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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 THE REGIONS

on the review and update of the third European Union Implementation Plan in accordance with Article 9(4) of Regulation (EU) 2019/1021 on persistent organic pollutants

{COM(2021) 408 final}

PREFACE

This document presents the fourth revised and updated European Union (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 Union towards the Protocol to the UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP) on POPs[1] and Regulation (EU) 2019/1021 of the European Parliament and of the Council ("POPs Regulation")[2], which replaces Regulation (EC) No 850/2004 of the European Parliament and of the Council[3]. The implementation plan sets out the Union's regulatory framework for POPs and persistent, bioaccumulative and toxic (PBT) substances, and what have been identified as the key challenges facing the 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.

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)[4], and further updated with a third implementation plan in late 2018 (SWD(2018)495)[5]. The further review and update of the third implementation plan is needed to reflect developments both within the policy environment (i.e. further addition of new POPs to the Convention and the Union legislation) and scientific environment (i.e. where new research furthers the understanding of POPs).

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 on the implementation of the POPs Regulation 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.

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

2 Regulation (EU) 2019/1021 of the European Parliament and of the Council of 20 June 2019 on persistent organic pollutants (OJ L 169, 25.6.2019, p. 45)

3 Regulation (EC) No 850/2004 of the European Parliament and of the Council of 29 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC (OJ L 158, 30.4.2004, p. 7)

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

5 http://chm.pops.int/Portals/0/download.aspx?d=UNEP-POPS-NIP-EU-COP7.English.pdf

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AFFF – Aqueous film forming foam

ABS – Acrylonitrilebutadiene styrene

AMAP – Arctic Monitoring and Assessment Programme

ASR – Automotive Shredder Residue

BAT – Best Available Technologies

BREF – BAT Reference Document

BFR – Brominated flame retardant

BRS – Basel, Rotterdam, and Stockholm Conventions

CBC – Cross-Border cooperation

CLP – Classification, Labelling and Packaging

CLRTAP – Convention on Long-Range Transboundary Air Pollution

COPHES – Consortium to Perform Human Biomonitoring on a European Scale

COP – Conference of the Parties

BDE – Brominated Diphenyl Ethers

BEP – Best Environmental Practices

CLEA – Contaminated Land Exposure Assessment

DDT – Dichloro-diphenyl-trichloroethane

EAF – Electric arc furnaces

EASIS – Endocrine Active Substances Information System

ECHA – European Chemicals Agency

EEA – European Environment Agency

EEE – Electrical and electronic equipment

EFSA – European Food Safety Authority

EHBMI – European Human Biomonitoring Initiative

ELV – Emission Limit Values

EMEP – European Monitoring and Evaluation Programme

ENI – European Neighbourhood Instrument

ENP – European Neighbourhood Policy

ENRTP – Thematic Programme for Environment and Sustainable Management of Natural Resources

E-PRTR – European Pollutant Release and Transfer Register

ERA – European Research Area

ESIS – European Substance Information Systems

EU – European Union

FAO – Food and Agriculture Organisation

FP – Framework Programme

GEF – Global Environment Facility

GEOSS – Global Earth Observation System of Systems

GENASIS – Global Environmental Assessment Information System

GPGC – Global Public Goods and Challenges

HBB – Hexabromobiphenyl

HBCDD – Hexabromocyclododecane

HBM – Human Biomonitoring

HCB – Hexachlorobenzene

HCBD – Hexachlorobutadiene

HCH – Hexachlorocyclohexane

HIPS – High Impact Polystyrene

IED – Industrial Emissions Directive

IPCheM – Information Platform for Chemical Monitoring

IPA – Instrument for Pre-Accession Assistance

IPPC – Integrated Pollution Prevention and Control

JRC – Joint Research Centre

KBBE – Knowledge Based Bio-Economy

LCD – Liquid Crystal Display

LRTAP – Long- Range Transboundary Air Pollution

NIPs – National Implementation Plans

OECD – Organisation for Economic Co-operation and Development

PAHs – Polycyclic aromatic hydrocarbons

PBDE – Polybrominated diphenyl ether

PCBs – Polychlorinated Biphenyls

PBT/vPvB – Persistent, Bioaccumulative and Toxic / Very Persistent and Very Bioaccumulative

PCDDs – Polychlorinated dibenzo-p-dioxins

PCDFs – Polychlorinated dibenzofurans

PCN – Polychlorinated Napthalenes

PCP – Pentachlorophenol

PeCB – Pentachlorobenzene

PFAA – Perfluoroalkyl Acids

PFAS – Per- and Polyfluoroalkyl Substances

PFOA – Perfluorooctanoic Acid

PFHpA – Perfluoroheptanoic acid

PFOS – Perfluorooctane sulfonic acid

PFOSF – Perfluorooactane sulfonyl fluoride

PM – Particulate Matter

PMT/vPvM - Persistency, Mobility and Toxicity (PMT) / Very Persistent and Very Mobile (vPvM)

POP – Persistent Organic Pollutant

PPP – Plant Protection Products

PXDD/PXDFF – Polyhalogenated dibenzo- p- dioxins/ Polyhalogenated dibenzofurans

QSAR – Quantitative Structure–Activity Relationship

REACH – Registration, Evaluation, Authorisation and Restriction of Chemicals

RMOA – Regulatory Management Option Analysis

RoHS – Restriction of Hazardous Substances

SAICM – Strategic Approach to International Chemicals Management

SCCPs – Short Chain Chlorinated Paraffins

SMEs – Small and Medium-sized Enterprises

SVHC – Substances of Very High Concern

UN – United Nations

UNECE – United Nations Economic Commission for Europe

UPOPs – Unintentionally Produced POPs

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 Union sinks of POPs. International action has been deemed necessary to reduce and eliminate manufacture[6], use and releases of these substances. The substances addressed in the international legal instruments on POPs are listed in Table 1.

At Union level, significant progress towards the elimination of POPs has been achieved. Manufacture and use of all POP chemicals is prohibited with some minor time limited exemptions that are phased-out over time. A main challenge for the Union 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 POPs[7]

The Executive Body to the UNECE Convention on Long-Range Transboundary 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 11 pesticides, 2 industrial chemicals and three unintentional by-products. In 2009, Parties adopted decisions to list seven new substances. However, those decisions did not yet enter into force. The ultimate objective is to eliminate any discharges, emissions and losses of these POP substances. The POPs Protocol has been approved by the European Union and 23 Member States[8].

The UNECE Protocol on POPs bans the manufacture and use of some substances outright (aldrin, chlordane, chlordecone, dieldrin, endrin, hexabromobiphenyl, hexachlorobutadiene, hexachlorocyclohexane (technical HCH), hexaBDE, heptaBDE, tetraBDE, pentaBDE, pentachlorobenzene, polychlorinated napthalene (PCN), mirex and toxaphene). Others are scheduled for elimination at a later stage (dichloro-diphenyl-trichloroethane (DDT), heptachlor, hexachlorobenzene (HCB), polychlorinated biphenyls (PCBs), perfluorooctane sulfonate (PFOS), and short-chain chlorinated paraffins (SCCPs)). In addition, the latest

6 The recast of the EU POPs regulation (EU) 2019/1021 aligns terminology with the EU REACH Regulation (EC 1906/2006) for consistency. Under the recast the term ‘production’ used by the Stockholm Convention is replaced by ‘manufacture’ used by REACH. For the purposes of consistency, all references in the UIP have been amended to ‘manufacture’, but the reader should assume that manufacture and production relate to the same activity.

7 https://www.unece.org/environmental-policy/conventions/envlrtapwelcome/guidance-documents/protocol-on-pops.html

8 Greece, Malta, Poland and Portugal did not yet approve the POPs Protocol (https://treaties.un.org/Pages/ParticipationStatus.aspx?clang=_en).

version of the UNECE Protocol on POPs, adopted in December 2009, severely restricts the use of gamma-hexachlorocyclohexane (lindane)[9].

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 (taking the total to 26). 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 steel manufacture. 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/2009/14[10]). The amendments for Annexes V and VII entered into force on 13 December 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[11]

The Stockholm Convention on POPs was adopted in 2001 and entered into force in 2004. The overall objective of the Stockholm Convention is to protect human health and the environment from POPs. It promotes global action on 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 under the Convention.

At the time the Stockholm Convention entered into force in 2004, a total of 12 substances were listed within Annexes A, B and/or C comprising nine pesticides, one industrial chemical and two unintentionally created substances with no commercial value (dioxins and furans). Since 2004 additional substances have been added at subsequent Conferences of the Parties (COP). On 26 August 2010 (following COP-4) a further nine substances were added,

[9] Note that Annex I to the Protocol states that the use of lindane was limited to control of topical insect pests for public health purposes. The use was intended to be re-evaluated in 2012 or one year after entering into force, which ever was later. The amendments were adopted in June 2016, meaning the review should have taken place in 2017, but no further information on whether this has been completed.

[10] https://digitallibrary.un.org/record/669615?ln=en

[11] http://chm.pops.int/Convention/ConventionText/tabid/2232/language/en-GB/Default.aspx

including a new Annex C substance (pentachlorobenzene). At COP-5 (held in 2011) the pesticide endosulfan was added to Annex A with specific exemptions (SC5/3). At COP-6 (held in 2013) the flame retardantant hexabromocyclododecane (HBCDD) was added to Annex A of the Convention with specific exemptions for manufacture as allowed for the parties listed in the register of specific exemptions and for use in expanded polystyrene and extruded polystyrene in buildings. At COP-7 (held in 2015) a further three substances were added to the Annexes (Hexachlorobutadiene and pentachlorophenol (PCP) and its salts and esters were added to Annex A, while polychlorinated napthalenes (PCN) were added to Annexes A and C). At COP-8 (held in 2017) the decision was made to amend Annexes A and C of the Convention by listing Decabromodiphenyl ether (commercial mixture, c-decaBDE) and short-chain chlorinated paraffins (SCCPs) in Annex A with specific exemptions as well as further extending the listing of hexachlorobutadiene to both Annex A and C. These additions made in the period 2011 (COP-5) to 2017 (COP-8) took the total number of substances regulated under the Convention to 28.

Additionally 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-PBDEs) 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.

At the COP-9 meeting, held in April/May 2019, further decisions were made to add dicofol (no exemptions) and perfluorooctanoic acid (PFOA), its salts and PFOA related compounds (with specific exemptions) to Annex A of the Convention (see Sections 3.2.6 and 3.2.14 for further details).

In addition, under Annex B of the Stockholm Convention the manufacture and use of DDT (a pesticide still used in many developing countries) and PFOS (a surfactant) are severely restricted. The continued use of DDT has been the subject of review and assessment at COP-5, COP-6, COP-7 and COP-8. When PFOS was listed under Annex B of the Stockholm Convention in 2009, the listing included eight acceptable purposes (non-time limited exemption) and twelve specific exemptions (time limited). At COP-9, the number of exemptions for PFOS was substantuially reduced, and additional requirements for Parties to register for remaining specific exemptions were put in place (see Section 3.2.7).

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 artifcles to the Secretariat of the Stockholm Convention.

Releases of unintentionally produced by-products listed in Annex C, including polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), PCBs, pentachlorobenzene (PeCB), HCB, PCNs and hexachlorobutadiene (HCBD), 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 Transboundary 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. All Parties are obliged to develop and endeavour to implement National Implementation Plans (NIPs), 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 candidate POPs. They shall also regularly report to the COP on the measures taken to implement the provisions of the 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 Stock-holm Convention	Listed in the UNECE Protocol on POPs	Listed in the POPs 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	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) (including its isomers)	25637-99-4 3194-55-6 134237-50-6 134237-51-7 134237-52-8	Annex A	No	Yes
Hexabromodiphenyl ether and heptabromodiphenyl ether	36483-60-0; 68928-80-3;	Annex A	Yes	Yes Yes

Substance	CAS	Listed in Stockholm Convention	Listed in the UNECE Protocol on POPs	Listed in the POPs Regulation
	and others			
Hexachlorobenzene (HCB)	118-74-1	Annex A	Yes	Yes
Alpha hexachlorocyclohexane*	319-84-6; 608-73-1	Annex A	Yes: Hexachlorocyclohexanes (HCH; CAS: 608-73-1[12]), 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 and others	Annex A	No	Yes – added with the 2019 recast
Polychlorinated biphenyls (PCB)	1336-36-3 and others	Annex A	Yes	Yes
Tetrabromodiphenyl ether and pentabromodiphenyl ether	40088-47-9; 32534-81-9; 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; 2795-39-3; 29457-72-5; 29081-56-9; 70225-14-8; 56773-42-3; 251099-16-8; 1691-99-2; 24448-09-7; 307-35-7, and others	Annex B	Yes	Yes
Perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds	335-67-1	Annex A	No	Yes – added April 2020
SCCPs – short chain chlorinated paraffins	85535-84-8; and others	Annex A	Yes	Yes
HCBD – hexachlorobutadiene	87-68-3	Annex A	Yes	Yes
PCN –polychlorinated naphthalenes	70776-03-3 and others	Annex A	Yes	Yes
Bis(pentabromophenyl)ether, also known as Decabromodiphenyl ether (c-decaBDE)	1163-19-5	Annex A	No	Yes – added with the 2019 recast
Dicofol	115-32-2	Annex A	No	Yes – added June 2020
Unintentionally produced POPs				
Polychlorinated dibenzo-p-dioxins (PCDD)	1746-01-6	Annex C	Yes	Yes
Polychlorinated	1746-01-6	Annex C	Yes	

[12] 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 POPs Regulation
dibenzofurans (PCDF)				
Hexachlorobenzene (HCB)	118-74-1	Annex C	Yes	Yes
Pentachlorobenzene	608-93-5	Annex C	Yes	Yes – added with the 2019 recast
Polychlorinated Biphenyls (PCBs)	1336-36-3 and others	Annex C	Yes	Yes
PCN – polychlorinated napthalenes	70776-03-3 and others	Annex C	Yes	Yes – added with the 2019 recast
Polycyclic aromatic hydrocarbons (PAHs)	207-08-9 and others	No	Yes	Yes
HCBD – hexachlorobutadiene	87-68-3	Annex C	Yes	Yes – added with the 2019 recast

* 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 POPs 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. Furthermore, ordinary meetings of the Conferences of the Parties were held back-to-back in 2015, 2017 and 2019.

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 COP-7 meeting in May 2015 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, 2015[13]). At the COP-8 meeting in 2017, reports on reviews of the synergies arrangements for

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

the Basel, Rotterdam and Stockholm Conventions were discussed and the BRS Secretariat was requested to continue to seek opportunities for enhanced coordination and cooperation among the conventions (BRS Secretariat, 2017).

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 Convention. For the Union, this obligation is also transferred to the Article 9 of the POPs Regulation. 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 POPs[14].

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:

- Union policy and legislative documents used to govern and manage the policy landscape on chemicals;
- Member States' reports submitted to the European Commission as per Article 12 of Regulation (EC) No 850/2004;
- Member States National Implementation Plans;
- Union databases on chemicals including:
  - o Chemical databases held by the European Chemicals Agency as part of the REACH[15] and CLP[16] Regulations;
  - o European Pollutant Release and Transfer Register (E-PRTR);

[14] http://ec.europa.eu/environment/chemicals/international_conventions/index_en.htm

[15] Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (OJ L 396, 30.12.2006, p. 1)

[16] Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on the classification, labelling and packaging of substances and mixtures (OJ L 353, 31.12.2008, p. 1)

  - UNECE EMEP database for POPs release estimates;
  - Eurostat;
  - Pesticides database[17];
  - European Substance Information Systems (ESIS) database;
  - The EFSA OpenFoodTox database[18]
- 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 Union, including information on releases and monitoring of POPs.

2. 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 Union legislation related to the implementation of obligations in the mentioned international frameworks as well as related Union 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 manufacture, 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 Union 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.

2.1. Key Union Legislation and Policies related to the Union's Obligations under the Stockholm Convention and UNECE Protocol on POPs

The Union 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.

[17] http://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/public/?event=homepage&language=EN
[18] https://www.efsa.europa.eu/en/data/chemical-hazards-data

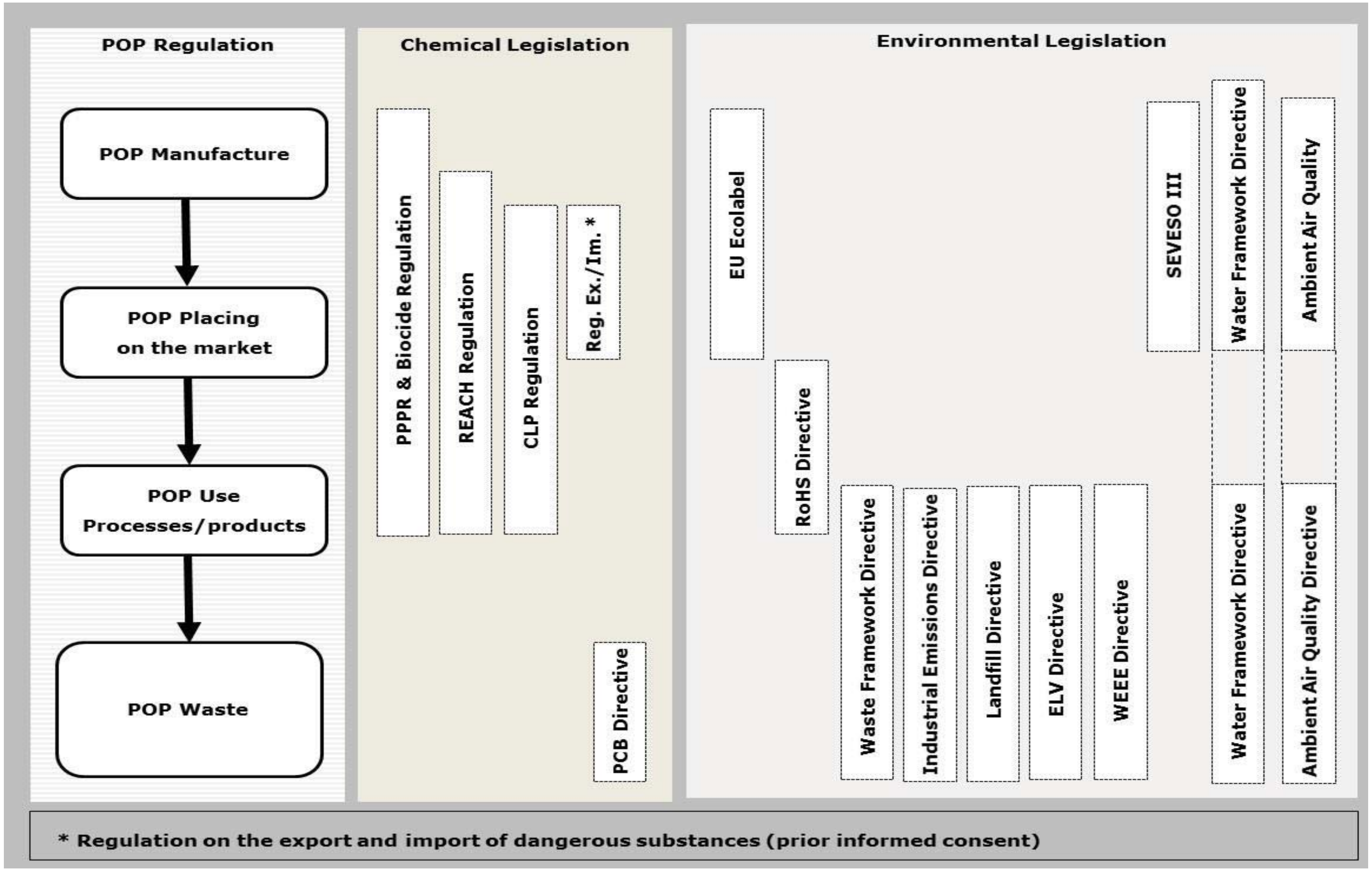

Figure 1 Overview of the main chemical and environmental legislation related to POPs

2.2. Legislative instruments

2.2.1. Regulation (EC) No 850/2004 (First POPs Regulation)

As signatory to both the Stockholm Convention and the UNECE Protocol on POPs, in order to implement the Union's international obligation, the European Union legislators adopted the Regulation on persistent organic pollutants (hereafter called "Regulation (EC) No 850/2004") to uphold the aims of the Convention and Protocol at Union level. This Regulation entered into force on 20 May 2004 and was directly applicable in all Member States, including those which are not yet Parties to the Stockholm Convention or the UNECE POP Protocol.

Regulation (EC) No 850/2004 contains provisions regarding manufacturing, 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 POPs Regulation are limited to a minimum. Furthermore, Regulation (EC) No 850/2004 contains provisions requiring the setting up of emission inventories for unintentionally produced POPs, national and Union implementation plans and monitoring and information exchange mechanisms. To a certain extent Regulation (EC) No 850/2004 goes further than the international agreements emphasising the aim to eliminate the manufacture and use of the internationally recognised POPs, notably this includes the development of legally binding thresholds for POPs within waste, which are detailed in Annex IV of the Regulation. Where the thresholds are exceeded, only certain disposal or recovery operations can be applied to the waste containing POPs in such a way as to ensure that the POP content is irreveribly transformed or destroyed. POP substances separated from waste cannot be recycled under any circumstance and have to be destroyed.

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 according to the specified requirements.

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 (under Annex IV) 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].

[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."

2.2.2. *Recast of the POPs Regulation ((EU) 2019/1021)*

2.2.2.1. Introduction

Regulation (EC) No 850/2004 has been amended several times to take into account changes within the Convention and Protocol annexes as well as changes in other related Union legislation such as REACH. On 22 March 2018 the Commission adopted a proposal to recast the POPs Regulation[20]. The position of the European Parliament was adopted on 18 April 2019, and passed to the Council of the European Union in early May 2019. The recast of the POPs Regulation was adopted on 20 June 2019 and formally published in the Official Journal of the European Union on 25 June 2019[21].

While the overall structure of the POPs Regulation is broadly similar to Regulation (EC) No 850/2004, there are a number of important changes included, which can be broadly grouped into five categories:

- Institutional changes for the role of the European Chemicals Agency (ECHA) and the Commission;
- Changes related to Member States reporting;
- Changes related to waste and waste management;
- Changes made to terminology to build greater alignment to REACH;
- POP specific changes (notably for PCBs and PBDEs).

2.2.2.2. Institutional changes for the role of ECHA and the Commission

The POPs Regulation provides a significant new role for ECHA in its implementation and development of technical and scientific dossiers. Article 8 of the POPs Regulation defines the new duties that are undertaken by ECHA (further supported by the Forum for Exchange of Information on Enforcement established under the REACH Regulation, hereafter referred to as "the Forum").

In particular ECHA has a key role to support the Commission by assisting in identifying new substances that meet the criteria to be considered 'POPs', and development of the risk profile and risk management evaluation dossiers, which are to be developed for the review process under the Stockholm Convention. These changes also allow greater transparency in the process for identification of new POPs. Under the POPs Regulation ECHA is required to publish notice on its website that a proposal for the listing of a substance (screening dossier) will be prepared by the Commission and allow comments from all interested parties within eight weeks of the publication.

Furthermore, during the development of the risk profile and risk management evaluation dossiers, the POPs Regulation also allows input (and new data) from all interested parties, again with an eight-week window for commenting following publication on the ECHA website.

[20] COM(2018) 144 final. Proposal for a Regulation of the European Parliament and of the Council on persistent organic pollutants (recast).

[21] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R1021&from=EN

ECHA also has further duties to provide technical input (upon request from the Commission) to ongoing processes under the Convention, collation and publication of information reported by the Member States and maintain a section on the ECHA website dedicated to POPs.

The Forum has the role to establish a network of Member State authorities responsible for the enforcement of the POPs Regulation. This network will co-ordinate enforcement efforts carried out at Member State level and will also address waste and waste-related matters that fall under the POPs Regulation.

Article 16 of the POPs Regulation states that ECHA's budget for this new role will be sourced through a combination of a subsidy from the Commission and donations from the Member States.

The POPs Regulation also grants new powers to the Commission for amendment of the Annexes. Under Article 15 of the POPs Regulation, the Commission is empowered to adopt delegated acts amending Annexes I, II and/or III. The European Parliament and the Council still have the right to object, but the use of delegated acts is intended to make the amendment of Annexes in light of changes under the Convention or the Protocol more efficient. The Commission also has a watching brief to monitor Annexes IV and V for any necessary amendments. The Commission is also (under Article 10) able to consider the need for mandatory monitoring of substances listed in Part B of Annex III. Additionally, under Article 7(5) of the POPs Regulation, the Commission may adopt implementing acts concerning waste management, in particular with regard to the format of information to be submitted by the Member States concerning exemptions from the prescribed waste disposal and recovery provisions set out in the Regulation.

2.2.2.3. Changes related to Member States reporting

Reporting is a key component of the POPs Regulation and builds upon the work completed at Member State level to tackle the issues posed by POPs. Under Regulation (EC) No 850/2004, Article 12 included obligations on Member States to report annually (on management of substances list in Annex I or II) and triennially (on the broader issues, including emission inventories) to the Commission. Additionally, Article 12 then also placed obligations on the Commission to produce a report every three years on the Union's progress towards the aims of the regulation.

Taking into account the Commission Report on Actions to Streamline Environmental Reporting and its related Fitness Check, the POPs Regulation proposes a different approach to reporting. Under Article 13, Member States are obligated to develop reports on their progress to implement the regulation, including data on annual monitoring and statistics which will be published at national level. These reports are to be kept up to date, with annual updates for any new data, or if no new data is available, with an update at least once every three years as a minimum.

Under Article 17 of the POPs Regulation, the Agency, in cooperation with the Member States, specifies formats and software for the publication of data by the Member States pursuant to the Regulation and makes them available free of charge on its website.

Additionally, for monitoring data the POPs Regulation highlights the importance of the new Information Platform for Chemical Monitoring (IPCheM), and that all monitoring data should be provided to IPCheM, again with formats to be agreed between the Member States and ECHA.

2.2.2.4. Changes related to waste and waste management

The POPs Regulation provides a stronger focus on POPs wastes and waste-management. In particular, the POPs Regulation comments that for national reports and implementation plans Member States are encouraged to include any information on the identification of contaminated sites. Additional focus is also given to management of POPs within waste streams and traceability to avoid regrettable re-entry to the market through recycling. Recital 17 of the POPs Regulation specifically states:

> "*In order to promote the traceability of waste containing POPs and ensure control, the provisions of the record keeping system established in accordance with Article 17 of Directive 2008/98/EC should apply also to such waste containing POPs which is not defined as hazardous waste according to Commission Decision 2014/955/EU*[22]".

This means that for wastes containing POPs, even when not classified as hazardous, the record-keeping obligations that apply to producers or installations managing hazardous waste, will also apply, including documenting the quantity, nature and origin of the waste and the destination of the waste. As a minimum this requires the holders of such waste to notify the competent authority of the POP content of their wastes.

The recast further comments that the Commission is assisted by the Committee established under the Waste Framework Directive (2008/98/EC) to ensure a consistent approach to how wastes are managed within the Union.

2.2.2.5. Changes made to terminology to build greater alignment to REACH

A number of smaller but important changes have been included within the POPs Regulation to help build closer alignment with other related Union legislation. In particular under Article 2 this includes the revision of terminology in a number of places to align more closely with REACH. For example, the Stockholm Convention refers to 'production', while the REACH Regulation refers to 'manufacture', covering the same set of activities.

2.2.2.6. POP specific changes (notably for PCBs and PBDEs)

The majority of the changes in the POPs Regulation affect functional elements of how the legislation works and roles and obligations for different bodies. However, there are a small number of changes which specifically affect certain POPs substances, with the two key changes of importance relating to polybrominated diphenyl ethers (PBDEs) and polychlorinated biphenyls (PCBs):

- PBDEs: The POPs Regulation made provisions under Annexes IV and V for management of wastes containing PBDEs as a family defined by homologue groups

[22] Commission Decision 2014/955/EU of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament and of the Council (OJ L 370, 30.12.2014, p. 44).

(i.e. pentaBDE, hexaBDE, heptaBDE, etc.). By Commission Regulation (EU) 1342/2014[23] the Annex IV threshold (for low POP content) for wastes containing PBDEs as an aggregated sum was set at 1000 mg/kg (1000ppm). The POPs Regulation notes the advances made in analytical chemistry and states that within two years of entry into force (not later than 16 July 2021) the Commission should review that concentration limit and should, where appropriate and in accordance with the Treaties, adopt a legislative proposal to lower that value to 500 mg/kg.

Furthermore, under Annex I of the POPs Regulation a new clause has been added regarding the presence of PBDEs (tetra, penta, hexa, hepta and deca homologues) within new articles placed on the market. This sets a maximum threshold of 500 mg/kg for unintentional trace contamination of mixtures and articles with PBDEs.

- PCBs: Annex I part A of the POPs Regulation now includes the additional text for PCBs: "*Member States shall identify and remove from use equipment (e.g., transformers, capacitors or other receptacles containing liquid stocks) containing more than 0,005 % PCBs and volumes greater than 0,05 dm^3, as soon as possible but no later than 31 December 2025.*" This incorporates the overall aim from the Stockholm Convention to eliminate the remaining use of PCBs within di-electric equipment by 2025.

The POPs Regulation also includes the addition of new terminologies, in particular the addition of 'unintentional trace contamination', which is defined as:

"'*unintentional trace contaminant' means a level of a substance that is incidentally present in a minimal amount, below which the substance cannot be meaningfully used, and above the detection limit of existing detection methods to enable control and enforcement*".

2.2.3. European Union chemicals legislation

Other chemicals legislation complements the POPs Regulation in implementing the obligations of the Stockholm Convention and the POPs 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 Union 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	Manufacture, placing on the market & use
CLP	Regulation (EC) No 1272/2008	Inventory of classification and labelling of hazardous substances.	Classification, Labelling,

[23] http://data.europa.eu/eli/reg/2014/1342/oj

Acronym	Legal reference	POPs regulated / POP reference	Areas of regulation
			Packaging
Plant Protection Product Regulation	Regulation (EC) No 1107/2009	An active substance, safener or synergist shall only be approved where it is not considered to be a persistent organic pollutant (POP) resp. PBT substance. Active substances meeting two of the PBT criteria shall be candidates for substitution	Placing on the market & use
Biocidal Products Regulation	Regulation (EU) 528/2012	Active substances meeting the PBT criteria shall not be approved. 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

2.2.3.1. REACH

Regulation (EC) No 1907/2006 (REACH) inter alia includes provisions to ensure that industrial chemicals having POP characteristics are identified and prevented from being produced or imported in the Union. 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 Union 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)[24]. 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 hazards;
(b) physicochemical hazards;
(c) environmental hazards;
(d) persistent, bioaccumulative and toxic (PBT) and very persistent and very bioaccumulative (vPvB) properties.

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

[24] https://echa.europa.eu/substances-of-very-high-concern-identification-explained

the ‘substance of very high concern’ (SVHC) criteria[25] 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, 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 manufacture of substances by listing them in Annex XVII of REACH. This is another legal instrument that can be used to prevent manufacture 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 manufacture. 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.

2.2.3.2. CLP

The CLP Regulation (EC) No 1272/2008 is the Union Regulation on Classification, Labelling and Packaging of substances and mixtures[26]. The legislation introduces throughout the Union a system for classifying and labelling chemicals, based on the United Nations’ Globally Harmonised System (UN GHS). CLP is about the hazards of substances and mixtures and how to inform others about them. 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 inventory[27] set up by the CLP Regulation makes available relevant information that can be used to identify new potential POP candidates and also provides classification and labelling of several POPs.

2.2.3.3. Regulation on Plant Protection Products

Regulation (EC) No 1107/2009 concerning the placing of plant protection products on the market[28] (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 substance (PBT) or a very persistent and very bioaccumalative substance (vPvB). In addition, a substance may only be approved as a candidate for substitution if it meets two of the PBT criteria.

[25] http://echa.europa.eu/addressing-chemicals-of-concern/authorisation/substances-of-very-high-concern-identification
[26] OJ L 353, 31.12.2008, p. 1.
[27] http://echa.europa.eu/en/information-on-chemicals/cl-inventory
[28] OJ L 309, 24.11.2009, p.1.

Regulation (EC) No 396/2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin sets the highest level of a pesticide residue that is legally tolerated in or on food or feed when pesticides are applied correctly. This includes MRL values for several POPs (see Section 2.1.5).

2.2.3.4. Biocidal Products Regulation

Regulation (EU) No 528/2012 concerning the making available on the market and use of biocidal products[29] aims to promote substitution of substances that exhibit PBT characteristics in biocidal products for less hazardous ones. The use of PBT 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 as a candidate for substitution and shall be identified as such in a regulation approving an active substance under the Biocides Regulation. A similar process also exists under the PPP Regulation. The approval of an active substance that is considered as a candidate for substitution shall be renewed for a period not exceeding seven 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.

2.2.3.5. 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 chemicals[30]. 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 Annexes A and B of the Stockholm Convention and in the POPs Regulation. The decisions made at the COP-4 to the Stockholm Convention held on 4–8 May 2009 listing new substances[31] were implemented by Regulation (EU) No 214/2011. The fifth Conference of the Parties to the Stockholm Convention (COP-5) (April 2011) decided to list endosulfan in Annex A. That decision was implemented in the Union by Commission Regulation (EU) No 73/2013, which adds endosulfan to the list of chemicals that are banned for export. Under Regulation (EU) No 649/2012 substances listed in Annex I are as a minimum subject to the export notification requirements. For POP-PBDEs and PFOS listed in Annex I, this includes in addition explicit consent requirements (with the potential for exceptional waivers) from receiving non-EU countries.

29 OJ L 167, 27.6.2012, p. 1.
30 OJ L 201, 27.7.2012, p. 60.
31 Including chlordecone, hexabromobiphenyl, alpha and beta hexachlorocyclohexanes, lindane pentachlorobenzene and pentabromodiphenyl ether

2.2.3.6. 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)[32]. 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 dm^3. 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:

- 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/EEC[33], the Commission:

- had to fix the reference methods of measurement to determine the PCB content of contaminated materials[34];
- could fix technical standards for the other methods of disposing of PCBs;

[32] OJ L 243, 24.9.1996, p. 31.
[33] OJ L 194, 25.7.1975, p. 39.
[34] 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.

- had to make available a list of the manufacture names of capacitors, resistors and induction coils containing PCBs[35];
- 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. Furthermore, under the recast of the POPs Regulation (EU) 2019/1021 all remaining PCBs within di-electric equipment (above 0.005% PCB in volumes greater than 0.05 dm3) are to be irreveribly destroyed by 2025.

2.2.4. Other environmental legislation with POP relevance

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

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, four new legislative acts have been adopted: Directive 2008/98/EC on Waste (Waste Framework Directive), Regulation (EC) No 1013/2006 on shipments of waste, 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, the Industrial Emissions Directive (IED)[36] 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 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 BAT.

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35 In 2001 the Commission has drawn up a list and made it available to the Member States.
36 OJ L 334, 17.12.2010, p. 17.

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 as Commision Implementing Decision. 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 installation[37].

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[38] A product cannot obtain an ecolabel if it contains a PBT/vPvB substance.	Different product categories, see: [39]
RoHS Directive	Directive 2011/65/EU	Ban of PBDE and other hazardous substances in electrical and electronic equipment.	Manufacture 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.[40]	Waste
Waste Shipments Regulation	Regulation (EC) No 1013/2006	This regulation establishes procedures and control regimes for the shipment of waste. Reference is made in Annex VIII of this Regulation to technical guidelines under the framework of the Basel Convention, on the environmentally sound management of waste containing or contaminated with POPs.	Waste
Industrial Emissions Directive	Directive 2010/75/EU	Waste incineration: Emission limit values for air, discharges of waste water for dioxins and furans. Industrial activities: Polychlorinated dibenzodioxins and polychlorinated	Industrial emissions

[37] 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.

[38] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:332:0001:0016:EN:PDF

[39] http://ec.europa.eu/ecat/

[40] https://ec.europa.eu/environment/waste/framework/framework_directive.htm See also EU 1357/2014 which replaces Annex III of the Waste Framework Directive. In particular recital 2 details the measures for hazardous wastes.

Acronym	Legal reference	POPs regulated / POP reference	Areas of regulation
		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).	
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 2012/19/EU (recast)	Provisions on waste containing hazardous substances, e.g. removal of PCB containing capacitors and plastic containing brominated flame retardants from all separately collected WEEE, mandatory segregation of PCB-containing components,. Note the original WEEE Directive (2002/96/EC) was recast in 2012.	Treatment of waste electrical and electronic equipment (WEEE)
Environmental Liability Directive	Directive 2004/35/EC	Intended to reduce incidents and also ensure remediation on the basis of the polluter pays principle of significant emissions both to land (and as a consequence soil) and water. The Directive raises expectations in terms of preventive action, reducing the incidence of emissions as well as promoting remediation.	The directive is focused on instances of environmental damage, such as emissions of pollutants that change the status of land, water, and biodiversity. The Directive only applies to environmental damage caused by an emission, event or incident which took place after 30 April 2007 where such damage derives either from activities carried out after that date or activities which were carried out but had not finished before that date
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.
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 PAHs, and pesticides (aldrin, dieldrin, heptachlor and heptachlor epoxide).	Quality of water intended for human consumption

Acronym	Legal reference	POPs regulated / POP reference	Areas of regulation
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
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.
SEVESO III Directive	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 polutants
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.
Fertilising Products Regulation	Regulation (EC) No 2003/2003 will be replaced from 16 July 2022 by Regulation (EU) 2019/1009	The new legistlation includes a compost safety limit for total PAHs (EPA 16) of 6 mg/kg dm, which also applies to any material recirculated through the composting process	Fertilising products applied to land

2.2.5. *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).

EFSA conducts an annual monitoring programme for residues of pesticides in food. POPs formerly used as pesticides are covered by MRLs and are therefore included in the monitoring programme. EFSA is responsible for preparing an annual report[41] on pesticide residues based on an analysis of information submitted by Member States in accordance with Regulation (EC) No 396/2005.

In comparison with the situation when the first Implementation Plan was drafted, there are substantial changes in the Union 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 2015[42] 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 the modelling approach for toxicology and accepted no observed adverse effect level (NOAEL) between SCF/JECFA and US-EPA resulted in US-EPA values being three 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.

In June 2018 EFSA published a paper on the risk for animal and human health related to the presence of dioxins and dioxin-like PCBs in feed and food[43]. The data from experimental animal and epidemiological studies were reviewed and it was decided to base the human risk assessment on effects observed in humans and to use animal data as supportive evidence. The study essentially led to a new health-based guidance value for dioxins and dioxin-like polychlorinated biphenyls (dl-PCB)[44].

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[41] EFSA (2019) The European Union report on pesticide residues in food, https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2019.5743

[42] 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

[43] http://www.efsa.europa.eu/en/efsajournal/pub/5333

[44] https://www.efsa.europa.eu/en/press/news/181120

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 (EU) No 252/2012[45]	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 animal feed	Directive 2002/32/EC	Aldrin, Dieldrin, Camphechlor (toxaphene), Chlordane, DDT, Endosulfan, Endrin, Heptachlor, Hexachlorobenzene (HCB), Hexachlorocyclohexane (HCH, incl. Lindane), Dioxins (sum of polychlorinated dibenzo-para-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs).
	Regulation (EC) No 152/2009[46]	Methods of sampling and analysis for checking the levels of dioxins and dioxin-like PCBs in feed for regulatory purposes

2.2.6. Information exchange between the Commission and the 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 Union rapid alert systems and both are publicly available. The legal basis for their establishment are provided in Regulation (EC) No 178/2002, Directive 2001/95/EC and Regulation (EC) No 765/2008.

The Rapid Alert System for Food and Feed (RASFF)[47] 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 PAHs.

The Rapid Alert System for non-food dangerous Products (RAPEX)[48] 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.

45 OJ L 84, 23.3.2012, p. 1.
46 OJ L 314, 1.12.2009, p. 66.
47 http://ec.europa.eu/food/food/rapidalert/index_en.htm
48 http://ec.europa.eu/consumers/safety/rapex/index_en.htm

2.2.7. *Food monitoring within the European Union*

Routine monitoring of food and feed is an important aspect of early detection of contamination of food and feed by POPs. Under Regulation (EU) 2017/625[49], a EU Reference Laboratory (EURL) was established in Freiburg, Germany[50] 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.

Under Regulation (EC) 396/2005, Member States are required to share results of their official controls and other relevant information to the Commission. EFSA then prepares an annual report on pesticide residues in the Union, based on an analysis of this information (see Section 2.1.5).

2.2.8. *Emission monitoring legislation*

The European Pollutant Release and Transfer Register (E-PRTR) Regulation[51] 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, and 65 economic activities which have to be reported by regulated facilities above set reporting thresholds. 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 2.3.9 on monitoring efforts of the Union) compared to previous EPER inventories.

The E-PRTR also collects and collates information on the transfer and management of waste, which includes total quantities of hazardous waste disaggregated to facility level. Further information on specific pollutants or concentrations of pollutants within hazardous waste is not a reporting requirement of the E-PRTR.

The European Commission launched an initative early in 2016 to aid access to monitoring data, which includes information on POPs, called the Information Platform for Chemical Monitoring data (IPCheM)[52]. The platform 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 aims to support a more coordinated approach for collecting, storing, accessing and assessing data related to the occurrence of chemicals and chemical mixtures, in relation to humans and the

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[49] Regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017 on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products (OJ L 95, 7.4.2017, p. 1)

[50] EURL laboratory: http://www.crl-dioxin-freiburg.eu/

[51] OJ L 33, 4.2.2006, p. 1.

[52] http://ipchem.jrc.ec.europa.eu/#home-page

environment. In the current version of the platform (IPCheM Version 5.0, March 2018), the portal was revisited and integrated with sections dedicated to end users and data providers.

The POPs Regulation furthermore identifies the key role of the IPCheM platform for monitoring data. The POPs Regulation states that IPCheM will act as the main repository for POPs monitoring data developed and reported by Member States. It also states that the format of data and software to be used when developing and submitting data to IPCheM will be agreed between the Member States and ECHA to help maximise efficiency and comparability.

2.2.9. Public access to environmental information

The Directive 2003/4/EC on public access to environmental information[53] 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.

2.3. Strategies, policies, and programmes

2.3.1. Sustainable development

In 2001, the European Union adopted the Sustainable Development Strategy (EU SDS) to provide a long-term vision combining economic dynamism, social cohesion and high environmental standards[54]. In 2009, the European Commission Communication COM(2009) 400 final[55] 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 manufacture as well as public health.

The review reaffirms the position of the European Council about sustainable development as a fundamental Union 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 Member States. In the Union, a key issue is to mainstream sustainable development thinking into various parts of the Europe 2020 Strategy. The EU SDS contributed to moving Europe out of the crisis and laying the foundations for a more sustainable future built on smart, sustainable and inclusive growth. In monitoring progress under the EU SDS, the Commission (EUROSTAT) has produced bi-annual monitoring reports on sustainable development, most recently in September 2015.

Concerning sustainable development, the European Union had a key role during the UN negotiations on the 2030 Agenda for Sustainable Development, including the sustainable

[53] 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

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

[55] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0400:FIN:EN:PDF

development goals (SDGs), which was adopted by the General Assembly on 25 September 2015. There are 17 goals, which are to be achieved by 2030[56] and which include responsible consumption and manufacture; 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 European Union and its Member States undertake to promote resource efficiency and sustainable consumption and manufacture, 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. To help support these aims the POPs Regulation places a key focus on waste and sustainability. This includes increased traceability for all wastes that contain POPs and obligations on Member States to put in place measures to support the implementation of the Regulation to identify POPs within waste and their final destination. The Regulation already includes low-POP thresholds in its Annex IV at concentrations equal or above which wastes must not be recycled (although pre-treatment operation to separate POP substances or to sort out POP-containing waste are permitted), however, the new requirements for traceability will also cover below threshold concentrations for POPs in waste.

The Stockholm Convention and the POPs 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.

2.3.2. 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 that do not have the characteristsics detailed under Annex D of the Stockholm Convention. Within European Union 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' (SVHCs)[57]. A key aim of the REACH Authorisation process is to ensure that SVHCs are progresively replaced with suitable alternatives. Action to restrict the use of certain PBT substances and require the use of alternatives, has also been taken through the REACH restriction process. Note that under the POPs Regulation, ECHA will take a central role in the development of scientific dossiers for new candidate POPs, allowing greater synergies between REACH and POPs on the international stage.

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 project[58] was intended to help develop alternatives to brominated flame-retardants (including substances identified as

[56] UN Sustainability goals, http://www.un.org/sustainabledevelopment/sustainable-development-goals/
[57] ECHA, substances of very high concern: https://echa.europa.eu/substances-of-very-high-concern-identification-explained
[58] Enfiro project: http://www.enfiro.eu/ and https://cordis.europa.eu/project/rcn/92068/factsheet/en

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 Union make contact with partner organisations to look at the issue of substitution, which includes the issue of substitution for SVHCs substances within commercial manufacture and goods. A number of other valuable resources are also open to industry including the information provided by the ECHA website[59], Subsport[60], and Medswitch[61] amongst others.

2.3.3. 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.

In June 2013, political agreement was reached on the seventh Environment Action Programme (EAP), the 7th EAP. The 7th EAP sets out the priority objectives for European Union 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 objectives:

- 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: https://ec.europa.eu/environment/action-programme/.

The 7th EAP sets out a framework to support the achievement of nine priority objectives through development and better implementation of Union 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 Union'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 assessment of the combination effects of substances and the effective management through relevant Union legislation.

[59] ECHA website: https://echa.europa.eu/substitution-to-safer-chemicals
[60] Subsport website: http://www.subsport.eu/
[61] MedSwitch website: http://www.switchmed.eu/en

In July 2018, a report was published on the study 'Towards an 8th Environmental Action Programme – Local and regional dimension'[62]. The purpose of the study was to inform the Committee of the Regions (CoR) in the preparation of its own-initiative opinion on the EAP, focused specifically on a possible 8th EAP. The study aimed to support the opinion through an analysis of the local and regional dimensions of a potential 8th EAP.

More recently in December 2019, the European Commission presented the European Green Deal[63], setting out a roadmap for making the Union's economy fully sustainable. As part of the roadmap the Green Deal also sets ambitions for eliminating pollution, including an action plan for zero-pollution and a new chemicals strategy for a toxic-free environment.

2.3.4. The Thematic Strategy for Soil Protection

The Thematic Strategy for Soil Protection was adopted by the European Commission in 2006. The purpose of the Strategy is to "*protect the soil while using it sustainably, through the prevention of further degradation, the preservation of soil function and the restoration of degraded soils*". The four pillars of the Strategy are awareness raising, research, integration, and legislation.

The Strategy has resulted in an increased focus on soil issues, with this becoming the focus of many research projects. To date these have been primarily on issues such as soil degradation, impacts of agriculture, etc., rather than on POPs[64]. However, with soil protection and remediation of soil contamination falling under the Strategy, there is the potential for this to be the subject of future research, in particular on the consolidated harmonisation of soil monitoring for POPs and other contaminants. Indeed, the POPs Regulation now gives much greater onus on contaminated sites, encouraging Member States to include details of identified sites and work to identify contaminated sites within both national reports and national implementation plans.

2.3.5. Strategies for control of pesticides and chemicals

The Chemicals Strategy for Sustainability[65], which was adopted in October 2020, strives for a toxic-free environment, where chemicals are produced and used in a way that maximises their contribution to society including achieving the green and digital transition, while avoiding harm to the planet and to current and future generations. It envisages the EU industry as a globally competitive player in the production and use of safe and sustainable chemicals. The strategy proposes a clear roadmap and timeline for the transformation of industry with the aim of attracting investment into safe and sustainable products and production methods.

This strategy sets a pathway towards implementation of this vision through actions to support innovation for safe and sustainable chemicals, strengthen the protection of human health and

[62] https://publications.europa.eu/en/publication-detail/-/publication/f106cce3-9535-11e8-8bc1-01aa75ed71a1/language-en/format-PDF

[63] https://ec.europa.eu/info/files/communication-european-green-deal_en

[64] European Commission 2012 Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – the implementation of the Soil Thematic Strategy and ongoing activities. COM (2012) 46 final. Dated 13.2.2012

[65] COM(2020) 667 final

the environment, simplify and strengthen the legal framework on chemicals, build a comprehensive knowledge base to support evidence-based policy making, and set the example of sound management of chemicals globally.

The Union Strategy for Dioxins, Furans and Polychlorinated Biphenyls adopted in 2001 (COM(2001) 593)[66] 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 final[67] 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)[68]. 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/EU[69] for further reduction of dioxins and furans, and dioxin-like PCBs within food groups, as amended by Commission Recommendation 2014/663/EU of 11 September 2014. This Recommendation called for increased monitoring of these substances within free range eggs, organic eggs, lamb and sheep livers and sea food (particularly crabs). The recommendation also indicates acceptable levels for the presence of dioxins and furans, and dioxin-like PCBs, within food.

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

2.3.6. OpenFoodTox database for pesticide residues in food

Since the creation of EFSA in 2002, the authority has completed food-based risk assessments for more than 4,000 substances. For individual substances, a summary of human health (and depending on relevant legislation animal health and ecological hazard assessments) data and conclusions have been collated and summarised within a publicly available database called ‘OpenFoodTox’. This database provides high level summarised data on a substance-by-substance basis including details of outcomes for specific toxicological endpoints, and hazard reference values that have been developed and then adopted by different expert committees. This includes data on the safe limits for pesticide residues in food covering a number of the POPs covered by the POPs Regulation.

66 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52010DC0593:EN:NOT
67 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0396:FIN:EN:PDF
68 http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0562:FIN:EN:PDF
69 http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013H0711

2.3.7. *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 Commission (COM(2007) 314 final[70]). 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. The progress report on the implementation of the EHAP of March 2010 (SEC(2010) 387)[71] 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.

2.3.8. *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 party in more than 40 international environmental agreements[72], 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 Union in 2009 and welcomed by the SAICM Governing body at ICCM4, in September 2015. The finalised Programme and the accompanying guidance can be found on UNEP's web page[73].

2.3.9. *Monitoring efforts of the Union*

Monitoring efforts in the Union cover monitoring of emission loads into the environment and monitoring of environmental concentrations.

The European Monitoring and Evaluation Programme (EMEP) is a scientifically based and policy 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

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[70] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2007:0314:FIN:EN:PDF
[71] http://register.consilium.europa.eu/pdf/en/10/st08/st08201.en10.pdf
[72] http://ec.europa.eu/environment/international_issues/pdf/agreements_en.pdf
[73] https://www.unenvironment.org/explore-topics/chemicals-waste/what-we-do/emerging-issues/chemicals-products

unintentionally produced POPs into the air, water and soil, the EMEP emission inventory and the E-PRTR database 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), with the first cycle covering the 2009-2015 period. The fourth implementation report (2015)[74] included a review of progress in the implementation of the Programmes of Measures planned by Member States in their RBMPs. A Commission report on the assment of Member States' second RBMPs is ongoing and is expected later in 2019. The EEA report on 'European waters – Assessment of status and pressures 2018'[75], indicated that inputs from urban wastewater treatment plants lead to contamination of over 13,000 water bodies with polyaromatic hydrocarbons (PAHs), mercury, cadmium, lead, and nickel being the dominated substances causing failure to achieve good chemical status. PAHs in particularly have been linked to atmospheric deposition from combustion of fuels, rather than direct release to water.

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 Union 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 contamination[76]. 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[77,78]. 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.

As mentioned in Section 2.1.5, for POPs present in pesticide residues, EFSA provides an annual monitoring report, based on an analysis of information provided by Member States.

2.4. Financial instruments

Using different funding instruments, the 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.

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[74] http://ec.europa.eu/environment/water/water-framework/impl_reports.htm
[75] EEA Report No 7/2018: https://www.eea.europa.eu/ds_resolveuid/2c13c637dfe84d37b8a9d39e2b1fb30f
[76] http://www.eea.europa.eu/publications/92-9167-058-8/page004.html
[77] https://www.eea.europa.eu/data-and-maps/indicators/eea32-persistent-organic-pollutant-pop-emissions-1/assessment-10
[78] http://www.eea.europa.eu/publications/NYM2/page005.html

2.4.1. *Funding instruments for the Union*

The LIFE programme supports environmental and nature conservation projects within the Union to protect the environment and limit negative anthropogenic effects. The programme was established in 1992 and operated through individual phases, each one running for 4 years.

The phase between 2007 and 2013 was called LIFE+ and had a budget of €2.1 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.

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 age[79], and the second to evaluate emission exposure of PAHs in the population[80]. The LIFE+ programme was designed to complement other funding programmes for the environment which are described as follows.

LIFE programme has also supported investigations into the implementation of bioremediation techniques for the mitigating of soil contamination, with contaminants including PCBs, pesticides and PAHs (LIFE97 ENV/IT/000024 and LIFE03 ENV/IT/000321).[81]

There are numerous other funds of the Union with different target groups that do not specifically refer to POPs, but which support the implementation of the environmental legislation or the supply of technical solutions (the Competitiveness and Innovation Framework Programme[82], for example, supports small and medium-sized enterprises (SMEs) innovation activities (including eco-innovation), while the NGO operating grants[83] 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 set the framework for the first four years for the management of the 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

79 http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=3433
80 http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=3756
81 European Commission 2014 LIFE and Soil Protection
82 https://www.welcomeurope.com/european-funds/cip-competitiveness-innovation-framework-programme-572+472.html#tab=onglet_details
83 http://ec.europa.eu/environment/ngos/index_en.htm

€1.1 billion under the sub-programme for Environment and €0.4 billion under the sub-programme for Climate Action.

The European Commission proposes to raise the budget of the LIFE programme to €5.45 billion between 2021 and 2027. The new LIFE programme would have four sub-programmes: nature and biodiversity; circular economy and quality of life; climate change mitigation and adaptation; and clean energy transition.

With regards to soil contamination, the Cohesion Funds have provided support to the regeneration of brownfield sites across the Union. In the period 2007-2013, around €3.1 billion of funding was allocated under the Cohesion Policy, with Hungary, Czechia and Germany allocated the most funding. Note that it is not known how much of this related to soil contamination by POPs.[84] More recently a range of additional projects have been launched to tackle the issue of soil contamination from POPs, including:

- LindaNET[85] which is a collaborative effort amongst regions to work towards the improvement of sites contaminated by HCH and Lindane.
- DISCOVERED[86] which is project launched in the Aragon region of Spain to tackle lindane pollution. The project aims to develop a prototype pollution mitigation system based on in-situ chemical oxidation with alkaline activation to restore water quality.
- The JRC also reported in 2018 on progress with indicators for management of contaminated sites in the Union[87].

2.4.2. *Funding for neighbouring and partner countries*

The European Neighbourhood Policy (ENP) was initially launched in 2003 and fully developed in 2004, as a foreign relations instrument to build ties with countries to the east and south of the Union. The main objective of the ENP is 'avoiding the emergence of new dividing lines between the enlarged Union and our neighbours and instead strengthening the prosperity, stability and security of all concerned'.[88] The ENP applies to the Union's immediate neighbours by land or sea, including, the 16 ENP countries being Algeria, Armenia, Azerbaijan, Belarus, Egypt, Georgia, Israel, Jordan, Lebanon, Libya, Moldova, Morocco, Palestine, Syria, Tunisia and Ukraine. The ENP was reviewed in November 2015, in parallel with the the work conducted on the Union's Global Strategy.

The central element of the inititive are the bilateral ENP Action Plans agreed between the Union and each partner country. Aspects relating to environment, climate change, energy, transport and sustainable development are amongst the topics covered by the ENP Action Plans. Through the ENP, Union environmental policy acknowledges that many environmental problems go beyond the borders of individual countries and the Union,

[84] European Commission 2012 Report from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions – the implementation of the Soil Thematic Strategy and ongoing activities. COM (2012) 46 final. Dated 13.2.2012

[85] https://www.interregeurope.eu/lindanet/

[86] https://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=4633

[87] https://esdac.jrc.ec.europa.eu/public_path/shared_folder/doc_pub/EUR29124.pdf

[88] http://ec.europa.eu/environment/archives/enlarg/med/pdf/enp_flyer_en.pdf

specifically noting the importance of acid rain, biodiversity, desertification, hazardous wastes, oil spills, persistent organic pollutants, the protection of the great rivers and seas as well as tropical forests.

The ENP's financial arm is the European Neighbourhood Instrument (ENI) and is worth €15.4 billion from 2014 – 2020. The ENI functions through 10 priority areas including Climate Change Adaption and Management of Natural Resources. The ENI provides the bulk of Union funding to the 16 ENP partner countries mentiond above, the vast majority of the ENI funding being used for bilateral cooperation.

The ENP follows on from the previous programme, the European Neighbourhood and Partnership Instrument (ENPI), which targeted sustainable development and approximation to EU policies and standards –including the implementation of the POP Regulation– in neighbouring third Countries as well as through a strategic partnership with the Russian Federation. The ENPI operated for the period 2007-2013, with nearly €12 billion in Union funding available to support these partners' reforms. The ENPI had 15 cross-border cooperation (CBC) programmes which receive a funding of €1.2 billion for the same period. The Instrument for Pre-Accession Assistance (IPA) 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.

2.4.3. Multilateral programmes funded by the Union

The promotion of measures to address worldwide environmental problems is a key objective of the Union 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 Union, including the Environment and Sustainable Management of Natural Resources including Energy Thematic Programme (ENRTP). Some examples funded within the ENRTP:

- Support to the Secretariat of Stockholm Convention of about €1,000,000 in the period 2007 to 2011 to support Parties to implement their obligations under the Stockholm Convention, to further elaborate the dioxin and furan toolkit to better adapt the toolkit guidance to the needs of developing countries and to support the gathering of monitoring data on POPs.
- Support to the Secretariat of Stockholm Convention of €1,450,000 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.
- Through ENRTP – phase III (2012-2017) of the global capability development under the Life Cycle Initiative was supported with €4 million, which focussed on

promotion and training of life-cycle analysis approaches to improve sustainability and avoid regrettable substitution for POPs.

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:

- Support to the Secretariat of Stockholm Convention of €2,000,000 to support their 2014-2015, 2016-2017 and 2018-2019 programmes of work, including the global monitoring plan, the programme on unintentionally produced POPs, the support of developing countries to establish their POPs inventories and to draw-up and review national implementation plans, and the development and revision of guidance, including on the BAT/BEP toolkit and on reporting.

Further support was provided to the following initiatives:

- the Quick Start Programme Trust Fund of the Strategic Approach to International Chemicals Management (SAICM)[89], which aims at supporting the sound management of chemical and waste in order to minimise significant adverse impacts on the environmnet 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 (€17 million).
- the promotion and further development of the IOMC toolbox (phase III - €2 million), including training of users in developing countries.
- The programme for the period 2018-2020 of the GPGC Environment and Climate envelope will continue support to combat pollution and promote sound management of chemicals ands waste through the Switch to Green Flagship Initiative.

2.5. 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 the Union.

The Seventh Framework Programme (FP7), ran for the period 2007-2013 with a total budget of over €50.5 billion from which €1.9 billion was attributed to the relevant thematic areas of ‘Environment (including Climate Change)’, €1.9 billion to ‘Food, Agriculture and Fisheries, and Biotechnology’ and €6.1 billion to ‘Health’. These thematic areas particularly supported research on projects related to POPs (see Table 13). The programmes ‘Ideas’ (€7.5 billion over 7 years) and ‘People’ (€4.7 billion over 7 years) of the FP7 also funded some projects

89 http://www.saicm.org/Implementation/QuickStartProgramme/tabid/5523/language/en-US/Default.aspx

with reference to POPs. The thematic areas and programmes are indicated in Table 13 in section 8 of this document. 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 Union. Projects with POPs 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 Union 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 and improving the understanding of environmental and human exposure to chemicals such as PCBs and perfluorinated compounds[90] 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 for the period between 2014 – 2020. The programme has an overall budget of about €80 billion euros. Key overall themes for Horizon 2020 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 environment[91], work to assist with the de-

[90] https://ec.europa.eu/environment/integration/research/pdf/fp7_catalogue.pdf
[91] http://ec.europa.eu/environment/enlarg/med/horizon_2020_en.htm

pollution of the mediterranean[92], and the management of 'POPs' substances within consumer supply chains.

2.5.1. 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 Union 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 Horizon 2020 budget dedicated to the JRC is around €1.9 billion (about 53% of the JRC budget), of which around €210 million is dedicated to operational research activities conducted through through its seven research institutes, specialised in different areas of research[93]. 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 Union 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/), and will act as the main repository for POPs monitoring data under the recast of the POPs regulation (EU 2019/1021).

The JRC also elaborates the Best Available Techniques Reference Documents (BREFs) based on the IPPC Directive initially, and now based on the IED. BREFs have been created covering a wide range of industry sectors[94,95]; with regular work to provide updates over time where needed[96]. Under the IED, the BAT conclusions of the BREF are adopted as Commission Implementing Decisions[97]. Several of the BREFs also contain information on

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

93 http://www.europarl.europa.eu/RegData/etudes/IDAN/2015/571312/EPRS_IDA%282015%29571312_EN.pdf

94 The BREFs can be downloaded from the website of the European IPPC Bureau, https://eippcb.jrc.ec.europa.eu/reference

95 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'.

96 Further detail on the current BREFs and ongoing update work can be found here: https://eippcb.jrc.ec.europa.eu/reference.

97 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

POPs and related BAT as well as the corresponding emission levels associated with the application of BAT (BAT-AELs).

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.

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

Modern research in a global environment necessitates co-operation at different levels. The fragmentation of the Union's efforts cannot be overcome without determined actions. Taking up this challenge, the European Commission, Member States and the European Parliament, the scientific community and industry have created the "European Research Area" (ERA[98]), this provides a framework for researchers and technologists to move freely within the Union, including promoting open access to results and gender equality. As of 2017, the ERA included a database of research positions covering 40,000 opportunities per annum and 250 service centres to help facilitate researchers resettling to new locations within the Union. Funding under horizon 2020 (€6 billion) and the European Research Council (€13 billion) have been provided to bring together the combined scientific knowledge across the Union as part of the European Research Area.

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 Union created The European Network for Observing our Changing Planet (ERA-PLANET) in January 2016, which includes a network of 38 partner organisations from 14 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 resources[99].

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.

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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

98 https://ec.europa.eu/info/research-and-innovation/strategy/era_en

99 ERA-Planet: http://eraplanet.meteo.noa.gr

2.5.3. *Future research and innovation*

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 2.3.8).

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 takes place between 2016-2021. The objective is to create a European joint programme for monitoring and scientific assessment of human exposures to chemicals and potential health impacts, building on previous activities undertaken at Union 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 Union 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 Union 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 Joint Research Centre[100].

The preliminary work in 2015 identified nine priority groups of chemical substances that were examined to develop factsheets covering substance classification, policy-related questions and research objectives to span the science-policy interface. In 2017 a further nine priority groups of substances were identified to undergo the same process. Upon completion of developing factsheets, the HBM4EU project has continued the research on the first nine priority substances, with results reported in 2019[101,102]. The HBM4EU groups of substances include PAHs, PFAS, and flame retardants (including POP flame-retardants) in the original (2015) list. The 2017 list further includes pesticides as a general grouping.

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[100] 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

[101] https://www.hbm4eu.eu/the-substances/

[102] https://www.hbm4eu.eu/wp-content/uploads/cmdm/6740/1571732940_HBM4EU_AD5.2_Reporting_first_set_of_substances_v1.1_final.pdf

Further actions on research and innovation around POPs are being carried out by the Stockholm Convention Regional Cenres (see section 2.5.1).

2.6. Information Exchange, Public information, awareness and education

2.6.1. Overview

The Union 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 Union 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 POPs hosted by ECHA[103,104]. In addition the European Commission hosts databases such as Eur-Lex, statistic databases of Eurostat, the E-PRTR[105], the Union pesticide database[106], and OpenFoodTox for pesticide residues in food, and databases of Union institutions on specific topics such as the The Chemical Lists Information System (CheLIST)[107]. The Directorate General for Environment maintains the POP-specific website containing information on Union legislation and POP-related research projects. As part of the POPs Regulation, ECHA now also has a key role to play on hosting information on POPs, including new elements on candidate POPs and the stakeholder consultation (which takes place over eight-weeks) during the preparation of a nomination and the review of a nominated substances[108]. Additionally, the European Environment Agency (EEA) publishes a substantial amount of information relevant to POPs[109], and the European Food Safety Authority (EFSA) has a role in communication of the risks regarding POPs in food.

Under the POPs Regulation, there is also a requirement for Member States to develop and publish reports on their progress against the Articles of the regulation. This includes statistical and monitoring data, and is required to be kept up to date, with revisions annually (or at least once every three years where no new data is available).

In addition the general public or any interested stakeholder can have access to certain information on the presence of SVHC substances[110] 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 days[111].

Within SAICM, the Union 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

103 http://ec.europa.eu/environment/chemicals/international_conventions/index_en.htm
104 https://echa.europa.eu/understanding-pops
105 http://prtr.ec.europa.eu/
106 https://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/public/?event=homepage&language=EN
107 http://chelist.jrc.ec.europa.eu/
108 https://echa.europa.eu/proposals-for-new-pops
109 https://www.eea.europa.eu/data-and-maps/indicators/eea32-persistent-organic-pollutant-pop-emissions-1
110 According to Article 57 of the REACH Regulation; see also section 0.
111 According to Article 33 of the REACH Regulation.

on chemicals in products. Stakeholders include businesses, governments, intergovernmental agencies, recyclers, waste management actors, non-governmental organisations, and consumer groups. The programme document[112] 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.

Furthermore, as part of the revised waste framework that entered into force in July 2018, ECHA is required to establish a new database of information for Substances of Concern In articles as such or in complex objects (Products) (the SCIP Database)[113]. Those companies supplying articles and/or products containing SVHCs have to provide data to the SCIP Database, to help ensure that information on such articles is available throughout the whole lifecycle of products and materials, including at the waste stage. The information in the database is made available to waste operators and consumers.

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 Union's principle of subsidiarity, public information, awareness raising and education on POPs fall within the remit of the Member States, while the POPs 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,[114] with the third synthesis report expected later in 2020.

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 POPs Regulation, nomination of chemicals that exhibit POP caracteristics to the Stockholm Convention, exchange of information on occurrence and elimination of POPs and data gathering via reporting obligations under the POPs Regulation.

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[112] SAICM, 2015, 'The Chemicals in Products Programme', http://www.saicm.org/Portals/12/Documents/EPI/Guidance%20for%20Stakeholder%20in%20Exchanging%20CiP%20Information_October2015.pdf

[113] https://echa.europa.eu/scip-database

[114] 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.

2.6.2. *Stockholm Convention Regional Centres*

The Stockholm Convention has established a network of 16 regional centres globally[115] 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 Union two such centres exist, one based in Czechia (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 Czechia.

The two Stockholm Convention regional centres located in the Union have obligations to support knowledge exchange and raise awareness; they also work to ensure that duplication of effort is avoided[116]. 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 centres[117].

The Stockholm Convention Regional Centre for Capacity Building and the Transfer of Technology (SCRC) in Czechia has been established to promote chemicals management and management of wastes containing toxic chemicals in the Central and Eastern European region and worldwide by providing training, capacity building, expertise support in a number of fields. The Regional Centre is hosted by the Research Centre for Toxic Compounds in the Environment (RECETOX).

This is achieved primarily through the GENASIS (Global ENvironmental ASsessment Information System), a platform that disseminates information on POP levels in the environment and gives access to formation on individual POPs. GENASIS was created in cooperation of RECETOX with IBA MU, institutes of the Masaryk University, Brno, Czechia. GENASIS combines expertise, validated data from partner institutions, input from regular environmental monitoring programmes and provides a data repository, analytical tools and data management, providing the user with available up-to-date information on spatial and temporal trends in POPs concentrations in various environmental matrices (air, water, soil, biota and human tissues).

Experts from RECETOX between 2010-2014 in collaboration with UNDP, UNIDO and NATO built capacities in Armenia, Kazakhstan and Kyrgyzstan; in 2013-2015 intensively and in long term cooperated with Turkey, Bosnia and Herzegovina and Serbia; and in the years 2012-2016 for example, performed short-term training in Armenia, Brazil, China, Ghana, South Korea, Malaysia, Mali, Maldives, Seychelles, Ukraine and other countries.

The SCRC RECETOX 2016-2019 work plan has the following key goals: strengthening global capacities in chemical analyses of toxic chemicals, support in implementation of the Global Monitoring Plan to the Stockholm Convention by operating monitoring networks and training experts in sampling, and monitoring and data mining and management.

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[115] Stockholm Convention Regional Centres: http://chm.pops.int/Partners/RegionalCentres/Overview/tabid/425/Default.aspx

[116] Personal Communication, Recetox, 2016.

[117] http://chm.pops.int/Partners/RegionalCentres/Overview/tabid/425/Default.aspx

RECETOX has also supported knowledge exchange through a series of ‘international summer schools’ open to experts and general interest groups. The 14th Summer School on Toxic Compounds in the Environment (2018) focussed on contaminants in the environment, including modeling long-range transport, sampling and analysis, and use of GIS data.[118] The latest summer school (15th international summer school) held in June 2019 was organised in association with the HBM4EU programme and had a focus on human biomonitoring data.

The Regional Activity Centre for Sustainable Consumption and Production (SCP/RAC) in Barcelona, Spain, is a centre for international cooperation with Mediterranean countries on development and innovation in the manufacture sector and civil society, based on more sustainable consumption and manufacture models. This centre undertakes activities in the Mediterranean region related to technical assistance and promotion of capability and information exchange in relation to resource efficiency, clean manufacture and pollution prevention. It also works on providing support related to the reduction of hazardous chemicals through BAT and BEP (Best Environmental Practices).

For example, the GRECO project is a Mediterranean initiative designed to promote green competitiveness in the region by showing the economic benefits that businesses can gain from an environmental approach. The SCP/RAC also support the identification of the assets and challenges for Green Entrepreneurship in the Mediterranean region and collection and dissemination of successful case studies of Green Entrepreneurs. Furthermore, the SWIM-H2020 SM Project (Sustainable Water Integrated Management and Horizon 2020 Support Mechanism 2016-2019) funded by the Union aims to contribute to reduced marine pollution and a sustainable use of scarce water resources in the countries of North Africa and the Middle East.

SCP-RAC acts as the Stockholm Convention regional centre for the Mediterranean covering all of the southern 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 manufacture activities as well as the wider supply chain. SCP-RAC have supported this process with provision of information for substituition detailed on the subsport website[119] and input to the ‘SwitchMed’[120] programme.

3. OVERALL ASSESSMENT OF THE POPS ISSUE IN THE UNION

At Union level, significant progress towards the elimination of POPs has been achieved. Manufacture and use of all POPs is prohibited with some exemptions that are decreasing. A main challenge for the Union 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 Union for the different POPs.

[118] http://www.sense.nl/courses/past/10892612/14th-Summer-School-on-Toxic-Compounds-in-the-Environment-2018

[119] Subsport website http://www.subsport.eu/

[120] SwitchMed website http://www.switchmed.eu/en

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 Regulation (EC) No 850/2004 before 2008, i.e. before the new POP substances were listed in the Stockholm Convention or the POP Protocol in 2009, 2011, 2013, 2015, 2017 and 2019 (cf. section 3.2). The data on old POPs presented in the following sections are based on the third synthesis report and draft version of the fourth synthesis report covering 2010 – 2013 and 2013 – 2015 respectively; which includes all annual reports and the 2010 – 2013 and 2013 – 2015 triennial reports of the Members States.

3.1.1. Manufacture

The old POPs are no longer manufactured in the Union.

The specific exemption of the use of DDT in dicofol manufacture has been withdrawn from the POPs 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)[121] 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 transition period granted by the Member States expired by 30 March 2010. Up to the year 2006, dicofol has been produced by Montecinca SA. at Monzón, Spain. The yearly manufacture amounted to approx. 1500 t. Manufacture was discontinued in 2006, when the registration for Spain expired. Until 2009, dicofol[122] was furthermore formulated and used in Italy[123].

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 Union. Remaining uses of old POPs are only in articles that were produced and placed on the market before the entry into force of the POPs Regulation and as standards for research purposes. Some illegal placing on the market of imported fireworks containing HCB has been reported by some Member States in the period 2010-2013 and again in 2013-2015. Other Member States also indicated the presence of SCCPs and/or HCB in items such as childrens toys, christmas lights, plastics bags, electric products and other articles in 2014 and 2015 which resulted in products being withdrawn from the market. The enforcing authorities of the relevant Member States have intervened to stop these illegal practices and ensured a proper disposal of the products, although no penalites were reported as a result.

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[121] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:262:0040:0041:EN:PDF

[122] Dicofol meets the Stockholm Convention Annex D criteria

[123] http://www.unece.org/env/lrtap/TaskForce/popsxg/2010/Exploration%20of%20management%20options%20for%20Dicofol%20final.pdf

3.1.3. Import, export and intra-Union shipments

Waste containing POPs (e.g. obsolete pesticides or contaminated equipments) has been shipped into some Member States for the purpose of its disposal and elimination. These shipments originate from EU and non-EU countries that lack adequate technology for proper disposal of such waste. These shipments, including imports are being undertaken in accordance with the provisions of the Stockholm Convention and they contribute to the overall reduction of POPs. Slovenia, for example, indicated that there are no technical facilities for disposing of PCB and PCB equipment (with final disposal or destruction of PCB) in an environmentally sound manner in the country. Therefore the waste PCB and waste PCB equipment is shipped to other Member States, i.e. France, Germany and Austria, for disposal in an environmentally sound manner.

Some illegal imports of POPs embedded in products occurred in the period 2013-2015. Hexachlorobenzene was imported as part of fireworks, which also occurred during the 2010-2013 period, along with SCCPs found in plastic items including toys, electrical products and bathroom items. As mentioned in the sub-section 3.1.2, the enforcing authorities took appropriate measures to remove them from the market as soon as possible.

There is very little Union export of POPs. In the period 2013-2015, a few kilograms of the following substances have been exported under the exemption for standards for research purposes:

- Aldrin, Lindane, Dieldrin, Endrin, DDT, HCB, PCBs, heptachlor, HCH, endosulfan, and hexachlorobutadine

Conversely a review of the ECHA website for notifications on exports from non-EU countries to the Union showed that in 2019 the USA notified the export of the following substances:

- Endrin to Germany,
- PCBs to France, Germany and the UK,
- Pentachlorobenzene to Germany,
- PFOA to France and the UK,
- SCCPs to France, Germany and the UK.

3.1.4. Stockpiles and waste

Only one Member State (Spain) reported information on stockpiles of obsolete pesticides in their triannual reports covering the period 2013-2015. For comparison, in the third synthesis report (covering the period 2010-2012), four Member States were reported to have provided information on stockpiles of obsolete pesticides, i.e., Bulgaria, Hungary, Lithuania and the United Kingdom. The reported quantities varied between 88 kg in the United Kingdom to 200 tonnes in Hungary.

In the Member States NIPs no information on stockpiles of obsolete pesticides was reported for the period 2013-2015 and beyond or Member States indicated that all identified stockpiles have been disposed.

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.

It is noted that, ‘in almost all Member States where lindane production took place, the elimination and de-pollution of soils, surface water and groundwater is needed’ and that ‘hot-spots’, with thousands, and often hundred thousands, of tonnes of lindane and HCH waste, are pending remediation activities in Czechia, France, Germany, Hungary, Italy, Poland, Romania, Slovakia and Spain[124].

In their triannual report (2013-2015), Spain provided information on sites contaminated by HCH in four regions, i.e. Aragón, Castilla y León, País Vasco and Galicia. In the region of Aragón, lindane was manufactured between 1975 and 1989, with the generated solid and liquid waste disposed in the landfills of Sardas and Bailín. Many decontamination actions have been undertaken and actions are still planned, such as hydrogeological monitoring or further testing activities.

PCB disposal by end of 2010 (PCBs in larger equipment) and 2025 (all remaining PCBs)

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 Union level the aims of the Convention are incorporated into Directive 96/59/EC on the disposal of PCBs and PCTs (cf. section 2.2.3) and further in the POPs Regulation (cf. section 2.2.2). The PCB directive places a requirement on all Member States to develop registers of equipment containing more than 5 dm^3 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 (of more than 5 dm^3) in the registers were decontaminated or disposed of by 31 December 2010 at the latest.

Under the PCB Directive equipment smaller than 5 dm^3, with concentrations between 0.05% and 0.005% PCB could still be included within the register, but could be marked as ‘PCB contaminated <0.05%’ and would therefore not be subject to the 31 December 2010 deadline. The POPs Regulation includes a provision under Part A, Annex I of the regulation that all remaining PCBs in-use for di-electric equipment (with greater than 0.005% concentration and 0.05 dm^3 size) must be identified and removed from use by no later than 31 December 2025.

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 Directive[125] 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 the Union, with some Member States close to meeting the 2010 target. However, most Member States had not met the target

[124] European Union (2016) “Lindane (persistent organic pollutant) in the EU”, Report for the European Parliament, Policy Department C: Citizen’s Rights and Constitutional Affairs

[125] European Commission, 2014: Ex-post evaluation of certain waste stream directives.

of decontamtion or disposal of liquids and equipment contaminated with PCB on registers by 31 December 2010.

In order to better understand and complement the data on PCB-containing equipment, a request for information was sent out by the contractor to the Member State Competent Authorities in April 2017. Acknowledging the levels of uncertainty inherent to the estimates of PCBs in such equipment, the request asked for input on the quantities of PCB actively in use in di-electric equipment, both in 1990 and in 2015, as well as the quantities of PCBs that have been destroyed between 1990 and 2015. In total, 14 Member States responded to the request. The majority of the Member States reported that in 2015 <10% of the PCBs in-use from the 1990 reference year were still in use. Five of these Member States estimated a fraction of PCB in use below 1%. Croatia and Romania reported significantly higher PCB fractions still in use, 30% and 49%, respectively. It should be noted that their estimates were based on different reference years, i.e. 2008 for Croatia and 2005 for Romania.

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 Union. 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 (500 mg/kg) PCB and equipment containing more than 50 ppm (50 mg/kg) 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.

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 Member States in the coming years.

The POPs triennial synthesis report for the period 2010-2012, which is based on data from submissions by Member States under Article 12 of Regulation (EC) No 850/2004, highlighted that work to identify, remove and dispose of PCB-contaminated liquids was still ongoing after 2010. However, since different approaches to quantify materials have been used, it is difficult to comment on total 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, 7th, 8th and 9th COP meetings held in May 2009[126], in April 2011, in May 2013, in May 2015, in May 2017, and in May 2019 respectively, and in the POP Protocol at the 27th

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

meeting of the Executive Body of LRTAP Convention held in December 2009[127] and that were not listed in any of these instruments before. An summary of 'new' POPs added to the Convention since 2009 is provided in Table 5 below.

Table 5 New POPs added to the Stockholm Convention since 2009

COP	Date	POPs added
4	4 to 8 May 2009	• Alpha hexachlorocyclohexane in Annex A without specific exemptions (decision SC-4/10) • Beta hexachlorocyclohexane in Annex A without specific exemptions (decision SC-4/11) • Chlordecone in Annex A without specific exemptions (decision SC-4/12) • Hexabromobiphenyl in Annex A without specific exemptions (decision SC-4/13) • Hexabromodiphenyl ether and heptabromodiphenyl ether in Annex A with specific exemptions (decision SC-4/14) • Lindane in Annex A with specific exemptions (decision SC-4/15) • Pentachlorobenzene in Annex without specific exemptions and in Annex C (decision SC-4/16) • Perfluorooctane sulfonic acid, its salts and perluorooctane sulfonyl fluoride in Annex B with acceptable purposes and specific exemptions (decision SC-4/17) • Tetrabromodiphenyl ether and pentabromodiphenyl ether in Annex A
5	25 to 29 May 2011	• Technical endosulfan and its related isomers in Annex A with a specific exemption (decision SC-5/3)
6	28 April to 10 May 2013	• Hexabromocyclododecane in Annex A with specific exemptions (decision SC-6/13)
7	4 to 15 May 2015	• Hexachlorobutadiene in Annex A without specific exemptions (decision SC-7/12) • Pentachlorophenol and its salts and esters in Annex A with specific exemptions (decision SC-7/13) • Polychlorinated naphthalenes in Annex A with specific exemptions and in Annex C (decision SC-7/14)
8	24 April to 5 May 2017	• Decabromodiphenyl ether (commercial mixture, c-decaBDE) in Annex A with specific exemptions (decision SC-8/10) • Short-chain chlorinated paraffins in Annex A with specific exemptions (decision SC-8/11) • Hexachlorobutadiene in Annex C (decision SC-8/12)
9	29 April to 10 May 2019	• Perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds in Annex A with specific exemptions • Dicofol in Annex A, with no exemptions

Prior to their listing the new POPs were subject to prohibition or severe restrictions in the Union. 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-PBDEs 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 2011).

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

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.

Table 6 Overview on the new POPs (ESWI 2011 + additional references where indicated)

Substance	Purpose	Manufacture	Use/Stockpiles in Products	Import	Export	Waste	Emissions
Chlordecone*	Pesticide	Historical manufacture began in the USA in the early 1950s. No Union manufacture but was marketed in the Union until 1993[128]. No current manufacture 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 manufacture 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[129].	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 manufacture in Europe amounted to 10.000 to 50.000 tonnes per year. Manufacture stopped latest in 2007.	No current use is reported.	Banned	Banned	No information available.	No information available.
Hexabromobiphenyl*	Industrial Chemical	Historical manufacture within the USA from early to late 1970s. No manufacture in the Union, but was marketed. No current manufacture expected.[130]	No current use is reported.	Banned	Banned	No information available.	No information available.

[128] Stockholm Convention Risk Management Evaluation (UNEP/POPS/POPRC.3/20/Add.2)
[129] 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.
[130] Stockholm Convention Risk Management Evaluation (UNEP/POPS/POPRC.3/20/Add.3)

Substance	Purpose	Manufacture	Use/Stockpiles in Products	Import	Export	Waste	Emissions
Tetrabromo-diphenyl ether and penta-bromodiphenyl ether	Industrial Chemical	Manufacture in the Union 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: ~6 t in 2010
Hexabromo-diphenyl ether and hepta-bromodiphenyl ether	Industrial Chemical	Manufacture within the Union 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-Octa-BDE; amount of C-OctaBDE not quantifiable	128 t of C-OctaBDE in 2010	c-OctaBDE emissions : ~3 t in 2010
Perfluorooctan e sulfonic acid (PFOS), its salts and per-fluorooctane sulfonyl fluoride	Industrial Chemical	Within the Union 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[131] (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: >1 t in 2010
Hexabromocyc lododecane	Industrial Chemical	Manufacture and use within the Union was subject to REACH Authorisation. 13 companies were granted Authorisation in 2016 for two specific applications.[132]	As of January 2016 only two applications were granted continued use: as a flame-retardant for expanded polystyrene boards and as a flame-retardant in expanded polysyrene beads. The Authorisation expired in August 2017. Data on usage rates post-January 2016	No current data post-REACH Authorisation	No current data post-REACH Authorisation	No information available.	41 kg per/annum to air and 35 kg to water during manufacture and 530 kg to air/560 kg to water from use

[131] Represents the existing stock of the substance in product in use.
[132] ECHA news update: http://echa.europa.eu/view-article/-/journal_content/title/authorisations-granted-for-two-uses-of-hbcdd

Substance	Purpose	Manufacture	Use/Stockpiles in Products	Import	Export	Waste	Emissions
			unknown. Data from 2014[133] suggested manufacture rates of 5,000 – 7,500 tonnes per annum.				phase[116].
Pentachlorobenzene (PeCB)	Industrial Chemical; Intermediate in pesticide manufacture; By-product	No intentional manufacture or use	Sources in Europe accounts for about 2,632 kg/y (dominated by the power manufacture from coal)	No information available[134]. In the POPRC risk profile for PeCB[135] no trade or stockpiles have been reported.		307,8 kg 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 ~ 2.151 t and in used products 22.132 t in 2010	No information available.	No information available.	2.082 t SCCPs in 2010	SCCPs emissions: ~69t in 2010
HCBD – hexachloro-butadiene	Industrial Chemical By-product	No use and manufacture in the Union; unintentional manufacture 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.	500 kg 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 manufacture in the Union; unintentional manufacture 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

133 VECAP annual report: http://www.vecap.info/publications-2/
134 http://ihcp.jrc.ec.europa.eu/our_databases/edexim
135 UNEP/FAO/RC/CRC.7/9/Add.2, document No. 4, November 2007

Substance	Purpose	Manufacture	Use/Stockpiles in Products	Import	Export	Waste	Emissions
Decabromodiphenyl ether***	Industrial chemical	No manufacture in the Union after 1999. Use declined from mid-2000s, some remaining use permitted for legacy automotive and aircraft parts	Between 1970 – 2010 around 185,000 – 250,000 tonnes of c-decaBDE was used in the EU. Earnshaw et al (2013) assumes stockpiles of 75,000 tonnes in 2000. Consumption rates declined from 11,000 tonnes per annum in 1999 to 4,000 tonnes in 2012. REACH restriction on decaBDE 2 March 2019 limits placing on the market above 0.1% w/w.	No information available	No information available	Assuming 10 year lifespan of goods and stockpile of 75,000 tonnes would equate to 7.5 tonnes of waste per annum (in plastics, textiles and soft furnishings).	Predicted decaBDE emissions in the EU: Air 4 tonnes p/a; water 2.75 tonnes p/a and soil 0.25 tonnes per annum (Earnshaw et al, 2013)
Pentachlorophenol and its salts and esters****	Pesticide (timber treatment)	No manufacture or use in the Union. Under the POPs Regulation, from 2019 pentachlorophenol and its salts and ester are not permitted for manufacture, and shall not be used in the production of another substance, mixture, or article. Before, REACH restriction limited concentrations to 0.1% w/w when placed on the market since 2008.	Use of PCP was heavily restricted in the EU from 1991 (Council Directive 91/173/EEC), however treated timbers can have a long life span up to 50 years. Total quantity of remaining stocks of timber contaminated with PCP is unknown. Usage of PCP in the EU had dropped to 100 tonnes per annum (import) by 1996, with only five Member States still using PCP at that time (Eurochlor, 1999).	Banned	Banned	No information available.	No information available.

Substance	Purpose	Manufacture	Use/Stockpiles in Products	Import	Export	Waste	Emissions
Perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds	Surfactant and processing aid for production of fluoropolymers	Production of PFOA related substances in the Union in 2014 estimated at 100 to >1000 t/y (ECHA, 2015) Under the POPs Regulation, from 2020 PFOA, its salts and related compounds are not permitted for manufacture, and shall not be used in the production of another substance, mixture, or article. However, a number of exemptions apply.	Estimated volumes of use in the EU in 2014 were (ECHA, 2015): • Textile and leather treatment (~1,000 t) • Paper treatment (>150 – 200 t) • Firefighting agents (>50 – 100 t) • Paints and inks (>50 – 100 t) • Others uses (>0.1 – 0.5 t) • Manufacture of fluoropolymers (<20 t) • Photo industry (1.0 t) • Semiconductor industry (<0.05 t) • Other uses (0.5-1.5 t) From 2020, under the POPs Regulation the use of PFOA was restricted with a number of specifically exempted uses.	Banned (from 2020), but with derogations	Not yet listed in PIC Regulation.	No information available.	No information available.
Dicofol	Pesticide	Around 1,500 t were produced in the Union in 2000 (primarily in Spain and Italy). Use was around 90 – 150 t/y, primarily in Spain, where use ceased in 2009. Under the POPs Regulation, from 2020 dicofol is prohibited for manufacture and use in another substance, mixture, or article.	From 2020, the POPs Regulation prohibited all uses.	Banned	Banned	No information available.	No information available.

* 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 greatist issue now posed by this substance relates to contaminated land. Further discussion of HCH and lindane is provided in section 3.4.2

***Details on manufacture and stockpiles based on EU risk assessments from 2001 and 2003 and REACH striction dossier (2014), information on waste and emissions based on Earnshaw et al, (2013).

****Details based on EU regulation, and Eurochlor dossier (1999).

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 manufacture in the Union 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 manufacture in Europe amounted to 10,000 to 50,000 tonnes per year[136].

In the Union, 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, stalky 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 manufacture, placing on the market and use has been banned by adding it to the appropriate Annex of the POP Regulation (Regulation (EC) No 2019/1021). Further information such as relating to endosulfan stockpiles in the Member States is not available. However, for imported food products, the EFSA OpenFoodTox database reports that in 2012 safe limits for residues within food (based on an acute reference dose (ARfD)) were calculated at 0.015 mg/kg bw/day.

3.2.2. *POP Polybrominated diphenyl ethers (POP PBDEs)*

Polybrominated diphenyl ethers are a family of chemicals which have been used as flame retardants in a range of applications covering plastics, textiles, soft furnishings, adhesives, sealants, coatings and inks . A number of commercial products containing POP-PBDEs have been placed on the market in the Union (such as DE-71, Bromkal, Saytex[137]), which are categorised based on their major homologue groups called "Commercial Pentabromo diphenyl ether (C-PentaBDE)", "Commercial Octabromo diphenyl ether (c-octaBDE)', and 'Commercial Decabromo diphenyl ether (C-decaBDE)'. While the names for the commercial groups of PBDEs bear the name of the major homologue, in practice they are mixtures, which can vary depending on the specific manufacturer / product. La Guardia et al. (2006) (see Table 6) provides a further overview of the typical mixtures for c-pentaBDE, c-octaBDE and c-decaBDE based on analysis of DE-71, Bromkal and Saytex.

A growing concern for the environmental and health effects of PBDEs (based on a weight of evidence), particularly for lower order homologue groups, led to a ban of the C-PentaBDE and c-octaBDE in the Union in 2004 (by Directive 2003/11/EC). Since June 2009, these restrictions for c-pentaBDE and c-octaBDE were included in REACH Annex XVII on

[136] Risk profile and risk management plan by the POPRC (UNEP/POPS/POPRC.5/10/Add.2 and UNEP/POPS/POPRC.6/13/Add.1)

[137] Note that Saytex includes a range of different products and compositions. The UIP in this context refers to only those specific Saytex products that contained PBDEs.

restrictions on the manufacture, placing on the market and use of certain dangerous substances, preparations and articles by the Regulation 552/2009. Furthermore, in 2009 the chemical homologues tetra, penta, hexa and heptaBDE were added to Annex A (banned) of the Stockholm Convention at the fourth conference of the parties (COP-4).

Table 7 Breakdown of commercial PBDE products on the Union market

Commercial Penta BDE mixture as % wt/wt		Commercial Octa BDE mixture as %wt/wt		Commercial Deca BDE mixture as % wt/wt*	
Tetra	38-42%	Hexa	0.2 – 10%	Deca	>97%
Penta	55 – 65%	Hepta	13 – 44%	Nona/Octa	<3%
Hexa	5%	Octa	19 – 41%		
Hepta	2.7 – 4.5%	Nona	1 – 12%		
		Deca	1.3 – 50%		

*Concentrations of c. decaBDE post 1995 expected to be aligned to OECD voluntary scheme.

While the c-pentaBDE and c-octaBDE were banned in 2004, the use of c-decaBDE was permitted to continue. The concerns eluded to regarding environmental and human health effects of lower order PBDE homologue groups were also identified in the OECD risk assessment, published in 1994. The discussions around the perceived risks, lead to a global voluntary agreement by manufacturers in 1995 not to produce other PBDEs than those already on the market and stricter control over the homologues used in commercial mixtures. For C-decaBDE this included an agreement that c-decaBDE should not contain less than 97% w/w of the decaBDE homologue.

Subsequently a growing weight of evidence has continued to develop around the environmental and health effects of decaBDE, in particularly its capacity to degrade within the environment to form lower order homologue groups through a process of debromination. Following a nomination by Norway (in 2013) decaBDE was added to the Stockholm Convention under Annex A (banned) at the COP-8 in 2017. In the Union, decaBDE was added to the candidate list for substances of very high concern (SVHC) under the REACH Regulation in December 2012. In 2014 the Norwegian Environment Agency submitted a proposal for decaBDE to be added to Annex XVII of REACH (Restriction). In February 2017 decaBDE was added to Annex XVII of REACH (by Commission Regulation (EU) 2017/227). This restriction prohibited the substance decaBDE from being used at greater than 0.1% w/w in the manufacture of or placing on the market in another substance as a constituent, a mixture, or an article or any part thereof after 2 March 2019. Finally, decaBDE was listed in the POPs Regulation in 2019, which further restricts the use in the Union in line with the Stockholm Convention and replaces the restriction in Annex XVII of REACH. Additionally the POPs Regulation sets targets for critical thresholds of PBDEs within wastes. This includes the aim to lower the critical threshold (Annex IV) within two years from entry into force from 1000 mg/kg to 500 mg/kg.

Further information on the homologues tetra and penta, hexa and hepta, and decaBDE (POP PBDEs) as added to the Stockholm Convention is provided in the following sub-sections.

3.2.3. *Tetrabromodiphenyl ether and pentabromodiphenyl ether*

Tetrabromodiphenyl ether (tetraBDE) and pentabromodiphenyl ether (pentaBDE) were the main homologue groups found in C-PentaBDE. Since 1997, tetraBDE and pentaBDE have no longer been produced in the Union (ESWI 2011) but they continued to be used for some time after this in certain articles.

As indicated the use and placing on the market of c-pentaBDE was banned in the Union from 2004. Furthermore, the RoHS Directive 2011/65/EC, inter alia restricts the use of POP-PBDEs 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 the sum of PBDE congeners. Note, however, under Annex IV of RoHS, one exemption was granted for spare parts.

Further, relevant legal documents on Union level addressing PBDE is the Water Framework Directive 2000/60/EC and the E-PRTR Regulation (EC) No 2006/166. An annually averaged EQS for inland surface waters has been established for the sum of PBDE congeners of 0.0005 µg/L and 0.0002 µg/L for other surface waters.

WHO (1994) estimates that total Union manufacture and consumption of PBDEs (all commercial mixtures) was around 10,000-11,000 tonnes per annum in 1989. The Union risk assessment report (2001) comments that approximately 10% (1,000 – 1,100 tonnes) of this was c-pentaBDE, usage rates of c-penta BDE began to decline from the mid-to-late 1990s, with quoted usage rates for 2000 (300 tonnes) and 2001 (150 tonnes) indicating the use in the early 2000s had declined significantly before use ceased in 2004.

The most common use of c-pentaBDE in the Union was in flexible polyurethane foam (95%) that was mainly used for upholstery and automotive applications, thus applications with long expected lifetimes of 10 – 20 years. For these two sectors the overall discharge of c-pentaBDE 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.

In 2013 the Ireland EPA had collected 50 samples from 22 end of life vehicles, which were tested for POP-PBDEs. Samples were taken from dashboards, headrests, seats, door panels and bumpers[138]. A further study by the United Kingdom (2016)[139] analysed plastic and foam from an automated treatment facility (ATF) based on 30 samples based on vehicles and white goods processed at the facility (samples were taken from final processed materials) POP-PBDE concentrations detected in the Irish and UK studies are listed in Table 8.

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[138] Ireland (2018) National implementation plan.

[139] Defra (2016) 'A Further update of the UK's POPs multi-media emission inventory – Work Package 3: 'Analysis of PBDEs from end of life vehicles', ref CB0489

Table 8 Results of analysis for POP-PBDE congeners from ELVs and white goods in Irish (2015) and UK (2016) studies

PBDEs	Concentration range (mg/kg) Ireland EPA (2015) based on ELVs	Concentration range in (mg/kg) UK (2016) based on ELVs and white goods - Plastics	Concentration range in (mg/kg) UK (2016) based on ELVs and white goods - Foams
TetraBDE	1.2 - 370	0.1 - 1.2	0.5 - 9.6
PentaBDE	1.6 - 130	0.1 - 1.4	0.6 - 17
HexaBDE	0.2 - 16.7	0.06 - 3.4	0.05 - 3
HeptaBDE	-	0.1 - 14	0.2 - 0.7
DecaBDE	100 - 200	30 - 260	30 - 110

As for automotive applications, assuming a lifetime of 12 years and a phase out in 2000, the majority of c-pentaBDE in automotive applications should already have entered the waste stream. However, there may be some variability across the Union, 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 Union 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 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 Stockholm Convention 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-PBDEs in the waste stream from the automotive industry in 2010 were 1096 kg for tetraBDE and 2109 kg for pentaBDE. Emissions resulting from this mass flow were estimated to be 69 kg and 127 kg for petraBDE 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 Union 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 Stockholm Convention confirmed that 2004 was considered the latest time that POP-PBDEs would have been used in products. The mass flow of POP-PBDEs in EEE in the waste stream in 2010 were estimated to be 1.4 t, 2.2 t and 13.4 t for pentaBDE, hexaBDE and heptaBDE, respectively.

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

3.2.4. Hexabromodiphenyl ether and heptabromodiphenyl ether

Hexabromodiphenyl ether (hexaBDE) and heptabromodiphenyl ether (heptaBDE) are the main homologue groups of c-octaBDE. Manufacture of these substances has ceased within the Union in 1996/98.

WHO (1994) estimates that total Union manufacture and consumption of PBDEs (all commercial mixtures) was around 10,000-11,000 t per annum in 1989. The Union risk assessment report (2003) comments that approximately 15% (1,500 – 1,650 tonnes) of this was c-octaBDE, usage rates of c-octaBDE began to decline from the mid-to-late 1990s, with quoted usage rates for 2001 (610 t) indicating the use in the early 2000s had declined significantly before use ceased in 2004.

The main historical use of c-octaBDE was as a flame retardant in Acrylonitrilebutadiene-styrene (ABS) polymers with a concentration between 10-18% by weight (95% of its use in the Union 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-PBDEs 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 kg and 32 kg for heptaBDE and hexaBDE, respectively.

The placing on the market of electrical and electronic equipment containing c-octaBDE is regulated under the RoHS Directive (2011/65/EU). Again, as with the other PBDEs one exemption was granted under Annex IV of RoHS for spare parts.

The annual amount of c-octaBDE mainly from electronics entering the environment in the Union 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.

A significant amount of used and end-of-life electrical and electronic equipment (EEE) is being illegally exported from the Union, most of it being declared as still functioning EEE. For instance, a study published by the German UBA and German Federal Ministry for Environment, Nature Conservation and Nuclear Safety indicates that in 2008 between 93,000 t and 216,000 t of used and/or end-of-life EEE 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 Union – 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 and Manhart 2010[140]; Manhart et al. 2011[141]; Schluep et al. 2011[142]).

In the Union, there are indications that only a few full scale e-waste recycling facilities separate plastics containing PBDE as required by Union legislation. For instance, one facility with automatic separation step for WEEE plastic containing halogens,including brominated flame retardants (BFRs) is known in Switzerland (UNEP 2011[143]). Based on consultation with the European Electronics Recyclers Association (EERA) in 2018, it is estimated that there were approximately 30 specialised WEEE plastic recyclers in the EU[144]. This suggests that there is capacity to manage the flow of waste but that also the market is relatively small and specialised.

Furthermore, thermoplastics (i.e. mainly outer casings) separated from WEEE is also being exported 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-manufacture through improper end-of-life treatment of these products (Manhart 2012[145]).

Also, screening of plastic products in China has revealed that even sensitive uses like children toys (Chen 2009[146]) along with household goods (Chen 2010[147]) can be contaminated with PBDE and other BFRs. The PBDE concentrations in electrical or electronic toys were below the threshold limit (1000 ppm) required by Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS), except for one hard plastic toy with a total PBDE concentration of 5.3 mg/g. Human exposure from the presence of POP-PBDEs 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.

BSEF (2020)[148] estimated that 55% of WEEE plastics entering WEEE plastic recycling facilities will be converted to regranulates for use as raw material in recycled plastic.

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

141 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.

142 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.

143 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.

144 Ramboll, 2019, 'Study to support the review of waste related issues in Annex IV and V of regulation (EC) 850/2004', Commission study under contract ref 07.0201/2017/767748/ETU/ENV.B.3.

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

146 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

147 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

148 BSEF, 2020, 'study on the impacts of brominated flame retardants on the recycling of WEEE plastics in Europe', industry study.

3.2.5. *Decabromodiphenyl ether*

Decabromodiphenyl ether (decaBDE) is the main homologue of c-decaBDE. The REACH Annex XV restriction proposal (2014)[149] comments that from the 1990s there were nine major manufacturers of c-decaBDE globally (including three in the Union – The Netherlands, France and the United Kingdom), however, that manufacture ceased by 1999, after which the Union continued to import mixtures and articles containing c-decaBDE. Earnshaw et al. (2013)[150] comments that between 1970 – 2010 around 185,000 – 250,000 tonnes of c-decaBDE was placed on the market in the Union (from manufacture and import), with peak consumption at 9,000 t per annum (based on data from BSEF) in the late 1990s.

The US EPA (2010)[151] gave notice that remaining manufacturers of c-decaBDE would cease manufacture by 2012, with the only remaining manufacture continuing in China and Japan. Xiang et al (2007)[152] comment that manufacture of c-decaBDE within China was around 25,000 tonnes per annum in 2004. While manufacture in Japan was estimated at 600 tonnes per annum in 2013, with an import of a further 1,000 tonnes for use in vehicle seats (60%), construction materials (19%) and textiles (15%).

The Union risk assessment reports (2001 and 2003) comment that 75% of Union manufacture and consumption of all commercial PBDEs was c-decaBDE (7,500 – 8,250 t per annum) in 1989, with consumption continuing to increase in the 1990s. The REACH Annex XV restriction proposal (2014) comments that after manufacture ceased in 1999 the import of C-decaBDE declined from rates of between 9,000 – 11,000 tonnes per annum in 1999 (based on data from BSEF and Eurostat respectively) down to 3,600 t per annum in 2012, with a further 400 tonnes of c-decaBDE within imported articles.

Earnshaw et al (2013) comment that approximately 75% of C-decaBDE use would have been for polymer applications such as plastics (80% electrical goods, 20% non-electrical), with the remaining 25% of usage applied to textiles and foams. The REACH Annex XV restriction proposal (2014) comments that in 2002 around 80% of all c-decaBDE use in Europe had been for polymer applications, particularly plastics for electrical applications (based on data from the 2002 risk assessment report (RAR)), however, strong efforts to phase-out C-decaBDE from plastics commencing in the mid 2000s meant that by 2012 use was more evenly split (52% textiles, 48% plastics) (based on data from VECAP).

The REACH Annex XV restriction proposal (2014) highlights the in-use service life is the main phase for emissions to environment (87%) with manufacture (7%) and waste (6%) the other key points of release. Harrad et al. (2015)[153] highlights in particular the potential for release to indoor environments from dust contaminated with decaBDE through contact with treated soft furnishings and plastics. Ambient monitoring of indoor and outdoor decaBDE concentrations in air for the UK highlighted these significant differences, with indoor

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149 REACH, 2014. REACH Annex XV dossier for DecaBDE.

150 Earnshaw, M. R.; Jones, K. C.; Sweetman, A. J. (2013) Estimating European historical production, consumption and atmospheric emissions of decabromodiphenyl ether. Sci. Total Environ. 447, 133−142.

151 USEPA, 2010. An exposure assessment of polybrominated diphenyl ethers.

152 Xiang, C.-H.et al., 2007. Polybrominated diphenyl ethers in biota and sediments of the Pearl River, Estuary, South China. Environmental Toxicology Chemistry, 26(4), pp. 616-623.

153 Harrad, S. 2015. A meta-analysis of recent data on UK environmental levels of POP-BFRs in an international context: Temporal trends and an environmental budget. Emerging Contaminants 1: 39-53. doi:10.1016/j.emcon.2015.08.001.

concentrations ranging from 48 – 4,000 pg/m^3 and outdoor concentrations ranging from non-dectable to 1,500 pg/m^3 in urban environments.

The REACH Annex XV restriction proposal (2014) followed the OECD methodology for emission scenarios and previous Union assessments from 2002, 2004 and 2007 to calculate potential annual emissions of decaBDE against assumed stockpiles and consumption rates. For 2014, the REACH Annex XV restriction proposal estimates annual releases of 1.46 tonnes to air, 2.32 t to water and 0.96 t to soil (total annual release of 4.74 t per annum). As an alternative estimate Earnshaw et al. (2013) used a life-cycle source-flow approach to map use of C-decaBDE with releases during, manufacture, and waste. Figure 2 provides an outline of emission pathways over time showing both the increase in emissions as use of C-decaBDE increased and then a decline from 2000 onwards as use also declined.

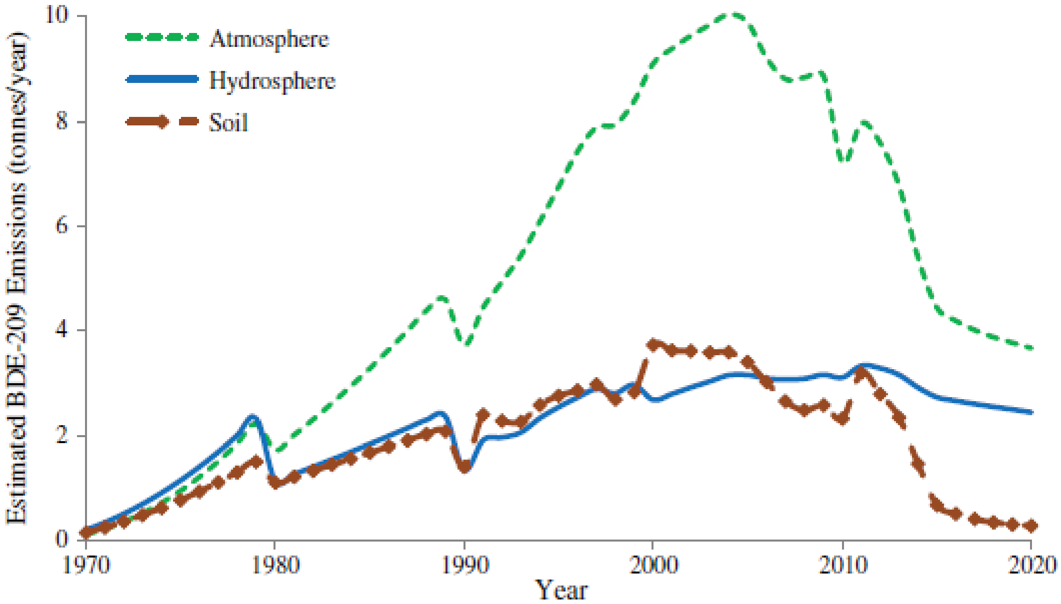

Figure 2 DecaBDE emissions to European environment under the realistic scenario $E_{Realistic}$ (Earnshaw et al. 2013)

Earnshaw et al. (2013) highlights the atmospheric pathway as dominant, while the REACH Annex XV restriction proposal highlights water as the dominant pathway. However, review of both references highlights the importance of indoor dusts and exposure. Washing of textiles is identified as a key pathway to transfer indoor atmospheric emissions to the hydrosphere as releases to sewer and ultimate loss to environment from urban waste water treatment works. Earnshaw et al. (2013) also highlights the importance of sewage sludge disposal to agricultural land as a major pathway for environmental release of decaBDE to soil.

Waste handling is also highlighted as potential emission source, particularly the management of contaminated dusts during the breaking of electrical goods. Morf (2007)[154] comments on a study in Switzerland where samples from a plant processing small sized WEEE detected concentrations of decaBDE at 510 mg/kg. Whiting et al. (2016)[155] comments on a sampling study at an Automotive Shredder Residue (ASR) plant in the UK managing end of life vehicles and white goods. Pelletised plastics produced at the ASR had concentrations of decaBDE ranging from 30 – 270 mg/kg.

Earnshaw et al (2013) comments that the in-use stocks of decaBDE peaked at around 75,000 tonnes in 2000. Assuming a service life of 10 years, and phase-out by 2019 would mean final in-use stockpiles entering the waste stream in the late 2020s. Assuming a longer lifecycle of 15 years would mean final phase-out by the mid-2030s.

The REACH Annex XV restriction proposal also states that much of the material entering the waste stream may end up in landfill, meaning that environmental burden may be extended well beyond 2030.

Ramboll (2019)[156] estimate that, as of 2015, 1.2 million tonnes of plastics from waste electrical and electronic equipment was generated, containing 630 tonnes of decaBDE (estimated average concentration of 525 mg/kg). For those plastics containing decaBDE, Ramboll (2019) go on to estimate that 534.5 tonnes (84%) (519t high bromine fraction, 15.5t other bromine fractions) are destroyed via incineration. A further 89 tonnes (14%) is recycled and 6.5 tonnes (2%) is consigned to landfill.

It is important to note that decaBDE used within plastics for electrical applications will go through a designated waste stream compliant with the waste electrical and electronic equipment Directive (WEEE Directive, 2012/19/EU). DecaBDE was also used for textiles and soft-furnishings, particularly the treatment of back-coatings, Ramboll (2019) estimate that about 10% of total decaBDE use was used in these applications.

The management of bulky soft furnishings such as sofas, armchairs, mattresses, carpets, other commercial seating and soft furnishings (such as heavy curtains and drapes from public buildings, cinemas, schools, etc) may be an area where the detection and management of decaBDE is weaker as it falls within general muncipal waste streams. Ramboll (2019) comment that use of decaBDE was largely phased-out in the Union by 2014, with the assumed lifespan of the treated articles ranging from 10-15 years. This means that final phase-out and entry of decaBDE in textiles/soft furnishings to the waste stream would occur by the mid-late 2020s and mid 2030s.

Drage et al. (2018)[157] document a sampling survey of waste handling for soft furnishings in Ireland in 2018 (covering 122 samples), with mean avearage concentrations varying from 3.7 mg/kg (curtains) to 6,800 mg/kg (fabric coverings used in sofas and armchairs). Drage et al.

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[154] Morf, 2007, 'Dynamic Substance Flow Analysis Model for Selected Brominated Flame Retardants as a Base for Decision Making on Risk Reduction Measures (FABRO)'

[155] Whiting et al. 2016 Annual Defra Report: A Further Update of the UK's Persistent Organic Pollutants Multi-media Emissions Inventory.

[156] Ramboll, 2019, 'Study to support the review of waste related issues in annexes IV and V of Regulation EC 850/2004, Report for the European Commission Project No. 352000134

[157] Drage et al. 2018. 'Brominated flame retardants in Irish waste polymers: concentrations, legislative compliance, and treatment options' Science of the total environment, vol 625 pp 1535-1543

(2018) comment that decaBDE was detected in 75 out of 122 samples analysed with 10 samples exceeding the current low POP content threshold (1000 mg/kg).

Based on the results of the sampling survey and national statistics for Ireland, Drage et al. (2018) estimate that annually 15 tonnes of decaBDE enter the waste stream from the textiles and soft-furnishings. Ramboll (2019) provide some further comment on final destinattion, stating that at Union level, 25% of treated textiles are destroyed by incineration, with 75% of treated textiles consigned to landfill. The Ramboll study assumes no recycling of decaBDE treated textiles from the soft furnishings sector.

3.2.6. Perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds

PFOA and its salts are most widely used as processing aids in the production of fluoroelastomers and fluoropolymers. PFOA-related compounds have historically been used as surfactants and surface treatment agents (e.g., in textiles, paper and paints, fire-fighting foams) and for the manufacture of side-chain fluorinated polymers. PFOA, its salts and PFOA-related compounds are used in a wide variety of applications and consumer products across many sectors (see UNEP/POPS/POPRC.12/11/ Add.2).

Releases occur from past and ongoing production, use and disposal. Direct releases to the environment occur from the production of the raw substances, during the processing, use and disposal of the chemical, and from treated articles and from products contaminated with PFOA (see UNEP/POPS/POPRC.13/3). Main emission vectors of PFOA and its salts are expected to be from wastewater and particles/aerosols.

In 2013, the ECHA Member State Committee, identified PFOA as persistent, bioaccumulative and toxic substance (‘PBT’) in accordance with REACH Article 57(d) and classified as toxic for reproduction category 1B in accordance with the CLP.[158] Subsequently, ECHA made the decision to include PFOA in the Candidate List of Substances of Very High Concern (‘SVHC’) for possible inclusion in Annex XIV to Regulation (EC) No 1907/2006.[159]

In 2017, PFOA its salts and PFOA-related substances[160] were added to Annex XVII of the REACH Regulation (EC) No 1907/2006[161]. However, that listing in Annex XVII was removed in 2020 by Commission Regulation (EU) 2020/2096[162] after the listing of PFOA in the POPs Regulation for reasons of legal clarity.

PFOA was also previously included in Annex VI of the Classification, Labelling and Packaging (CLP) Regulation (Regulation (EC) No 1272/2008), by the Commission Regulation (EU) No 944/2013 of 2 October 2013 (index number: 607-704-00-2). PFOA has

158 See https://echa.europa.eu/documents/10162/8059e342-1092-410f-bd85-80118a5526f5

159 See https://echa.europa.eu/documents/10162/8059e342-1092-410f-bd85-80118a5526f5

160 Any related substance (including its salts and polymers) having a linear or branched perfluoroheptyl group with the formula C7F15- directly attached to another carbon atom, as one of the structural elements; Any related substance (including its salts and polymers) having a linear or branched perfluorooctyl group with the formula C8F17- as one of the structural elements.

161 Commission Regulation (EU) 2017/1000 amending Annex XVII to Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning REACH as regards perfluorooctanoic acid (PFOA), its salts and PFOA-related substances (see https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017R1000).

162 Commission Regulation (EU) 2020/2096 of 15 December 2020 (OJ L 425, 16.12.2020, p. 3).

been classified as Carc. 2 H351, Repr. 1B H360D, Lact H362, STOT RE 1 (liver) H372, Acute tox 4 H332, Acute tox 4 H302 and Eye dam 1 H318.

In 2015, the Union submitted a proposal to list PFOA, its salts and PFOA-related compounds in Annexes A, B, and/or C to the Stockholm Convention (UNEP/POPS/POPRC.11/5). At its twelfth meeting in 2016, the POPRC concluded that PFOA fulfilled the screening criteria in Annex D of the Convention (i.e., persistent, bioaccumulative and toxic to animals including humans). The POPRC recommended that PFOA, its salts and PFOA-related compounds that degrade to PFOA are likely, as a result of their long-range environmental transport, to lead to significant adverse human health and/or environmental effects such that global action is warranted (UNEP/POPS/POPRC.12/11 /Add.2).

At the COP-9 meeting in May 2019, based on a consideration of the risk profile[163], the risk management evaluation[164] and the addendum to the risk management evaluation[165] for PFOA, its salts and PFOA related compounds, the COP made the decision (UNEP/POPS/COP.9/CRP.14), to list PFOA, its salts and PFOA-related compounds under Annex A of the Convention with specific exemptions for its production and use. These specific exemptions are outlined in Table 9 .

In addition, the COP added Part X to Annex A of the Convention, specifying that, where Parties have registered for a specific exemption for use of PFOA in firefighting foams, these Parties shall:

- ensure that fire-fighting foam that contains or may contain PFOA, its salts and PFOA-related compounds shall not be exported or imported except for the purpose of environmentally sound disposal.
- not use fire-fighting foam that contains or may contain PFOA, its salts and PFOA-related compounds for training
- not use fire-fighting foam that contains or may contain PFOA, its salts and PFOA-related compounds for testing unless all releases are contained.
- by the end of 2022, if it has the capacity to do so, but no later than 2025, restrict uses of fire-fighting foam that contains or may contain PFOA, its salts and PFOA-related compounds to sites where all releases can be contained.
- make determined efforts designed to lead to the environmentally sound management of fire-fighting foam stockpiles and wastes that contain or may contain PFOA.

On the use of perfluorooctyl iodide for the production of perfluorooctyl bromide for the purpose of producing pharmaceutical products, the COP agreed to review at COP-13 and at every second ordinary meeting thereafter the continued need for this specific exemption, which shall in any case expire at the latest in 2036.

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163 UNEP/POPS/POPRC.12/11/Add.2
164 UNEP/POPS/POPRC.13/7/Add.2
165 UNEP/POPS/POPRC.14/6/Add.2

Table 9 Amended text of Part I of Annex A to the Stockholm Convention listing PFOA, its salts and PFOA-related compounds, and specific exemptions

Chemical	Activity	Specific exemption
Perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds "Perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds" means the following: (i) Perfluorooctanoic acid (PFOA; CAS No. 335-67-1), including any of its branched isomers. (ii) Its salts. (iii) PFOA-related compounds which, for the purposes of the Convention, are any substances that degrade to PFOA, including any substances (including salts and polymers) having a linear or branched perfluoroheptyl group with the moiety (C_7F_{15}) C as one of the structural elements. The following compounds are not included as PFOA-related compounds: (i) C_8F_{17}-X, where X= F, Cl, Br. (ii) Fluoropolymers that are covered by $CF_3[CF_2]_n$-R', where R'=any group, n>16. (iii) Perfluoroalkyl carboxylic and phosphonic acids (including their salts, esters, halides, and anhydrides) with ≥8 perfluorinated carbons. (iv) Perfluoroalkane sulfonic acids (including their salts, esters, halides, and anhydrides) with ≥9 perfluorinated carbons. (v) Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOSF), as listed in Annex B to the Convention.	Production	• Fire-fighting foam: None • For other production, as allowed for the Parties listed in the Register in accordance with the provisions of part X of this Annex
	Use	In accordance with the provisions of part X of this Annex: • Photolithography or etch processes in semiconductor manufacturing. • Photographic coatings applied to films. • Textiles for oil- and water-repellency for the protection of workers from dangerous liquids that comprise risks to their health and safety. • Invasive and implantable medical devices • Fire-fighting foam for liquid fuel vapour suppression and liquid fuel fires (Class B fires) in installed systems, including both mobile and fixed systems, in accordance with paragraph 2 of part X of this Annex. • Use of perfluorooctyl iodide for the production of perfluorooctyl bromide for the purpose of producing pharmaceutical products, in accordance with the provisions of paragraph 3 of part X of this Annex. • Manufacture of polytetrafluoroethylene (PTFE) and polyvinylidene fluoride (PVDF) for the production of: o High-performance, corrosion-resistant gas filter membranes, water filter membranes and membranes for medical textiles o Industrial waste heat exchanger equipment o Industrial sealants capable of preventing leakage of volatile organic compounds and PM2.5 particulates. • Manufacture of polyfluoroethylene propylene (FEP) for the production of high-voltage electrical wire and cables for power transmission • Manufacture of fluoroelastomers for the production of O-rings, v-belt and plastic accessories for car interiors

The listing of PFOA under the Stockholm Convention has been implemented in the Union by adding PFOA, its salts and PFOA-related compounds to Annex I of the POPs Regulation through Commission Delegated Regulation (EU) 2020/784[166]. The listing in the POPs Regulation is more restrictive than the listing under the Stockholm Convention, however, some uses that cannot be phased-out immediately benefit from an exemption.

Furthermore, in March 2018, EFSA's panel on contamination of food (CONTAM) revised the tolerable weekly intake for both PFOA and PFOS[167]. The panel commented that there was still insufficient data on concentrations within food but toxicological data was sufficient to lower the values. For PFOA the original limits set in 2008 of 1500 ng/kg bw per day (214 ng/kg bw per week) were proposed to be lowered to 13 ng/kg bw per week.

3.2.7. 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/EC[168]. These restrictions were later taken up in REACH Annex XVII by Commission Regulation (EC) 552/2009. Now, the manufacture, placing on the market and use of PFOS, its salts and other derivatives is regulated under the POPs Regulation. Exemptions initially granted by the POPs Regulation were significantly less numerous than in the Stockholm Convention, as alternatives were available for many of those uses. The derogations for PFOS were given for manufacture 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.

At the POPRC-14 meeting in September 2018, on the basis of reviewing an assessment of alternatives to PFOS[169], the Committee made a number of recommendations regarding the current exemptions in place under the Stockholm Convention. Several of these relate to the exemptions also specified under the POPs Regulation. These recommendations include:

[166] Commission Delegated Regulation (EU) 2020/784 of 8 April 2020 amending Annex I to Regulation (EU) 2019/1021 of the European Parliament and of the Council as regards the listing of perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds (OJ L 188, 15.6.2020, p. 1)

[167] EFSA (2018) 'Risk to human health related to the presence of perfluorooctane sulfonic acid and perfluorooctanoic acid in food', opinion of the Contam panel for EFSA.

[168] 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

[169] UNEP/POPS/POPRC.14/INF/13 (http://chm.pops.int/TheConvention/POPsReviewCommittee/Meetings/POPRC14/Overview/tabid/7398/Default.aspx)

- Based on the steadily declining use of PFOS, its salts and PFOSF for semiconductors (photo-resist and anti-reflective coatings for semiconductors; etching agent for compound semiconductors and ceramic filters) and the commercial availability of alternatives, the acceptable purpose for the use of PFOS for photo-resist and anti-reflective coatings for semiconductors and as etching agent for compound semiconductors and ceramic filters should no longer be available under the Convention.
- Based on the assessment and the availability of alternatives and the withdrawal of a number of Parties from the register of acceptable purposes, the acceptable purpose for the use of PFOS for aviation hydraulic fluids should no longer be available under the Convention.
- Based on the availability of alternatives to PFOS for metal plating (hard metal plating) only in closed-loop systems and their assessment, and the fact that some Parties have indicated that the use of PFOS is either declining or has been completely phased out, while others have indicated a continued need for the use of PFOS, the Committee recommends that the use of PFOS, its salts and PFOSF for metal plating (hard metal plating) only in closed-loop systems be amended from an acceptable purpose to a (time-limited) specific exemption.

At the COP-9 meeting in April/May 2019, based on a consideration of the alternatives assessment report on PFOS and an evaluation report on PFOS[170], the COP decided to revise the current listing of PFOS under Annex B, part I of the Convention. This revision removes a substantial number of the specific exemptions or acceptable purposes, previously allowed for the use of PFOS (e.g. for photo imaging, for photo resist and anti-reflective coatings for semi-conductors, for etching agent for compound semi-conductors and ceramic filters, in photo masks in the semiconductor and liquid crystal display (LCD) industries, in metal plating, in electrical and electronic parts for some colour printers and colour copy machines, in insecticides for control of red imported fire ants and termites, in aviation hydraulic fluids, in chemically driven oil production, and in certain medical devices), or converts previous acceptable purposes into time-limited specific exemptions (e.g. in fire-fighting foams and metal plating (hard metal plating) only in closed-loop systems). The revised listing in shown in Table 10.

At the COP-9, the decision was also made to to amend part III of Annex B to the Convention, outlining specific requirements for Parties registering for the specific exemption on firefighting foams. This includes the requirement to:

- ensure that fire-fighting foam that contains or may contain PFOS, its salts and PFOSF shall not be exported or imported except for the purpose of environmentally sound disposal;
- not use fire-fighting foam that contains or may contain PFOS, its salts and PFOSF for training or testing (unless all releases are contained);

[170] UNEP/POPS/COP.9/INF/12, http://chm.pops.int/TheConvention/ConferenceoftheParties/Meetings/COP9/tabid/7521/Default.aspx

- by the end of 2022, if it has the capacity to do so, restrict uses of fire-fighting foam that contains or may contain PFOS, its salts and PFOSF to sites where all releases can be contained;
- make determined efforts designed to lead to the environmentally sound management of fire-fighting foam stockpiles and wastes that contain or may contain PFOS, its salts and PFOSF as soon as possible.

Table 10 New listing of perfluorooctane sulfonic acid (CAS No. 1763-23-1), its salts and perfluorooctane sulfonyl fluoride (CAS No. 307-35-7) in part I of Annex B to the Stockholm Convention as set out in the decision SC 9/4 of the COP-9

Chemical	*Activity*	*Acceptable purpose or specific exemption*
Perfluorooctane sulfonic acid (CAS No. 1763-23-1), its salts[a] and perfluorooctane sulfonyl fluoride (CAS No. 307-35-7) [a] For example: potassium perfluorooctane sulfonate (CAS No. 2795-39-3); lithium perfluorooctane sulfonate (CAS No. 29457-72-5); ammonium perfluorosulfonate (CAS No. 29081-56-9); diethanolammonium perfluorooctane sulfonate (CAS No. 70225-14-8); tetraethylammonium perfluorooctane sulfonate (CAS No. 56773-42-3); didecyldimethylammonium perfluorooctane sulfonate (CAS No. 251099-16-8)	Production	**Acceptable purpose**: In accordance with part III of this Annex, production of other chemicals to be used solely for the use below. Production for uses listed below. **Specific exemption**: None
	Use	**Acceptable purpose**: In accordance with part III of this Annex for the following acceptable purpose, or as an intermediate in the production of chemicals with the following acceptable purpose: • Insect baits with sulfluramid (CAS No. 4151-50-2) as an active ingredient for control of leaf-cutting ants from *Atta* spp. and *Acromyrmex* spp. for agricultural use only **Specific exemption**: • Metal plating (hard-metal plating) only in closed-loop systems. • Fire-fighting foam for liquid fuel vapour suppression and liquid fuel fires (Class B fires) in installed systems, including both mobile and fixed systems, in accordance with paragraph 10 of part III of this Annex

In the Union, two acceptable purposes listed under the Convention before the COP-9 amendment in 2019 were reported to be used until 2018: i) photo resist and anti-reflective coatings for semi-conductors; ii) metal plating (hard metal plating) only in closed-loop systems. As of July 2019, only the use as mist suppressant for non-decorative hard chromium (VI) plating in closed loop systems is still allowed. Estimates of use within the Union for 2013-2015 are dominated by use in the metal plating industry (~ 4 tonnes in 2013, 7 tonnes in 2014, ~200 kg in 2015), the photographic industry (several tens kg/year) and the semiconductor industry. No Member States (between 2013-2015) mentioned its use in hydraulic fluids in the aviation industry. Germany have reported using the most PFOS in both 2013 and 2014, followed by the Netherlands and Sweden who have reported using 150 kg and 140 kg in 2013, respectively. During the 2013-2015 reporting period use has fallen in Sweden (from 140 kg in 2013 to 25 kg in 2016), however the Netherlands have not updated their reporting since so current use is unknown but it is expected to have decreased since 2009 (~390 kg). Germany indicate no further use of PFOS in 2015 howevery they are still producing approximtaely 9 tonnes per annum.

After expiration of the derogation for wetting agents for the use in controlled electroplating systems in 2015, the only specific exemption on the use of PFOS in electroplating applies to 'mist suppressants for non-decorative hard Cr(VI) plating in closed loop systems'. During hard metal plating, a significant amount of gases may be released from the process tanks. The generated gases rise to the surface as bubbles and form aerosols. If no mist suppressant agents or other technology is used, aerosols consisting of process liquids containing for instance chromic acid may expose workers and the environment. Therefore, a closed-loop system needs to be utilized when using PFOS or PFOS-related substances as mist suppressants.

In the Union, it is obligatory to apply a closed-loop system when using PFOS-related substances as mist suppressants for non-decorative hard Cr(VI) metal plating. In addition, the Industrial Emissions Directive (2010/75/EU) is applicable to installations for surface treatment of metals or plastic materials using an electrolytic or chemical process where the volume of the treatment vats exceeds 30 m^3. These installations must apply best available techniques (BAT) for the prevention and minimisation of emissions of PFOS described in the relevant BREF.

The definition of a closed-loop system has been much discussed in recent years and still plays an important role in individual cases for authorizations of new projects and for change of authorizations as well as regarding chromium(VI), for the authorization under REACH. However, so far, there is no harmonised definition for a closed-loop system regarding PFOS or Cr(VI). A recent industry survey commissioned by the German Environment Agency documented that there is a variety of processing equipment and many processes to manufacture for different end uses and that there is not a "one fits all" closed-loop-system for metal plating.

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 lifetimeare 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 manufacture 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)[171].

[171] All figures in this section are estimations made by ESWI 2011

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)[172].

Furthermore, in March 2018, EFSA's panel on contamination of food (CONTAM) revised the tolerable weekly intake for both PFOA and PFOS. For PFOS the original limits set in 2008 of 150 ng/kg bw per day (21.4 ng/kg bw per week) were proposed to be lowered to 6 ng/kg bw per week.

3.2.8. 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 POPs Regulation which bans its manufacture, placing on the market and use.

Therefore, it is not being intentionally produced or used anymore within the Union. Historic intentional uses comprised the application together with polychlorinated biphenyls (PCBs) in electrical equipment, as flame-retardant and as intermediate in the manufacture of the pesticide quintozene. ESWI (2011) estimated that the current most relevant source of PeCB manufacture and emission are incineration and combustion processes of different wastes/materials including coal[173]. 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 manufacture 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 – 2017. For the years when data are reported, 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 t per annum, based on three metal facilities reporting per annum for 2008 to 2010, and two in 2011. No emissions of PeCB to air have been reported to the E-PRTR after 2012.

A small number (five) of Member States report emissions of PeCB under the requirements of Article 12 . Overall emission estimates indicate the levels of PeCB in Member States vary from <0.01 kg/y to >50 kg/y.

PeCB releases to water reported in the E-PRTR (2007-2015) illustrate a small number of sources. Waste water treatment works, petroleum refineries, and hazardous waste treatment report in almost every year (oil and gas refineries were not reported in 2013 or 2015). However the inventory for the 2007-2015 period is dominated by one facility within the organic chemicals manufacture sector which reported releases of PeCB to water of 640 kg in

[172] 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

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

2009. From the E-PRTR information it could not be decided whether this release stemmed from current manufacture 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 manufacture of certain solvents (tetrachlorometane, tetrachloroethene and trichloroethene) have generated and often deposited tonnes of HCB/PeCB waste (UNEP 2010)[174].

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

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. 2011)[175]. These releases constitute most of the E-PRTR 2009 water releases and more than 50% of total E-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 by climate change (Weber et al. 2011)[176] .This is also underpinned by a case from Czechia where the releases of HCB and PeCB have, and are, contaminating the river Elbe sediments (Heinisch et al. 2006)[177]. For this site the releases have not been included yet in the E-PRTR. The possible high impact of PeCB release from organochorine manufacture 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 Union contributed between 15 and 88 kg of PeCB per year with an average of 56 kg per annum for the period 2007-2015. Petroleum refineries contributed between 2 and 120 kg per annum with an average of 40 kg for the timeframe 2007-2015 within the E-PRTR data.

3.2.9. SCCPs – short chain chlorinated paraffins

Short chain chlorinated paraffins (SCCPs) are already regulated in the Union 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%[178]. This

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

[175] 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.

[176] 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.

[177] 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.

[178] 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)

restriction was taken up in REACH Annex XVII. Furthermore, SCCPs (Alkanes, C_{10-13}, chloro) were included in the candidate list of REACH because of their PBT and vPvB properties. Following the inclusion of SCCPs in the POPs Protocol, SCCPs were listed in Annex I of the POPs Regulation (Commission Regulation (EC) No 519/2012[179]).

Since July 2012, the manufacture, use and placing on the market of SCCPs is forbidden by the POPs 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 manufacture, 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 seleants. 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) 2015/2030[180], in order to further restrict their use.

The rubber industry (conveyor belt, gaskets, hoses) was the main application of SCCPs (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 SCCPs (31 t/y).

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 SCCPs in the past can enter the waste stream due to its long lifetime.

Additionally, concerns have been raised over the presence of SCCPs within recycled plastics, where SCCPs have been used in the past as a softener within plastic materials. Miller and Di Gangi (2017)[181] comment on a survey of plastic products from 10 countries (including two Member States) where SCCPs were detected. The study targeted in particular children's toys based on 60 articles. For the Member State samples, concentrations ranged from 13 to 9,715 mg/kg (reported as ppm), noting that the LPCL for SCCPs within waste under the POPs regulation (2019/1021) is 10,000 mg/kg. The European Commission (2019)[182] review of LPCLs for POPs (including SCCPs) further noted that the legal limit for placing of new articles or mixtures on the market was 1% w/w. However, the report (by DiGangi (2017)) comments that SCCPs concentrations above the legal limits are regularly detected in various kinds of consumer products, largely through recycled materials in imported products. The study also commented that, even though a limit of 10,000 mg/kg could be adopted for SCCPs, it would not be possible to rule out exceeding this limit for some articles where POPs may be unintentionally in products that are recycled.

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

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

181 Miller and DiGangi (2017) 'Toxic industrial chemical recommend for global prohibition contaminates children's toys', Publication by IPEN, ACAT and Arnika

182 European Commission (2019) 'Study to support the review of waste related issues in annexes IV and V of regulation EC 850/2004', Contract number: No 07.0201/2017/767748/ETU/ENV.B.3

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

The relative distribution of environmental emissions from investigated sectors in the Union 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).

3.2.10. 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 POPs Regulation which is however still to be implemented.

The intentional use and manufacture 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 tetrachloro-methane. The estimated amount of HCBD produced during this process varies between ~0.7 kg/y up to possible ~500 kg/y (ESWI 2011).

Urban waste-water treatment plants are a second main source of HCBD (E-PRTR 2007 - 2017). The releases from urban waste-water treatment plants (based on E-PRTR) vary between 42 and 1,100kg per annum.

Unintentional manufacture 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 manufacture and is among the prime pollutants of "Hexachlorobenzene" wastes deposited in 10,000 tonnes scale from such manufactures in the past. Therefore such waste deposits can be considered to be the largest stock of HCBD (ESWI 2011).

3.2.11. PCN – polychlorinated naphthalenes

PCN was added to the POPs 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 POPs Regulation sets in place critical thresholds for PCN to identify those wastes characterised as being POPs-contaminated and requiring destruction or irreversible transformation of 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 Union. 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)[183]. 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 dyes[184].

PCN are currently formed mainly unintentionally during various thermal processes (UNECE 2007). As PCNs exhibit similar formation properties as PCDD/Fs, unintentional manufacture during incineration processes as municipal solid waste incineration (MSWI), hospital waste incineration, domestic burning, or different metal processing steps such as secondary copper manufacture, secondary aluminium manufacture, magnesium manufacture as well as iron sintering and electrical arc furnace processes for iron manufacture 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.

3.2.12. Hexabromocyclododecane (HBCDD)

HBCDD is a brominated flame retardant which has been in use since the 1960s, primarily within the Union for expandable polystyrene (EPS) and extruded polystyrene (XPS) insulation boarding used within roof and cavity wall insulation (greater than 90% of the use). It has also been used as a flame retardant in the textiles sector (found in polymer-dispersion coating agents used in textiles for upholstered fabric, furniture, mattress ticking and for seating in vehicles accounting for 9% of all use). HBCDD also has been used (around 1% of total HBCDD use) as a flame retardant for use in high impact polystryrene (HIPS) used for mouldings and housings of electrical goods such as computer monitors and CRT based televisions.

Total global HBCDD manufacture in 2011 was 31,000 tonnes, with manufacture ongoing in Europe, the USA and China[185]. For Europe the REACH Annex XV report (2016) comments that in 2009, demand for HBCDD was 12,000 t (6,000 t imported and 6,000 t manufactured), with one manufacture site based in the Netherlands.

Following the Stockholm Convention review process for proposals to list substances, HBCDD was added to Annex A of the Convention in 2013 at the fifth conference of the Parties (COP-5) with full entry into force in November 2014. HBCDD was also listed in the POP Regulation by Commission Regulation (EU) 2016/293.

[183] 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. https://www.unece.org/index.php?id=4897

[184] Jakobosson, 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.

[185] UNEP, Guidance for the inventory, identification and substitution of Hexabromocyclododecane (HBCD), April 2015

Furthermore under the REACH Regulation, HBCDD had already been identified as a SVHC at the time of its addition to the Stockholm Convention, and was subject to the authorisation process (Annex XIV), meaning permissions for specific applications were required for continued use in the Union. In January 2016 a time-limited authorisation was given to 13 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). This authorisation expired in August 2017 after which no further legal use of HBCDD was permitted in the Union.

The Netherlands (2016)[186] comment that working concentrations for insulation boarding containing EPS were between 0.5 and 1% and for XPS between 0.8 and 2.5% w/w. The REACH Annex XV report (2016) comments that the demand for HBCDD in 2009 was 12,000 tonnes. Based on the working concentrations stated this equates to between 480,000 tonnes and 2.4 million tonnes of HBCDD insulation boarding placed on the market per annum in the Union. As a comparison, the Netherlands (2016) comments that in 2016, 62,500 tonnes of insulation boarding containing HBCDD (50,000 t EPS and 12,500 t XPS) was placed on the market in the Netherlands.

ECHA (2009) states that the service life of EPS and XPS can be several decades (greater than 30 years). Therefore a potentially significant stockpile of in-use materials may exist in the Union with ongoing waste management for many years to come. Annex IV and V of the [initial] POPs Regulation were amended in 2016 (by Commission Regulation (EU) 2016/460) to provide a low POP concentration limit of 1,000 mg/kg for HBCDD, above which all waste must be destroyed or irreversibly transformed.

Drage et al (2018) comment on a sampling and analysis study of PBDEs in waste in Ireland, including HBCDD. Based on analysis of EPS and XPS insulation materials (60 samples), HBCDD was detected in 100% of the samples analysed with mean average concentrations of 2,100 mg/kg in EPS and 27 mg/kg in XPS. The study goes on to estimate that annually 4,200 tonnes of EPS/XPS enter the waste stream in Ireland, containing 5.5 tonnes of HBCDD. Based on their analysis Drage et al comment that 23% of this (966 tonnes of waste) would exceed the low POP concentration limit for HBCDD.

Another important source of HBCDD within wastes identified by Drage et al (2018) is the former use of HBCDD within textiles and soft-furnishings. While these applications were only a secondary use (≤9% of all use[187]), the analytical results from Drage et al (2018) suggest higher concentrations may have been used at time of application (five times greater than EPS/XPS). HBCDD was detected in 32 of the 122 samples of textile/soft furnishings analysed, with low POP concentration limits exceeded in 11 samples (six textile coverings and five foams). HBCDD was detected in textiles/soft furnishings with concentrations ranging from 1-400 mg/kg, with a median value of 4 mg/kg. Drage et al (2018) further comment that based on analytical results many samples below the low POP concentration threshold may represent migration and contact with treated articles in the waste stream rather than intentional treatment of the article itself. Where multiple different brominated flame-

[186] Ministry of Infrastructure and the Environment 2016 - HBCDD in EPS/XPS waste in the Netherlands. GR20161222

[187] Data taken from EBFRIP in 2010 estimated >90% by wt of all HBCDD was used in EPS/XPS. The remaining quantities were used in textiles and high impact polystyrene (HIPs) applications, with HIPs a minor use (≤1%). Textiles are therefore assumed as a maximum of 9% of all use.

retardants (including those not listed under the POP Regulation or REACH authorisation) have been used on both construction materials and textiles/soft furnishings, this poses a challenge for waste handling operators to identify and appropriately manage HBCDD wastes above the low POP concentration limit. Schlummer et al. (2015)[188] highlights that analysis of specific species of brominated chemicals in demolition waste can be both expensive and time-consuming (analysis and provision of results at laboratory facilities taking days), and therefore a need for rapid analysis is necessary. The study undertaken by Schlummer et al. (2015) investigated the possibility of handheld XRF equipment to identify bromine as a proxy marker for HBCDD and means of assessing wastes for low POP content and suitable management. This assumes that if the concentration of bromine (assuming all brominated species present are HBCDD) is below the low POP concentration limit further action is not needed. If the bromine concentration exceeds the low POP concentration limit this could be due to HBCDD or due to a combination of brominated flame-retardants (including those that are not POPs), suggesting further investigation might be needed.

The study by Schlummer et al. further comments that, for the construction sector in particular, handheld XRF is a valuable screening tool based on the fact that HBCDD can be extracted from insulation foams while the polymeric bromine replacement for HBCDD cannot. This allowed extraction and XRF analysis for bromine (as a proxy for HBCDD) as a means of testing for HBCDD concentration in insulation boarding.

Jeannerat et al (2016)[189] provide details of an alternate approach to the separation and identification of HBCDD from polystrene insulation foams using nuclear magnetic resonance (NMR). During 2013/14 field studies used laboratory analysis to place samples under liquid chromatography coupled with mass spectroscopy (LC-MS), which demonstrated different HBCDD isomers (α/ γ) for EPS and XPS, but also highlighted cases where handheld XRF detected bromine and LC-MS demonstrated no presence of HBCDD. NMR was then used to further determine which brominated flame-retardant species were present.

Sharkey et al. (2018)[190] provides a further study on the wider application of handheld XRF for POP BFRs (including HBCDD). The study took 555 samples from a waste handling facility in Ireland, which included plastics, textiles, foams and insulation materials and completed analysis by both handheld XRF and mass spectroscopy (MS) for POP-PBDEs, HBCDD, and tetra tetrabromobisphenol-A (TBBP-A). The results showed a strong correlation between XRF and MS as a linear regression for waste plastics used in electricals. However, the results also showed that for plastics, textiles and foams XRF may over-estimate concentrations (by a factor of up to 1.9) likely due to matrix effects influencing the XRF. However, for HBCDD used in insulation boarding a stronger correlation between XRF and MS was seen, possibly due to fewer bromine based compounds in use for this application. Even where over-estimation of brominated POP flame-retardants was identified (based on bromine content of the sample), the study results showed of the 555 samples analysed, the XRF approach only mistakenly identifies 6% (34/555) of samples as exceeding the limits.

188 Schlummer M, Vogelsang J, Fiedler D, Gruber L, Wolz G. 2015. Rapid identification of polystyrene foam wastes containing HBCD or its alternative polymeric brominated flame retardant by x-ray fluorescence spectroscopy, Waste Management & Research. 33(7):662-70.

189 Jeannerat et al, 2016, 'Discrimination of hexabromocyclododecane from new polymeric brominated flame retardant in polystyrene foam by nuclear magnetic resonance', Chemosphere vol 144 pp1391-1397

190 Sharkey M, Abdallah MA, Drage DS, Harrad S, Berresheim H. 2018. Portable X-ray fluorescence for the detection of POP-BFRs in waste plastics. Sci Total Environ. 639:49-57.

Therefore the use of handheld XRF may prove a valuable tool (particularly for HBCDD in construction and demolition) as a 'pass/fail' screening tool for low POP content in wastes.

However, one further issue highlighted by a 2019 industry paper[191] is that, while good advances are being made in the development and refinement of XRF as a screening tool, standards for laboratory practice are still needed. The paper asserts that currently only ISO or DIN standards for laboratory analysis of HBCDD exist for water and textiles. Further work is needed to develop and agree standards for foams and plastics, with industry currently implementing a range of analytical methodologies.

3.2.13. Pentachlorophenol (PCP)

Pentachlorophenol was first produced as wood preservative as early as the 1930s, but has been used as a biocide, pesticide, disinfectant, defoliant, anti-sapstain agent, and anti-microbial agent in the treatment of wood since that time (UNECE, 2010[192]). Furthermore, the ester pentachlorophenyl laurate (PCP-L) has had application as a biocide and pesticide for textiles, particularly heavy textiles such as tent canvass, where it was used to prevent mold and fungus, particularly for military applications. The Stockholm Convention risk profile (UNEP/POPS/POPRC.9/6) highlights that once released PCP-L degrades to form PCP as does the sodium salt of PCP (NaPCP), hence the listing under the Stockholm Convention covers PCP, its salts and esters.

Globally, manufacture and use peaked at around 50,000-60,000 tonnes per annum in the mid-1980s before declining (UNEP/POPs/POPRC.9/6). The manufacture of PCP and its sodium salt (NaPCP) ceased in the Union by 1992, although import of PCP and NaPCP, primarily for timber treatment and synthesis of PCP-L continued after this period (OSPAR, 2004[193]). In 1996, 378 tonnes of NaPCP and 30 tonnes of PCP were imported into Europe from the USA, primarily into France, Portugal, Spain, and the United Kingdom (OSPAR, 2004).

Restriction on the use of PCP within the Union entered into force in 1991 under Council Directive 91/173/EEC and a ban was placed with respect to the use of PCP as a synthesising or processing agent in industrial processes (including use a wood preservative) under Commission Directive 1999/51/EC. Since 2008 PCP has been controlled under the REACH Regulation with a restriction limiting the placing on the market of PCP as a constituent, mixture or in articles above 0.1 % w/w.

While the use of PCP, its salts and esters has ceased in the Union now for over a decade, the Stockholm Convention risk management evaluation (RME) for PCP (UNEP/POPs/POPRC.10/2) highlights that the service life of treated timbers can be up to 50 years. This includes primarily utility poles, but also railway sleepers, with those goods treated in the 1980s the most likely to contain PCP.

Treated timbers can also emit PCP during their service life, this includes both emissions directly to air, but also contamination of rain water which can then reach ground. The UNECE (2010) suggest that in the first 12 months after treatment as much as 30% of the PCP

[191] Industry paper (2019) 'Current state of affairs of HBCDD analysis in polystyrene foams EPS and XPS', paper produced by Plastics Europe, Exiba, and the International Bromine Council (BSEF).
[192] UNECE, 2010, 'Exploration of management options for PCP', paper presented to the UNECE task force on POPs.
[193] OSPAR, 2004, Hazardous substance series – pentachlorophenol' ISBN 0 946956 74 X

used in treatment can be volatised to air as equilibrium is reached, after the 12 month period the rate of emissions slow down considerably.

Pohlandt et al (1995[194]) comments on a sampling study within the Union of waste wood from a variety of sources. In total 207 samples were analysed with the highest concentrations of PCP found in window frames (163 mg/kg) and interior wood structural materials (11 mg/kg). The remaining wood types (fences, pallets, recycled wood chips, and wooden beams) ranged from 0.4 – 4.4 mg/kg of wood.

End of life options for timber treated with PCP include landfill, incineration or re-use (e.g. the use of railway sleepers for ornamental purposes in domestic gardens). The Stockholm Convention RME highlights the potential risk of dioxin and furan emissions linked to incomplete combustion of wood treated with PCP. ESWI (2011) provides some further comment that wood treated with PCP in Sweden and Germany is primarily disposed of via incineration as concentration limits prevent disposal via landfill. No information is available on how PCP is primarily managed in other Member States.

No current manufacture or use of PCP, its salts or esters exists within the Union, while stockpiles of treated timbers and textiles mainly from the mid-1980s to early 1990s can be expected to be declining. Appropriate management of waste materials contaminated with PCP may still pose an issue, particularly for incomplete combustion and re-use, particularly where identification of PCP treated wood in waste streams poses challenging. However, no available data on potential quantities has been identified.

3.2.14. Dicofol

Dicofol is an organochlorine miticidal pesticide, that has been used since the 1950s to control mites on a variety of crops including fruits, vegetables, ornamentals, field crops, cotton, tea, and Christmas tree plantations, as well as on non-agricultural outdoor buildings and structures.

Dicofol is chemically related to another Stockholm Convention POP, DDT. Production of the commercial dicofol mixture contains two isomers, o,p’dicofol (15-20%) and p,p’dicofol (80-85%), along with variable levels of DDT as an impurity. However, since 1998 agreements under the FAO limited DDT concentrations to no higher than 0.1%.

At its twelfth meeting the POPRC concluded that dicofol is likely, as a result of its long-range environmental transport, to lead to significant adverse human health and environmental effects such that global action is warranted. At the COP-9, in its decision (UNEP/POPS/COP.9/13), the COP decided to amend part I of Annex A to the Stockholm Convention to list dicofol without exemptions.

In Europe dicofol usage was estimated to have decreased from 317 t to 32 t between 2000 and 2009[195]. According to estimated emission data[196], the major consuming countries in

[194] Pohlandt et al, (1995) ‘Concentrations of pentachlorophenol and lindane in various assortments of waste wood’, volume 31, Issue 9, November 1995, Pages 4025-4031

[195] Li, L., Liu, J., Hu, J. (2014) Global inventory, long-range transport and environmental distribution of dicofol. Environmental Science and Technology, 49: 212-222.

[196] Van der Gon, H.D, Bolscher, M., Visschedijk, A., Zandveld, A. (2007) Emissions of persistent organic pollutants and eight candidate POPs from UNECE–Europe in 2000, 2010 and 2020 and the emission

Europe in 2000 were Spain, Italy, Turkey, Romania, and France. However, data regarding current concentrations in different environmental vectors is lacking due to the lack of regular monitoring of dicofol concentrations.

The permitted use of dicofol for plant protection products in the Union expired by 2010 at the latest according to Commission Decision 2008/764/EC. In addition, all non-agricultural uses were prohibited according to the Biocidal Products Regulation (EU) No 528/2012.

In 2020, dicofol has been listed in Annex I to the POPs Regulation by Commission Delegated Regulation (EU) 2020/1204[197] in order to implement the decision adopted under the Stockholm Convention. The POPs Regulation prohibits all manufacture, placing on the market and use of dicofol in the Union.

Dicofol is also included in Directive 2013/39/EU as a priority hazardous substance in the field of water policy. This sets environmental quality standards for dicofol, for inland surface waters (1.3×10^{-3} µg/l); other surface waters (3.2×10^{-5} µg/l); and biota (33 µg/kg wet weight). Additionally, because dicofol is a priority hazardous substance there is an obligation under the Water Framework Directive (Directive 2000/60/EC) for cessation of all discharges to the environment, which goes beyond the EQS target thresholds.

Data taken from the EFSA OpenFoodTox database indicates that in 2012 safe limit values for pesticide residues of dicofol (based on an accute reference dose (ARfD)) were calculated to be 0.15 mg/kg bw/day.

3.3. Unintentionally produced POPs

Releases of unintentionally produced POPs (UPOPs) remain an important POP source in the Union. 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 been comparitively fewer cases of Member States reporting data using 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

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reduction resulting from the implementation of the UNECE POP protocol. Atmospheric Environment, 41: 9245–9261.

[197] Commission Delegated Regulation (EU) 2020/1204 of 9 June 2020 amending Annex I to Regulation (EU) 2019/1021 of the European Parliament and of the Council as regards the listing of dicofol (OJ L 270, 18.8.2020, p. 4).

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 toolkit[198].

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, polychlorinadetd 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 inventories (EMEP 2011)[199]. This inventory data for the air vector is made publically available through the webdab database: http://www.ceip.at.

The E-PRTR database[200] contains reported data for point source emissions from approximately 34,000 facilities from the Union and Iceland, Liechtenstein, Norway, Serbia, Switzerland and the United Kingdom 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 2017. Table 11 presents the current data from Union facilities (above the reporting thresholds).

Table 11 Releases of unintentionally produced POPs according to the E-PRTR (PCDD + PCDF as TEQ) (for the EU27)[201]

POP substance	Year	Air	Water	Soil
Polychlorinated dibenzo-p-dioxins (PCDD) and Polychlorinated dibenzofurans (PCDF)	Units	kg I-TEQ unless indicated	g I-TEQ unless indicated	g-ITEQ unless indicated
	2007	1.2	10.8	213
	2008	1.2	22.4	No data reported
	2009	0.7	14,3	No data reported
	2010	0.8	296	No data reported
	2011	0.5	33.5	No data reported
	2012	0.4	75	No data reported
	2013	1.09	40.9	No data reported
	2014	1.16	242	No data reported
	2015	0.94	249	No data reported
	2016	1.11	47.7	No data reported

198 UNEP, 2005, 'Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases'
199 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.
200 https://prtr.eea.europa.eu/
201 Data was derived using the "EU28" search function in the E-PRTR and subtracting the national total for the United Kingdom. PRTR accessed on 02/02/2021

POP substance	Year	Air	Water	Soil
	2017	12.3*	22.9	No data reported
Main sources of PCDD/PCDF		Manufacture and processing of metals	Manufacture and processing of metals	Manufacture and processing of metals
Hexachlorobenzene (HCB)	Units	Kg unless indicated otherwise		
	2007	86.0	120.0	No data reported
	2008	68.1	93.0	No data reported
	2009	42.3	63.9	No data reported
	2010	20.5	72.5	No data reported
	2011	125	82.8	No data reported
	2012	No data reported	88.3	No data reported
	2013	42.2	25.2	No data reported
	2014	59.2	25.4	No data reported
	2015	32.0	27.7	No data reported
	2016	84.0	13.1	No data reported
	2017	68.5	27.7	No data reported
Main sources of HCB		Chemical industry, waste and wastewater management	Waste and wastewater management	-
Pentachlorobenzene	Units	Kg unless indicated otherwise		
	2007	No data reported	16.5	No data reported
	2008	1780	36.1	No data reported
	2009	347	661.0	No data reported
	2010	569	387.0	No data reported
	2011	508	24.0	No data reported
	2012	1.5	222.5	No data reported
	2013	No data reported	90.3	No data reported
	2014	No data reported	86.3	No data reported
	2015	No data reported	78.9	No data reported
	2016	No data reported	97.9	No data reported
	2017	No data reported	66.8	No data reported
Main sources of pentachlorobenzene		Manufacture and processing of metals	Chemical Industry, Waste and waste water management, Energy sector	-
Polychlorinated Biphenyls (PCBs)	Units	Kg unless indicated otherwise		
	2007	179.6	36.2	24.4
	2008	151.7	184.1	29.5
	2009	547.0	221.6	516.0
	2010	541.8	76.2	20.0

POP substance	Year	Air	Water	Soil
	2011	508.0	69.6	16.3
	2012	54.4	89.5	4.1
	2013	81.8	31.1	0.5
	2014	49.8	22.1	0.9
	2015	52.9	25.6	1.0
	2016	180.2	184.3	0.4
	2017	79.9	346.4	0.1
Main sources of PCBs		Manufacture 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)	Units	tonnes	tonnes	kg
	2007	177.9	8.3	18.4
	2008	132.8	5.9	17.4
	2009	68.7	4.4	130.0
	2010	79.7	3.2	98.3
	2011	81.1	2.9	32.6
	2012	58.1	4.9	No data reported
	2013	37.0	2.3	No data reported
	2014	34.2	2.4	No data reported
	2015	50.2	0.7	No data reported
	2016	45.0	1.9	15.7
	2017	44.4	1.8	No data reported
Main sources of PAHs		Combustion processes linked to power generation, metals production and cement clinker	Urban wastewater treatment plants, power stations, and hazardous waste management	-

Release values stated are the aggregated total for all E-PRTR reporting countries across 34,000 facilities
*possible errors have been identified in the reported data

E-PRTR can be used for trend analysis over the time frame (2007-2017); however, some care is needed in the interpretation, noting that the E-PRTR uses reporting thresholds. This means that in some cases a release is not reported for a given facility, not because there is no release but because it is below the reporting threshold. 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 4 facilities reporting emission to water in 2015 or for HCB where just 1 facility reported emissions to air in 2015. Part of the reason for this incomplete picture may relate to the level of understanding for UPOPs substances by operators that complete E-PRTR returns. 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 unusally 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, as shown in Table 11, the emissions to water of PCDD/Fs in

2009 was 14.3 kg I-TEQ, due almost entirely to the emissions reported by one iron and steel plant. This would appear to be an error.

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 (2007-2015), 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 Regulation (EC) No 850/2004 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 manufacturing facilities in Belgium and Finland report emissions of PeCB amounting to 107 and 240 kg respectively, while other facilities did not report any PeCB emissions at all, which assuming the reported data are correct would mean that all other metal manufacturing facilities have emissions of PeCB less than 1 kg 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 62% in the period from 1990 to 2015. PCDD/F emissions within the Northern Hemisphere (EMEP region, the USA and Canada) declined by 50% during the same period. Based upon the UNECE data for 2015 on air emissions covering PCDD/F, maximum emission reduction within the 1990 to 2015 period took place in the Netherlands (97%), Luxembourg, (96%), Belgium (95%), Romania (95%), and France (94%).

As regards the estimated emissions by EMEP reporting nations, it should be noted that despite strong improvements in reducing the uncertainty of the estimates in recent years, the overall uncertainties in the emission estimations remain relatively high, particularly in relation to emission factors and activity rates. A review of the POPs emission inventories submitted previously under the UNECE in 2012[202] 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.

More recently the EMEP[203] provide a comparitive analysis of predicted ambient air concentrations and measured data for HCB and PCBs for EMEP countries in 2014. The results suggest that there was agreement between predicted and measured concentrations, within a factor of 2 in 75% of cases for HCB and 85% of cases for PCBs. However, model predictions tend to underpredict concentrations. According to EMEP, the underprediction can be explained by the uncertainty of applied emission data, namely, spatial distribution of

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

203 EMEP 2016, Persistent Organic Pollutants: Assessment of Transboundary Pollution on Regional and Global Scales, Status Report 3/2016.

emissions and their seasonal variability that requires more detailed analysis. 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 and by the Directive 2004/107/EC on ambient air pollutants (see section 2.2.5).

The EMEP/EEA air pollutant emission inventory guidebook was updated in 2016 including updated emission factors for several POPs. The emission factors currently used for the 2016 guidebook are made availabel through the EEA's Emission Factor Database[204].

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 technical measures to be set in the operating permits for installations have to be based on BAT. The BAT are described and defined at Union level in Commission Implementing Decisions which can be downloaded from EurLex or the website of the European IPPC Bureau, along with the BAT reference documents[205]. The BAT conclusions describe the best available techniques for each industrial sector together with information on their applicability, their associated emission levels, monitoring and consumption levels and, where appropriate, relevant site remediation measures.

BAT conclusions are the reference for 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 BAT 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 (so-called Key Environmental Issues) and 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 minimum provisions for waste incineration and co-incineration plants[206]. Under the BAT conclusions adopted in November 2019, the IED sets BAT-AELs for emissions of PCDD/F and dioxin-like PCBs to air. Table 12 provides details of the new

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[204] http://efdb.apps.eea.europa.eu/?source=%7B%22query%22%3A%7B%22match_all%22%3A%7B%7D%7D%2C%22display_type%22%3A%22tabular%22%7D

[205] http://eippcb.jrc.ec.europa.eu/reference

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

BAT associated emission levelss for air. The BAT-associated emission level for water from incineration remains unchanged at 0.3 ng WHO-TEQ/l[207].

[207] From the cleaning of waste gases

Table 12 BAT associated emission levels for waste incineration in Commission Implementing Decision (EU) 2019/2010

Parameter	Unit	BAT-AEL		Averaging period
		New plant	Existing plant	
TVOC	Mg/Nm3	< 3 – 10	< 3 - 10	Daily average
PCDD/F(1)	Ng-ITEQ/Nm^3	< 0,01 – 0,04	<0,01 – 0,06	Average over the sampling period
		<0,01 – 0,06	< 0,01 – 0,08	Long-term sampling period(2)
PCDD/F + dioxin-like PCBs (1)	Ng WHO-TEQ/Nm^3	<0,01 – 0,06	< 0,01 – 0,08	Average over the sampling period
		<0,01 – 0,08	< 0,01 - 0,1	Long-term sampling period(2)

(1) Either the BAT-AEL for PCDD/F or the BAT-AEL for PCDD/F + dioxin-like PCB applies

(2) The BAT-AEL does not apply if the emission levels are proven sufficiently stable.

Definitions from the Waste Incineration BREF (2019) for right hand column of Table 12:

Average over the sampling period – Average value of three consecutive measurements of at least 30 minutes each.

Long-term sampling period – Value over a sampling period of 2 to 4 weeks.

In 2010, the European Committee for Standardization (CEN) 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)[208].

Combustion plants (other than those incinerating waste) with a rated thermal input of less than 50 MW are not covered by the IED[209]. 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 2015[210]. The proposed directive targets combustion plants with a rated thermal input greater than 1 MW and less than 50 MW. It aims to reduce emissions of SO_2, NO_x and particulate matter but does not covers POPs.

[208] https://standards.globalspec.com/std/1663048/bs-en-1948-4

[209] For installations with multiple combustion activities with a rated thermal input <50MW, if the total rated thermal input of all those combustion activities within the installation is 50 MW or more, then the whole installation is covered by the IED’s provisions (Chapter II) (aggregation rule).

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

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"[211]. 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"[212].

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.

Grochowalski (2009)[213] describes the importance that use of copper catalysts marketed in some European countries for cleaning domestic ovens may have for increasing 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.

According to EMEP emissions data[214] submitted by Member States under the Convention on Long-Range Transboundary Air Pollution, the proportion of PCDD/F emissions to air from residential combustion for the total EU28 rose from 7% in 1990 to 23% in 2015. A number of Member States, notably eastern European countries (e.g. Poland, Hungary, Czechia, Poland, Romania), note increases in PCDD/F emission between 2000 to 2015. The proportion of emissions to air from residential combustion in 2015 is substantially higher than the Union average for a number of eastern European or Baltic states (e.g Poland, 51%; Lithuania, 79%; Bulgaria, 75%; Croatia, 70%; Hungary, 65%; Slovenia, 65%).

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

Since the manufacture 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 environmental burden has been deposited or stored (Weber et al. 2008[215], Weber et al.

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211 BIPRO (2009): Information Exchange on Reduction of Dioxin Emissions from Domestic Sources. REFERENCE: 070307/2007/481007/MAR/C4. FINAL REPORT. 09 April 2009. https://ec.europa.eu/environment/archives/dioxin/pdf/brochure09.pdf

212 https://ec.europa.eu/environment/archives/dioxin/pdf/brochure09.pdf

213 Grochowalski, 2009, 'UNEP - 4-th Toolkit Expert Meeting, Preliminary report from the determination of PCDDs/PCDFs, PCBs and HCB/PeCB and HBCDD from combustion of coal and biomass', Krakow University of Technology.

214 http://www.ceip.at/ms/ceip_home1/ceip_home/webdab_emepdatabase/

215 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.

2011[216]). Secondary sources of POPs, such as PFOS and PFOA, may also include the spreading of sewage sludge on agricultural land and discharge of waste water; alongside the disposal of air pollution control residues from waste incinerators to landfill which can contain POPs such as dioxins and dioxin-like PCBs, and which contribute to contamination of landfill leachate. 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). The European Commision has also tentitively estimated that a total number of 2.5 million potential contaminated sites exist across Europe, with around 14% expected to be highly likely to be contaminated and hence require remediation (European Commission 2014)[217].

There is no Union policy or Directive that specifically addresses the issue of soil contamination[218]. Indirect protection for soils is provided through several items of Union legislation, such as the Water Framework Directive, Environmental Liability Directive, Industrial Emissions Directive and REACH (Ecologic Institute 2017[219] European Commission 2014[217]). For example, 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.

A lack of specific Union legislation on soils and contaminated land means that there is no coherent and consistent approach to the discovery and investigation of POP contaminated soil sites across the Union. This is not helped by the fact that there is no agreed definition for contaminated land or soils in Union policy or between Member States.

The Soil Inventory report found that approximately 50% of Member States appear to have a register of contaminated sites in place; however, it was recognised that the existence of a register could not be linked to proactive action on soil protection (Ecologic Institute 2017[209]). This was supported by the JRC report on the management of contaminated sites in Europe, which found that 28 of the 39 countries surveyed maintained comprehensive inventories for Contaminated Sites, with only 12 out of 39 countries having made signficant progress since 2011 in the mapping of polluting activities and potentially contaminated sites. The most frequent contaminants were identified as mineral oils and heavy metals, accounting for nearly 60% of contaminated soil sites, with PAHs identified for 11% of the sites. It was not mentioned how many of these sites have others POPs as a main contaminant, although ‘other’ contaminants accounted for 10%.

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[216] 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).

[217] European Commission (2014) Joint Research Centre (JRC) Reference Reports, Progress in the management of Contaminated Sites in Europe, Report EUR 26376 EN

[218] Note that the POPs Regulation does give greater onus to the issue of contaminated sites encouraging Member States to include information within national reports and national implementation plans. However, there are no specific mandatory requirements to develop such data.

[219] Ecologic Institute, Berlin (2017) Updated Inventory and Assessment of Soil Protection Policy Instruments in EU Member States, Final Report 08 February 2017

A number of Member States have national policies in place which specifically looks at dealing with land contamination, with the identification, prioritisation, and remediation of sites. In Austria, the Law on the Remediation of Contaminated Sites required the prioritisation of polluted sites according to the severity of risks. In Germany, the Federal Soil Conservation Act and Federal Soil Conservation and Contaminated Land Regulations provide the standards and procedural steps for the investigation and management of contaminated sites with the aim of protecting and restoring soil functions. The Netherlands have the Soil Protection Act which focuses on the remediation of contaminated sites and sets out a programme of actions to improve knowledge and understanding on risk assessment and remediation. In the UK, Part 2A of the Environmental Protection Act covers Contaminated Land and places the responsibility of identifying, prioritising, assessing, and determining of site as Contaminated Land by local authorities at a regional level. The remediation of the sites then aims to follow the 'polluter pays' principle.

In several Member States there are no apparent binding policy instruments in place which go beyond the Union Directives on waste, industrial installations, and water. However, this is an evolving area of policy focus with some Member States, such as Poland, Portugal, and Spain undergoing developments in policy to specifically address contaminated soils (Ecologic Institute 2017[219]). There is also a strong reliance in some Member States on the link to development, with contamination issues addressed under the planning regime, particularly for the redevelopment of brownfield sites. For all Member States, the remediation of sites tends to be closely linked to the availability of state funding and broader development needs.

Investigations tend to involve the comparison of contaminant concentrations against screening values (SVs), which are referred to under a diverse variety of terms (for example, soil quality standards, guidance values, target and intervention values, trigger values, maximum, acceptable concentrations etc.). The SVs are based on the application of exposure and toxicological modelling for varying receptors (human health, controlled waters, and ecology), although these is no coherent framework across Europe for the derivation. JRC found that the main methodologies adopted by Member States were the European Commission Technical Guidance Document on Risk Assessment[220], the procedures adopted by RIVM in The Netherlands, methods developed in the United States (such as ASTM[221]), and the former Soviet Union procedures and values (mainly Central and Eastern European Countries). The use of SVs are often based on requirements established under the national regulatory framework, with the type and number of substances with SVs varying by country and hence do not always include POPs.

A number of Member States appear to be reviewing their SVs in relation to POPs. The Environment Agency of England (2017)[222] has recognised the need for SVs for various POPs to support the Environmental Permitting Regulations and appraisal of standard rules permits

[220] European Commission, Joint Research Centre, European Chemicals Bureau, Technical Guidance Document on Risk Assessment in support of Commission Directive 93/67/EEC on Risk Assessment for new notified substances, Commission Regulation (EC) No. 1488/94 on Risk Assessment for existing substances, Directive 98/8/EC of the European Parliament and of the Council concerning the placing of biocidal products on the market, Part II, EUR 20418 EN/2

[221] ASTM International, Guide for Risk-Based Corrective Action (PS104-98 (1998) – now superseded by E2081-00 (2015))

[222] Environment Agency (2017), Derivation and use of soil screening values for assessing ecological risk, Report – ShARE id26, November 2017, Environment Agency, Bristol

for the application of waste materials to land. This has included an update in the approach for the derivation and use of soil screening values for assessing ecological risk, with published soil screening values for POPs, including benzo(a)pyrene, HBCDD, HCB, PCP, PeCB, PCBs, PCDDs/PCDFs, PFOS and PFOA.

The JRC[223] indicate that the preferred use of SVs by many countries is as trigger levels for site investigations, with the final decision of remediation based on site a site-specific assessment, taking account of site-specific land use and environmental conditions. Some Member States have derived generic SVs using models and/or software that can be adapted on a site-by-site basis and utilised as part of a site-specific quantitative risk assessment, such as contaminated land exposure assessment (CLEA) model derived by the Environment Agency of England[224] and exposure model CSOIL developed by the RIVM[225] for the Netherlands.

3.4.1. PCB contaminated sites and deposits

Weber et al. (2011)[226] note that the legacy of previous industrial manufacture coupled with (historically) poor waste management and landfill management has resulted in an important and long-term source of POPs to the environment. Such previously ongoing practises can result in an on-going source of POPs to the wider environment (particularly groundwater and rivers) via leaching and flooding.

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)[227] 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)[228] 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 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.

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223 JRC (2007) 'Derivation methods of soil screening values in Europe. A review and evaluation of national procedures towards harmonisation', EUR 22805 EN - 2007

224 Environment Agency (2009) Updated technical background to the CLEA model, Science Report: SC050021/SR3

225 Brand, E. Otte, P. F, Lijzen, J.P.A. (2007) CSOIL 2000: an exposure model for human risk assessment of soil contamination. A model description, RIVM report 711701054/2007

226 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

227 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

228 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

Concentrations of PCBs in near surface soils (top 20 cm) were found to be of concern in central Romania. The ‘background’ levels of PCBs were believed to be as a result of the deposition of PCB emissions from industry (primarily the metal industry, including lead manufacture, pig iron and steel manufacture centres). Although, the levels of PCB release were considered unlikely to increase, the concentrations of PCBs identified in surface soils were deemed to require continued monitoring (Science Communication Unit 2013)[229].

In several European rivers, the maximum level set for dioxin-like PCBs in food[230] was found to have been exceeded in fish (e.g. BUWAL 2010[231], NIP Germany[232]). 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. 2010[233]). 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 (Tremp 2011[234]). No similar mapping approach to track directly the point sources for PCB contamination has been discovered in the assessment of NIPs of Member States and any Union agency reports. The only other example identified is a comprehensive mapping of PCB contaminated sites established for France by a NGO[235]. Wimmerová et al. (2015)[236] investigated the relationship between blood serum PCB concentrations and distance for residents living around a former major PCB manufacture site in Slovakia. The authors reported that elevated serum concentrations could be linked to the manufacture 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)[237] 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 manufacture 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 manufacture

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229 Science Communication Unit, University of the West of England, Bristol (2013) Science for Environmental Policy In-depth Report: Soil Contamination: Impacts on Human Health. Report produced for the European Commission DG Environment, September 2013.

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

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

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

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

234 Tremp J. (BUWAL; Schweizer Bundesamt für Umwelt), Personal communication 20.06. 2011.

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

236 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.

237 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.

chain resulting in exceedance of regulatory levels (e.g. Malisch and Kotz, 2014)[238] the source of the contamination was known and could be traced. However, the source of contamination of foodstuffs from free range manufacture is more challenging as the supply chain is more complex. A survey of German meat samples collected between 2009 and 2012 revealed that animals grazing on flood plains impacted by historical industrial chemical manufacture 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 Union as an alternative to DDT from the 1940s onward[239]. 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)[240,241] 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. 2011[242] provides an estimate of 300,000 tonnes of lindane used within the 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 signficiant challenge. Wycisk et al. (2013)[243] 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 manufacture 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 km^2. Analysis reported in the Wycisk et al. paper also quotes a sampling

238 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.

239 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.

240 International HCH and Pesticide Association (2006a) The legacy of lindane HCH isomer production. Mainreport; http://www.ihpa.info/docs/library/reports/Lindane%20Main%20Report%20DEF20JAN06.pdf

241 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/

242 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.

243 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.

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[244] 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 5 500 tonnes of HCH waste in the Netherlands has created a regional soil contamination of nearly 400,000 m^3. Similar experiences can be stated from Basque Country where nearly 90,000 tonnes of HCH waste has led to a soil pollution of 500,000 to 1 million tonnes of soil contaminated with HCH.

A review on global perspective on the management of lindane and its waste isomers (Vijgen et al. 2011)[245] identifies the following Member States with former lindane manufacture: Austria, Czechia, France, Germany, Hungary, Poland, Romania, Slovakia, Spain and The Netherlands. Additionally in Europe Macedonia and Switzerland have produced lindane.

A recent review on the current status of sites that are potentially contaminated with lindane in the Union found that many Member States have not fully identified sites of concern (ERA-Consult, 2016)[246]. In their study no information was provided on HCH contaminated sites by Bulgaria and Croatia where the manufacture of lindane is understood to have been undertaken. Several Member States, such as Austria, Hungary, Spain and Slovakia have identifed potentially contaminated sites, but little or no further investigations have been undertaken to date and/or remediation is still pending. Other countries, such as Czechia, Germany, Italy, Poland, Romania and The Netherlands are more advanced, and have been remediating some sites for many years, although not all sites have been subject to the full investigatory process. However, despite this a large contamination reservoir, in the scale of 100s of 1000s of tonnes of HCH waste is still belived to be present across the Union (ERA-Consult, 2016).

The chemical manufacture sites were typically located near rivers and river flood areas, which has contributed to the diffuse mobilisation of contamination, such as that identified at the Sabinaniog and Vitoria site and the Ebro River in Spain and Bitterfield-Wolfen site and Elbe River in Germany (ERA-Consult, 2016). This provides so called ‘mega sites’ in need of remediation, with the high associated financial cost and potential cross boundary migration acting as constaints to the investigation and clean up of these areas.

In August 2019 the Lindanet project was launched to join the efforts across European regions to work towards the identification and improvement of contaminated HCH (Lindane) sites, including the sharing of best practice, development of an action plan for each region, and stakeholder groups for knowledge exchange. The Lindanet project is led by the government of Aragon (Spain), with partners in Germany, Italy, Poland and Czechia. The first thematic workshop was hosted in November 2019, with further workshops planned for Spring 2020.

244 http://www.ihpa.info/docs/library/reports/Lindane%20Main%20Report%20DEF20JAN06.pdf

245 Vijgen, J., Abhilash, P. C., Li Y.F., Lal, R., Forter, M., Torres, J., Singh, N., Yunus, M., Tian, G. and Schäffer, A. (2011). Hexachlorocyclohexane (HCH) as new Stockholm Convention POPs—a global perspective on the management of Lindane and its waste isomers, Environmental Science and Pollution Research Vol. 18(2), 152- 162.

246 ERA Consult. (2016) Lindane (persistent organic pollutant) in the EU, study for the PETI Committee, European Union, 2016.

The project is due to complete on 31 January 2023 and has an associated budget of €1.3 million.

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)[247] and can contribute to contamination of food in the Union.

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

A review study by Weber et al (2018)[248] highlights the importance of identifying and managing sites contaminated by dioxins and dioxin-like PCB to prevent ingress back into the food chain. This includes how wastes containing dioxins and PCBs are managed to prevent loss to land leading to effects in the food chain. The review comments on a number of cases where contamination of eggs and meat by dioxins and furans have occurred, particularly free range chickens, with identification of the main sources of contamination coming from historically contaminated soils, PCBs present at farms (including use if open applications such as paint and sealants). The study concludes that further research is needed.

Similarly at Union level a review of the risks associated with dioxins and dioxin-like PCBs by EFSA resulted in a reduction of the safe tolerable weekly intake (TWI) to 2 picograms WHO-TEQ/kg bw[249]. This represents a reduction in the TWI by a factor of seven. The reduction in the TWI has primarily been applied in order to reduce the risk of health effects on human semen quality. The authors comment that the main dietary exposure within the Union came from fish, cheese and red meat.

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 manufactures which amounted to 10,000 tonnes for individual factories (UNEP 2010)[250].Within the Union, only one such case has been documented, including the resulting releases to water (Heinisch et al. 2006)[251]. 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, ratherthan to manufacture itself.

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247 www.ihpa.info

248 Weber et al (2018) 'Reviewing the relevance of dioxin and PCB sources for food from animal origin and the need for their inventory, control and management', Environmental science for Europe Vol 30 issue 42.

249 https://www.efsa.europa.eu/en/press/news/dioxins-and-related-pcbs-tolerable-intake-level-updated

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

251 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.

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 contaminations[252]. This case was subsequently remediated[253].

In the UK, the Food Standard Agency[254] has identified the need for further investigation into the levels of PCDD/F (which are not currently routinely analused) in rural sections of canal systems. These are commonly dredged and recycled directly to agricultural land. The impact of this on soil concentrations and on the foodchain, particulalry through the ingestion of herbage and soil by animals reared on these areas, is currently poorly understood.

3.4.5. PBDE contaminated sites

POP-PBDEs contaminated sites or hot spots have mainly been reported from primitive treatment of electronic waste (Wong et al. 2007)[255] and from the release of PBDE from landfills (Weber et al. 2011)[256]. 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)[257].

For PBDE manufacture 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-PBDEs 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-PBDEs 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-PBDEs 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 0.3 kg, 0.1 kg and 0.03 kg for tetra-, penta- and hexa-BDE, respectively.

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252 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.

253 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.

254 Nicholson, F, Metcalf, P, Gale, P, Taylor, M, Tompkins, D, Tyrrel, S, Longhurst, P, Weeks, J and Hough, R. (2016) Final Report – Identification and Proritisation of risks to food safety and quality associated with the use of recycled waste-derived materials in agriculture and other aspects of food production, FS301020, Prepared for the Food Standards Agency, 3 August 2016.

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

256 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).

257 https://www.isi.fraunhofer.de/content/dam/isi/dokumente/ccn/2011/COHIBA-WP4-Final-report_1.pdf

3.4.6. PFOS contaminated sites

The landfilling of waste originating from the manufacture and use of PFOS and other perfluorinated compounds has generated large contaminated sites (Bantz 2011[258], Kroefges et al. 2007[259], Oliaei et al. 2011[260], Weber et al. 2011[256]). 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 COP-5[261].

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. For example, in 2015 Sweden undertook a national screening programme for environmental toxins, including PFASs in surface and groundwater with over 2,000 potential sites identified. Five hundred samples were collected, which were combined with 5,600 older samples and a survey of potential sources of PFASs. The results revealed over 2,000 potential local sources of contamination, although insufficient information was available to identify individual point sources (KEMI 2016)[262].

In one instance, drinking water was polluted for more than 4 million people (Kroefges et al. 2007). The PFOS/PFOA within contaminated sludge was imported into Germany from the Netherlands as a hazardous waste conforming to the Waste Shipment Regulation for final treatment and disposal. However, in a criminal act, the receiving company re-labelled the sludge as bio-solid for soil improver and sold it to farmers which treated the agricultural fields with it thereby contaminating many areas around Soest, in the North Rhine-Westphalia part of Germany. From there, perfluorinated compounds leached into rivers and the drinking water reservoir (Skutlarek et al. 2006).[263]

Other PFOS contaminated sites have been described for application sites of fire fighting foams (Norwegian Pollution Control Agency[264], State of Jersey 2004[265], Weber et al. 2011). The Danish Environmental Protection Agency (DEPA) found that fire training at civil and military airports was a high potential source of PFAS contamination (Concawe 2016)[266]. Concawe noted that the PFAS profiles on contaminated sites can vary in response to different fire-foam types and compositions being utilised.

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[258] 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.

[259] 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).

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

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

[262] KEMI (Swedish Chemicals Agency) (2016) Strategy for reducing the use of highly fluorinated substances, PFAS. Interim report as part of a Government assignment. Report 11/16.

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

[264] Norwegian Pollution Control Agency (2008) Screening of Polyfluorinated Organic Compounds at four firefighting training areas. TA- 2444/2008.

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

[266] Concawe (2016) Environmental fate and effects of poly- and perfluoroalkyl substances (PFAS), June 2016

A further study by the Finnish Environment Agency (Syke, 2019)[267] assessed four sites used for training of fire-fighters using PFAS-based foams. Monitoring of groundwater and assessment of environmental fate concluded that the use of PFAS (which includes PFOS and PFOA) within an open dispersive application like fire-fighting meant the possible contamination of the environment with the very high mobility of PFAS to penetrate to groundwater bodies. The study notes that further recommendations are needed for remediation of the sites following the contamination identified.

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)[268]. 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)[269]. 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 ng/g and in groundwater up to 51,000 ng/l and surface waters up to 79 ng/l. 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 2008[270]), Germany (Busch 2010[271]) and Sweden (Woldegiorgis 2006[272]) 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.

A Europe-wide study of 90 waste water treatment plant effluents, in 27 countries, identified PFOA, PFHpA and PFOS in 90% of the waters (Loos et al. 2012)[273]. The discharge of waste waters is one of the principal routes of entry of PFOS into surface waters, with waste water being a major contributor to river flows. There is also the potential for the contamination of soil and water resources by the application of contaminated sewage sludge (solid waste of the waste water treatment process) to agricultural land. A study in Bayreuth, Germany, found that PFOA was fully discharged into the river, while about half of the PFOS was retained in the

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267 SYKE (2019), 'Environmental studies and risk assessment of perfluorinated alkyl compounds', http://hdl.handle.net/10138/301524.

268 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.

269 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.

270 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.

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

272 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.

273 Loos, R. Carvalho, R. Comero, S., Antonio, D.C. Ghiani, M. Lettieri, T. Locoro, G. Paracchini, B. Tavazzi, S. Gawlik, B.M. Blaha, L. Jarosova, B. Voorspoels, S. Schwesig, D. Haglund, P. Fick, J., Gans, O. (2010) European Commission JRC Scientific and Policy Reports, EU Wide Monitoring Survey on Waste Water Treatment Plant Effluents, European Union, Luxembourg.

sewage sludge (Becker et al 2010)[274]. PFAAs are also known to be produced during waste water treatment as break down products, with the degradation of precursors (polyfluoroalkyl compounds)[275].

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 2007[276] 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). 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 airport[277].

In 2013, PFOS and its derivatives were includes in the Directive on Environmental Quality Standards (2013/39/EU amending 2008/105/EC). The date set for Union-wide compliance with the EQS is 22 December 2027, with Member States required to submit a supplementary monitoring programme and preliminary programme of measures to achieve compliance by 22 December 2018.

Monitoring of surface water across Europe has identified widespread occurance of PFAS (including PFOS), with the EQS often being exceeded. In a Union-wide survey undertaken in 2007, 122 water samples were collected in streams and rivers of 27 European countries. PFOS was identified in 93% of samples analysed, with the highest concentration of 1,371 µg/l found in the River Krka in Slovenia (Concawe 2016).

In 2018 the drinking water directive (98/83/EC) was reviewed following a regulatory fitness evaluation[278]. This included the introduction of new measures for PFAS chemicals. The proposed recast directive takes into account the WHO recommended limits for PFOS (0.4µg/l) and PFOA (4µg/l), but also that the EQS limits for PFOS within the water framework directive is lower (0.00065 µg/l) than the WHO recommendations. The proposal for a recast directive also identifies the emerging issue with other PFAS species such as PFHxS and therefore includes proposed drinking water limits for each indiviudal PFAS species of 0.1µg/l and 0.5µg/l for PFAS in total[279]. A provisional agreement on the recast of drinking water directive was reached between the European Parliament and European Council at a December 2019 trilogue. The European Parliament further formally approved

274 Becker, A.M, Suchan, M. Gerstmann, S. Frank, H. (2010) Perflorooctanoic acid and perflurooctance sulfonate released from a wastewater treatment plant in Bavaria, Germany, Environment Science and Pollution Research 17, 1502-1507.
275 Hamid, H. and Li, L. Y. (2016) Role of Wastewater treatment plant in environmental cycling of poly- and perfluroroalkyl substances, Ecocycles, 2 (2), 43-53.
276 Environment Agency of England and Wales (2007) 'Investigation of PFOS and other perfluorochemicals in groundwater and surface water in England and Wales'.
277 PFAS monitoring: Report 6709, March (2016). Swedish Environmental Protection Agency.
278 https://ec.europa.eu/environment/water/water-drink/pdf/SWD_2016_428_F1.pdf
279 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2017%3A753%3AFIN

the recast of the drinking water directive in February 2020[280], paving the way for approval by the Council and likely entry into force in July 2020.

Additionally, the CONTAM Panel at EFSA undertook a review of the human health toxicology of PFOS and PFOA and 25 other prioritised PFAS substances as part of a risk assessment for human health from exposure to presence of PFAS in food. The study assessed 20,000 analytical results for dietary exposure, noting very large differences between upper and lower bound exposure data. The study estimated human half-lives for PFOS and PFOA of around 5 years and 2-4 years, respectively. Based on this analysis, the CONTAM Panel made recommendations in March 2018 for tolerable weekly intake (TWI) of 13 ng/kg body weight for PFOS and 6 ng/kg per week for PFOA[281]. In March 2020 at the stakeholders meeting on the draft scientific opinion on the risks to human health related to the presence of PFAS in food the CONTAM Panel further endorsed the draft opinion, and proposed a mixture approach to focus on the most relevant PFAS for human bioaccumulation. The draft opinion has also been the subject of an 8-week public consultation, which was launched in February 2020, including a group TWI for PFAS substances.

The need for further research into the potential transfer of contaminants from the recycling and use of waste materials has been previously identified by the UK Food Standards Agency. This included the need to fully understand the implications of uptake in the foodchain from the application of non-source segregated compost/digestate which may contain a wide spectrum of POPs (Nichloson et al. 2016). The Commission further conducted a Regulatory Management Option Analysis (RMOA) study on the use of digestate and compost as fertilisers in 2017/2018, which included consideration of the potential transfer of contaminants from 17 substance groups, including POPs (dioxins and furans, PCBs, HBCDD, PAHs and PFAS), into the environment[282]. The study includes assessments of the contribution of different material flows and applications of compost and digestate for concentrations of the different contaminants against background concentrations and/or safe limits. The study also draws conclusions on the merits of possible control options, including setting concentration limits for contaminants in commercial compost and digestate including POPs substances, as well as greater control over specific material flows such as sewage sludge.

In summary, these examples show that the production and use of PFOS (and other perfluorinated compounds) can result in PFAS 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. This is beginning to be looked at by some Member States, with Sweden, Denmark and Germany currently developing legislation and technical approaches for PFOS and PFOA in soil, groundwater, and sediments, with collaboration taking place between the three countries (KEMI 2016, Witteveen and Bos 2016[283]).

[280] https://www.europarl.europa.eu/meetdocs/2014_2019/plmrep/COMMITTEES/ENVI/DV/2020/02-17/1198614EN.pdf

[281] https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2018.5194

[282] https://ec.europa.eu/environment/chemicals/reach/pdf/40039%20Digestate%20and%20Compost%20RMOA%20-%20Final%20report%20i2_20190208.pdf

[283] Witteveen+Bos (2016) Inventory of awareness, approaches and policy, Insight in emerging contaminants in Europe Final version 03 RW2034-1/16-003.303 prepared on behalf of Ministry of Infrastructure and Environment, the Netherlands and Public Waste Agency of Flanders, Belgium.

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 manufacture of aluminium and graphite rods and as a plant protection product[284]. 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 conducted[285].

3.4.8. *Hexabromocyclododecane in waste stream*

HBCDD has been extensively used as a flame-retardant, primarily for polystyrene-based insulation materials (90% of all use), but also within moulded plastics and textiles (see section 3.2.12). HBCDD has been in use since the 1960s, with estimated annual use of 12,000 tonnes in 2009. The Netherlands (2016) comments that in 2016 this equated to 62,500 tonnes of insulation boarding containing HBCDD, this is extrapolated to estimates between 480,000 and 2.4 million tonnes for the whole Union. While new use of HBCDD has now ceased (as of August 2017), a very significant bank of 'in-use' material can be expected to exist. This poses a significant challenge for the construction and demolition sector to manage HBCDD contaminated wastes.

The POPs Regulation was amended in 2016 (Commission Regulation 2016/460 amending Regulation 850/2004) to update Annex IV with a threshold value of 1,000 mg/kg for HBCDD. This threshold provides a critical value for how waste should be managed. However, where a range of different brominated flame-retardants have been used, some of which are POPs and others not, correct identification is of high importance.

The correct identification of brominated chemical species and concentrations requires laboratory analysis, which represents both a costly and timing consuming process (laboratories can take days/weeks to turnaround analysis). Therefore, research is developing around new approaches for quick identification and appropriate management. Section 3.2.12 provides further discussion around the role of handheld XRF to identify bromine as a marker and screening tool for critical thresholds.

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[284] UNEP/POPS/POPRC.12/6 – Information on the listing of HCBD in Annex C of the Stockholm Convention.

[285] https://cot.food.gov.uk/committee/committee-on-toxicity/cotstatements/cotstatementsyrs/cotstatements2000/hexachlorobutadiene- COT statement on hexachlorobutadiene.

Ramboll (2019) provide some additional commentary on material flows, commenting that based on studies by Giraf, (2018)[286] in the Netherlands that 70% of EPS/XPS from construction waste contained HBCDD above the 1000 mg/kg low POP content threshold. However, 96% of this came from EPS. Furthermore, the study by Conversio (2018)[287] noted that for the EU28+2 in 2017 a total of 138.7 kt of EPS within construction waste was generated. This included 40kt (29%) of off-cuts from new installation (free of HBCDD) and 98.6 kt (71%) from demolition, which included waste containing HBCDD.

Ramboll (2019) calculate waste flows for EPS in 2017 assuming 690 tonnes of HBCDD contained within 98.6kt of EPS. This assumes 68.6 kt of EPS (480t HBCDD) is incinerated, a further 28.7 kt EPS (200t HBCDD) is consigned to landfill and 1.3kt EPS (9t HBCDD) is recycled within the EU28+2.

Ramboll (2019) also calculate waste flows for XPS in 2017 assuming 636 tonnes of HBCDD within 32.8kt of XPS. This assumes 70% (23.2kt of XPS) is incinerated, with 30% (9.6kt of XPS) consigned to landfill, and no recycling of XPS within the EU28+2.

While the new use of HBCDD in XPS/EPS is no longer permitted, the significant previous use and long lifespan of treated articles means that HBCDD in demolition and construction waste will continue to require management. This is an area for further research to better understand and manage how construction and demolition companies control HBCDD in the waste stream.

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 Union has submitted two-thirds of the proposals for new POPs under the Stockholm Convention (endosulfan, commercial octabromodiphenyl ether, pentachlorobenzene, SCCPs, HCBD, PCNs, PCP, PFOA, dicofol and methoxychlor) and PFOS and trifluralin in addition under the POP Protocol.

In May 2019, at COP-9, it was decided to list two new chemicals which had been recommended by the POPs Review Committee (POPRC), namely dicofol and PFOA in Annex A.

Three substances (perfluorohexane sulfonic acid (PFHxS), its salts and PFHxS-related compounds, dechlorane plus, and methoxychlor) are currently under review by the Stockholm Convention for addition to the Convention Annexes as POPs. At the POPRC-15 meeting in 2019[288], a draft risk management evaluation (RME) of PFHxS was presented and adopted. POPRC recommendation is to list PFHxS, its salts and PFHxS related compounds in Annex A without exemptions. Furthermore screening dossiers for dechlorane plus and

[286] Giraf, 2018, HBCDD concentrations in EPS/XPS products and waste streams, Inventory in the Netherlands, Final Report, Ministry of Infrastructure and Water Management Netherlands, 15 March 2018.
[287] Conversio, 2018, Post-Consumer Waste Generation and Management in European Countries 2017. EPS Packaging Waste & EPS Construction Waste, Final Report for Eumeps, July 2018.
[288] UNEP/POPS/POPRC.15/7

methoxychlor were presented and adopted, with agreement from the POPRC members that both substances meet the Annex D criteria (of the Convention) to be considered POPs. It is expected that PFHxS will be listed under Annex A of the Convention (as per the POPRC recommendation) at the next Conference of the Parties, COP10.

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 2.2.3).

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 SVHCs, which may be added to Annex XIV to REACH and would then be subject to authorisation[289]. The results of the screening are going to be used also for the identification of POPs candidates. Under the POPs Regulation, ECHA has also a central role for the development of scientific and technical dossiers for substances proposed by the Union for listing under the Stockholm Convention. The strong synergies between the REACH Regulation and the POPs Regulation and the new more central role of ECHA within the POPs Regulation will maximise the synergies with REACH processes for identification of candidate POPs.

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 RIVM[290] to help develop an approach for analysis of substances presented at the POPRC meeting. Studies have also been carried out in Norway[291] to assess potential candidate substances against the Stockholm Convention criteria.

A 2018 study by McLachlan[292] suggests the criteria to screen for new POPs under the Stockholm Convention can lead to false negative and false positive conclusions when applied to chemicals that lie outside of the basic criteria set down in Annex D of the Stockholm Convention. In particular, McLachlan (2018) comments that trying to apply simple indicators to complex processes of chemical transport, fate and exposure will not be successful across a wide spectrum of chemicals. For example, the authors note that bioconcentration in fish and biomagnification, the Annex D criteria primarily used to assess bioaccumulation, are of no relevance in the case of PFOA and PFOS. Furthermore, the authors noted that the reliance on tissue levels in humans or top predators as a substitute for bioaccumulation metrics can be problematic, as chemicals can be rapidly metabolized or excreted and still have adverse effects, therefore bioaccumulation will not necessarily be a requirement for adverse effects of chemicals in remote regions. It is that suggested that consideration of persistence is

[289] https://echa.europa.eu/documents/10162/19126370/screening_definition_document_en.pdf/e588a9f8-c55e-4412-a760-49ddbf7ac687

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

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

[292] McLachlan, M.S., 2018, Can the Stockholm convention address the spectrum of chemicals currently under regulatory scrutiny? Advocating a more prominent role for modelling in POP screening assessment. Environmental Science: Processes & Impacts, 20, 32.

particularly significant in POPs screening as this can provide an indication as to the potential for non-reversible exposure for humans to these chemicals.

The German Environment Agency[293] has developed a persistency, mobility and toxicity (PMT) as well as very persistent and very mobile (vPvM) criteria and an assessment procedure to identify substances that pose a hazard to drinking water. An initial list of 167 substances registered under REACH were assessed for the PMT/vPvM criteria. A total of 134 substances based on suspected PMT properties combined with expected environmental emissions are recommended[294]. A workshop was held by the German Environment Agency in 2018 to discuss how this initiative can best serve industry in fulfilling its obligations under REACH[295].

Since the work of the German Environment Agency in 2017 to develop the concept of "PMT" and mobility as a potential criterion to assess substances which spread ubiquitously through the environment to reach higher trophic levels of the food chain, additional work has been completed to assess its validity as a method of identifying POPs. A study on behalf of the European Commission (2019)[296] evaluated the use of mobility as a supporting piece of evidence for Annex D criteria c(ii)[297] of the Stockholm Convention. It concluded that, based on analysis of a range of substances using modelled approaches underpinned by monitoring data, mobility may be important depending on receiving environment and times taken to reach higher trophic levels. The study goes on to suggest possible criteria for developing critical thresholds of mobility alongside other PBT criteria for the identification of POPs.The use of PMT and mobility as a criteria to identify chemicals of concern, particularly for drinking water, has also been increasingly recognised by industry groups. In particular EurEau (2019)[298] highlights within their August 2019 briefing note the importance of early identification and management of PMT substances to avoid health effects and costing impacts for the water treatment industry. EurEau highlight in particular the concerns around per and poly fluorinated alkyl substances (PFAS), regulation of which has to date included PFOS, PFOA and PFHxS, with growing potential concerns for shorter chain PFAS substances in the environment.

4. PART II – IMPLEMENTATION PLAN

This section presents the Union's implementation plan, including actions to address the issues identified within the Party Baseline (Part I of the UIP). The Union Implementation Plan is an

[293] German Environment Agency, 2017. Protecting the sources of our drinking water, A revised proposal for implementing criteria and an assessment procedure to identify Persistent, Mobile and Toxic (PMT) and very Persistent, very Mobile (vPvM) substances registered under REACH.

[294] https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/2018-02-12_texte_09-2018_pmt-of-167-reach-substances_v3.pdf

[295] https://psi.ul.com/en/resources/article/german-environment-agency-proposes-pmt-and-vpvm-criteria-under-reach-and-clp/

[296] Evaluation of using mobility of chemicals in the environment to fulfil bioaccumulation criteria of the Stockholm Convention. https://ec.europa.eu/environment/chemicals/reach/publications_en.htm

[297] Annex D, c(ii): "*Evidence that a chemical presents other reasons for concern, such as high bio-accumulation in other species, high toxicity or ecotoxicity*".

[298] EurEau briefing note, August 2019,'Moving Forward on PMT and vPvM substances', EurEau industry publication.

evolving document which develops alongside the emerging science and policy through periodic updates. The actions included within the implementation plan include both more general activities which will always be needed to meet the obligations of the POPs Regulation, and actions aimed at addressing specific issues.

As part of the update to the current version of the UIP (presented here) any actions from the previous version which are now obsolete have been removed and are presented in Section 9. This is because the action has either been completed or the further evolution of the science and policy means that the action is no longer needed.

Section 5also includes new actions added for the first time; where this is the case it is clearly stated in the text.

5. IMPLEMENTATION OF THE BASIC OBLIGATIONS OF THE STOCKHOLM CONVENTION

5.1. Elimination of intentional manufacture and use of POPs (Article 3(1))

5.1.1. POP pesticides, plus decabromodiphenyl ether, HBB, HBCDD, HCBD, PeCB, PCNs, and SCCPs.

Obligation: Article 3, paragraph 1(a)(i) of the Convention: prohibit and/or take legal or administrative measures necessary to eliminate the manufacture and use of aldrin, alpha and beta hexachlorocyclohexane, chlordane, chlordecone, decabromodiphenyl ether, dicofol, dieldrin, endosulfan, endrin, heptachlor, hexabromocyclododecane, hexabromobiphenyl, hexachlorobenzene, hexachlorobutadiene, lindane, mirex, PCP, PeCB, PCNs, SCCPs, as well as toxaphene (additions to the POPs Regulation since 2009 are underlined).[299]

Implementation so far: Manufacture, placing on the market and use of the above-mentioned substances as such, in mixtures or in articles is prohibited in the Union by the POPs Regulation.

Analysis: Legal measures regarding manufacture, placing on the market and use are sufficiently comprehensive. There is no need for further legislative measures at Union level. No Member State currently reports the intentional manufacture of any of the POPs listed above.

Border and market surveillance by the Member States remain necessary and following recent findings of HCB presence in 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.

In March 2016 HBCDD was added to Annex I of the [initial] POPs Regulation (by Commission Regulation (EU) 2016/293). This included exemptions to cover two authorisations for HBCDD under the REACH Regulation, both of which expired in August 2017. While new use of HBCDD is prohibited, the lifespan of previously treated mixtures and articles means that presence of HBCDD within in-use mixtures and articles is still an issue, and this will further present legacy issues for the waste cycle and management of wastes containing HBCDD. It is still necessary to gather more information to support the

[299] Those substances that have been added to the Convention in 2009, 2011, 2013, 2015, and 2017, are underlined.

exchange of information on methods for identification of that chemical within the waste stream.

Similarly, dicofol was only added to Annex I of the POPs Regulation in June of 2020 (Commission Delegated Regulation (EU) 2020/1204). In the Union, there was one manufacturer based in Spain (with some further formulation in Italy) with production and use in the Union declining over time from 317t per annum to 32t per annum between 2000 and 2009[300]. According to the EFSA pesticide database[301], that one manufacturer based in Spain (Dow) had reapplied for dicofol to be added to Annex I of the Plant Protection Products Regulation (as an approved active substance). This was rejected in 2008 (over concerns for human health and environment and lack of substantiating data), with the existing approval expiring in 2010. On that basis, manufacture and use of dicofol in the Union has not been allowed for at least a decade, with a strong decline in use preceding the phase-out. Additionally, under the Regulation for maximum residues of pesticides in or on food and feed (Regulation (EC) No 396/2005), thresholds for dicofol have been in place since 2008 (see Regulation (EC) No 149/2008), and under the Environmental Quality Standards Directive (Directive 2013/39/EU) dicofol was identified as a priority substance with thresholds set for surface water in 2013.

It is possible that, like the other obsolete POP pesticides, limited remaining stockpiles may exist within the Union. However, given the significant period of time that has passed since legal use has ceased, it is likely that quantities will be small, even if such stockpiles exist.

The public consultation on the draft UIP completed in 2019 (August-November) did further specifically highlight that the general public had high concerns regarding stockpiles of obsolete pesticides, with no publicly available central repository containing information on quantities and management.

Action 1: 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. (ongoing action)

Action 2: Commission to explore options for the best method to facilitate the compilation of information on stockpiles of obsolete pesticides. In particular this should include a public facing component to address concerns raised in UIP consultation. (new action)

300 Li, L., Liu, J., Hu, J. (2014) Global inventory, long-range transport and environmental distribution of dicofol. Environmental Science and Technology, 49: 212-222.

301 https://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/public/?event=homepage&language=EN

5.1.2. 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 manufacture and use of PCBs.

Implementation so far: Manufacture, placing on the market and use of PCBs as such and in mixtures is fully prohibited by the POPs Regulation. Articles containing PCBs already in use are covered by specific provisions laid down in Directive 96/59/EC (PCB Directive) (cf. section 2.2.3). The Directive requires Member States to compile inventories of equipment with PCB volumes of more than 5 dm^3, and to phase-out and destroy such PCB (larger) equipment before the deadline of 31 December 2010. Furthermore, the POPs Regulation requires all remaining PCBs within contaminated equipment (greater than 0.005% and larger than 0.05 dm^3) to be identified and removed for irreversible destruction by 31 December 2025.

Analysis: Legal measures on manufacture, marketing and new use of PCBs (and PCTs) are sufficiently comprehensive and there is no need for further legislative measures at Union level.

Directive 96/59/EC addresses the main application areas of PCBs and lays down a timetable for specific essential control actions, with one further final target detailed within the POPs Regulation. 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 Union given that the information on PCB inventories had become obsolete (cf. section 3.1.4). The survey showed that there are still 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 a study for the European Commission on “Support to selected Member States in improving hazardous waste management based on assessment of Member States' performance” (2017)[302], the PCB/ PCB waste management situation in 14 selected Member States was investigated. The study indicated that major shares of PCB equipment have been identified and eliminated. Nevertheless, the overarching challenge in most Member States is that further identification of PCB equipment does not seem to be on top of the priorities of the competent authorities in the Member States. This means that in many cases neither targeted actions, inspections and controls, nor further awareness raising campaigns are carried out anymore in order to inform companies concerning their responsibilities for PCB equipment. By contrast, Member States actively and continuously searching for further PCB equipment report ongoing identification and elimination of such equipment which indicates that not all equipment may have been identified yet in the Member States. Furthermore, it was concluded that although most Member States already substantially addressed PCB from ‘closed’ applications, activities in this direction should not be abandoned as some holders of PCB equipment have not yet been identified.

[302] BiPro, 2017. Support to selected Member States in improving hazardous waste management based on assessment of Member States' performance. Study for the European Commission (070201/2016/736294/ENV.B.3): http://ec.europa.eu/environment/waste/studies/index.htm

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.

This is particularly relevant given that the POPs Regulation sets a target for full final removal of all PCBs in dielectric equipment (containing more than 0.005% w/w PCB in volumes greater than 0.05 dm^3) by no later than 31 December 2025, to meet the same target listed under the Stockholm Convention. Based on contact with Member States from the recent request, this final deadline may prove challenging. While significant progress has been made towards elimination, identification of remaining stockpiles within networks is likely to require significant additional efforts, as evidenced in part by the industry feedback on the recast of the initial POPs Regulation[303].

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. (ongoing 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 it[304].

Member States are required to develop a register of larger (>5 dm^3) size equipment containing PCBs and adopt a plan for disposal of inventoried equipment. In addition, they

303 https://ec.europa.eu/info/law/better-regulation/initiatives/com-2018-144/feedback_en?p_id=198418

304 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.

have to define processes for the collection and disposal of non-inventoried equipment (e.g. small electrical equipment that can be present in household appliances). Member States were required to dispose of larger equipment by the end of 2010. However, this work was still ongoing in many cases. Several Member States reported a downward trend in stockpiles with PCB-containing equipment.

Acknowledging the levels of uncertainty inherent to the estimates of PCBs in such equipment, the request asked for input on the quantities of PCB actively in use in di-electric equipment, both in 1990 and in 2015, as well as the quantities of PCBs that have been destroyed between 1990 and 2015. Responses were received from 14 Member States, which indicated that in the majority of cases that <10% of stockpiles remained in 2015 compared to the 1990 estimates. However, a small number of Member States highlighted that identification and removal of PCB from di-electric equipment was still ongoing, with the highest estimate of 49% of stocks still in-use for 2015 compared to the 1990 baseline.

Recommendations COP-9

COP-9 in its document UNEP/COP.9/6/Add.1 identifies a set of key recommendations for the further elimination and safe management of PCBs, which includes:

- Urging Parties to take legal and administrative measures to ensure that, by 2025, Parties identify and remove from use, equipment containing greater than 0.005 per cent PCB and volumes greater than 0.05 litres.

- Encouraging Parties, as appropriate, to include in their regulatory frameworks provisions to ensure the environmentally sound management of PCB, e.g., interim storage, avoiding cross-contamination, decontamination and elimination;

- Urging Parties to take legal and administrative measures to ensure that, as soon as possible but no later than 2028, Parties make determined efforts designed to lead to the environmentally sound waste management of liquids containing PCB and equipment contaminated with PCB having a PCB content above 0.005 percent.

- Reminding Parties, in accordance with subparagraph (f) of part II of Annex A to the Convention, to endeavour to identify articles containing more than 0.005 per cent PCB in open applications such as cable sheaths, cured caulk and painted objects, and manage them in accordance with paragraph 1 of Article 6.

- Encouraging Parties to raise awareness on PCB in open applications as well as other persistent organic pollutants with similar open applications as PCB, such as polychlorinated naphthalenes and short-chain chlorinated paraffins, and build capacities to identify and manage them.

- Inviting Parties to develop, in collaboration with PCB experts, guidance on best available techniques and best environmental practices (BAT/BEP) for PCB in open applications.

5.1.3. POP-PBDEs (tetra-, penta-, hexa-, hepta- and decabromodiphenyl 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 manufacture and use of hexabromodiphenyl ether, heptabromodiphenyl ether, tetrabromodiphenyl ether, pentabromodiphenyl ether and decabromodiphenyl 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 either, 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 manufacture 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.

During the eigth Conference of the Parties (COP8) held in May 2017, decabromodiphenyl ether was added to Annex A (SC8/10). Under Annex A, part IX of the Convention, the manufacture and use of decabromodiphenyl ether shall be eliminated except for Parties that have notified of their intention to produce and/or use it in accordance with Article 4 (specific exemptions). Annex A, part IX of the Convention lists the following specific exemptions (time limited) for decabromodiphenyl ether:

- Parties for use in vehicles specified in paragraph 2 of Part IX of Annex A (parts for legacy vehicles, defined as vehicles that have ceased mass manufacture, defined on the specific categories listed in part IX [of Annex A?]of the Convention). Expires at end of life or 2036 which ever is sooner.
- Aircraft for which approval has been applied for before December 2018 and has been received before December 2022 and spare parts for those aircraft.
- Textile products that require anti-flammable characteristics, excluding clothing and toys.

- Additives in plastic housing and parts for heating home appliances, irons, fans, immersion heaters that contain or are in direct contact with electrical parts or are required to comply with fire retardancy standards, at concentrations lower than 10 per cent by weight of the part.
- Polyurethane foam for building insulation.

Note under Article 4(4) of the Convention unless a different date is indicated, all specific exemptions shall expire after five years from the entry into force unless an extension is granted by the Conference of the Parties following a request from a Party.

Recommendations COP-5, 7 and 8

COP-5 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 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 Convention[305] 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 Convention[306].

At COP-7 recommendations were made subject to the availability of resources, to commission a technical paper on POP-PBDEs within articles, based upon the terms of reference to be prepared by the POPRC, to be completed in time for its consideration by the Committee at its eighth meeting.

At COP-8 further review and steps were taken to assess progress towards controlling POP-PBDEs within wastes. Within the information document COP8/22/Add.1 two further key recommendations were made:

[305] 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.

[306] 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 recyclate.

- In order to evaluate the progress made in elimination of PBDEs, Parties and observers should provide quantitative information on articles containing BDEs, including in recycling and waste streams.
- The guidance documents made available at the seventh meeting of the Conference of the Parties should be completed in consultation with the Basel Convention so that they can be used widely to develop more comprehensive inventories of BDEs and help with the application of best available techniques and best environmental practices for the recycling and waste disposal of articles containing BDEs.

The Stockholm Convention website provides a guidance document for inventory development of POP-PBDEs, including within articles and waste, last updated in 2017[307].

Implementation so far: Manufacture, placing on the market and use of hexabromodiphenyl ether, heptabromodiphenyl ether, tetrabromodiphenyl ether and pentabromodiphenyl ether is prohibited fully by the POPs Regulation. Furthermore, Commission Regulation (EU) 2017/227 (establishing a new entry 67 in Annex XVII to Regulation (EC) No 1907/2006 (REACH)) on decabromodiphenyl ether states that the manufacture, placing on the market or use of decabromodiphenyl ether shall only be allowed for the manufacture of aircrafts until 2 March 2027, for spare parts of aircrafts produced before the expiry of that period, and for the manufacture of spare parts for motor vehicles, agricultural and forestry vehicles or machinery produced before 2 March 2019. From 2 March 2019 the use of decabromodiphenyl ether shall be subject to a limit of 0,1% w/w for its use in manufacture of or placing on the market in another substance as a constiuent, mixture or article.

In addition, Directive 2011/65/EU on the restriction of hazardous substances in electrical and electronic equipment (EEE) (RoHS Directive, see section 2.2.4) allows the use of all POP-PBDEs in EEE put on the Union 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 POPs Regulation, tetra, penta, hexa, hepta and decaBDE are listed in Annex I, part A, which prohibits the manufacturing, placing on the market and use of substances on their own, in mixtures or articles (unless set exemptions apply). However, as part of the listing of the POP-PBDEs, thresholds are applied below which their presence is assumed as an unintentional trace contamination. For the POP-PBDEs the threshold for individual homologues (e.g. tetraBDE) present in substances is 10 mg/kg (0.001% by weight) and for the sum of tetra, penta, hexa, hepta and deca present in mixtures and articles is 500 mg/kg. Additionally, by way of derogation for tetra, penta, hexa and hepta homologues, the limits set under the RoHS Directive apply, and articles in use before August 2010 are exempt.

For decaBDE, additional exemptions also apply to allow continuity between the POPs Regulation and the Stockholm Convention[308].

Analysis: Legal measures on manufacture, placing on the market and use of tetra, penta, hexa, hepta and decabromodiphenyl ether are comprehensive and there is no need for further legislative measures at Union level.

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[307] http://chm.pops.int/Implementation/NIPs/Guidance/GuidancefortheinventoryofPBDEs/tabid/3171/Default.aspx
[308] See listing for decaBDE in Annex I part A of EU 2019/1021

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-PBDEs 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 3.2.3 and 3.2.4). This also recognises that the phase-out of c-decaBDE began much later than c-pentaBDE and c-octaBDE.

As stated in sections 3.2.3 and 3.2.4, 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 (EU) No 1342/2014 updated Annexes IV and V of the POPs Regulation to put in place thresholds for PBDE containing wastes. This is set as the sum of the congeners tetra-, penta-, hexa-, hepta and decaBDE which must not exceed 1000 mg/kg. Any waste which exceeds the threshold in Annex IV must be subjected to a treatment that destroys or irreversibly transforms the POP substances it contains.

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-PBDEs. For these activities also the recommendations of the COP5 should be considered.

At the international level, limit values for POP-PBDEs were discussed at COP14 of the Basel Convention in June 2019. The technical guidelines presented at COP14 quote three potential values of 50, 500, and 1000mg/kg for the sum of POP-PBDEs[309], but agreement on the most appropriate value was not reached during the meeting. The established Union limits could provide valuable input to the international process.

The study to support the review of waste-related issues in Annexes IV and V of the POPs Regulation (Ramboll, 2019) revealed that POP-PBDEs (particularly decaBDE) are still contained in some articles still in use and in material flows at the end of life in the Union.

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 Union 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[310]. 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-PBDEs.

[309] http://www.basel.int/Portals/4/download.aspx?d=UNEP-CHW.14-7-Add.1-Rev.1.English.pdf

[310] Note the recent creation of the Substances of Concern In articles as such or in complex objects (products) database (the SCIP Database). This covers SVHCs under REACH. While decaBDE is listed as an SVHC, the lower order homologues are not, and furthermore their earlier phase-out may create issues for gathering and submitting relevant data to the SCIP Database.

Some Member States are doing screenings of end of life vehicles to generate necessary data, in particular studies by Ireland[311], Sweden[312], and the United Kingdom[313] have assessed working concentrations of POP-PBDEs within plastics and foams from vehicles, suggesting significant declines in working concentrations for c-pentaBDE homologues since the global ban in 2004. However, it would still be useful to have data from several other Member States to have a more comprehensive and representative overview.

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 mange 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.

Action 4: Commission to continue to collect available data on presence of POP-PBDEs in end of life goods including vehicles, waste electrical and electronic equipment (WEEE), and waste plastics and facilitate exchange of information among the Member States. (ongoing action)

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 electrical and electronic equipment (EEE).

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) along with household goods (Chen 2010) and video tapes (Hirai 2007)[314] can be contaminated with PBDE and other BFRs.

While concentrations of POP-PBDEs within products manufactured in the Union may be expected to have declined, import may be an issue. One study by Whiting et al[315] (2017) based on analysis of high street goods in the UK manufactured outside of the Union (based on product markings) (30 samples including 15 electrical items and 15 non-electrical items) indicated concentrations of hexaBDE from 6-2,700 mg/kg and of heptaBDE from 15 – 21,000 mg/kg. Homologues of c-octaBDE (hexa and hepta) were detected in 18 out of 30 samples. Import of plastic goods that contain POP-PBDEs as a result of recycling, in less expensive electrical goods such as keyboards and IT periphals is another potential supply route for goods reaching the Union market. Where such supply chains are complex and flow

[311] Ireland EPA (2015), ‘studies reported within the Ireland National Implementation Plan.

[312] 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”.

[313] Defra (2016), ‘Annual report for Further update of the UK’s POPs multi-media emission inventory – Work Package 3: ‘Analysis of PBDEs from end of life vehicles’, ref CB0489

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

[315] Defra (2017), ‘Annual report for Further update of the UK’s POPs multi-media emission inventory – Work Package 3: ‘Analysis of PBDEs from non-EU plastics’, ref CB0489.

of material globally is not well tracked, identification of PBDE contaminated material proves difficult.

The Stockholm Convention Secretariat have however provided detailed guidance for the development of POP-PBDE emission inventories (including waste aspects)[316] as well as guidance on sampling, analysis and screening of POPs (including POP-PBDEs) in articles and waste[317].

Information at Union level is variable across different Member States. UNEP comment that only a few full scale e-waste recycling facilities were separating PBDE containing plastic (UNEP 2011a,b)[318]. One facility in Switzerland had an automatic separation step for WEEE plastic containing BFRs (halogens). Additionally, information is available from Sweden on the separation of BFR-containing plastics from WEEE plastics[319]. Ramboll (2019) provide mass-flow estimates for some PBDEs (in particular decaBDE – see next section) but also comment that materials likely to contain high PBDE concentrations can be readily separated in waste treatment plants by density separation. BSEF (2020) commented that 55% of plastics from WEEE entering WEEE processing facilities is converted to regranulated plastics for recycling. The Ramboll (2019) report states that, based on feedback from EERA, approximately 30 specialised recycling facilities exist across Europe.

However, for WEEE articles recycled outside of the Union, the waste management may operate to lower standards. This represents a possible issue for imported plastic granulate (as a raw material) or articles that include recycled plastics manufactured outside of the Union.

Action 5: Commission to encourage Member States to make use of the UNEP guidance documents on POP-PBDE emission inventories, and sampling, analysis and separation of POP-PBDEs in waste as part of national level planning for implementation plans. (new action)

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, and depending on the outcome and the quality of information take further actions. (ongoing action)

316 UNEP (2017) Guidance for the inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants.
317 http://chm.pops.int/Implementation/NIPs/Guidance/GuidancefortheinventoryofPBDEs/tabid/3171/Default.aspx
318 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.
319 Recycling of WEEE Plastics Containing Brominated Flame Retardants- a Swedish perspective", Recycling Development AB and Vascaia, made for the Swedish EPA, 2010.

5.1.4. *C-DecaBDE uses*

The main use of c-decaBDE was as a flame-retardant in within articles; in particular the dominant use of c-decaBDE was within plastics (circa-80%), particularly for electrical goods. However c-decaBDE has also been used within textiles and foams (circa-20%). The lifespan of all potential goods treated with c-decaBDE can be in excess of ten years. Noting that the phase-out of c-decaBDE began much later than c-pentaBDE and c-octaBDE[320]. Furthermore, c-decaBDE was used more extensively than c-pentaBDE or c-octaBDE. The Union risk assessments from 2001 and 2003 comment that total use of all commercial PBDEs in the Union at that time amounted to 11,000 tonnes per annum. However, use of c-decaBDE accounted for 75% of this quantity. Furthermore, Ramboll (2019) estimated that, as of 2015, 1.2 million tonnes of plastics from waste electrical and electronic equipment were generated containing 630 tonnes of decaBDE.

The extensive use of c-decaBDE and potentially significant stockpile of in-use plastics and textiles yet to enter the waste stream represents a significant challenge for the waste handling sector. Decabromodiphenyl ether has been added to Annex IV of the POPs Regulation to define the critical threshold (low POP content value), which is currently set at 1,000 mg/kg for waste.

However, one key point of interest is the need for quick and easy identification of POP brominated flame-retardants in plastics, foams and textiles, including decabromodiphenyl ether. A range of POP and non-POP BFRs have been used within plastics, foams and textiles, with analysis of specific species both costly and time consuming (requiring full laboratory analysis). Therefore it is a challenge for the waste handling industry to manage wastes appropriately in order to comply with the thresholds in Annex IV and V of the POPs Regulation.

Section 3.2.12 highlighted the exploratory work around the use of handheld XRF equipment, used to identify bromine as a marker for where a BFR has been used, and extrapolation against the critical thresholds for waste listed under Annex IV and V of the POPs Regulation. However, further analysis and work is needed to provide guidance on how techniques can be used for the correct management of waste and to avoid POPs re-entering commercial markets through recycled materials. The POPs Regulation recognised this fact and sets in place a requirement for the Commission to review the Annex IV waste threshold within two years of entry into force, with the aim to reduce the threshold from 1000 mg/kg to 500 mg/kg if possible.

Finally, one further consideration is the type of waste flow affected. Earnshaw et al (2013) commented that 75% of decaBDE was used within plastic applications, particularly electrical equipment and vehicles which have a defined waste stream under the WEEE and the end of life vehicles Directives. The remaining 25% of usage was within textiles and foams (which includes use in vehicles). For those waste streams not covered by WEEE or end-of-life vehicles requirements, it may be more challenging to identify decaBDE waste mixed in with general municipal waste flows. Note however that usage would likely be related to bulky items such as sofas, armchairs, mattresses, and carpets. However, it is highly likely that there

[320] European phase-out for the use of c-pentaBDE and c-octaBDE began in the late 1990s / early 2000s leading up to a ban in 2004. C-decaBDE was expected to have begun phase-out from the latter part of the 2000s, leading up the SVHC listing in 2012, but in some application phase-out may not have begun until after this

> Action 7: Commission to review how best to support screening and management techniques for POP-PBDEs and HBCDD within textiles and foam waste streams. (new action).

will be a lower level of awareness of POP-PBDEs for waste operatives managing such waste, and application of screening techniques such as handheld XRF is unlikely. Further note that there may be similar issues for HBCDD which was also used in soft furnishing applications.

5.1.5. DDT

Obligation: Article 3, paragraph 1(b) and Annex B, Part II of the Convention: restrict the manufacture 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: Manufacture, placing on the market and use of DDT as such, in mixtures or in articles is totally prohibited by the POPs Regulation. No exemption is granted by the Regulation.

On the basis of note (iii) of Annex B, Part I, of the Stockholm Convention, the POPs Regulation initially granted an exemption for Spain to continue the existing manufacture of dicofol using DDT as site-limited, closed-system intermediate until 1 January 2014. This notes that dicofol itself was subsequently listed as a POP under the Stockholm Convention. The exemption of use of DDT in dicofol manufacture was withdrawn from Regulation (EC) No 850/2004 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 (Commission Decision 2008/764/EC)[321] 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. However, feedback from the Spanish environment ministry (MITECO) confirmed that the only manufacturer of dicofol in Spain ceased production in 2006.

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

5.1.6. 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 manufacture 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 had initially been granted for the manufacture and/or use. By decision SC-4/17, adopted at COP9, the vast majority of acceptable purposes and specific exemptions were deleted.

Article 3, paragraph 6: take appropriate measures to ensure that any manufacture 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

[321] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:262:0040:0041:EN:PDF

release shall be to the minimum extent necessary, taking into account any applicable standards and guidelines.

Recommendations COP-7

At COP-7 it was agreed 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;

Implementation so far: Manufacture, placing on the market and use of perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride as such, in mixtures or in articles is severely restricted by the POPs Regulation. 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 mixtures;
- 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/m^2 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, manufacture 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: mist suppressants for non-decorative hard chromium (VI) plating in closed loop systems (more detail in 3.2.7);

Manufacturing of perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride was in recent years limited to only one Member State (Germany). According to the annual reporting information submitted by Member States under Regulation (EC) No 850/2004 in 2013, 2014 and 2015, PFOS was still produced in Germany in quantities of around 9 tonnes per annum. This was primarily used for hard chromium (VI) plating (cf. section 3.2.7).

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, wheareas 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 Union, and are still in the process of disposal (cf. section 3.2.7).

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.

Annex I, Part A of the POPs 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.

At COP-9, the Conference of Parties decided to amend the entry regarding PFOS in Annex B, with the removal or modification of several acceptable purposes and specific exemptions. The POPs Regulation already took into account this amendment with the exception of the use for chromium plating in closed loop system. The modification under the Convention has been implemented in the POPs Regulation through Commission Delegated Regulation (EU) 2020/1203[322].

Analysis: The use of PFOS in the metal plating industry is the only remaining use of PFOS in the Union. Alternatives and substitutes have already been investigated for this use but there is a lack of practical implementation (cf. section 3.2.7). With a view to phase-out this use of PFOS, support of practical implementation projects to help mostly concerned SMEs in phasing in alternative processes to PFOS might be desirable.

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 Committee[323].

[322] Commission Delegated Regulation (EU) 2020/1203 of 9 June 2020 amending Annex I to Regulation (EU) 2019/1021 of the European Parliament and of the Council as regards the entry for perfluorooctane sulfonic acid and its derivatives (PFOS) (OJ L 270, 18.8.2020, p. 1).

[323] http://chm.pops.int/Convention/POPsReviewCommittee/hrPOPRCMeetings/POPRC5/POPRC5Followupcommunications/PFOSalternativesguidanceInvitationforcomments/tabid/741/language/en-US/Default.aspx

This has since been supplemented with the body of work looking at alternatives presented at the 10th POP Review Committee meeting and will continue to be updated in future POPRC 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 POPs Regulation sets in place threshold values under Annexes IV and V regarding wastes that may be contaminated with POPs. Those wastes that exceed the thresholds in Annexes IV and V, from which the POP content cannot be separated, must be disposed of or recovered (in accordane with the Annexes) in such a way as to ensure that the POP content is irreversibly transformed or 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 PFOS[324].

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. The Commission understands that this assessment method has now been validated.

No exemptions for recycling of PFOS containing articles have been granted. Therefore recycling of PFOS containing materials above the limit of 50 mg/kg defined in Annex IV of the POPs Regulation is not allowed. Commission contracted a study (ESWI 2011)[325] 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 precursors[326]. Other materials potentially contaminated with PFOS or PFOS precursors are e.g. textiles, paper or aviation fluid.

5.1.7. Perfluorooctanoic acid, its salts and related-compounds (PFOA)[327]

Obligation: The decision adopted at COP9 of the Convention (SC-9/12) stipulates that perfluorooctanoic acid, its salts and related-compounds are listed within Annex A, part I of the Convention. Under Article 3, paragraph 1(a) this prohibits the manufacture and/or use of PFOA, its salts and related compounds, unless an acceptable purpose or specific exemption is granted. The decision does not identify any acceptable purpose; however, a wide range of specific exemptions are listed, largely covering only use. The decision states that production

324 http://www.basel.int/Implementation/POPsWastes/Meetings/MeetingoftheSIWGonPOPs/tabid/4349/Default.aspx

325 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.

326 See for example http://www.carpetrecyclinguk.com

327 Note that at the time of writing (November 2020) the update of the convention text by the Secretariat of the Convention for additions at COP9 was still being prepared. The text presented here is based on the standard text of the Convention and decision documents from COP9.

of fire-fighting foams containing PFOA, its salts or related-compounds is not granted a specific exemption.

Under the COP9 decision specific exemptions for use are listed for the following applications:

- Photolithography or etch processes in semiconductor manufacturing.
- Photographic coatings applied to films.
- Textiles for oil and water repellency for the protection of workers from dangerous liquids that comprise risks to their health and safety.
- Invasive and implantable medical devices.
- Fire-fighting foam for liquid fuel vapour suppression and liquid fuel fires (Class B fires) in installed systems, including both mobile and fixed systems, in accordance with paragraph 2 of part X of this Annex.
- Use of perfluorooctyl iodide for the production of perfluorooctyl bromide for the purpose of producing pharmaceutical products, in accordance with the provisions of paragraph 3 of part X of this Annex.
- Manufacture of polytetrafluoroethylene (PTFE) and polyvinylidene fluoride (PVDF) for the production of:
    - High-performance, corrosion-resistant gas filter membranes, water filter membranes and membranes for medical textiles
    - Industrial waste heat exchanger equipment
    - Industrial sealants capable of preventing leakage of volatile organic compounds and PM2.5 particulates.
- Manufacture of polyfluoroethylene propylene (FEP) for the production of high-voltage electrical wire and cables for power transmission.
- Manufacture of fluoroelastomers for the production of O-rings, v-belts, and plastic accessories for car interiors.

As part of the specific exemptions, the COP9 decision states that, by the end of 2022, if operators have capacity to do so, but no later than 2025, the uses of PFOA, its salts and related-compounds within fire-fighting foam must be restricted to sites where releases can be contained.

Recommendations from COP-9

At COP-9 the Secretariat invited Parties and Observers to provide data by December 2025 on the production, use, efficacy of control measures, information on alternatives, status of control and monitoring, and any national or regional control actions taken. The Secretariat will use this information to compile a document for use by the POPs Review Committee in 2026, to make further recommendations on the phase-out of PFOA and replacement by safer alternatives.

The further discussions at COP9 (detailed in the meeting report – UNEP/POPS/COP.9/30) highlighted the importance of substance identity for PFOA-related compounds. The recommendations from the POPRC outline an approach and nomenclature to identify PFOA-related compounds. However, the number of substances included within the scope may be substantial.

Implementation so far: In 2017, PFOA its salts and PFOA-related substances[328] were added to Annex XVII of the REACH Regulation (No 1907/2006)[329]. The entry on PFOA in Annex XVII has been deleted by Commission Regulation (EU) 2020/2096[330] to ensure legal clarity after PFOA had been added to Annex I of the POPs Regulation through Commission Delegated Regulation (EU) 2020/784[331].

The listing means that, as of 4 July 2020, PFOA, its salts and related compounds must not be manufactured, or placed on the market as substances on their own, and must also not be used in the production of another substance, mixture, or article. In addition, PFOA, its salts and related-compounds are subject to all other requirements of the POPs Regulation, including those on waste.

A number of exemptions are listed under Commission Delegated Regulation (EU) 2020/784.
Analysis: To date PFOA has had a wide range of uses, primarily linked to its water and oil repellency as well as thermal stability, which provide a technical function as a surfactant, levelling agent, or water/oil/dirt repellant. It has also been used as a processing aid in the manufacture of fluoropolymers, particularly polytetrafluoroethylene (PTFE). However, mounting concerns over C8 per/polyfluoroalkyl acids (PFAAs), which began in the 1990s with PFOS, meant that industry began to transition away from PFOA as early as the mid 2000s[332]. The US EPA stewardship Group, formed in 2006, by the eight largest global manufacturers of PFOA aimed to phase-out production of PFOA by 2015[333], which was shortly followed by the nomination to the Stockholm Convention, also in 2015.

The REACH restriction for PFOA, its salts and related-compounds which entered into force in March 2019, with thresholds implemented from July 2020, further enforced the phase-out of PFOA, its salts and related-compounds from use in the Union.

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[328] Any related substance (including its salts and polymers) having a linear or branched perfluoroheptyl group with the formula C7F15- directly attached to another carbon atom, as one of the structural elements; Any related substance (including its salts and polymers) having a linear or branched perfluorooctyl group with the formula C8F17- as one of the structural elements.

[329] Commission Regulation (EU) 2017/1000 amending Annex XVII to Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning REACH as regards perfluorooctanoic acid (PFOA), its salts and PFOA-related substances (see https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32017R1000)

[330] Commission Regulation (EU) 2020/2096 of 15 December 2020 (OJ L 425, 16.12.2020, p. 3).

[331] Commission Delegated Regulation (EU) 2020/784 of 8 April 2020 amending Annex I to Regulation (EU) 2019/1021 of the European Parliament and of the Council as regards the listing of perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds (OJ L 188 I, 15.6.2020, p. 1).

[332] Wang et al, 2014, 'Global emission inventories for C4-C14 perfluoroalkyl carboxylic acid (PFCA) homologues from 1951-2030, Part I: production and emissions from quantifiable sources', Environmental International Vol 70 pp 62-75

[333] The PFOA stewardship group reported that phase-out of production had been achieved in early 2016. See: https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/fact-sheet-20102015-pfoa-stewardship-program (however, note that non-member companies may have continued to produce PFOA after this date).

During discussions at subsequent POPRC meetings and COP9 the issue of remaining stockpiles was discussed, particularly related to fire-fighting foams. Where PFOS and PFOA were both used in firefighting foams (as C8 PFAS chemistry), it is suggested that the transition away from PFOS likely also included a transition away from C8 chemistry more generally (including PFOA).

The bigger issue, given the more recent phase-out date of PFOA, is management of PFOA within stockpiles and legacy waste more generally. PFOA has been used across a very wide range of articles (such as textiles, components for transport, medical devices, construction, and semi-conductors), and therefore may present challenges both in terms of management of PFOA wastes in the waste cycle, but also releases to environment from final waste disposal sites (landfill).

Furthermore, while the Commission has mandated the work of European Committee for Standardization (CEN) to develop a standard analytical method for determination of PFOS in articles, no such standard is currently in place for PFOA or PFOA related-compounds. The PFOS standard may form a good basis for the development of a subsequent PFOA standard.

While PFOA, its salts and related-compounds were added to the POPs Regulation in April 2020, work to define a low POP content threshold under Annex IV is ongoing, with the expectation that management of PFOA within waste will be a key issue for the POPs Regulation in the short to medium term (i.e. next five to ten years).

5.2. Elimination of import and export of POPs - Article 3(2) of the Stockholm Convention

Obligation: Article 3, paragraph 1(a)(ii): 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.

Implementation so far: Import is regarded as placing on the market in the Union and thus import of all Annex A and B chemicals is prohibited by the POPs Regulation 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, mixtures 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 POPs Regulation, e.g. PFOS for the exempted use.

Export of POPs listed in Annex V to Regulation (EU) No 649/2012 is prohibited, 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 exported for the purpose of research or analysis.

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 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 8: Commission to investigate the possibility to initiate international work on development of individual tariff codes for POP substances[334]. (ongoing action)

5.3. Prevention of the manufacture and use of new chemicals exhibiting characteristics of POPs - Article 3(3) of the Stockholm Convention

Obligation: Article 3(3): Take measures to regulate with the aim of preventing the manufacture 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 the POPs Regulation repeats the provision of the Stockholm Convention but the practical implementation is left to be done in the framework of the existing Union regulatory and assessment schemes for chemicals, plant protection products and biocides. The REACH Regulation (EC) No 1907/2006 (cf. section 2.2.3.1), Regulation (EC) No 1107/2009 (plant protection products) (cf. section 2.2.3.3) and Regulation (EU) No 528/2012 (biocidal products) (cf. section 2.2.3.4) are in this regard of particular importance.

Analysis: Manufacture and placing on the market of POP like substances can in principle be effectively prevented within the existing regulatory frameworks for chemicals (cf. section 2.2.3). 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 SVHCs 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 1107/2009[335] 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 PBT substance or a very persistent and very bioaccumalative 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, in principle, approved if it meets the criteria for being persistent, bioacumulative and toxic or very persistent and very bioacumulative 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.

[334] 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.
[335] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:309:0001:0050:EN:PDF

The Chemicals Strategy for Sustainability[336] announces that the Commission will work towards adding hazard classess for PBT and vPvB substances in the CLP Regulation. This will help identifying and restricting, as appropriate, potential POP substances throughout all relevant legislation in a more effective and consistent manner.

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 9: 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 Union. (continuous action)

5.4. Assessing and controlling chemicals in use - Article 3(4) of the Stockholm Convention

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 the POPs Regulation 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 section 2.2), the practical 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.

5.5. General exemptions

Obligation: Article 3(5) of the Stockholm Convention: 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 the POPs Regulation lay down the general exemptions. Member States are obliged to notify all articles containing any of the listed

[336] COM(2020) 667 final

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 Union does not use such terms but they rather refer 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 POPs Regulation for the newly listed POPs with use in articles will contain fixed concentration values below which a substance is considered to be an "unintentional trace contaminant" (see sections 2.2.1 and 3.2.12).

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.

5.6. Reduction of total releases from unintentional production - Article 5 of the Stockholm Convention

5.6.1. Obligations and implementation

Obligation: Article 5: To reduce the total releases of the chemicals listed in Annex C (PCDDs, PCDFs, PCBs, HCB, PeCB, PAHs, hexachlorobutadiene and PCNs) 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 BAT and 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 the POPs Regulation addresses substances for which releases should be reduced and minimised, with a view to eliminate them if feasible. The substances or groups of substances concerned are PCDDs/ Fs, PCBs, HCB, PeCB, HCBD, PCNs 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 POPs 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, August 2012 for PeCB, and by June 2021 for HCBD and PCNs which were included in the POPs Regulation in 2019.

Article 6 of the POPs 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 (Industrial Emissions 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.

Since the mid-1990s, 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 Annex C substances (with the exception of PCNs) 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 BAT-AELs will be another step to further reduce releases of PCDD/F and other unintentionally produced POPs from industrial activities. Note that this now also includes BAT-AELs for dioxin-like PCBs (c.f. Table 12)

The Union Strategy for Dioxins, Furans and Polychlorinated Biphenyls adopted in 2001 (COM (2001) 593)[66] 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)[68] 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 particulates that acts as a seeding surface for UPOPs, or through removal of the contaminated particulates 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.

5.6.2. Analysis of implementation

Analysis: In section 3.3 of Part I, it is described that in the Union the release from POPs due to unintentional manufacture 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 manufacture of POPs has historically been largely related to industrial processes such as manufacture of iron and steel (sinter plants, electric arc furnaces), the manufacture 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-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 and update process. This should make sure that the prevention of the formation of POPs as well as the control of POP releases is taken into consideration adequately, with a view to developing BAT conclusions (including BAT-AELs where possible) concerning emissions of unintentionally produced POPs.

Action 10: 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. (ongoing action)

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 exists and in the Waste Incineration BREF fly ash values from German incinerators below 0.5 ng TEQ/g are mentioned.

Action 11: 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. (ongoing action)

The European Commission have contracted an ongoing study to review the Annex IV and V threshold values under the POPs Regulation. This will include dioxins and furans, with the results potentially addressing Action 12 above. The study is due to be completed in July 2021.

In addition to emissions from the large industrial installations also small scale incinerators and diffuse sources are contributing to the release of PCDDs/PCDFs 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).

Overall, the emissions of UPOPs to air across Europe have declined significantly over the past 25 years, largely due to the measures outlined above. Data from the EMEP Webdab for reported emissions in each Member State indicate that emissions of PCBs, PCDDs/PCDFs, and HCB between 1990 and 2015, declined 74%, 75%, and 95% respectively.

The relative contribution of different source categories to the oberved total emissions of UPOPs in Europe has changed notably for some pollutants over the past 25 years. While the total quantity of emissions has declined, the balance between regulated point sources and non-regulated domestic or diffuse sources has shifted. In the case of PCDDs/PCDFs, the proportion attributed to industry has declined, with a corresponding increase in contribution from residential combusion. PCB emissions from industrial sources have also declined with the introduction of more efficient combustion and abatement processes, while the emissions from electrical equipment (e.g. dielectric fluid, leaks from transformers and capacitors and wastes) have declines a lot more slowly, leading to a greater overall relative proportion from these sources.

Action 12: Commission to table an implementing measure to set out minimum eco-design requirements for solid fuel small combustion installations. (ongoing action)

As regards emissions of dioxins and PCBs from raw or treated sewage sludge that is used as fertilising product, the Commission is carrying out a study with a view to adopt further measures that aim at reducing such emissions, as appropriate. The study will be finalised in 2021 and any measures may be proposed thereafter. Moreover, limits might be set for PCDD/F and non-dioxin like PCBs from other input materials for fertilisers such as struvite, biochar, incineration ashes.

Action 13: Commission to finalise the study on contaminants in fertilising products and to propose/finalise measures that aim at further controlling unintentional emissions from such sources, as appropriate. (new action)

5.6.3. Pentachlorobenzene (PeCB)

PeCB was listed in the Stockholm Convention Annexes A and C without exemptions in 2009. In the Union PeCB is not intentionally produced it is only addressed in the section of UPOPs.

According to the results of the E-PRTR (2007-2017 data) PeCB remains unintentionally produced in the Union due to releases to air, largely from the manufacture and processing of metals, and to water, largely from urban waste water treatment plants, with lesser contributions from chemical manufacture plants and oil and gas refineries. 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. 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 assesses 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/non-reporting from a number of similar facilities within the metal manufacture sector, where releases of PeCB and potentially also HCB might be expected[337] to be considerably above 1 kg/y. 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. 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.

Manufacture of chlorinated organics and their deposits from historic manufacture were described in a recent POP Reviewing Committee Report (UNEP 2010c)[338] 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 E-PRTR database of PeCB releases.

Up to now measures to reduce unintentionally produced POPs largely focused on PCDDs/Fs. While the reduction of formation of PCDDs/Fs 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. (ongoing action)

5.7. Identification and environmentally sound management of stockpiles and wastes

5.7.1. Obligations and implementation

Obligations: Article 5 of the Stockholm Convention: 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 (waste framework directive) sets a number of provisions that ensure wastes including stockpiles are handled in an environmentally sound manner (see Annex I). Amongst others, this includes waste prevention promotion,

[337] 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's kg/year and should have been reported to the E-PRTR.

[338] 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)

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 the POPs Regulation 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.

Article 7 of the POPs Regulation 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. The lower POP limit values are specified in Annex IV to the POPs Regulation, which is regularly updated to set limit values for new or revise limit values for existing POPs. 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 in Annex V to the Regulation[339].

Additionally, the POPs Regulation exceeds its predecessor Regulation (EC) 850/2004 as it includes further additional requirements for traceability of wastes containing POPs (even if below the Annexes IV and V critical thresholds). The POPs Regulation places obligations on Member States to take the necessary measures to ensure control and traceability of POPs in accordance with Article 17 of Directive 2008/98/EC (on the control of hazardous waste within the waste framework directive), including records for quantities of waste, its nature and origin and the final destination of the waste.

5.7.2. Analysis of implementation

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 section).

With regard to obsolete pesticides the Commission Study (BiPRO 2005)[340] estimated that there are stocks containing 5,370 t in the Union, mainly in the new Member States joined in 2004. Information about Romania and Bulgaria is not available.

In addition the first community implementation plan (2007) 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

[339] 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.”

[340] 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.

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 Union might amount up to 1.8 to 3 million tonnes considering a lindane manufacture 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 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-PBDEs and PFOS. Since they are mostly included in articles (see Section 3.2) but also in matrices like sewage sludge the assessment of their disposal is more complex.

Action 15: The Commission to review Annexes IV and V and to propose amendments, as appropriate, to ensure environmentally sound management of waste consisting of or contaminated by POPs. (continuous action)

5.7.3. Disposal and destruction of POP-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)[341] 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 Basel Convention further established guidelines for the destruction and/or irreversible transformation of wastes containg brominated flame retardants (including POP-PBDEs) (UNEP/CHW.12/5/Add.6/Rev.1).

The revised Basel Convention technical guidelines published in 2017 (UNEP/CHW.13/6/Add.1/Rev.1) go further, indicating that possible suitable approaches for destruction / irreversible transformation include:

- Advanced solid waste incineration (ASWI)[342];

[341] 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).

[342] UNEP/CHW.13/6/Add.1/Rev.1 states: There are many types of municipal waste incinerators not all of which are appropriate to destroy POP PBDEs. ASWI are designed to safely treat contaminants present within

- Cement kiln co-incineration (noting that cement kilns operate at high temperatures (c.1450°C);
- Gas phase chemical reduction (GPCR)[343];
- Hazardous waste incineration; and
- Thermal and metallurgic production of metals (again at high temperatures ≥850°C).

While the Basel Convention technical guidelines may in part be superceded the findings of the Stockholm Convention COP-5 recommendations, the remaining key recommendations from COP-5 include:

- 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 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 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 section 3.2, the largest part of PBDE containing materials has been disposed of via landfill. 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)[344].

The COP-5 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.

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municipal waste involving maintaining a minimum temperature of 850°C and residence time of not less than 2 seconds in the combustion chamber.

343 UNEP/CHW.13/6/Add.1/Rev.1 states: GPCR involves thermochemical reduction of organic compounds, using temperatures not less than 850 Celsius and low-pressure environments.

344 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.

- 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-PBDEs and PFOS. The guidance could also include techniques for identification and separation of materials and products with high POPs concentrations.

The Basel Convention technical guidelines outline that thermal metallurgic production may be a viable option for destruction. However, note that 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. 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 process is slightly more ambiguous when considering material and energy recovery in smelters used for tens of thousands of tonnes of printed wire boards (PWB) which contain precious metals. PWBs may also contain 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 need further assessment for specific issues relating to the processing of PBDE containing materials. In particular, the POP Reviewing Committee report further highlights that in these applications PBDD/PBDF and Polyhalogenated dibenzo-p-dioxins/ Polyhalogenated dibenzofurans (PXDD/PXDFF) are likely to be formed and should be considered for the assessment of these facilities (UNEP 2011a,b)[345].

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. (ongoing action)

[345] 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.

5.7.4. Disposal and destruction of PFOS, PFOA and related PFAS-compounds

Disposal of PFOS and PFOA containing materials

In respect to end of life management, recommendations were made at COP-5 for PFOS, which are likely to be relevant for both PFOS and PFOA:

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

In the past longer chain PFAS compounds (≥C8) including PFOS and PFOA have been widely used as water, oil and stain repellents in textile applications, including use in soft furnishings (e.g. carpets and furniture) with these articles deposited into landfill at end of life. Considering that PFAS compounds generally have a high solubility poses concerns for landfill leachate, particularly in older landfills or landfills with poor capture systems. Weber et al (2011) highlighted the potential release to ground and ground water for PFAS chemicals such as PFOS from landfills. Therefore there is no justification to deposit PFOS and PFOA containing materials considering the burden such practice would bring to future generations.

Additionally, longer chain PFAS compounds including PFOS and PFOA have been used as surfactants within certain types of fire-fighting foams. The Risk Management Evaluation for PFOA (UNEP/POPS/POPRC.13/3) highlighted concerns around the use of PFOA within such mixtures given that the application of fire-fighting foam is widespread and dispersive with high potential for loss to environment.

The listing of PFOA within the Stockholm Convention annexes at COP-9 includes exemptions for fire-fighting foams placed on the market before 4 July 2020; and further allows the continued use of PFOA-based fire-fighting foams for training purposes, provided that emissions to the environment are minimised and effluents collected are safely disposed of.

Kemi (2016)[346] comment that, for longer chain PFAS such as PFOS and PFOA, destruction via incineration would require temperatures at or above 1,100°C. Note that Kemi go on to state that, for shorter chain compounds, the temperature may need to be even higher with C4 PFAS compounds requiring 1,450°C.

The Basel Convention technical guidelines published in 2017 (UNEP/CHW.13/6/Add.1/Rev.1) provide some further details on suitable destruction/irreversible transformation of PFOS within wastes, which is likely also relevant to other PFAS compounds, including PFOA:

- Cement kiln co-incineration (noting that cement kilns operate at high temperatures (c.1450°C);

[346] Kemi, 2016, 'Strategy for reducing the use of highly fluorinated substances, PFAS. ISSN 0284-1185. Article number: 361 210.

- Gas phase chemical reduction (GPCR); and
- Hazardous waste incineration.

PFOS and PFOA containing materials like textiles (such as carpets or other soft furnishings), coated paper, and treated articles such as plastics end up to a considerable share in municipal waste incinerators (operated at ≤850ºC). Further sewage sludge containing PFAS may 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.

Furthermore, data on stockpiles of mixtures and articles containing PFOS and PFOA, particularly items like fire-fighting foams and treated textiles, is very limited. This poses its own challenges for management of stockpiles and wastes at Member State level. It is advisable that Member States share information among themselves and with the Stockholm Convention Secretariat on their experiences with PFOS and PFOA destruction projects (including data on material flows and lifecycle) and appropriate destruction technologies.

PFHxS has been nominated to the Stockholm Convention as a third PFAS substance, and perfluorobutane sulfonate (PFBS) (a fourth PFAS) has been identified as a SVHC under REACH. There is therefore wider analysis needed more generally on PFAS substances and what kind of controls may be needed. In 2019 the European Commission commenced two studies to assess the uses and risks of PFAS in fire-fighting foams and textiles respectively, with both studies expected to complete before the end of 2020.

Action 17: The Commission to develop an action plan for PFAS (including PFOS, PFOA, PFHxS) as part of the wider framework for a chemicals strategy. (ongoing action)

Action 18: The Commission and Member States to develop approaches to quantify remaining stockpiles of fire-fighting foams that contain C8 PFAS compounds (including PFOS and PFOA). This should be used to help support the action plan identified in Action 17. (new action)

5.7.5. 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 Pestides Association (IHPA) in 2008 suggested that for the then ‘EU-25’, approximately 30,000-32,000 tonnes of obsolete pesticide stockpiles existed[347]. Based on the Article 12 reported

347 http://www.ihpa.info/how-to-be-involved/how-big-is-the-problem/

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 quanities. 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.

5.7.6. Destruction of PCB and PCB containing materials

The Basel Convention technical guidelines published in 2017 (UNEP/CHW.13/6/Add.1/Rev.1) provide some further details for suitable destruction/irreversible transformation of PCBs and PCB containing materials within wastes, which include:

- Alkali metal reduction[348];
- Base catalysed decomposition (BCD)[349];
- Catalytic hydrodechlorination (CHD)[350];
- Cement kiln co-incineration (noting that cement kilns operate at high temperatures (c.1450°C);
- Gas phase chemical reduction (GPCR);
- Hazardous waste incineration;
- Plasma arc[351];

348 UNEP/CHW.13/6/Add.1/Rev.1 states: Alkali metals react with chlorine in halogenated wastes to produce chlorine salts. Typically the process operates at standard atmospheric pressure and 60-180°C.

349 UNEP/CHW.13/6/Add.1/Rev.1 states: The BCD process involves treatment of wastes in the presence of a reagent mixture consisting of a hydrogen-donor oil, an alkali metal hydroxide and a proprietary catalyst. When the mixture is heated to above 300 °C, the reagent produces highly reactive atomic hydrogen. The atomic hydrogen reacts with the waste to remove constituents that confer toxicity to the compounds.

350 UNEP/CHW.13/6/Add.1/Rev.1 states: CHD involves the treatment of wastes with hydrogen gas and a palladium on carbon (Pd/C) catalyst dispersed in paraffin oil. Hydrogen reacts with chlorine in halogenated waste to produce hydrogen chloride (HCl) and non-halogenated waste. In the case of PCBs, biphenyl is the main product. The process operates at atmospheric pressure and at temperatures of between 180°C and 260°C

- Plasma melting decomposition method (PMD)[352];
- Supercritical water oxidation (SCWO) and subcritical water oxidation[353].

Several Member States 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 processes[354].

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.

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[351] UNEP/CHW.13/6/Add.1/Rev.1 states: The waste, as a liquid or gas, is injected directly into the plasma and is rapidly (<1 ms) heated up to about 3,100°C and pyrolysed for about 20 ms in the water-cooled reaction chamber (flight tube). The high temperature causes compounds to dissociate into their elemental ions and atoms.

[352] UNEP/CHW.13/6/Add.1/Rev.1 states: The plasma melting decomposition method (PMD) is a thermal destruction method for solid waste containing or contaminated with PCBs. Solid waste containing or contaminated with PCBs is canned directly into containers, such as drums or pails, without shredding or disassembling. In a plasma furnace, a plasma torch generates high temperature plasma gas (air) so that the furnace temperature is maintained to melt the waste together with the container itself. All the organic substances, including PCBs, are decomposed into CO_2, H_2O and HCl under the high temperature conditions of the plasma furnace, and inorganic materials, including metals, are oxidised to become molten slag. The plasma furnace temperatures exceed 1,400˚C.

[353] UNEP/CHW.13/6/Add.1/Rev.1 states: SCWO and subcritical water oxidation treat wastes in an enclosed system using an oxidant (such as oxygen, hydrogen peroxide, nitrite, nitrate, etc.) in water at temperatures and pressures above the critical point of water (374°C and 218 atmospheres) and below subcritical conditions (370°C and 262 atmospheres). Under these conditions, organic materials become highly soluble in water and are oxidised to produce carbon dioxide, water and inorganic acids or salts.

[354] 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.

5.8. 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) of the Stockholm Convention 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. Since its implementation, numerous soil awareness raising tools and networks have been established. This includes the European Network for Soil Awareness (ENSA) and setup of the European Soil Data Centre (ESDAC), with soil issues increasingly becoming the focus of research projects across Europe.

The proposal for a framework Directive on the protection of soil was withdrawn in May 2014, following sustained opposition by a minority of Member States. However, soil is an evolving area of policy focus at a national level across Europe. Member States, such as Sweden, Germany and Denmark, are also developing legislation and technical approaches specific for POPs, such as PFOS. Collaboration is taking place, both between Member States and supporting organisations, such as the Common Forum on Contaminated Land in Europe (CF) and Network for Industrially Co-ordinated Sustainable Land Manangement in Europe (NICOLE), with the aim of working towards harmonised and efficient working practices and management approaches

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.

In 2013, PFOS and its derivatives were included in the Directive on Environmental Quality Standards (Directive 2013/39/EU amending Directive 2008/105/EC). The date set for Union-wide compliance with the EQS is 22 December 2027, with Member States required to submit a supplementary monitoring programme and preliminary programme of measures to achieve compliance by 22 December 2018.

The POPs Regulation further puts greater onus on contaminated sites, specifically encouraging Member States to include any data that has been developed within national reports and national implementation plans, which are publically made available.

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

Recent studies have identified the widespread presence of PFOS (and other PFAS) contamination within water resources across Europe. Investigations into the extent of this problem and potential sources, including waste water effluents and sewage sludges applied to agricultural land, also warrants further analysis.

A recent study into the current status of lindane contamination across Europe has found that many Member States are yet to commence investigation and remediation of contaminated sites, leading to 'hot-spots' of lindane and HCH waste persisting in these countries[355]. This delay is likely to worsen the diffuse contamination associated with such sites, as contamination is mobilised and migrates through groundwater and surface waters. The need for further investigation and clean up of such sites is therefore of high importance.

Action 19: The Commission and the Member States should develop a strategy for identifying sites contaminated by POPs and for their environmentally sound remediation. (ongoing action)

6. IMPLEMENTATION OF THE OBLIGATIONS ON SUPPORTING ACTIVITIES

6.1. Information exchange

Obligation: Article 9 of the Stockholm Convention: To facilitate or undertake information exchange relevant to the reduction or elimination of the manufacture, use and release of POPs and alternatives to POPs including information relating to their risks as well as their economic and social costs. Each Party to the Convention are required to designate a national focal point for the exchange of information as specified under Article 9 of the Convention. 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.

COP-5 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 and the European Chemicals Agency are disseminating information on these activities mainly through the websites hosted by the Directorate-General Environment and ECHA respectively. Additionally, different publicly

355 European Union (2016) "Lindane (persistent organic pollutant) in the EU", Report for the European Parliament, Policy Department C: Citizen's Rights and Constitutional Affairs.

accessible databases such as Eur-Lex, statistic databases of Eurostat, the E-PRTR, the Union pesticide database, OpenFoodTox and databases of Union institutions on specific topics, for example EFSA has a key role in the dissemination of information related to pesticides and food contamination.

Analysis: Obligations derived from the implementation of the POPs Regulation are changing as new substances are further added to the annexes of the Regulation. Note also the POPs Regulation, which continues to build upon the existing approaches, but with significant new elements altering the roles of key bodies (such as ECHA), and with greater onus on waste (including traceability of materials), and monitoring data (reported to IPCheM). The stakeholders and key regulatory bodies 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.

The vast majority of Member States have information exchange mechanisms in place, and a number of these provide details of these mechanisms in their NIPs. In many cases, informatione exchange is facilitated through the Member States' National Competent Authority.

Action 20: 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. (ongoing action)

Action 21: Commission and Member States to ensure that all players (including industry) are fully informed about the obligations under the Stockholm Convention. (continuous action)

Action 22: Commission and Member States to exchange their experiences and success stories with other countries. (continuous action)

Action 23: 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. (continuous action)

6.2. Public information, awareness and education

Obligations: Article 10 of the Stockholm Convention: 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 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 2.6). Additionally, under the POPs Regulation, the ECHA website now hosts pages on POPs, including the new selection process for candidate POPs.

Alongside the Commission and ECHA, EFSA have a key role in the assessment of pesticide residues in food and communication to the general public (via databases such as OpenFoodTox). Additionally, the Union makes use of rapid alert systems (RASFF and RAPEX) to share information on POPs in food and feed and consumer products between Member State authorities as means of early warning and intervention.

More recent ECHA have also begun work on the SCIP database for SVHCs (which includes POPs) in articles and compex objects, which is intended to help better inform those working in the waste sector of where POPs (among other SVHC) may be found.

As consultations with stakeholders are an integral part of the Union's environment policy in order to provide opportunities for input from representatives of authorities, civil society or individual citizens, this present Union Implementation Plan has been 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 Member States. The Commission has concentrated on information on Union legislation and other activities with a broader pan-European scope.

As most Member States have developed their NIPs and report information under the requirements of Article 12, it is now possible to evaluate the need for and the added value of such concerted action in the field of POPs.

The vast majority of Member States have adopted measures to raise public awareness, some as part of wider strategies or frameworks for wider community action. For example, most countires provide the public with information, accessible through the websites of government departments, ministries or agencies, and many report the provision of leaflets, brochures or newsletters to provide the public with information.

However, the feedback from the public consultation on the draft UIP in the autumn of 2019 highlighted a concern from both the general public and experts regarding communication on POPs. The respondents highlighted a lack of visibility of what activities were ongoing at

Member State level, and further a lack of communication on POPs and what the key concerns are. In particular the general public stakeholder group highlighted concerns over obsolete pesticide stockpiles and risks related to POPs in food.

Based on the above paragraphs it is possible that, while Member State authroities are developing and making such information publically available, the public themselves may be unaware that it exists or of where to find such information. This further prompts the need for further review of the methodology of communication and what actions may be needed as coordinated information campaigns at pan-European level.

Action 24: 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/EC[53]. (continuous action)

6.3. Research, development and monitoring

Obligations: Article 11 of the Stockholm Convention: 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), FP 7 (2007-2013) and Horizon 2020 (2014-2020). Details on projects funded under FP5 are given in the first Union Implementation Plan prepared in 2007. The Horizon 2020 programme has an overall budget of about €80 billion euros (see section 2.5). Details on projects funded under Horizon 2020 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 andexposure assessments to POPs and contributed to the development of a Toolkit for the indentification and quantification of releases of dioxins, furans and other unintentionally produced POPs particularly by determination of emission factors for non-standard emission sources.

The European Food Safety Authority (EFSA) has a key role to play in the monitoring of different pesticide residues in food for the European Union.

Furthermore, the Joint Research Centre has been instrumental in the creation of the IPCheM platform for monitoring data, which acts as a central repository for such information. The recast of the POPs Regulation specifically identifies IPCheM as the preferred repository of monitoring data going forward and includes an Article under the Regulation for Member States and ECHA to agree common formats and software for the reporting of monitoring data into IPCheM.

Under the Water Framework Directive and Environmental Quality Standard Directive, 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 some POP substances are still used due to lack of alternatives.

There are a range of inconsistencies in E-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 5.6, 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 manufacture 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 2.5.2), 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 Union bodies are making significant efforts to monitor numerous chemicals in various matrices (water, air, biota, soil, human milk, etc.) as a consequence of Union 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 25: The Commission should ensure that the current EU Framework Programme for Research and Innovation Horizon 2020 (and Horizon Europe, which covers 2021-2027) will encourage research and innovation activities for the above identified challenges (alternatives (both chemical and non-chemical), characterisation of sources, review of industrial processes to avoid unintentional formation, data management, testing, and health impacts) and promote a coordinated approach between Member States 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. (continuous action)

Action 26: 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. (ongoing action)

7. IMPLEMENTATION OF OTHER COMMITMENTS

7.1. Technical assistance

Obligations: Article 12 of the Stockholm Convention: 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.

Furthermore the POPs Regulation gives ECHA a more central role in the development of technical information. This includes technical assistance upon request of the Commission and others. EFSA also provides technical assistance through its role in the risk assessment of POPs in food.

COP-5 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 2.4.2 and 2.4.3. 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 strenghthening the instutional capacity in chemicals management of developing countries and countries with economies in transition.

The 2018 Action Programme for Environment and Climate Change under the GPGC has been published[356], specifying a Union contribution of €74 million.

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:. 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.

Under Component 3 of the GPGC 2018-2020 thematic programme, 'Transformation towards an inclusive green and circular economy and taking into account environmental sustainability, climate change and disaster risk reduction', one of the expected results is "enabling policy and institutional frameworks supporting the transition to a green economy and combating pollution, including through the sound management of chemicals and waste are developed in partner countries".

Action 27: 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. (continuous action)

7.2. 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.

[356] https://www.gtai.de/resource/blob/41602/9d46a5e0cc98b52a24ea3ed6a6d1a781/pro201810185000-data.pdf

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 Union provides significant amount of funding within the Union, in neighbouring countries and in developing countries, by different funding instruments in order to contribute to the implementation, updating and development of Union (environmental) policy (see section 2.4.1), 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 2.4.3).

Analysis: The Union 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 Union 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 Union has earmarked since 2007 a part of its development cooperation budget for environment through thematic programmes: the Environment and Natural Rersources 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 overall budget for the Environment and Climate Change programme under the GPGC is €2 billion for the 2014-2020 period. The Commission has looked for opportunites 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 Union 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).

Furthermore, the Union and individual Member States also provide input to the Stockholm Convention Trust Fund. The total mandatory contribution of Member States and the Union in 2019 represented 42% of the total mandatory financial contribution of Parties to the Convention (total contributions in 2019 were $4 million USD with contributions for Member States and the Union of $1.7 million USD). In addition, important amounts are regularly contributed by the Union and its Member States to the voluntary trust fund.

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

Action 28: The Commission should consider the scope for funding POPs related assistance under the new Neighbourhood, Development and International Cooperation Instrument (NDICI) when drawing up the Annual Action Plans (AAP) and in the cooperation with non-EU countries. (ongoing action)

7.3. Reporting

Obligations: Article 15 to the Stockholm Convention: 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 manufacture, 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: The POPs Regulation includes provisions under Article 9 to develop national implementation plans covering the major issues relating Annexes A, B and C of the Stockholm Convention (as well as Annexes I, II and III of the regulation which largely mirror the Convention) which are reported to Secretariat of the Convention, the European Commission and ECHA. Similarly, under Article 9 of the POPs Regulation, the Commission supported by ECHA are to maintain a Union Implementation Plan (this document) which is reported to the Convention.

Formerly under Regulation (EC) 850/2004 Article 12 stipulated that Member States were required to gather, collate and report information annually to the Commission on quantities of Annex A and B substances placed on the market (including enforcement activities), as well as triannually on Annex C emission inventories. The reporting under Article 12 has been further used to develop triannual synthesis reports on POPs at the Union level. To date four triennial synthesis reports (2004-2006, 2007-2009, 2010-2012 and 2013-2015[357]) have been published based on data submitted by the Member States under Article 12 of Regulation (EC) No 850/2004, 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

Under the POPs Regulation, Article 13 states that the information covering Annexes A and B substances, quantities placed on the market, enforcement, and release inventories will be managed at national level and made publicly available on a periodic basis. All raw data will be provided to ECHA, with formats for reporting of such data to be agreed between ECHA and the Member State Competent Authorities pursuant to Article 17.

357 Draft report currently being prepared by the Commission

Analysis: Reporting from Member States to the Commission is a prerequisite for the Union 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 may launch infringement procedures in this respect to address the issue.

Following-up on national reporting under the POPs 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 3.2.7). 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 Member States.

Action 29: The Commission should consider launching infringement procedures against the Member States in case of non-compliance with reporting obligations. (ongoing action)

Action 30: Commission and Member States to regularly verify the need for the use of any specific exemption for Annex A and Annex B substances. (ongoing action)

7.4. Effectiveness evaluation

Obligations: Article 16 of the Stockholm Convention: 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 10 of the POPs Regulation 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 Union-level exists for emissions of all by-product POPs through the 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, 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 a Union coordinated approach to Human Biomonitoring (HBM), a research project on the development of a coherent approach to human biomonitoring in Europe was granted leading to the concept of 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 environmental pollutants. In December 2009, the Union project for a Consortium to Perform Human Biomonitoring on a European Scale (COPHES) was created as a pan European effort involving scientists from all 28 Member States. A feasibility study called DEMOCOPHES was launched in September 2010 and concluded in November 2012 with finance from Life plus. The study measured biomarkers for mercury, cadmium, phthalates, bisphenol A and environmental tobacco smoke in human hair and urine from around 120 mother-child pairs in the 17 participating countries, in total almost 4000 samples, across 17 Member States. This is the first time that information has been derived on the distribution of chemicals in 17 Member States which are comparable between the countries and with international data.

More recently, the HBM4EU[358] project (launched in 2017 under Horizon2020) – involving all the Member States, the EEA, ECHA, EFSA and the Commission – aims to address concerns around a priority set of substances (many of which are POPs) to help guide policy making. The HBM4EU project is a five year study due to be completed at the end of 2021.

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. An information platform for chemical monitoring data has been established (IPCheM), 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 POPs Regulation and of the Stockholm Convention in the Union by facilitating access to the monitoring data and by improving comparability of the data.

7.5. 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 an 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 Union 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 much emphasis on the widening of the initial list of 12 POP substances to additional POP substances warranting global action. The proper functioning of the POPRC 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 POPRC in its work in order to ensure timely and thorough evaluation of the submitted proposals.

358 https://www.hbm4eu.eu/about-hbm4eu/

Through the implementation of the Union legislation, in particular the REACH Regulation, the Plant Protection Products Regulation, the Biocides Regulation and the Water Framework Directive, the Union is in the possession of a huge amount of valuable chemicals data. This data should be used to identify and assess any further candidates for the inclusion into the Stockholm Convention.

The recast of the POPs Regulation in 2019 more closely aligns the POPs Regulation with REACH, including a more central role for ECHA to support in the identification of candidate POPs. This includes alignment to REACH processes and use of eight-week public consultation rounds allowing input from the Member States, industry, NGOs and other interested parties in the nomination of POPs to the Stockholm Convention.

Action 31: 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. (continuous action)

8. EU RESEARCH PROJECTS SINCE 2007 WITH REFERENCES TO POP ISSUES

Table 13 Research Projects with references to POPs funded under Horizon 2020

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
1	NADiRA, Nurturing Africa Digital Revolution for Agriculture, EU Contribution €1.9M	H2020-EU.2.1.6.3. Start date: 2017-11-01 End date: 2020-04-30	NADiRA aims to incorporate Copernicus, other Earth Observation products and in-situ IoT devices into mAgriTM, an existing value chain orchestration platform connecting, in smallholder contract farming, producers with banks, insurers, input providers and agro-industries to control risks and improve the productivity, security, and welfare of tens of thousands of African farmers. By industrializing EO products , NADiRA reduces mAgriTM's operating costs, while increasing the timeliness, granularity and reach of its following services: (1) Agricultural investment risk mapping, to reduce finance institutions cash-out and increase availability of input credit to smallholders, (2) More robust, affordable agricultural insurance contracts, to reduce persistent climate risk, (3) Improved smallholder tactical management of crop nutrient deficiencies and post-harvest losses to increase productivity, harvest quality and income. NADiRA demonstrates, on a large market scale, the economic and commercial viability of the combination of EO, IoT and mobile technology and its leverage on the new business model implemented by MANOBI, Swiss Re, credit and insurance institutions and agro-industries to improve smallholder productivity. Four pilots run in parallel in Senegal and Nigeria targets (i) different crop types and production systems (irrigated rice, rainfed peanuts, maize and sorghum) in (ii) 10 crop campaigns (4 irrigated, 3 rainfed) and (iii) various production environments and management practices. This demonstration sustains the development of a business plan with financial objectives and an associated roadmap to capture 30% of the addressable market in Africa. The outreach actions benefits from the communications channels of the NADiRA partners, active in Africa (MANOBI, Swiss Re, ICRISAT, local banks and farmers associations), in Europe (SPACEBEL, University of Liège, Viveris and EUGENIUS association) and Asia (ICRISAT). A Copernicus Relay will be established in West Africa.	https://cordis.europa.eu/project/rcn/212436_en.html
2	RECOPHARMA, Removal and Recovery of Pharmaceutical Persistent Pollutants from Wastewater by Selective Reagentless Process, EU Contribution €900,000	H2020-EU.1.3.3. Start date: 2018-01-01 End date: 2021-12-31	Pharmaceutical drugs, characterized by their environmental persistence (e.g. cytostatic drugs [CDs]) have been detected in water bodies (drinking water, groundwater, surface water, and effluent wastewater) at concentrations up to µg/L level. Actual methods for the removal and degradation of CDs, including electrochemical, photochemical, and biological methods have been developed. However, these methods are expensive and sometimes inefficient for CDs complete removal from the treated water. Including the exploitation of previous results from EU funded projects, the goal of project RECOPHARMA is to design, develop, validate and demonstrate a novel process by	https://cordis.europa.eu/project/rcn/212474_en.html

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
			sequential integration the potentials offered by Molecular Imprinted Polymers (MIPs), Reagentless Thermosorption (RTS), Nanocomposites Functional Materials, Advanced Oxidation Processes, for an effective treatment aiming the recovery of target recalcitrant CDs and degradation of corresponding transformation products or metabolites, working in a continuous operation mode. The suggested approach offers versatile, fast, highly efficient, and low-cost treatment for wastewaters. RECOPHARMA brings together academic research centres and the private sector, with a long-term goal of designing and developing advanced water treatment technologies in the interest of the society and integrate them for demonstration following a circular economy approach. Through the scheduled secondments, the involved staff will perform the required R&I to demonstrate the technical and economic feasibility of the developed process, including the technical formation of specialists as a fundamental activity to project success. The secondments will also enhance the exchange of knowledge, best practices, know-how, innovations, experience, mutual cooperation and culture of work between different organizations, regions and countries through the partners' well-established reputation as transfer hubs.	
3	MULTIEPIGEN, Ancestral environmental exposures and offspring health – a multigenerational epidemiologic cohort study across 3 generations, EU Contribution €2.5M	H2020-EU.1.1. Start date: 2017-11-01 End date: 2022-10-31	MULTIEPIGEN seeks to solve does ancestral exposure to various stressors transmit to offspring via epigenetic mechanisms. Thus far animal models have indicated that exposure to certain stressors can lead to phenotypic changes not only in the predisposed individuals, but also in the future generations, such that individuals can acquire phenotypes caused by exposures of their ancestors. Such effects do not involve new DNA mutations, but are transmitted to offspring via epigenetic mechanisms such as the transfer of non-coding RNA molecules in the semen. In humans, intergenerational transmission has been examined extremely little because a priori designed population-based studies across several generations are lacking. To close this gap MULTIEPIGEN will expand the well-characterized Cardiovascular Risk in Young Finns Study (YFS) to the parents and offspring of the original YFS participants. During the ERC funding period, we will perform field studies involving N~9000 individuals across 3 generations and test 3 key ancestral exposures with very high plausibility causing intergenerational effects on obesity-related phenotypes, cognitive function and psychological well-being. The studied exposures are 1) tobacco smoke, 2) persistent organic pollutants, and 3) accumulation of psychosocial adversities. We will collect serum, blood and semen samples for epigenetic marker analysis to provide understanding of the mechanisms of intergenerational transmission in humans. Specifically, we will seek proof for the hypothesis that paternal stressors can lead to phenotypic changes in the offspring via non-coding RNA molecules in the semen. Multigenerational epidemiologic data showing robust links between ancestral exposures and offspring phenotypes that operate with biologically plausible epigenetic mechanism would provide a conceptual change in the developmental biology in humans and have substantial ramifications on public health.	https://cordis.europa.eu/project/rcn/212173_en.html
4	FreshwaterMPs, The	H2020-EU.1.3.2.	EU Member States are currently working towards the realisation of environmental goals specified in	https://cordis.europa.eu/

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
	environmental fate and effects of microplastics in freshwater ecosystems, EU Contribution €1.6M	Start date: 2015-04-01 End date: 2017-03-31	the Water Framework Directive (WFD), which aims to protect both human and ecosystem health. Microplastic particles (MPs) are emerging pollutants of increasing concern and are formed primarily when plastic waste degrades in the environment. The impacts of MPs on freshwater biota are not known, however, they may present a potentially persistent and ecotoxicological pollution problem. Accordingly, the goal of this project is to assess the environmental risk of MPs in freshwater habitats. To achieve this, a detailed investigation of MP environmental persistence will be carried out. This will provide environmental fate summaries for different polymer classes and enable the modelling of their degradation processes. This will be combined with laboratory studies to assess relevant sub-lethal endpoints such as reproduction, fitness, inflammation, and oxidative stress. As MPs are known to accumulate co-occurring organic pollutants, the toxicity of virgin MPs will be compared to MPs conditioned with relevant freshwater pollutants. This work will build towards a sophisticated state-of-the-art mesocosm study that will evaluate both MP fate and impacts in model ecosystems. The establishment of a novel framework for the environmental risk assessment of MPs will inform our ability to achieve conservation objectives taking into account MPs as emerging pollutants. The merit of this is that protection goals may be better accommodated in policy and management through the generation of so far unavailable data on MP persistence and environmental toxicity. Taken together, the project will generate so far unavailable data sets to assess for the first time the environmental impacts of freshwater MPs. Thus, the outcomes will highly relevant for academia, politics, stakeholders and society.	project/rcn/195924_en.html
5	MAT4TREAT, Enhancing water quality by developing novel materials for organic pollutant removal in tertiary water treatments, EU Contribution €630,000	H2020-EU.1.3.3. Start date: 2015-01-01 End date: 2018-12-31	The MAT4TREAT project consists in a consortium of 8 Universities, 5 of them European (UNITO, AAU, POLITO, UPV and UOI), and the other three from outside the EU (UNLP, McGill, SU), as well as two non academic institutions (ACEA and LQT). These groups are committed to work in the development of novel materials to be used in innovative integrated water tertiary treatments (to remove, for instance, Emerging Pollutants). This ambitious goal will be achieved by world leading research groups in the following fields: (i) graphene-based and other carbon-related materials, (ii) polymeric materials, (iii) oxidic ceramic materials, and (iv) hybrid inorganic-polymeric materials. The new materials will be used as adsorbents, as photocatalysts and as active layers for the fabrication of membranes, and thus tested for the pollutant removal from model aqueous solutions as well as from real water samples. Furthermore, approaches combining different materials and pollutant abatement technologies will be proposed and a demonstrative lab-bench apparatus for the integrated treatment of wastewaters will be built-up with the support of two European non academic institutions, which will directly participate to the project. Chemometric approach will be followed to optimize both materials manufacture and experimental conditions for analytical purposes. Life Cycle Assessment of new materials and proposed technologies will be performed in order to evaluate their economic and environmental sustainability.	https://cordis.europa.eu/project/rcn/194348_en.html
6	ECO-INK, ECO-INNOVATIVE WATER-	H2020-EU.2.1.5. Start date: 2017-01-01	The ECO-INK project proposes a green, innovative and comprehensive solution to the great limitations of the digital printing technology within the ceramics decoration sector. The main	https://cordis.europa.eu/project/rcn/207085_en.

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
	BASED INKS FOR THE CERAMIC SECTORS, EU Contribution €50,000	End date: 2017-05-31	objectives of the project are to explore new market opportunities and boost the competitiveness of METCO srl business, while addressing EU/global challenges on Climate Change and following the indications of the "Stockholm Convention on persistent organic pollutants" & the ""Stimulating technologies for sustainable development: an environmental technologies action plan for the European Union"": ECO-INK will promote environmentally-friendly activities as well as guarantee the safe elimination of substances, harmful to human health and the environment, as well as the reductions in their manufacture and use, through the substitution of current solvent based ink with water based inks (WSI) for ceramic tile manufacture. for METCO itself, with the introduction of WSI in their manufacture chain, there will be a saving of about 240-360t of solvent each year, corresponding to save about 0,5-1M€ if the solvent substituted is naphtha and approximately 728–1,093t of CO2 emissions per year. Considering the global market the expected figure is very impressive, since it'll be possible to save 620,000t CO2 emission per year. METCO srl foresees a 2-years investment (about 1.8M€) to complete the optimization of WSI and to setup the whole technological package. METCO then envisages a full manufacture and commercialization of 450-1.350-2.700t ECOINK ecoformulations per Years 3-4-5. This is expected to result in a +487% ROI by 2019 and in a METCO srl growth with +45 human resources by 2021.	html
7	NanoScreen, Disruptive portable device for pre-screening of Persistent Organic Pollutants –POPs- in food products and water, EU Contribution €1.2M	H2020-EU.3.2.4. Start date: 2017-06-01 End date: 2019-05-01	Persistent organic pollutants (POPs) are organic compounds produced by human action resistant to environmental degradation and whose bioaccumulative capacity and toxicity can cause harmful health effects e.g. cancer. Hence, they have become global threats for human and environment. The most extended analytic methods used nowadays for detecting POPs are gas chromatography and/or mass spectroscopy to separate and identify them. These methods are expensive -€1,000/sample-, time-consuming -24h-, require a laborious sample preparation and a well-equipped laboratory. Consequently, there is a great demand to increase the number of water and food quality tests if available for a lower price and shorter time. SAFTRA PHOTONICS will bring to market NanoScreen - a portable nano-optical sensing chip for pre-screening purpose that detects food or water contamination by POPs. We will offer a rapid method (10 minutes) to detect the most important POPs (ppb) present in food products and water, carrying out an in-situ analysis for less than 100€ per sample. By putting NanoScreen solution into the the European, Japanese and USA market, in 2023 we expect to sale 55,000 chips with revenue of €4,800,000 (27% Y/Y growth) and ROI 3.25. This ensures sustainability of 37 new full time job positions at company. The project resubmission (13.61) reflects couple of great achievements of 2016: FS has elaborated in detail the NanoScreen business plan, the company has signed two investment agreements, three business partners and two distribution partners. Moreover, we have identified another two major	https://cordis.europa.eu/project/rcn/210851_en.html

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
			replication opportunities of future joint ventures that can form a new business-industrial ecosystem for online nano-screening. The vision is to reach a unique one-box-system tailored for specific applications, e.g. security, agriculture and sport. The Phase 2 funding will help us to close the gap from design validation to industrial manufacture and significantly shorten the market entry period.	
8	ELECTRON4WATER, Three-dimensional nanoelectrochemical systems based on low-cost reduced graphene oxide: the next generation of water treatment systems, EU Contribution €1.5M	H2020-EU.1.1. Start date: 2017-05-01 End date: 2022-04-30	The ever-increasing environmental input of toxic chemicals is rapidly deteriorating the health of our ecosystems and, above all, jeopardizing human health. Overcoming the challenge of water pollution requires novel water treatment technologies that are sustainable, robust and energy efficient. ELECTRON4WATER proposes a pioneering, chemical-free water purification technology: a three-dimensional (3D) nanoelectrochemical system equipped with low-cost reduced graphene oxide (RGO)-based electrodes. Existing research on graphene-based electrodes has been focused on supercapacitor applications and synthesis of defect-free, superconductive graphene. I will, on the contrary, use the defective structure of RGO to induce the manufacture of reactive oxygen species and enhance electrocatalytic degradation of pollutants. I will investigate for the first time the electrolysis reactions at 3D electrochemically polarized RGO-coated material, which offers high catalytic activity and high surface area available for electrolysis. This breakthrough approach in electrochemical reactor design is expected to greatly enhance the current efficiency and achieve complete removal of persistent contaminants and pathogens from water without using any chemicals, just by applying the current. Also, high capacitance of RGO-based material can enable further energy savings and allow using intermittent energy sources such as photovoltaic panels. These features make 3D nanoelectrochemical systems particularly interesting for distributed, small-scale applications. This project will aim at: i) designing the optimum RGO-based material for specific treatment goals, ii) mechanistic understanding of (electro)catalysis and (electro)sorption of persistent pollutants at RGO and electrochemically polarized RGO, iii) understanding the role of inorganic and organic matrix and recognizing potential process limitations, and iv) developing tailored, adaptable solutions for the treatment of contaminated water.	https://cordis.europa.eu/project/rcn/206054_en.html
9	NANOSCREEN, Disruptive portable device for pre-screening of Persistent Organic Pollutants –POPs- in food products and water, EU Contribution €50,000	H2020-EU.2.3.1. Start date: 2015-12-01 End date: 2016-04-30	From SAFTRA PHOTONICS we will bring to the market: NanoScreen, a portable sensing device that will detect in-situ contamination in any food matrix and water with most deleterious Persistent Organic Pollutants -POPs- at a cost-effective price and in a reduced time-span, with a simpler procedure when comparing to current methodologies, allowing multiplexing. Persistent Organic Pollutants are transported across international boundaries far from their sources, even to regions where they have never been used or produced. These POP pose a threat to the environment and to human health all over the globe. A total of 152 countries have participated in the Stockholm Convention, the international event in which strategies for controlling POPs. In the EU there is a strong legal framework that must be followed in order to reduce POPs burden, which includes analysis and detection. Article 11 of the resulting document of	https://cordis.europa.eu/project/rcn/199497_en.html

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
			the Stockholm Convention encourages the generation of new technologies for POPs monitoring and elimination. The most extended analytic methods used nowadays for detecting POPs are gas chromatography and/or mass spectroscopy (GC-MS) to separate and identify them. These methods are expensive -€1,000/sample-, time-consuming -24h-, require a laborious sample preparation and a well-equipped laboratory. The functioning of the Nanoscreen device is a revolutionary technique that makes much easier and functional the way of detecting and analysing POPs in food and water. We have mainly three advantages that make NanoScreen a fruitful innovation: Easy process for sample collection that can be done by non-specialists; Quick method, in which only 10 minutes are needed; Competitive price per analysis of 100€. Nanoscreen presents a ROI in 2022 of 2.45 and it is expected to reach its payback in July 2020 (two years and one month after the beginning of its commercialization).	

Table 14 Research Projects with references to POPs funded under FP7

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	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. 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. 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.	http://cordis.europa.eu/project/rcn/186554_en.html
2	Optimising the use of lichens as biomonitors of atmospheric PAHs	FP7-People Start date: 2014-04-01 End date: 2016-03-31	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. 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. 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	http://cordis.europa.eu/project/rcn/187821_en.html
3	Impact of polyaromatic hydrocarbons on arbuscular mycorrhizal fungi and biochemical and molecular mechanisms involved in	FP7-People Start date: 2014-04-01 End date: 2016-03-31	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) 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	http://cordis.europa.eu/project/rcn/187767_en.html

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
	plant protection and pollutant dissipation		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 sytems, such as the ivory gull (Pagophila eburnea), 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., organohalogens, 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. 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.	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
7	Global contaminated land management	FP7-People Start date: 2011-12-01 End date: 2015-11-30	Complex hazardous contamination of soil and water are obstructing sustainable re-development of previously industrialized urban land in Europe as well as in China. 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. 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.	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	Improvement of cumulative exposure assessment and cumulative hazard assessment methodology; Development of new models for aggregated exposure assessment addressing different routes of exposure; Setting up of new toxicological testing for identifying possible synergistic effects and development of a strategy for refinement of cumulative assessment groups; Integration of cumulative and aggregate risk models integrated in a web-based tool, including accessible data for all stakeholders; Improvement of the understanding of cumulative risk assessment methodology of different stakeholders.	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	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. 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. 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. Comparison of the role of climate change on the transport, fate and food web transfer of pollutants in 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'	http://www.arcrisk.eu/

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
			contaminants in selected populations in the Arctic and exposed local populations in the EU.	
10	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
11	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
12	BRIDGE, Bridging mechanisms into risk assessment: An integrated European research network targeting contaminants in milk, EU Contribution €3.48M	FP7-KBBE Duration: 36 months	Risk assessment data for exposure to contaminants in milk, particularly during the vulnerable stages 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.	http://www.ncp-bio.net/media/documents/successstories/bridge.pdf - no project website
13	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
14	CADASTER, Case studies	FP7-ENVIRONMENT	The project provides a practical guidance to integrated risk assessment by carrying out a full hazard	http://www.cadaster.eu/

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
	on the development and application of in silico techniques for environmental hazard and risk assessment, EU Contribution €2.69M	Start date: 2009-01-01 End date: 2012-12-31	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.	
15	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
16	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 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.	http://www.inuendo.dk/clear/
18	CONFFIDENCE, 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	http://www.conffidence.eu/

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
			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.	
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 environment and identification of biomarkers for an improved risk assessment on environmental exposure, EU Contribution €2.58M	FP7-ENVIRONMENT Start date: 2011-01-01 End date: 2014-12-31	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 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.	http://www.nib.si/eng/index.php/aktualno/project/287-national-institute-of-biology-nib-is-coordinating-7-framework-programme-project-which-has-33-million-eur-budget-.html - no project website yet

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
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 biochem-istry underpinning (de)halorespiration, an exciting bacterial metabo-lism 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 Start date: 2012-01-01 End date: 2015-12-31	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 stakeholder.	http://ec.europa.eu/research/environment/pdf/fp7_catalogue.pdf - no project website yet
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 manufacture 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 manufacture and impact on the function and reliability of end products; selection of	http://www.enfiro.eu/

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
			substitution options for specific BFRs for further study in a small number of case studies; technical assessment studies on application requirements regarding manufacture properties and application functions; technical assessment on five alternative FR/product combinations: printed circuit boards, electronic components, injection-moulded products, textile back coatings and intumesent 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.	
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	ENVIROGENOMARKERS, Genomic Biomakers 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 high-priority environmental exposures (e.g., water disinfection by-products).	http://www.envirogenomarkers.net/
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&R

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
				CN=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 Contribution €0.98M	FP7-ENVIRONMENT Start date: 2011-10-01 End date: 2014-09-30	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 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.	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
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_PROJ_EN&ACTION=D&DOC=1&CAT=PROJ&QUERY=0130b236edee: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 ECDs in food identified as potential inducers of obesity and related disorders later in life, sing 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 besogenic EDCs in food, by integrating maternal exposure through food, contaminant exposure and health effect data in children, and hazard characterization and mechanistic information in animal and in in-vitro studies.	http://www.theobelixproject.org/
35	OPENTOX, An open source predictive toxicology framework, EU Contribution €2.97M	FP7-HEALTH Start date: 2009-07-01 End date: 2014-06-30	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;	http://www.opentox.org/

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
			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; 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; 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.	
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_PROJ_EN&ACTION=D&DOC=13&CAT=PROJ&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	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. 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.	http://www.perfood.eu/
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.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
				- 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 compounds, EU Contribution €2.7M	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 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.	http://www.systeqproject.eu/
42	TATOO, Tagging Tool	FP7-ICT	To set up a semantic web solution to close the discovery gap that prevents a full and easy access to	http://www.tatoo-

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
	based on a Semantic Discovery Framework, EU Contribution €2.52M	Start date: 2010-01-01 End date: 2012-12-31	environmental resources on the web. The Central and Eastern European Centre for Persistent Organic Pollutants will participate in the project of validation.	fp7.eu/tatooweb/
43	TMP53COMPMIX, 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/
45	DEROCA, Development of safe and eco-friendly flame retardant materials based on CNT co-additives for commodity polymers, EU Contribution €2.95M	FP7-NMP Start date: 2012-12-01 End date: 2015-11-30	Currently, best flame retardant formulations are still often based on halogenated flame retardants (FR). Those halogneted FR are supsected to endcrine disrupters when leaching from the material and produce toxic fumes and acids (HBr, HCl, organoirritants, PCDD/Fs etc.).	https://cordis.europa.eu/project/rcn/105644/factsheet/en
46	MOSQUITOBLOCK, Integrated biomolecular methods to control mosquito-borne diseases,	FP7-PEOPLE Start date: 2015-12-01 End date: 2016-11-30	DEROCA project aims at (i) developing and introducing new safer and more eco-friendly FRs through exploiting the synergistic effect of carbon nanotubes with phosphorus based flame retardants and other new promising additives in intumescent or carbon crust formation systems by promoting a more efficient/cost competitive solution; (ii) developing small scale test methods and models to	https://cordis.europa.eu/project/rcn/106494/factsheet/en

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
	EU Contribution €15,000		predict full end product standard scale test results based on small scalte tests.	
47	4G-PHOTOCAT, Fourth generation photocatalysts: nano-engineered composites for water decontamination in low-cost paintable photoreactors, EU Contribution €3.73M	FP7-NMP Start date: 2013-01-01 End date: 2015-12-31	The approach will be multifaceted: (i) to better understand and promote interactions between CNT and different (FR) additives; (ii) to develop FR applications for five final products which represent large volumes of commodity polymers, i.e. automotive industry, wire and cable, industrial packaging and foam; (iii) to demonstrate and to assess fire performance of end-products, including fire toxicity; (iv) to develop models for the prediction of fire classification of materials based on small scale tests; (v) to introduce small scale test methods and models developed into international standardization; (vi) to assess the mechanical and other product specific essential properties of the FR polymer; (vii) to assess toxcicity and environmental impact of the FRs developed both in the manufacture chain and in the end use product; (ix) to assess the overall envrionmental impact of the Frs developed FRs through LCA."	http://www.4g-photocat.eu/
48	MOSQUITOBLOCK, Integrated biomolecular methods to control mosquito-borne diseases, EU Contribution €280,000	FP7-PEOPLE Start date: 2013-09-01 End date: 2015-08-31	Mosquitoes transmit some of the world's most serious diseases. The most important disease vectors are members of the subfamilies Anophelinae and Culicinae. Anopheles mosquitoes transmit malaria, filarial parasites , and a few arboviruses. There are 30 genera in the Culicidae subfamily, but the medically important mosquitoes are Culex, Aedes, Mansonia, and Annigeres (Culex would be important in Europe for West Nile Disease and Avian malaria), while (Aedes would be more important in Tropical countries). Over the last 45 years, the use of chemical pesticides such as dichlorodiphe-nyltrichloroethane (DDT), gammaxane, malathion, and chlordane has been the method of choice for mosquito control, and the antimalarial drugs chloroquine and the affordable pyrimethamine-sulfadoxine combination have proved successful in lowering morbidity and mortality. In addition, the emergence of pesticide and drug resistant mosquitoes, coupled with a clearer appreciation of the long-term detrimental effects of powerful chemicals to non pest insects and concern about accumulation of pesticides in the food chain and environment, has high lighted the need to quickly develop an alternative. A promising alternative is biological control. So, this project would focus on non-chemical methods of control mosquitoes	https://cordis.europa.eu/project/rcn/106417/factsheet/en
49	TDSEXPOSURE, Total Diet Study Exposure, EU Contribution €5.97M	FP7-KBBE Start date: 2012-02-01 End date: 2016-01-31	The project 4G-PHOTOCAT allies the expertise of 7 academic and 3 industrial partners from 5 EU countries (Germany, United Kingdom, Czechia, Poland, and Finland) and 2 ASEAN countries (Malaysia and Vietnam) for the development of a novel generation of low-cost nano-engineered photocatalysts for sunlight-driven water depollution. Through rational design of composites in which the solar light-absorbing semiconductors are coupled to nanostructured redox co-catalysts based on abundant elements, the recombination of photogenerated charges will be suppressed and the rate of photocatalytic reactions will be maximized. In order to achieve fabrication of optimal architectures, advanced chemical deposition techniques with a high degree of control over composition and morphology will be employed and further developed. Furthermore, novel protocols will be developed for the implementation of the photocatalysts into a liquid paint, allowing for the deposition of robust photoactive layers onto flat surfaces, without compromising the photoactivity of immobilized photocatalysts. Such paintable photoreactors are envisaged particularly as low-cost	http://www.tds-exposure.eu/

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
			devices for detoxification of water from highly toxic persistent organic pollutants which represent a serious health issue in many remote rural areas of Vietnam and other countries. The 4G-PHOTOCAT project will provide novel scientific insights into the correlation between compositional/structural properties and photocatalytic reaction rates under sunlight irradiation, as well as improved fabrication methods and enhanced product portfolio for the industrial partners. Finally, 4G-PHOTOCAT will lead to intensified collaboration between scientists working at the cutting edge of synthetic chemistry, materials science, heterogeneous photocatalysis, theoretical modelling, and environmental analytics, as well as to unique reinforcement of cooperation between scientists and industry partners from EU and ASEAN countries.	
50	FOLDHALO, Folding with Halogen Bonding, EU Contribution €1.39M	FP7-IDEAS-ERC Start date: 2013-03-01 End date: 2018-02-28	Mosquitoes transmit some of the world's most serious diseases. The most important disease vectors are members of the subfamilies Anophelinae and Culicinae. Anopheles mosquitoes transmit malaria, filarial parasites , and a few arboviruses. There are 30 genera in the Culicidae subfamily, but the medically important mosquitoes are Culex, Aedes, Mansonia, and Annigeres (Culex would be important in Europe for West Nile Disease and Avian malaria), while (Aedes would be more important in Tropical countries). Over the last 45 years, the use of chemical pesticides such as dichlorodiphe-nyltrichloroethane (DDT), gammaxane, malathion, and chlordane has been the method of choice for mosquito control, and the antimalarial drugs chloroquine and the affordable pyrimethamine-sulfadoxine combination have proved successful in lowering morbidity and mortality. In addition, the emergence of pesticide and drug resistant mosquitoes, coupled with a clearer appreciation of the long-term detrimental effects of powerful chemicals to non pest insects and concern about accumulation of pesticides in the food chain and environment, has high lighted the need to quickly develop an alternative. A promising alternative is biological control. So, this project would focus on non-chemical methods of control mosquitoes	https://cordis.europa.eu/project/rcn/106982/factsheet/en
51	DEGRAPOLL, Degradative potential of rivers as a key driver of the environmental fate and sink of organic pollutants, EU Contribution €170,000	FP7-PEOPLE Start date: 2011-11-01 End date: 2013-10-31	Total Diet Studies (TDS) allow getting information on real dietary exposure to food contaminants consumption (heavy metals, mycotoxins, POPs...) and estimating chronic exposure to pesticide residues in food and food additives intake. TDS consider total exposure from whole diets and are based on food contamination as consumed rather than contamination from raw commodities, thus ensuring a realistic exposure measure.	https://cordis.europa.eu/project/rcn/99555/factsheet/en
52	MOSSCLONE, Creating and testing a method for controlling the air quality based on a new biotechnological tool. Use of a devitalized moss clone as passive contaminant sensor, EU Contribution	FP7-ENVIRONMENT Start date: 2012-04-01 End date: 2015-03-31	TDS facilitate risk assessment (RA) and health monitoring (HM). Some EU Member States (MS) and Candidate Countries (CC) have no TDS programme or use various methods to collect data, which were not examined yet to tell whether they are comparable or not. This is of interest for EFSA or WHO-FAO. Similarly it is important to harmonise methods to assess dietary exposure risks in MS, CC and at the European level compared with other world regions.	https://cordis.europa.eu/project/rcn/103148/factsheet/en

No.	Acronym, Project Title, EU contribution	Programme, Duration time	Short description and main objectives	More information
	€3.49M			
53	TOP, Trophodynamics of Organic Pollutants Studied by Compound-Specific Isotope Analysis, EU Contribution €15,000	FP7-PEOPLE Start date: End date:	The methods proposed will aim for food sampling, standard analytical procedures, exposure assessment modelling, priority foods and selected chemical contaminants consistency across MS and CC. Various approaches and methods to identify sampling and analyses will be assessed and best practice defined. Contaminants and foods which contribute most to total exposure in European populations will be defined.	https://cordis.europa.eu/project/rcn/193060/factsheet/en
54	TOP, Trophodynamics of Organic Pollutants Studied by Compound-Specific Isotope Analysis, EU Contribution €250,000	FP7-PEOPLE Start date: 2010-03-01 End date: 2012-02-29	Priority will be given to training and support in EU MS and CC currently without TDS. It will demonstrate best practice in creating a TDS programme using harmonised methods in regions previously lacking TDS, and ensure consistency of data collected. A database will be set up describing existing EU studies and collating harmonised exposure measures and designed to allow risk assessors and managers handling dietary exposure more accurately and more specifically.	https://cordis.europa.eu/project/rcn/92328/factsheet/en

Table 15 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: 01.04.2010 End date: 01.10.2010	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: 01.10.2010 End date: 31.12.2013	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
3	LIFE-COMBASE - COMputational tool for the assessment and substitution of Biocidal Active substanceS of Ecotoxicological concern, €680,000	Start date: 03.10.2016 End date: 30.09.2019	The LIFE-COMBASE project will demonstrate a new computational tool for assessing and reducing the impact of biocides of ecotoxicological concern, and will promote their substitution with safer substances. Project results will be communicated to the Biocidal Products Committee (BPC) of the European Chemicals Agency (ECHA), in order to boost replicability. The project will make a special contribution to the EU Biocides Product Regulation, especially regarding the precautionary principle; the promotion of low-risk substances; and the reduction of animal testing.	http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=5749
4	LIFE-BIOREST - Bioremediation and revegetation to restore the public use of contaminated land, €970,000	Start date: 01.07.2016 End date: 30.06.2019	Contamination by hazardous substances is one of the main causes of soil degradation and loss of terrestrial ecosystem services. The most common soil contaminants in Europe are heavy metals, mineral oils, polycyclic aromatic hydrocarbons (PAHs) and mixtures of benzene, toluene, ethylbenzene and xylene (BTEX). Mineral oils, PAHs and BTEX make up 45% of the inventory of contaminants in Europe. The LIFE-BIOREST project aims to provide a viable method that uses fungal and bacterial strains for the in situ bioremediation of contaminated sites.	http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=5769
5	LIFE BIOPOL - Manufacture of Leather making BioPolymers from biomasses	Start date: 01.07.2016 End date: 30.09.2019	The leather industry consumes large volumes of water and chemicals. The chemicals used are mostly petrochemical-based, due to the easy availability of such materials and to	

	and industrial by products,through Life Cycle Designed processes, €2.1M		their chemical stability. The BIOPOL project aims to demonstrate the technical performance and economic viability of an innovative process for producing new biopolymers ('green chemicals') to be used in the tanning industry. Decreasing use of water and the use of hazardous chemicals and pollutants such as heavy metals, formaldehyde, chromium, chlorinated paraffin, VOCs (volatile organic compounds) and inorganic salts.	
6	LIFE-FLAREX - Mitigation of environmental impact caused by Flame Retardant textile finishing chemicals, €700,000	Start date: 01.07.2017 End date: 30.06.2020	Flame retardants (FRs) are a group of anthropogenic environmental contaminants, many of them are considered toxic, persistent and bio-accumulative. The main objective of the LIFE-FLAREX project is to promote the use of safer alternative flame retardants (FRs) in order to mitigate the environmental and health impacts caused by toxic compounds in FRs containing bromine, formaldehyde and antimony in textile finishing products.	http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=6182
7	LIFE VERMEER - Integrating VEGA, toxRead, MERLIN-Expo, and ERICA in a platform for risk assessment and substitution of risky substance, €1.5M	Start date: 01.09.2017 End date: 30.06.2021	LIFE VERMEER project is to deliver flexible and user-friendly software tools, called SPHERA and ToxEraser, for the substitution of harmful chemicals. An assessment of the risks must evaluate the impacts on human health and environment, which are separate disciplines. The indicators for distinguishing between safe and unsafe chemicals must incorporate multiple criteria related to both exposure and hazard.	http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=6191
8	LIFE PHOENIX - Perfluorinated compounds HOlistic ENvironmental Interistitutional eXperience, €1.3M	Start date: 01.09.2017 End date: 31.03.2021	The LIFE PHOENIX project aims to demonstrate how a new interinstitutional governance system, supported by innovative forecast tools based on ongoing monitoring, can more effectively and efficiently manage the risks related to the diffusion of Persistent Mobile Organic Contaminants (PMOC) – with a particular focus on PerFluorinated Alkyl Substances (PFAS). This system will help avoid, or at least reduce, public expenditure on damage caused by PMOC, which represents a major threat to public health through drinking and irrigation water.	http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=6206
9	LIFE-PSLOOP - Polystyrene Loop, €2.7M	Start date: 01.07.2017 End date: 01.07.2021	Expanded polystyrene (EPS) foam is used extensively throughout Europe as an insulation material. EPS that was produced before 2015 contains the flame retardant Hexabromocyclododecane (HBCD). The objective of the PSLoop project is to recycle both EPS construction waste	http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=6263

			and extruded polystyrene (XPS) and to demonstrate an economically viable alternative to incineration.	
10	LIFE AskREACH - Enabling REACH consumer information rights on chemicals in articles by IT-tools, €4.2M	Start date: 01.09.2017 End date: 31.08.2022	LIFE AskREACH has the overall goal of helping the implementation of the REACH Regulation.	http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=6325&docType=pdf
11	LIFE SURFING - SURFactant enhanced chemical oxidation for remediatING DNAPL, €1.2M	Start date: 01.01.2019 End date: 30.06.2022	The LIFE SURFING project aims to fully eradicate pervasive pollutants in sites contaminated by Lindane. Regional authorities in Aragon, Spain, will demonstrate the benefits of combining techniques from surfactant enhanced aquifer remediation and surfactant-enhanced in situ chemical oxidation to extract Lindane residues from even the smallest fractures in rocks and remove it from natural environments completely.	http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=6765
12	LIWE LIFE - Lidköping Innovation Wastewater Eco-Hub, €3.0M	Start date: 01.07.2018 End date: 30.06.2023	The LIWE LIFE project aims to demonstrate advanced wastewater treatment technologies that improve water quality while boosting both resource and energy efficiency. The so-called Circular Wastewater System (CWS) developed by the municipality of Lidköping will tackle emerging pollutants and pathogens in local effluents, notably removing pharmaceuticals, hormones and micro-plastics that conventional wastewater plants struggle to filter out of water supplies. The project expects to Reduce the concentration of micro-plastics and persistent organic pollutants by 99.5%	http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=6768&docType=pdf
13	LIFE APEX - Systematic use of contaminant data from apex predators and their prey in chemicals management, €2.0M	Start date: 01.09.2018 End date: 31.08.2022	The LIFE APEX project aims to enable regulators of chemicals to make more systematic use of monitoring data from apex predators and prey. This will reduce exposure to harmful substances and protect human health and the environment. Data from apex predators and prey samples will be used to detect the presence of chemical contaminants in the environment, help pick the most relevant substances for further hazard assessment, assess the impact and effectiveness of substance risk mitigation measures, and define predominant chemical mixtures in the environment	http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=6747

9. OBSOLETE ACTIONS FROM PREVIOUS UIP

This section provides details of actions from the previous version of the UIP which have either been completed or which are no longer relevant for other reasons. The actions presented here have retained the numbering used from the previous UIP with a brief description of how the action has been completed or is no longer needed.

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. (ongoing action)

The primary use of HBCDD (≥90% of all use) was within polystyrene insulation boarding (EPS/XPS). Authorisations under REACH for HBCDD within these two applications were granted but these expired in August 2017. Since the Authorisations for use of HBCDD have now expired, it is expected that alternatives have been identified and are in use.

Furthermore, in January 2019, the Stockholm Convention Secretariat published details on its guidance for alternatives to HBCDD[359], which includes data from the European Union and ECHA. This action can now be considered complete.

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. (ongoing action).

The UNEP Stockholm Secretariat published two sets of guidance in 2017, one with detailed information on guidance for developing POP-PBDE emission inventories including waste activities, and a second with detailed information on guidance for sampling, analysis, and separation of POP-PBDEs within waste streams. These two documents could be expected to fulfil Action 5, meaning that the action is no longer needed, but is replaced by a new action for the Commission to encourage the use of the guidance in Member State planning and implementation plans.

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". (This action was also listed within the previous implementation plan and is still ongoing)

359 http://chm.pops.int/Implementation/NationalImplementationPlans/Guidance/tabid/7730/ctl/Download/mid/20999/Default.aspx?id=1&ObjID=27217

The recast of the POPs Regulation in 2019 now includes a definition of what is meant by closed-site, which will cover 'closed-loop' as detailed within Action 7. This Action is now considered complete.

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. (ongoing action)

The technical specification for measuring PFOS in coated and impregnated solid articles, liquids and fire-fighting foams has been developed and can be used in a CEN standard. Therefore, this action can be removed as completed.

Action 17: The Commission and the Member States should support the work on decontamination of POP PBDE containing materials through collection of information that should be disseminated to all stakeholders. This would also include promotion of techniques to manage POP PBDE containing materials across the European Union. (This action was also listed within the previous implementation plan and is still ongoing)

A Study by Ramboll (2019) on behalf of the European Commission assessing the waste thresholds under Annex IV and V includes detailed information on decaBDE, including material flows and identification of where emission sources may occur. Furthermore, two guidance documents published in 2017 by the UNEP Stockholm Convention Secretariat on development of emission inventories for POP-PBDEs and sampling, analysis, and screening of POP-PBDEs in waste provide significant amounts of data addressing Action 17. Finally, CEN standards for PBDEs released from WEEE have also been developed to assist in monitoring of PBDEs. This action is considered completed.

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)

The creation of the IPCheM platform[360] provides a centralised repository for key information on POPs. This fulfils Action 25.

[360] https://ipchem.jrc.ec.europa.eu/RDSIdiscovery/ipchem/index.html