



Brussels, 21.1.2019
SWD(2018) 495 final/2

CORRIGENDUM

This document corrects document SWD(2018)495 final of 4.1.2019
Insertion of the title of the Commission Staff Working Document
The text shall read as follows:

COMMISSION STAFF WORKING DOCUMENT

**European Union Implementation Plan for the Stockholm Convention on Persistent
Organic Pollutants**

Accompanying the document

**REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE
COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE
COMMITTEE OF REGIONS**

**On the review and update of the second European Community Implementation Plan in
accordance with Article 8(4) of Regulation No 850/2004 on persistent organic pollutants**

{COM(2018) 848 final}

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PREFACE

This document presents the European Union implementation plan required by the Stockholm Convention on Persistent Organic Pollutants (POPs), of which the European Union is a Party. This document also details the work undertaken by the European Union towards the Protocol to the UNECE Convention on Long- Range Transboundary Air Pollution (CLRTAP) on POPs¹ and Regulation (EC) No 850/2004 on POPs. The implementation plan sets out the Union's regulatory framework for POPs and PBT substances, and what have been identified as the key challenges facing the European Union within Part I (Party Baseline). Part II subsequently sets out the Union's response to these key challenges and what actions need to be undertaken to help achieve the overall aims of protecting human health and the environment from exposure to POPs. This version of the implementation plan presents the Union's third implementation plan since the entry into force of the Stockholm Convention in 2004.

The first plan, titled the 'Community Implementation Plan' was developed in 2007 (SEC(2007) 341). The implementation plan was updated with a 'Union Implementation Plan' published in 2014 (SWD(2014) 172 final)². The review and update of the second implementation plan has become necessary to further address: 1) the inclusion of a number of new POPs into the Stockholm Convention; and 2) the technical and legislative progress made in the area.

The updated implementation plan will be submitted to the Secretariat of the Stockholm Convention and published on the website of the European Commission.

This document can also be read alongside the triennial synthesis reports (2004-2006, 2007-2009 and 2010-2012) that were developed on the basis of information submitted by the Member States of the European Union pursuant to Article 12 of Regulation (EC) No 850/2004) regarding progress towards the objectives of the Regulation, Convention and Protocol.

¹ Protocol to the 1979 UNECE (United Nations Economic Commission for Europe) Convention on Long- Range Transboundary Air Pollution on Persistent Organic Pollutants
² http://ec.europa.eu/environment/chemicals/international_conventions/index_en.htm

1. INTRODUCTION

1.1. Persistent Organic Pollutants (POPs)

Persistent Organic Pollutants (POPs) are chemicals that persist in the environment, bio-accumulate and pose a risk of causing significant adverse effects to human health or the environment. These pollutants are transported across international boundaries far from their sources and even accumulate in regions where they have never been used or produced. POPs pose a threat to the environment and to human health all over the globe, with the Arctic, Baltic and the Alpine regions being examples of EU sinks of POPs. International action has been deemed necessary to reduce and eliminate production, use and releases of these substances. The substances addressed in the international legal instruments on POPs are listed in Table 1.

At European Union level, significant progress towards the elimination of POPs has been achieved. Production and use of all POP chemicals is prohibited with some minor time limited exemptions that are decreasing. A main challenge for the EU is to eliminate POPs from the waste cycle and remaining stockpiles as these still present a major emission source.

1.2. International agreements addressing POPs

1.2.1. UNECE Protocol on POPs³

The Executive Body to the UNECE Convention on Long-Range Trans-boundary Air Pollution (CLRTAP) adopted the UNECE Protocol on POPs on 24 June 1998 in Aarhus, Denmark. The UNECE Protocol on POPs, focuses currently on a list of 16 substances comprising eleven pesticides, two industrial chemicals and three unintentional by-products. The ultimate objective is to eliminate any discharges, emissions and losses of these POP substances.

The UNECE Protocol on POPs bans the production and use of some substances outright (aldrin, chlordane, chlordecone, dieldrin, endrin, hexabromobiphenyl, mirex and toxaphene). Others are scheduled for elimination at a later stage (dichloro-diphenyl-trichloroethane (DDT), heptachlor, hexachlorobenzene (HCB) and polychlorinated biphenyls (PCBs)). In addition, the UNECE Protocol on POPs also severely restricts the use of hexachlorocyclohexane (HCH) (including lindane). The Protocol includes provisions for dealing with the wastes of substances that are banned and it obliges Parties to reduce their emissions of dioxins, furans, polycyclic aromatic hydrocarbons (PAHs) and HCB below their levels in 1990 (or an alternative year between 1985 and 1995). For the incineration of municipal, hazardous and medical waste, it lays down specific emission limit values.

On 18 December 2009, Parties to the Protocol on POPs adopted decisions 2009/1, 2009/2 and 2009/3 to amend the Protocol to include nine new substances: hexachlorobutadiene, hexa and heptabromodiphenyl ether (found in the commercial octabromodiphenyl ether product), tetra and penta bromodiphenyl ether (found in the commercial pentabromodiphenyl ether product), pentachlorobenzene, perfluorooctane sulfonic acid (PFOS), its salts and other derivatives, polychlorinated naphthalenes, and short-chain chlorinated paraffins. Furthermore, the Parties revised obligations for DDT, heptachlor, HCB and PCBs as well as certain emission limit values (ELVs) from waste incineration, sinter plants and electric arc furnaces for secondary

³ http://www.unece.org/env/lrtap/pops_h1.htm

steel production. Parallel to this, with a view to facilitating the Protocol's ratification by countries with economies in transition, the Parties introduced flexibility for these countries regarding the time frames for the application of ELVs and best available technologies (BAT). Finally, the Parties adopted decision 2009/4 to update guidance on BAT to control emissions of POPs in annex V and turn parts of it into a guidance document (ECE/EB.AIR/2009/14⁴). The amendments for annex V and VII entered into force on 13/12/2010, while the 2009/1 and 2009/2 amendments have not yet entered into force.

The Union formally accepted the amendments on 24 June 2016, based on Council Decision (EU) 2016/769 of 21 April 2016 on the acceptance of the Amendments to the 1998 Protocol to the 1979 Convention on Long- Range Transboundary Air Pollution on Persistent Organic Pollutants.

1.2.2. *Stockholm Convention*⁵

The Stockholm Convention on POPs was adopted in 2001 and entered into force in 2004. It promotes global action on an initial cluster of twelve POP substances, with an overall objective to protect human health and the environment from POPs and requires Parties to take measures to eliminate or reduce the release of POPs into the environment. Specific reference is made to a precautionary approach as set forth in Principle 15 of the 1992 Rio Declaration on Environment and Development. This principle is implemented by Article 8 of the Convention, which lays down the rules for including additional chemicals in the Stockholm Convention.

The Annexes A, B and C to the Convention were amended at the fourth Conference of the Parties (COP-4) in 2009 to include nine new POPs. The amendments entered into force on 26 August 2010 and add the following chemicals to Annexes A, B and/or C of the Convention: alpha hexachlorocyclohexane; beta hexachlorocyclohexane; chlordecone; hexabromobiphenyl; hexabromodiphenyl ether and heptabromodiphenyl ether (commercial octabromodiphenyl ether); lindane; pentachlorobenzene; PFOS, its salts and perfluorooctane sulfonyl fluoride (PFOSF); and tetrabromodiphenyl ether and pentabromodiphenyl ether (commercial pentabromodiphenyl ether).

During the discussions of the fifth Conference of the Parties (COP-5) in 2011, a work plan (following decision SC-4/19) was put in place to limit and reduce the emissions to the environment of the four Stockholm Convention homologue groups of polybrominated diphenyl ethers (POP-BDEs) from wastes and also to help close the knowledge gaps for PFOS. COP-5 was also used to promote closer ties between the Stockholm Convention and the related policy instruments covered by the Rotterdam Convention and Basel Convention.

Additionally during the discussions of COP-5 it was agreed to add Endosulfan (SC5/3) to Annex A of the Convention with specific exemptions.

During the discussion of the sixth Conference of the Parties (COP-6) in 2013, the decision was made to add the flame retardant hexabromocyclododecane (HBCDD) to Annex A of the Convention with specific exemptions for production as allowed for the parties listed in the register of specific exemptions and for use in expanded polystyrene and extruded polystyrene in buildings.

⁴ <http://www.unece.org/env/documents/2009/EB/eb/POPs/Guidance%20document%20on%20BAT.e.pdf>
⁵ <http://chm.pops.int/Convention/ConventionText/tabid/2232/language/en-GB/Default.aspx>

During the discussion of the seventh Conference of the Parties (COP-7) in 2015, the decision was made to add three further substances to the Annexes of the convention. Hexachlorobutadiene and pentachlorophenol (PCP) and its salts and esters were added to Annex A, while polychlorinated naphthalenes (PCN) were added to Annexes A and C. The addition of PCN and its salts and esters to Annex C was due to the fact that PCNs were also used in di-electric equipment in a similar fashion to PCBs, and thus represent an unintentional emission source. COP-7 also held further discussions on the possible addition of hexachlorobutadiene to Annex C, with agreement reached that further evidence should be gathered and reviewed at the next COP. Discussion was also held on the continued use of PFOS and the exemptions currently in place to assess which applications still required exemptions.

These additions at COP-5, COP-6 and COP-7 took the total number of substances to 26 as regulated under the Convention. The amendment for endosulfan entered into force on 27 October 2012, while the amendment for HBCDD entered into force on 26 November 2014. The three additional substances that were agreed to be added to the Annexes of the Convention at COP-7 (following the details of UNEP/POPS/COP.7/15) entered into force in December 2016.

There are 22 chemicals currently listed in Annex A of the Stockholm Convention which are subject to a prohibition on production and use, except where there are generic or specific exemptions. In addition, the production and use of DDT, a pesticide still used in many developing countries, is severely restricted, as set out in Annex B of the Stockholm Convention. The continued use of DDT has been the subject of review and assessment at COP-5, COP-6 and COP-7. There are also exemptions and acceptable uses in place for PFOS, its salts and PFOSF that have been added as part of the 2009 amendments (COP-4).

The generic exemptions allow laboratory-scale research, use as a reference standard and unintentional trace contaminants in products and articles. Articles containing POPs manufactured or already in use before the date of entry into force of the relevant obligation are also subject to an exemption provided that Parties submit information on the uses and a national plan for waste management for such articles to the Secretariat of the Stockholm Convention.

Releases of unintentionally produced by-products listed in Annex C (dioxins, furans, PCBs, PeCB, HCB and from December 2016 also PCNs) are subject to continuous minimisation with the ultimate objective of total elimination, where feasible. According to Annex C, Parties shall promote and, in accordance with their action plans, require the use of best available techniques for new sources within their major source categories identified in Part II and Part III of Annex C of the Stockholm Convention.

The Stockholm Convention also foresees identification and safe management of stockpiles containing or consisting of POPs. Waste containing, consisting of or contaminated with POPs shall be disposed of in such a way that the POP content is destroyed or irreversibly transformed so that it does not exhibit POPs characteristics. 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 recovery or re-use of POPs are explicitly forbidden. With regard to shipment of wastes, relevant international rules, standards and guidelines, such as the 1989 Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal, are to be taken into account.

In addition to control measures, the Stockholm Convention includes several general obligations. Each Party is obliged to develop and endeavour to implement a National Implementation Plan (NIP), facilitate or undertake the exchange of information and promote and facilitate awareness and public access to information on POPs. The Parties shall also encourage or undertake appropriate research, development, monitoring and co-operation pertaining to POPs, and where relevant, to their alternatives and to candidate POPs. They shall also regularly report to the Conference of the Parties on the measures taken to implement the provisions of the Stockholm Convention.

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

Table 1 Overview on POPs regulated at international level; the new POPs under the Stockholm Convention (since 2009) are highlighted in grey

Substance	CAS	Listed in Stockholm Convention	Listed in the UNECE Protocol on POPs	Listed in the EU POP Regulation
Intentionally produced POPs				
Aldrin	309-00-2	Annex A	yes	yes
Chlordane	57-74-9	Annex A	yes	yes
Chlordecone	143-50-0	Annex A	yes	yes
Dieldrin	60-57-1	Annex A	yes	yes
Endosulfan	959-98-8 33213-65-9 115-29-7 1031-07-8	Annex A	no	yes
Endrin	72-20-8	Annex A	yes	yes
Heptachlor	76-44-8	Annex A	yes	yes
Hexabromobiphenyl (HBB)	36355-01-8	Annex A	yes	yes
Hexabromocyclododecane (HBCDD)	25637-99-4 3194-55-6	Annex A	no	yes
Hexabromodiphenyl ether and heptabromodiphenyl ether	68631-49-2 207122-15-4 446255-22-7 207122-16-5 and others	Annex A	yes	yes
				yes
Hexachlorobenzene (HCB)	118-74-1	Annex A	yes	yes
Alpha hexachlorocyclohexane*	319-84-6	Annex A	yes: Hexachlorocyclohexanes (HCH; CAS: 608-73-1 ⁶), including lindane (CAS: 58-89-9)	Yes (all isomers including gamma HCH found in lindane)
Beta hexachlorocyclohexane*	319-85-7	Annex A		
Lindane*	58-89-9	Annex A		
Mirex	2385-85-5	Annex A	yes	yes
Pentachlorobenzene	608-93-5	Annex A	yes	yes
Pentachlorophenol (PCP)	87-86-5	Annex A	no	no
Polychlorinated biphenyls (PCB)	all PCBs and their mixtures have	Annex A	yes	yes

⁶ This CAS No. covers the isomer mixture of alpha, beta, gamma, delta and epsilon HCH.

Substance	CAS	Listed in Stockholm Convention	Listed in the UNECE Protocol on POPs	Listed in the EU POP Regulation
	different CAS numbers			
Tetrabromodiphenyl ether and pentabromodiphenyl ether	5436-43-1 60348-60-9 and others	Annex A	yes	yes
				yes
Toxaphene	8001-35-2	Annex A	yes	yes
DDT	50-29-3	Annex B	yes	yes
Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride (PFOS)	1763-23-1 s, 307-35-7, and others	Annex B	yes	yes
SCCPs – short chain chlorinated paraffins	85535-84-8	under review	yes	yes
HCBD – hexachlorobutadiene	87-68-3	Annex A	yes	yes
PCN – polychlorinated naphthalenes	all PCNs & their mixtures have different CAS numbers	Annex A	yes	yes
Unintentionally produced POPs				
Polychlorinated dibenzop-dioxins (PCDD)	1746-01-6	Annex C	yes	yes
Polychlorinated dibenzofurans (PCDF)	1746-01-6	Annex C	yes	
Hexachlorobenzene (HCB)	118-74-1	Annex C	yes	yes
Pentachlorobenzene	608-93-5	Annex C	yes	yes
Polychlorinated Biphenyls (PCBs)	all PCBs & their mixtures have different CAS numbers	Annex C	yes	yes
PCN – polychlorinated naphthalenes	all PCNs & their mixtures have different CAS numbers	Annex C	yes	no
Polycyclic aromatic hydrocarbons (PAHs)	207-08-9 and others	No	yes	yes

* Lindane, Alpha- and Beta hexachlorocyclohexane, as well as Chlordecone and Hexabromobiphenyl are new POPs under the Stockholm Convention but have already been covered under the POP Protocol and the EU POP Regulation.

1.2.3. Coordination and cooperation among the Basel, Rotterdam and Stockholm Conventions

The Basel, Rotterdam and Stockholm Conventions are multilateral environmental agreements, which share the common objective of protecting human health and the environment from hazardous chemicals and wastes. These agreements can assist countries to manage chemicals at different stages of their life-cycle.

Recognizing the potential for synergistic work under the three conventions at the national, regional and global levels, the international community has worked over the past years on enhancing cooperation and coordination among the Basel, Rotterdam and Stockholm Convention. These efforts culminated in the adoption of recommendations on enhancing

cooperation and coordination among the three conventions by the three Conferences of the Parties held in 2008 and 2009, and the holding of simultaneous extraordinary meetings of the Conferences of the Parties to the Basel, Rotterdam and Stockholm Conventions in Bali, Indonesia in February 2010, and in Geneva in May 2013 and May 2015.

One of the first steps of the synergies process was the restructuring of the secretariats in a manner that strengthens organizational synergies while respecting the legal autonomy of each convention. Further steps taken at successive triple COP meetings resulted in aligning and integrating the work of the Stockholm, Basel and Rotterdam Conventions including cross-cutting measures for information exchange. Today, the enhanced coordination and cooperation resulting from the synergies process is a fundamental pillar of all the work that is done under the conventions in order to increase policy coherence and maximise efficiency and resources. The synergies are mainstreamed in all relevant activities, as appropriate, rather than being a separate activity. The May 2015 COP meeting introduced 17 new joint activities building on these synergies, and also broadened the remit of the global environment facility (GEF) to cover financing for projects on both chemicals and waste (BRS Secretariat, 2015⁷).

1.3. Purpose of the Union Implementation Plan on POPs

The Stockholm Convention lays down an obligation to all Parties, to develop and endeavour to implement a plan for the implementation of its obligations under the Stockholm Convention. For the Union, this obligation is also transferred to the Article 8 of Regulation (EC) No 850/2004 on Persistent Organic Pollutants. The Union has in 2007 therefore developed an Implementation Plan on POPs (SEC(2007) 341), which also covers the substances that fall under the UNECE Protocol on POPs⁸.

The overall purpose of the implementation plan is not only to fulfill legal obligations, but also to take stock of actions taken and lay down a strategy and action plan for further Union measures related to POPs included in the Stockholm Convention and/or in the UNECE Protocol on POPs.

The implementation plan therefore aims to:

- review the existing Union level measures related to POPs;
- assess their efficiency and sufficiency in meeting the obligations of the Stockholm Convention;
- identify needs for further Union level measures;
- establish a plan for implementing the further measures;
- identify and strengthen links and potential synergies between POPs management and other environmental policies and other policy fields; and
- increase awareness on POPs and their control measures.

In developing this implementation plan information and data has been taken from the following key sources:

⁷ BRS Secretariat, 2015, '10 years of synergies decisions – compilation of decisions related to enhancing co-operation among the Basel, Rotterdam and Stockholm Conventions'

⁸ http://ec.europa.eu/environment/chemicals/international_conventions/index_en.htm

- European Union policy and legislative documents used to govern and manage the Union's policy landscape on chemicals;
- Member States' reports submitted to the European Commission as per Article 12 of the POP Regulation;
- Member States National Implementation Plans;
- European Union databases on chemicals including:
 - Chemical databases held by the European Chemicals Agency as part of the REACH and CLP Regulations;
 - European Pollutant Release and Transfer Register (E-PRTR);
 - UNECE EMEP database for POPs release estimates;
 - Eurostat;
 - Pesticides database⁹;
 - European Substance Information Systems (ESIS) database;
- Scientific journal literature;
- Input from key experts in the field.

Further detailed information can also be found within Member State national implementation plans, and triennial synthesis reports developed by the European Commission, which detail work undertaken within Europe, including information on releases and monitoring of POPs.

⁹ <http://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/public/?event=homepage&language=EN>

PART I – PARTY BASELINE

This section presents the Union’s baseline with regard to POP chemicals regulated under the Stockholm Convention and the Protocol on POPs. As such it includes at first an overview on the key EU legislation related to the implementation of obligations in the mentioned international frameworks as well as related EU strategies and programmes, followed by a description of existing financial instruments to support the implementation as well as research activities. In order to get a full picture of the status quo of the implementation, a description will be provided on what efforts are currently being undertaken by the Union to raise awareness and enhance communication. Furthermore, an overall assessment of POPs regarding their production, their use, their placing on the market as well as with regard to existing stockpiles and the contamination of the waste stream will be described.

This Part I ‘Party Baseline’ presents the basic information on the EU situation and will be followed by an in-depth analysis in Part II regarding each single obligation of the Stockholm Convention. This analysis is followed by the identification of actions to improve the implementation.

2. KEY UNION LEGISLATION AND POLICIES RELATED TO THE UNION’S OBLIGATIONS UNDER THE STOCKHOLM CONVENTION AND UNECE PROTOCOL ON POPs

The EU has implemented a number of legislative measures that are related to POPs addressing both the aims of the Stockholm Convention but also the UNECE Protocol on POPs. The following figure gives an overview of the main chemical and environmental legislation relating to POPs and to which stage of the lifecycle it refers to. Details on the legislation related to POPs are described in the following sub-sections.

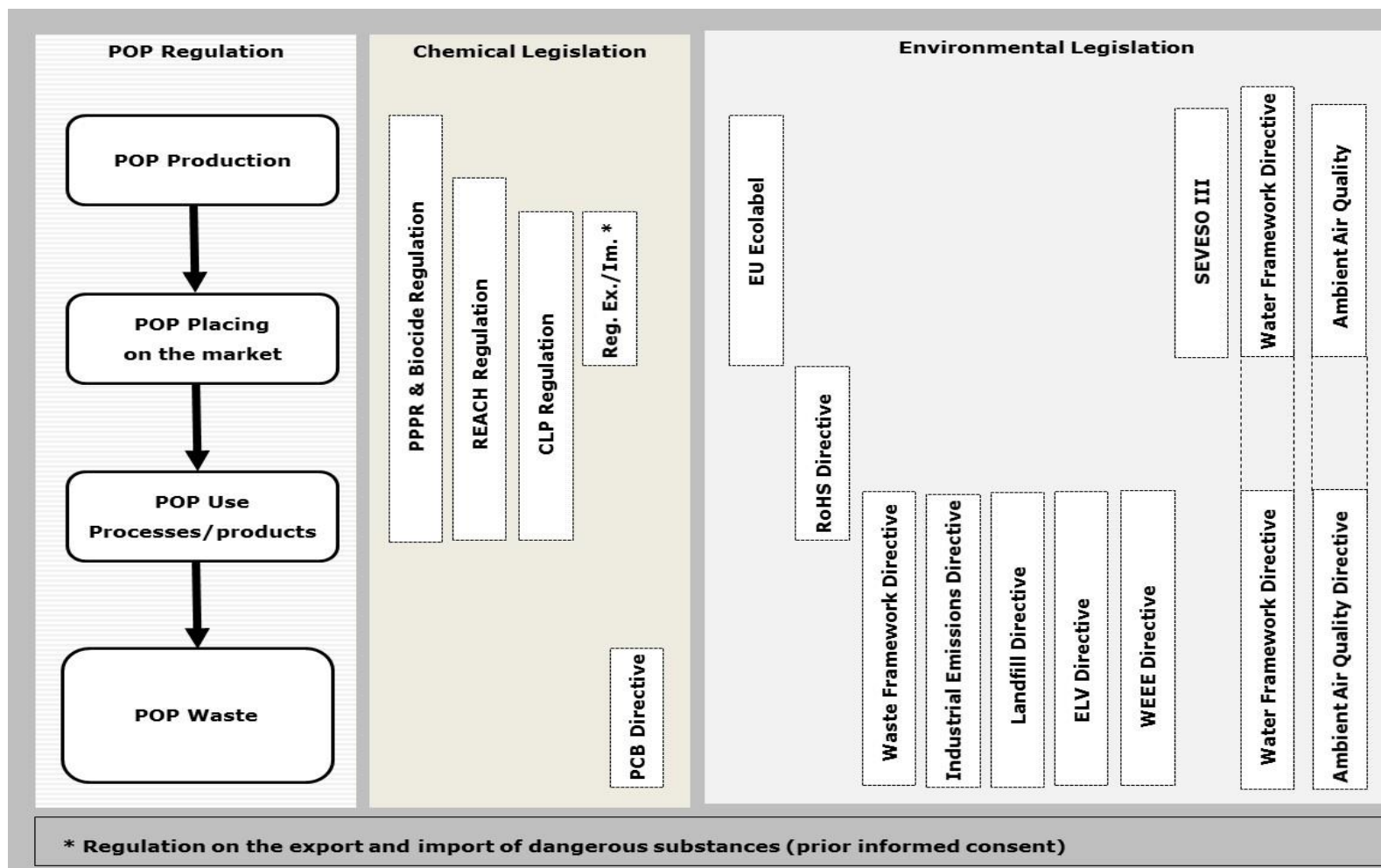


Figure 1: Overview on the main chemical and environmental legislation related to POPs

2.1. Legislative instruments

2.1.1. *The POP Regulation*

The main legal instrument for implementing the Stockholm Convention and the UNECE Protocol on POPs is Regulation (EC) No 850/2004 on persistent organic pollutants (POPs) (hereafter called the “POP Regulation”). This Regulation entered into force on 20 May 2004 and as a regulation it is directly applicable in all Member States, including those which are not yet Parties to the Stockholm Convention or the UNECE POP Protocol.

The POP Regulation contains provisions regarding production, placing on the market and use of chemicals, management of stockpiles and wastes and measures to reduce releases of unintentionally produced POPs. Exports of POPs are regulated under Regulation (EU) No 649/2012 concerning the export and import of hazardous chemicals. The exemptions to the prohibitions under the POP Regulation are limited to a minimum. Furthermore, the POP Regulation contains provisions requiring the setting up of emission inventories for unintentionally produced POPs, national and European Union implementation plans and monitoring and information exchange mechanisms. To a certain extent the POP Regulation goes further than the international agreements emphasising the aim to eliminate the production and use of the internationally recognised POPs, notably this includes the development of thresholds for POPs within waste, which are detailed in Annex IV and V of the Regulation. Where the thresholds are exceeded the waste cannot be recycled and should be treated in a way that the POP content is irreversibly transformed or destroyed.

The POP Regulation has been amended several times. The concentration limits in Annex IV and V were established by Regulation (EC) No 1195/2006¹⁰ and 172/2007¹¹ and by Regulation (EU) 2016/460¹², respectively. Annex V was further amended by Regulation (EC) No 323/2007¹³ in order to allow pre-treatment operations prior to the permanent storage of wastes containing POPs. Regulation (EC) No 219/2009¹⁴ empowered the Commission to establish some concentration limits in the annexes, to amend annexes whenever a substance is listed in the Convention or the Protocol, to modify the existing entries and to adapt annexes to scientific and technical progress. The decision of the Conference of the Parties to the Basel Convention on the updated general technical guidelines for the environmentally sound management of waste consisting of, containing or contaminated with POPs was taken up by Regulation (EC) No 304/2009 amending Annexes IV and V as regards the treatment of waste containing POPs in thermal and metallurgical production processes¹⁵. The decisions of the fourth meeting of the Conference of the Parties (COP4) to the Stockholm Convention on 4–8 May 2009 to list new substances were taken up by the Regulation (EU) No 757/2010¹⁶ amending Annexes I and III and by the Regulation (EU) No 756/2010 of 24 August 2010 amending Annexes IV and V¹⁷.

¹⁰ OJ L 217, 8.8.2006, p. 6.

¹¹ OJ L 55, 23.2.2007, p. 1.

¹² OJ L 80, 31.3.2016, p. 17.

¹³ OJ L 85, 27.3.2007, p. 3.

¹⁴ OJ L 87, 31.3.2009, p. 109.

¹⁵ OJ L 96, 15.4.2009, p. 33.

¹⁶ OJ L 223, 25.8.2010, p. 29.

¹⁷ OJ L 223, 25.8.2010, p. 20.

The Commission further adopted Regulation (EU) No 519/2012¹⁸ amending Annexes IV and V to set the missing concentration limit values (the so-called lower and upper POP content) for PFOS and POP-BDEs, as well as amending Annexes I, IV and V to take into account the decisions of COP-5 to list Endosulfan, COP-6 to list HBCDD, and COP-7 to list hexachlorobutadiene, and PCNs. This also includes the 27th Session of the CLRTAP Executive Body to list hexachlorobutadiene (HCBd), polychlorinated naphthalenes (PCN) and short-chained chlorinated paraffins (SCCP).

Concerning management of stockpiles, the Regulation provides that all remaining stockpiles for which no use is permitted shall be managed as waste. Stockpiles greater than 50 kg meant for permitted uses shall be notified to the competent authority and managed in a safe, efficient and environmentally sound manner. Holders of a stockpile consisting of or containing any POPs for which no use is permitted shall manage that stockpile as waste generally in such a way that the POP content is destroyed or irreversibly transformed.

With regard to wastes, producers and holders of waste are obliged to undertake measures to avoid contamination of waste with POP substances. Waste with POPs content higher than the above mentioned lower POP limits must generally be disposed of or recovered in such a way that the POP content is destroyed or irreversibly transformed. By way of derogation, wastes containing POPs below the limit values indicated in Annex V may be otherwise dealt with in accordance with a method listed in Annex V, part 2, subject to the conditions outlined in Article 7.4 (b)¹⁹.

2.1.2. EU chemicals legislation

Other chemicals legislation complements the POP Regulation in implementing the obligations of the Stockholm Convention and the POP Protocol. As Table 2 shows, the other chemicals legislation particularly ensures that the export ban on POPs is implemented and that allowed imports and exports are in conformity with the rules of the Stockholm Convention, ensures that POPs are collected and irreversibly destroyed and prevents that the chemicals exhibiting POP characteristics are produced or marketed.

Table 2 EU chemicals legislation relevant for POPs

Acronym	Legal reference	POPs regulated / POP reference	Areas of regulation
REACH	Regulation (EC) No 1907/2006	Testing on PBT (persistent, bioaccumulative and toxic) criteria according to Annex XIII	Production, placing on the market & use
CLP	Regulation (EC) No 1272/2008	Inventory of classification and labelling of hazardous substances.	Classification, Labelling, Packaging
Plant Protection Product Regulation	Regulation (EC) No 1107/2009	Active substance, safener or synergist shall only be approved where it is not considered to be a persistent organic pollutant (POP) resp. PBT substance.	Placing on the market & use

¹⁸ OJ L 159, 20.6.2012, p. 1.

¹⁹ The upper concentration limits are not valid for permanent underground landfilling. Regulation (EC) 172/2007 amending Regulation (EC) 850/2004: „These limits exclusively apply to a landfill site for hazardous waste and do not apply to permanent underground storage facilities for hazardous wastes, including salt mines.”

Acronym	Legal reference	POPs regulated / POP reference	Areas of regulation
		Active substances meeting two of the PBT criteria shall be candidates for substitution	
Biocidal Products Regulation	Regulation (EU) 528/2012	Active substances meeting two of the PBT criteria shall be candidates for substitution	Placing on the market & use
PIC Regulation concerning the export and import of hazardous chemicals	Regulation (EU) No 649/2012	POPs as listed in Annexes A and B of the Stockholm Convention are subject to export ban	Export and import of dangerous chemicals
PCB Directive	Directive 96/59/EC	Disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT)	Disposal

2.1.2.1. REACH

Regulation (EC) No 1907/2006 concerning 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. Furthermore under the authorisation and restriction processes, the promotion of innovation, use of safer alternatives and contribution to the goal of achieving sustainable development of chemical use are covered.

REACH requires EU companies which manufacture or import chemical substances in quantities of one tonne or more per year to register these substances and ensure that they can be used safely. This information is submitted in the form of registration dossiers to the European Chemicals Agency (ECHA)²⁰. The submission contains a technical dossier and, for substances manufactured or imported in quantities of 10 tonnes per annum (tonnes p.a.) or above, a Chemical Safety Report (CSR). The chemical safety assessment detailed by the CSR has to cover:

- (a) human health hazard assessment;
- (b) physicochemical hazard assessment;
- (c) environmental hazard assessment;
- (d) persistent, bioaccumulative and toxic (PBT) and very persistent and very bioaccumulative (vPvB) assessment.

For hazardous substances (such as those assessed to be a PBT or vPvB), an exposure assessment and risk characterisation must be included in the Chemical Safety Report. For some of the substances identified as PBT or vPvB, an authorisation from the Commission is required for particular uses. This is the case when a substance meeting the requirements of the very high concern (SVHC) criteria²¹ is included in Annex XIV of the Regulation and will then become banned once the set sunset date has passed unless an authorization is granted. Only specific uses for which a request for authorization has been made following specific requirements with regard to the assessment of the substance can be allowed. Prior to inclusion into Annex XIV the selected substances are part of the so-called Candidate List

²⁰ <http://echa.europa.eu/>

²¹ <http://echa.europa.eu/addressing-chemicals-of-concern/authorisation/substances-of-very-high-concern-identification>

which in itself already implies a number of obligations such as e.g. the obligation to deliver information on the content of a substance in an article.

REACH further includes the possibility to restrict the use, placing on the market or production of substances by listing them in Annex XVII of REACH. This is another legal instrument that can be used to prevent production and use of substances having POP characteristics.

With the above described measures REACH gives greater responsibility to industry to manage the risks from chemicals and to provide safety information on the substances. This information has to be passed down the chain of production. The REACH Regulation also aims to increase the knowledge of the chemicals properties and of the exposure through the required provision of specific documentation and to improve the risk management of chemicals.

2.1.2.2. CLP

The CLP Regulation (EC) No 1272/2008 is the European Union Regulation on Classification, Labelling and Packaging of chemical substances and mixtures²². The legislation introduces throughout the EU a system for classifying and labelling chemicals, based on the United Nations' Globally Harmonised System (UN GHS). CLP is about the hazards of chemical substances and mixtures and how to inform others about them. The CLP does not contain a specific hazard class for PBT and vPvB substances, however article 53(2) calls for the promotion at the UN level for the harmonisation of the criteria for classification and labelling of PBT and vPvB substances. However, the classification and labelling inventory²³ set up by the CLP Regulation make available relevant information that can be used to identify new potential POP candidates and also provides classification and labelling on several POPs.

2.1.2.3. Regulation on Plant Protection Products

Regulation (EC) No 1107/2009 concerning the placing of plant protection products on the market²⁴ (PPP Regulation) prevents chemicals exhibiting POP characteristics from being used in plant protection products. This is achieved by the provisions according to which an active substance, safener or synergist shall only be approved for use in plant protection products where it is not considered to be a POP or if it is not considered to be a persistent, bioaccumulative and toxic (PBT) substance or a very persistent and very bioaccumulative substance (vPvB). In addition, a substance shall be approved as a candidate for substitution if it meets two of the PBT criteria.

2.1.2.4. Biocidal Products Regulation

Regulation (EU) No 528/2012 concerning the making available on the market and use of biocidal products²⁵ aims to promote substitution of substances that exhibit POP or PBT characteristics in biocidal products for less hazardous ones. The use of POP or PBT

²² OJ L 353, 31.12.2008, p. 1.

²³ <http://echa.europa.eu/en/information-on-chemicals/cl-inventory>

²⁴ OJ L 309, 24.11.2009, p.1.

²⁵ OJ L 167, 27.6.2012, p. 1.

substances in biocidal products is only allowed if there are no alternatives available. This is achieved by the provision that an active substance that meets two of the PBT criteria as set out in Annex XIII of the REACH Regulation shall be considered a candidate for substitution and shall be identified as such in Annex I of the new Biocide Regulation. The inclusion of an active substance in Annex I that is considered as a candidate for substitution shall be renewed for a period not exceeding ten years. As part of the evaluation of an application for an authorisation (or a renewal of an authorisation) of a biocidal product containing an active substance that is a candidate for substitution, the Competent authority shall perform a comparative assessment to evaluate whether there are other authorised biocidal products (or non-chemical control or prevention methods) which present significantly lower risk for human or animal health or the environment.

2.1.2.5. Regulation on the export and import of hazardous chemicals

The export of POP substances or articles containing POPs is regulated by Regulation (EU) No 649/2012 concerning the export and import of hazardous chemicals²⁶. This Regulation implements the Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for certain hazardous chemicals and pesticides in international trade and provides for an export ban of POP substances listed in Annex A and B of the Stockholm Convention and in Regulation (EC) No 850/2004. The decisions of the fourth meeting of the Conference of the Parties (COP4) to the Stockholm Convention held on 4–8 May 2009 to list new substances were implemented by Regulation (EU) No 214/2011. The fifth Conference of the Parties to the Stockholm Convention (April 2011) decided to list endosulfan in Annex A. That decision was implemented in the Union by Regulation (EU) No 73/2013, which adds endosulfan to the list of chemicals that are banned for export. The export of all POPs listed in Regulation (EU) No 649/2012 is banned, except for PFOS, which still benefits from a number of exemptions under the Stockholm Convention for which the export is currently still possible, but only on condition that the importing country consents to the import of that chemical.

2.1.2.6. PCB Directive (Directive 96/59/EC)

Articles containing PCBs already in use are covered by specific provisions laid down in Council Directive 96/59/EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT)²⁷. The directive aims for the approximation of the laws of the Member States on the controlled disposal of PCBs, the decontamination or disposal of equipment containing PCBs and/or the disposal of used PCBs in order to eliminate them completely. According to the Directive, Member States had to take the necessary measures to ensure that used PCBs are disposed of and that PCBs and equipment containing PCBs are decontaminated or disposed of in an appropriate manner.

Member States were obliged to compile inventories of equipment with PCB volumes of more than 5 dm³. These inventories were to be sent to the Commission by September 1999 at the latest. The equipment and PCBs contained in the inventories had to be decontaminated or disposed of by 2010 at the latest (deadlines are different for the new Member States). The inventories must supply the following data:

²⁶ OJ L 201, 27.7.2012, p. 60.

²⁷ OJ L 243, 24.9.1996, p. 31.

- the names and addresses of the holders;
- the location and description of the equipment;
- the quantity of PCBs contained in the equipment;
- the date and type of treatment planned;
- the date of the declaration.

Moreover, the Directive stipulates that any equipment which is subject to inventory must be labelled. Member States must prohibit the separation of PCBs from other substances for the purpose of reusing the PCBs and the topping-up of transformers with PCBs.

Concerning the appropriate waste management, Member States had to take the necessary measures to ensure that:

- PCBs, used PCBs and equipment containing PCBs which is subject to inventory are transferred to licensed undertakings, at the same time ensuring that all necessary precautions are taken to avoid the risk of fire;
- any incineration of PCBs or used PCBs on ships is prohibited;
- all undertakings engaged in the decontamination and/or the disposal of PCBs, used PCBs and/or equipment containing PCBs obtain permits;
- transformers containing more than 0.05% by weight of PCBs are decontaminated under the conditions specified by the Directive.

In accordance with the committee procedure referred to in Directive 75/442/EEC²⁸, the Commission:

- had to fix the reference methods of measurement to determine the PCB content of contaminated materials²⁹;
- could fix technical standards for the other methods of disposing of PCBs;
- had to make available a list of the production names of capacitors, resistors and induction coils containing PCBs³⁰;
- had to determine, if necessary, other less hazardous substitutes for PCBs.

The Commission completed the tasks mentioned above, as appropriate.

Within three years following the adoption of Directive 96/59/EC, Member States had to draw up plans for the decontamination and/or disposal of inventoried equipment and the PCBs contained therein and plans for the collection and subsequent disposal of equipment not subject to inventory.

2.1.3. *Other environmental legislation with POP relevance*

In addition to the chemical legislation, environmental legislation especially those targeting water, waste and products also cover POP-related issues.

²⁸ OJ L 194, 25.7.1975, p. 39.

²⁹ This task has been addressed by Commission Decision 2001/68/EC establishing two reference methods of measurement for PCBs pursuant to Article 10(a) of Council Directive 96/59/EC.

³⁰ In 2001 the Commission has drawn up a list and made it available to the Member States.

Table 3 summarizes the most relevant legislation with POP relevance and indicates which POPs are regulated. The table also includes environmental legislation covering releases of unintentionally produced POPs. The legislation is presented in more detail in Part II if further measures for the implementation may be necessary.

In comparison with the first Implementation Plan, 4 new legislative acts have been adopted: Directive 2008/98/EC on Waste (Waste Framework Directive), Directive 2010/75/EU on Industrial Emissions (including waste incineration), Regulation (EC) No 66/2010 on the EU Ecolabel and Directive 2006/11/EC on pollution caused by certain dangerous substances discharged into the aquatic environment.

The most important legislation covering the release of unintentionally produced POPs is Directive 2010/75/EU on industrial emissions (IED)³¹ which since 7 January 2014 has repealed and replaced Directive 2008/1/EC concerning integrated pollution prevention and control (IPPC Directive) and Directive 2000/76/EC on Waste Incineration (amongst others).

The purpose of the IED is to ensure a high level of protection of the environment taken as a whole. Industrial installations operating activities covered by Annex I of the IED are required to obtain an environmental permit from the authorities in the EU Member States. Emissions of all relevant polluting substances (including POPs), which are likely to be emitted in significant quantities, have to be regulated in the permit. The whole environmental performance of the installation is taken into account, covering e.g. emissions to air, water and land, generation of waste, use of raw materials, energy efficiency, noise, prevention of accidents, and restoration of the site upon closure. The conditions set out in this permit, in particular the emission limits, have to be based on the application of the Best Available Techniques (BAT).

The definition of BAT in the IED generally corresponds with the one of the Stockholm Convention. In order to identify BAT, the Commission organises an information exchange, where BAT is described and defined for the different industrial sectors in so-called Best Available Techniques REFerence Documents (BREFs). Where relevant, also for POPs, BAT Associated Emission Levels (BAT-AELs) are developed. Under the IED, the BAT conclusions is the part of the BREF that is formally adopted by the Commission. The BAT and BAT-AELs set out therein are to be used by the permitting authorities in setting permit conditions and emission limit values for permits. Emission levels set in the permits for certain pollutants should be within the BAT-AELs unless a derogation from BAT-AELs applies to the installation³².

³¹ OJ L 334, 17.12.2010, p. 17.

³² [A derogation may apply only where an assessment shows that the achievement of emission levels associated with the best available techniques as described in BAT conclusions would lead to disproportionately higher costs compared to the environmental benefits due to the geographical location or the local environmental conditions of the installation concerned; or the technical characteristics of the installation concerned.](#)

Table 3 Further environmental legislative instruments with relevance on the use and disposal of POPs (including unintentionally produced POPs).

Acronym	Legal reference	POPs regulated / POP reference	Areas of regulation
EU Ecolabel	Regulation (EC) No 66/2010	Criteria of product categories laid down in Commission decisions may cover POPs e.g. in textile floor covering for trace contamination with POP pesticides ³³ A product cannot obtain an ecolabel if it contains a PBT/vPvB substance.	Different product categories, see: ³⁴
RoHS Directive	Directive 2011/65/EU (recast of 2002/95/EC)	Ban of PBDE and other hazardous substances in electrical and electronic equipment.	Production and import of electrical and electronic products
Waste Directive	Directive 2008/98/EC	The classification of waste as hazardous waste should be based, inter alia, on the Union legislation on chemicals, in particular concerning the classification of preparations as hazardous, including concentration limit values used for that purpose. ³⁵	Waste
Industrial Emissions Directive	Directive 2010/75/EU which from 7 January 2014 repealed and replaced Directive 2000/76/EC on Waste Incineration and Directive 2008/1/EC on Industrial Pollution Prevention Control	Waste incineration: Emission limit values for air, discharges of waste water for dioxins and furans. Industrial activities: Polychlorinated dibenzodioxins and polychlorinated dibenzofurans are among the main air pollutants to be considered in permitting and persistent hydrocarbons and persistent and bioaccumulable organic toxic substances among the main water pollutants. First series of Commission Implementing Decisions establishing BAT conclusions for the different industrial sectors have been adopted under the IED (with more to follow over the coming years).	Industrial emissions
Directive 76/464/EEC has been codified as 2006/11/EC	Directive 2006/11/EC	Pollution through the discharge of the various dangerous substances within List I into the aquatic environment must be eliminated. List I contains certain individual substances selected mainly on the basis of their toxicity, persistence and bioaccumulation.	Pollution caused by certain dangerous substances discharged into the aquatic environment
Landfill Directive	Directive 1999/31/EC	Hazardous waste for landfills needs a prior treatment.	Waste
WEEE Directive	Directive 2002/96/EC, repealed with effect from 15 February 2014 by Directive 2012/19/EU	Provisions on waste containing hazardous substances, e.g. PCB (PCBs/PCTs containing capacitors), mandatory segregation of PCB-containing components.	Treatment of waste of electrical and electronic equipment
ELV Directive	Directive 2000/53/EC	Due to the segregation of hazardous components from the vehicle, the releases of unintentionally produced POPs from shredder plants are decreased.	Collection, treatment, recycling and disposal of end-of-life vehicles.

³³ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:332:0001:0016:EN:PDF>
³⁴ http://ec.europa.eu/environment/ecolabel/ecolabelled_products/product_categories_en.htm
³⁵ http://ec.europa.eu/environment/waste/framework/framework_directive.htm

Acronym	Legal reference	POPs regulated / POP reference	Areas of regulation
Water Framework Directive	Directive 2000/60/EC	The Water framework directive acts as the parent piece of legislation for all water and water quality related issues within the EU. For POPs the water framework directive along with the daughter directive on Environmental Quality Standards put in place the requirements to quantify and manage the release of POPs into the water environment. This includes the development of River Basin Management Plans to actively identify and manage the anthropogenic burdens upon waters within the EU.	Protection of inland surface waters, transitional waters, coastal waters and groundwater.
Environmental Quality Standards (EQS)	Directive 2013/39/EC	The EQS directive repeals the ‘Annex X’ list of priority and priority hazardous substances quoted under the water framework directive (2000/60/EC). Annex I of the EQS Directive expands upon the Annex X list with additional named pollutants, deemed as priority or priority hazardous substances (including POPs) for which maximum environmental concentrations (EQS) must not be exceeded. In the case of priority hazardous substances, discharges, emissions and losses must be phased out to natural background levels. The directive also creates a ‘watch-list’ for monitoring additional substances of concern in the natural environment. The directive also places a requirement for inventories of discharges, emissions and losses for priority substances which should inform planning and reporting under the river basin management plans (RBMPs) communicated under the water framework directive.	Protection of inland surface waters, transitional waters, coastal waters and groundwater. Dioxins and Furans, PCBs PAHs, hexachlorobenzene, hexachlorobutadiene, pentachlorobenzene are included in Annex I as PHS, i.e. there is an objective to phase out discharges, emissions and losses.
Groundwater Directive	Directive 2006/118/EC	Groundwater quality standards and threshold values for most important pollutants, among them pesticides.	Protection of groundwater from detrimental concentrations of harmful pollutants.
Drinking Water Directive	Council Directive 98/83/EC	Standards for the most common substances (so-called parameters), among them polycyclic aromatic hydrocarbons, and pesticides (aldrin, dieldrin, heptachlor and heptachlor epoxide).	Quality of water intended for human consumption
Marine Strategy Framework Directive	Directive 2008/56/EC	Synthetic compounds identified as priority substances under directive 2000/60/EC which are relevant for the marine environment.	Protection of marine waters under the sovereignty and jurisdiction of Member States
SEVESO I/II / III Directive	Directive 96/82/EC was repealed with effect from 1 June 2015 and replaced by Seveso III Directive 2012/18/EU	Pollution from industrial accidents.	Prevention, Preparedness and Response to chemical accidents
Ambient air quality	Directive 2004/107/EC	Limit values for benzo[a]pyrene as a marker for PAH in ambient air.	Protection of ambient air quality for identified pollutants

2.1.4. Legislation on food and feed and on the protection of public health

Regulations (EC) No 1881/2006 and 396/2005 and Directive 2002/32/EC set maximum residues levels for POP substances in food and feed. Regulation (EC) No 1883/2006 sets minimum requirements on methods of sampling and analysis for the official control of levels of dioxins and dioxin-like PCBs in certain foodstuffs and Regulation (EC) 152/2009 sets minimum requirements on methods of sampling and analysis for the official control of levels of dioxins and dioxin-like PCBs in feed (see Table 4). In comparison with the situation when the first Implementation Plan was drafted, there are substantial changes in the EU food and feed legislation: These changes relate to the conversion of the maximum levels in feed and food for dioxins and dioxin-like PCBs, previously expressed in Toxic Equivalent Factors (TEF) 1998, into maximum levels expressed in TEF 2005. Furthermore maximum levels for non dioxin like PCBs (the so called indicator PCBs) have been established in feed and food. The POP Regulation requires the setting up of emission inventories for unintentionally produced POPs, some of which may enter the food chain via atmospheric deposition and bioaccumulation. More detail can be found in section 2.1.1.

The European Food Safety Authority (EFSA) produced a report in May 2015³⁶ to evaluate the methodologies used internationally in deriving health based safety values for dioxins, furans and dioxin-like PCBs within food. This study aimed to better understand the methodologies used by the Joint FAO/WHO Expert Committee on Food Additives (JECFA), US EPA, and Scientific Committee on Food (SCF). The study notes that, while the JECFA and SCF base assessments on animal data, the USEPA make use of human data. Further differences in modelling approach for toxicology and accepted no observed adverse effect level (NOAEL) between SCF/JECFA and US-EPA resulted in US-EPA values being 3 orders of magnitude lower than the SCF/JECFA values. EFSA have stated that these differences warrant a comprehensive risk assessment to further understand the relationship between animal and human toxicology data.

Table 4 Food & Feed related legislation with relevance to POPs

Acronym	Legal reference	POPs regulated / POP reference
Maximum levels for certain contaminants in foodstuffs	Regulation (EC) No 1881/2006	- Dioxins (sum of polychlorinated dibenzo-para-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) and dioxin-like PCBs and non-dioxin-like PCBs (indicator PCBs) - benzo(a)pyrene and the sum of of benzo(a)pyrene, benz(a)anthracene, benzo(b)fluoranthene and chrysene as a marker of carcinogenic PAH in certain foodstuffs
	Regulation (EC) No 1883/2006 ³⁷ shall be repealed by Regulation (EU) No 252/2012 ³⁸	Methods of sampling and analysis for the control of levels of dioxins and dioxin-like PCBs in food for regulatory purposes
Pesticide Residues in Food	Regulation (EC) No 396/2005	Setting Maximum Residue Levels for POP Pesticides in food products
Undesirable substances in	Directive 2002/32/EC	Aldrin, Dieldrin, Camphechlor (toxaphene), Chlordane, DDT, Endosulfan, Endrin, Heptachlor, Hexachlorobenzene (HCB), Hexachlorocyclohexane

³⁶ EFSA, 2015, 'Scientific statement on the health-based guidance values for dioxins and dioxin-like PCBs', doi:10.2903/j.efsa.2015.4124. <http://www.efsa.europa.eu/en/efsajournal/doc/4124.pdf>

³⁷ OJ L 364, 20.12.2006, p.32.

³⁸ OJ L 84, 23.3.2012, p. 1.

Acronym	Legal reference	POPs regulated / POP reference
animal feed		(HCH, incl. Lindane), Dioxins (sum of polychlorinated dibenzo-para-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs)..
	Regulation (EC) 152/2009 ³⁹	Methods of sampling and analysis for checking the levels of dioxins and dioxin-like PCBs in feed for regulatory purposes

2.1.5. Information exchange between Commission and Member States on POPs in food and consumer products

The information exchange among the Member States authorities and the Commission on the presence of POPs in food and consumer products is ensured by the rapid alert systems. There are currently two EU rapid alert systems and both are publicly available. The legal basis for their establishment provides Regulation EC/178/2002, Directive 2001/95/EC and Regulation 765/2008.

The Rapid Alert System for Food and Feed (RASFF)⁴⁰: was put in place to provide food and feed control authorities with an effective tool to exchange information about measures taken responding to serious risks detected in relation to food or feed. This exchange of information helps Member States to act more rapidly and in a coordinated manner in response to a health threat caused by food or feed. Notifications cover e.g. the contamination of food and feed with dioxins and dioxin-like PCBs or with polycyclic aromatic hydrocarbons.

The Rapid Alert System for non-food dangerous Products (RAPEX)⁴¹: RAPEX facilitates the rapid exchange of information between Member States and the Commission on measures taken to prevent or restrict the marketing or use of products (non-feed/non-food) posing a serious risk to the health and safety of consumers. Measures ordered by national authorities and measures taken voluntarily by producers and distributors are reported by RAPEX.

2.1.6. Food monitoring within the European Union

Routine monitoring of food and feed is an important aspect of early detection for contamination of food and feed by POPs. Under Regulation EC 882/2004 a European Union Reference Laboratory (EURL) was established in Freiburg, Germany⁴² tasked with developing analytical standards for dioxins and furans and PCBs within food and feed. EURL is further complemented by national laboratories within the Member States, who have the role of carrying out analysis for routine monitoring. In order to ensure comparability between EURL and national reference laboratories, proficiency tests are conducted twice annually. These tests involve the use of the same sample, which is issued for analysis by all national laboratories. The results are then collated and assessed with any marked deviation from the average result requiring process amendment and further testing for any specific national reference laboratory. Representatives from the national reference laboratories and EURL meet twice annually to review and discuss any specific topics of interest for analysis.

³⁹ OJ L 314, 1.12.2009, p. 66.

⁴⁰ http://ec.europa.eu/food/food/rapidalert/index_en.htm

⁴¹ http://ec.europa.eu/consumers/safety/rapex/index_en.htm

⁴² EURL laboratory <http://www.crl-dioxin-freiburg.eu/>

2.1.7. *Emission monitoring legislation*

The European Pollutant Release and Transfer Register (PRTR) Regulation⁴³ aims to enhance public access to environmental information. The E-PRTR replaced the European Pollutant Emission Register (EPER) in 2007 and includes additional pollutants and economic activities. E-PRTR covers 91 pollutants compared to 50 in EPER, and 65 economic activities compared to 56 in EPER. The E-PRTR also implements stricter threshold levels for a number of pollutants (including POPs) (see also sections 3.3.1 on emission monitoring and 2.2.6 on monitoring efforts of the EU) compared to previous EPER inventories.

The European Commission launched an initiative early in 2016 to aid access to monitoring data, which includes information on POPs, called the Information Platform for Chemical Monitoring data (IPChem)⁴⁴. This website resource is managed by the Joint Research Centre in collaboration with a number of international and national bodies. It draws together monitoring data-sets in the form of ‘modules’, which are available publicly. IPChem will provide a valuable resource to researchers and allow cross-reference of different data-sets quickly and easily.

2.1.9. *Public access to environmental information*

The Directive 2003/4/EC on public access to environmental information⁴⁵ guarantees the right of access to environmental information held by or for public authorities. This right is for any applicant (private individuals, organisations etc.) and has to be granted without any justification. With regards to emissions, no request can be refused. Thus, this directive is a powerful instrument to gather emission data, also on POPs and can be used supplementary to the above mentioned on E-PRTR.

2.2. **Strategies, policies and programmes**

2.2.1. *Sustainable development*

In 2001, the European Union adopted the EU Sustainable Development Strategy (EU SDS) to provide a long-term vision combining economic dynamism, social cohesion and high environmental standards⁴⁶. In 2009, the European Commission communication COM(2009) 400 final⁴⁷ reviewed the EU SDS to respond to the most recent economic and financial crisis from the perspective of a long-term sustainable development with the goal to further mainstream the EU SDS into the European policy fields. From the seven key challenges proposed, two contain POPs related issues though they are not explicitly mentioned, i.e. sustainable consumption and production as well as Public health.

The review reaffirms the position of the European Council about sustainable development as a fundamental EU objective under the Treaty of Lisbon. This follow-up of the Lisbon Strategy was adopted in June 2010 by the heads and governments of the EU Member States.

⁴³ OJ L 33, 4.2.2006, p. 1.

⁴⁴ <http://ipchem.jrc.ec.europa.eu/#home-page>

⁴⁵ Directive 2003/4/EC of the European Parliament and the Council of 28 January 2003 on public access to environmental information and repealing Council Directive 90/313/EEC, OJ L 41, 28.1.2003, p. 26

⁴⁶ See communication of the Commission COM(2001) 264 final and the conclusions from the Gothenburg European Council.

⁴⁷ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0400:FIN:EN:PDF>

Concerning sustainable development, the European Union had a key role during the UN negotiations on the 2030 Agenda for Sustainable Development, including the sustainable development goals (SDGs), which was adopted by the General Assembly on 25 September 2015. There are 17 goals which are to be achieved by 2030⁴⁸ and which include responsible consumption and production; good health and well being; industry, innovation and infrastructure; life below water and life on land. The new European Consensus for Development frames the implementation of the 2030 Agenda in partnership with all developing countries, taking due account of the framework provided by the Lisbon Treaty. In particular, the EU and its Member States undertake to promote resource efficiency and sustainable consumption and production, including the sustainable management of chemicals and waste, with a view to decouple economic growth from environmental degradation and enable the transition to a circular economy.

The Stockholm Convention and POP Regulation are intended to protect human health and the environment from those substances identified as POPs. Part of this work includes aspects around innovation and sustainability to ensure that one POP substance is not replaced by another POP. In the Union this is further controlled by the REACH Regulation under the authorisation and restriction processes.

2.2.1.1. Substitution of substances for intentional use

A fundamental component of sustainable development and elimination of POPs from goods intentionally placed on the market is the substitution of POPs substances by alternatives which do not have the characteristics detailed under Annex D of the Stockholm Convention. Within Europe the REACH Regulation aims to identify substances which are persistent, bioaccumulating and/or toxic (in addition to those that are carcinogenic, mutagenic or toxic to reproduction or substances which give rise to an equivalent level of concern), termed ‘substances of very high concern’⁴⁹. A key aim of the REACH Authorisation process is to ensure that SVHCs are progressively replaced with suitable alternatives. Action to restrict the use of certain PBT substance, and require the use of alternatives, has also been taken through the REACH restriction process.

As part of the 7th EAP, the European Commission funded a pilot project to look at substitution with regard to brominated flame-retardants. The Enfiro project⁵⁰ was intended to help develop alternatives to brominated flame-retardants (including substances identified as POPs), as well documenting lessons learnt in order to help others successfully transition away from POPs based substances to safer alternatives.

Alongside the Enfiro project the European Commission has aimed to promote collaboration in the field of substitution. The Executive Agency for Small and Medium Sized Enterprises (EASME) (part of the programme to assist small and medium sized enterprises (SMEs) for innovation (COSME)); has developed the Partnership Opportunities Database (POD) to help SMEs within the EU make contact with partner organisations to look at the issue of substitution, which includes the issue of substitution for SVHCs substances within commercial production and goods. A number of other valuable resources are also open to

⁴⁸ UN Sustainability goals, <http://www.un.org/sustainabledevelopment/sustainable-development-goals/>

⁴⁹ ECHA, substances of very high concern: <http://echa.europa.eu/uk/addressing-chemicals-of-concern/authorisation/substances-of-very-high-concern-identification>

⁵⁰ Enfiro project : <http://www.enfiro.eu/>

industry including the information provided by the ECHA website⁵¹, Subsport⁵², and Medswitch⁵³ amongst others.

2.2.2. *Environment Action Programme*

The Union's principal strategy for environmental policy is the Environment Action Programme (EAP), which is also relevant for this implementation plan. The sixth Environment Action Programme (6th EAP) was active during the 2002-2012 period, and sets out the framework for environmental policy-making, which promotes full integration of environmental protection requirements in the Union for sustainable development, and establishes strategic approaches to meet the environmental goals and objectives.

In particular the 6th EAP priority area 'Environment and health' aimed to reduce the hazards of environmental pollutants such as pesticides, endocrine disruptors, dioxins and PCBs in Europe and sought for a high level of quality of life and well-being for citizens, aspiring to reduce harmful effects on human health and the environment.

In June 2013, political agreement was reached on a new Environment Action Programme (EAP), the 7th EAP. The 7th EAP sets out the priority objectives for EU environment policy to 2020, set out in an ambitious longer-term vision for an inclusive, green and competitive European economy that safeguards the environment. The programme identifies three key objectives⁵⁴:

- to protect, conserve and enhance the Union's natural capital;
- to turn the Union into a resource-efficient, green, and competitive low-carbon economy;
- to safeguard the Union's citizens from environment-related pressures and risks to health and wellbeing.

The priority areas can be found at: <http://ec.europa.eu/environment/newprg/intro.htm>.

The 7th EAP sets out a framework to support the achievement of nine priority objectives through development and better implementation of EU environment law, state of the art science, securing the necessary investments in support of environment and climate change policy, and improving the way that environmental concerns and requirements are reflected in other policies. The Programme aims to boost efforts to help EU cities become more sustainable, and improve the EU's capacity to meet regional and global environment and climate challenges.

Priority objective 3 of the 7th EAP "To safeguard the Union's citizens from environment-related pressures and risks to health and well-being", specifically aims to tackle hazardous chemicals, including nanomaterials, and chemicals that interfere with the endocrine system. This will in particular focus on the issues that arise from chemicals in combination, as part of a broader, strategic approach for a non-toxic environment. This area of focus will include work to assess the combination effects of substances and effective management through relevant EU legislation.

⁵¹ ECHA website: <http://echa.europa.eu/regulations/substituting-hazardous-chemicals>

⁵² Subsport Website: <http://www.subsport.eu/>

⁵³ MedSwitch website: <http://www.switchmed.eu/en>

⁵⁴ <http://ec.europa.eu/environment/newprg/>

2.2.3. *Strategies for control of pesticides and chemical substances*

In July 2006, the Commission adopted a Communication on Sustainable Use of Pesticides (COM (2006) 372 final)⁵⁵ to prevent any undesirable effects and risks to humans and the environment by minimising exposure as much as possible and by encouraging the research and development of less polluting alternatives. One of the measures to be integrated through the application of already existing instruments is to provide financial and technical assistance (capacity building) in numerous programmes such as the Strategic Approach to International Chemicals Management (SAICM).

The Union Strategy for Dioxins, Furans and Polychlorinated Biphenyls adopted in 2001 (COM(2001) 593)⁵⁶ has the goal to assess the current state of the environment and the ecosystem and to reduce exposure from dioxins and PCBs to humans and the environment. In July 2007, the Communication of the Commission COM(2007) 396 final⁵⁷ provided the second progress report on the main achievements with regard to the implementation of the strategy during the period between 2004 and 2006, elucidating the several environmental measures on POPs which have been adopted in 2004 and the new maximum levels for contaminants in food and feed, which have been updated in 2006.

In October 2010, the Commission adopted the third progress report on the Dioxin strategy for the period 2007 to 2009 (COM(2010) 562 final)⁵⁸. The report concluded that the overall objective of the Strategy, i.e. to develop an integrated approach in order to reduce the presence of dioxins, furans and PCBs in the environment as well as in feed and food, has been achieved to a large extent, bearing in mind the reduction of industrial emissions of these pollutants by about 80% over the past two decades. The report further concluded that additional sources should be targeted by national or local measures.

In December 2013, the Commission put forward Recommendation 2013/711/EU⁵⁹ for further reduction of dioxins and furans, and dioxin-like PCBs within food groups. This included a requirement for increased monitoring of these substances within free range eggs, organic eggs, lamb and sheep livers and sea food (particularly crabs). The recommendation also sets acceptable levels for the presence of dioxins and furans, and dioxin-like PCBs, within food.

Further progress is expected within the framework of the European Union Implementation Plan on Persistent Organic Pollutants and the relevant National Implementation Plans (NIPs) elaborated by Member States.

2.2.4. *Environment and Health Action Plan*

The Environment and Health Action Plan (EHAP) was launched in June 2004 to coordinate health, environment and research areas and to develop a system for integrated information on environment and health and to assess the environmental impact on human health more efficiently. In June 2007, a mid-term report was published in a Communication of the

⁵⁵ http://ec.europa.eu/environment/ppps/pdf/com_2006_0372.pdf

⁵⁶ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52010DC0593:EN:NOT>

⁵⁷ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0396:FIN:EN:PDF>

⁵⁸ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0562:FIN:EN:PDF>

⁵⁹ <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013H0711>

Commission (COM(2007) 314 final⁶⁰). It highlighted the growing links between environment policy and health policy. It showed, for example, that an important development in relation to the Strategy on Dioxins and PCBs was the adoption of Regulation (EC) No. 850/2004 on POPs. The progress report on the implementation of the EHAP of March 2010 (SEC(2010) 387)⁶¹ presented the progress of activities after the mid-term review, assessed the results achieved since 2004 and suggested the follow-up for the Action Plan post 2010.

2.2.5. *Multilateral Environmental Agreements (MEAs)*

Many environmental problems transcend national boundaries and can only be efficiently handled through international co-operation. The European Union is a contracting party in more than 40 international environmental agreements⁶², among them the Stockholm Convention, the Basel Convention, the Rotterdam Convention and the Minamata Convention.

Within the Strategic Approach to International Chemicals Management (SAICM), a number of useful documents that address the question of how to improve communication on chemicals in products and articles including POPs have been developed. The Chemicals in Products Programme (CiP Programme) was initiated by the EU in 2009 and welcomed by the SAICM Governing body, ICCM4, in September 2015. The finalised Programme and the accompanying guidance can be found on UNEP's web page⁶³.

2.2.6. *Monitoring efforts of the EU*

Monitoring efforts in the EU covers monitoring of emission loads into the environment and monitoring of environmental concentrations.

The European Monitoring and Evaluation Programme (EMEP) is a scientifically based and policies driven programme for international cooperation under the Convention on Long-range Transboundary Air Pollution (CLRTAP). The EMEP provides scientific information about emission inventories and emission projections, atmospheric monitoring and modelling as well as an integrated assessment to help solve transboundary air pollution problems. This set of information is an important basis for developing further emission control strategies and implementing the Convention and its Protocols.

Several measures relating to the monitoring of POPs' emissions have been taken by the Member States in order to identify and characterize sources and releases of these substances. Many of these measures are included in the NIPs and have benefited from the numerous national policy frameworks. Besides the national emission inventories for the release of unintentionally produced POPs into the air, water and soil, the EMEP emission inventory and the E-PRTR data base are further available inventories of releases. Article 4 of the Water Framework Directive (Directive 2000/60/EC) also requires the development of inventories of discharges and losses for priority and priority hazardous substances (which includes some POPs). This information is intended to inform planning and reporting for river basin management plans (RBMPs); which were due for publication at the end of 2015. As of June

⁶⁰ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0314:FIN:EN:PDF>

⁶¹ <http://register.consilium.europa.eu/pdf/en/10/st08/st08201.en10.pdf>

⁶² http://ec.europa.eu/environment/international_issues/pdf/agreements_en.pdf

⁶³ <http://www.unep.org/hazardoussubstances/UNEPsWork/ChemicalsInProductsproject/tabid/56141/Default.aspx>.

2016, ten Member States have adopted the updated river basin management plans, with a further two adopting part of the updated RBMPs⁶⁴.

As regards the monitoring of environmental concentrations, there are several regional monitoring programmes established as part of regional conventions or initiatives that covers part of the EU and includes some of the POPs. The Arctic Monitoring and Assessment Programme (AMAP) analyses fluxes, pathways and environmental levels of POPs and presents an assessment of the Arctic environment contamination⁶⁵. Other examples are the Trilateral Monitoring and Assessment Programme of the Waddensea (TMAP), the Monitoring Network in the Alpine Region for Persistent and other Organic Pollutants (MONARPOP) as well as sea conventions (such as e.g. HELCOM, OSPAR and MED POL).

The mission of the European Environment Agency (EEA) is to provide sound and independent information on the environment, with the goal to ensure that decision-makers and the general public are kept informed about European environmental data, knowledge and assessments. The Agency collects data on POP emissions and where available data on POP concentrations in the environment and analyses their trends^{66,67}. Some of the Agency's data on POPs originate from the monitoring of Priority Substances in water bodies conducted by Member States under the Water Framework Directive. In addition, Member States have contributed data on some substances to a working database specifically developed for the Commission's 2011 review of the Priority Substances list.

2.3. Financial instruments

Using different funding instruments, the European Union provides a significant amount of funding to environmental projects and programmes, both within the EU as well as in neighbouring countries and in developing countries. There are several financial instruments and programmes that can be relevant also for POP related projects.

2.3.1. Funding instruments for the EU

The LIFE programme is the financial instrument for supporting environmental and nature conservation projects and promoting policy priorities in the EU as well as in some candidate, acceding and neighbouring countries. The European Commission proposed replacing most existing environmental funding, including the former LIFE+ categories, with a single fund focused on supporting development, implementation, monitoring, evaluation and communication of Union environmental policy and legislation. This new phase was called LIFE+ and entered into force the 9th of June 2007⁶⁸. It ran for the period 2007-2013 with a budget of €2.143 billion, while funding was provided via three key areas: LIFE+ Nature & Biodiversity, LIFE+ Environmental Policy & Governance, and LIFE+ Information & Communication, where at least 78 percent of the budgetary resources was used for action grants to projects.

⁶⁴ http://ec.europa.eu/environment/water/participation/map_mc/map.htm

⁶⁵ <http://www.eea.europa.eu/publications/92-9167-058-8/page004.html>

⁶⁶ <http://www.eea.europa.eu/data-and-maps/indicators/eea32-persistent-organic-pollutant-pop-emissions-1/assessment>

⁶⁷ <http://www.eea.europa.eu/publications/NYM2/page005.html>

⁶⁸ <http://ec.europa.eu/environment/life/funding/lifeplus.htm>

LIFE+ projects promoted synergies between different priorities under the 6th Environment Action Programme. Two projects in relation with POPs were funded by the LIFE+ programme: one to evaluate the extent of exposure of the general population, especially women of reproductive age⁶⁹, and the second to evaluate emission exposure of PAHs in the population⁷⁰. The LIFE+ programme was designed to complement other funding programmes for the environment which are described as follows.

There are numerous other funds of the EU with different target groups that do not specifically refer to POPs, but which support the implementation of the EU environmental legislation or the supply of technical solutions (the Competitiveness and Innovation Framework Programme⁷¹, for example, supports small and medium-sized enterprises (SMEs) innovation activities (including eco-innovation), while the NGO operating grants⁷² inter alia promote the active participation of NGOs in the development and implementation of environmental policy).

On the 20th of December 2013 the LIFE 2014-2020 Regulation (EU) No 1293/2013 was published in the Official Journal (L 347, p. 185). The Regulation establishes the Environment and Climate Action sub-programmes of the LIFE Programme for the next funding period, 2014–2020. The budget for the period is set at €3.4 billion. On the 19th of March 2014, the LIFE multiannual work programme for 2014-2017 was adopted by Commission Implementing Decision (2014/203/EU).

The LIFE multiannual work programme for 2014-2017 sets the framework for the next four years for the management of the new LIFE Programme 2014-2020. It contains an indicative budget, explains the selection methodology for projects and for operating grants and establishes outcome indicators for the two LIFE sub-programmes – for Environment and for Climate Action. The total budget for funding projects during the period covered amounts to €1.1 billion under the sub-programme for Environment and €0.36 billion under the sub-programme for Climate Action.

2.3.2. *Funding for neighbouring and partner countries*

The European Neighbourhood and Partnership Instrument (ENPI) is designed to target sustainable development and approximation to EU policies and standards – which includes the implementation of the POP Regulation as well – in neighbouring third Countries as well as through a strategic partnership with the Russian Federation.⁷³ This programme replaces the former programmes MEDA, TACIS and EIDHR mentioned in the first Implementation Plan. For the period 2007-2013, nearly €12 billion in EU funding are available to support these partners' reforms. The ENPI has 15 cross-border cooperation (CBC) programmes which receive a funding of €1.18 billion for the same period. The Instrument for Pre-Accession Assistance (IPA)⁷⁴ which replaces several programmes (e.g. the PHARE programme) and financial instruments for candidate countries (Iceland, Turkey, Serbia, Montenegro and the former Yugoslav Republic of Macedonia) or potential candidates (Albania, Bosnia and Herzegovina, Kosovo) also provides nearly €12 billion. Most African, Caribbean and Pacific

⁶⁹ http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=3433

⁷⁰ http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=3756

⁷¹ http://ec.europa.eu/cip/index_en.htm

⁷² http://ec.europa.eu/environment/ngos/index_en.htm

⁷³ http://ec.europa.eu/world/enp/funding_en.htm

⁷⁴ http://europa.eu/legislation_summaries/agriculture/enlargement/e50020_en.htm

States benefit from development support under the Cotonou Convention financed through the European Development Fund (€23 billion for the period 2007 – 2013) while South Africa and other developing countries, notably in Asia and Latin America benefit from the Development Cooperation Instrument (over €17 billion for 2007 – 2013).

Within the DCI is a substantial specific programme for environmental support, open to all partners except actual and potential candidates, the “Thematic programme on environment and sustainable management of natural resources, including energy” (Thematic Programme for Environment and Sustainable Management of Natural Resources (ENRTP), worth about €1.1 billion for the period 2007-2013)⁷⁵. This programme has provided support to the work of Secretariat of the Stockholm Convention and has also funded projects on the ground.⁷⁶

2.3.3. *Multilateral programmes funded by the EU*

The promotion of measures to address worldwide environmental problems is a key objective of the EU policy. The Commission thus provides funding to international and multilateral programmes.

The current instrument is the thematic programme on Global Public Goods and Challenges (GPGC), which covers the period 2014-2020 and replaces previous sectoral programmes funded by the European Union including the Environment and Sustainable Management of Natural Resources including Energy Thematic Programme (ENRTP). Some examples funded within the ENRTP:

- The further elaboration of the dioxin and furan toolkit: €100,000 in 2007, to better adapt the toolkit guidance to the needs of developing countries by including the type of industrial installations and levels of pollution found in those countries.
- The evaluation of the Convention’s effectiveness: €400,000 has been allocated in 2009 for completing data on the levels of POPs in the air, and in breast milk for Africa, Latin America and the Caribbean to establish an adequate baseline for further evaluations.
- Support to the Secretariat of Stockholm convention of €480.000 in 2010 to support Parties to implement their obligations under the Stockholm Convention, i.e. developing countries in the following regions: Africa, Asia, Latin America and the Caribbean, and Middle East and countries with economies in transition in CEE.
- Support to the Secretariat of Stockholm convention of €1.450.000 in 2011 to support their 2012-2013 programme of work, including the technical assistance programme, the global monitoring plan for effectiveness evaluation, the programme on unintentionally produced POPs, the programme on endosulfan, the programme on new POPS and candidate POPs and support for participation of developing countries at COP-6.
- Further ENRTP support includes €4.5 million to FAO for the cleaning up of obsolete pesticides in the Africa Stockpiles Programme.

⁷⁵ http://ec.europa.eu/europeaid/how/finance/dci/environment_en.htm

⁷⁶ http://ec.europa.eu/environment/pops/pdf/convention_stockholm_en.pdf

- Through ENRTP the development of the IOMC toolbox (phase I - €3 million and phase II - €2 million) and OECD work on chemicals assessment (€800.000) was also supported.

The initial programming for the period 2014-2017 of the GPGC Environment and Climate envelope provided financial support to the Secretariat of the Basel, Rotterdam and Stockholm Conventions to implement the programme of work as agreed by the Conferences of the Parties, which also included the provision of technical assistance to developing countries and countries with economies in transition. Further support was provided to the following initiatives:

- the Quick Start Programme Trust Fund of the Strategic Approach to International Chemicals Management (SAICM)⁷⁷, which aims at supporting the sound management of chemical and waste in order to minimise significant adverse impacts on the environment and human health;
- the Special Programme to support the institutional strengthening at the national level for the implementation of the Basel, Rotterdam and Stockholm Conventions, the Minamata Convention and the Strategic Approach to International Chemicals Management.

2.4. Research and Development and the Framework Programmes

Research and development is essential for the support of policies such as, inter alia, consumer protection or the protection of the environment. The Research Framework Programme (FP) is the main instrument for funding research and development in Europe.

The Sixth Research Framework Programme (FP6) ran between 2003 and 2007 with a budget of €17.5 billion. Within FP6, 37 projects out of the 66 projects funded⁷⁸ addressed some aspects of chemical safety. However, a smaller number of projects focused on exposure to and potential health impacts of POPs. Table 8 (in section 7 of this document) shows the research projects within the FP6; besides nine large-scale projects in FP6⁷⁹, the table focuses on projects with starting dates in 2007 and later.⁸⁰

The Seventh Framework Programme (FP7) which has been recently replaced by Horizon 2020, ran for the period 2007-2013 with a total budget of over € 50.5 billion from which € 1.89 billion was attributed to the relevant thematic areas of ‘Environment (including Climate Change)’, €1.94 billion to ‘Food, Agriculture and Fisheries, and Biotechnology’ and

⁷⁷ <http://www.saicm.org/index.php?ql=h&content=home>

⁷⁸ http://ec.europa.eu/research/environment/pdf/european_research_on_environment_and_health_fp6.pdf

⁷⁹ NORMAN Network of reference laboratories and related organisations for monitoring of emerging environmental pollutants; OSIRIS - Optimized strategies for risk assessment of industrial chemicals through integration of non-test and test information; NEWGENERIS - Newborns and genotoxic exposure risks; DEVNERTOIX - Toxic threats to the developing nervous system; PIONEER – Puberty onset – influence of nutritional, environmental and endogenous regulators; ATHON - Assessing the toxicity and hazard of non-dioxin-like PCBs present in food; CASCADE – Chemicals as contaminants in the food chain; PHIME – Public health impact of long-term, low-level mixed element exposure in susceptible population strata; BENERIS – Benefit-risk assessment for food: an iterative value-of information approach.

⁸⁰ The first ECIP summarizes the research projects of 6FP that were granted until beginning of 2007.

€ 6.1 billion to 'Health'. These thematic areas particularly supported research on projects related to POPs (see Table 7). The programmes 'Ideas' (€7.5 billion over 7 years) and 'People' (€4.7 billion over 7 years) of the FP7 also funded some projects with reference to POPs. The thematic areas and programmes are indicated in Table 7 in section 7 of this document (second column). The primary aim of funding the 'Food, Agriculture and Fisheries, and Biotechnology' research theme under the FP7 was to build a European Knowledge Based Bio-Economy, KBBE being the abbreviation for this thematic area.

Thirtyseven projects with POP relevance have been funded under the FP7 receiving around €143 million from the EU. Projects with POP reference have especially been funded within the framework of the thematic area 'Environment' – 22 projects– as it included the environment and health sub-activity. This sub-activity funded research to support EU policy initiatives such as the European Environment and Health Action Plan 2004-2010, the Community Strategy for Endocrine Disrupters, and the Stockholm Convention on persistent organic pollutants (POPs). The projects funded deal with, inter alia, harmonising human (bio)monitoring, in Europe, and improving the understanding of environmental and human exposure to chemicals such as PCBs and perfluorinated compounds⁸¹ and their potential health effects.

Within the thematic strategy 'Food, Agriculture and Fisheries, and Biotechnology' / 'Knowledge Based Bio-Economy', nine large POP-projects were funded, focussing on food safety aspects such as sampling strategies and detection methods for specific foods and on quality and safety assurance of feed. Furthermore under this thematic area, projects are funded seeking alternative solutions to chemical pesticides.

In 2007, the Commission also saw the need to examine development of affordable alternatives to DDT to control malaria, e.g. by exploiting available biological knowledge on the mosquito vector. On the topic of "affordable alternatives for DDT", no research project was granted within FP7. As for identification of substances that can be used as alternatives to POP, there is one research project on substitution options for specific brominated flame retardant.

Horizon 2020 has taken over from FP7 with a new body of research planned for the period between 2014 – 2020. This is intended to have an overall budget of about €80 billion euros. Key overall themes for Horizon 2020 will include:

- the programme to assist small and medium sized enterprises (SMEs) for innovation (COSME);
- a programme relating to consumer protection and products;
- the third health programme;
- a research programme for coal and steel;
- the justice programme relating to civil and commercial matters; and
- a programme for the promotion of agriculture products.

Research relating to POPs will feature in a number of these thematic areas with key work looking at monitoring of POPs in the natural environment⁸², work to assist with the de-

⁸¹ http://ec.europa.eu/research/environment/pdf/fp7_catalogue_eh.pdf.

⁸² http://ec.europa.eu/environment/enlarg/med/horizon_2020_en.htm

pollution of the mediterranean⁸³, and the management of 'POPs' substances within consumer supply chains.

2.4.1. *European Research Institutions including the JRC*

The Joint Research Centre (JRC) has been established as part of the European Commission in 1958. As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle. Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing its know-how with the Member States, the scientific community and international partners. The JRC holds an annual budget of around €330 million for direct support to EU institutions within the FP7 which is distributed in seven institutes. Some of these have relevant projects with POPs.

The JRC, for example, develops and provides testing methods and reference material also for POP substances. The JRC performs monitoring of POPs, supports the development and standardization of analytical protocols in the frame of the European Committee for Standardization and within the Water Framework Directive and supports the implementation of the Stockholm Convention at the EU level. The JRC provides access to several web-based information tools, for example, EASIS (Endocrine Active Substances Information System) which includes results from different scientific studies on chemicals related to endocrine activity (<https://easis.jrc.ec.europa.eu/>) as well as IPCHEM (Information Platform for Chemical Monitoring), which provides access to chemical occurrence data in various media (e.g. environment, humans, food/feed, indoor air and consumer products) (<https://ipchem.jrc.ec.europa.eu/>).

The JRC also elaborates the Best Available Techniques Reference Documents (BREFs) based on the IPPC Directive initially and now based on the IED. In the period 1997 – 2008 32 BREFs^{84,85} were drawn up under the IPPC Directive and will have to be updated under the IED with a view to adopting all BAT conclusions by 2020. In addition, a limited number of new BREFs have to be developed covering the activities that have been added to the scope of the IED as compared to the IPPC Directive. Under the IED, the BAT conclusions of the BREF will be adopted as Commission Implementing Decisions⁸⁶. Several of the BREFs also contain information on POPs and related BAT as well as the corresponding emission levels associated with the application of BAT (BAT-AELs).

Moreover, the JRC performs multimedia monitoring of POPs at EU and global level, based on the monitoring requirements in the Stockholm Convention. In addition, it provides guidance and experimental support to the "Toolkit Expert Group" in terms of the estimation of worldwide releases of unintentionally produced POPs. The JRC also develops global

⁸³ <http://ec.europa.eu/environment/enlarg/med/pdf/horizon2020/mid-term%20review%20EN.pdf>

⁸⁴ The BREFs can be downloaded from the website of the European IPPC Bureau, <http://eippcb.jrc.es/>

⁸⁵ An additional document, the Management of Tailings and Waste-Rock in Mining Activities BREF, was developed under the framework of the Commission's Communication COM(2000) 664 on the 'Safe Operation of Mining Activities'.

⁸⁶ Commission Implementing Decision 2012/119/EU of 10 February 2012 laying down rules concerning guidance on the collection of data and on the drawing up of BAT reference documents and on their quality assurance referred to in Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions, OJ L 63/1, 2.3.2012

emissions inventories for greenhouse gases (GHGs), air pollutants (APs) and toxic pollutants such as mercury. Recently included in this JRC database are polycyclic aromatic hydrocarbons (benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene and indeno[1,2,3-cd]pyrene), dioxins&furans, hexachlorobenzene and polychlorinated biphenyls that are unintentionally emitted from power generation, residential and transport sectors; these emissions are estimated for all world countries for 1970-2012 period; global gridmaps of 0.1x0.1 degree resolution are also available.

Furthermore, the JRC is involved in several research activities that include monitoring programmes and case studies for inland and marine waters, ambient air, soil including contaminated sites, sediments, sewage sludge, compost, food and biota, as well as multi-media modelling of POPs.

2.4.2. Supporting co-operation, co-ordination and networking

Modern research in a global environment necessitates co-operation at different levels. The fragmentation of Europe's efforts cannot be overcome without determined actions at European level. Taking up this challenge, the European Commission, Member States and the European Parliament, the scientific community and industry are committed to work jointly towards the creation of a "European Research Area" (ERA) where innovation and trade could flourish for the benefit of the whole European Union. This effort was launched by a European Commission Green Paper in 2007 followed in 2008, by a new political partnership between the Member States and the Commission called the "Ljubljana Process", which aimed to overcome fragmentation and to build a strong ERA.

Additionally as part of the Horizon 2020 planning, the EU created The European Network for Observing our Changing Planet (ERA-PLANET) in January 2016, which includes a network of 38 partner organisations from 14 EU Member States, one European Economic Area country and one associated country aiming at strengthening the European Research Area in the domain of Earth Observation in coherence with the European participation to Group on Earth Observation (GEO) and the Copernicus. The partners will reinforce the interface with user communities, whose needs the Global Earth Observation System of Systems (GEOSS) intends to address. It will provide more accurate, comprehensive and authoritative information to policy and decision-makers in four distinct topics of the ERA-PLANET that reflect the key societal benefit areas reflected in both GEO and Copernicus: Smart cities and Resilient societies; Resource efficiency and Environmental management; Global changes and Environmental treaties; Polar areas and Natural resources⁸⁷.

The domains will address, among others: chemical pollution by persistent contaminants, assessment of global change patterns, impact of long-range transport of air pollutants and their atmospheric deposition, challenging issues for cities and society such as urban growth, air quality, health and contaminated sites as well as resource efficiency and depletion. The current ERA-Planet project strives to strengthen the European leadership within the current GEO 2015-2025 Work Plan.

⁸⁷ ERA-Planet: <http://eraplanet.meteo.noa.gr>

2.4.3. *Future research and innovation*

The Research Centre for Toxic Compounds in the Environment (RECETOX), which is based in the Czech Republic, organised a global meeting for 50 world-leading researchers active in POPs research to address the future research needs and mark the ten years anniversary of the Stockholm Convention (22.-24.5.2011, Brno, Czech Republic). The workshop identified in 10 points the current knowledge gaps and urgent research needs that require a coordinated global action and formulated them into a joint scientific declaration. The outcome was published in the *Environmental Science and Technology Journal* (<http://pubs.acs.org/doi/pdfplus/10.1021/es202751f>).

The ongoing discussion on the fate of newly listed POPs present in articles of everyday use and on the associated challenges with recycling and disposal of such articles will certainly result in identification of additional research needs. Such research could also make use of the documents that address how industry can improve information on chemicals in articles that have been developed under the Chemicals in Products Project (CiP) (see section 2.2.5)

Horizon 2020 and in particular Societal Challenge 1 “Health, Demographic Change and Wellbeing”, Societal Challenge 2 “Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy” and Societal Challenge 5 “Climate Action, Environment, Resource Efficiency and Raw Materials” provide new opportunities for Research and Innovation to develop new solutions to prevent and detect POPs contamination and toxicity to the environment and human health, including marine wastes, pesticides in agriculture and food products.

As part of Horizon 2020, the European Human Biomonitoring Initiative (EHBMI) has been created. This is a new medium term European initiative whose full implementation under Horizon 2020 will take place between 2016-2021, with an expected start in December 2016. The objective is to create a European joint programme for monitoring and scientific assessment of human exposures to chemicals and potential health impacts in Europe, building on previous activities undertaken at EU and national levels with a special focus on linking research to evidence based policy decision making.

The aim of this interdisciplinary initiative is to assess the exposure of European citizens to chemicals of concern through human biomonitoring (HBM), to link this information to data on exposure sources and epidemiological surveys and to promote research on the exposure response relationships in humans.

In addition, it should coordinate HBM activities at national and EU level, promote capacity building and the spread of best practice, provide a platform through which harmonised and validated information and data collected at national level can be accessed and compared and support research and innovation (improving underlying methods and procedures, biomarkers etc). Data generated will be included in the Information Platform for Chemical Monitoring Data (IPChem platform) developed by the EU Joint Research Centre⁸⁸.

To date, the preparatory phase conducted in 2015 has identified nine priority groups of chemicals that would be examined in detail via a provisional work plan for 2016; this includes two sets of chemicals found in the Stockholm Convention - POP-BDEs and PFOS.

⁸⁸ IPChem aims to support a coordinated approach to collecting, storing and accessing monitoring data on chemicals and chemical mixtures in humans and in the environment:
<http://ipchem.jrc.ec.europa.eu/#home-page>

2.5. Information Exchange, Public information, awareness and education

The EU institutions are committed to ensuring transparency and the involvement of stakeholders and the general public. This is stipulated in the Regulation 1049/2001 on public access to EU documents and transparency in the decision-making processes and in the communication from the Commission 2002/704 towards a reinforced culture of consultation and dialogue. The public access to environmental information is specifically laid down in Directive 2003/4/EC.

The main instruments for transparency and information access are the Europa website and a specific website dedicated to POPs⁸⁹. In addition the European Commission hosts databases such as Eur-Lex, statistic databases of Eurostat, the E-PRTR⁹⁰, the EU pesticide database⁹¹, and databases of EU institutions on specific topics such as the European Chemical Substances Information System⁹². The Directorate General for Environment maintains the POP-specific website containing information on Union legislation and POP-related research projects. Moreover, the European Environment Agency (EEA) publishes a substantial amount of information relevant to POPs⁹³.

In addition the general public or any interested stakeholder can have access to certain information on the presence of SVHC substances⁹⁴ in articles in the context of the REACH Regulation. A request can be sent to the supplier of an article who has to provide a reply within 45 days⁹⁵.

Within SAICM, the EU has actively promoted the development of the Chemicals in Products Programme, which is a voluntary initiative designed to assist all stakeholders throughout the product life cycle who are seeking procedures for the exchange of information on chemicals in products. Stakeholders include businesses, governments, intergovernmental agencies, recyclers, waste management actors, non-governmental organisations and consumer groups. The programme document⁹⁶ explains the objectives of the Programme's information exchange system and describes the roles and suggested responsibilities of stakeholders in respect of the exchange of chemicals in products information throughout the product life cycle.

The Guidance for stakeholders on exchanging information on chemicals in products has been created to support the Chemicals in Products Programme. It is intended to guide those who are designing a chemicals-in-products information system or those seeking to participate in an existing system. It is also aimed at guiding stakeholders who require assistance in exchanging information on their chemicals in products by describing the steps that are commonly taken in scoping, designing and building information exchange systems on chemicals in products.

⁸⁹ http://ec.europa.eu/environment/pops/index_en.htm

⁹⁰ <http://prtr.ec.europa.eu/>

⁹¹ http://ec.europa.eu/sanco_pesticides/public/index.cfm

⁹² <http://ecb.jrc.ec.europa.eu/esis/>

⁹³ <http://glossary.en.eea.europa.eu/terminology/sitesearch?term=persistent+organic+pollutants>

⁹⁴ According to Article 57 of the REACH Regulation; see also section 0.

⁹⁵ According to Article 33 of the REACH Regulation.

⁹⁶ SAICM, 2015, 'The Chemicals in Products Programme', <http://www.unep.org/chemicalsandwaste/Portals/9/CiP/Documents/Chemical%20in%20Products%20Programme.pdf>

Consultations with stakeholders are an integral part of the Union's environment policy and provide the opportunity for authorities, civil society and individual citizens to provide input. Accordingly, the draft Implementation Plans are also subject to an open consultation process.

In keeping with the EU's principle of subsidiarity, public information, awareness raising and education on POPs fall within the remit of the Member States, while the POP Regulation urges the Member States to provide awareness programmes and public information. A summary of the activities at Member State level can be found in the second synthesis report,⁹⁷ with the third synthesis report expected later in 2016.

The Commission and Member States exchange information at regular Competent Authority meetings where national representatives for POP issues meet. Core topics are: implementation of the Convention and the POP Regulation, nomination of chemicals that exhibit POP characteristics to the Stockholm Convention, exchange of information on occurrence and elimination of POPs and data gathering via reporting obligations under the POP Regulation.

2.5.1. *Stockholm Convention Regional Centres*

The Stockholm Convention has established a network of 16 regional centres globally⁹⁸ with a mandate for knowledge transfer and awareness raising for the issues surrounding POPs. The network has an obligation to support information exchange on a global basis with individual centres working both at a level within their own regional geography but also to provide support to other areas of the planet where needed. Within the EU two such centres exist, one based in the Czech Republic (RECETOX) and one based in Spain (The Regional Activity Centre for Sustainable Consumption and Production (SCP-RAC)). Additionally under the Basel Convention a regional centre with similar obligations is also based within the Czech Republic.

The two Stockholm Convention regional centres located in the EU have obligations to support knowledge exchange and raise awareness; they also work to ensure that duplication of effort is avoided⁹⁹. This means that those two regional centres have different core interests and focus as well as promoting knowledge exchange and awareness raising. Details of the future work plans 2016 – 2019 for both centres are detailed on the Stockholm Convention website under the details for the individual centres¹⁰⁰.

RECETOX has supported knowledge exchange through a series of 'international summer schools' open to experts and general interest groups, with the latest event held in 2015¹⁰¹. A core focus of the centre is monitoring of POPs within the natural environment. This has included the development of the Global ENvironmental ASsessment and Evaluation System

⁹⁷ BIO IS (2011): Technical Support on Reporting Obligations and Update of the Community Implementation Plan under POP Regulation. ENV.D.3/SER/2010/0068r. Synthesis report. June 2011.

⁹⁸ Stockholm Convention Regional Centres:
<http://chm.pops.int/Partners/RegionalCentres/Overview/tabid/425/Default.aspx>

⁹⁹ Personal Communication, Recetox, 2016.

¹⁰⁰ <http://chm.pops.int/Partners/RegionalCentres/Overview/tabid/425/Default.aspx>

¹⁰¹ <http://www.recetox.muni.cz/index-en.php?pg=events--11th-summer-school-on-toxic-compounds-in-the-environment-2015>

(GENASIS)¹⁰² web-portal, which provides a repository of environmental monitoring data from across Europe.

SCP-RAC acts as the Stockholm Convention regional centre for the Mediterranean covering all of the southern European Member States, but also countries in northern Africa and countries at the far east of the Mediterranean area bordering with the Middle East. The core focus of the SCP-RAC centre is sustainability and the elimination of POPs from the supply chain. This includes review of both production activities as well as the wider supply chain. SCP-RAC have supported this process with provision of information for substitution detailed on the subport website¹⁰³ and input to the ‘SwitchMed’¹⁰⁴ programme.

3. OVERALL ASSESSMENT OF THE POPs ISSUE IN THE EU

At European Union level, significant progress towards the elimination of POPs has been achieved. Production and use of all POP substances is prohibited with some minor exemptions that are decreasing. A main challenge for the EU is to eliminate POPs from the waste cycle and remaining stockpiles as these still present a major emission source.

The following sections briefly introduce the situation in the EU for the different POP substances.

3.1. POPs regulated before 2009 (“old POPs”)

The term “old POPs” covers the substances listed in the Stockholm Convention or the POP Protocol and regulated by the POP Regulation at EU level before 2008, i.e. before the new POP substances were listed in the Stockholm Convention or the POP Protocol in 2009, 2011, 2013 and 2015 (cf. section 3.2). The data on old POPs presented in the following sections are based on the second synthesis report¹⁰⁵ and draft version of the third synthesis report covering 2007-2009 and 2010 – 2013 respectively; which includes all annual reports and the 2007-2009 and 2010 - 2013 triennial reports of the Members States.

3.1.1. Production

The old POPs are no longer produced in the EU.

The specific exemption of the use of DDT in dicofol production has been withdrawn from the POP Regulation. This notes that dicofol itself has been found to meet the Annex D criteria for consideration as a POP under the Stockholm Convention (UNEP/POPs/POPRC.10/3). The Commission decided on the non-inclusion of dicofol in Annex I to Council Directive 91/414/EEC and on the withdrawal of authorisations for plant protection products containing that substance (2008/764/EC)¹⁰⁶ in 2008. According to the Commission Decision, all existing authorizations for dicofol in plant protection products had to be withdrawn before 30 March 2009. National registration of dicofol was no longer possible after March 2009. Any

¹⁰² GENASIS web portal for POPs monitoring data: <http://www.recetox.muni.cz/index-en.php?pg=structure--genesis-information-system>

¹⁰³ Subport website <http://www.subsport.eu/>

¹⁰⁴ SwitchMed website <http://www.switchmed.eu/en>

¹⁰⁵ http://ec.europa.eu/environment/pops/pdf/syntesis_report2.pdf

¹⁰⁶ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:262:0040:0041:EN:PDF>

transition period granted by the Member States expired by 30 March 2010. Up to the year 2008, dicofol has been produced by Montecinca SA. at Monzón, Spain. The yearly production amounted to approx. 1500 tonnes. Production was discontinued in 2009, when the registration for Spain expired. Until 2009, dicofol¹⁰⁷ was furthermore formulated and used in Italy¹⁰⁸.

3.1.2. *Use and placing on the market*

The use of the old POPs listed in Annexes A and B has been progressively phased-out in the EU. The specific exemption for use of lindane as public health and veterinary topical insecticide has expired in the EU by 31.12.2007. Remaining uses of old POPs are only in articles that were produced and placed on the market before the entry into force of the POP Regulation and as standards for research purposes. Both remaining uses are covered by general exemptions granted in the Stockholm Convention and the POP Regulation. Some illegal placing on the market of medicinal products containing lindane and fireworks containing hexachlorobenzene has been reported by some Member States in the period 2008-2010 and again in 2010-2013. The enforcing authorities of the Member States have intervened to stop these illegal practices and ensured a proper disposal of the products.

3.1.3. *Import and export*

Waste containing POPs (e.g. obsolete pesticides or contaminated equipments) is being imported into some EU Member States for the purpose of its disposal and elimination. These imports originate from EU and non-EU countries that lack adequate technology for proper disposal of such waste. These imports are being undertaken in accordance with the provisions of the Stockholm Convention and they contribute to the overall reduction of POPs in the EU and globally.

Some illegal imports of POPs embedded in products occurred in the period 2007-2009. Lindane was imported as part of a pharmaceutical product and hexachlorobenzene was imported as part of fireworks, which also occurred during the 2010-2013 period. As mentioned in the sub-section 3.1.2, the enforcing authorities took appropriate measures to prevent placing on the market of those products and ordered their elimination.

There is very little export of POPs outside the EU. In the period 2007-2009, and 2010-2013, few kilograms of lindane have been exported from one Member State out of the EU under the exemption for standards for research purposes.

3.1.4. *Stockpiles and waste*

In a few Member States there are still stockpiles of obsolete pesticides which contain POP substances (or are most likely to) and for which production, use and placing on the market are now strictly forbidden under the POP Regulation. This stockpiles amount to less than 50.000 tonnes, estimated to contain between 2.000 and 9.000 tonnes of POPs. Some stockpiles exist where the POP substances are embedded in formulations (this was reported for lindane and

¹⁰⁷ Dicofol meets the Annex D criteria of SC

¹⁰⁸ <http://www.unece.org/env/lrtap/TaskForce/popsxg/2010/Exploration%20of%20management%20options%20for%20Dicofol%20final.pdf>

Heptachlor). Reported stockpiles are subject to corresponding management measures. Additionally issues have been identified with contaminated land at former sites of manufacture which in turn can generate waste which requires management during remediation works; this may be an issue in particular for sites where manufacture of lindane previously took place. Another example described by Austria relates to a site that was manufacturing chlorinated solvents and acetylene in Southern Austria. Wastes from the production line, which included HCB, were deposited in the grounds with slaked lime. In 2001 the site was declared a contamination site of high priority, with the contaminated soil incinerated at a nearby cement kiln (at temperatures believed to be around 800 to 1000 °C). The careful management and irreversible destruction of POP containing wastes are managed as per the requirements of Annex IV and V of the POP Regulation.

PCB disposal by end of 2010

The Stockholm Convention has set an objective to eliminate the use of PCBs in equipment by 2025 and to make determined efforts to achieve environmentally sound waste management of liquids and equipment contaminated with PCBs by 2028.

At European level the aims of the Convention are incorporated into Directive 96/59/EC on the disposal of PCBs and PCTs (cf. section 2.1.2). This places a requirement on all Member States to develop registers of equipment containing more than 5 dm³ of PCBs and communicate the registers to the European Commission. Furthermore the PCB Directive required the Member States to take action to ensure that the equipment containing PCBs in the registers was decontaminated or disposed of by 31.12.2010 at the latest.

In compliance with the PCB Directive, inventories of PCB-containing equipment, as well as action plans for their disposal and collection were compiled by all Member States.

In December 2011, the Commission launched a survey to assess what progress had been made against this target, and requested the Member States to provide information about PCB wastes. Additionally in 2014 an ex-post evaluation of the PCB Directive¹⁰⁹ also assessed what progress had been made towards the 2010 target. Both the 2011 survey and 2014 evaluation identified that good progress had been made towards the identification of PCB-containing equipment and disposal of PCB wastes within Europe, with some Member States close to meeting the 2010 target, particularly for the EU15 Member States. However most Member States had not met the target of decontamination or disposal of liquids and equipment contaminated with PCB on registers by 31.12.2010.

A number of reasons have been cited for difficulties in achieving this target in both the 2011 survey and 2014 ex-post evaluation. In particular the survey highlighted issues with identification of PCB-containing equipment with a lack of reliable and comparable data in the EU. Reporting has been in some cases incomplete and in some cases, the number of pieces of equipment instead of the PCB content (expressed in kg or tonnes) were reported. Some Member States did not distinguish between equipment containing more than 500 ppm PCB and equipment containing more than 50 ppm PCB, as is listed in the Directive. Therefore analysis is required which can be costly. This is a position which can be further complicated where di-electric equipment containing heat transfer fluids that may contain PCBs are 'topped up' to replace lost fluids with non-PCB-based oils. This does not remove the contamination but only dilutes it.

¹⁰⁹ European Commission, 2014: Ex-post evaluation of certain waste stream directives.

The ex-post evaluation also noted that, for newer Member States e.g. Bulgaria and Croatia not benefiting from transition provisions in accession treaties, meeting the 2010 deadline was extremely challenging. However the ex-post evaluation also goes on to state that work is still ongoing towards the overall aims of of the PCB Directive, and the target of disposal and decontamination of PCB-containing equipment can be expected to be achieved by at least 90% of EU Member States in the coming years.

The POPs triennial synthesis report for the period 2010-2013, which is based on data from submissions by Member States under Article 12 of the POP Regulation, highlighted that work to identify, remove and dispose of PCB-contaminated liquids was still ongoing after 2010. However again where different approaches to quantifying materials have been used, it is difficult to comment on total European Union quantities that are still existing in use or stockpiles requiring disposal.

3.2. POPs regulated from 2009 (“new POPs”)

The new POPs are the substances that were listed in the Stockholm Convention at the 4th, 5th, 6th and 7th Conference of the Parties (COP) to the Stockholm Convention held in May 2009¹¹⁰, in April 2011, in May 2013, and in May 2015 respectively, and in the POP Protocol at the 27th meeting of the Executive Body of LRTAP Convention held in December 2009¹¹¹ and that were not listed in any of these instruments before. Thus, the new POPs are tetra-, penta-, hexa-, and hepta-BDE (Polybrominated diphenylethers; POP-BDEs), hexabromobiphenyl (HBB), isomers of hexachlorohexane including lindane (alpha, beta and gamma), chlordecone, pentachlorobenzene (PeCB), PFOS (including salts) and PFOSF, endosulfan, short-chained chlorinated paraffins (SCCPs), hexachlorobutadiene (HCBd), hexabromocyclododecane (HBCDD) and polychlorinated naphthalenes (PCNs). These substances have been included in the POP Regulation. Additionally at COP-7 the Stockholm Convention added pentachlorophenol (PCP) its salts and esters, which has not yet been added to the POP Regulation.

Prior to their listing the new POPs were subject to prohibition or severe restrictions in the EU. With the new amendments of the POP Regulation, certain restrictions go further than previously was the case in order to comply with the new international commitments.

In this context it needs to be highlighted that HBCDD, POP-BDEs and PFOS in contrast to the other new POPs will continue to challenge the management of certain waste streams due to the long life-span of the major product groups containing them (e.g. vehicles, electronics), and due to the fact that they are contained in products that are still in use (ESWI 2011¹¹²).

The following table gives a first overview on the situation concerning the new POPs. Please, note that the figures from ESWI are estimates. Further information on the individual substances is given in the sections below.

¹¹⁰ α -, β -, γ -HCH, chlordecone, HBB, tetra-, penta-, hexa-, and hepta- BDE, PeCB, PFOS (including salts) and PFOSF

¹¹¹ SCCPs (short chain chlorinated paraffins), HCBd (hexachlorobutadien) and PCN (polychlorinated naphthalenes); http://www.unece.org/env/lrtap/pops_h1.htm

¹¹² ESWI (2011): Study on waste related issues of newly listed POPs and candidate POPs. Service request under the framework contract No ENV.G.4/FRA/2007/0066. Final report of 13 April 2011

Table 5 Overview on the new POPs (ESWI 2011)

Substance	Purpose	Production	Use /Stockpiles in Products	Import	Export	Waste	Emissions
Chlordecone*	Pesticide	Historical production began in the USA in the early 1950s. No EU manufacture but was marketed in the EU until 1993 ¹¹³ . No current production expected	No current use is reported	Banned	Banned	No information available.	No information available.
Hexacyclohexane – including lindane**	Pesticide	Technical HCH (containing alpha and beta isomers) began production in the mid-1940s. Vijgen et al estimate that 300,000 tonnes of HCH including lindane was made and used in Europe between 1950-2000 ¹¹⁴ .	No current use is reported.	Banned	Banned	Potential significant contaminated land issue. For every 1 tonne of lindane produced up to 10 tonnes of toxic waste containing HCH isomers was produced.	No information available.
Endosulfan	Pesticide	Historic production in Europe amounted to 10.000 to 50.000 tonnes per year. Production stopped latest in 2007	No current use is reported.	Banned ¹¹⁵	Banned	No information available.	No information available.
Hexabromobiphenyl*	Industrial Chemical	Historical production within the USA from early to late 1970s. No	No current use is reported.	Banned	Banned	No information available.	No information available.

¹¹³ Stockholm Convention Risk Management Evaluation (UNEP/POPS/POPRC.3/20/Add.2)

¹¹⁴ Vijgen et al.. (2011). HCH as new Stockholm Convention POPs – a global perspective on the management of Lindane and its waste isomers. *Env Sci Pollut Res.* 18, 152-162.

¹¹⁵ http://ihcp.jrc.ec.europa.eu/our_databases/edexim

Substance	Purpose	Production	Use /Stockpiles in Products	Import	Export	Waste	Emissions
		production in Europe, but was marketed in Europe. No current production expected. ¹¹⁶					
Tetrabromo-diphenyl ether and penta-bromodiphenyl ether	Industrial Chemical	Production in the EU ceased in 1997	Historical use in applications with a high lifetime, such as automotive and upholstery application that are still in use. Estimated amount of C-PentaBDE in automotive applications in 2010: 258,3 t Accumulated amount of C-PentaBDE in upholstery applications: 321 t. Estimated amount of C-PentaBDE in upholstery applications in 2010: 96.95 t	No amount of C-PentaBDE in imported finished articles	Estimated C-PentaBDE exported in ELVs in 2010: 4,1 t	C-PentaBDE in automotive waste: ~243.3 t in 2010 C-PentaBDE in upholstery applications: 91.3 t in 2010	C-PentaBDE in automotive emissions: ~15 t in 2010 C-PentaBDE in upholstery emissions: ~6t in 2010
Hexabromo-diphenyl ether and hepta-bromodiphenyl ether	Industrial Chemical	Production within the EU stopped in 1996/98	Historical use in Acrylonitrilebutadiene-styrene (ABS) polymers (95%) Estimated amount of C-OcteBDE in EEE applications in 2010: 258,3 t	No amount of HexaBDE in imported finished articles	(Illegal) E-waste possibly contaminated with C-OctaBDE; amount of C-OctaBDE not quantifiable	128 t of C-OctaBDE in 2010	c-OctaBDE emissions : ~3t in 2010
Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride	Industrial Chemical	Within the EU exemptions for specific uses	Estimated current uses: the metal plating industry (6,500 kg/y), hydraulic fluids (730 kg/y), photographic industry (562 kg/y used +~1,280 kg from historical storage), semiconductor industry (9.3 kg/y), fire fighting foams (90t in stocks) Total sources 163 t/y and 1,730 t in product ¹¹⁷ (mainly from carpets)	No information available, except for the photo industry: finished articles containing PFOS account for 150 kg/y	No information available, except for the photo industry: finished articles containing PFOS account for 250 kg/y	163t PFOS in 2010	PFOS emissions: >1t in 2010
Hexabromocycloiododecane	Industrial Chemical	Production and use within Europe is subject to REACH Authorisation. 13 companies were	As of January 2016 only two applications are granted continued use: as a flame-retardant for expanded polystyrene boards and as a flame-retardant in expanded polystyrene beads. The Authorisation granted is due to be reviewed in	No current data post-REACH Authorisation	No current data post-REACH Authorisation	No information available.	41kg per/annum to air and 35kg to water during production and

¹¹⁶ Stockholm Convention Risk Management Evaluation (UNEP/POPS/POPRC.3/20/Add.3)

¹¹⁷ Represents the existing stock of the substance in product in use.

Substance	Purpose	Production	Use /Stockpiles in Products	Import	Export	Waste	Emissions
		granted Authorisation in 2016 for two specific applications. ¹¹⁸	August 2017. Data on usage rates post-January 2016 unknown. Data from 2014 ¹¹⁹ suggested production rates of 5,000 – 7,500 tonnes per annum.				530kg to air/560kg to water from use phase ¹¹⁶ .
Pentachlorobenzene (PeCB)	Industrial Chemical; Intermediate in pesticide production; By-product	No intentional production or use	Sources in Europe accounts for about 2,632 kg/y (dominated by the power production from coal)	No information available ¹²⁰ . In the POPRC risk profile for PeCB ¹²¹ no trade or stockpiles have been reported.		307,8kg PeCB in 2010	PeCB emissions: ~2.324t in 2010
SCCPs – short chain chlorinated paraffins	Industrial Chemical	Use and placing on the market for some applications restricted since 2002	Total sources ~ 2.151t and in used products 22.132 t in 2010	No information available.	No information available.	2.082t SCCPs in 2010	SCCPs emissions: ~69t in 2010
HCBD – hexachlorobutadiene	Industrial Chemical By-product	No use and production in EU; unintentional production as by-product	Total sources 506 kg in 2010 Estimated amount of HCBD from the chlorine industry in 2010: ~500 kg Accumulated amount of HCBD from sewage sludge: ~6 kg	No information available.	No information available.	500kg HCBD in 2010	HCBD emission from the plastic industry to waste water in 2008: 24 kg; no further information available
PCN - polychlorinated naphthalenes	Industrial Chemical By-product	No use and production in EU; unintentional production as by-product	Historical use mainly in the electrical industry	No information available.	No information available.	3.240,74 kg PCN in 2010	PCN emissions: ~12kg in 2010

* The limited use of chlordecone and hexabromobiphenyl within Europe means the potential risk for release to environment is equally low. Further discussion is not provided within this section.

** The manufacture and use of hexachlorohexane including Lindane was significant in Europe. However the greatest issue now posed by this substance relates to contaminated land. Further discussion of HCH and lindane is provided in section 3.4.2

¹¹⁸ ECHA news update: http://echa.europa.eu/view-article/-/journal_content/title/authorisations-granted-for-two-uses-of-hbcdd

¹¹⁹ VECAP annual report: <http://www.vecap.info/publications-2/>

¹²⁰ http://ihcp.jrc.ec.europa.eu/our_databases/edexim

¹²¹ UNEP/FAO/RC/CRC.7/9/Add.2, document No. 4, November 2007

3.2.1. Endosulfan

Endosulfan is an insecticide that has been used since the 1950s to control crop pests, tsetse flies and ecto parasites of cattle and as a wood preservative. Its production in the EU stopped in 2006/2007. Export was allowed to continue until banned by Regulation (EU) 649/2012. Germany was the second-largest endosulfan producer after India (approximately 4,000 tonnes per year) while historic production in Europe amounted to 10,000 to 50,000 tonnes per year¹²².

In the EU, the use of endosulfan in plant protection products was prohibited in 2005. However, by way of derogation from the provisions of Regulation (EC) No 1107/2009 concerning the placing of plant protection products on the market under special circumstances a Member State may authorise for a period not exceeding 120 days the placing of plant protection products containing endosulfan on the market for a limited and controlled use. Some Member States have made use of this for e.g. the use as an insecticide for hazelnut (harmful organism – *Curculio nucum*), the use as rodenticide for rape, orchards, starchy cereals crops (harmful organisms – *Microtus arvalis*) or the use in plant protection products and in antifouling products.

As a consequence of listing of Endosulfan in Annex A of the Stockholm Convention, its production, placing on the market and use has been banned by adding it to the appropriate Annex of the POP Regulation (Regulation (EC) No 850/2004). Further information such as relating to endosulfan stockpiles in the EU Member States is not available.

3.2.2. Tetrabromodiphenyl ether and pentabromodiphenyl ether

Tetrabromodiphenyl ether (TetraBDE) and pentabromodiphenyl ether (PentaBDE) were the main components of commercial pentabromodiphenyl ether (C-PentaBDE) an additive flame retardant. Since 1997, TetraBDE and PentaBDE have no longer been produced in the EU (ESWI 2011) but they continued to be used for some time in certain articles.

The use and placing on the market of C-PentaBDE was banned in the EU in 2004 by Directive 2003/11/EC¹²³. Since June 2009, these restrictions for C-PentaBDE were included in REACH Annex XVII on restrictions on the manufacture, placing on the market and use of certain dangerous substances, preparations and articles by the Regulation 552/2009¹²⁴. The RoHS Directive 2011/65/EC¹²⁵ inter alia restricts the use of Polybrominated Diphenylethers (POP-BDEs) in electrical and electronic equipment (EEE). The maximum concentration values in new EEE is 0.1 % by weight (1,000 ppm) in homogeneous material and applies to

¹²² Risk profile and risk management plan by the POP RC (UNEP/POPS/POPRC.5/10/Add.2 and UNEP/POPS/POPRC.6/13/Add.1)

¹²³ Directive 2003/11/EC of the European Parliament And Of The Council of 6 February 2003 amending for the 24th time Council Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations (pentabromodiphenyl ether, octabromodiphenyl ether) <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:042:0045:0046:EN:PDF>

¹²⁴ Commission Regulation (EC) No 552/2009 of 22 June 2009 amending Regulation (EC) No 1907/2006 of the European Parliament and of the Council on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) as regards Annex XVII; <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:164:0007:0031:EN:PDF>

¹²⁵ Directive 2011/65/EU of the European Parliament And Of The Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast)

the sum of PBDE congeners. Tetra- and Penta-BDEs, the main components of C-PentaBDE, are now regulated by the POP Regulation which bans their production, placing on the market and use.

Derogation is granted for production, placing on the market and use of electrical and electronic equipment within the scope of RoHS Directive, i.e. the EEE must comply with the maximum concentration values. A further derogation is granted for the production, placing on the market and use of articles and preparations containing concentrations below 0,1 % of TetraBDE or PentaBDE by weight when produced partially or fully from recycled materials or materials from waste prepared for re-use.

Further, relevant legal documents on EU-level addressing PBDE is the Water Framework Directive 2000/60/EC¹²⁶ and the PRTR Regulation (EC) No 2006/166¹²⁷. An annually averaged EQS for inland surface waters has been established for the sum of PBDE congeners¹²⁸ of 0.0005 µg/L and 0.0002 µg/L for other surface waters.

The most common use of C-PentaBDE in Europe was in flexible polyurethane foam (95%) that was mainly used for upholstery and automotive applications, thus applications with long expected lifetimes (see footnote 104). For these two sectors the overall discharge of C-PentaBDE in Europe was estimated by ESWI 2011 to be 355 t/y with an overall distribution of the discharge of ~6 % (21 t/y) as emissions and ~94 % (334 t/y) for waste.

Two samples of automotive shredder residue (ASR) taken from the 2014 Composition, Recycling and Recovery Trial for End of Life Vehicles in the Republic of Ireland were analysed for a range of metals and POPs¹²⁹. The study determined that POP-BDEs were present ranging from 103 to 197 µg/kg (sum of tetra-, penta-, hexa- and hepta- congeners). The sample contained shredder waste from ELVs with an average age of 15 years, with a range of between 10 and 26 years old. The contribution to the waste is ~105 t/y for TetraBDE and ~200 t/y for PentaBDE.

As for automotive applications, assuming a lifetime of 12 years and a phase out in 2000¹³⁰, the majority of C-PentaBDE in automotive applications should already have entered the waste stream¹³¹. However, there maybe some variability across Europe, for example, in Bulgaria over 57% of cars are over 15 years old. ESWI (2011) estimated the amount of C-PentaBDE present in automotive applications in the EU at 28 t in 2015. As for waste, ESWI estimated that of the 243.3 t of C-PentaBDE present in automotive waste in 2010, ~98.5 t was

¹²⁶ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

¹²⁷ Regulation (EC) No 166/2006 of the European Parliament and of the Council of 18 January 2006 concerning the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EEC and 96/61/EC

¹²⁸ Sum of 28 (tri), 47 (tetra), 99 (penta), 100 (penta), 153 (hexa) and 154 (hexa)

¹²⁹ ELV Environmental Services CLG (ELVES, 2016) Analysis of Automotive Shredder Residue from the Composition, Recycling and Recovery Trial for End of Life Vehicles in the Republic of Ireland (http://www.housing.gov.ie/sites/default/files/attachments/analysis_of_asr_from_the_irish_elv_composition_trial_feb_2016.pdf)

¹³⁰ According to information from the European Automobile Manufacturers Association (ACEA), the automotive industry voluntarily phased out C-PentaBDE latest from 2000 even though the legislative ban came into force only in 2004.

¹³¹ Other assumptions could be made that could lead to different estimations: According to information from a car recycler, the average age of ELVs in the Netherlands is 16 years. Assuming a corresponding lifetime and a phase out in 2004, the majority of C-PentaBDE in automotive applications would be disposed of around latest 2020.

landfilled, incinerated without energy recovery, ~17 t was incinerated with energy recovery and ~ 29.0 t was recycled.

Additional information provided by Germany to support the SC suggested that the stockpile of vehicles manufactured prior to 2000 will decline gradually with a significant proportion of the waste from end-of-life vehicles being incinerated. The reuse of car parts in Germany is thought to be minimal and no recycling facilities were identified where potentially POP containing material can enter into newly formed products. Estimates of the mass flow of POP-BDEs in the waste stream from the automotive industry in 2010 were 1096 kg for TetraBDE and 2108.8 kg for PentaBDE. Emissions resulting from this mass flow were estimated to be 69 kg and 127.3 kg for TetraBDE and PentaBDE, respectively.

The accumulated amount of C-PentaBDE in upholstery applications for 2014 is estimated at 0 t, however in 2010 it was estimated to have been 321 t. The ESWI (2011) report stated that the upholstery sector contributed about 97 t/y, with approximately 91.3 t of C-PentaBDE in upholstery applications estimated to have been treated in the EU in 2010. The C-PentaBDE entering the waste stream in 2010 was landfilled (~61.3 t), incinerated without energy recovery (~18.4 t) and incinerated with energy recovery (~11.6 t). With an assumed lifetime of 10 years all C-PentaBDE in upholstery applications should have already entered the waste stream (by 2014).

Additional information provided by Germany to support the SC confirmed that 2004 was considered the latest time that POP-BDEs would have been used in products. The mass flow of POP-BDEs in EEE in the wastestream in 2010 were estimated to be 1.41 t, 2.22 t and 13.35 t for PentaBDE, HexaBDE and HeptaBDE, respectively.

As regards the relevant exports, no further information is available.

3.2.3. *Hexabromodiphenyl ether and heptabromodiphenyl ether*

Hexabromodiphenyl ether (HexaBDE) and heptabromodiphenyl ether (HeptaBDE) are the main congeners of the commercial octabromodiphenyl ether mixture (C-OctaBDE). Production of these substances has ceased within the EU in 1996/98.

The main historical use of C-OctaBDE was as a flame retardant in Acrylonitrilebutadienestyrene (ABS) polymers with a concentration between 10-18 % by weight (95% of its use in the EU compared to 70% globally). ABS in turn was mainly used for housing of Electrical and Electronic Equipment (EEE), typically office equipment and business machines. Throughout the 90's C-OctaBDE in ABS was increasingly replaced by alternative flame retardants such as Tetrabromobisphenol A. There was also a shift from ABS (1990s) towards PC/ABS and HIPS for outer casings.

Additional information provided by Germany to support the SC provided estimates of the mass flow of POP-BDEs in the waste stream from the automotive industry in 2010. These were 479 kg for HeptaBDE and 1208 kg for HexaBDE. Emissions resulting from this mass flow were estimated to be 23.2 kg and 32 kg for HeptaBDE and HexaBDE, respectively.

Like C-PentaBDE, the use of C-OctaBDE was banned in the EU in 2004 by the Directive 2003/11/EC and in June 2009 by inclusion in Annex XVII of the REACH Regulation (Regulation 552/2009). Furthermore, the placing on the market of electrical and electronic equipment containing C-OctaBDE is also regulated under the RoHS Directive (2011/65/EU). Hexa- and Hepta-BDEs including in C-OctaBDE are now regulated by the POP Regulation

which bans their production, placing on the market and use. Derogation is granted for production, placing on the market and use of electrical and electronic equipment within the scope of RoHS Directive, i.e. the EEE must comply with the maximum concentration values. A further derogation is granted for the production, placing on the market and use of articles and preparations containing concentrations below 0,1 % of HexaBDE or HeptaBDE by weight when produced partially or fully from recycled materials or materials from waste prepared for re-use.

The annual amount of C-OctaBDE mainly from electronics entering the environment in the EU was estimated by ESWI (2011) to be approximately 131 t in 2010, of which 128 t are contained in end-of-life equipment (corresponding to ~8 t/y of PentaBDE, ~8 t/y of HexaBDE and ~45 t/y of HeptaBDE) and 3 t are emitted directly from the products. According to one scenario included in the ESWI study, out of these 128 t of C-PentaBDE wastes, 66 t were incinerated, 40 t were landfilled and 23 t recycled. Alternatively a different scenario based on the assumption that C-OctaBDE-contaminated plastics from the waste electronics fraction are incinerated as specified by the WEEE Directive (2002/96/EC), resulted in 128 t (the contaminated plastic waste fraction) being incinerated (ESWI 2011).

According to the ESWI study, it is estimated that all C-OctaBDE contained in EEE will have been disposed of by the end of 2012.

A significant amount of used and end-of-life electrical and electronic equipment (EEE) is being illegally exported outside the EU, most of it being declared as still functioning EEE. For instance, a recent study published by the German UBA and German Federal Ministry for Environment, Nature Conservation and Nuclear Safety¹³² indicates that in 2008 between 93,000 t and 216,000 t were exported from the port of Hamburg (Germany) to non-European destinations. Other studies carried out in Ghana and Nigeria – two of the main destinations of these exports where approximately 85% of the EEE imports originate from the EU – suggest that a significant portion of these products are either repaired locally and reused as second-hand-products (70%) or directly recycled by informal scrap metal workers (30%). In both cases, end-of-life management is largely unregulated and frequently makes use of open fires to liberate copper from wire insulation or to reduce plastic waste volumes, generating significant amounts of POPs (Prakash & Manhart 2010¹³³, Manhart et al. 2011¹³⁴, Schluep et al. 2011¹³⁵).

In the EU, there are indications that only few full scale e-waste recycling facilities separate plastics containing PBDE as required by EU legislation. For instance, one facility with automatic separation step for WEEE plastic containing halogens (including BFRs) is known

¹³² Sander, K.; Schilling, S. (2010): Transboundary shipment of waste electrical / electronic equipment / electronic scrap – Optimization of material flows and control.

http://www.umweltbundesamt.de/uba-info-medien/mysql_medien.php?anfrage=Kennnummer&Suchwort=3933

¹³³ Prakash, S.; Manhart, A.: Socio-economic assessment and feasibility study on sustainable e-waste management in Ghana. Öko-Institut e.V., Freiburg, 2010.

¹³⁴ Manhart, A.; Osibanjo, O.; Aderinto, A.; Prakash, S.: Informal e-waste management in Lagos, Nigeria – socio-economic impacts and feasibility of international recycling co-operations. Lagos & Freiburg, 2011.

¹³⁵ Schluep, M.; Manhart, A.; Osibanjo, O.; Rochat, D.; Isarin, N.; Müller, E.: Where are WEee in Africa? Findings from the Basel Convention E-Waste Africa Programme. Geneva, 2011.

in Switzerland (UNEP 2011)¹³⁶. Therefore, there are some doubts whether the capacity of European WEEE recycling plants for separation of PBDE (BFR) containing plastic from other plastic are currently sufficiently developed to separate a major part of PBDE/BFR containing plastic waste stream.

Furthermore, thermoplastics (i.e. mainly outer casings) separated from waste EEE is also being exported to non-European countries on a regular basis, where it is used as recyclate for the plastics industry, which might in some cases lead to cross-contamination of products and thus unintentional POPs-production through improper end-of-life treatment of these products (Manhart 2012¹³⁷).

Also, screening of plastic products in China has revealed that even sensitive uses like children toys (Chen 2009)¹³⁸ along with household goods (Chen 2010)¹³⁹ can be contaminated with PBDE and other BFRs. The PBDE concentrations in the toys were below the threshold limit (1000 ppm) required by the European Commission's Restriction of Hazardous Substances (RoHS) and Waste Electrical and Electronic Equipment (WEEE) directives in all of the toys, except for one hard plastic toy with a total PBDE concentration of 5.3 mg/g. Human exposure from the presence of POP-BDEs in household products from the Pearl River Delta region of South China was estimated to be low when compared to exposure via the inhalation of indoor air.

These data suggest that the flow of plastics recovered from WEEE and containing PBDE is not currently being properly controlled in European recycling operations.

3.2.4. *Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride*

Perfluorooctane sulfonate is a fully fluorinated anion, which is commonly used as a salt or incorporated into larger polymers.

The use of PFOS, its salts and other derivatives has been restricted in the EU since 2008 by Directive 2006/122/EC¹⁴⁰. These restrictions were later taken up in REACH Annex XVII by Regulation (EC) 552/2009. Now, the production, placing on the market and use of PFOS, its salts and other derivatives is regulated under the POP Regulation. Exemptions granted by the POP Regulation are significantly less numerous than in the Stockholm Convention, as

¹³⁶ In the "Technical Review of the Implications of Recycling Commercial Pentabromodiphenyl Ether and Commercial Octabromodiphenyl Ether" for the POP Reviewing Committee (UNEP/POPs/POPRC.6/2 and UNEP/POPs/POPRC.6/INF/6) such information has been compiled including information on facilities operated.

¹³⁷ Personal Communication, 24.2.2012 with Andreas Manhart – EEE expert.

¹³⁸ Chen S.-J., Ma Y.-J., Wang J., Chen D, Luo, X.-J. Mai, B.-X. (2009). Brominated Flame Retardants in Children's Toys: Concentration, Composition, and Children's Exposure and Risk Assessment. *Environ Sci Technol* 43(11): 4200- 4206

¹³⁹ Chen, S.-J., Ma, Y.-J., Wang, J., Tian, M., Luo, X.-J., Chen, D. Mai, B.-X. (2010). Measurement and human exposure assessment of brominated flame retardants in household products from South China. *Journal of Hazardous Materials* 176(1-3): 979-984

¹⁴⁰ Directive 2006/122/EC of the European Parliament and of the Council of 12 December 2006 amending for the 30th time Council Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (perfluorooctane sulfonates); <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:372:0032:0034:EN:PDF>

alternatives are available for many of those uses. The derogation for PFOS was given for production and placing on the market for the following uses until 26 August 2015 (a) 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.

The production of PFOS in the EU was phased out between 2000 and 2004 although exemptions were provided for in the POP Regulation which resulted in limited on-going production in Germany and Italy. At its seventh meeting in May 2015 the COP (decision SC-7/1) noted that there were no longer any parties registered for the specific exemptions for the production and use of PFOS, its salts and PFOSF for carpets, leather and apparel, textiles and upholstery, paper and packaging, coatings and coating additives and rubber and plastics, Under the Stockholm Convention specific exemptions with registered parties remain for photo masks in the semiconductor and liquid crystal display (LCD) industries, Metal plating (hard metal plating), Metal plating (decorative plating), Electric and electronic parts for some colour printers and colour copy machines, and Insecticides for control of red fire ants and termites.

Estimates of uses within the EU for 2010 includes the metal plating industry (6,500 kg/y), use in hydraulic fluids in the aviation industry (730 kg/y), the photographic industry (562 kg/y used + ~1,280 kg from historical storage) and semiconductor industry (9.3 kg/y). PFOS has also been present in fire fighting foams (90 t in stocks) although these stocks should have been destroyed by 27 June 2011. There are also historical stockpiles of PFOS from use in the photographic industry (1,280 kg) (ESWI 2011). In the past PFOS was used as a surface-active agent in different applications and products, in coatings and coating additives, in carpets and textiles, in rubber and plastics, in upholstery and in the leather industry. Such products with an expected long lifetime are likely to eventually enter the waste stream i.e. carpets or (leather) upholstery.

The carpet sector dominates the major waste streams accounting for ~93% of the total PFOS generated from all sectors. The waste stream generated from use of fire fighting foams accounts for ~4 % although all stocks should have been disposed of by 2011. Leather production and the metal plating industry each account for ~1 % of the PFOS waste stream with the remainder generated by the photographic industry and hydraulic fluids used in the aviation industry (ESWI 2011)¹⁴¹.

The majority of PFOS waste is currently disposed of to landfills for non-hazardous waste (63%) followed by non-hazardous incineration (31%). It is estimated that only 1.31 % of all PFOS containing waste is currently reused or recycled. The remaining PFOS containing waste is destroyed in hazardous waste incineration plants (ESWI 2011).

3.2.5. *Pentachlorobenzene (PeCB)*

Pentachlorobenzene (PeCB) was listed as new POP in Annex A and C of the Stockholm Convention in May 2009. It is now regulated by the POP Regulation which bans its production, placing on the market and use.

¹⁴¹ All figures in this section are estimations made by ESWI 2011

Therefore, it is not being intentionally produced or used anymore within the EU. Historic intentional uses within Europe comprised the application together with polychlorinated biphenyls (PCBs) in electrical equipment, as flame-retardant and as intermediate in the production of the pesticide quintozone. ESWI (2011) estimated that the current most relevant source of PeCB production and emission are incineration and combustion processes of different wastes/materials including coal¹⁴². Emissions of PeCB to the environment (mainly air and to a lesser degree soil) were estimated from ESWI to approximately 2,324 kg/y with the main contribution resulting from power production from coal (ca. 83%) followed by domestic burning of solid fuels, wood and mixed wastes (8%).

Within the E-PRTR data-set only a limited number of sites across Europe report the emission of pentachlorobenzene to air for the period 2007 – 2012; no emissions of pentachlorobenzene were reported for 2013 (published May 2015). In all but two of the reported cases the emissions have been linked to manufacture of iron and steel, particularly the manufacture of pig iron. The other reported minor sources were a waste water treatment works, and a plant for the processing of vegetable and animal matter.

The reported releases to air for pentachlorobenzene in the iron and steel manufacture sector range from 0.3 to 1.8 tonnes per annum, based on three metal facilities reporting per annum for 2008 to 2010, and two in 2011.

PeCB release to water reported in E-PRTR (2007 - 2013) illustrates a small number of sources with waste water treatment works, petroleum refineries, and hazardous waste treatment reported in almost every year (oil and gas refineries were not reported in 2013). However the inventory for the 2007-2013 period is dominated by one facility within the organic chemicals manufacture sector which reported releases of PeCB to air of 640 kg in 2009. From the E-PRTR information it could not be decided whether this release stemmed from current production or from deposits of the site. However, the associated water release of 88 kg of HCH from the same site indicate that larger releases stem from deposits and thus most probably the PeCB releases also stem from deposits. It is known that organochlorine production of certain solvents (tetrachlorometane, tetrachloroethene and trichloroethene) have generated and often deposited tonnes of HCB/PeCB waste (UNEP 2010)¹⁴³.

The E-PRTR data shows that these solvents are also being released from the same factory, which further supports the hypotheses that the reported case is a release of PeCB from a HCB/PeCB deposit from former tetrachlorometane, tetrachloroethene and trichloroethene production.

The importance to inventory and to assess HCB/PeCB waste deposits was emphasised in the POPs inventory session at Dioxin 2011 in Brussels (Weber et al. 2011b)¹⁴⁴. These releases constitute most of the EU PRTR 2009 water releases and more than 50% of total PRTR 2009 PeCB releases. Furthermore, a recent review on the future relevance of POPs deposits highlighted the necessity to assess the impact of flooding risks of such sites in particular in the context of increased flooding in recent years and in future occurring in Europe triggered

¹⁴² If waste incinerators and coal boilers would have the estimated emission of ESWI (2011) estimate they would have to report to PRTR. This inconsistency should be clarified.

¹⁴³ Stockholm Convention (2010): Information document for the 6th POP Reviewing Committee meeting (UNEP/POPs/POPRC/6/INF/21).

¹⁴⁴ Weber R, Watson A, Malkov M, Costner P, Vijgen J (2011) Unintentionally produced hexachlorobenzene and pentachlorobenzene POPs waste from solvent production – the need to establish emission factors and inventories. *Organohalogen Compounds* 73.

by climate change (Weber et al. 2011)¹⁴⁵. This is also underpinned by a case from Czech Republic where the releases of HCB and PeCB have and are contaminating the river Elbe sediments (Heinisch et al. 2006)¹⁴⁶. For this site the releases have not been included yet in the PRTR system. The possible high impact of PeCB release from organochlorine production and deposits (in particular specific solvents) was also highlighted by a recent POP Reviewing Committee Document (UNEP 2010)

As a comparison to the reported release from organic chemicals manufacture, the emissions from waste water treatment works across the EU contributed between 1.5 and 120 kg of PeCB per year with an average of 40kg per annum for the period 2007-2013. Petroleum refineries contributed between 2 and 120 kg per annum with an average of 42 kg for the timeframe 2007-2012 within the E-PRTR data.

3.2.6. SCCPs – short chain chlorinated paraffins

Short chain chlorinated paraffins (SCCPs) are already regulated in the EU since 2002 by a restriction of the use of SCCPs for metal working fluids and fat liquoring as substances or as constituents of other substances or preparations in concentrations higher than 1%¹⁴⁷. This restriction was taken up in REACH Annex XVII. Furthermore, SCCPs (Alkanes, C10-13, chloro) were included in the candidate list for REACH Annex XIV because of their PBT and vPvB properties. Following the inclusion of SCCPs in the POPs Protocol SCCPs were listed in Annex I of the POP Regulation (Commission Regulation (EC) No 519/2012¹⁴⁸).

Since July 2012, the production, use and placing on the market of SCCP is forbidden by the POP Regulation. Uses for SCCPs have included application in paints, adhesives and sealants, plastics and rubber, flame retardants as well as textiles and polymeric materials (e.g. PCB substitute in gaskets).

There are on-going derogations contained in the POP Regulation, which include the on-going production, placing on the market and use of substances or preparations containing SCCPs in concentrations lower than 1% by weight. There are also derogations allowing the use of SCCPs as fire retardants in rubber used in conveyor belts in the mining industry and in dam sealants. In order to make use of these derogations Member States have to report to the Commission by no later than 2015 (and every four years thereafter) progress to eliminate the use of SCCPs. The listing of SCCPs was amended in 2015 by Commission Regulation (EU) 2015/2030¹⁴⁹, in order to further restrict their use.

The rubber industry (conveyor belt, gaskets, hoses) was the main application of SCCP (1,254 t/y) followed by the sealants and adhesives sector (459 t/y) and by the paints and varnishes sector (337 t/y). The textile industry covered only a small fraction of the overall used amount of SCCP (31 t/y).

¹⁴⁵ Weber R, Watson A, Forter M, Oliaei F. (2011) Persistent Organic Pollutants and Landfills – A Review of Past Experiences and Future Challenges. *Waste Management & Research* 29 (1) 107-121.

¹⁴⁶ Heinisch E, Kettrup A, Bergheim W, Wenzel S. (2007) Persistent chlorinated hydrocarbons, source-oriented monitoring in aquatic media. 6. Strikingly high contaminated sites. *Fresenius Environ Bull* 16(10): 1248-1273.

¹⁴⁷ Directive 2002/45/EC of the European Parliament and of the Council of 25 June 2002 amending for the twentieth time Council Directive 76/769/EEC relating to restrictions on the marketing and use of certain dangerous substances and preparations (short-chain chlorinated paraffins)

¹⁴⁸ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:159:0001:0004:en:PDF>

¹⁴⁹ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015R2030&rid=1>

The relevant waste flows have been established for all of the sections and the corresponding figure represents that the highest share of non-hazardous waste comes from landfilling (66%) followed by incineration with about 20%.

Also leather which has been impregnated with SCCP in the past can enter the waste stream due to its long lifetime.

The total SCCP containing waste amount (without sewage sludge) sums up to about 44 kt/y.

The relative distribution of environmental emissions from investigated sectors in the EU is as follows: The most important source of emissions is volatile and particulate releases from sealants and adhesives (42 % or 36 t/y) followed by rubber (31 % or 25 t/y) as well as from paints and varnishes (21 % or 17.4 t/y) and textiles (5% or 4.1 t/y) (ESWI 2011).

3.2.7. *HCBD – hexachlorobutadiene*

HCBD is listed as priority hazardous substance in the Water Framework Directive, for which discharge, emission or loss must cease or be phased out. Nevertheless, the inclusion of HCBD in the POPs Protocol has triggered the obligation to take up HCBD in the POP Regulation which is however still to be implemented.

The intentional use and production of HCBD has not occurred in Europe for many years (UNECE 2007). HCBD is mainly formed as an unintentional by-product during several industrial processes (as a solvent for rubber and other polymers, in heat transfer fluids, as a transformer liquid or hydraulic fluid). However available information about these industrial processes is scarce.

Nowadays, the most important source of HCBD is due to the manufacture of chlorinated solvents through chlorolysis of tri- and tetrachloroethene, tetrachloroethylene and tetrachloromethane. The estimated amount of HCBD produced during this process varies between ~0.7 kg/year up to possible ~500 kg/year (ESWI 2011).

Urban waste-water treatment plants are a second main source of HCBD (E-PRTR 2007 - 2013). HCBD in waste water treatment works accumulate in the sewage sludge. A total amount of HCBD which ends up in the sewage sludge in all 28 EU Member States is estimated to be approximately 6 kg/year. It must be noted here that this estimation is based on sewage sludge contamination data from China since no data from European facilities were identified (ESWI 2011).

Unintentional production and releases from the plastic (PVC) industry may be relevant, but specific data is not available yet.

HCBD is and has been produced as by-product of certain chlorinated solvent production and is among the prime pollutants of “Hexachlorobenzene” wastes deposited in 10,000 tons scale from such productions in the past. Therefore such waste deposits can be considered to be the largest stock of HCBD (ESWI 2011).

3.2.8. *PCN – polychlorinated naphthalenes*

PCN was added to the POP Regulation by Regulation (EC) 519/2012 which coincides with addition of PCN to the UNECE POPs Protocol. Wastes containing PCN are characterised as hazardous waste under Annex VIII entry A3180 of the Basel Convention. Furthermore as of

2014 Regulation (EC) 1342/2014 amending annexes IV and V of the POP Regulation sets in place critical thresholds for PCN to identify those wastes characterised as being POPs-contaminated and requiring destruction that irreversibly destroys PCN.

PCNs are a group of substances based on the naphthalene ring system and they are structurally similar to the PCBs. PCNs are no longer commercially produced in the EU. They were produced in the past as mixtures of several congeners and with different product names e.g. Halowax, Nibren Waxes, Seekay Waxes and Cerifal Materials (UNECE 2007)¹⁵⁰. The main use of PCNs was in the electrical industry as separators in storage batteries, capacitor impregnates, as binders for electrical grade ceramics and sintered metals, and in cable covering compositions. They have also been used for impregnation of wood, paper and textiles to attain water proofness, flame resistance and protection against insects, moulds and fungi. Furthermore, they were used as additives in gear and cutting oils, in lacquers and underwater paints and as raw material for dyes¹⁵¹.

PCN are currently formed mainly unintentionally during various thermal processes (UNECE 2007). As PCNs exhibit similar formation properties as PCDD/Fs, unintentional production during incineration processes as municipal solid waste incineration (MSWI), hospital waste incineration, domestic burning, or different metal processing steps such as secondary copper production, secondary aluminium production, magnesium production as well as iron sintering and electrical arc furnace processes for iron production are of relevance. Moreover, the accumulation in sewage sludge from diffuse sources is a relevant pathway (ESWI 2011).

The total waste amount is estimated about 3,200 kg of PCN (ESWI 2011). The main waste stream found its way into the recycling and recovery channel (about 90%). Emissions of polychlorinated naphthalenes to the environment amount to approximately 12 kg/year.

3.2.9. Hexabromocyclododecane (HBCDD)

HBCDD is a brominated flame retardant which has to date been extensively used across the EU within expandable polystyrene (EPS) and extruded polystyrene (XPS) insulation boarding used within roof and cavity wall insulation. HBCDD also has a more limited application (around 1% of total HBCDD use) as a flame retardant for use in high impact polystyrene (HIPS) used for mouldings and housings of electrical goods such as computer monitors and CRT based televisions.

Following the Stockholm Convention review process for candidate substances, HBCDD was added to Annex A of the Convention in 2013 following the fifth conference of the parties (COP5) with full entry into force in November 2014. HBCDD has been listed in the POP Regulation by Commission Regulation (EU) 2016/293¹⁵².

The manufacture and use of chemical goods within Europe is controlled under the REACH Regulation. HBCDD had already been identified as a substance of very high concern (SVHC)

¹⁵⁰ UNECE (2007): Exploration of management options for Polychlorinated Naphthalenes (PCN) Paper for the 6th meeting of the UNECE CLRTAP Task Force on Persistent Organic Pollutants, Vienna, 4-6 June 2007.

<http://www.unece.org/env/lrtap/TaskForce/popsxg/2007/6thmeeting/Exploration%20of%20management%20options%20for%20PCN%20final.doc.pdf>

¹⁵¹ Jakobsson, E.; Asplund, L. (2000): Polychlorinated Naphthalenes (PCNs), The Handbook of Environmental Chemistry Vol. 3 Part K, New Types of Persistent Halogenated Compounds, Chapter 5, 2000.

¹⁵² OJ L 55, 2.3.2016, p. 4.

at the time of its addition to the Stockholm Convention, and has been subject to the authorisation process, meaning permissions for specific applications were required for future use in the Union. In January 2016 authorisation was given to thirteen companies for two specific applications for use as a flame retardant in expanded polystyrene boarding and use as a flame retardant in the manufacture of expanded polystyrene beads (Commission Implementing Decision C(2015) 9812 final)¹⁵³. The review period for these Authorisations is two years and the authorisation may be assessed again in August 2017. The sunset date for HBCDD was August 2015.

3.3. Unintentionally produced POPs

Releases of unintentionally produced POPs (UPOPs) remain an important POP source in the EU. Where regulation and policy have identified and reduced the emissions from industrial sources over the past two decades, diffuse sources linked to for example domestic combustion or open burning of waste become increasingly important UPOPs sources.

However such sources can be more difficult to monitor and tackle. Reduction and phase out of these emissions is complex, indeed impossible in the case of most thermal sources and of emissions from open burning. Furthermore, the sources of unintentionally produced POPs are rather disperse and thus measures cannot be as targeted as for intentionally produced and used POPs.

Member States extensively reported monitoring data for the release of unintentionally produced POPs into the air, water and soil using three methodologies: Stockholm Convention's emission inventories, E-PRTR's and EMEP's. A remarkable amount of information is available on air and water emissions, in particular from the E-PRTR and EMEP databases that are standardised, user-friendly and are readily available in electronic form for analysis. Yet, however, there have only been few cases of reported data related to the Stockholm Convention methodology. One possible reason for this lack of reported data may relate to the difficulty in accurately accounting for activity data in diffuse sources e.g. quantity of waste burnt on open fires for an entire nation. The Stockholm Convention has aimed to assist inventory compilers through the provision of guidance material such as the dioxins and furans toolkit¹⁵⁴.

3.3.1. Estimation and monitoring of emissions

The regulated emissions to air, water and soil of the unintentionally produced POPs listed in Annex C of the Stockholm Convention or in Annex III of the POP Protocol (hexachlorobenzene, pentachlorobenzene, polychlorinated biphenyls, polychlorinated dibenzo-p-dioxins and dibenzofurans and polycyclic aromatic hydrocarbons) are registered in the European Pollutant Release and Transfer Register (E-PRTR). Furthermore, EMEP is monitoring and modelling UPOPs levels in air for the EMEP region and is compiling the air

¹⁵³ ECHA news update: http://echa.europa.eu/view-article/-/journal_content/title/authorisations-granted-for-two-uses-of-hbcdd

¹⁵⁴ UNEP, 2005, 'Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases'

inventories (EMEP 2011).¹⁵⁵ This inventory data for the air vector is made publically available through the webdab database: <http://www.ceip.at/>

The establishment of the E-PRTR database is based on the European Pollutant Release and Transfer Register Regulation (EC) No 166/2006 (see section 2.1.7). The E-PRTR database¹⁵⁶ contains reported data from approximately 28,500 facilities from the EU-28 and Iceland, Liechtenstein, Norway, Serbia and Switzerland in 65 economic activities for 91 pollutants, including the unintentionally produced POPs that are covered under the Stockholm Convention and the POP Protocol from 2007 to 2013 (see Table 7).

Table 6 Emissions of unintentionally produced POPs according to E-PRTR (PCDD + PCDF as TEQ)

POP substance	Year	Air	Water	Soil
Polychlorinated dibenzo-p-dioxins (PCDD) and Polychlorinated dibenzofurans (PCDF)	2007	1,2 kg I-TEQ	11.7 g I-TEQ	213,0 g I-TEQ
	2008	1,6 kg I-TEQ	23,4 g I-TEQ	2,0 g I-TEQ
	2009	0,8 kg I-TEQ	240,9 g I-TEQ*	No data available
	2010	1,4 kg I-TEQ	297,7g I-TEQ	No data available
	2011	0,6 kg I-TEQ	31,7g I-TEQ	No data available
	2012	2,6 kg I-TEQ	74,9 g I-TEQ	No data available
	2013	2,4 kg I-TEQ*	52,8 g I-TEQ	No data available
Main sources		Production and processing of metals	Production and processing of metals	Production and processing of metals
Hexachlorobenzene (HCB)	2007	86,0 kg	120,0 kg	No data available
	2008	259,0 kg	93,0 kg	No data available
	2009	42,3 kg	63,9 kg	No data available
	2010	20,5 kg	72.5 kg	No data available
	2011	125,4 kg	78.9 kg	No data available
	2012	No data available	88.3 kg	No data available
	2013	42.2 kg	25.1 kg	No data available
Main sources		Chemical industry waste and wastewater management	Waste and wastewater management	-
Pentachlorobenzene	2007	No data available	16,5 kg	No data available
	2008	1,8 kg	36,1 kg	No data available
	2009	348,0 kg	661,0 kg	No data available
	2010	569,0 kg	387,0 kg	No data available
	2011	508,0 kg	24,0 kg	No data available
	2012	1,5 kg	222,5 kg	No data available
	2013	No data available	90,3 kg	No data available

¹⁵⁵ Gusev A., Dutchak S., Rozovskaya O., Shatalov V., Sokovykh V., Vulykh N. Aas W., Breivik K. Persistent Organic Pollutants in the Environment. EMEP Status Report 3/2011; June 2011.

¹⁵⁶ <http://prtr.ec.europa.eu/pgAbout.aspx>

POP substance	Year	Air	Water	Soil
Main sources		Production and processing of metals	Chemical Industry, Waste and waste water management, Energy sector	-
Polychlorinated Biphenyls (PCBs)	2007	190,0 kg	36,8 kg	24,4 kg
	2008	159,0 kg	185,5 kg	29,5 kg
	2009	552,0 kg	222,3 kg	516,0 kg
	2010	547,0 kg	76,6 kg	20,0 kg
	2011	513,0 kg	69,0 kg	16,3 kg
	2012	63,9 kg	90,7 kg	4,1 kg
	2013	87,9 kg	31,7 kg	0,5 kg
Main sources		Production and processing of metals, mineral industry	Waste and waste water management (urban waste-water treatment plants)	Waste and waste water management, Animal and vegetable products from the food and beverage sector
Polycyclic aromatic carbons (PAHs)	2007	182,2 t	8,6 t	101,3 kg
	2008	135,3 t	6,2 t	17,4 kg
	2009	69,7 t	4,7 t	130,3 kg
	2010	99,0 t	3,9 t	98,3 kg
	2011	86,4 t	4,0 t	32,4 kg
	2012	60,5 t	5,4 t	No data available
	2013	56,7 t	2,9 t	No data available
Main sources		Production and processing of metals	Production and processing of metals	Waste and waste water management, production and processing of metals

*data based on review and removal of any significant outliers

E-PRTR data are not suitable for establishing trends since reporting data can vary between different years depending on which plants report, recognising that the E-PRTR makes use of reporting thresholds which means the number of facilities that are required to report can also vary year on year. Even for those facilities above the reporting threshold the datasets held by the E-PRTR are also rather incomplete at least for several UPOPs. This can be seen e.g. for PeCB with just 8 facilities reporting or for HCB where just 6 facilities reported. Part of the reason for this incomplete picture may relate to the level of understanding for UPOPs substances within the operators that complete the returns for the E-PRTR. This is particularly important for operators when assessing whether a source exists or not, and to aid with making sense of the values derived for real world emissions.

For a number of the UPOPs released to given vectors (air, water, land) and years a small number of sites with unusually high reported emissions can have a significant impact on the overall annually reported data. In some cases the data reported suggests potential errors such as unit errors. For example one site in the 2013 E-PRTR data-set reports an emission of 114 tonnes of dioxins and furans to air which is clearly incorrect. On other occasions the reporting of data could be due to problems at the plant or genuine reasons for why an emission might be high. For example one facility with a high release of PeCB to water of 640 kg reported in 2009 had, for all other years in the E-PRTR database (2007-2013), PeCB emissions from this facility below the reporting threshold (1 kg). Comparison to other inventories such as those

reported to the European Commission for Article 12 of the POP Regulation suggests this value is high but not outside the bounds of possibility. However, it is unclear whether in this case the reported value is genuine or an error.

Furthermore the E-PRTR makes use of reporting thresholds below which operators are not required to submit data. However it is less clear when examining data for UPOPs why some facilities provide data where others do not. For example looking at 2009 data where two metal manufacture facilities report emissions of PeCB amounting to 100 and 200 kg respectively, while other facilities did not report any PeCB emissions at all, which assuming the reported data is correct would mean that all other metal manufacturer facilities have emissions of PeCB less than 1kg per annum.

The examples alluded to highlight why examining time trends within the E-PRTR dataset are currently difficult and need a detailed systematic assessment of reporting facilities.

According to the official and unofficial emission data considered by EMEP, total emissions of PCDD/Fs within the EMEP domain decreased by 60% in the period from 1990 to 2012. PCDD/F emissions within the Northern Hemisphere (EMEP region, the USA and Canada) declined by 50% during the same period (Figure 7).

Based upon the UNECE data for 2012 on air emissions covering PCDD/F, maximum emission reduction within the period took place in the Netherlands (97%), the Czech Republic (96%), France (95%), Romania (95%), Germany (91%), and Belgium (90%).

As regards the emission estimate data it should be noted that despite the improvements achieved in the past years uncertainties in the emission estimations remain to be relatively high, particularly in relation to emission factors and activity rates. A review of the POPs emission inventories submitted under the UNECE in 2012¹⁵⁷ highlighted that a number of inventories had key source gaps, particularly for HCB and PCB. The same review also identified issues with transparency with a range of emission factors in use for similar sources which highlighted differences between data reported by different Member States.

In addition, the comparison of measured and modelled data for dioxins and hexachlorobenzene revealed that modelled data underestimated measured air concentrations by a factor of 5 and more (EMEP 2011). According to EMEP, the underestimation can be related to the incompleteness of available emission data, underestimation of the role of secondary emission sources, differences in congener profiles and general underestimation of emissions. Thorough analysis of contemporary and historical emissions is thus needed to refine the assessments of pollution levels.

The exposure of the population to unintentionally produced POPs is addressed by the food and feed regulations (see section 2.1.4) and by the Directive 2004/107/EC on ambient air pollutants (see section 2.1.4).

3.3.2. *Addressing industrial sources*

The core instrument covering the environmental performance of industrial installations (covering emissions to air, water and land and generation of waste) is the Industrial Emissions Directive 2010/75/EU (IED). The emission limit values, parameters or equivalent

¹⁵⁷ Whiting, 2012, 'Inventory Review 2012 - Review of POP emission inventories', report by the Centre for Emission Inventories and Projections (CEIP)

technical measures to be set in the permits of the installations covered have to be based on the Best Available Techniques (BAT). The BAT are described and defined at EU level in the Best Available Techniques REFerence Documents (BREFs documents) which can be downloaded from the website of the European IPPC Bureau¹⁵⁸. The BAT conclusions are the part of the BREF laying down the conclusions on best available techniques, their description, information to assess their applicability, the emission levels associated with the best available techniques, associated monitoring, associated consumption levels and, where appropriate, relevant site remediation measures. This is the document that is formally adopted by the Commission under the IED. In the area of POPs, relevant BAT conclusions recently adopted include those for:

- Iron and steel production;
- Cement, lime and magnesium oxide production; Refining of mineral oil and gas;
- Pulp and paper production;
- Tanning of hides and skins.

The BAT conclusions for non-ferrous metals, which are also relevant, have already been adopted; and the BAT conclusions for large combustion plants should follow shortly (see Commission Implementation Decision EU 2016/1032 on the Industrial Emissions Directive). Other relevant sectors, for which BREFs have been adopted previously under the IPPC Directive include ferrous metals, waste incineration smitheries and foundries and. As for the status of these documents (as of June 2015):

- Ferrous metal processing: Review has been on hold, but restarted in 2016. As part of the process a call for initial responses was published with a deadline of April 2016.
- Waste incineration: Review started in January 2015.
- Smitheries and foundries: Not currently under review. BREF document is from 2005.

The BAT conclusions are to be the reference for the permitting authorities in setting conditions for installations covered by the IED. In this context, emission limit values have to be set by the competent authorities for all relevant pollutants that can be emitted from the installations. The technical working groups involved in the information exchange leading to the drafting or revision of the BREFs and the Commission co-ordinating the process will for each of the sectors concerned assess which pollutants are to be dealt with in the BREF and BAT conclusions contained therein and will endeavour to exchange information on the techniques to prevent or reduce emissions of those pollutants, including their performance and costs. However, the information exchange is a voluntary process, so it will depend on the information that is provided by the stakeholders or can be gathered by the European IPPC Bureau. It may not always be the case that all 'relevant' pollutants in the context of an individually permitted installation will be covered by the BREFs and it will be up to the competent authorities concerned to determine the additional pollutants for which an emission limit value may need to be set at the installation level.

All waste incineration and co-incineration facilities are covered by Chapter IV of the IED which includes special provisions for waste incineration and co-incineration plants¹⁵⁹. The IED sets limit values for emissions of PCDD/F to air (0.1 ng /Nm³) and water (0.3 ng/l).

¹⁵⁸ <http://eippcb.jrc.ec.europa.eu/>

¹⁵⁹ Since 7 January 2014 Directive 2010/75/EU on industrial emissions repealed and replaced the Directive 2000/76/EC on incineration of waste.

In 2010, CEN has adopted part 4 of the standard EN 1948 for the determination of the mass concentration of PCDDs/PCDFs and dioxin-like PCBs from stationary source emissions (covering sampling and analysis of dioxin-like PCBs).

Combustion plants (other than those incinerating waste) with a rated thermal input of less than 50 MW are not covered by the IED. The IED includes a review clause in Article 73(2) according to which the Commission shall review the need to control emissions from these installations and shall report the results to the European Parliament and the Council accompanied by a legislative proposal, if appropriate. The review has already been performed and the Commission has submitted a new Directive on the limitation of emissions of certain pollutants into the air from medium combustion plants, the directive was adopted on 25 November 2015¹⁶⁰. The proposed directive targets combustion plants with a rated thermal input greater than 1MW and less than 50MW. It aims to reduce emissions of SO₂, NO_x and particulate matter but does not covers POPs.

3.3.3. Addressing domestic sources

Domestic sources are also important for the release of unintentional POPs. The Commission has issued a study on “Information Exchange on Reduction of Dioxin Emissions from Domestic Sources”¹⁶¹. The key messages regarding labelling were: “Eco-labelling schemes for solid fuel fired domestic appliances are established or planned in 10 Member States. The focus is on energy efficiency, low CO and dust (PM) emissions. Effects on dioxin and furan emissions are only indirect (reduced fuel consumption via increased energy efficiency).” The Commission published the results of the study in a brochure in order “to stimulate awareness raising, exchange of good practice as well as to encourage development of new solutions and measures”¹⁶².

In this respect, currently under the EuP Directive a preparatory study on “Solid Fuel Small Combustion Installations” (Lot 15) has been undertaken. The study concluded that no measures with regards dioxins and furans will be taken.

Recently it has been described (Grochowalsky (2010)) that use of copper catalysts that are marketed in some European countries for cleaning domestic ovens increases the dioxin and furan emission from a domestic source by several orders of magnitude. Even assuming that only a small percent of the population would use such a catalyst, the release from this already relevant source could considerably increase. Therefore, the desirability of such practice might need to be examined.

3.4. Information on the state of knowledge on stockpiles and contaminated sites

Since the production of most POPs ended some years ago, only a minor part is still in use in the anthroposphere. However, exposure of humans and the environment can continue from landfills, dumps, stockpiles or contaminated sites where a large part of the POPs

¹⁶⁰ http://eur-lex.europa.eu/resource.html?uri=cellar:a66f7f82-77a9-11e3-b889-01aa75ed71a1.0023.04/DOC_1&format=PDF

¹⁶¹ BIPRO (2009): Information Exchange on Reduction of Dioxin Emissions from Domestic Sources. REFERENCE: 070307/2007/481007/MAR/C4. FINAL REPORT. 09 April 2009.

¹⁶² <http://ec.europa.eu/environment/dioxin/pdf/report09.pdf>
<http://ec.europa.eu/environment/dioxin/pdf/brochure09.pdf>

environmental burden has been deposited or stored (Weber et al. 2008¹⁶³, Weber et al. 2011¹⁶⁴). Therefore the identification and assessment of POPs contaminated sites, deposits, their on-going presence in products such as sealants and paints along with an assessment of their current impact is a crucial part of assessing POPs exposure risk and management needs.

The European Environmental Agency estimated that potentially polluting activities have occurred at nearly 3 million sites and stressed that investigation is needed to establish, whether remediation is required (European Environment Agency 2007), while some Member States have now developed registers of contaminated land sites to manage the issue, notably the Netherlands and Finland. In this overview report it was however not mentioned how many of these sites have POPs as a main contaminant.

Monitoring under the Water Framework Directive, particularly if done in biota and/or sediment, should increasingly contribute to knowledge of the contamination of water bodies with several of the POPs and thus support the targeting of remediation.

3.4.1. PCB contaminated sites and deposits

A number of the POPs considered under the Stockholm Convention are associated with consumer goods which will enter the waste stream at the end of their useful lives. As a result, there has been a significant flow of POPs into landfills across Europe. Weber et al. (2011)¹⁶⁵ suggested that such practise results in an on-going source of POPs to the wider environment (particularly groundwater and rivers) via leaching and flooding. The authors suggest that the legacy of previous industrial production coupled with (historically) poor waste management and landfill management has resulted in an important and long-term source of POPs to the environment.

Measurement data for PCBs in ambient air has suggested that urban areas represent an on-going source of POPs to the environment. Diefenbacher et al (2016)¹⁶⁶ carried out a passive air sampling campaign in Zurich in 2011 and 2013 reporting concentrations of a range of six indicator PCB congeners ranging from 54 to 3160 pgm-3. A correlation between ambient air concentrations and the number of buildings built between 1955 and 1975 was suggested by the authors to demonstrate that PCB containing building materials such as sealants represent on-going important primary sources.

Jartun et al. (2009)¹⁶⁷ undertook a study involving the analysis of PCBs in old paint samples from Bergen, Norway and reported concentrations of PCBs up to 3.4 g/kg. Estimates of historical use of PCBs in Norway suggested that out of the 1140 tonnes used in applications, approximately 5% (7.8 tonnes) were used in paint applications. PCB samples collected from

¹⁶³ Weber R, Tysklind M., Gaus C. et al. (2008) Dioxin- and POP-contaminated sites—contemporary and future relevance and challenges. *Env Sci Pollut Res* 15, 363-393.

¹⁶⁴ Weber R, Watson A, Forter M, Oliaei F. Persistent Organic Pollutants and Landfills - A Review of Past Experiences and Future Challenges. *Waste Management & Research* 29 (1) 107-121 (2011).

¹⁶⁵ Weber, R., Watson, A., Forter, M. and Oliaei, F. (2011) Persistent organic pollutants and landfills – a review of past experiences and future challenges. *Waste Management and Research*, 29, 107–121

¹⁶⁶ Diefenbacher, P.S., Gerecke, A.C. Bogdal, C. and Hungerbühler, K. (2016) Spatial Distribution of Atmospheric PCBs in Zurich, Switzerland: Do Joint Sealants Still Matter? *Environmental Science Technology*, 50, 232–239

¹⁶⁷ Jartun, M., Ottesen R.T., Steinnes, and Volden T. (2009) Painted surfaces – Important sources of polychlorinated biphenyls (PCBs) contamination to the urban and marine environment. *Environmental Pollution*, 157, 295-302

a concrete bridge previously coated with PCB-containing paint were separated into outer- and inner samples indicating that PCBs are still present in high concentrations despite renovation.

In several European rivers, the maximum level set for dioxin-like PCBs in food¹⁶⁸ was found to have been exceeded in fish (e.g. BUWAL 2010¹⁶⁹, NIP Germany¹⁷⁰). In a study in Switzerland – considering this European maximum levels for dioxin-like PCBs – such fish contamination could be tracked back to PCB point sources (e.g. landfill containing condensers or metal smelting industry having used and/or processed PCB containing equipment) (Zennegg et al. 2010¹⁷¹). Due to the experiences with PCB contaminated sites and their impact on fish in surface waters the Swiss environmental agency (BUWAL) is currently establishing a manual for competent authorities to track potentially PCB contaminated sites (Trempp 2011¹⁷²). No similar mapping approach to track directly the point sources for PCB contamination has been discovered in the assessment of NIPs of EU Member States and other EU agency reports. The only other example identified is a comprehensive mapping of PCB contaminated sites established for France by a NGO¹⁷³. Wimmerová et al. (2015)¹⁷⁴ investigated the relationship between blood serum PCB concentrations and distance for residents living around a former major PCB production site in Slovakia. The authors reported that elevated serum concentrations could be linked to the production site at distances of up to 70km which demonstrates the importance of historical contamination hot-spots as on-going sources of contamination.

A review carried out by Weber et al. (2014)¹⁷⁵ of data on the transfer of PCBs and PCDD/Fs from soil to meat products highlighted that regulatory limits can be exceeded even under free range grazing conditions. While most of the meat and milk samples on the European market meet regulatory limits, the study discussed a number of cases where meat from free range production entering the food-chain has exceeded regulatory limits. Whilst there have been a number of incidents in the past when contaminated feed has entered the food production chain resulting in exceedance of regulatory levels (e.g. Malisch and Kotz, 2014)¹⁷⁶ the source of the contamination was known and could be traced. However, the source of contamination of foodstuffs from free range production is more challenging as the supply chain is more complex. A survey of German meat samples collected between 2009 and 2012

¹⁶⁸ (EC) No 1881/2006 of 19 December 2006 setting maximum levels for certain contaminants in foodstuffs

¹⁶⁹ BUWAL Schweizer Bundesamt für Umwelt (2010) Polychlorierte Biphenyle (PCB) in Schweizer Gewässern. Abschlussbericht 26.04.2010.

¹⁷⁰ Federal Republic of Germany (2006) National Implementation Plan. Berlin, 03 April 2006.

¹⁷¹ Zennegg M, Schmid P, Trempp J. PCB fish contamination in Swiss rivers – tracing the point sources. *Organohalogen Compounds*, 72, 362-365 (2010).

¹⁷² Trempp J. (BUWAL; Schweizer Bundesamt für Umwelt), Personal communication 20.06. 2011

¹⁷³ http://www.robindesbois.org/PCB/PCB_hors_serie/ATLAS_PCB.html

¹⁷⁴ Wimmerová, S., Watson, A., Drobná, B., Šovčíková, E., Weber, R., Lancz, K., Patayová, H., Richterová, D., Koštiaková, V., Jurečková, D., Závacký, P., Strémy, M., A. Jusko, T.A., Murínová, L.P., Hertz-Picciotto, I. and Trnovec, T. (2015). The spatial distribution of human exposure to PCBs around a former production site in Slovakia. *Environmental Science and Pollution Research*, 22, 14405–14415.

¹⁷⁵ Weber, R., Albrecht, M., Ballschmiter, K., Berger, J., Bruns-Weller, E., Kamphues, J., Körner, W., Malisch, R., Nöltner, T., Schenkel, H., Severin, K., Vossler, C. and Wahl, K. (2014) Safe food production from free range beef – minimizing TEQ-levels in meat by tracking PCB sources. *Organohalogen Compounds*, 76, 815-818.

¹⁷⁶ Malisch, R. and Kotz, A. (2014) Dioxins and PCBs in feed and food — Review from European perspective. *Science of The Total Environment*, 491–492, 2–10

revealed that animals grazing on flood plains impacted by historical industrial chemical production could result in exceedance of regulatory limits. Weber et al. (2014) also discussed a number of other possible sources of contamination that may result in meat products becoming contaminated. These included ingestion of dredged sediments, application of sewage sludge, use of contaminated paints on silos and rubber belts used for feeding calves. These findings suggest that identification and monitoring of potential contamination sources would form an important part of European food surveillance.

3.4.2. HCH contaminated sites and waste deposits

Technical HCH (comprised chiefly of the α and β isomers) was used as a pesticide within the European Union as an alternative to DDT from the 1940s onward¹⁷⁷. However concerns over the safety of HCH meant that it was gradually replaced by lindane which contains 99% wt/wt of the γ -isomer of HCH. The International HCH and Pesticides Association (IHPA) (2006a)^{178,179} note that the inefficient manufacturing processes for lindane meant that for every one tonne of commercial lindane produced up to ten tonnes of hazardous waste containing the α and β isomers was also produced, requiring final treatment or disposal. Vijgen et al. 2011¹⁸⁰ provides an estimate of 300,000 tonnes of lindane used within the European Union between 1950 and 2000, which would equate to 1.8 to 3 million tonnes of HCH-contaminated wastes which required safe disposal.

The identification of contaminated sites of former manufacture or waste disposal represents a significant challenge. Wycisk et al (2013)¹⁸¹ provides a case study detailing such a site in Bitterfeld, Germany. The site at Bitterfeld in the Eastern part of Germany was formerly used for the manufacture of a number of chloro-organic substances including lindane and DDT, which were produced there between 1951 and 1982. Waste materials containing the isomers α and β HCH were disposed of on site as part of the production process. Wycisk et al detail a sampling and analysis campaign over a ten year period which indicates contamination of both soil and ground water within Bitterfeld requiring remediation over an area of approximately 40 km². Analysis reported in the Wycisk et al paper also quotes a sampling and analysis study for fish in the nearby Mulde and Elbe rivers, where elevated levels of HCH were detected in biological samples.

Two further European case studies are quoted by the IHPA 2006 a,b on HCH in the Netherlands and Spain (Basque country). These cases have proven that often the original waste problem has additionally resulted in a huge soil problem. For example, the original amount of 5500 tons of HCH waste in the Netherlands has created a regional soil contamination of nearly 400 000 m³. Similar experiences can be stated from Basque Country

¹⁷⁷ Whiting et al, 2012, 'A further update of the UK source inventories for emissions to air, land and water of dioxins, dioxin-like PCBs, PCBs and HCB, incorporating multimedia emission inventories for nine new POPs under the Stockholm Convention', Report for Defra, UK CB0429.

¹⁷⁸ International HCH and Pesticide Association (2006a) The legacy of lindane HCH isomer production. Mainreport; http://ew.eea.europa.eu/Agriculture/Agreports/obsolete_pesticides/lindane_production.pdf/

¹⁷⁹ International HCH and Pesticide Association (2006b) The legacy of lindane HCH isomer production. Annexes; http://ew.eea.europa.eu/Agriculture/Agreports/obsolete_pesticides/lindane_annexes.pdf/

¹⁸⁰ Vijgen et al. (2011). HCH as new Stockholm Convention POPs – a global perspective on the management of Lindane and its waste isomers. *Env Sci Pollut Res.* 18, 152-162.

¹⁸¹ Wycisk et al, 2013, 'Integrated methodology for assessing the HCH groundwater pollution at the multi-source contaminated mega-site Bitterfeld/Wolfen', *Environmental Science and Pollution Research* (2013) 20:1907–1917

where nearly 90000 tons of HCH waste has led to a soil pollution of 500.000 to 1 Million tons of soil contaminated with HCH.

A recent review on global perspective on the management of lindane and its waste isomers (Vijgen et al. 2011) identifies the following EU Member States with former lindane production: Austria, Czech Republic, France, Germany, Hungary, Poland, Romania, Slovakia, Spain, The Netherlands, and the UK. Additionally in Europe Macedonia and Switzerland have produced lindane.

3.4.3. *Other POPs Pesticides*

Sites contaminated with POP pesticides are particularly a challenge in East European countries and are associated with POP-pesticide stockpiles and former sites where POP pesticides have been stored. These sites pose critical exposure risk for local population (IHPA 2011)¹⁸² and can contribute to contamination of food in EU.

3.4.4. *Contaminated sites from unintentionally formed POPs (PCDD, PCDF, PCB, HCB, PeCB, PAHs)*

At country level Sweden has comprehensively assessed PCDD/PCDF contaminated sites and started with remediation and securing activities.

In respect to PeCB and HCB, an UNEP report from the POP Reviewing Committee also highlights the relevance of deposited HCB/PeCB wastes from organochlorine productions which amounted to 10,000 tonnes for individual factories (UNEP 2010). Within the EU, only one such case has been documented, including the resulting releases to water (Heinisch et al. 2006)¹⁸³. The largest known emissions of PeCB in water reported under the PRTR relate to basic organochemical production (largest release 640 kg2009), and mineral oil and gas refineries (largest release 121 kg, 2010). The other key point of release, urban wastewater treatment works, is more likely to be attributed to a range of minor sources as contamination in the waste flows, rather than to production itself.

Further relevant contaminated sites concern the former disposal of residues from chloralkali plants highly contaminated with PCDD/F, PCN, PAH and Barium. One case revealed the significance of such contaminations¹⁸⁴. This case was subsequently remediated¹⁸⁵.

3.4.5. *PBDE contaminated sites*

POP-BDEs contaminated sites or hot spots have mainly been reported from primitive treatment of electronic waste (Wong et al. 2007)¹⁸⁶ and from the release of PBDE from

¹⁸² www.iHPA.info

¹⁸³ Heinisch E, Kettrup A, Bergheim W, Wenzel S. (2007) Persistent chlorinated hydrocarbons, source-oriented monitoring in aquatic media. 6. Strikingly high contaminated sites. *Fresenius Environ Bull* 16(10): 1248-1273.

¹⁸⁴ Lutz, G.; Otto, W.; Schoenberger, H.; Neue Altlast – hochgradig mit polychlorierten Dibenzofuranen belastete Rueckstaende aus der Chlorerzeugung gelangten jahrzehntelang in die Umwelt, *Muellmagazin* 4(3), pp 55-60.

¹⁸⁵ Otto, W. et al.; Case study on remediation of a German city contaminated by a chloralkali plant and PCP production, *Organohalogen Compounds* 68, pp 880-885.

landfills (Weber et al. 2011)¹⁸⁷. The assessed landfills were located in the US, Canada, Japan and South Africa. PBDE have been detected in the leachates or ground water in all the landfills under investigation. There are also studies that have been made in European countries and in which PBDE has been analysed in landfill leachates (COHIBA 2011)¹⁸⁸.

For PBDE production sites or areas where PBDE have been used, e.g. in the plastic industry, no reports on contaminated sites have been found in the public domain. A systematic assessment of environmental contamination in the life cycle of PBDE is missing in this respect.

Canada, under the National Chemicals Management Plan, provided additional information to the SC on the potential of landfill leachate to provide an ongoing source of POP-BDEs to the environment. A survey was carried out at 10-12 Canadian municipal solid waste landfills to determine leachate PBDE concentrations and the potential for removal with remedial treatment. The survey revealed a 100% detection rate for POP-BDEs in leachate with median concentrations of 93 ng/L, 28 ng/L and 9 ng/L for Tetra-BDEs, Penta-BDEs and Hexa-BDEs, respectively. The survey also assessed treatment efficiencies for the removal of POP-BDEs from leachate and reported an 85% removal rate. Based on an approximate total volume of landfill leachate collected in 2011, the cumulative annual loadings to the Canadian environment were estimated to be 0.3kg, 0.1kg and 0.03kg for tetra-, penta- and hexa-BDE, respectively.

3.4.6. *PFOS contaminated sites*

The landfilling of waste originating from the production and use of PFOS and other perfluorinated compounds has generated large contaminated sites (Bantz 2011¹⁸⁹, Kroefges et al. 2007¹⁹⁰, Oliaei et al. 2011¹⁹¹, Weber et al. 2011¹⁸⁷). Therefore, the need of a comprehensive assessment of PFOS contaminated sites along the life cycle of PFOS is reflected also in the recommendations of the COP5¹⁹².

A systematic assessment on PFOS contaminated sites has not yet been reported by any of the Member States. However, some ad hoc work has started in Europe in recent years.

In one instance, drinking water was polluted for more than 4 million people (Kroefges et al. 2007). The PFOS/PFOA source was contaminated sludge imported to Germany as hazardous waste which then was relabelled by the importing company and sold to farmers which treated

¹⁸⁶ Wong MH et al. (2007) Export of toxic chemicals – A review of the case of uncontrolled electronic-waste recycling. *Environmental Pollution* 149, 131-140.

¹⁸⁷ Weber R, Watson A, Forter M, Oliaei F. Persistent Organic Pollutants and Landfills – A Review of Past Experiences and Future Challenges. *Waste Management & Research* 29 (1) 107-121 (2011).

¹⁸⁸ <http://www.cohiba-project.net/>.

¹⁸⁹ Bantz I, Valentin I, Weber R (2011) Monitoring of PFOS and PFC Pollution in Düsseldorf/Germany. 11th International HCH and Pesticide Forum, Baku, Azerbaijan 7-9. September 2011.

¹⁹⁰ Kröfges P et al. (2007) PFOS/PFOA Contaminated Megasites in Germany Polluting the Drinkingwater Supply of Millions of People. *Organohalogen Compd.* 69, 877–880 (2007).

¹⁹¹ Oliaei, F., Kriens, K., Kessler, K. (2006) investigation of perfluorochemical (PFC) contamination in Minnesota phase one. Report to Senate Environment Committee February 2006.

¹⁹² UNEP (2011) Work programmes on new persistent organic pollutants. 5th Conference of Parties, Geneva 21-25 April 2011 (UNEP/POPS/COP.5/15).

the agricultural fields with it thereby contaminating many areas. From there, perfluorinated compounds leached into rivers and the drinking water reservoir (Skutlarek et al. 2006).¹⁹³

Other PFOS contaminated sites have been described for application sites of fire fighting foams (Norwegian Pollution Control Agency¹⁹⁴, State of Jersey 2004¹⁹⁵, Weber et al. 2011).

A study of perfluoroalkyl acids (PFAAs) contamination around Stockholm Arlanda airport demonstrated contamination of water, sediment and biota (Perch) as a result of the use of aqueous fire fighting foams at the airport fire training facilities (Ahrens et al. 2015)¹⁹⁶. An analysis of water samples covering a period from 2009 to 2013 showed no significant decreasing trend and suggested that the airport may represent a long-term source into the local environment.

The distribution of a range of PFAAs, including PFOS, was determined in soil, groundwater, surface water, a drinking water supply well and fish muscle around a decommissioned military airfield in Stockholm, Sweden (Filipovic et al. 2015)¹⁹⁷. The study reported that the site, which was abandoned in 1994, could still represent a point source of PFAAs. PFOS and PFOA were found to be ubiquitous in soils at the site with concentrations up to 8520 ngg⁻¹ and in groundwater up to 51,000 ngL⁻¹ and surface waters up to 79 ngL⁻¹. This suggests that previous use of PFAAs at the site has resulted in the contamination of the local aquifer.

The analysis of leachate from municipal solid waste landfills in Denmark (Bossi 2008¹⁹⁸), Germany (Busch 2010¹⁹⁹) and Sweden (Woldegiorgis 2006²⁰⁰) has revealed that leachates can contain high levels of PFCs including PFOS. An assessment of deposited wastes and related releases has not been performed up to now.

In 2005 a severe fire at the Buncefield oil storage terminal, UK, required the UK Fire Service to make use of all available fire fighting foams to put the blaze out. The use of AFFF fire fighting foams containing PFOS which had been retained for destruction were used as part of the stocks to bring the incident to a close, causing ground and surface water contamination with PFOS. Control and remediation of the site included extensive groundwater monitoring. Data from 2007²⁰¹ two years after the incident still recorded high PFOS concentrations of 3 µg/l in ground water at Buncefield.

A systematic assessment on PFOS contaminated sites has been reported on the city level for Düsseldorf/Germany (Bantz et al. 2011). In Sweden inventories have been carried out

¹⁹³ Skutlarek D, Exner M, Färber H (2006) Perfluorinated Surfactants in Surface and Drinking Waters Environ Sci Pollut Res 13 (5) 299–307 (2006).

¹⁹⁴ Norwegian Pollution Control Agency (2008) Screening of Polyfluorinated Organic Compounds at four fire fighting training areas. TA- 2444/2008.

¹⁹⁵ State of Jersey (2004) Jersey Airport Fireground Remediation – Deed of settlement. Lodged au Greffe on 19th October 2004.

¹⁹⁶ Ahrens, L., Norström K., Viktor, T., Palm Cousins, A. and Josefsson, S. (2015) Stockholm Arlanda Airport as a source of per- and polyfluoroalkyl substances to water, sediment and fish. Chemosphere, 129, 33-38.

¹⁹⁷ Filipovic, M., Woldegiorgis, A., Norström, K., Bibi, M., Lindberg, M. and Österås, A-H (2015) Historical usage of aqueous film forming foam: A case study of the widespread distribution of perfluoroalkyl acids from a military airport to groundwater, lakes, soils and fish Chemosphere, 129, 39-45.

¹⁹⁸ Bossi, R., Strand, J., Sortkjær, O. Larsen, M.M. (2008) Perfluoroalkyl compounds in Danish wastewater treatment plants and aquatic environments. Environment International 34(4): 443–450.

¹⁹⁹ Busch, J. (2009) Analysis of poly- and perfluorinated compounds (PFCs) in landfill effluent using HPLC-MS/MS. Lüneburg. Bachelor thesis (Diplomarbeit).

²⁰⁰ Woldegiorgis, A., Anderson, J., Remberger, M., Kaj, L. (2006). Results from the Swedish National Screening Programme 2005. Subreport 3: Perfluorinated Alkylated Substances (PFAS) IVL report B1698. Stockholm.

²⁰¹ Environment Agency of England and Wales, 2007, 'Investigation of PFOS and other perfluorochemicals in groundwater and surface water in England and Wales'.

regarding sources of PFAS (including PFOS) in the environment and over 2000 potential local sources have been identified. Measured concentrations in the environment show that humans and the environment risk exposure to PFAS at levels that may cause adverse effects. PFAS have been analysed in raw water or drinking water from 35% of the public water supplies in Sweden. The water supplies with confirmed levels above 90 nanograms per litre are located close to a fire training site at an airport²⁰².

In summary, these examples show that PFOS (and other perfluorinated compounds) can result in PFOS (PFC) contaminated sites and – due to their mobility – in water, too, thus impacting the wider environment. Hence, a systematic assessment of such sites including contaminated groundwater bodies is necessary.

3.4.7. *Hexachlorobutadiene contaminated sites*

Hexachlorobutadiene formerly had a number of commercial applications including applications such as a solvent (for rubber and other polymers), as a “scrubber” to recover chlorine-containing gas or to remove volatile organic components from gas, as hydraulic, heat transfer or transformer fluid, in gyroscopes, in the production of aluminium and graphite rods and as a plant protection product²⁰³. It was however also produced as a contaminant in waste streams linked to the manufacture of chlorinated solvents, in particular trichloroethylene, tetrachloroethylene and carbon tetrachloride. Depending on how contaminated wastes have been previously managed, there is a potential risk of contaminated sites both at the former sites of manufacture of these solvents, but also for waste landfill sites. Knowledge on the number of sites and level of contamination within Europe is limited. However examples do exist where HCBd has been discovered warranting action; this includes one site in the UK near a former site of manufacture. HCBd was detected as a gas emanating from contaminated land in a quarry near the village of Weston, UK in 2000 which required properties to be evacuated and remediation work to be conducted²⁰⁴.

3.5. **Emerging risks from POPs**

Both international agreements on POPs foresee listing of additional substances in the annexes of substances to be banned, restricted or otherwise controlled. Any Party may propose amendments to this end, and criteria and procedure for review of the proposals have been established. The aim of the European Union and the Member States is to include further POP substances particularly under the Stockholm Convention agreement in order to contribute to achieving the 2020 chemicals target adopted at the World Summit on Sustainable Development.

The EU has submitted two-thirds of the proposals for new POPs under the Stockholm Convention (endosulfan, commercial octabromodiphenyl ether, pentachlorobenzene, short-chain chlorinated paraffins (SCCPs), hexachlorobutadiene (HCBd), polychlorinated naphthalenes (PCNs), pentachlorophenol (PCP) and dicofol) and PFOS and trifluralin in addition under the POP Protocol. In May 2015, at COP 7, it was decided to include HCBd,

²⁰² PFAS monitoring: Report 6709, March 2016. Swedish Environmental Protection Agency.

²⁰³ UNEP/POPS/POPRC.12/6 – Information on the listing of HCBd in Annex C of the Stockholm Convention.

²⁰⁴ <https://cot.food.gov.uk/committee/committee-on-toxicity/cotstatements/cotstatementsyrs/cotstatements2000/hexachlorobutadiene> - COT statement on hexachlorobutadiene.

PCP and PCN under the Stockholm Convention, including PCN as a new Annex C substance. Four substances are under review by the Stockholm Convention for addition to the Convention Annexes as POPs. This includes dicofol and pentadecafluorooctanoic acid (PFOA, perfluorooctanoic acid), its salts and PFOA-related compounds for which a risk profile has been produced; and short chain chlorinated paraffins and decabrominated diphenyl ether, for which a risk management evaluation dossier has been produced.

The registration of chemicals under the REACH Regulation may serve as a main source of information for screening for identification of POP-candidate substances. Although there are tonnage triggers for registration below which the data submitted to the authorities are not necessarily sufficient for POP assessment, the REACH Regulation addresses specifically PBT or vPvB substances (see section 2.1.2).

Since 2013, together with the Member States, ECHA has developed a common screening process, which identifies (groups of) substances that have the greatest potential for adverse impacts on human health and the environment, including substances that meet the PBT / vPvB criteria. This process also aims at identifying candidates for substances of very high concern, which may be added to Annex XIV to REACH and would then be subject to authorisation²⁰⁵.

Work has also been undertaken to help develop strategies for identification of those substances that may meet the Annex D criteria under the Stockholm Convention to be considered a POP. This includes work led by RIVM²⁰⁶ to help develop an approach for analysis of substances presented at the POP review committee meeting. Studies have also been carried out in Norway²⁰⁷ to assess potential candidate substances against the Stockholm Convention criteria.

²⁰⁵ https://echa.europa.eu/documents/10162/19126370/screening_definition_document_en.pdf/e588a9f8-c55e-4412-a760-49ddb7ac687

²⁰⁶ RIVM, 2011, Identifying potential POP and PBT substances: Development of a new Persistence/Bioaccumulation-score, Report No. Report 601356001/2011.

²⁰⁷ Bergfeld, 2011, Identifying POP candidates for the Stockholm Convention, Report No. TA-2871/2011.

PART II – IMPLEMENTATION PLAN

4. IMPLEMENTATION OF THE BASIC OBLIGATIONS OF THE STOCKHOLM CONVENTION

4.1. Elimination of intentional production and use of POPs (Article 3(1))

4.1.1. POP pesticides, HBB, HBCDD, HCB and PeCB

Obligation: Article 3, paragraph 1(a)(i) of the Convention: prohibit and / or take legal or administrative measures necessary to eliminate the production and use of aldrin, alpha and beta hexachlorocyclohexane, chlordane, chlordecone, dieldrin, endosulfan, endrin, heptachlor, hexabromocyclododecane, hexabromobiphenyl, hexachlorobenzene, lindane, mirex, pentachlorobenzene as well as toxaphene.²⁰⁸

Implementation so far: Production, placing on the market and use of the above-mentioned substances as such, in preparations or in articles is prohibited in the EU by Regulation (EC) No 850/2004, including HBCDD, which has been added to Annex I of that regulation by Commission Regulation (EU) 2016/293²⁰⁹ and is also controlled as part of the Authorisation process under the REACH Regulation. The EU does provide for a specific exemption in line with the Convention until expiry of the authorisation under REACH on 21 August 2017²¹⁰.

Analysis: Legal measures regarding production, placing on the market and use are sufficiently comprehensive. There is no need for further legislative measures at Union or Member State level.

Border and market surveillance by the Member States remain necessary and following recent findings of HCB presence in some fireworks it is desirable to intensify compliance controls of products in line with Regulation (EC) No 765/2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products. Cases of non-compliance need to be reported to the Commission.

Since HBCDD has only recently been listed in Annex A to the Convention and in Annex 1 to Regulation (EC) No 850/2004 it is still necessary to gather more information on alternatives and to support the exchange of information on methods for identification of that chemical in products that are in use and in waste.

Action 1: Commission to compile information on HBCDD alternatives from the REACH process and feed this information into the Stockholm Convention process on alternatives to HBCDD to guide the selection process of HBCDD alternatives for the uses in expanded polystyrene and extruded polystyrene in buildings. (New action)

Action 2: Commission to gather available information on validated methods for identification of HBCDD in products/articles/wastes and facilitate exchange of information among the Member States. (New action)

²⁰⁸ Those substances that have been added to the Convention in 2009, 2011 and 2013, are underlined.

²⁰⁹ Commission Regulation (EU) 2016/293 of 1 March 2016, OJ L 55, 2.3.2016, p.4.

²¹⁰ Commission Implementing Decision C(2015) 9812 final of 8.1.2016.

4.1.2. PCBs

Obligation: Article 3, paragraph 1(a)(i) and Annex A, Part II of the Convention: prohibit and / or take legal or administrative measures necessary to eliminate the production and use of PCBs.

Implementation so far: Production, placing on the market and use of PCBs as such and in preparations is fully prohibited by Regulation (EC) No 850/2004. Articles containing PCBs already in use are covered by specific provisions laid down in Directive 96/59/EC (PCB Directive) (cf. section 2.1.2). The Directive requires Member States to compile inventories of equipment with PCB volumes of more than 5 litres, and to phase-out and destroy such PCB equipment before the deadline of 31.12.2010.

Analysis: Legal measures on production, marketing and new use of PCBs (and PCTs) are sufficiently comprehensive and there is no need for further legislative measures at Union or Member State level. Directive 96/59/EC addresses the main application areas of PCBs and lays down a timetable for specific essential control actions. In conformity with the PCB Directive, inventories of PCB containing equipment, as well as action plans for their disposal and collection were compiled by all Member States. The Commission has gathered information about current amounts of PCB equipment and PCB wastes in the EU given that the information on PCB inventories had become obsolete (cf. section 3.1.4). The survey showed that there are still significant quantities of PCB equipment in use. In addition, only three Member States achieved to decontaminate or to dispose of large PCB equipment by the end of 2010 as required by the Directive. In those cases where the deadline for the disposal and decontamination of large PCB equipment has not been met and in those cases where Member States did not provide any information, the Commission will consider the need to take legal steps.

PCBs have been used in several open applications (e.g. sealants, anti-corrosion paints, flame retardants, specific paper). Open applications are highlighted by the PCB Elimination Network in the Stockholm Convention context due to the relevance of human exposure in kindergarten, schools and other public buildings such as swimming pools, but also private housing and farm buildings constructed in the 1950s to the early 1970s. The quantities of PCB that were used in open applications is unknown, as is the quantities of products containing PCBs still in use or capable of emitting to the natural environment. For paints and sealants there is also a potential issue of replacement paint or sealant to be added on top of the existing layers, causing secondary contamination and extending the lifespan of product use. Understanding the magnitude of PCB use for open applications and as a potential source of emission is an important component for the management and elimination of PCBs.

Action 3: The Commission and the Member States shall work to identify products, substances and materials containing PCB in open applications and raise awareness about environmental release from open applications of PCBs (paints and sealants) within the European Union. (New action)

Another potential issue for PCBs that have been used in open applications, particularly in anti-corrosion paints included bridges and other constructions as well as electric poles, is the

end of life legacy impacts. When this equipment reaches the end of its useful life, the large metal parts are recycled in electric arc furnaces (EAF). Since the combustion processes in these batch operations are incomplete, a considerable share of these PCBs will most probably evaporate and not be destroyed. Furthermore, these conditions promote the development of PCDF which is associated with an increased toxicity. Currently, there is no assessment available as to how much PCB painted scrap is entering the waste stream and the secondary metal treatment. Also, there is no data on dedicated testing of associated releases. However, it is known from measurements in EAF that considerable PCB loads are emitted which only can be explained by PCB input from material treated with it²¹¹.

4.1.3. *Hexabromodiphenyl ether, heptabromodiphenyl ether, tetrabromodiphenyl ether and pentabromodiphenyl ether*

Obligation: Article 3, paragraph 1(a)(i) and Annex A, Part IV and Part V of the Convention: prohibit and / or take legal or administrative measures necessary to eliminate the production and use of hexabromodiphenyl ether, heptabromodiphenyl ether, tetrabromodiphenyl ether and pentabromodiphenyl ether.

A Party may allow recycling of articles that contain or may contain hexabromodiphenyl ether, heptabromodiphenyl ether, tetrabromodiphenyl ether and pentabromodiphenyl ether, and the use and final disposal of articles manufactured from recycled materials that contain or may contain hexabromodiphenyl ether, heptabromodiphenyl ether, tetrabromodiphenyl ether and pentabromodiphenyl ether, provided that:

- a) The recycling and final disposal is carried out in an environmentally sound manner and does not lead to recovery of tetrabromodiphenyl ether, pentabromo diphenyl ether, hexabromodiphenyl ether and heptabromodiphenyl ether for the purpose of their reuse;
- b) The Party takes steps to prevent exports of such articles that contain levels/concentrations of tetrabromodiphenyl ether, pentabromodiphenyl ether, hexabromodiphenyl ether and heptabromodiphenyl ether exceeding those permitted for the sale, use, import or manufacture of those articles within the territory of the party; and
- c) The Party has notified the Secretariat of its intention to make use of this exemption

Article 3, paragraph 6: take appropriate measures to ensure that any production or use under a specific exemption in accordance with Annex A or a specific exemption or an acceptable purpose in accordance with Annex B is carried out in a manner that prevents or minimizes human exposure and release into the environment. For exempted uses or acceptable purposes that involve intentional release into the environment under conditions of normal use, such release shall be to the minimum extent necessary, taking into account any applicable standards and guidelines.

Recommendations COP5

COP5 in its decision SC-5/5 encouraged parties and other relevant stakeholders to implement the recommendations provided in the decision POPRC-6/2 on the elimination from the waste

²¹¹ Also, the PCB pattern from EAF have often a congener finger print of industrial PCBs demonstrating that the main PCB release stem from the input material and are not unintentionally formed.

stream of brominated diphenyl ethers with the objective to achieve the elimination as swiftly as possible. SC-5/5 also included further steps to help eliminate the use of PFOS under existing exemptions. The recommendations set out in SC-5/5 include:

- Parties and other relevant stakeholders to implement where appropriate, taking into account national circumstances, the recommendations set out in the annex to decision POPRC-6/2 on the elimination from the waste stream of brominated diphenyl ethers that are listed in Annex A to the Convention²¹² and on risk reduction for perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride.
- Parties to ensure that waste materials containing brominated diphenyl ethers listed in Annex A are not exported to developing countries or countries with economies in transition, consistent with the provisions of the Stockholm Convention, including its paragraph 1 (d) of Article 6, and relevant provisions of the Basel Convention²¹³.
- Parties to submit information on their experiences in implementing the recommendations, where applicable, or other actions that have the same objectives, to the Secretariat no later than six months before the sixth meeting of the Conference of the Parties.
- The Secretariat to prepare a compilation of the information received for consideration by the Conference of the Parties at its sixth meeting and to transmit it to the appropriate bodies of the Basel Convention.
- The Persistent Organic Pollutants Review Committee at its seventh meeting to develop terms of reference for a technical paper on the identification and assessment of alternatives to the use of perfluorooctane sulfonic acid in open applications, including the consideration of the following aspects of the substitution of perfluorooctane sulfonic acid, taking into account the general guidance on considerations related to alternatives and substitutes for listed persistent organic pollutants and candidate chemicals:
 - Technical feasibility;
 - Health and environmental effects;
 - Cost-effectiveness;
 - Efficacy;
 - Availability;
 - Accessibility;

²¹² Failure to do so will inevitably result in wider human and environmental contamination and the dispersal of brominated diphenyl ethers into matrices from which recovery is not technically or economically feasible and in the loss of the long-term credibility of recycling. Time is short because articles containing brominated diphenyl ethers are already present in many existing waste streams as a result of the time frame of former production of these articles. Brominated diphenyl ethers should not be diluted since this would not reduce the overall quantity in the environment.

²¹³ That is articles for which the flame retardant content was added for the purposes of flame retardancy rather than articles which contain some flame retardant as a consequence of contaminants in recycle.

- The Secretariat, subject to the availability of resources, to commission a technical paper, based upon the terms of reference to be prepared by the Persistent Organic Pollutants Review Committee pursuant to the preceding paragraph, to be completed in time for its consideration by the Committee at its eighth meeting.
- The Persistent Organic Pollutants Review Committee to develop recommendations on the basis of the technical paper for consideration by the Conference of the Parties at its sixth meeting.

Implementation so far: Production, placing on the market and use of hexabromodiphenyl ether, heptabromodiphenyl ether, tetrabromodiphenyl ether and pentabromodiphenyl ether is prohibited fully by Regulation (EC) No 850/2004. In addition, Directive 2002/95/EC on the restriction of hazardous substances in electrical and electronic equipment (EEE) (RoHS Directive, see section 2.1.3) allows the use of all POP-BDEs in EEE put on the EU market only below the maximum concentration value of 0.1 weight-% in the homogeneous material and in case of specific exemptions listed in the Directive's Annex.

Under the POP Regulation uses of hexabromodiphenyl ether, heptabromodiphenyl ether, tetrabromodiphenyl ether and pentabromodiphenyl ether that fall under the scope of the RoHS Directive and are allowed as exemption as well as concentrations of hexabromodiphenyl ether, heptabromodiphenyl ether, tetrabromodiphenyl ether and pentabromodiphenyl ether equal to or below 10 mg/kg (0,001% by weight) when it occurs in substances, preparations, articles or as constituents of the flame-retarded parts of articles. Articles and preparations containing concentrations below 0,1% of hexabromodiphenyl ether, heptabromodiphenyl ether, tetrabromodiphenyl ether and pentabromodiphenyl ether by weight when produced partially or fully from recycled materials or materials from waste prepared for re-use are also exempted from the obligation.

Furthermore, the POP Regulation stipulates that the use of articles already in use in the Union before 25 August 2010 containing hexabromodiphenyl ether, heptabromodiphenyl ether, tetrabromodiphenyl ether and pentabromodiphenyl ether as a constituent of such articles shall be allowed.

Analysis: Legal measures on production, placing on the market and use of hexabromodiphenyl ether, heptabromodiphenyl ether, tetrabromodiphenyl ether and pentabromodiphenyl ether are comprehensive and there is no need for further legislative measures at Union or Member State level.

Border and market surveillance by the Member States is a necessity. Cases of non-compliance need to be reported to the Commission.

In particular POP-BDEs will continue to challenge the waste management sector due to the long life-span of the major product groups (e.g. vehicles, electronics), containing them and the existence of recycling schemes for these waste streams (cf. sections 3.2.2 and 3.2.3).

As stated in sections 3.2.2 and 3.2.3, the major remaining PBDE input into the economic goods cycle is via the use in products and their further input into recycling, stockpiles and the waste stream. Commission Regulation (EC) 1342/2014 amending Regulation (EC) 850/2004 updated annex IV and V of the POP Regulation to put in place thresholds for PBDE containing wastes. This is set as the sum of the congeners tetra, penta, hexa and heptaBDE which must not exceed 1000 mg/kg in order to be treated as standard waste. Any waste which does exceed the threshold must be treated as hazardous and irreversibly destroyed.

The application of thresholds sets clear boundaries on how PBDE wastes need to be managed, however, further efforts are needed at Member States level in order to ensure a reduction of PBDE input to recycling operations and with regard to exports and appropriate management and treatment of the waste stream.

A strategy and methodology needs to be developed for the identification of articles in use, in the recycling, in stockpiles and wastes that contain POP-BDEs. For these activities also the recommendations of the COP5 should be considered.

The Stockholm Convention has not yet set a low POPs limit and this will be done in cooperation with the Basel Convention. The established European limits could provide valuable input to these processes.

The POPs in waste report prepared for the Commission (ESWI 2011) as well as the consultancy for the POPs Reviewing Committee (UNEP 2010 a,b)²¹⁴ revealed that POP-BDEs are still contained in articles in use and in some material flows at the end of life in the EU.

C-PentaBDE (TetraBDE and PentaBDE) uses

A main material flow is cars and other transport vehicles produced from the 1970s to 2000 (and some possibly up to 2004). They are partly used and sold within the EU and partly exported to other regions. There is no database on producer and year of cars/transport vehicles containing PBDE and also no monitoring activity or scheme for this. Only limited information is available from the (former) producers of cars. Such information would be a good base in which to better understand the situation on use and reuse of these cars/transport vehicles and the export of vehicles containing POP-BDEs. Some Member States are doing screenings of end of life vehicles to generate necessary data, however, it would be useful to have data from several Member States to have a more comprehensive and representative overview. Information on waste treatment of PBDE material from vehicles is available from Sweden²¹⁵.

The ongoing discussion on the fate of listed POPs present in articles of everyday use and on the associated challenges with recycling and disposal of such articles is linked to the CiP programme as a forum where stakeholders can showcase their actions to understand, inform about and manage chemicals in their products throughout the life cycle. CiP information can also be a way to meet legal obligations with regards to POPs in products.

²¹⁴ UNEP (2010) “Technical Review of the Implications of Recycling Commercial Pentabromodiphenyl Ether and Commercial Octabromodiphenyl Ether” from 6th POP Reviewing Committee meeting Geneva October 2010 (UNEP/POPs/POPRC.6/2 (a) and related Annex report UNEP/POPs/POPRC.6/INF/6 (b).

²¹⁵ Swedish Environmental Protection Agency, 2010, “The Use of Brominated Flame Retardants in Automotive and Construction Materials and the Treatment of Such Materials in the Waste Stream”.

Action 4: Commission to continue to collect available data on presence of POP-BDEs in end of life goods including vehicles, waste electricals, and waste plastics and facilitate exchange of information among the Member States. (This action was also listed within the previous implementation plan and is still ongoing).

C-OctaBDE (HexaBDE and HeptaBDE) uses

The main remaining C-OctaBDE in articles in use, export and recycling is the use as flame retardant in plastic in electronics.

PBDE/BFR-containing plastic (mainly) from WEEE is often recycled to other plastic materials by blending them with virgin polymer materials. Due to the mix of polymer types the WEEE plastic is typically down-cycled to products in applications with less material demanding properties. Screening of plastic products has revealed that even sensitive uses like children toys (Chen 2009)¹³⁸ along with household goods (Chen 2010)¹³⁹ and video tapes (Hirai 2007)²¹⁶ can be contaminated with PBDE and other BFRs. Import into the EU of plastic goods that contain POP-BDEs as a result of recycling, such as coat hangers, is another potential supply route for goods reaching the EU market. Where such supply chains are complex and flow of material globally is not well tracked, identification of PBDE contaminated material proves difficult.

There is little information on how the flow of plastics recovered from WEEE and containing PBDE is controlled in recycling operations.

In the assessment of the POP Review Committee only a few full scale e-waste recycling facilities were separating PBDE containing plastic (UNEP 2011a,b)²¹⁷. One facility in Switzerland had an automatic separation step for WEEE plastic containing BFRs (halogens). Information is available from Sweden on the separation of BFR-containing plastics from WEEE plastics.²¹⁸

It would appear that not all European WEEE recycling plans have bought appropriate equipment to identify and separate PBDE (BFR) containing plastic from other plastic. It is also not known how much of the plastic generated at such plants are exported outside the EU for further recycling.

Action 5: Commission to continue to gather available information on the effective screening and separation of PBDE-containing materials in the recycling flow of WEEE in the EU and depending on the outcome consider further actions. (This action was also listed within the previous implementation plan and is still ongoing).

²¹⁶ Hirai, Y. Sakai, S.-i. (2007). Brominated Flame Retardants in Recycled Plastic Products. BFR2007: 4th International Symposium on Brominated Flame Retardants.

²¹⁷ In the “Technical Review of the Implications of Recycling Commercial Pentabromodiphenyl Ether and Commercial Octabromodiphenyl Ether” for the 6th POP Reviewing Committee meeting Geneva October 2010 (UNEP/POPs/POPRC.6/2 (a) and UNEP/POPs/POPRC.6/INF/6 (b)), such information has been compiled including information on facilities operated.

²¹⁸ Recycling of WEEE Plastics Containing Brominated Flame Retardants- a Swedish perspective”, Recycling Development AB and Vascaia, made for the Swedish EPA, 2010.

Action 6: Commission to gather validated measurement methods to control the export of waste plastic containing PBDE in particular electronic waste in the Member States, depending on the outcome and the quality of information take further actions. (This action was also listed within the previous implementation plan and is still ongoing).

4.1.4. DDT

Obligation: Article 3, paragraph 1(b) and Annex B, Part II of the Convention: restrict the production and/or use of DDT, in accordance with the provisions of Annex B, Part II. The use of DDT as disease vector control is allowed as acceptable purpose.

Implementation so far: Production, placing on the market and use of DDT as such, in preparations or in articles is totally prohibited by Regulation (EC) No 850/2004. No exemption is granted by the Regulation.

On the basis of note (iii) of Annex B, Part I, of the Stockholm Convention, the POP Regulation initially granted an exemption for Spain to continue the existing manufacture of dicofol using DDT as site-limited, closed-system intermediate until 1st January 2014. This notes that dicofol itself is currently under review for addition to the Stockholm Convention as a POP. The exemption of use of DDT in dicofol production was withdrawn from the POP Regulation in 2010. The Commission decided on the non-inclusion of dicofol in Annex I to Council Directive 91/414/EEC and on the withdrawal of authorisations for plant protection products containing that substance (2008/764/EC)²¹⁹ in 2008. According to the Commission Decision, all existing authorizations for dicofol in plant protection products had to be withdrawn before 30 March 2009. National registration of dicofol was not possible after March 2009. Any transition period granted by Member States should end by 30 March 2010 at the latest (cf. section 3.1.1).

Analysis: Legal measures are considered comprehensive. There is no need for further legislative measures at Union or Member State level.

4.1.5. *Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride (PFOS)*

Obligation: Article 3, paragraph 1(b) and Annex B, Part III of the Convention: restrict the production and/or use of perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride, in accordance with the provisions of Annex B, Part III. For registered parties, numerous acceptable purposes and specific exemptions are granted for the production and/or use.

Article 3, paragraph 6: take appropriate measures to ensure that any production or use under a specific exemption in accordance with Annex A or a specific exemption or an acceptable purpose in accordance with Annex B is carried out in a manner that prevents or minimizes human exposure and release into the environment. For exempted uses or acceptable purposes that involve intentional release into the environment under conditions of normal use, such release shall be to the minimum extent necessary, taking into account any applicable standards and guidelines.

²¹⁹ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:262:0040:0041:EN:PDF>

Implementation so far: Production, placing on the market and use of perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride as such, in preparations or in articles is severely restricted by the Regulation (EC) No 850/2004. On the basis of acceptable purposes and specific and general exemptions granted by the Convention, the Regulation provides for the following exemptions:

- placing on the market and use is allowed in concentrations of PFOS equal to or below 10 mg/kg (0,001 % by weight) when it occurs in substances or in preparations;
- concentrations of PFOS in semi-finished products or articles, or parts thereof is allowed, if the concentration of PFOS is lower than 0,1 % by weight calculated with reference to the mass of structurally or micro-structurally distinct parts that contain PFOS or, for textiles or other coated materials, if the amount of PFOS is lower than 1 µg/m² of the coated material;
- use of articles already in use in the Union before 25 August 2010 containing PFOS as a constituent of such articles is allowed;
- if the quantity released into the environment is minimised, production and placing on the market is allowed for the following specific uses provided that Member States report to the Commission every four years on progress made to eliminate PFOS:
 - until 26 August 2015, wetting agents for use in controlled electroplating systems;
 - photoresists or anti reflective coatings for photolithography processes;
 - photographic coatings applied to films, papers, or printing plates;
 - mist suppressants for non-decorative hard chromium (VI) plating in closed loop systems;
 - hydraulic fluids for aviation.

There is limited on-going production of perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride in the EU. According to the information submitted by parties in 2012²²⁰, PFOS is still produced in Germany although German producers only sell PFOS for the remaining legal uses in electroplating (>95%) and in the photo industry (< 5%) in Europe PFOS is still placed on the market and used for allowed applications as listed above (cf. section 3.2.4).

Concerning fire-fighting foams that were placed on the market before 27 December 2006 continued use was allowed up until 27 June 2011. In this regard it is worthwhile making the distinction between public fire and rescues services and private fire services, such as those used to protect airports. Public services attend to more ‘real’ incidents and would be expected to have a higher rate of replacement for stocks of foams, whereas private brigades tend to make use of foams for training exercises. Efforts have been made to gather and remove PFOS containing fire fighting foams across Europe, however it is likely that some stocks remain in the EU, and are still in the process of disposal (cf. section 3.2.4)

There is an onus on Member State Competent Authorities to work with fire services to identify and remove such stockpiles, which should extend to those private fire services that may still retain older stockpiles.

²²⁰ <http://chm.pops.int/TheConvention/POPsReviewCommittee/Meetings/POPRC11/POPRC11Followup/tabid/4723/Default.aspx>

Annex I, Part A of the Regulation also provides that as soon as new information on details of uses and safer alternative substances or technologies for the specific uses becomes available, the Commission shall review the derogations in the second subparagraph so that:

- the uses of PFOS will be phased out as soon as the use of safer alternatives is technically and economically feasible;
- a derogation can only be continued for essential uses for which safer alternatives do not exist and where the efforts undertaken to find safer alternatives have been reported on;
- releases of PFOS into the environment have been minimised by applying best available techniques.

As part of the discussions for the 10th POP Review Committee meeting under the Stockholm Convention held in October 2014, the review of alternatives to PFOS was presented. Working document 10/5 and Information documents 10/INF/7 and 10/INF/8 provide details on the existing exemptions and potential alternatives. The alternatives were also assessed for the annex D criteria under the Convention to avoid the issue of replacing one POP for another POP substance. The results of the discussion and details of the review should be used to feed into the work of the European Commission and identification for phase out of exemptions at the earliest opportunity.

Analysis: Challenges in substitution remains for PFOS application for which exemptions were granted in the POP Regulation. Support of the development and phasing in of alternatives is therefore desirable.

The use of PFOS in the metal plating industry is the main remaining source for PFOS releases from an intended purpose. Alternatives and substitutes have already been investigated for this use but there is a lack of practical implementation (cf. section 3.2.4). With a view to phase-out the use of PFOS in this area within the EU, support of practical implementation projects to help mostly concerned SMEs in phasing in alternative processes to PFOS might be desirable. There has also been further discussion in the Union over what constitutes ‘closed-loop’, noting that the vapours from chrome metal include hydrogen. A fully closed system could allow the build up of hydrogen to form explosive mixtures with air, and therefore careful management of gases is needed. Where the definition is unclear it is also unclear what quantities of PFOS may be lost to the environment.

Action 7: The Commission should develop guidance related to “closed-loop” in the metal plating industry including PFOS-containing waste handling as part of the “closed-loop”. (New action)

The collection of information for BAT/BEP for PFOS use in industrial processes under the Convention has just been initiated. It is desirable that Member States gather information and document BAT/BEP for the listed exemptions and forward the information to the Stockholm Convention Secretariat for consideration in the Stockholm Convention process.

The Stockholm Convention has a dedicated process for collecting information on PFOS alternatives, with a first report developed in 2010 for the POPs Reviewing Committee²²¹. This has since been supplemented with the body of work looking at alternatives presented at the 10th POP Reviewing Committee meeting and will continue to be updated in future POP Review Committee meetings. PFOS is present in broad range of articles at relatively low concentrations. Measurement of concentration of PFOS and its precursors in articles at low levels is the major challenge of compliance and border controls. Additionally the POP Regulation sets in place threshold values under Annex IV and V regarding wastes that may be contaminated with POPs. Those wastes that breach the thresholds in Annex IV and V must be irreversibly destroyed. Therefore analytical assessment of wastes is also important in the correct management of these materials.

Under the Stockholm Convention a small intersessional working group (SIWG) which is chaired by Canada has been created to help develop technical guidelines for POPs, which includes review of low POP concentrations for PFOS²²².

The Commission has mandated the work of European Committee for Standardization (CEN) to develop a standard analytical method for determination of PFOS in articles. Technical specification CEN/TS 15968 titled 'Determination of extractable PFOS in coated and impregnated solid articles, liquids and fire-fighting foams – Method for sampling, extraction and analysis by LC-qMS or LC-tandem/MS' was adopted by the CEN in 2010. In order to develop a fully standardized method, there is a need to perform a validation of the measurement method described in the technical specification.

Action 8: Commission to support the validation of a CEN standard on measurement of PFOS in coated and impregnated solid articles, liquids and fire-fighting foams. (This action was also listed within the previous implementation plan and is still ongoing)

For PFOS no exemptions for recycling of PFOS containing articles have been granted. Therefore recycling of PFOS containing materials is not allowed. Commission contracted a study (ESWI 2011) to gather information on the status of recycling flows possibly including PFOS containing materials. The study showed that recycling activities of some potentially PFOS containing materials are taking place but the concentration of PFOS is low. Probably the most relevant recycling activity in this respect is the recycling of synthetic carpets potentially contaminated with PFOS or PFOS precursors²²³. Other materials potentially contaminated with PFOS or PFOS precursors are e.g. textiles, paper or aviation fluid.

4.2. Elimination of import and export of POPs (Article 3(2))

Obligation: Article 3, paragraph 1(a)(ii) of the Convention: prohibit and / or take legal or administrative measures necessary to eliminate the import and export of the chemicals listed in Annex A. Article 3, paragraph 2 of the Convention: take measures regarding the import and export of chemicals in Annex A or Annex B.

²²¹ <http://chm.pops.int/Convention/POPsReviewCommittee/hrPOPMeeting/POPMeeting5/POPMeeting5Followupcommunications/PFOSalternativesguidanceInvitationforcomments/tabid/741/language/en-US/Default.aspx>

²²² <http://www.basel.int/Implementation/POPsWastes/Meetings/MeetingoftheSIWGonPOPs/tabid/4349/Default.aspx>

²²³ See for example <http://www.carpetrecyclinguk.com>

Implementation so far: Import is regarded as placing on the market in the EU and thus import of all Annex A and B chemicals is prohibited by Regulation (EC) No 850/2004 except for the following exemptions:

- A substance used for laboratory-scale research or as a reference standard;
- A substance occurring as an unintentional trace contaminant in substances, preparations or articles;
- A substance as such or as part of articles for the purpose of environmentally sound disposal;
- A substance as such or as part of articles for a use or purpose which is permitted by the Regulation (EC) No 850/2004, i.e. PFOS for exempted uses.

Export of all Annex A and B chemicals except for PFOS and Endosulfan (cf. section 2.1.2.5) is explicitly prohibited by Regulation (EU) No 649/2012, except for chemicals in quantities not likely to affect health or the environment, and in any event not more than 10 kg, provided that they are imported or exported for the purpose of research or analysis. The export of PFOS and Endosulfan is currently possible, but only on condition that the importing country consents to the import of the chemicals under the framework of the Rotterdam Convention.

Analysis: The existing legal measures on import and export cover the obligations laid down in the Stockholm Convention. The above mentioned regulations are directly applicable legislation in all EU-Member States.

To enforce the legislation, effective border control by Member States is a necessity. This may benefit from individual tariff codes for the listed POP chemicals.

Action 9: Commission to investigate the possibility to initiate international work on development of individual tariff codes for POP substance²²⁴. (This action was also listed within the previous implementation plan and is still ongoing)

In 2011 Endosulfan was added to the Annex A of the Convention and the legal act implementing total ban of its production, placing on the market and use came into force in July 2012. The ban on the export of endosulfan under Regulation (EU) 649/2012 was introduced on 25th of January²²⁵ 2013 and applies from 1 April 2013.

4.3. Prevention of the production and use of new chemicals exhibiting characteristics of POPs (Article 3(3))

Obligation: Article 3(3): Take measures to regulate with the aim of preventing the production and use of new chemicals and pesticides which, taking into consideration criteria in paragraph 1 of Annex D of the Stockholm Convention, exhibit the characteristics of persistent organic pollutants.

Implementation so far: Article 3(3) of Regulation (EC) No 850/2004 repeats the provision of the Stockholm Convention but the practical implementation is left to be done in the

²²⁴ This action had already been part of the ECIP issued in 2007 and has not yet been achieved. It is hence taken over as an action into the current implementation plan.

²²⁵ Commission Regulation (EU) No 73/2013 of 25 January 2013 amending Annexes I and V to Regulation (EC) No 689/2008 of the European Parliament and of the Council concerning the export and import of dangerous chemicals

framework of the existing Union regulatory and assessment schemes for chemicals, plant protection products and biocides. The REACH Regulation (EC) No 1907/2006 (EU regulatory framework for chemicals) (cf. section 0), Regulation (EC) No 1107/2009 (plant protection products) (cf. section 2.1.2.3) and Regulation (EU) No 528/2012 (biocidal products) (cf. section 2.1.2.4) are in this regard of particular importance.

Analysis: Production and placing on the market of POP like substances can in principle be effectively prevented within the existing regulatory frameworks for chemicals (cf. section 2.1.2). Although there are tonnage triggers for registration below which the data submitted to the authorities will not necessarily be sufficient for POP assessment in the framework of the REACH Regulation, it addresses specifically substances of very high concern with PBT criteria through its system of authorisation that does not have any tonnage trigger. Furthermore, the European Chemicals Agency has a right to request further information from companies if it suspects that a substance might exhibit POP characteristics (cf. section 2.1.2).

Regulation (EC) No 1107/2009²²⁶ concerning the placing of plant protection products on the market (PPP Regulation) prevents chemicals exhibiting POP characteristics from being used in plant protection products. This is achieved by the provisions according to which an active substance, safener or synergist shall only be approved for use in plant protection products where it is not considered to be a POP or if it is not considered to be a persistent, bioaccumulative and toxic (PBT) substance or a very persistent and very bioaccumulative substance (vPvB). In addition, a substance shall be approved as a candidate for substitution if it meets two of the PBT criteria.

Regulation (EU) No 528/2012 on biocidal products prevents chemicals exhibiting POP characteristics from being used in biocidal products. This is achieved by the provisions according to which an active substance cannot be authorised if it meets the criteria for being persistent, bioaccumulative and toxic or very persistent and very bioaccumulative according to Annex XIII to REACH Regulation. In addition, a substance shall be approved as a candidate for substitution if it meets two of the PBT criteria.

Proper enforcement of the obligation will require concerted action by the industry, rapporteur Member States, other Member States, the Commission and the European regulatory Agencies involved in the risk assessment of chemicals.

Action 10: Commission and Member States to ensure that the POP assessment is properly incorporated in the assessment of chemicals subject to different legislative provisions within the EU (in general as continuous task)

4.4. Assessing and controlling chemicals in use (Article 3(4))

Obligation: Article 3(4): Take into consideration within assessment schemes for pesticides and chemicals in use, the criteria in paragraph 1 of Annex D when conducting assessments of pesticides and chemicals.

Implementation so far: Article 3(3) of Regulation (EC) No 850/2004 not only repeats but strengthens the provision of the Stockholm Convention: It requires the Commission and the Member States to take “appropriate control measures” on existing chemicals and pesticides exhibiting POP characteristics. As in the case of new chemicals (see 2.1), the practical

²²⁶ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:309:0001:0050:EN:PDF>

implementation is left to be done in the framework of the existing Union regulatory and assessment schemes for industrial chemicals, plant protection products and biocides.

Analysis: From the Stockholm Convention's legal implementation point of view, the legislative measures taken by the Union can be regarded as fully sufficient.

The distinction of new and existing substances is not anymore regarded as fully justified within the Union. This change is reflected in the REACH Regulation and will be reflected also in the regulatory frameworks set up for plant protection products and biocides when the extensive review programmes on the existing active substances have been accomplished.

4.5. General exemptions

Obligation: Article 3(5): Not to apply prohibitions and restrictions to quantities of a chemical to be used for laboratory-scale research or as a reference standard. Notes (i)-(ii) of Annexes A and B: Quantities of a chemical occurring as unintentional trace contaminant in products and articles or occurring as constituents of articles manufactured or already in use before or on the date of entry into force of the relevant obligation are exempted from the prohibitions / restrictions.

Implementation so far: Article 4(1) and (2) of Regulation (EC) No 850/2004 lay down the general exemptions. Member States are obliged to notify all articles containing any of the listed substances as constituents to the Commission, who in turn will notify the Secretariat in line with note (ii) of Annexes A and B. So far no such articles have been identified by the Member States.

The term of "unintentional trace contaminants" as mentioned in the Convention's Annex A note (i) and Annex B note (i) is a challenge for the enforcement, particularly if a chemical is used in articles. Therefore other environmental and chemical legislation in the EU does not use such terms but they rather refers to concrete maximum concentration values (e.g. the RoHS Directive). The aim of these fixed thresholds is to facilitate uniform enforcement and control and provides legal certainty to economic operators. Therefore, the POP Regulation for the newly listed POPs with use in articles will contain fixed concentration values below which substance is considered to be an "unintentional trace contaminant" (see sections 2.1.1 and 3.2.9).

Analysis: The legal actions are sufficient and no further legal measures are needed. Border and market surveillance by the Member States is necessary and cases of non-compliance need to be reported to the Commission.

4.6. Reduction of total releases from unintentional production (Article 5)

Obligation: Article 5: To reduce the total releases of the chemicals listed in Annex C (PCDDs, PCDFs, PCBs, HCB and PeCB) with the goal of continuing their minimisation and, where feasible, achieving their elimination; To develop an action plan to identify, characterise and address the releases of by-product POPs; To promote the application of available, feasible and practical measures to achieve a reasonable level of release reduction or source elimination and to promote the development and require the use of materials, products and processes to prevent the formation and release of chemicals listed in Annex C; To promote and require the use of best available techniques (BAT) and best environmental

practices (BEP) to prevent the release of chemicals listed in Annex C for new sources in main source categories; To promote the use of BAT and BEP for existing sources from the main source categories as well as other categories.

Implementation so far: Article 6 of Regulation (EC) No 850/2004 on POPs addresses substances for which releases should be reduced and minimised, with a view to eliminate them if feasible. The six substances or groups of substances concerned are PCDDs, PCDFs, PCBs, HCB, PeCB and PAHs, as listed in Annex III of the Regulation. Of these, all with the exemption of PAHs are listed in the Stockholm Convention and are therefore the main focus for the present implementation plan.

According to Article 6 of the POP Regulation, Member States shall draw up and maintain release inventories for the substances listed in Annex III into air, water and land in accordance with their obligations under the Convention and the Protocol. Member States were obliged to do so by 20 May 2006 for PCDDs, PCDFs, PCBs, and HCB and by 26 August 2012 for PeCB which was listed in 2010.

Article 5 of the POP Regulation further stipulates that Member States shall develop an action plan on measures to identify, characterise and minimise the releases of unintentionally produced POPs. The action plan shall include measures to promote the development and, where it deems appropriate, shall require the use of substitute or modified materials, products and processes to prevent the formation and release of the substances listed in Annex III.

Member States shall furthermore, when considering proposals to construct new facilities or significantly to modify existing facilities using processes that release chemicals listed in Annex III of the Regulation, without prejudice to Directive 2010/75/EU (IED Directive), give priority consideration to alternative processes, techniques or practices that have similar usefulness but which avoid the formation and release of substances listed in Annex III.

Over the past twenty years, important legislation has been adopted to reduce the emissions of PCDD/F, in particular in the areas of waste incineration and integrated pollution prevention and control, resulting in decreasing levels in the environment and in the human population (see section 3.3.2).

Inclusion of all five substances in the Water Framework Directive has further contributed to the reduction of emissions of these substances into aquatic environment, as Member States have an obligation to ensure that concentrations of these substances in the environment is below the environmental quality standard level.

The implementation of the BAT conclusions adopted under the IED which establish Emission Levels Associated with the Best Available Techniques (BAT-AELs) will be another step to further reduce releases of PCDD/F and other unintentionally produced POPs from industrial activities.

The Union Strategy for Dioxins, Furans and Polychlorinated Biphenyls adopted in 2001 (COM (2001) 593)⁵⁶ had the goal to assess the current state of the environment and the ecosystem, to reduce exposure from dioxins and PCBs to humans and the environment. In October 2010 the Commission adopted the third progress report on the Dioxin strategy (COM (2010) 562 final)⁵⁸ for the period 2007 to 2009. The report showed that over the last two decades 80% reduction of industrial emissions of PCDD/Fs and PCBs was achieved.

The generation of UPOPs within thermal industrial processes typically relate to the contamination of particulate matter within the waste exhaust system. Abatement measures

designed to reduce the emission of PCDD/F releases into the atmosphere are likely to have synergistic benefits for the reduction in emissions of the unintentionally produced PeCB, HCB, PAH and PCB. This reduction can occur through removal of particulate that acts as a seeding surface for UPOPs, or through removal of the contaminated particulate as air pollution control residues. On this basis it can be assumed that the above mentioned reduction of PCDD/F already had a similar effect for these other UPOPs.

Further progress is expected within the framework of the European Union Implementation Plan on Persistent Organic Pollutants and the relevant National Implementation Plans (NIPs) elaborated by Member States.

Analysis: In section 3.3 of Part I, it is described that in the EU the release from POPs due to unintentional production remains one of the most important issues to be tackled. Several actions are thus dedicated to the development of corresponding measures with the goal to reach a further reduction of POP emissions.

As the unintentional production of POPs is largely related to industrial processes such as production of iron and steel (sinter plants, electric arc furnaces), the production of non-ferrous metals, the incineration of waste etc, the legislation dealing with industrial emissions is the main instrument to tackle releases of unintentionally produced POPs. The IPPC Directive has been replaced by the Industrial Emissions Directive (IED) that came into effect in January 2013. Further improvement of the situation is expected with the IED, because the BAT Associated Emission Levels (BAT-AELs) as listed in the BAT conclusions are to be used by permitting authorities when issuing permits for industrial installations.

As the IED has a much wider scope than just reduction of POP emissions, it is important that POP-related expertise is present in the discussions about the BAT and BAT-AELs during the BREF review process. This applies particularly for the review of the relevant BREFs (especially those on "Non-Ferrous Metal Industries", "Large Combustion Plants", "Ferrous Metals Processing", "Waste Incineration", "Waste Treatment"), where involvement of POP-experts must be encouraged to make sure that the prevention of the formation as well as the control of POP releases is taken adequately into consideration with a view of developing BAT conclusions (including BAT-AELs where possible) concerning emissions of unintentionally produced POPs.

Action 11: Commission and Member States to ensure that BAT conclusions under the IED and related implementation measures consider the reduction of emissions of unintentionally produced POPs, including their potential transfer to other media and their presence in waste. (This action was also listed within the previous implementation plan and is still ongoing)

For air pollution control residues (fly ashes) and articles other than food and feed no PCDD/F regulation exists and the only relevant limit is the low POPs content of 15 ng TEQ/g as low POPs content. This value is high and there is a considerable debate on this provisional Basel Convention low POPs limit. For fly ashes in Japan e.g. a limit of 3 ng TEQ/g exist and in the incineration BREF fly ash values from German incinerators below 0.5 ng TEQ/g are mentioned.

Action 12: To assess levels of PCDD/PCDFs in critical solid residues (fly ashes) and articles and take action to possibly develop BAT and maximum concentrations in this respect. (This action was also listed within the previous implementation plan and is still ongoing)

In addition to emissions from the large industrial installations also small scale incinerators and diffuse sources are contributing to the release of PCDD/PCDF and other UPOPs.

One activity which can contribute to reduction of UPOPs in this sector is the minimum eco-design requirements for solid fuel small combustion installations. Even though preparatory work is underway concerning this action it is being renewed here as the inclusion of POP-related aspects (especially the generation of unintentionally produced POPs) should be a main focus of the still to be developed implementing measure (cf. section 3.3.3).

Action 13: Commission to table an implementing measure to set out minimum eco-design requirements for solid fuel small combustion installations. (This action was also listed within the previous implementation plan and is still ongoing)

4.6.1. *Pentachlorobenzene (PeCB)*

PeCB has been newly listed in the Stockholm Convention Annexes A and C without exemptions. In the EU PeCB is not intentionally produced it is only addressed in the section of UPOPs.

According to the results of the EU PRTR (2007-2013 data) PeCB remains unintentionally produced in the EU due to releases largely from the metal industry and minor impact from power production from coals. Emissions from domestic sources are not covered by the scope of the E-PRTR Annex I activities under Regulation (EC) No 166/2006, although PeCB is expected to be emitted from the domestic use of coal and open burning of wastes, particularly the plastic content. Review of the data-set provided in the E-PRTR highlights the issue of PeCB releases to water from facilities in the sector covering manufacture of basic organic chemicals. In such cases, an integrated view is required looking at all emissions of halogenated compounds and other pollutants to understand the individual situation. It would be beneficial if companies in this sector or Member State Competent Authorities could assess what BAT measures for reduction of PeCB emissions from this source sector could be used.

The review of E-PRTR data also highlights that some facilities report releases of PeCB significantly above the reporting threshold (1kg) and others do not at all. Based on the data reviewed it might be possible that there is under reporting/nonreporting from a number of similar facilities within the metal manufacture sector, where releases of PeCB and potentially also HCB might be expected²²⁷ to be considerably above 1 kg/year. One reason for these inconsistencies and missing data could possibly be the lack of measurements of PeCB and HCB in IED facilities as there are no legal requirements for PeCB and HCB measurements.

²²⁷ Furthermore this two facilities reporting on elevated PeCB air emissions have not reported on HCB emissions. Since the ratio of PeCB to HCB in such thermal sources are normally between 0.2 and 2, the HCB from these two facilities can also be estimated in the order of several 10 kg/year and should have been reported to PRTR.

Another possible reason for the lack of reporting may stem from a lack of awareness regarding sources of UPOPs with operators, which includes allowing operators to understand what a realistic set of emissions might look like for their facility.

Production of chlorinated organics and their deposits from historic production were described in a recent POP Reviewing Committee Report (UNEP 2010c)²²⁸ as probably the largest global source of PeCB. Therefore it seems necessary to increase understanding of PeCB emissions among the chemical industries and improve the PRTR database of PeCB releases.

Up to now measures to reduce unintentionally produced POPs largely focused on PCDD/PCDF. While the reduction of formation of PCDD/PCDF from thermal sources (primary measure) will at the same time have synergistic benefits to reduce PeCB (and other new POPs) secondary measures like adsorption technologies might have to be adjusted to also address the more volatile PeCB.

Action 14: The Commission to work with Member States to examine how the characterisation of PeCB releases can be improved, and to identify whether BAT/BEP could be appropriately updated to further decrease PeCB releases. (This action was also included in the previous implementation plan and is still ongoing)

4.7. Identification and environmentally sound management of stockpiles and wastes

Obligations: Article 6: To develop appropriate strategies for identifying stockpiles, products and articles containing, consisting of or contaminated with chemicals listed in Annexes A, B or C; manage stockpiles in a safe, efficient and environmentally sound manner; implement measures to reduce or eliminate releases from stockpiles and wastes containing chemicals listed in Annexes A, B or C in a manner that protects human health and the environment; take appropriate measures to ensure that waste products and articles containing chemicals listed in Annexes A, B or C are handled in an environmentally friendly manner; dispose of waste products and articles containing chemicals listed in Annexes A, B or C in a way that destroys the POPs content, taking into consideration the Technical guidelines for the environmentally sound management of POP wastes developed under the Basel Convention.

Implementation so far: Directive 2008/98/EC on waste sets a number of provisions that ensure wastes including stockpiles are handled in an environmentally sound manner (see Annex D). Amongst others, this includes waste prevention promotion, classification rules for hazardous waste, the obligation to collect waste and to package and label it appropriately, to elaborate waste management plans, to permit waste disposal and recovery installations and the prohibition to dispose of waste in an uncontrolled manner.

Article 5 of Regulation (EC) No 850/2004 requires stockpiles to be managed as waste. The holder of stockpiles greater than 50 kg, consisting of or containing any POP and the use of which is permitted shall provide the competent authority with information concerning the nature and size thereof. The stockpile shall be managed in a safe, efficient and environmentally sound manner. Member States must monitor the use and management of notified stockpiles.

²²⁸ UNEP (2010) “Additional consideration of new persistent organic pollutants: pentachlorobenzene” Stockholm Convention document from 6th POP Reviewing Committee meeting (UNEP/POPS/POPRC.6/INF/8)

Article 7 of the Regulation (EC) No 850/2004 sets that producers and holders of waste are obliged to undertake all reasonable efforts to avoid contamination of waste with POP substances. Waste consisting of, containing or contaminated by POPs shall be disposed of without undue delay. Waste with POPs content higher than the lower POP limits set in the Regulation must generally be disposed or recovered in such a way that the POP content is destroyed or irreversibly transformed. Also those wastes, which are managed in an environmentally preferable way instead of being destroyed or irreversibly transformed have to meet the upper POP concentration limits set by the Regulation²²⁹.

Analysis: The existing legal framework basically ensures the environmentally sound management of stockpiles and waste consisting of contaminated or containing POPs. Some actions should be envisaged as follow-up or complementation of the tasks to be addressed by the Basel Convention (see following subchapter).

With regard to obsolete pesticides the Commission Study (BiPRO 2005)²³⁰ estimated that there are stocks containing 5,370 tonnes in the EU, mainly in the new Member States joined in 2004. Information about Romania and Bulgaria is not available.

In addition the last ECIP estimated 500,000 t of deposited HCH waste which at that time were not POPs waste. With inclusion of alpha-, beta- and gamma-HCH these deposited wastes can largely be considered the POPs waste since the other isomer contribute only a minor share of HCH waste isomers (IHPA 2006 a,b, Vijgen et al. 2011). An updated assessment revealed that deposited HCH wastes within the EU might amount up to 1.8 to 3 million tonnes considering a lindane production volume of 300,000 t (Vijgen et al. 2011).

The identification and management of sites contaminated by HCH waste represents a challenge within the Union. Seventeen Member States have identified contaminated land as an issue within existing national implementation plans, with further action needed to help address this issue. While the issue should be primarily dealt with on a Member State level, with the costs borne by the "polluter-pays" principles as laid down in the Waste Framework Directive, the exchange of information at European level would be beneficial to help collaboration and learning in management of such issues.

Beyond the issue of contaminated land, the European Union's funds are eligible for the disposal of the stockpiled obsolete pesticides.

Other new POPs in products in use, in the waste flow and in disposal schemes are POP-BDEs and PFOS. Since they are mostly included in articles (see chapter 3.2) but also in matrices like sewage sludge the assessment of their disposal is more complex.

Action 15: The Commission and the Member States should develop a strategy for identifying sites contaminated by POPs and for their environmentally sound remediation. (New action)

²²⁹ The upper concentration limits are not valid for permanent underground landfilling. Regulation (EC) 172/2007 amending Regulation (EC) 850/2004: „These limits exclusively apply to a landfill site for hazardous waste and do not apply to permanent underground storage facilities for hazardous wastes, including salt mines.”

²³⁰ BiPRO (2005): Study to facilitate the implementation of certain waste related provisions of the Regulation on Persistent Organic Pollutants (POPs). ENV.A.2/ETU/2004/0044. European Commission, DG Environment, Brussels 2005.

4.7.1. Disposal and destruction of PBDE containing materials

The “Technical Review of the Implications of Recycling Commercial Pentabromodiphenyl Ether and Commercial Octabromodiphenyl Ether” (UNEP/POPs/POPRC.6/2 and related Annexes UNEP/POPs/POPRC.6/INF/6) from the POP Reviewing Committee (UNEP 2010a,b)²³¹ emphasized that most recovery and destruction technologies where PBDE containing materials are treated have not been assessed for their appropriateness (destruction efficiency and releases).

The COP5 recommendations in this respect were:

- To generate and collect information on releases of brominated diphenyl ethers and unintentionally produced brominated organic compounds such as polybrominated dibenzodioxins and polybrominated dibenzofurans (PBDD/PBDF) in emissions to air and in the solid residues from thermal processes used in treating materials contaminated with brominated diphenyl ethers.
- To identify disposal options that would comply with the Stockholm Convention guidelines to be developed for the destruction of wastes containing brominated diphenyl ethers. These may include best available technique incinerators with effective primary and secondary combustion zones that operate under best environmental practice conditions with continuous monitoring and sampling to ensure that brominated diphenyl ethers and/or PBDD/PBDF are not released.
- To undertake further assessment and produce best available technique and best environmental practice guidance. These tasks should be undertaken by the Stockholm Convention’s expert bodies and include consideration of polybrominated diphenyl ethers and PBDD/PBDF releases from smelters and other thermal recovery technologies, including secondary metal industries, cement kilns and feedstock recycling technologies.
- To improve and extend as necessary disposal options to ensure compliance with Stockholm Convention obligations and guidelines, taking into account the relevant decisions of the Persistent Organic Pollutants Review Committee on the updating of the Basel Convention technical guidelines on the environmentally sound management of persistent organic pollutants.
- To collect information relevant to the establishment of best available techniques and best environmental practices for treatment and disposal techniques for materials containing brominated diphenyl ethers.

As described in chapter 3.2, the largest part of PBDE containing materials has been disposed of. Depending on the quality of the landfills and the leachate controls POPs could be released from such deposits and contaminated the environment (Weber et al. 2011)²³².

²³¹ UNEP (2010) “Technical Review of the Implications of Recycling Commercial Pentabromodiphenyl Ether and Commercial Octabromodiphenyl Ether” from 6th POP Reviewing Committee meeting Geneva October 2010 ((a) UNEP/POPs/POPRC.6/2 and related Annex report (b) UNEP/POPs/POPRC.6/INF/6).

²³² Weber, R., Watson, A., Forter, M., Oliaei, F. (2011): Persistent Organic Pollutants and Landfills - A Review of Past Experiences and Future Challenges. *Waste Management & Research* 29 (1) 107-121.

The COP5 also discourage the landfilling of PBDE containing waste and recommends in this respect

- Reducing releases of polybrominated diphenyl ethers from landfills by avoiding the landfilling of waste containing them. Significant reductions can be made by restricting the landfill disposal of waste streams with high concentrations of brominated diphenyl ethers. A “proper management to isolate the landfill contents” permanently from the environment cannot be achieved. Therefore maximum concentration limits for (above-ground) landfills for hazardous waste pursuant to Annex V of the POP Regulation should be set.
- Assessing further the long-term chemistry of polybrominated diphenyl ethers in landfill sites and the fate and risk of polybrominated diphenyl ether release from landfills into the environment.
- Providing guidance for MS on how to focus efforts on products/materials with the highest concentrations of POP-BDEs and PFOS. The guidance could also include techniques for identification and separation of materials and products with high POPs concentrations.

Another issue for PBDE containing materials is the thermal treatment at the end of life. A share of waste ends up in dedicated waste incinerators while several PBDE containing materials are treated at in metal industries and possibly co-incinerated in cement kilns. The report for the POP reviewing committee has summarized the following point:

- Most metallurgical processes fall into the category of end-of-life treatments rather than recovery operations in relation to treatment of PBDE. Whilst metals are recovered for recycling the polymer to which the PBDE had been added is not recovered. Instead it is used for the recovery of energy. Alternatively it may have been introduced to the process incidentally due to a failure to separate PBDE-containing materials from the metals being recovered. An example would be where scrap cars were compacted for recovery in secondary steel industry without first removing all the PBDE-containing polymers). The presence, and recovery, of the metal in these cases is due to the mixing processes, usually shredding or compacting, used in disassembly rather than to any specific use of PBDE in metal components. This allocation is slightly more ambiguous when considering material and energy recovery in smelters used for tens of thousands of tonnes of PWB, some containing PentaBDE in the resin, as BFR containing plastic is often added to the process.

Options for energy recovery of plastics containing PBDE (or just the recovery of metals incidentally mixed with BDE-containing plastics) include:

- a) Electric arc furnaces for iron scrap recycling (entering e.g. with car scrap),
- b) Secondary aluminium (entering e.g. with electronic waste parts),
- c) Antimony recovery from PBDE/BFR plastics containing antimony,
- d) Energy recovery from PBDE/BFR containing high calorific waste in cement kilns,
- e) Energy recovery and, in theory at least, bromine recovery from PBDE/BFR containing materials in incinerators.

As highlighted by the POP Reviewing Committee report these facilities with the exemption of BAT incinerator have not been assessed for their appropriateness (destruction efficiency) of processing PBDE containing materials. The POP Reviewing Committee report further highlights that in these applications PBDD/PBDF and PXDD/PXDFF are likely to be formed

and should be considered for the assessment of these facilities (UNEP 2011a,b)²³¹. Development of guidelines for the safe destruction of brominated substances should also take into consideration the work being conducted under the Basel Convention to look at safe waste management of brominated POPs such as HBCDD²³³.

Action 16: The Commission and Member States should as part of the regular review process of BREFs evaluate how PBDE containing materials are dealt with within IED activities and identify whether BAT/BEP could be included / updated to prevent, and where that is not possible to minimise emissions of brominated and brominated-chlorinated dioxins. (This action was also listed within the previous implementation plan and is still ongoing)

Action 17: The Commission and the Member States should support the work on decontamination of POP PBDE containing materials through collection of information which should be disseminated to all stakeholders. This would also include promotion of techniques to manage POP PBDE containing materials across the European Union. (New action)

4.7.2. *Disposal and destruction of PFOS and PFOS precursor containing materials*

Disposal of PFOS containing materials

In respect to end of life of PFOS containing articles the COP5 recommends

- No landfilling of these wastes should be permitted, unless leachate containing PFOS is properly treated.
- Resulting sludge, adsorbents and wastes containing PFOS should be destroyed and not deposited.

In the past much of PFOS containing materials (e.g. carpets and furniture) have been deposited. Considering the water solubility of PFOS and that the lifetime of PFOS is longer than securing measures of landfills (in the time frame of a few decades up to possibly a century), all PFOS and PFC will be released over time even from BAT landfills (Weber et al. 2011). Therefore there is no justification to deposit PFOS containing materials considering the burden such practice would bring to future generations.

Destruction of PFOS containing materials

The basis for the COP5 recommendations in respect to management of PFOS containing residues is

- To use best available technique and best environmental practice destruction technologies for wastes containing PFOS in current production and industrial uses of PFOS.

Since the C-F bond is more stable compared to other carbon-halogen bond, the destruction of PFOS and other PFCs require appropriate destruction technologies like BAT hazardous waste

²³³ Basel Convention, 2015, UNEP/CHW.12/CRP.18/Add.6 – Technical guidelines for environmentally sound management of wastes consisting of, containing or contaminated with HBCDD

incinerators (operated normally at 1100°C). PFOS containing materials like carpets or coated paper end up to a considerable share in municipal waste incinerators (operated at 850°C). Further PFOS containing sewage sludge end up partly in sewage sludge incinerators often operated at lower temperature compared to municipal waste incinerators. Full scale tests with assessment of destruction efficiency and degradation products have not been published for municipal waste incinerators and sewage sludge incinerators.

It is advisable that Member States share information among themselves and with the Stockholm Convention Secretariat on their experiences with PFOS destruction projects and appropriate destruction technologies.

4.7.3. Disposal and destruction of POPs Pesticides

Data reported by Member States has shown that there are still a number of existing stockpiles of POP pesticide and POP-containing wastes. A study by the International HCH and Pesticides Association (IHPA) in 2008 suggested that for the then 'EU-25', approximately 30,000 tonnes of obsolete pesticide stockpiles existed. Based on the Article 12 reported data for both the second synthesis report and draft third synthesis report (spanning the periods 2007-2009, and 2010-2012 respectively) significant work has been completed to reduce these quantities. This has included the export of waste stockpiles across political boundaries within Europe for destruction by incineration. The Article 12 reports for the period 2010-2012 do however suggest that significant levels of stockpiles remain, particularly in the Central and Eastern European Member States with programmes of management and final destruction in place to handle remaining stockpiles. This work is partly hindered by the difficulties in identifying those waste stockpiles that may be contaminated with POPs pesticides. The inclusion of a number of POPs pesticides in the POP Regulation since 2009, particularly lindane and alpha and beta HCH, leads to the necessity of assessment and possibly remediation of HCH waste deposits. This recognises that for every tonne of lindane manufactured up to nine tonnes of waste contaminated with alpha and beta HCH was generated. The identification of contaminated land sites and sites of former manufacture is partly covered by those Member States with contaminated land registries, with some such deposits having been cleaned or secured in the past. The management of POPs pesticide stockpiles and any contaminated land issues are primarily for the action at the Member States level.

4.7.4. Destruction of PCB and PCB containing materials

Several European countries are importing PCB and other POPs containing wastes for destruction. It has been revealed that the activity of a major importer of PCB waste to Germany (ENVIO) led to the contamination of workers and resulted in the contamination of storage sites and the area where the PCB transformers were treated. It is advisable that Member States share their experience and lessons learned from such cases.

PCB destruction of open applications: As mentioned above, PCBs have been used in anti-corrosion paints (e.g. bridges and other constructions, electric poles, large water pipes) in the 1950s to the early 1970s. Some of this equipment is now coming to the end of life stage and will need to be treated. The large metal parts are normally recycled in electric arc furnaces (EAF) and possibly other secondary metal processing plants. Since the combustion processes in these batch type operations can be considered incomplete, most probably a considerable share of these PCBs are evaporated and not destroyed. This is supported by the relatively high emissions of PCB reported from EAF. Furthermore the conditions in such facilities are

favourable to form PCDF with associated increase of toxicity. Currently there is no assessment of how much PCB painted scrap materials are entering the end of life and enter secondary metal treatment. Also no dedicated tests have been published on releases associated with such practice. However it is known from measurements in EAF that considerable PCB loads are emitted which only can be explained by PCB input by treated material and cannot be explained by unintentionally formation of PCB in this processes²³⁴.

Another open application are sealants containing PCB in buildings from the 1960s and 1970s. A share of these buildings is renovated in the frame of insulation measures while another share is torn down.

It is advisable that Member States share their findings on the PCB contaminated construction materials and paints and share their experiences in handling such waste.

4.8. Identification of contaminated sites (Annex A, B and C Chemicals) and if addressed then remediation in an environmentally sound manner

Obligations: Article 6 1 (e) emphasize that parties “Endeavour to develop appropriate strategies for identifying sites contaminated by chemicals listed in Annex A, B or C; if remediation of those sites is undertaken it shall be performed in an environmentally sound manner”

Implementation so far: As regards the identification and remediation of sites contaminated by chemicals in Annexes A, B or C, the Commission has adopted in September 2006 a Thematic Strategy on soil protection and made a proposal for a framework Directive on the protection of soil. This proposal requires Member States to prevent soil contamination, to make an inventory of contaminated sites (including sites contaminated by substances in Annexes A, B and C) and to remediate the sites identified. Member States are also required to take measures to raise awareness and promote the transfer of knowledge and experience for a sustainable use of soil. This could include an exchange of information on the best available technologies for the remediation of POP-containing sites. The Strategy and the proposal have been sent to the other European Institutions for the further steps in the decision-making process. Discussions are still on-going to reach a political agreement and thus the protection of soils is currently an exclusive competence of Member States.

The Water Framework Directive includes many POPs and hence imposes monitoring obligations on Member States regarding their presence in ground water and surface waters. In this respect it provides a mechanism to identify contaminated sites associated with water bodies.

Analysis: As described above (3.4), several POPs (e.g. PCB, HCH, PCDD/PCDF, PAH, PFOS) have resulted in a wide range of POPs contaminated sites. Due to the relative mobility of POPs these sites are a threat for the wider environment and by contamination of related river systems and the fish or flood plains and related grazing cattle also impact human nutrition. Furthermore the more water soluble POPs (PFOS and HCBd) also contaminate related ground and surface waters and can impact drinking water.

For the EU, the historical contamination of soil with HCH and at former production sites and stores of HCH are probably one of the main problems linked to POP compounds.

²³⁴ Also the PCB pattern from EAF have often a congener finger print of industrial PCBs demonstrating that the main PCB release stem from the input material and are not unintentionally formed.

Identification and quantification of the extent of this problem to develop appropriate risk management should be regarded as a priority action for the Member States.

5. IMPLEMENTATION OF THE OBLIGATIONS ON SUPPORTING ACTIVITIES

5.1. Information exchange

Obligation: Article 9: To facilitate or undertake information exchange relevant to the reduction or elimination of the production, use and release of POPs and alternatives to POPs including information relating to their risks as well as their economic and social costs. This information exchange, either directly or through the Secretariat, can also be used to develop alternatives to POPs. Where Parties exchange information on health and safety of humans and the environment it must not be treated as confidential. Parties that exchange other information must protect any confidential information as mutually agreed.

COP5 recommendations:

- To exchange information on and experiences of successful environmentally sound handling, management and disposal of articles and wastes containing brominated diphenyl ethers.
- Especially developed countries, are encouraged to exchange their experiences and success stories with other countries. Results should be reported to the Secretariat/COP which should result in valuable information for developing and transition countries and support implementation in these countries.

Implementation so far: The Commission is disseminating widely information on these activities mainly through the Europa-website with the Directorate-General Environment hosting the POP-specific website but also by different publicly accessible databases such as Eur-Lex, statistic databases of Eurostat, the E-PRTR, the EU pesticide database, and databases of EU institutions on specific topics e.g. the European chemical Substances Information System (see section 2.5). In addition, risk assessment reports are made publicly available, as well as the voluntary risk assessment reports submitted to ECHA based on industry initiative.

Analysis: Obligations derived from the implementation of the POP Regulation are changing (cf. 2009 addition of new substances as well as 2011 addition of endosulfan and 2013 addition of HBCDD) and stakeholders concerned by these changes need to be proactively informed and supported in the implementation of the corresponding obligations. This could inter alia take place via workshops, projects in cooperation with associations and federations (industry and NGOs) as well as common dissemination strategies such as websites and paper documentation.

Action 18: Commission and Member States should facilitate the exchange of information and experiences on elimination of PCBs (e.g. through a workshop) This should be used to further explore the progress made on the elimination of PCBs within di-electric equipment, obstacles faced, and what learning lessons could be implemented by Member States. (New action)

Action 19: Commission and Member States to ensure that all players (including industry) are fully informed about the obligations under the Stockholm Convention. (This is a continuous action)

Action 20: Commission and Member States to exchange their experiences and success stories with other countries. (This is a continuous action)

Action 21: Commission to facilitate the identification of both chemical and non-chemical options which can act as alternatives to POPs and to disseminate their risk assessment reports more widely. (This is a continuous action)

5.2. Public information, awareness and education

Obligations: Article 10: Promote and facilitate awareness of POPs, among policy and decision makers, and, along with industry and professional users, provide and facilitate up-to-date information to the public as well as develop education and training programmes. To give consideration to the development of mechanisms, including pollutant release and transfer registers, for the collection and dissemination of information on the release and disposal of chemicals listed in Annexes A, B and C. To consult with national stakeholders when developing and implementing the national implementation plan.

Implementation so far: Access to environmental information and consultation with stakeholders are an integral part of the Union environment policy. In general, a lot of emphasis is put on dissemination of information to citizens, industry and other interested parties on the European Union's environment policy and activities. The main tool for public information is the Europa-website, a specific website dedicated to POPs and different European databases (see section 2.5).

As consultations with stakeholders are an integral part of the European Union's environment policy in order to provide opportunities for input from representatives of authorities, civil society or individual citizens, this present European Union Implementation Plan will be subjected to an open consultation (see Preface).

Analysis: As the Member States' NIPs highlight a range of specific issues that can vary from State to State, the role of disseminating information to the public, awareness raising and education on POPs best remain at the domain of the EU Member States. The Commission has concentrated on information on European Union legislation and other activities with a broader pan-European scope. An additional problem for EU level awareness raising is the language barrier, where the EU has more than 20 official languages. The Commission has limited possibilities to put in place large information campaigns on POPs in all languages. However, information campaigns at European Union level are not excluded if they are deemed appropriate. As most Member States have developed their NIPs, it is now possible to evaluate the need for and the added value of such concerted action in the field of POPs.

Action 22: The Commission and Member States to evaluate the need for and the added value of a concerted action - coordinated information campaigns at European Union level - in the field of POPs taking into consideration the obligation of Member States to disseminate environmental information on POPs pursuant to Directive 2003/4/EC⁴⁵. (This is a continuous action)

5.3. Research, development and monitoring

Obligations: Article 11: To encourage research, development and monitoring of POPs on their sources, releases and transport to the environment, presence, levels, trends and effects in humans and the environment, socio-economic and cultural impacts, release reduction and/or elimination and harmonised methodologies for making inventories and analytical techniques for measuring releases. In taking this action, Parties should also support and further develop international programmes aimed at research, data collection and monitoring, support efforts to strengthen national scientific and technical research capabilities, take into account the concerns and needs of developing countries to improve their capability to participate, undertake research towards alleviating the effects of POPs and make the results of this available to the public and encourage and/or undertake cooperation with regard to storage and maintenance of this generated information.

Implementation so far: Research and development are essential for the support of policies such as inter alia consumer protection or the protection of the environment. The Framework Programmes (FP) are the main instrument for funding research and development in Europe. POP related research was funded in FP 5 (1998 – 2002), FP 6 (2002-2006) and the funding continued also in FP 7 (2007 – 2013). Details on projects funded under FP5 are given in the first Union Implementation Plan prepared in 2007. Under FP7, 44 projects have been selected for funding, addressing the issue of chemical pollution in the environment, with an EU contribution of over €140 M (see section 2.4). Details on projects funded under FP6 and FP7 are given in the Section 7.

The Joint Research Centre – the Commission's scientific body – has performed several monitoring activities of POP substances in the environment, has performed exposure assessment to POPs and contributed to the development of Toolkit for the identification and quantification of releases of dioxins, furans and other unintentionally produced POPs particularly by determination of emission factors for non-standard emission sources.

Under the Water Framework Directive (Directive 2000/60/EC) and Environmental Quality Standard Directive (2013/39/EC), Member States are obliged to monitor substances placed on the priority list (many of which have POP characteristics), if they are discharged into the river basin or sub-basin. In addition, Member States have to monitor also other pollutants if they are discharged in significant quantities in the river basin or sub-basin.

Analysis: As regards the research and development, support will mainly come from Horizon 2020 Societal Challenge 1 “Health, Demographic Change and Wellbeing”, Societal Challenge 2 “Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy” and Societal Challenge 5 “Climate Action, Environment, Resource Efficiency and Raw Materials” since POP substances are still used due to lack of alternatives.

There are a range of inconsistencies in PRTR data e.g. for PeCB, HCB and HCBd (see section 3.3.1). A research into characterisation of sources of these substances might be desirable to improve the situation.

As stated in section 4.6, prevention of the unintentional formation of POPs through the development of processes and technologies that avoid their formation should mainly be addressed in the area of industrial production but also cover domestic sources such as diffuse incineration sources. There is still need for additional research and technological development.

Though the coordination of research efforts already marks a good way towards the minimisation of effort duplication (see section 2.4.2), this action should be continued in the future. Especially the aspect of coordination and exchange at international level should be set more in focus. Ensuring the communication between policy makers and scientific research communities is a key aspect to maintaining a healthy flow of new data needed to underpin logical policy making in the field of science for POPs. This includes identification of priority data needs in advance to help guide scientific research communities to where existing data gaps exist, and likewise to ensure publicly funded research does not duplicate academic research efforts. In this respect exchanges between research and development aid should be supported and further developed.

As regards the monitoring, despite the fact that Member States' authorities, research organisations and EU bodies are making significant efforts to monitor numerous chemicals in various matrices (water, air, biota, soil, human milk, etc.) as a consequence of EU legislation, national and international initiatives and scientific curiosity, there is a knowledge gap on the chemical burden. This occurs because the chemical data generated by the monitoring activities are not being collected, managed and assessed in a coherent manner and accessible manner. To address this gap, an information platform for chemical monitoring data should be established at the European scale which would ensure a coordinated and integrated approach to collecting, storing, accessing and assessing of data.

Action 23: Commission should ensure that the current EU Framework Programme for Research and Innovation Horizon 2020 will encourage research and innovation activities for the above identified challenges (alternatives (both chemical and non-chemical), characterisation of sources, review of industrial process to avoid unintentional formation, data management, testing, and health impacts) and promote a coordinated approach between MS as well as with international counterparts inter alia long-term health impacts of exposure to POPs at environmentally relevant concentrations or development of affordable alternatives to POP substances still in use. (This is a continuous action)

Action 24: The Commission and the Member States should ensure better co-ordination and communication between scientific research communities and relevant national, Union and international bodies to, amongst others, communicate priority data needs for management of POPs issues. (New action)

Action 25: Commission to promote a more coherent approach to the generation, collection, storage and use of chemical monitoring data in relation to humans and the environment, through the creation and maintenance of an information platform for chemical monitoring data. (This is a continuous action)

6. IMPLEMENTATION OF OTHER COMMITMENTS

6.1. Technical assistance

Obligations: Article 12: To cooperate, in response to requests to provide timely and appropriate technical assistance to developing Parties and Parties with economies in transition, especially least developed countries and small island developing states, to assist them, to develop and strengthen their capacity to implement their obligations under the Stockholm Convention. Article 12.3 places an obligation on developed country Parties to provide such assistance and also mandates the establishment of regional and sub-regional centres for capacity-building and transfer of technology.

COP5 recommendations:

- To encourage developed countries to promote the transfer to developing countries of screening and separation techniques.
- The transfer of knowledge and technology, including capacity-building to identify PFOS in articles and applications and monitor PFOS in the environment, should be promoted to support full participation in global efforts to reduce PFOS risks.
- To encourage developed countries to promote the transfer to developing countries of screening and separation techniques (for PBDE containing materials).

Implementation so far: Union technical assistance responds to requests and is financed through its aid programmes which are described in sections 2.3.2 and 2.3.3. The main instrument for assessing developing countries and partner organisations was until 2013 the Thematic Programme for Environment and Sustainable Management of Natural Resources (ENRTP) within the EuropeAid.

ENRTP has been replaced by the thematic programme on Global Public Goods and Challenges (GPGC), which covers the period 2014-2020. The initial programming for the period 2014-2017 of the GPGC Environment and Climate envelope included substantial support of the Special Programme on Chemicals and Waste, which aims at strengthening the institutional capacity in chemicals management of developing countries and countries with economies in transition.

In addition, financial support was provided to the Secretariat of the Basel, Rotterdam and Stockholm Conventions through the GPGC. Those resources were used to implement the programme of work as agreed by the Conference of the Parties, which also included the provision of technical assistance.

Analysis: The technical assistance for the implementation of the Stockholm Convention was taken up in the ENRTP “2011-2013 Strategy Paper & Multiannual Indicative Programme” as one point in “Priority 2. Environment for Development” and it was thus assured for the period until 2013.

As of 2014, the GPGC replaced the ENRTP and addressed chemicals management, including the implementation of the Stockholm Convention, under the Environment and Climate envelope and in the envelope sub-delegated to DG ENV. The latter was used to support projects carried out by the Secretariat of the BRS Conventions that inter alia provided targeted technical assistance developing countries and countries with economies in transition.

Action 26: The European Union should develop mechanisms for better coordination between the bilateral aid programmes of the Commission and those of the Member States with regards to POPs. (This is a continuous action)

6.2. Financial Assistance

Obligations: Article 13: All parties undertake to provide financial support and incentives in respect of those national activities that are intended to achieve the objective of the Stockholm Convention in accordance with their national plans, priorities and programmes. Developed country Parties are required to provide new and additional financial resources through the financial mechanism to enable developing country Parties and Parties with economies in transition to meet the agreed full incremental costs of implementing measures which fulfil their obligations under the Stockholm Convention.

Implementation so far: Basically, it is for the Member States rather than the Union to fund domestic implementation in accordance with Article 13.1. Nevertheless, the EU provides significant amount of funding both within the EU, in neighbouring countries and in developing countries, by different funding instruments in order to contribute to the implementation, updating and development of EU (environmental) policy (see section 2.3.1), including through relevant international instruments.

Regarding sound management of chemicals and waste, including the Stockholm Convention, the European Commission provides funding to developing and neighbouring countries directly and also contributes to multilateral and international programmes, such as the Special Programme to support institutional strengthening at the national level for implementation of the Basel, Rotterdam and Stockholm Conventions, the Minamata Convention and the Strategic Approach to International Chemicals Management (SAICM) and the Voluntary Trust Funds of the Basel, Rotterdam and Stockholm Conventions (see section 2.3.3).

Analysis: The EU provides funding through numerous programmes and instruments. However, there is no fund exclusively for the implementation of the Stockholm Convention. Indeed a specific fund to support partner countries to implement the Convention would not be in line with agreed international best practice in aid effectiveness since developing countries are in the best position to set their own priorities. Nevertheless the EU does recognise that for structural reasons, notably the absence of future generations in decision-making, environment tends to get neglected when countries decide on the use of aid allocated to them. It is for this reason that the EU has earmarked since 2007 a part of its development cooperation budget for environment through thematic programmes: the Environment and Natural Resources Thematic Programme in 2007-2013, and the current 2014-2020 Multi-annual Financial Framework the Global Public Goods and Challenges (GPGC) Thematic Programme includes environment as one of its priority areas. The Commission has looked for opportunities to increase requests for aid related to sound chemicals and wastes management, not least by

being the largest donor to the Quick Start Programme of the Strategic Approach to International Chemicals Management, which works to raise political awareness and action on sound chemicals management in developing countries. The EU has played a leading role in the definition and negotiation of the Integrated approach to financing sound management of chemicals and waste adopted through UNEA resolution 1/5 on chemicals and waste. That resolution launches the Special Programme to support institutional strengthening at the national level for implementation of the Basel, Rotterdam and Stockholm Conventions, the Minamata Convention and the Strategic Approach to International Chemicals Management (SAICM) that will complement the support for the Stockholm Convention provided through the Global Environment Facility (GEF).

To increase awareness and demonstrate the support provided by EU financial instruments that are relevant for POP-related action, specific information could be provided on the POP specific Commission website.

Action 27: To consider the scope for funding POPs related assistance when revising and approving the Thematic Strategy Paper (TSP) governing the use of the GPGC for the remaining period 2018–2020 and thereafter when drawing up the Annual Action Programmes (AAP). (This action was also listed within the previous implementation plan and is still ongoing)

6.3. Reporting

Obligations: Article 15: To report to the Conference of the Parties on the measures the Party has taken to implement the provisions of the Stockholm Convention and on the effectiveness of such measures in meeting the objectives of the Stockholm Convention. Reporting shall include data on the total quantity of production, import and export of the chemicals listed in Annexes A and B and a list of countries from which it has imported and exported substances.

Implementation so far: Both the Union and the Member States have to report to the COP according to the timetable laid down by the COP. In order to provide the information basis for reporting, Member States are obliged by Article 12 of the Regulation (EC) No 850/2004 to report regularly on the implementation of the Regulation to the Commission and the Commission should compile a summary and synthesis report from these Member States reports and forward them to the European Parliament and the Council. On issues which belong to the Union competence, the Commission is responsible for the joint reporting on behalf of the Union. To date three triennial synthesis reports (2004-2006, 2007-2009 and 2010-2012) have been published based on data submitted by the Member States under Article 12 of the POP Regulation, further supplemented by other existing data to provide a state of the union set of information on progress towards the objectives of the Convention. These reports are available on the European Commission website: http://ec.europa.eu/environment/chemicals/international_conventions/index_en.htm

Analysis: Reporting from Member States to the Commission is a prerequisite for the EU to be able to identify further measures for the implementation of the Stockholm Convention and also for submitting adequate reports to the Stockholm Convention. However, several Member States have not yet met their reporting obligations and the Commission should launch infringement procedures in this respect to address the issue.

Following-up on national reporting under the POP Regulation and on the still to be delivered NIPs under the Stockholm Convention, the Commission should assess which specific

exemptions and acceptable purposes are still needed respectively fix a timeline until when a complete phase-out is possible. There are hints that for example the main remaining acceptable purposes for PFOS are the use in metal plating industry and in aviation fluids (cf. section 3.2.4). For all other registered applications PFOS seems to have been phased-out. However, this would have to be verified with data and information reported by the EU's Member States.

Action 28: Commission should consider launching infringement procedures against the Member States in case of non-compliance. (This action was also listed within the previous implementation plan and is still ongoing)

Action 29: Commission to verify the need for continuation of specific exemptions and registered acceptable purposes for Annex A and Annex B substances. (This action was also listed within the previous implementation plan and is still ongoing)

6.4. Effectiveness evaluation

Obligations: Article 16: Conference of the Parties to periodically evaluate the effectiveness of the Stockholm Convention, starting four years after entry into force. The evaluation will be conducted on the basis of available scientific, environmental, technical and economic information.

Implementation so far: Article 9 of Regulation (EC) No 850/2004 stipulates that the Commission and the Member States shall establish, in close cooperation, appropriate programmes and mechanisms, consistent with the state of the art, for the regular provision of comparable monitoring data on the presence of dioxins, furans and PCBs as identified in Annex III in the environment.

Harmonised monitoring at EU-level exists for emissions of all by-product POPs through the release register E-PRTR. There is also harmonised monitoring in the area of feed and food where it is recommended that a number of defined food and feed samples are analysed yearly. Common methods for sampling and analysis ensure comparability of the results that will be compiled by the Commission in a database with the aim of having a clear picture of the time trends in background presence of these substances in feed and food.

Under the Water Framework Directive (Directive 2000/60/EC), Member States are obliged to monitor substances placed on the priority list (many of which have POP characteristics), if they are discharged into the river basin or sub-basin. In addition, Member States have to monitor also other pollutants if they are discharged in significant quantities in the river basin or sub-basin.

In order to check the feasibility of an EU coordinated approach to Human Biomonitoring (HBM), a research project on the development of a coherent approach to human biomonitoring in Europe²³⁵ was granted under the FP6 that lead into a concept to establish biomonitoring as a policy making tool. HBM is a viable tool to evaluate the effectiveness of policies because it allows good assessment of temporal trends in total human exposure to

²³⁵ http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_RCIN=7917953

environmental pollutants. In December 2009, under the FP7 funded EU project COPHES, a consortium of experts from nearly all EU countries began to work towards an EU HBM framework. The goals of the work were to harmonise national and local activities on HBM to contribute to better data comparability across the EU and to coordinate HBM programmes across the EU. This initiative has been accompanied by a feasibility study called DEMOCOPHES which started in September 2010 and concluded in November 2012 with finance from Life plus. Both projects have now been finalised and their results demonstrated that a more coordinated and harmonised approach to HBM in Europe is useful to protect the health of Europeans also in the future²³⁶

Analysis: The Union and the Member States will continue to play an active role in the international work regarding the effectiveness evaluation and will continue to generate exposure data for their territory. An information platform for chemical monitoring data will be established, to improve accessibility of the data and coherence in collection, management and assessment (see section 5.3). The platform will improve effectiveness evaluation of the implementation of the POP Regulation and of the Stockholm Convention in the EU by facilitating access to the chemical monitoring data across EU and by improving comparability of the data.

6.5. Addition of Future Chemicals to the Stockholm Convention

Obligations: The Stockholm Convention does not lay down any particular obligation concerning addition of chemicals to it but allows any Party to propose amendment of the Stockholm Convention by listing of further substances in it.

Implementation so far: The Commission has initiated the inclusion of several of the new POPs and supported the proposals submitted by other parties. The Commission has an active role in supporting the position of the Member States through review of nominated substances at EU level prior to submission to the Stockholm Convention secretariat.

Analysis: The Union and the Member States have put throughout the negotiations on the Stockholm Convention a lot of emphasis on the widening of the initial list of 12 POP substances to additional POP substances warranting global action. The proper functioning of the POP Review Committee is of crucial importance in this regard. It is evident that the Commission and the Member States need to actively participate in and support the POP Review Committee in its work in order to ensure timely and thorough evaluation of the submitted proposals.

Through the implementation of the EU legislation, particularly of REACH Regulation and Water Framework Directive, the EU is in the possession of a huge amount of valuable chemicals data. This data should be used to assess any further candidates for the inclusion into the Stockholm Convention and the POP Protocol.

The addition of the new substances to the POP Protocol in 2009 goes along with a restriction on production and use except for certain exemptions. The Commission is to verify implementation of these provisions in the EU through data gathering and exchange with Member States.

²³⁶ <http://www.eu-hbm.info>

Action 30: Commission and Member States to continue work on identification of potential POP substances warranting international action. Commission to initiate formal proposals by the Union, when appropriate. Commission and the Member States to increase and strengthen Union wide and international cooperation and information exchange concerning identification of potential POP substances and on concentrations of POP-candidate substances especially in remote regions and on the extent of trans-boundary dispersion. (This is a continuous action)

7. EU RESEARCH PROJECTS SINCE 2007 WITH REFERENCES TO POP ISSUES

Table 7 Research Projects with references to POPs funded under FP7 (by June 2011)

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
1	Impact of global change on the remobilization and Bioaccumulation of organic Pollutants in Polar aquatic food webs	FP7-People Start date: 2015-05-01 End date: 2018-04-30	<p>Global warming is affecting the Polar Areas, with some of the most rapid changes associated with warming in polar terrestrial, freshwater and marine ecosystems, associated with changes in sea ice dynamics, nutrient loadings and perturbation of sinks of persistent organic pollutants (POPs). In addition to the direct influence that increasing temperatures will have on the polar ecosystems, perturbations of the carbon cycle driven by a warming climate will affect the biogeochemical cycle of POPs, and thus their transport, fate and effects along the polar aquatic food webs.</p> <p>However, these effects are still far from being well understood. Biogeochemical cycles of POPs and C in aquatic ecosystems may be linked in various ways such as for example water-air exchange and soil-air exchange processes or metabolic processes such as respiration although there are still important gaps in the literature.</p> <p>In terms of the understanding of the impacts, the BioPollAr project aims to understand how POPs are coupled with the C-cycle in polar aquatic ecosystems and how climate change will affect the fate and bioavailability of POPs and their effects through the food webs.</p>	<p>http://cordis.europa.eu/project/rcn/186554_en.html</p>
2	Optimising the use of lichens as biomonitors of atmospheric PAHs	FP7-People Start date: 2014-04-01 End date: 2016-03-31	<p>Polycyclic aromatic hydrocarbons (PAHs) have received increased attention in recent decades in air pollution studies due to their carcinogenicity and mutagenicity. Directive 2004/107/EC recommends the use of other monitoring methods (aside from passive samplers), notably biomonitors (living organisms), to complement data and to assess spatial deposition of PAHs.</p> <p>Biomonitoring methods have been developed during the last decades for this purpose. Within biomonitors, lichens are the most used organisms to monitor atmospheric deposition of several air pollutants. However, one of the main drawbacks of using lichens to monitor atmospheric PAHs has been reported as the impossibility to translate PAH values in lichens into the atmospheric equivalents, in order to use this information for regulatory purposes.</p> <p>It is also missing an understanding of the mechanisms through which lichens intercept and accumulate PAHs, which means it is difficult to assess a critical level for PAHs in lichens – lowest level that will affect lichen structures and functions, which will be valuable when identifying areas with high ecological/environmental risk. POPLAIR aims to fulfill these gaps of knowledge and to study the feasibility of introducing lichens in the market as a well-known tool to be applied in environmental monitoring assessments</p>	<p>http://cordis.europa.eu/project/rcn/187821_en.html</p>
3	Impact of polyaromatic hydrocarbons on arbuscular mycorrhizal fungi and	FP7-People Start date: 2014-04-01 End date: 2016-03-31	<p>Polyaromatic hydrocarbons (PAHs) are frequently associated to polluted soils. PAHs are harmful for human health (carcinogenic and/or mutagenic) and can disrupt the ecosystem functioning. To clean-up the PAHs-polluted soils, phytoremediation assisted by arbuscular mycorrhizal fungi (AMF)</p>	<p>http://cordis.europa.eu/project/rcn/187767_en.html</p>

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
	biochemical and molecular mechanisms involved in plant protection and pollutant dissipation		represent an innovative approach, cost-effective and environmental friendly. The present project aims to determine the impact of PAHs on AMF having different life history strategies, i.e. adapted to grow either under stable (K-strategists) or disturbed (r-strategists) environments. We postulate that PAHs may differently affect AMF r/K-strategists which in turn may (1) protect the plant from PAHs toxicity in a different way and (2) differently participate in the dissipation of PAHs.	
4	Pollutants accumulation and effects in relation to trophic niches of the high-arctic ivory gull	FP7-People Start date: 2014-05-01 End date: 2016-04-30	Seabirds living in the Arctic coastal systems, such as the ivory gull (<i>Pagophila eburnea</i>), are particularly vulnerable to contaminants from long range transport because they bioaccumulate toxic compounds throughout their life and are top predators displaying high levels of contamination (through biomagnification). This project aims at (1) comparing temporal variations of persistent organic pollutants (POPs) and trace element levels (TEs) in the ivory gull population of Svalbard to evaluate the effect of climate change on contaminant loads in this species, (2) assess spatial variations of POPs and TEs along gulls circumpolar distribution (Svalbard, Canada, Greenland and Russia), (3) investigating the relation between contaminant concentrations and trophic habits of gulls, and (4) evaluating the effect of contaminants on wild gull metabolism at the cellular and organism levels.	http://cordis.europa.eu/project/rcn/187663_en.html
5	Next-Generation Electrochemical Technology for the Treatment of Hospital Wastewater: Electrogenerated Sulfate Radicals for Complete Destruction of Persistent Pollutants	FP7-People Start date: 2014-11-17 End date: 2016-11-16	Hospital wastewater effluents have been identified as the primary sources of DNA-damaging compounds, and are considered as the major source of antibiotic resistance in the environment. There is no established technology for the treatment of hospital wastewater. Biological treatment is incapable of degrading more persistent contaminants, e.g., organohalogenes, cytostatics, and antibacterial agents. This project proposes a next-generation technology for the treatment of contaminated hospital wastewater, based on the electrochemical generation of sulfate and hydroxyl radicals. Highly oxidizing sulfate and hydroxyl radicals are formed by applying current to an anode at atmospheric temperature and pressure. Excellent preliminary results achieved show an outstanding capacity of the electrochemically generated sulfate radicals in removing persistent organic contaminants at up to 80 times higher rates than with hydroxyl radicals alone. Sulfate radicals react mainly through electron transfer and hence are less subject to scavenging by the background matrix, which allows their accumulation in the solution and drastically enhances the oxidation efficiency.	http://cordis.europa.eu/project/rcn/185866_en.html
6	Sustainable use of Biochar in Mediterranean Agriculture	FP7-People Start date: 2013-03-01 End date: 2016-02-29	The application of biochar (charcoal or biomass-derived black carbon (BC)) to soil is proposed as a novel approach to establish a significant long-term sink for atmospheric carbon dioxide in terrestrial ecosystems. Additionally the fertilizing properties of biochar were re-discovered and are nowadays divulged and encouraged within the concept of using biochars produced under controlled combustion conditions as soil amendment. On the other hand, Polycyclic Aromatic Hydrocarbons (PAHs), persistent organic pollutants formed during biochar production due to incomplete combustion process (pyrolysis step), will enter the environment when the biochar is applied as soil conditioner.	http://cordis.europa.eu/project/rcn/108342_en.html

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
			However, an accurate assessment of the impact of biochar addition on the release of PAHs is still missing and will constitute the other main objective of this proposal.	
7	Global contaminated land management	FP7-People Start date: 2011-12-01 End date: 2015-11-30	<p>Complex hazardous contamination of soil and water are obstructing sustainable re-development of previously industrialized urban land in Europe as well as in China.</p> <p>The main objective of this program is to strengthen the quality of research by developing international collaborations and advance the decision making on complex issues in contaminated land management. Specifically, in this collaboration UNIVE will involve its expertise on multicriteria decision analysis, decision support systems and risk assessment. UmU will bring understanding of mobilization processes for persistent organic and inorganic pollutants in soil and ground water. CRAES will offer its expertise on ecology, risk assessment and management of contaminated site and BNU on environment risk assessment and characteristic of soil pollution.</p> <p>This will be done by the organization of several exchange activities in the fields of contaminated soil characterization, environmental risk assessment and decision making processes. These exchange activities aim to increase quality and mutual benefit of the transfer of knowledge between the involved researchers from EU and China.</p>	http://cordis.europa.eu/project/rcn/101419_en.html
8	ACROPOLIS, Aggregate and cumulative risk of pesticides: an on-line integrated strategy, EU Contribution €3M	FP7-KBBE Start date: 2010-06-01 End date: 2013-05-31	<p>Improvement of cumulative exposure assessment and cumulative hazard assessment methodology;</p> <p>Development of new models for aggregated exposure assessment addressing different routes of exposure;</p> <p>Setting up of new toxicological testing for identifying possible synergistic effects and development of a strategy for refinement of cumulative assessment groups;</p> <p>Integration of cumulative and aggregate risk models integrated in a web-based tool, including accessible data for all stakeholders;</p> <p>Improvement of the understanding of cumulative risk assessment methodology of different stakeholders.</p>	http://acropolis-eu.com/
9	ARCRISK, Arctic Health Risks: Impacts on health in the Arctic and Europe owing to climate-induced changes in contaminant cycling, EU Contribution €3.5M	FP7-ENVIRONMENT Start date: 2009-06-01 End date: 2013-12-31	<p>Exploration and use of selected climate change and chemical usage scenarios, the changing routes and mechanisms by which persistent chemical pollutants and air pollutants are delivered to the Arctic and the possible role of global climate change.</p> <p>Study of the deposition and accumulation of air pollutants and persistent chemical pollutants on snow/ice and on ice-free surfaces, their fate and transfer to aquatic food chains with melt-water runoff.</p> <p>Exploration of the transfer of pollutants from the abiotic Arctic environment into the base of food chains and to higher trophic level organisms (e.g., fish, marine mammals, reindeer) consumed by humans.</p> <p>Comparison of the role of climate change on the transport, fate and food web transfer of pollutants in</p>	http://www.arcrisk.eu/

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
			the Arctic to the situation in relevant selected areas with exposed local populations in the EU; Identify and quantify the current main health outcomes in relation to exposure to 'legacy' contaminants in selected populations in the Arctic and exposed local populations in the EU.	
10	BASELINE, Selection and improving of fit-for-purpose sampling procedures for specific foods and risks, EU Contribution €5.15M	FP7-KBBE Start date: 2009-08-01 End date: 2013-07-31	Review of the sampling schemes currently available for food authorities and food producers to perform food safety quantitative risk assessment in a European level; Assessment of the relevance and suitable limit values of Performance Objectives (POs) and Food Safety Objectives (FSOs) for biological and chemical risks; Evaluation of the need for new or adapted methods for sampling and testing of the risk factors identified. The selected protocols and methods should be able to produce suitable data for risk analysis; Development of predictive mathematical models for biological risks and investigate and model sources and pathways of chemical contaminants to improve sampling schemes; Validation and harmonisation of the sampling schemes developed in the project and alternative detection methods; Sharing and dissemination of the scientific knowledge deriving from the project to stakeholders.	http://www.baselineurope.eu/
11	BASIS, PAH Anaerobic Biodegradation Assessment by Stable Isotope Technologies, EU Contribution €170,000	FP7-PEOPLE Start date: 2011-05-01 End date: 2013-04-30	The main goals of this proposed project are to assess in situ biodegradation of PAHs under anaerobic environments in marine and fresh water systems, to describe microbial activities and to identify microbial key players	http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&DOC=1&CAT=PROJ&QUERY=0130b705787f.3ad5:58e8706f&RCN=98660 - no project website
12	BAYEX, Atmospheric Exchange of Persistent Chemicals in Bothnian Bay, Northern Baltic Sea, EU Contribution €240,000	FP7-PEOPLE Start date: 2011-04-15 End date: 2013-04-14	Atmospheric deposition and air-sea exchange of persistent chemicals in Bothnian Bay are investigated with goals of understanding current atmospheric loadings and how future loadings will respond to changes in ice cover and air concentrations	http://eu.project.umu.se/projectweb/4a851ad5f0ec5/Baltic%20region.html http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&DOC=1&CAT=PROJ&QUERY=0130b701efac.1e64:56f2a86f&RCN=96896 - no project website
13	BRIDGE, Bridging mecha-	FP7-KBBE	Risk assessment data for exposure to contaminants in milk, particularly during the vulnerable stages	http://www.ncp-

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
	nisms into risk assessment: An integrated European research network targeting contaminants in milk, EU Contribution €3.48M	Duration: 36 months	of foetal and infant development; characterisation of the endocrine disruptive effects of chemical and microbiological toxins in milk and produce novel tools to improve consumer safety and prevent disease.	bio.net/media/document/s/successstories/bridge.pdf - no project website
14	BROWSE, Exposure models to assess the risks to operators, workers, residents and bystanders from exposure to plant protection products (PPPs), EU Contribution €2M	FP7-ENVIRONMENT Start date: 2011-01-01 End date: 2013-12-31	Review, improve and extend the models currently used in the risk assessment of plant protection products (PPPs) to evaluate the exposure of operators, workers, residents and bystanders. Use the new and improved exposure models to contribute to the implementation of Regulation (EC) 1107/2009 on authorisation of PPPs, replacing Directive 91/414/EC and the implementation of the Thematic Strategy on the Sustainable Use of Pesticides. Involve all relevant stakeholders and end-users and take full account of relevant gender issues in developing the exposure models and policy tools.	http://cordis.europa.eu/fetch?CALLER=FP7_ENV_PROJ_EN&ACTION=D&DOC=56&CAT=PROJ&QUERY=0129fe7c8e02:8b2f:41abc192&RCN=97105 - no project website
15	CADASTER, Case studies on the development and application of in silico techniques for environmental hazard and risk assessment, EU Contribution €2.69M	FP7-ENVIRONMENT Start date: 2009-01-01 End date: 2012-12-31	The project provides a practical guidance to integrated risk assessment by carrying out a full hazard and risk assessment for chemicals belonging to four compound classes. Collection of data and models; development and validation of QSAR models; integration of QSARs within hazard and risk assessment; outreach via development of website, newsletters/workshop(s) and standalone tools for dissemination of project results.	http://www.cadaster.eu/
16	CARBPOL, Investigating the role of the carbon cycle on the environmental fate of semivolatile organic pollutants, EU Contribution €170,000	FP7-PEOPLE Start date: 2008-04-01 End date: 2010-03-31	Semivolatile organic compounds (SOCs) are a heterogeneous class of chemicals including many ubiquitous toxic pollutants such as the notorious persistent organic pollutants (POPs). The main hypothesis behind the present project is that the C cycle controls the global environmental cycling of SOCs.	http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&DOC=1&CAT=PROJ&QUERY=0130b706c02a:6e26:55bf2629&RCN=87358 - no project website
17	CLEAR, Climate Change, Environmental Contaminants and Reproductive Health, EU Contribution €2.37M	FP7-ENVIRONMENT Start date: 2009-05-01 End date: 2013-04-30	Identification and description of mechanisms by which climate change affect the exposure of Arctic and other human populations to contaminants through change in chemical use and emissions, delivery to the ecosystems as well as processing within the physical environment and human food chain; Expansion of the existing knowledge database on human contaminant exposure in the Arctic and selected European countries by measurements of biopersistent and non-persistent compounds in serum samples, namely polybrominated diphenylethers, perfluorinated surfactants, phthalates and metals; Increase knowledge on links between parental blood levels of environmental contaminants and	http://www.inuendo.dk/clear/

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
			reproductive health outcomes in terms of functional and biological measures of fertility and child development; Investigation of mechanisms related to effects of contaminants on reproductive health; Integration of data on relative climate induced changes in contaminant mobility and distribution, external and internal exposure of humans and links between contaminant exposure and health surveys into a risk assessment and risk evaluation.	

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
18	CONFIDENCE, Contaminants in food and feed: inexpensive detection for control of exposure, EU Contribution €5.8M	FP7-KBBE Start date: 2008-05-01 End date: 2012-04-30	Provide long-term solutions to the monitoring of POPs, perfluorinated compounds, pesticides, veterinary pharmaceuticals (coccidiostats, antibiotics), heavy metals and biotoxins (alkaloids, marine toxins, mycotoxins) in high-risk products such as fish and fish feed; Assurance of quality and safety in the European food supply from farm to fork by the development of new simplified detection methods for chemical contaminants with effective features; development of new detection tools for key and emerging risks as recognised by the European Food Safety Agency (EFSA); improvement of consumer exposure assessments to achieve a better understanding of contaminant levels in food and feed; contribution to the validation of risk-benefit and predictive hazard behaviour models in accordance with the strategic agenda of the European Technology Platform (ETP) Food for Life; extensive dissemination and training of new detection methods to all relevant stakeholders, including industrial and governmental end-users and students, to advance technology exploitation.	http://www.confidence.eu/
19	CONTAMED, Contaminant mixtures and human reproductive health – novel strategies for health impact and risk assessment of endocrine disrupters, EU Contribution €3.5M	FP7-ENVIRONMENT Start date: 2008-05-01 End date: 2011-12-31	The project will explore the hypothesis that combined exposure to endocrine disrupting chemicals (EDC) in foetal life may lead to adverse delayed impacts on human reproductive health. Preparation of the ground for epidemiological studies able to capture cumulative EDC exposure by developing and evaluating biomarkers for total effective internal EDC load; Substantiation of observations from human studies in extended developmental toxicity rat studies by investigating the possible role of mixtures of oestrogens, anti-androgens and other classes of EDC in producing long-lasting delayed adverse reproductive effects at environmentally relevant levels; Bringing together human epidemiology and predictive toxicological risk assessment by comparing internal EDC exposures in humans with those resulting from controlled exposures producing clear effects in laboratory animal experiments; Searching for previously unrecognised EDCs in human tissues.	http://www.contamed.eu/
20	COPHES, Consortium to Perform Human Biomonitoring on a European Scale, EU Contribution €4M	FP7-ENVIRONMENT Start date: 2009-12-01 End date: 2012-11-30	The project will develop a coherent approach to human biomonitoring (HBM) in Europe, using existing and planned HBM projects and programmes of work and capabilities. It will investigate what is needed to advance and improve comparability of HBM data across Europe. Definition of priorities for biomonitoring of chemical exposures and effects in the general European population; improvement of comparability of HBM data in Europe by developing strategies to harmonise recruitment, sampling, quality control, data exchange, data analysis, and reporting strategies; guarantee of high scientific standards and use of up-to-date scientific technology and approaches in human biomarker development and integration of HBM into health impact assessment; provision of a communication strategy and common ethical standards, development of a programme for capacity building and of a concept for sustainable organisation and structure of an EU HBM network.	http://www.eu-hbm.info/
21	CYTOTHREAT, Fate and effects of cytostatic pharmaceuticals in the	FP7-ENVIRONMENT Start date: 2011-01-01	Assess the risks of pharmaceuticals released in the environment, focusing on cytostatic drugs because of genotoxic properties which may cause unexpected long term effects. Their release in the environment may lead to systemic ecological effects and increased cancer incidence, reduced fertility	http://www.nib.si/eng/index.php/aktualno/projekt/287-national-

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
	environment and identification of biomarkers for an improved risk assessment on environmental exposure, EU Contribution €2.58M	End date: 2014-12-31	and malformations in the offspring in humans. Special emphasis is put on the combined effects of environmentally relevant mixtures; combination of state-of-the art analytical chemistry, in vivo and in vitro systems, and 'OMICS' technologies is applied. Comparisons with the hazardous effects of other groups of pharmaceuticals will provide knowledge on the magnitude of the problem; it will generate new knowledge on environmental and health risks of cytostatics and provide objective arguments for recommendations and regulations.	institute-of-biology-nib-is-coordinating-7-framework-programme-project-which-has-33-million-eur-budget.html - no project website yet
22	DEER, Developmental Effects of Environment on Reproduction, EU Contribution €3.5M	FP7-ENVIRONMENT Start date: 2008-05-01 End date: 2012-04-30	This research project will improve the understanding of the role of environmental factors in the development and establishment of human reproductive health. Investigation of connections between normal and abnormal foetal and perinatal reproductive development and subsequent maturation of reproductive function at puberty and in adulthood; study of systemic gene-environment interactions underlying reproductive disorders taking into account genetic susceptibility, multiple exposures (mixtures of environmental chemicals and natural products) and their timing (perinatal, peripubertal, adult); investigation of connections between perinatal reproductive development and obesity/metabolic disorders in later life.	http://www.eu-deer.net/index.htm
23	DEHALORES, Breathing chlorinated compounds: unravelling the biochemistry underpinning (de)halorespiration, an exciting bacterial metabolism with significant bioremediation potential, EU Contribution €1.15M	FP7-IDEAS Start date: 2008-09-01 End date: 2013-08-31	Seeks to unlock the full potential of bacterial metabolism for bioremediation of persistent organohalides, such as polychlorinated biphenyls (PCBs) and tetrachloroethene. However, the regulation, mechanism and structure of the reductive dehalogenase (the enzyme responsible for delivering electrons to the halogenated substrates) are poorly understood. This ambitious proposal seeks to study representatives of the distinct reductive dehalogenase classes as well as key elements of the associated regulatory systems.	http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&DOC=1&CAT=PROJ&QUERY=0130b2397c56:cc2a:18356864&RCN=87942 - no project website yet
24	DENAMIC, Developmental neurotoxicity assessment of mixtures in children, EU Contribution €6.99M	FP7-ENVIRONMENT Duration: 48 months	Exposure to low doses of environmental biologically active contaminants during human development can alter gene expression and have deleterious effects on cognitive development in childhood. project is focused on reducing such effects of environmental contamination on learning and developmental disorders in children. It aims to study and evaluate environment-health relationships in children. Develop tools and methods for neurotoxic effects of mixtures of environmental pollutants at low levels, possibly resulting in (subclinical) effects on learning (cognitive skills) and developmental disorders in children; study mechanisms of disease development and the role of individual susceptibility; improve assessment of exposures and effects, focus on combined exposures to environmental agents that can interact to enhance adverse effects and reduction of health inequalities of children through Europe; dissemination will ensure the project results to arrive at policymakers' desks, and will also illustrate the subject for a scientific audience and the public. The very large network of the consortium ensures dissemination to European industries, and every other interested	http://ec.europa.eu/research/environment/pdf/fp7_catalogue.pdf - no project website yet

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
			stakeholder.	
25	ENFIRO, Life Cycle Assessment of Environment-Compatible Flame Retardants: Prototypical Case Study, EU Contribution €3.16M	FP7-ENVIRONMENT Start date: 2009-09-01 End date: 2012-08-31	The project offers a prototypical case study on substitution options for specific brominated flame retardants (BFRs). It delivers a comprehensive dataset on viability of production and application, environmental safety, and a life cycle assessment of the alternative flame retardants (FRs). Collection of information on the availability of alternative FRs, their characteristics in relation to fire safety regulations, environmental behaviour, possible toxic effects, economic aspects, compatibility with polymer production and impact on the function and reliability of end products; selection of substitution options for specific BFRs for further study in a small number of case studies; technical assessment studies on application requirements regarding production properties and application functions; technical assessment on five alternative FR/product combinations: printed circuit boards, electronic components, injection-moulded products, textile back coatings and intumescent paints; determination of toxicological effects and environmental behaviour, performance of risk assessment based on all environmental and human hazard information and performance of life-cycle assessment (LCA) and a life cycle costing (LCC) analysis of the alternative FRs studied.	http://www.enfiro.com/
26	ENRIECO, Environmental Health Risks in European Birth Cohorts, EU Contribution €0.91M	FP7-ENVIRONMENT Start date: 2009-03-01 End date: 2011-02-28	The project will focus on exposure response relationships in environment and health in pregnancy and early childhood based and supported of the wealth of data generated by past or ongoing studies funded by the EU and national programmes. Inventories of birth cohorts, including health and exposure data, biological samples, environmental exposure response functions, expertise, and access; assurance of quality and interoperability and validation of exposure, health and exposure-response data; extraction and rigorous evaluation of quality of the data, including developing protocols; data access, databases and analysis, including setting-up of protocols for data access, database building and analyses, and exposure-response analyses; conduction of specific analyses on exposure and health data to obtain exposure-response functions and specific meta/pooled analyses to obtain exposure-response functions; recommendations for data collection in the future to improve environment health linkages and information for data collection (exposure, health etc), for possible analyses (laboratory and statistical) and for exchange of knowledge between (older and newer) cohorts; dissemination of information through the project website, virtual network, workshop(s), easy accessible info and a database with exposure-response functions.	http://www.enrieco.org/
27	ENVIROGENOMARKER S, Genomic Biomarkers of Environmental Health, EU Contribution €3.5M	FP7-ENVIRONMENT Start date: 2009-03-01 End date: 2013-02-28	The project will aim at the development and application of a new generation of biomarkers to study the role of environmental agents in human disease. Discovery and validation of novel biomarkers predictive of increased risks of chronic diseases, in which the environment may play an important role (breast cancer, NHL, allergy, neurological and immune diseases, thyroid disruption); exploration of the association of such risk biomarkers with environmental exposures, including high-priority pollutants (carcinogens and immunotoxicants) and emerging exposures (such as phthalates and brominated flame retardants), many of which are also endocrine disrupters; discovery and validation of biomarkers of exposure to the above and other	http://www.envirogenomarkers.net/

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
			high-priority environmental exposures (e.g., water disinfection by-products).	
28	EXPLOIT-CSIA, Exploiting the potential use of compound specific isotope analysis (CSIA) in marine environment, EU Contribution €240,000	FP7-PEOPLE Start date: 2010-09-01 End date: 2012-08-31	To explore, develop and exploit the potential use of Compound Specific Isotope Analysis (CSIA) to PAHs and POPs compound groups in marine environments in order to unambiguously allocate and distinguish their contaminant sources, track their contamination pathways (environmental forensics), identify and quantify transformation reactions, chemical or biological remediation processes as well as degradation mechanisms	http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&DOC=1&CAT=PROJ&QUERY=0130b71262d3:c74c:56e3be5f&RCN=96372 - no project website yet
29	FACET, Flavourings, Additives and food Contact materials Exposure Task, EU Contribution €5.88M	FP7-KBBE Start date: 2008-09-01 End date: 2012-08-31	The project will estimate exposure to flavours, additives and food contact materials across Europe and the creation of a food chemical exposure surveillance system. Recording the occurrence levels of targeted chemicals in representative regions of the EU food supply. This will include a major survey of food packaging usage in countries representative of the regional groupings of FACET; creation of a database of targeted food chemical concentrations in foods, working closely with the food and packaging sectors, and the regulatory authorities; establishment of a migration modelling framework for complex packaging materials into foods under real conditions of use to deliver realistic concentration estimates for consumer exposure modelling; construction of a tiered food intake database aimed at foods, which are relevant to the target food chemicals; development of a personal computer-based, publicly available software programme, taking in to account the variation of national food consumption data, which will draw on limited data, build on known laws governing food intake and in particular build on small national surveys and local knowledge to model regional intake of target foods; building of new databases, populate them with the data generated by the project and to estimate exposure assessment using a probabilistic model.	http://www.ucd.ie/facet/
30	FOODSEG, Safe food for Europe – Coordination of research activities and dissemination of research results of EU funded research on food safety, EU Contribution €1M	FP7-KBBE Start date: 2011-05-01 End date: 2014-04-30	The project will disseminate state-of-the-art research results in food safety and quality topics through a series of symposia, expert working group meetings, an online platform with best practise examples and coordination of cooperation and a plan for the preparation of future activities.	http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&DOC=1&CAT=PROJ&QUERY=0130b6fc6aa8:2f48:57083f56&RCN=98810 - no project website yet
31	HEROIC, Health and environmental risks: organisation, integration and cross-fertilisation of scientific knowledge, EU	FP7-ENVIRONMENT Duration: 36 months	Due to the lack of mutual understanding between experts of individual disciplines, data from toxicological and ecotoxicological studies is not readily accessible by risk assessors across disciplines. However, the need for risk assessment (RA) will continue to along with budget restrictions and political and public pressure to reduce the number of animal tests. More cost effective, predictive and rapid tests for high quality sustainable RA are needed including a	http://ec.europa.eu/research/environment/pdf/fp7_catalogue.pdf - no project website yet

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
	Contribution €0.98M		better exploitation of existing data. Better risk communication to regain consumer/public trust and to give unambiguous guidance for improved risk management. Divergence often arises on risk policies and measures, sometimes due to different RA approaches. The project will establish and co-ordinate a global network of European and international experts and stakeholders from different disciplines to establish stronger interfaces between human and environmental RA, between RA and risk management, between the various agencies and countries within the EU and between agencies and industry.	
32	INTERNAL EXPOSURE, Internal exposure in tissue equilibrium sampling to bridge the missing link between bioavailability and bioaccumulation, EU Contribution €180,000	FP7-PEOPLE Start date: 2008-04-15 End date: 2011-10-14	The overall goal of this application is to improve the understanding of the link between concentrations of organic contaminants in the marine environment and the contaminant levels in the tissues of higher organisms where adverse effects are occurring, analysing internal exposure, bioaccumulation and bioavailability of organic contaminants. Investigation in the missing link between external concentrations of POPs and their levels at target sites in organisms where adverse effects occur.	http://www.itm.su.se/page.php?pid=492
33	MARPAH, Marine micro-algae as global reservoir of polycyclic aromatic hydrocarbon degraders, EU Contribution €330,000	FP7-PEOPLE Start date: 2008-10-20 End date: 2011-10-19	To manage and mitigate the impacts of PAH pollution in the marine environment, it is necessary that we understand the mechanisms involved in their biodegradation.	http://cordis.europa.eu/fetch?CALLER=FP7_PROJECT_EN&ACTION=D&DOC=1&CAT=PROJ&QUERY=0130b236ede:17bb:77108fab&RCN=88345 - no project website yet
34	OBELIX, Obesogenic Endocrine disrupting chemicals: Linking prenatal exposure to the development of obesity later in life, EU Contribution €3M	FP7-KBBE Start date: 2009-05-01 End date: 2013-04-30	It will investigate if prenatal exposure to endocrine disrupting compounds in food plays a role in the development of obesity and related disorders later in life. Assessment of prenatal exposure in humans to major classes of EDCs in food identified as potential inducers of obesity and related disorders later in life, using mother-child cohorts from various European regions with different food contaminant exposure patterns; Relating markers for early life exposure to EDCs with effect biomarkers, novel biomarkers and health outcome data, which are related to risk for obesity and related disorders later in life; Performing hazard characterization of in utero exposure to representatives of major classes of EDCs in food with respect to the development of obesity later in life, using dose-response analysis in a rodent (mouse) model; Determination of mechanisms of action of obesogenic EDCs using analysis of effect biomarkers, gene expression and epigenetic analysis. Mouse models, in vitro models and analysis in peripheral mononuclear cells of biological samples from the cohorts, will be used as complementary tools; Performing risk assessment of prenatal exposure to obesogenic EDCs in food, by integrating maternal exposure through food, contaminant exposure and health effect data in children, and hazard	http://www.theobelixproject.org/

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
			characterization and mechanistic information in animal and in in-vitro studies.	
35	OPENTOX, An open source predictive toxicology framework, EU Contribution €2.97M	FP7-HEALTH Start date: 2009-07-01 End date: 2014-06-30	<p>The project will create a unified access framework to toxicological data, quantitative models and supporting information and it will provide tools for the integration of data from various sources. Development of a framework providing a unified access to toxicity data, (Q)SAR models, procedures supporting validation and additional information that helps with the interpretation of (Q)SAR predictions;</p> <p>Provision of accessibility at three levels: (i) A simple and intuitive interface for toxicological experts that provides unified access to (Q)SAR predictions, toxicological data, (Q)SAR models and supporting information; (ii) An expert interface for the streamlined development and validation of new (Q)SAR models; (iii) An application programming interface for the development, integration and validation of new (Q)SAR algorithms;</p> <p>Development as an open source project to optimise the dissemination and impact, to allow the inspection and review of algorithms and to attract external contributors;</p> <p>Close collaboration with related projects (e.g., OECD QSAR toolbox) and relevant authorities to agree on common standards and to avoid duplicated and redundant work.</p>	http://www.opentox.org/
36	OUTREACH, Overlooked Unresolved Toxic Organic Pollutants: Resolution, Identification, Measurement and Toxicity, EU Contribution €2M	FP7-IDEAS Start date: 2009-07-01 End date: 2014-06-30	Identification, measurement and study of the effects of unresolved and unidentified, complex mixtures (UCMs) of organic chemicals	http://cordis.europa.eu/fetch?CALLER=FP7_PROJECT_EN&ACTION=DETAILS&DOC=13&CAT=PROJECT&QUERY=0130b2290de1:7015:28acdc28&RCN=91068 - no project website yet
37	PERFOOD, Perflourinated organic in our diet, EU Contribution €3M	FP7-KBBE Start date: 2009-08-01 End date: 2012-07-31	<p>The project focuses on the development of robust and reliable analytical tools, including reference materials for the determination of PFCs in food items. The aim is to qualify and quantify PFCs in our diet, understand how PFCs are transferred from the environment into dietary items, and quantify the possible contribution of food/beverage contact materials and food and water processing to the overall PFC levels in our diet.</p> <p>Assessment of the origin of PFCs in our diet and the contribution of the diet to the total human exposure to PFCs; development of robust and reliable analytical tools for the determination of PFCs, and using of these to (i) qualify and quantify PFCs in our diet; (ii) understand how PFCs are transferred from the environment into dietary items, and (iii) quantify the possible contribution of food/beverage contact materials and food and water processing to the overall PFC levels in our diet; evaluation of the possible routes, including their relative importance, of human exposure to PFCs via our diet; assessment of the role of the technosphere in the contamination of our food; identification of ways to reduce the PFC contamination of dietary articles.</p>	http://www.perfood.eu/

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
38	PHARMAS, Ecological and human health risk assessments of antibiotics and anti-cancer drugs found in the environment, EU Contribution €2.8M	FP7-ENVIRONMENT Start date: 2011-01-01 End date: 2013-12-31	Assess the risks to wild animals and humans posed by environmental exposure to pharmaceuticals. This project will concentrate on two classes of human pharmaceuticals, namely antibiotics and anti-cancer drugs, considering uncertainty to obtain accurate data on both exposure concentrations and effects levels.	http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&DOC=7&CAT=PROJ&QUERY=012d5027c1d5:b8ab:4d39d878&RCN=97551 - no project website
39	QSAFFE, Quality and safety of feeds and food for Europe, EU Contribution €2.99M	FP7-KBBE Start date: 2011-03-01 End date: 2014-08-31	The project will deliver better, faster and economically viable means of ensuring the quality and safety of animal feeds in Europe. Provide an integrated approach to the reduction and management of chemical and microbiological contamination in animal feeds, better ways of preventing contamination and fraud, identifying and assessing new risks and providing scientific evidence of the risks of transfer of microbiological and chemical contaminants from feed to food. Development of new strategies for quality and safety assurance in the feed chain using existing testing methods and emerging technologies; development and improvement of systems of traceability and authenticity monitoring of the major feed materials used in Europe; identify the emerging risks (chemical and microbiological) from new sources of animal feed materials that may arise from changes to the formulation/composition of animal feeds and due to economic factors; undertake optimization and application of pharmaco-kinetic models focussing on a number of carefully selected transfer problems such as dioxins and PCBs, melamine and related compounds, Salmonella spp. and Listeria monocytogenes based on existing data and data generated in the studies performed within the project.	http://www.qsaffe.eu/
40	REEF, Reproductive effects of environmental chemicals in females, EU Contribution €2,92M	FP7-ENVIRONMENT Start date: 2008-05-01 End date: 2011-04-30	The project will use a pattern of gestational development similar to humans, exposed long-term to a broad range of environmental chemicals (ECs) at low/environmental concentrations. This will provide a real-life model for human exposure. Examination of the effects of sewage sludge exposure during specific periods of foetal ovarian development in the sheep; examination of the effects of environmental concentrations of bis(2-ethylhexyl)phthalate (DEHP) and polychlorinated biphenyls (PCBs) on female reproductive development in the sheep and mouse; investigation of the transgenerational effects of DEHP and PCB exposure on F2 sheep and mouse ovaries; examination of the effects of DEHP and PCBs on cultured human and sheep foetal ovaries; integration of human and animal models.	http://www.abdn.ac.uk/reef/
41	SYSTEQ, The development, validation and implementation of human systemic Toxic Equivalencies (TEQs) as biomarkers for dioxin-like	FP7-ENVIRONMENT Start date: 2009-02-01 End date: 2013-01-31	TEQs are developed as biomarkers for exposure and risk of dioxin-like compounds, since chlorinated dioxins and biphenyls (PCBs) commonly occur in the human food chain and can still be detected at levels that might cause long term health effects. Establishment of possible differences between 'uptake' and 'systemic' TEFs; study of novel quantifiable biomarkers in in-vitro experiments; exploration of the possibility to use effects in peripheral lymphocytes as novel biomarkers; study of differences in TEFs between humans and	http://www.systemeproject.eu/

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
	compounds, EU Contribution €2.7M		experimental animal species in in-vitro experiments; testing of polychlorinated dibenzodioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs) in different in vitro systems; comparison of systemic TEFs (rodent models) and in vitro TEFs (rodent and human models) by applying multivariate statistical techniques; contribution to risk assessment; validation of biomarkers; contribution to establishing international consensus values of human 'systemic' TEF values for dioxin-like compounds, including some highly toxic PCBs.	
42	TATOO, Tagging Tool based on a Semantic Discovery Framework, EU Contribution €2.52M	FP7-ICT Start date: 2010-01-01 End date: 2012-12-31	To set up a semantic web solution to close the discovery gap that prevents a full and easy access to environmental resources on the web. The Central and Eastern European Centre for Persistent Organic Pollutants will participate in the project of validation.	http://www.tatoo-fp7.eu/tatooweb/
43	TMP53COMPPIX, Transcriptional mutagenesis in mammalian cell systems: p53 signaling as a probe of cellular effects, EU Contribution €100,000	FP7-PEOPLE Start date: 2010-05-01 End date: 2014-04-30	The model is based on the central role of p53 in the cellular response to DNA damages derived from carcinogenic polycyclic aromatic hydrocarbons (PAHs).	http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&DOC=1&CAT=PROJ&QUERY=0130b238120e:ba93:06e913f6&RCN=94459 - no project website yet
44	TRANSPHORM, Transport related Air Pollution and Health impacts - Integrated Methodologies for Assessing Particulate Matter, EU Contribution €6.91M	FP7-ENVIRONMENT Start date: 2010-03-01 End date: 2014-02-28	The project will develop and implement an integrated methodology to assess the health impacts of particulate matter (PM) resulting from transport related air pollution. Quantification of pollutant-specific human exposure to airborne particulate matter in urban environments resulting from emissions from the main transport sectors; conduction of measurement campaigns in Rotterdam, Helsinki and Thessaloniki for source apportionment, exposure assessment and model evaluation purposes establishing new and unique datasets to better reflect actual exposure to air pollution caused by the transport sector; development, improvement and integration of air quality dispersion and exposure models for urban and regional scales; determination of improved and, where necessary, new emission factors of ultrafine particle number expressed as PN0.1 and mass fractions of PM1, PM2.5 and PM10 for key transport sources; development of an integrated assessment methodology to connect the various transport sources to human exposure to air pollution; development of new concentration-response or exposure-response functions linking long and short-term ambient residential exposure to size-resolved and speciated PM with key health endpoints; application of the full chain integrated health assessment method to a number of selected European cities experiencing pollution from road traffic, harbours and shipping, airports and other sources such as railways.	http://www.transphorm.eu/

Table 8 Research Projects with references to POPs funded under the FP6 and by other programmes, focusing on projects with starting date from 2007 on.

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
1	ATHON, Assessing the toxicity and hazard of non-dioxin-like (NDL)-PCBs present in food, EU Contribution €4.61M	FP6-FOOD Start date: 2006-04-01 End date: 2010-03-31	<p>NDL-PCBs are poorly characterised from a toxicological point of view and constitute a major part of the PCBs found in food and human tissues. It aims to provide missing critical information for hazard characterisation, to clarify biological mechanisms underlying the various types of toxicity of NDL-PCBs and to evaluate these data from a regulatory toxicology point-of-view.</p> <p>Establish quality-controlled experimental in vivo and in vitro models for studies of NDL-PCBs; provide toxicokinetic data of for NDL-PCBs and quantitative and qualitative toxicity profiles for NDL-PCBs; provide a new classification strategy for NDL-PCB congeners based on effect biomarker information; provide an up-to-date compilation and evaluation of toxicological effect and exposure data on NDL-PCBs and PCB metabolites.</p>	http://www.cascadenet.org/~athon
2	BENERIS, Benefit-risk assessment for food: an iterative value-of information approach, EU Contribution €0.64M	FP6-FOOD Start date: 2006-04-01 End date: 2009-09-30	<p>Food safety and risks are highly sensitive issues, sometimes resulting in crises. This project will undertake a benefit/risk assessment with an iterative top-down approach to explore risks of food and its contaminants.</p> <p>Develop and use integrated methods to evaluate both the risks and health benefits related to any given food item. Decision analytical methods will be used to find out the critical uncertainties for decision-making; work on existing databases of food intake and nutrients, and food consumption studies in several European countries and its applicability to other countries; estimation of health effects of contaminants and nutrients by using new methods, integrating both epidemiological and toxicological data.</p>	http://www.ist-world.org/ProjectDetails.aspx?ProjectId=3cef10b6d8c74fbb8291eb7c4a1d005e&SourceDatabaseId=7cff9226e582440894200b751bab883f http://cordis.europa.eu/fetch?CALLER=FP6_PROJ&ACTION=D&DOC=2&CAT=PROJ&QUERY=0130b7231180:68af:57db2ab4&RCN=79852

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
3	CASCADE, Chemicals as contaminants in the food chain: a Network of Excellence (NoE) for research, risk assessment and education, EU Contribution €14.4M	FP6-FOOD Start date: 2004-02-01 End date: 2010-01-31	The harmful effects of dietary chemical contaminants represent a major health problem in every society. However since there is insufficient information it has proved difficult to assess the health risks they constitute for humans. Europe has recognized this threat and extensive research efforts have been undertaken to identify the problems caused by food borne contaminants. A European wide Network of Excellence (NoE) under the leadership of the Karolinska Institutet has been established to enhance coordination and integration of information, procedures and measures in the European level on the human health effects of chemical residues in food.	http://www.cascadenet.org/
4	CAT-DEC, New catalysts prepared from LDH for reductive dechlorination: towards an alternative POP destruction system, EU Contribution €150,000	FP6-MOBILITY Start date: 2007-01-01 End date: 2008-12-31	Alternative approach for destruction of polychlorinated chemicals via catalytic reduction. The main objective is to develop a new dechlorination system based on the supported metal catalysts prepared from layered double hydroxides	http://cordis.europa.eu/fetch?CALLER=FP6_PROJ&ACTION=D&DOC=1&CAT=PROJ&QUERY=0130b280aa74:cf18:5bcab2fa&RCN=82650
5	DELAC, Engineering fungal laccases by directed molecular evolution and semi-rational approaches: application in bioremediation of polycyclic aromatic hydrocarbons (pahs), EU Contribution €150,000	FP6-MOBILITY Start date: 2007-09-24 End date: 2009-09-23	The current research proposal claims to carry out the technology of the enzymatic bioremediation of polycyclic aromatic hydrocarbons (PAHs) by using biocatalysts (both native and tailored by directed molecular evolution).	http://cordis.europa.eu/fetch?CALLER=FP6_PROJ&ACTION=D&DOC=1&CAT=PROJ&QUERY=0130b286d0a6:0fc3:69e600d5&RCN=82587
6	ENDURE, European Network for the Durable Exploitation of crop protection strategies, EU Contribution €11.2M	FP6-FOOD Start date: 2007-01-01 End date: 2010-12-31	Cross-disciplinary project for the development and implementation of pest control strategies, reduction of pesticides inputs and the creation of supporting network institutions for training and services.	http://cordis.europa.eu/fetch?CALLER=FP6_PROJ&ACTION=D&DOC=1&CAT=PROJ&QUERY=0130b287d1d5:3858:25a8d3d2&RCN=81525
7	ENVIRISK, Assessing the risks of environmental stressors: Contribution to the development of integrating methodology, EU Contribution €0.9M	FP6-POLICIES Start date: 2007-03-01 End date: 2009-02-28	Develops an integrated methodological framework to identify health risks caused by exposures to environmental factors, with a view to provide for quantitative assessment and comparison of the benefits of alternative prevention and targeted policy measures against their respective costs It includes assessment of existing information on exposure and health effects, establishment of links between exposure and health including framework and protocol development, and contribution to the WHO ECEH Environment and Health Information System (ENHIS-2). A framework for assessment of exposure and of relations between exposure and health	http://cordis.europa.eu/fetch?CALLER=FP6_PROJ&ACTION=D&DOC=1&CAT=PROJ&QUERY=0130b286184d:f479:322c724b&RCN=84078

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
			will be developed, and piloted on studies on several exposure and health indicator relationships: exposure to atmospheric PAH and pregnancy outcome, exposure to PCBs, dibenzofurans and dioxins and neuro developmental and endocrine effects, and exposure to atmospheric particulate matter and other irritants and respiratory morbidity and mortality.	
8	INTAS 2005, Soil and compost organic matter structural compounds to promote the photo-degradation of pesticides in the environment: for a better knowledge of photoactive components, EU Contribution €150,000	INTAS ²³⁷ Start date: 2007-01-01 End date: 2009-06-30	Comprehensive investigation on the chemical nature of the main components of humic substances (HS) or humic-like substances (HLS) regarding photochemical activity and the photosensitising properties toward herbicides. Composted organic wastes containing HLS with high photo-inductive activity towards pollutants of the environment will be useful for a considerable improvement of wastes management especially in the implementation of the Stockholm Convention on POPs.	http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_LANG=EN&PJ_RCN=9948460&pid=36&q=71C62A94D00BAB5E46E5AE6743DE415A&type=sim
9	MESOCAT, Mesoporous Photocatalysts for the degradation of persistent organic pollutants, EU Contribution €35,000	FP6-MOBILITY Start date: 2008-11-01 End date: 2009-10-31	Understanding of chemical mechanisms and catalyst design factors that influence photocatalysed degradation of selected pesticides in aqueous solution	http://cordis.europa.eu/fetch?CALLER=FP6_PROJ&ACTION=D&DOC=1&CAT=PROJ&QUERY=0130b2874bea:7362:14e1413a&RCN=81101
10	NEWGENERIS, Development and application of biomarkers of dietary exposure to genotoxic and immunotoxic chemicals and of biomarkers of early effects, using mother-child birth cohorts and biobanks, EU Contribution €13.59M	FP6-FOOD Start date: 2006-02-01 End date: 2011-07-31	The project will test the hypothesis that maternal exposure to dietary compounds with carcinogenic and immunotoxic properties results in <i>in-utero</i> exposure and molecular events in the unborn child leading to increased risk of cancer and immune disorders in later childhood.	http://www.newgeneris.org/

²³⁷

International Association for the promotion of cooperation with scientists from the independent states of the former Soviet Union

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
11	NORMAN, Network of reference laboratories for monitoring of emerging environmental pollutants, EU Contribution €1.9M	FP6-SUSTDEV Start date: 2005-09-01 End date: 2008-11-30	<p>It is a permanent self-sustaining network, of reference laboratories, research centres and related organisations for the monitoring and biomonitoring of emerging environmental substances.</p> <p>Enhance the exchange of information and collection of data on emerging environmental substances; encourage the validation and harmonisation of common measurement methods and monitoring tools so that the demands of risk assessors can be better met; ensure that knowledge on emerging pollutants is maintained and developed by stimulating coordinated, interdisciplinary projects on problem-oriented research and knowledge transfer to address identified needs.</p>	http://www.norman-network.com/index_php.php
12	OSIRIS, Optimized Strategies for Risk assessment of chemicals based on Intelligent testing, EU Contribution €10M	FP6-SUSTDEV Start date: 2007-04-01 End date: 2011-09-30	<p>A strong need to strengthen and advance human and environmental risk assessment knowledge and practices with regard to chemicals, in accord with the precautionary principle, for the safe manufacture and use of chemicals.</p> <p>Develop integrated testing strategies (ITS) fit for REACH that enable to significantly increase the use of non-testing information for regulatory decision making, and thus minimise the need for animal testing.</p> <p>The framework includes alternative methods such as chemical and biological read-across, in vitro results, in vivo information on analogues, qualitative and quantitative structure-activity relationships, thresholds of toxicological concern and exposure-based waiving, and takes into account cost-benefit analyses as well as societal risk perception.</p>	http://www.osiris.ufz.de
13	PHIME, Public health impact of long-term, low-level mixed element exposure in susceptible population strata. EU Contribution €13.43M	FP6-FOOD Start date: 2006-02-25 End date: 2011-08-24	<p>The project will epidemiologically assess the impact of toxic metals exposure through foods on diseases of public health. Some studies will utilize unique biobank material. Particular interest will be paid to interaction between toxic elements in mixed, benefits of exposures to essential elements and other dietary components and describe some aspects of risk/benefit relationships; new methods for biomonitoring of exposures will be developed and validated; define geographical patterns/sources of exposure in EU Member States, especially in children and women; assess time trends of exposure, retrospective and prospectively; explore mechanisms of uptake and distribution of toxic and essential elements in plants, which will make it possible to breed species with low concentrations of toxic elements and high of essential. This gives a possibility to change the intakes through plant foods and the transportation into animal foods.</p>	http://www.phime.org/

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
14	PIONEER, Puberty onset – influence of nutritional, environmental and endogenous regulators, EU Contribution €3M	FP6-FOOD Start date: 2005-03-01 End date: 2008-02-29	<p>The project will help to identify genetic subpopulations that may be at high risk for early sexual maturation and develop novel experimental test models, needed for the development of preventive strategies and will study the multifaceted interactions between genetic and nutritional factors that may influence sexual maturation.</p> <p>Obtain updated scientific data on the age of puberty onset in the different regions of Europe; identify some genetic and nutritional factors involved in the regulation of the onset of puberty, with special reference to their interactions; develop novel experimental test models, including in vivo animal models, optimized for the investigation of genetic and nutritional factors regulating onset of puberty; define if specific actions are necessary within EU, to avoid children from maturing too early sexually.</p> <p>An understanding role of nutritional factors, it is of paramount importance to know, which individuals have the genetic susceptibility to environmental factors, which may cause early maturation.</p>	http://cascade.projectcoordinator.net/~pioneer
15	REP-LECOTOX, Reinforcement of research potential of laboratory for ecotoxicology, EU Contribution €290,000	FP6-INCO Start date: 2007-01-01 End date: 2009-12-31	<p>Research focused on toxic impact of persistent organic pollutants on biota with special emphases on fresh water ecosystem The research activities are identification and characterization of aquatic ecotoxicity.</p>	http://cordis.europa.eu/fetch?CALLER=FP6_PROJ&ACTION=D&DOC=1&CALL=PROJ&QUERY=0130b2852405:0c35:42adb19&RCN=90042

Table 9 Research Projects with references to POPs funded by LIFE+

No.	Acronym, Title, EU contribution	Programme, Duration time	Project reference, Objectives or Main results	More information
1	WOMENBIOPOP, Linking Environment and Health: a Country-based Human Biomonitoring Study on Persistent Organic Pollutants in Women of Reproductive Age, €0,8M	Start date: 2010-04-01 End date: 2010-10-01	LIFE08/ENV/IT/000423, To respond to the increasing demand for information on the level of exposure to POPs of environmental origin. It will focus on the subpopulation of women of reproductive age (20-40 years), whose exposure to POPs will be assessed through biomonitoring.	http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=3433
2	EXPAH, Population Exposure to PAH, €2M	Start date: 2010-10-01 End date: 2013-12-31	LIFE09 ENV/IT/000082, To address the environmental and health problems caused by the emission, dispersion and transformation of PAH compounds.	http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=3756