention obligations. The UK has contributed over £410 million to the GEF since it was established.

(ii) UK Contributions to the Stockholm Convention

The UK contributed £100k per year to the POPs Club which was established under the United Nations Environment Programme (UNEP) to support the development of what is now the Stockholm Convention. Since the Convention entered into force in May 2004 the UK has an obligation to make annual assessed contributions to support the activities of the Secretariat and participation of developing countries. In 2012 the UK assessed contribution was US$370,453.

7.6 Reporting obligations under the Stockholm Convention

Under Article 15 Parties are required to report periodically on the measures taken and on their effectiveness in meeting the objectives of the Convention.

Reporting will include:

(a) data on the total quantities of production, import and export of the chemicals listed in Annexes A and B

(b) a list of countries from which it has imported and exported each of these

The purpose of reporting is to assess progress towards meeting obligations under the Convention. As required under Article 12 of the EU POPs Regulation, the UK has submitted annual and triannual reports to the EU Commission since 2007 outlining the progress made towards meeting the objectives of the Convention.

The UK's international reporting requirements and a schedule for the next five years to 2017 are outlined in Table 11 below:

Table 12: The UK's reporting requirements 2012-2017

Report	Reported to	Date for submission to Convention Secretariat
National Implementation Plan (update)	Stockholm Convention Secretariat	December 2012
2nd Stockholm Convention Article 15 report	Stockholm Convention Secretariat	2014 and periodically as required
EU POPs Regulation Article 12 Annual Report	EU Commission	Annually
EU POPs Regulation Article 12 Triannual Report	EU Commission	Triennially (next report due in 2013)

7.6.1 Review process for reporting

The review process on reporting for the NIP will be tied in with the review of the UK Action Plan. The reporting will be against the range of measures identified in the Action Plan, by April 2016 and every five years thereafter.

References

Ahlborg *et.al.* (1993)

Bailey RE (2001) Global HCB emission, published in Chemosphere 43, pp 167-182

Birgul, A., Katsoyiannis, A., Gioia, R., Crosse, J., Earnshaw, E., Ratola, N., Jones, K.C., and Sweetman, A.J. (2012) Polybrominated diphenyl ethers (PBDEs) in the United Kingdom atmosphere. Environmental Pollution, 169, 105-111

Dyke P (1997)

Lake *et.al.* (2005), 'Effects of River Flooding on PCDD/F and PCB Levels in Cows' Milk, Soil, and Grass,' Env. Sci. Technol. 39:23 (2005) 9033.

Prevedouros, K., Jones, K.C., and Sweetman, A.J. (2004). Production, Consumption and Emission Estimates for Pentabrominated Diphenyl Ether (PeBDE) in Europe (1970 to 2000), Environmental Science and Technology, 38(12), 3224-3231.

Van den Berg *et.al.* (1998) toxic equivalent factors for PCBs, PCDDs and PCDFs for humans and wildlife. Environmental Health Perspectives, 106, 12

Van den Berg *et.al.*(2005), 'The 2005 World Health Organisation Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds,' WHO TEQ 2005 revised values, quoted from WHO website: http://www.who.int/foodsafety/chem/tef_update/en/index.html

Yongfu Xu (2008) 'Review and update of the HCB inventory emissions to air, land and water, paper published by AEA.

Glossary of Terms and Units used

Anthropogenic	Caused or influenced by human activity
APC residues	Air Pollution Control residue is mainly fly ash (fine particles arising from flue gases caught in flue gas cleaning systems) plus activated carbon and lime (gas scrubbing materials)
BAT	Best Available Techniques
BFR	Brominated Flame Retardants
Biologically active	A material is considered bioactive if it has interaction with or effect on any cell tissue in the human body
CHAN 27	Chemical Hazard Alert Notice for dioxins issued by HSE
CIGN	Chief Inspector's Guidance Note
COMAH	Control of Major Accident Hazard Regulations 1999
Congener	A congener is any single, well-defined chemical compound within a closely related group. A PCB congener is a well-defined chemical compound in the PCB category. The name of a congener is associated with the total number of chlorine substituents and the position of each chlorine
COP	Conference of the Parties
COSHH	Control of Substances Hazardous to Health Regulations
COT	Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment
DEFRA	Department for Environment, Food and Rural Affairs
DDT	The chemical name for DDT is 1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane. The term DDT generally refers to para-DDT. However, the compound's structure permits several different isomeric forms including ortho para-DDT and meta para-DDT.
De Novo	Synthesis of a compound from simple molecules under certain favourable conditions
DfID	Department for International Development
Dioxin-like PCBs	PCB congener which has the same toxic action as to the most toxic dioxin congener (2,3,7,8-tetrachlorodibenzo-p-dioxin) but at a different level of potency on the basis of which it is assigned a TEF value
ELVs	Specified Emission Limit Values
EPA	Environmental Protection Act
E-PRTR	European Pollutant Release and Transfer Register, which is based on Regulation (EC) No 166/2006 implementing the obligations of the UN-ECE PRTR Protocol signed in May 2003 by 36 countries and the European Community.
FSA	Food Standards Agency
GEF	Global Environment Facility
HCB	Hexachlorobenzene
HCE	Hexachloroethane
HCH	Hexachlorocyclohexane
HPA	Health Protection Agency
HSE	Health and Safety Executive
HMRC	Her Majesty's Revenue and Customs
IPPC	Integrated Pollution Prevention and Control – integrated approach to controlling pollution from industrial sources across the European Union

Isomer	An isomer is a chemical species with the same number and types of atoms as another chemical species, but possessing different properties. There are structural isomers, geometric isomers, optical isomers and stereoisomers.
I-TEQ	International – Toxic Equivalent Quotient is the Nato (1989) based system of toxic equivalents used to present a quantity of dioxin and furan congeners as a single value based on the relative toxicity of all congeners to the most harmful congener – TCDD.
LAPPC	Local Authority Pollution Prevention and Control
LA-IPPC	Local Authority Integrated Pollution Prevention and Control
LR-TAP	Long-Range Transboundary Air Pollution
mg/m^3	milligrams per cubic metre
MSW	Municipal Solid Waste
NAEI	National Atmospheric Emissions Inventory
ng	nanogram (10-9 g)
ng/l	nanogram per litre
NGOs	Non Government Organisations
OECD	Organisation for Economic Co-operation and Development
PAH	Polycyclic aromatic hydrocarbons
PBDEs	Polybrominated diphenylethers
PCB	Polychlorinated biphenyl
PCDD	Polychlorinated dibenzo-p-dioxins (also known as 'dioxins')
PCCD/F	Mixture of congeners of PCDD and PCDF (referred to collectively as 'dioxins'
PCDF	Polychlorinated dibenzofurans (also known as furans)
PCP	Pentachlorophenol
PeCB	Pentachlorobenzene
PERC	Perchloroethylene
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate
PFOS-F	Perfluorooctane sulfonic fluoride
PG	Process Guidance
pg	picogram (10^{-12} g)
PI	Pollution Inventory
PIC	Prior Informed Consent
POPs	Persistent Organic Pollutants
PPC	Pollution Prevention and Control Regulations
PRP	Pollution Reduction Programme
PRTR	Pollutant Release and Transfer Registers
SAICM	Strategic Approach to International Chemical Management
SEPA	Scottish Environment Protection Agency
SPRI	Scottish Pollutant Release Inventory

TCDD	2, 3, 7, 8-tetrachlorodibenzo-p-dioxin
TDI	tolerable daily intake
TDS	Total Diet Study
TEF	Toxic equivalency factor
TEQ	Toxic equivalent quotient
TOMPs	Toxic Organic Micro-Pollutants
Toxicity	Harmfulness to living organisms. The capacity of a substance to cause toxic effects to organisms or their progeny
Toxicology	The study of the adverse effects of chemicals on living organisms
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
WHO	World Health Organisation
WID	Waste Incineration Directive

Descriptions of the persistent organic pollutants

Aldrin	A pesticide applied to soils to control termites, grasshoppers, corn rootworm, and other insect pests.
Chlordane	Used extensively to control termites and as a broad-spectrum insecticide on a range of agricultural crops.
Chlordecone	Is a synthetic chlorinated compound, which was mainly used as an agricultural pesticide. It was first produced in 1951 and introduced commercially in 1958.
DDT	DDT was widely used during World War II to protect soldiers and civilians from malaria, typhus, and other diseases spread by insects. It continues to be applied against mosquitoes in several countries to control malaria.
Dieldrin	Used principally to control termites and textile pests, dieldrin has also been used to control insect-borne diseases and insects living in agricultural soils.
Dioxins	Dioxins are families of structurally related compounds and belong to a class of environmental pollutants known as organochlorines. Dioxins is an umbrella description for polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF)
Endosulfan	Is an insecticide that has been used since the 1950s to control crop pests, tsetse flies and ectoparasites of cattle and as a wood preservative. As a broad-spectrum insecticide, endosulfan is currently used to control a wide range of pests on a variety of crops including coffee, cotton, rice, sorghum and soy.
Endrin	This insecticide is sprayed on the leaves of crops such as cotton and grains. It is also used to control mice, voles and other rodents.
Furans	Unintentionally produced compounds from many of the processes that produce dioxins, and also during the production of PCBs. Included in reference to dioxins
Hexabromobiphenyl	Is an industrial chemical that has been used as a flame retardant, mainly in the 1970s. It is no longer produced or used in most countries.
Hexabromodiphenyl ether and Heptabromodiphenyl ether	Are the main components of commercial octabromodiphenyl ether which has been used as a flame retardant. The only degradation pathway is through debromination and producing other bromodiphenyl ethers.
Tetrabromodiphenyl ether and pentabromodiphenyl ether	Are the main components of commercial pentabromodiphenyl ether which has been used as a flame retardant.
Heptachlor	Primarily employed to control soil insects and termites, heptachlor has also been used more widely to control cotton insects, grasshoppers, other crop pests, and malaria-carrying mosquitoes.
Hexachlorobenzene (HCB)	First introduced in 1945 to treat seeds, HCB was primarily used as a fungicide. It was widely used to control wheat bunt. It is also a by-product of certain industrial chemicals and exists as an impurity in several pesticide formulations. HCB emissions may also arise from combustion sources.
Hexachlorocyclohexane (alpha and beta)	Are still produced as a by-product of lindane, although the intentional use of alpha- and beta- HCH as an insecticide was phased out years ago.
Lindane (gamma hexachlorocyclohexane)	Is the common name for the gamma isomer of hexachlorocyclohexane (gamma-HCH). Lindane has been used as a broad-spectrum insecticide for seed and soil treatment, foliar applications, tree and wood treatment and against ectoparasites in both veterinary and human applications.
Mirex	This insecticide is applied mainly to combat fire ants and other types of ants and termites. It has also been used as a fire retardant in plastics, rubber, and electrical goods.

Pentachlorobenzene	PeCB was used in PCB products, in dyestuff carriers, as a fungicide, a flame retardant and as a chemical intermediate e.g. previously for the production of quintozene. PeCB might still be used as an intermediate. PeCB is also produced unintentionally during combustion, thermal and industrial processes. It also present as impurities in products such as solvents or pesticides.
Perfluoroctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F)	PFOS is both intentionally produced and an unintended degradation product of related anthropogenic chemicals. The current intentional use of PFOS is widespread and includes: electric and electronic parts, fire fighting foam, photo imaging, hydraulic fluids and textiles.
Polychlorinated Biphenyls (PCBs)	These compounds were used in industry as heat exchange fluids, in electric transformers and capacitors, and as additives in paint, carbonless copy paper, sealants and plastics. They can also be formed unintentionally as by-products in some chemical and combustion processes. It is now known that some PCBs exhibit similar biological activity to dioxins and these compounds are therefore referred to as dioxin-like PCBs.
Toxaphene –	This insecticide, also called camphechlor, is applied to cotton, cereal grains, fruits, nuts, and vegetables. It has also been used to control ticks and mites in livestock.

ANNEX 3

The Current UK requirements for Stockholm Convention Annex C Part II and Part III source categories

Part III source categories

These source categories are regulated through one or a combination of the following regulations, depending on their potential to pollute. The UK 2007 NIP (Annexes 5A) provided detail about how these applied for each sector.

- Integrated Pollution Prevention and Control (IPPC), covers installations known as A(1) installations, which are regulated by the Environment Agency in England and Wales;
- Local authority Integrated Pollution Prevention and Control (LA-IPPC) covers installations known as A(2) installations, which are regulated by local authorities in England and Wales; and
- Local authority Pollution Prevention and Control (LAPPC), covers installations known as Part B installations, also regulated by local authorities in England and Wales.

All three systems require the operators of certain industrial and other installations to obtain a permit to operate. Once an operator has submitted a permit application, the regulator then decides whether to issue a permit. If one is issued, it will include conditions aimed at reducing and preventing pollution to acceptable levels. A(1) installations are generally perceived to have a greater potential to pollute the environment than an A(2) installation, and Part B installations would have the least potential to pollute and are regulated for emissions to air only.

Sector guidance (SG) notes are issued by the Secretary of State for Environment, Food and Rural Affairs under regulation 37 of the Pollution Prevention and Control (England and Wales) Regulations 2000 Regulations (as amended). They form statutory guidance on what constitute the Best Available Techniques for LA-IPPC installations (also known as A2 installations) for each of the main sectors regulated.

Process Guidance (PG) notes are issued by the Secretary of State for Environment, Food and Rural Affairs under regulation 37 of the Pollution Prevention and Control (England and Wales) 2000 Regulations (as amended). They form statutory guidance on what constitute the Best Available Techniques (BAT) for LAPPC installations (also known as Part B installations) for each of the processes regulated.

Annex C Part III source categories

The Convention also requires the promotion, in accordance with its action plan, of the use of BAT and BEP for new and existing sources within source categories such as those within Part III of Annex C. The UK 2007 NIP (Annexes 5B) provided detail about how these applied for each sector.

TEQ Schemes for Dioxins and Furans, and dioxin-like PCBs

Measurement of toxicity for dioxins (Toxic Equivalency Factors)

Dioxins are found and released to the environment as complex mixtures of chemical congeners. There are 210 congeners in total. Only 17 of these congeners are considered biologically active and exhibit toxicity similar to that of 2, 3, 7, 8-tetrachlorodibenzo-p-dioxin (TCDD), the most toxic congener. In order to give a single measure of the toxicity of a sample and to simplify the handling of data on these compounds various 'toxic equivalent quotient' (TEQ) schemes have been proposed. These schemes provide a series of 'toxic equivalency factors' (TEFs) that are applied to the measured concentrations or amount of each congener to give a measure of the overall toxicity of a mixture. The toxic equivalent concentration is the amount of 2, 3, 7, 8-TCDD that is estimated to give the same overall effect as the mixture present.

There are two systems in current use for presenting toxic equivalency factors for dioxins; the International TEQ (I-TEQ) and the more recent World Health Organisation the (WHO TEQ). The latter also includes the dioxin-like PCBs. These are given in Annex 3a and 3b.

In the UK, the Committee on the Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) adopted the use of WHO-TEQ, while the I-TEQ scheme is widely used in UK and EU legislation. For purposes of this document both terms I-TEQ and WHO-TEQ will be used where appropriate. WHO reviewed their TEQ scheme in mid-2006 and have recommended some amendments, at time of publication of this report the WHO TEQ were being re-assessed for possible use in the UK or EU legislation. The 2005 WHO-TEFs have been incorporated into legislation relating to contaminants in food through Commission Regulation 1259/2011 and in feeding stuffs through Commission Regulation 277/2012.

Annex 4a – TEQ schemes for Dioxins and Furans

	I-TEQ (Nato 1989)	WHO TEQ (1997/98)*	WHO TEQ (2005 update)
Dioxins		**Humans/Mammals**	**Humans/Mammals**
2,3,7,8-TCDD	1	1	1
1,2,3,7,8-PeCDD	0.5	1	1
1,2,3,4,7,8-HxCDD	0.1	0.1	0.1
1,2,3,6,7,8-HxCDD	0.1	0.1	0.1
1,2,3,7,8,9-HxCDD	0.1	0.1	0.1
1,2,3,4,6,7,8-HpCDD	0.01	0.01	0.01
OCDD	0.001	0.0001	**0.0003**
Furans			
2,3,7,8-TCDF	0.1	0.1	0.1
1,2,3,7,8-PeCDF	0.05	0.05	0.03
2,3,4,7,8-PeCDF	0.5	0.5	0.3
1,2,3,4,7,8-HxCDF	0.1	0.1	0.1
1,2,3,7,8,9-HxCDF	0.1	0.1	0.1
1,2,3,6,7,8-HxCDF	0.1	0.1	0.1
2,3,4,6,7,8-HxCDF	0.1	0.1	0.1
1,2,3,4,6,7,8-1HpCDF	0.01	0.01	0.01
1,2,3,4,7,8,9-HpCDF	0.01	0.01	**0.03**

Van den Berg *et.al.* (1998) toxic equivalent factors for PCBs, PCDDs and PCDFs for humans and wildlife. Environmental Health Perspectives, 106, 12

Reference – *Van den Berg et.al*:

The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

WHO TEQ 2005 revised values, quoted from WHO website:
http://www.who.int/foodsafety/chem/tef_update/en/index.html

Annex 4b – TEQ schemes for dioxin-like PCBs

	Ahlborg *et.al.* (1993)	WHO-TEQ(1997/8)	WHO TEQ (2005)
Non-Ortho PCBs		**Humans/Mammals**	**Humans/Mammals**
3,4,4',5-TCB (81)		0.0001	**0.0003**
3,3',4,4'-TCB (77)	0.0005	0.0001	0.0001
3,3',4,4',5PeCB (126)	0.1	0.1	0.1
3,3',4,4',5,5'-HxCB(169)	0.01	0.01	**0.03**
Mono-Ortho PCBs			
2,3,3',4,4'-PeCB (105)	0.0001	0.0001	**0.00003**
2,3,4,4',5-PeCB (114)	0.0005	0.0005	**0.00003**
2,3',4,4',5-PeCB (118)	0.0001	0.0001	**0.00003**
2',3,4,4',5-PeCB (123)	0.0001	0.0001	**0.00003**
2,3,3',4,4',5-HxCB (156)	0.0005	0.0005	**0.00003**
2,3,3',4,4',5'-HxCB (157)	0.0005	0.0005	**0.00003**
2,3',4,4',5,5'-HxCB (167)	0.00001	0.00001	**0.00003**
2,3,3',4,4',5,5'-HpCB (189)	0.0001	0.0001	**0.00003**
Di-Ortho PCBs			
2,2',3,3',4,4',5-HpCB (170)	0.0001	0	0
2,2',3,4,4',5,5'-HpCB (180)	0.00001	0	0

(A1) Emissions of dioxins to Air (g I-TEQ)

Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Contributions from source category to total dioxin & furan emissions in 2010 %
Combustion in Energy Production																						
Public electricity and heat production	104	105	127	136	121	163	31.1	30	5.5	3.4	3.0	2.5	2.4	2.1	2.0	3.7	3.0	2.5	2.4	2.2	2.8	1.51
Petroleum refining	4.6	4.9	5.0	5.2	5.0	5.3	5.2	5.4	5.3	4.7	4.4	4.0	4.8	4.7	4.3	5.1	4.5	4.5	4.2	3.9	3.9	2.10
Manufacture of solid fuels and other energy industries	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.4	0.5	0.4	0.4	0.5	0.5	0.5	0.27
Combustion in Industry																						
Iron and steel	0.7	0.7	0.7	0.8	0.5	0.3	0.2	0.2	0.3	0.4	0.3	0.4	0.3	0.2	0.2	0.2	0.2	0.4	0.3	0.3	0.3	0.15
Non-ferrous metals	0.2	0.8	0.7	0.8	0.7	0.6	0.7	0.3	0.2	0.4	0.2	0.2	0.3	0.2	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.06
Other industrial combustion[1]	40.7	40.7	40.8	37.2	46	45.2	44.2	43.1	34.6	31.8	26	25.6	21	20.3	45.1	14.7	14.1	14.2	19.1	19.3	22.2	11.92
Transport Fuel Use																						
Road transport, passenger cars	26.5	23.5	20.7	17	13.9	11.1	9.0	7.2	5.5	3.9	2.4	2.3	2.3	2.2	2.1	2.0	1.9	1.8	1.7	1.7	1.6	0.87
Road transport, light duty vehicles	2.1	1.9	1.6	1.3	1.1	0.9	0.8	0.6	0.5	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.07
Road transport, heavy duty vehicles	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.14
Road transport, mopeds and motorcycles	0.23	0.2	0.15	0.12	0.11	0.1	0.09	0.09	0.07	0.06	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01
Railways	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.33
National navigation	1.5	1.5	1.4	1.4	1.5	1.6	1.6	1.6	1.6	1.6	1.5	1.4	1.5	1.5	1.5	1.5	1.4	0.4	0.4	0.4	0.4	0.20
Other mobile sources and machinery	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.1	0.1	0.11	0.11	0.12	0.12	0.13	0.14	0.15	0.15	0.15	0.14	0.13	0.07

1 Other industrial combustion – includes fuel combustion in industries other than iron and steel and non-ferrous metal production which are quoted separately and includes cement and lime production, brick and refractory manufacture and industrial off road vehicle use.

Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Contributions from source category to total dioxin & furan emissions in 2010 %
Combustion in Commercial and Residential Use																						
Commercial and institutional fuel combustion	48.4	51.7	47.4	32.8	19.6	24.3	4.0	2.1	1.0	1.0	0.7	0.7	0.5	0.4	0.4	0.5	0.4	0.4	0.4	0.5	0.4	0.23
Residential fuel combustion	16.6	17.8	16.2	17.2	14.4	10.9	11.4	10.3	10	10.4	8.4	7.8	6.5	5.6	5.2	4.6	4.7	5.1	5.6	5.6	5.9	3.16
Household and garden machinery	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.06
Agricultural fuel combustion	6.5	6.5	6.5	6.5	6.6	6.5	6.5	6.5	6.5	6.5	6.4	6.4	6.4	6.4	6.4	7.0	7.8	7.4	11.8	11.9	15.2	8.16
Off-road vehicles and other machinery	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3	1.2	1.1	1.1	1.1	1.1	0.62
Fugitive Emissions from Fuel Manufacture																						
Solid fuel transformation	3.7	3.2	2.6	2.2	1.9	1.6	1.5	1.5	0.9	0.9	0.9	0.8	0.6	0.7	0.6	0.7	0.7	0.8	0.7	0.6	0.7	0.35
Production Processes																						
Glass and asphalt production	1.3	1.3	1.3	1.3	1.4	1.4	1.2	1.1	1.1	1.1	1.0	1.1	1.1	1.1	0.9	1.0	1.0	1.0	0.9	0.8	0.8	0.43
Chemical production	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.03
Metal production	113	102	101	105	109	112	112	117	92	75	59	51	41	40	48	48	47	39	39	32	47	25.34
Wood impregnation	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Agriculture																						
Field burning of agricultural wastes	57.0	48.9	35.6	0.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00

Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Contributions from source category to total dioxin & furan emissions in 2010 %
Waste																						
Solid waste disposal on land	2.2	2.2	2.1	2.1	2.0	1.9	1.9	1.8	1.6	1.5	1.4	1.2	1.1	1.0	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.41
Small scale waste burning	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	13.45
MSW incineration and refuse derived fuel combustion	455	451	432	286	116	132	25.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Other waste disposal[2]	55.4	54.7	54.3	55.1	57.0	55.7	54.5	57.8	42.8	40.7	40.3	40.1	39.8	40.2	39.3	39.7	24.3	15.5	14.6	13.3	14.1	7.60
Vehicle fires	2.5	3.1	3.5	3.3	3.0	3.1	3.2	3.1	3.3	4.0	4.2	4.5	4.5	4.1	3.2	2.9	2.6	2.2	2.0	1.4	1.2	0.66
Accidental building fires	58.1	52	51.5	48.4	47.5	56.2	50.9	45.8	42.5	47.4	42.6	45.4	46.8	51.9	41.6	39.5	40.4	38.4	33.8	33.8	33.8	18.15
Other sources																						
Bonfire night	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	3.65
Cigarette smoke	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
Total	**1037**	**1009**	**989**	**795**	**604**	**670**	**402**	**371**	**291**	**270**	**238**	**231**	**215**	**217**	**237**	**207**	**190**	**169**	**172**	**163**	**186**	**100.00**
International navigation	2.7	2.7	2.8	2.8	2.5	2.6	2.9	3.1	3.2	2.4	2.1	2.2	1.7	2.0	2.3	2.4	3.2	3.0	3.4	3.1	2.7	
Accidental and natural fires	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	

2 Other waste includes agricultural waste burning, chemical incineration, activated carbon regeneration, sewage sludge incineration, clinical waste incineration, crematoria, foot and mouth pyres and animal carcass incineration

Annex 5 – (A2) Emissions of Dioxins to Land and water (g I-TEQ)

EMISSIONS OF DIOXINS AND FURANS TO LAND VECTOR (g I-TEQ per year)																						
Sector	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Contributions from source category to total dioxin & furan emissions in 2010 %**
Combustion in Energy Production																						
Public electricity and heat production	111	110	104	89.7	90.7	88.1	82.8	75.9	82.8	72.5	79.1	86.2	83.9	90.5	87.1	89.2	99.0	93.2	88.3	84.3	88.2	17.60
Combustion in Industry																						
Iron and steel	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.4	0.4	0.4	0.4	0.5	0.5	0.7	0.6	0.5	0.5	0.11
Non-ferrous metals	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Other industrial combustion[1]	10.4	10.0	9.6	9.0	10.8	11.0	10.1	9.4	9.1	8.5	7.6	7.2	7.6	7.4	7.5	6.6	6.7	6.5	6.9	6.0	6.0	1.21
Combustion in Commercial and Residential Use																						
Commercial and institutional fuel	0.6	0.5	0.4	0.4	0.3	0.2	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.02
Residential fuel	1.08	1.09	1.24	1.25	1.24	1.21	1.21	1.21	1.21	1.21	1.2	1.2	1.2	1.2	1.3	1.5	1.7	1.9	2.0	2.1	2.2	0.44
Agricultural fuel combustion	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.9	3.2	3.1	4.9	5.0	6.3	1.27
Fugitive Emissions from Fuel Manufacture																						
Solid fuel transformation	4.3	4.0	3.7	3.5	3.5	3.4	3.4	3.4	3.3	3.1	3.3	2.9	2.4	2.4	2.3	2.2	2.4	2.3	2.3	1.9	2.1	0.42
Production Processes																						
Chemical production	17.1	17.1	15.6	14.8	14.4	13.9	13.6	13.3	13.0	12.8	12.2	12.1	12.0	11.9	11.8	11.8	11.2	11.2	11.2	11.2	11.2	2.23
Metal production	124	106	104	104	110	105	98	93	81	72	68	58	47	41	36	26	22	14	11	7	5	1.03

1 Other industrial combustion – includes fuel combustion in industries other than iron and steel and non-ferrous metal production which are quoted separately and includes cement and lime, chemical production, paper and pulp, and food processing, beverages and tobacco.

EMISSIONS OF DIOXINS AND FURANS TO LAND VECTOR (g I-TEQ per year) (Continued...)																						
Sector	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Contributions from source category to total dioxin & furan emissions in 2010 %**
Agriculture																						
Field burning of agricultural wastes	39.3	33.7	24.5	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Waste																						
Solid waste disposal on land (incl. sewage sludge to agriculture)	180	181	180	184	186	193	193	198	201	207	220	247	258	260	261	261	262	253	248	246	246	49.06
Small scale waste burning	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	17.33
MSW incineration and refuse derived fuel combustion	312	308	296	261	190	174	190	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Other waste disposal[2]	65.2	65.2	64.9	64.6	64.2	64.0	63.7	63.4	63.5	63.6	63.6	63.7	63.8	63.2	62.7	62.1	27.5	6.7	4.8	4.7	4.7	0.95
Vehicle fires	1.0	1.3	1.4	1.4	1.2	1.3	1.3	1.3	1.4	1.6	1.7	1.8	1.8	1.7	1.3	1.2	1.1	0.9	0.8	0.6	0.5	0.10
Accidental building fires	58.1	52	51.5	48.4	47.5	56.2	50.9	45.8	42.5	47.4	42.6	45.4	46.8	51.9	41.6	39.5	40.4	38.4	33.8	33.8	33.8	6.75
Other sources																						
Domestic composting	3.1	3.2	3.3	3.4	3.6	3.7	3.8	3.9	4.0	4.4	4.8	5.1	7.7	10.6	6.8	6.5	6.2	7.3	7.7	7.6	7.5	1.49
Total	**1017**	**984**	**950**	**876**	**814**	**805**	**803**	**599**	**592**	**584**	**594**	**620**	**623**	**632**	**609**	**598**	**571**	**526**	**510**	**498**	**501**	**100**

2 Other waste includes agricultural waste burning, chemical incineration, sewage sludge incineration, clinical waste incineration, and crematoria

EMISSIONS OF DIOXINS AND FURANS TO WATER VECTOR (g I-TEQ per year)																						
Sector	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Contributions from source category to total dioxin & furan emissions in 2010 %**
Production Processes																						
Chemical production	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1.93
Waste																						
Releases from waste water treatment works	24.1	24.1	24.2	24.2	24.3	24.3	24.4	24.4	24.5	24.6	24.6	24.8	24.9	25.0	25.1	25.3	25.4	25.6	25.8	26.0	26.2	98.07
Chemical incineration	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**25**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**27**	**100**

AIR VECTOR																					
Sector	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Contributions from source category to total PCB emissions in 2010 %**
Combustion in Energy Production																					
Public electricity and heat production	88.7	82.8	70.6	58.5	55.9	51.1	43.3	45.3	38.9	43.1	47.0	44.1	47.8	45.7	46.4	50.3	45.6	41.5	34.5	35.4	4.43
Manufacture of solid fuels and other energy industries	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Combustion in Industry																					
Iron and steel	0.7	0.6	0.6	0.5	0.6	0.6	0.6	0.6	0.5	0.5	0.8	0.7	0.9	0.9	1.0	1.1	1.3	1.2	0.9	1.0	0.13
Cement and lime production and other industrial combustion	1.8	1.6	1.5	1.7	1.6	1.6	1.6	1.5	1.4	1.3	1.4	1.3	1.3	1.2	1.1	1.0	1.3	1.2	0.7	0.8	0.10
Combustion in Commercial and residential use																					
Commercial and institutional fuel combustion	9.3	9.5	8.6	8.1	7.6	6.3	5.9	5.0	4.8	4.2	4.3	4.2	4.2	4.0	3.7	3.6	3.4	3.8	4.0	3.8	0.48
Residential combustion	23.5	20.9	22.7	19.1	14.0	14.4	12.8	12.3	12.7	10.3	9.8	7.9	6.7	6.0	4.8	4.8	5.2	5.7	5.7	6.1	0.76
Agricultural combustion	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.11	0.10	0.13	0.02
Fugitive Emissions from Fuel Manufacture																					
Solid fuel transformation	10.8	9.8	9.2	9.2	9.1	9.0	9.0	8.8	8.6	8.8	7.6	6.2	6.1	5.8	5.8	6.2	6.2	6.2	5.3	6.0	0.75
Production Processes																					
Metal production	450	468	486	454	424	405	429	377	222	213	193	160	164	191	172	175	191	188	134	145	18.06
Emissions from PCB use	5327	5009	4715	4420.8	4149.7	3899.1	3666.7	3451	3249	847	793.1	746.2	702.93	662.85	625.61	590.89	558.5	528.1	499.6	472.8	59.10

AIR VECTOR (Continued...)

Sector	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Contributions from source category to total PCB emissions in 2010 %
Agriculture																					
Field burning of agricultural wastes	1.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Waste																					
Solid waste disposal on land	73.1	69.5	72.3	64.8	62.1	52.6	43.6	34.2	26.5	21.7	25.5	22.3	21.0	19.3	18.9	16.7	13.8	10.1	5.4	2.5	0.32
Waste incineration	11.4	10.9	9.8	7.3	6.0	5.4	1.5	1.7	1.6	1.5	1.4	1.3	1.1	1.0	0.8	0.7	0.6	0.5	0.4	0.4	0.05
Refuse derived fuel manufacture and combustion	10.0	10.0	10.0	8.9	7.9	6.8	5.7	4.6	3.6	2.5	2.4	2.2	2.1	1.9	1.8	1.6	1.5	1.3	1.2	1.0	0.13
Small scale waste burning	126	126	126	126	126	126	126	126	126	126	126	126	126	126	126	100	84	82	82	82	10.28
Vehicle fires	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003	0.0004	0.0004	0.0004	0.0
Accidental building fires	66.3	65.7	61.8	60.6	71.6	64.9	58.4	54.2	60.4	54.3	57.9	59.7	66.2	53.0	50.4	51.6	48.9	43.1	43.1	43.1	5.39
Other sources																					
Bonfire night	0.064	0.064	0.064	0.0643	0.0643	0.0643	0.0643	0.064	0.064	0.064	0.064	0.064	0.0643	0.0643	0.0643	0.0643	0.064	0.064	0.0643	0.064	0.01
Total	**6199**	**5885**	**5594**	**5239**	**4936**	**4643**	**4403**	**4121**	**3756**	**1334**	**1269**	**1182**	**1149**	**1119**	**1058**	**1003**	**962**	**913**	**817**	**800**	**100.00**

LAND VECTOR (Kg per year)																						
Sector	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Contributions from source category to total PCB emissions in 2010 %**
Combustion in Energy Production																						
Public electricity and heat production	23.8	23.6	22.2	18.5	17.5	16.7	15.5	13.1	13.5	11.4	12.9	14.2	13.3	14.7	14.1	14.6	16.1	14.7	13.3	11.0	11.6	0.39
Combustion in Industry																						
Iron and steel	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.4	0.3	0.4	0.01
Other industrial combustion[1]	6.0	6.0	5.8	5.4	5.5	5.5	5.1	5.1	4.8	4.5	4.3	3.9	3.5	3.4	3.3	3.1	3.3	3.2	3.5	3.2	3.4	0.12
Combustion in Commercial and Residential Use																						
Commercial and institutional fuel combustion	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.00
Residential combustion	1.3	1.5	1.3	1.4	1.2	0.9	0.9	0.9	0.8	0.8	0.7	0.6	0.5	0.4	0.4	0.3	0.2	0.3	0.3	0.3	0.3	0.01
Agricultural combustion	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.00
Fugitive Emissions from Fuel Manufacture																						
Solid fuel transformation	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.00
Production Processes																						
Metal production	56.4	47.5	50.0	52.2	53.1	54.8	51.2	54.7	46.9	44.6	43.7	39.5	32.4	31.5	38.8	33.7	33.9	37.9	38.1	26.6	29.9	1.02
Emissions from PCB use	56,422	55,791	48,758	42,692	37,424	32,280	27,933	24,254	20,601	17,613	10,035	8296	6895	5762	4842	4094	3485	2986	2578	2241	1962	66.78

LAND VECTOR (Kg per year) (Continued...)

Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Contributions from source category to total PCB emissions in 2010 %
Waste																						
Solid waste disposal on land	1250	1259	1257	1283	1298	1338	1346	1387	1423	1471	1552	1627	1704	1660	1605	1476	1381	1194	1050	974	928	31.58
waste incineration	8.4	8.3	7.8	7.4	6.9	6.4	5.9	5.5	5.5	5.5	5.6	5.6	5.6	4.8	4.0	3.2	2.4	2.5	2.6	2.3	2.4	0.08
Refuse derived fuel manufacture and combustion	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Total	**57770**	**57138**	**50104**	**44060**	**38808**	**33702**	**29358**	**25721**	**22096**	**19152**	**11655**	**9987**	**8656**	**7477**	**6508**	**5626**	**4922**	**4240**	**3686**	**3259**	**2938**	**100.00**

WATER VECTOR (Kg per year)

Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Contributions from source category to total dioxin & furan emissions in 2010 %
Waste																						
Dumping of sewage sludge at sea	83.1	83.1	79.0	82.3	82.5	89.8	87.7	86.1	82.6	82.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Total	**83**	**83**	**79**	**82**	**83**	**90**	**88**	**86**	**83**	**83**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.00**

Annex 5 – (C1) HCB emissions to Air (kg per year)

AIR VECTOR (Kg per year)																						
Sector	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Contributions from source category to total HCB emissions in 2010 %**
Combustion in Energy Production																						
Public electricity and heat production	1.0	1.0	1.2	1.7	2.7	3.0	2.9	3.7	5.3	5.1	5.3	5.8	6.2	6.3	6.1	6.1	6.8	6.9	7.2	8.8	9.2	28.48
Combustion in Commercial and Residential Use																						
Commercial and institutional fuel	0.6	0.6	0.5	0.5	0.5	0.6	0.4	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.93
Transport Fuel Use																						
National navigation	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.26
Production Processes																						
Chemical production	596	576	545	325	145	149	147	50	48	46	43	39	34	28	26	25	23	23	23	0	0	0.00
Non-ferrous metal processes	2435	2404	2732	3265	3720	3881	3925	4029	4292	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Agriculture																						
Pesticide use	132	76	88	86	85	91	93	89	83	42	30	25	25	28	42	39	35	31	27	22	23	69.91
Waste																						
Waste incineration	4.7	4.7	4.5	4.0	3.0	2.7	2.9	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.41
Total	**3170**	**3062**	**3370**	**3683**	**3956**	**4128**	**4171**	**4172**	**4428**	**94**	**80**	**70**	**66**	**64**	**75**	**71**	**66**	**62**	**58**	**32**	**32**	**100.00**
International Navigation	0.5	0.5	0.6	0.6	0.5	0.5	0.6	0.6	0.6	0.5	0.4	0.4	0.3	0.4	0.5	0.5	0.6	0.6	0.7	0.6	0.5	

Annex 5 – (C2) Emissions of HCB to Land and Water (kg per year)

LAND VECTOR (Kg per year)																						
Sector	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Contributions from source category to total HCB emissions in 2010**
Agriculture Pesticide use	54.2	31.4	36.0	35.5	34.7	37.5	38.1	36.6	33.9	17.2	12.4	10.4	10.2	11.5	17.4	16.1	14.5	12.9	11.0	9.1	9.3	100.00
Total	**54**	**31**	**36**	**35**	**35**	**37**	**38**	**37**	**34**	**17**	**12**	**10**	**10**	**11**	**17**	**16**	**15**	**13**	**11**	**9**	**9**	**100.00**

WATER VECTOR (Kg per year)																						
Sector	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Contributions from source category to total HCB emissions in 2010**
Agriculture Pesticide use	1.9	1.1	1.2	1.2	1.2	1.3	1.3	1.3	1.2	0.6	0.4	0.4	0.4	0.4	0.6	0.6	0.5	0.4	0.4	0.3	0.3	19.11
Waste																						
Waste water handling	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.4	80.89
Total	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**100.00**

Annex 5 – (D1) Emissions of PeCB to Air (kg per year)

AIR VECTOR (Kg per year)																						
Sector	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Contributions from source category to total PeCB emissions in 2010 %**
Combustion in Energy Production																						
Public electricity and heat production	3.4	3.5	4.2	6.0	9.5	10.4	10.1	13.1	18.5	17.9	18.6	2.0	2.2	2.2	2.1	2.1	2.4	2.4	2.5	3.1	3.2	9.1
Combustion in Industry																						
Other industrial combustion[1]	12.6	13.7	14.5	11.1	10.2	8.2	7.3	5.2	4.1	4.4	3.9	3.7	3.6	3.3	3.1	2.9	3.1	2.6	3.5	3.9	3.8	10.6
Combustion in Commercial and Residential Use																						
Commercial and institutional fuel combustion	5.0	4.8	4.2	3.7	3.2	2.8	2.4	1.9	1.5	1.6	1.5	0.8	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	1.4
Residential fuel combustion	8.9	9.0	8.3	7.9	5.9	4.3	4.7	4.4	4.7	5.2	3.6	2.9	2.5	2.2	1.8	1.6	1.8	2.1	2.3	2.2	2.3	6.4
Agricultural fuel combustion	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.3	0.8
Production Processes																						
Emissions from PCB use	47.5	44.7	42.0	39.6	37.1	34.9	32.8	30.8	29.1	27.4	7.2	6.7	6.3	6.0	5.6	5.3	5.0	4.7	4.5	4.2	4.0	11.3
Non-ferrous metal production	175	173	196	235	268	279	282	290	309	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Chemical production	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wood impregnation	3.7	3.7	3.7	3.7	3.7	3.6	3.5	3.4	3.3	3.2	3.0	2.9	2.7	2.5	2.4	2.3	2.1	2.0	1.9	1.8	1.7	4.8
Agriculture Pesticide use	73.4	11.0	11.0	2.6	2.6	2.4	2.4	2.4	2.4	31.6	31.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Waste																						
Solid waste disposal on land	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
Small scale waste burning	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	11.6	32.7
MSW incineration and refuse derived fuel combustion	15.4	15.2	14.6	12.9	9.4	8.6	9.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other waste disposal[2]	16.8	16.8	16.5	16.2	15.9	15.6	15.4	15.1	15.1	15.2	15.3	8.6	8.6	8.5	8.4	8.3	3.7	0.9	0.6	0.6	0.6	1.7
Vehicle fires	1.0	1.2	1.2	1.2	1.1	1.1	1.2	1.1	1.1	1.3	1.3	1.4	1.3	1.3	1.1	1.0	0.9	0.8	0.7	0.7	0.7	2.0
Accidental building fires	11.6	10.4	10.3	9.7	9.5	11.2	10.2	9.2	8.5	9.5	8.5	9.1	9.4	10.4	8.3	7.9	8.1	7.7	6.8	6.8	6.8	19.1
Total	**386**	**319**	**339**	**361**	**387**	**394**	**393**	**388**	**409**	**129**	**106**	**50**	**49**	**49**	**45**	**44**	**39**	**35**	**35**	**36**	**35**	**100**

[1] Other industrial combustion – includes fuel combustion in industries including non-ferrous metals, chemical production, paper and pulp, and food processing, beverages and tobacco.

[2] Other waste includes agricultural waste burning, chemical incineration, and clinical waste incineration

Annex 5 (D2): Emissions of PeCB to Land and Water (kg per year)

LAND VECTOR (Kg per year)																						
Sector	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Contributions from source category to total PecB emissions in 2010 %**
Combustion in Energy Production																						
Public electricity and heat production	0.5	0.5	0.6	0.8	1.3	1.4	1.3	1.7	2.5	2.4	2.5	2.7	2.9	2.9	2.8	2.8	3.2	3.2	3.3	4.1	4.3	
Combustion in Industry																						
Other industrial combustion[1]	0.008	0.008	0.009	0.007	0.006	0.005	0.004	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	
Combustion in Commercial and Residential Use																						
Commercial and institutional fuel combustion	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Residential fuel combustion	0.005	0.006	0.005	0.005	0.004	0.003	0.003	0.003	0.003	0.003	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	
Agricultural fuel combustion	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Production Processes																						
Emissions from PCB use	175	165	156	148	139	131	124	117	111	105	27	25	24	23	21	20	19	18	17	16	15	
Chemical production	0.01	0.02	0.02	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.03	
Agriculture																						
Pesticide use	30.1	4.5	4.5	1.1	1.1	1.0	1.0	1.0	1.0	12.9	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Waste																						
Small scale waste burning	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	
MSW incineration and refuse derived fuel combustion	2.0	2.0	1.9	1.7	1.2	1.1	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Other waste disposal[2]	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	86.8	36.3	5.4	2.6	2.6	2.6	
Vehicle fires	11.4	13.1	13.1	13.2	12.2	12.7	13.3	12.5	12.4	14.6	14.2	15.2	14.4	14.0	12.0	11.1	10.2	9.1	8.0	8.0	8.0	
Accidental building fires	129	115	114	107	105	125	113	102	94	105	94	101	104	115	92	88	90	85	75	75	75	
Total	**563**	**516**	**506**	**487**	**476**	**487**	**469**	**449**	**436**	**455**	**366**	**359**	**360**	**370**	**344**	**337**	**287**	**249**	**235**	**234**	**234**	

[1] Other industrial combustion – includes fuel combustion in industries including non-ferrous metals, chemical production, paper and pulp, and food processing, beverages and tobacco.

[2] Other waste includes agricultural waste burning

WATER VECTOR (Kg per year)																						
Sector	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Contributions from source category to total PecB emissions in 2010 %**
Chemical production	4.5 $x10^{-6}$	4.7 $x10^{-6}$	4.9 $x10^{-6}$	4.4 $x10^{-6}$	4.7 $x10^{-6}$	5.2 $x10^{-6}$	5.5 $x10^{-6}$	6.1 $x10^{-6}$	6.3 $x10^{-6}$	6.2 $x10^{-6}$	6.1 $x10^{-6}$	6.7 $x10^{-6}$	7.6 $x10^{-7}$	9.0 $x10^{-7}$	9.3 $x10^{-7}$	1.0 $x10^{-6}$	1.1 $x10^{-6}$	1.1 $x10^{-6}$	9.0 $x10^{-7}$	9.1 $x10^{-7}$	9.3 $x10^{-7}$	0.0
Agriculture																						
Pesticide use	1.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Waste																						
Waste water handling	2.90	2.90	2.91	2.91	2.92	2.92	2.93	2.94	2.94	2.95	2.96	2.98	3.00	3.01	3.02	3.04	2.96	2.94	2.88	2.89	2.92	100
Total	**4**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**100**

ANNEX 6

Review of the UK Dioxins Action Plan for unintentionally produced persistent organic pollutants (as outlined in the National Implementation Plan 2007)

1 Scope of the review

The review of the UK Dioxins Action Plan describes actions taken by the UK to minimise environmental and human exposure to dioxins and furans, polychlorinated biphenyls (PCBs) and hexachlorobenzene (HCB). It sets out our understanding of the key sources and trends for unintentionally produced substances listed in Annex C of the Stockholm Convention.

2 Requirements and progress

The Stockholm Convention contains provisions to reduce the total releases of dioxins and furans, PCBs and HCB from industrial and diffuse source categories. As part of the UK NIP 2007[1], activities were carried out using the best available knowledge to identify and address key sources for the UK. These included proposals for increased controls on:

- Industrial processes such as municipal waste incineration, metal processing plants, power stations and chemical manufacturing plants;
- Open burning of agricultural waste – now banned in the UK;
- Marketing and use controls on chemicals contaminated with dioxins and HCB (particularly HCB contaminated pesticides);
- Regulation and maximum limits for concentrations of dioxins and PCBs in sewage sludge consigned to agriculture; and
- Vehicular emissions.

The NIP also identified knowledge gaps within the source inventories for POPs and the need for better characterisation of specific emission sources and emission vectors. The results of this additional work, alongside the UK's ambient monitoring programme and research into the presence of POPs in food, have informed the UK understanding of the issues surrounding this set of pollutants and the measures needed to control them.

3 Source inventories

One of the key requirements of the Stockholm Convention is that an evaluation of current releases of POPs be undertaken. This includes the development and maintenance of source inventories and release estimates for dioxins, furans, HCB and PCBs. Ideally these source inventories should span five emission vectors:

- Air
- Water
- Land (i.e. direct release to land)
- Residue (contamination of wastes and by-products (recycled/landfill))
- Product (POP contaminated products sold to market (e.g. PCP compounds)

1 http://archive.defra.gov.uk/environment/quality/chemicals/documents/pop-nationalplan.pdf

The UK monitors emissions to air through the National Atmospheric Emissions Inventory (NAEI) which provides a standard reference inventory for a wide range of pollutants including POPs. The NAEI is based on activity estimates and emission factors for all identified industrial and non-industrial UK emission sources. The inventory may be found at: http://naei.defra.gov.uk/

In addition, the UK Environment Agencies operate pollution inventories which cover releases to air, water and land for large industrial processes which are regulated under the Integrated Pollution Prevention and Control Directive (IPPC) and are compiled annually. The 'Pollution Inventory (PI)' compiled by the England and Wales Environment Agency may be found here:
http://www.environment-agency.gov.uk/business/topics/pollution/32254.aspx

The 'Scottish Pollutant Release Inventory (SPRI)' compiled by the Scottish Environment Protection Agency may be found here:
http://www.sepa.org.uk/air/process_industry_regulation/pollutant_release_inventory.aspx

The Northern Ireland Environment Agency also compiles emission data for Northern Ireland and submits this to the UK Pollutant Release and Transfer Register (PRTR).

Alongside the requirements of the IPPC and the Stockholm Convention, the UK has ratified the UNECE Aarhus Convention on public access to information and participation in decision-making (http://www.unece.org/env/pp/introduction.html). Within Europe the Aarhus Convention is implemented via the PRTR (Pollutant Release and Transfer Registers) Regulations (EC 166/2006), which require Member States to compile and make publicly available information on releases to air, land and water. The PRTR regulation supersedes the EPER (European Pollutant Emission Register) which was originally established in 2001. The data provided by the UK pollution inventories is consolidated with data from other sources and may be found at: http://prtr.defra.gov.uk/

The first reporting year for the UK PRTR was 2007. The PRTR includes all emissions of POPs from industrial sources listed under IPPC Part A (2)[2] and greater, provided they exceed an annual emission threshold detailed below:

- Dioxins and Furans – 0.1g I-TEQ[3] (all vectors)
- Polychlorinated Biphenyls – 0.1kg (all vectors)
- Hexachlorobenzene – 10kg (air) 1kg (land and water)

One of the activities of the UK National Implementation Plan (2007) was to develop further and characterise the UK source inventories to produce a full multi-vector (air, land and water) emission inventory. The intention was to further develop land and water vectors and update the last review carried out by Patrick Dyke *et.al.* in 1997, which suggested these emissions may be significant.

The UK POPs multi-vector inventory and review of UK sources was completed in 2009. The inventory report is available here:
http://archive.defra.gov.uk/environment/quality/chemicals/documents/dioxins-report100630.pdf

2 This data also includes the IPPC Part A(2) facilities governed by the local authorities in England and Wales which are not currently included within the England and Wales Pollution Inventory
3 TEQ is a scheme used to provide the measurement of toxicity for dioxins.

This inventory was further improved in 2011 and now provides detailed information on the sources of POPs within the UK. It is a key part of the UK's assessment for further emissions and emission minimisation.

These improvements have addressed the areas of greatest uncertainty with regard to emissions of dioxins and furans, PCBs and HCB to air, land and water arising from waste facilities, product contamination and a key diffuse source (backyard burning). The inventories have been refined to reflect the following findings:

(a) Hazardous and Clinical incinerator plant sector

In contrast to the assumption that 100% of residual waste arising from waste incineration was consigned to landfill, it was identified that hazardous waste operators recycled 100% of their waste after further removal of any remaining hazardous substances present in the residue. Clinical incineration operations produced smaller quantities of residual waste than previously estimated, with only the fly ash[4] fraction of this waste being consigned to landfill.

(b) Non-Ferrous Metal Sector

That the secondary aluminium manufacture and recycling industries dominated this sector. As they produce smaller quantities of air pollution control (APC)[5] residue with higher levels of recycling than previously estimated the multi-vector inventory has been revised. The emission factors[6] have been retained as the results showed a lack of POPs monitoring data.

(c) Sewage sludge emissions

The original estimates used emission factors for PCBs based on the findings of a 2000 study which identified that emissions from previous use of PCB containing equipment were of concern. However, sampling and analysis of emissions from this source has shown a decline in PCB concentrations (from 440 µg/kg[7] to 42 µg/kg) since 2000. Higher concentrations from industrial flows compared to rural and urban flows were also noted, along with an indication of seasonal variations.

(d) Pesticide sector

Analysis of samples taken during the preparation of the chlorothalonil pesticide showed that HCB contamination ranged between 0.16 – 38 ppm[8] (mg/kg wt/wt). This gave a new weighted average of 8ppm compared to the previous estimate of 40ppm, which had been based on the UK legal limit.

(e) Backyard burning

A UK survey found that the burning of waste was not as widespread as had been previously believed. These survey results have shown that, while the burning of plastic waste is widely understood not to be advisable, there is less understanding that treated wood should not be burned. The burning of treated wood was found to be a particular issue among trades-people. The burning of tyres was found to be more common in some parts of the country than others.

4 Fine particles arising from flue gases caught in flue gas cleaning systems.
5 Mainly fly ash plus activated carbon and lime (used as gas scrubbing materials)
6 An experimentally derived factor which identifies the quantity of substance emitted per unit of activity. Emission estimates are derived by multiplying 'activity data' by an 'emission factor'.
7 Microgram per kilogram is a unit of measure for one millionth of a gram (1×10^{-6}) per thousand grams (1kg).
8 Parts per million is a unit of measure for one thousandth (1×10^{-3}) of a gram or one thousandth of a litre (1 millilitre) per thousand grams (1kg) .

4 Strategies to reduce emissions of dioxins, PCBs and HCB emissions to air

While the 2007 UK NIP confirmed a well-established base of knowledge on emissions to air, it identified some data gaps for dioxins and PCB emissions in some industrial sectors. It also identified a lack of data for many diffuse emission sources.

4.1 Emissions from industrial sources regulated by the Environment Agency (EA) and the Scottish Environment Protection Agency (SEPA)

4.1.1 Reduction of dioxin emissions from UK sinter plants

Sinter plants have been trialling a range of methods to abate and reduce dioxin emissions. These include various additives (e.g. activated carbon or urea) and abatement technology (e.g. bag filters and electrostatic precipitators). Unfortunately, any reductions have been off-set by a change in the sources of iron ore to the UK, with more recent supplies containing higher levels of impurities, leading to increased formation of dioxins.

The BREF[9] for Iron and Steel Production has been recently updated and sinter plants will need to meet their Best Available Technique (BAT) permit requirements by March 2016 (unless otherwise derogated). The EA is liaising with operators to agree environmental priorities.

4.1.2 Review of emission factors for the non-ferrous metal sector

The EA has confirmed that over the last five years, no significant releases of HCB or PCBs to air have been reported for the non-ferrous metals installations it regulates. Over the same period, releases to air of dioxins and furans from this regulated sector have decreased by half to less than 1g per annum in total.

4.1.3 Scottish review of source inventories

SEPA have identified the main sources of dioxin emissions in Scotland and considered potential means to achieve further reductions in emissions at sources that it regulates. The report of the study is available at http://www.sepa.org.uk/science_and_research/publications.aspx.

This report noted that the total inventory for Scotland due to emissions from all sources is estimated to be 29 grams ITEQ[10] per year. The most significant sources of dioxins and furans were identified to arise from sources not regulated by SEPA. These include accidental fires and agricultural and small scale waste burning.

In line with the report's recommendations, SEPA is in the process of reviewing the Scottish Pollutant Release Inventory (SPRI) to include additional information from process operators. SEPA is also developing guidance and an emissions database for use by operators.

9 Best Available Techniques (BAT) reference documents adopted under the European Commission IPPC and IED Directives to define the conclusions led down for best available techniques with regard to each industrial sector

10 I-TEQ is the international unit of measure for toxic equivalent concentration

4.2 Reducing dioxins, PCBs and HCB from diffuse sources

In the 2007 NIP the UK acknowledged that the disparate nature of diffuse sources made it harder to reduce emissions by conventional regulatory means alone. Alongside the ongoing implementation of the UK Waste Strategy, the Government is exploring opportunities to raise awareness on best practice to reduce emission from domestic sources. This work will seek to build on existing web-publishing platforms, which already provide comprehensive guidance. A selection of these websites are listed below.
http://www.direct.gov.uk/en/HomeAndCommunity/InYourHome/Escapingandrecoveringfromafire/DG_180786
http://www.environmental-protection.org.uk/neighbourhood-nuisance/garden-bonfires/#wa790
http://www.wycombe.gov.uk/council-services/environment/pollution/air-pollution/bonfires-dust-and-odours.aspx

5 Strategies to reduce exposure to dioxins, PCBs and HCB via food

5.1 Setting maximum permitted levels in food and animal feed

The UK has actively contributed to negotiations on revised limits for dioxins and dioxin-like PCBs and new limits for non dioxin-like PCBs in food and feed. These are based on a review of data provided by Member States in response to monitoring recommendations or from other surveys. They are compiled by the European Food Safety Agency (EFSA). The revised limits are established using the 2005 WHO-TEFs and there is limited tightening of existing limits in some cases. The new and revised limits for food are set out in Commission Regulation 1259/2011 and for feed in Commission Regulation 277/2012. Furthermore, following a feed contamination incident in Germany associated with use of contaminated vegetable oil as a feed ingredient, a more prescriptive regimen for dioxin testing by producers and processors in the feed chain has been introduced at European level. This is set out in Commission Regulation 225/2012.

5.2 Monitoring of food and animal feed

Between 2009 and 2011, the Food Standards Agency oversaw the testing of imported foods for dioxins and PCBs. No samples tested positive. Based on this outcome, it was concluded that random monitoring of food was not an effective use of resources, which should instead be directed towards higher risk areas such as certain feed ingredients, contamination hotspots and emerging risks. As with food, the monitoring of animal feed has resulted in no reported instances of non-compliance. Regular feed monitoring will continue.

5.3 Actions to protect consumers

Since 2007, the UK has been affected by one major incident relating to dioxins. This originated in the Republic of Ireland and was associated with very highly contaminated feed which was supplied mainly to pig farms in Ireland. Some potentially contaminated pork and pork products were exported to other Member States, including the UK, and were withdrawn from the food chain as a precaution. However, contaminated feed was also supplied to a small number of beef and dairy farms in Northern Ireland. As a consequence, several hundred tonnes of meat were withdrawn and destroyed and about 5,000 contaminated cattle were culled in order to protect consumers.

Although further product withdrawals have been instigated as a result of contamination incidents in other Member States, there have been no significant incidents in the UK.

The FSA has also provided advice in a number of instances of dioxin contamination of land used for food production, in particular allotments. Where necessary, most advice is directed to allotment holders who keep hens to provide eggs as uptake into plants is negligible. This advice, based on analysis of the eggs and keeping in mind that food produced for private consumption is not subject to regulatory control, has generally been to limit consumption and/or not to give them to children under a certain age.

5.4 Research programme on dietary intakes

Between 2007 and 2010 the Food Standards Agency carried out an investigation into levels of contaminants, including dioxins, PCBs and PBDEs, in fish in unmanaged inland UK waterways. One objective was to assess the risk to health for recreational anglers who may consume some of their catch. It was found that there is the potential for significant localised variation in contaminant levels, with POPs levels in fish in certain rivers being significantly above the regulatory limits applicable to commercial fish and fisheries products. The full report for the project is available on the FSA website at http://www.foodbase.org.uk/results.php?f_category_id=&f_report_id=571.

As noted in Section 6.3 (iv) of the 2007 NIP, following the 2001 Total Diet Study (TDS) for dioxins and PCBs, which showed a reduction of around 85% in dietary exposure over the period since 1982, a decision was made that regular four-yearly TDSs were no longer necessary. However, samples were collected between November 2011 and March 2012 for a new TDS for a range of contaminants including dioxins and PCBs. The full results of this new study will be available in early 2013.

5.5 Food chain pathway, mechanisms and livestock uptake

FSA followed up a previous investigation into the impact of repeated flooding events[11] with a more detailed, 5-year study to include the meat and offal of cows and sheep. The purpose of this study was to find out whether raised contamination levels in soil due to deposition of contaminated river silt during flooding led to an increase in the level of contaminants in food from animals raised on the floodplains. At the time of writing the final report is being prepared for publication on the FSA website.

11 see *Effects of River Flooding on PCDD/F and PCB Levels in Cows' Milk, Soil, and Grass*. Lake *et.al.*, Env. Sci. Technol. 39:23 (2005) 9033.

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