IRELAND's Update of National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants

ENVIRONMENTAL PROTECTION AGENCY
An Ghníomhaireacht um Chaomhnú Comhshaoil
PO Box 3000, Johnstown Castle, Co. Wexford, Y35 W821
Ireland
Telephone: +353 53 9160600 Fax: +353 53 9160699
Email: info@epa.ie Website: www.epa.ie
Lo Call 1890 33 55 99

National Implementation Plan

for the Stockholm Convention on Persistent Organic Pollutants

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Glossary of Terms

AA	Annual Average (Water Framework Directive)
AA*	Appropriate Assessment
BAT	Best Available Techniques
BEP	Best Environmental Practice
BFR	Brominated Flame Retardants
CLRTAP	Convention on Long-Range Transboundary Air Pollution
COP	Conference of Parties
DAFM	Department of Agriculture, Food and the Marine
DCCAE	Department of Communication, Climate Action & Environment
DDT	Dichloro-diphenyl-trichloroethane
DHPLG	Department of Housing, Planning & Local Government
DL	Dioxin-like
EPA	Environmental Protection Agency
EPER	European Pollutants Emissions Register
EPRTR	Electronic Pollutant Release Transfer Register
EQS	Environmental Quality Standard (Water Framework Directive)
FSAI	Food Safety Authority of Ireland
GAPS	Global Atmospheric Passive Sampling
GEF	Global Environment Facility
HBB	Hexabromobiphenyl
HBCD	Hexabromocyclododecane
HCB	Hexachlorobenzene
HCBD	Hexachlorobutadiene
HCH	Hexachlorocyclohexane
HSA	Health and Safety Authority
HSE	Health Service Executive
HPRA	Health Products Regulatory Authority

IED	Industrial Emissions Directive
IPC	Integrated Pollution Control
I TEQ	International Toxic Equivalent Concentration
kg	kilograms or 103 grams
LoD	Limit of Detection
LoQ	Limit of Quantification
LPCL	Low POP Concentration Level
MAC	Maximum Allowable Concentration (Water Framework Directive)
mg	milligrams or 10^{-3} gram
$mgkg^{-1}$	milligrams per kilogram ($1000mgkg^{-1} = 1gkg^{-1} = 1000ppm$)
µg	microgram or 10^{-6} gram
μgkg^{-1}	microgram per kilogram ($1000\ \mu gkg^{-1} = mgkg^{-1} = 1$ ppm)
ng	nanogram or 10^{-9} gram
NDL	Non-dioxin-like
NFR	Nomenclature for Reporting (under CLRTAP)
NIECE	Network for Ireland's Environmental Compliance and Enforcement
NRCP	National Residues Control Plan
MRL	Maximum Residue Level
MSW	Municipal Solid Waste
OECD	Organisation for Economic Cooperation & Development
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PAHs	Polycyclic Aromatic Hydrocarbons
PBBs	Polybrominated biphenyls
PBDEs	Polybrominated diphenyl ethers
PBT	Persistent, Bioaccumulative and Toxic
PCBs	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzo-p-dioxins (dioxins)
PCDF	Polychlorinated dibenzofurans (furans)

PCNs	Polychlorinated Naphthalenes
PE	Population Equivalent
PeCB	Pentachlorobenzene
POC	Perfluorinated Organic Compounds
PFAS	Perfluoroalkylated Substances
PFOS	Perfluorooctane sulfonic acid and its derivatives
PIC	Prior Informed Consent
pg	picogram or 10^{-12} gram
pgm^{-3}	picogram per cubic metre
POPs	Persistent Organic Pollutants
PRTR	Pollutant Release and Transfer Register
RBSP	River Basin Specific Pollutants (Water Framework Directive)
REACH	Registration, Evaluation and Authorisation of Chemicals
SWD	Shellfish Waters Directive
TDI	Tolerable daily intake
TEF	Toxic equivalency factor
TEQ	Toxic equivalent concentration
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environmental Programme
WFD	Water Framework Directive
WHO	World Health Organization
WSSD	World Summit on Sustainable Development

EXECUTIVE SUMMARY

The Stockholm Convention on Persistent Organic Pollutants (POPs) aims to eliminate or restrict the production and use of persistent organic pollutants (POPs). POPs are a group of chemical substances which persist in the environment, may accumulate in food and human tissue and are toxic. These substances can be divided into three main categories: pesticides, industrial chemicals and unintentional POPs such as dioxins and furans from backyard burning.

The Republic of Ireland signed up as a Party to the Stockholm Convention in November 2010 and as a Party to the Convention, has several obligations. Those obligations include the implementation and periodic review of a National Implementation Plan outlining the measures taken to eliminate or reduce the release of POPs into the environment from intentional production.

Organisations in Ireland that are considered to have a key role in the fulfilment of obligations under the Stockholm Convention are listed in Section 2.

Ireland's first National Implementation Plan (NIP) on POPs, together with an Action Plan, setting out the tasks required to reduce the releases of unintentional POPs, was published in 2012. Article 7 of the Stockholm Convention requires Parties to update the NIP when new POPs are added. This 2018 update of the NIP is in response to decisions made at the Conference of Parties (governing body for Stockholm Convention) meetings in 2013 and 2015 to list four additional substances to the Stockholm Convention.

This NIP update includes an assessment of POPs in the Irish environment and the actions Ireland is taking to monitor and reduce releases of these POPs. The production of this plan conforms to the Stockholm Convention Guidance/protocol for developing a National Implementation Plan. The plan was prepared in consultation with public authorities, national stakeholders and the public.

The following sections summarise the uses and monitoring measures for intentionally produced POPs at individual substance level and sources/uses/inventory data for unintentionally produced POPs in Ireland since 2012.

Intentionally produced POPs

Intentionally produced POPs are chemicals manufactured for specific purposes. These include POP pesticides for agricultural use or for protection of human health. These chemicals also include substances that were produced for industrial purposes, e.g. Polychlorinated Biphenyl (PCBs) for use in electrical equipment. The following groups of intentionally produced POPs are discussed in more detail below.

- POP pesticides

POP pesticides for plant protection listed under the Stockholm Convention have been banned for use in Ireland since the 1980s and 1990s. Despite this ban being in place, almost 2 tonnes of POP pesticides including lindane, dieldrin, DDT and endosulfan were collected over a 5-year long national farm hazardous waste collection pilot scheme (2013-2017), indicating the ongoing stockpiling of POP pesticides on farms. Ireland is considering a suitable way for the introduction of a farm hazardous waste collection scheme to ensure the collection and proper disposal of hazardous waste (including POPs waste) arising on farms.

Monitoring data supplied by the Department of Agriculture, Food and Marine, Food Safety Authority of Ireland and the Marine Institute indicates that some POP pesticides are still measurable at low concentration levels in water, air and soil as result of their past use and persistent nature.

- Polychlorinated Biphenyls (PCBs)

PCBs were used in electrical equipment such as transformers and capacitors due to their stability and ability to conduct heat. Ireland's PCB inventory shows a downward trend in the use and holdings of PCBs. Low levels of PCBs, have been detected in foods from animal origin. However, the levels found in Irish food are generally low compared with other industrialised countries and are not considered to present a risk to the health of the Irish consumer (FSAI, 2009). While the overall trend in PCB concentrations in the marine environment is downward, their persistent nature will mean that PCBs will likely be detected in the environment for many years. The identification of PCB sources and waste management measures concerning PCB-containing waste continue to remain a priority as outlined in the action plan.

- Polybrominated diphenyl ethers (PBDEs) (Tetra, Penta, Hexa, Hepta, Deca BDEs))

Polybrominated diphenyl ethers were used as flame retardants in consumer goods such as electrical equipment, construction materials, coatings, textiles and polyurethane foam (furniture padding). Generally, PBDEs have not been found in significant concentrations in food or in the Irish environment. However, they still remain in various consumer products that have not reached the end of their life. Therefore, there is still a risk for release and emissions of PBDEs into the environment if these products are not managed correctly when they arise as waste. Ireland will continue to monitor for the presence of these BDE's as part of the action plan.

- Hexabromobiphenyl (HBB)

HBB is another polybrominated flame retardant added to products during the 1970s. There is limited data on the levels of HBB in food and the environment, however the information available suggests that it is not present in significant amounts. Ireland will continue to monitor for polybrominated biphenyls including HBB in electrical and electronic equipment, packaging and food.

- Perfluorooctane sulfonic acid and its derivatives (PFOS)

PFOS has many applications including; electric and electronic parts, firefighting foam, photo imaging, hydraulic fluids and textiles. PFOS continues to be used in some of these applications in selected

countries under agreement with the Stockholm Convention[1]. To date, PFOS has not been found in significant levels in food or Irish environment based on available monitoring information. However, Ireland will continue to monitor PFOS in food and the environment, due to its capacity to undergo long-range transport. Further studies have been prepared at EU and national level to assist Member States to gain a better understanding of the presence of PFOS in various waste streams.

- Hexabromocyclododecane (HBCD)

HBCD was used mainly as a flame retardant in polystyrene-based insulation products. Generally, HBCD has not been found in significant concentrations in food or in the Irish environment to date. However due to the incorporation of HBCD in insulating materials, the risk for release and emissions of HBCD into the environment is likely to remain for considerable time. It is intended that the nature and extent of HBCD use in Irish construction applications when it arises as waste will be further explored through research as outlined in the action plan.

- Polychlorinated Naphthalene (PCN)

PCN has been used as insulating material for electrical wires, lubricants and mothproofing. There is little monitoring information regarding PCN in the Irish environment. However, limited monitoring in food has indicated the presence of PCN in relatively low concentrations. Further studies on nature and extent of PCN in the Irish environment will be undertaken as part of a wider study under the proposed action plan.

- Hexachlorobutadiene (HCBD)

HCBD was most commonly used as a solvent for other chlorine compounds and mainly generated as a by-product in the manufacturing of chlorinated hydrocarbons such as carbon tetrachloride. HCBD has not been found in significant concentrations in food or in the Irish environment. Further studies on nature and extent of HCBD in the Irish environment will be undertaken as part of a wider study under the proposed action plan.

- Pentachlorophenol and its salt and esters (PCP)

PCP has been used as a herbicide, insecticide, fungicide, algaecide, disinfectant and as an ingredient in antifouling paint. Limited monitoring of PCP has been carried out in water (under the Water Framework Directive) and wastewater sewage sludge. Information obtained from such investigations would indicate that PCP does not pose a serious environmental threat. However, further studies on nature and extent of PCP in the Irish environment will be undertaken as part of a wider study under the proposed action plan.

Unintentionally produced POPs

Unintentionally formed POPs are not specifically manufactured as commercial substances. These substances include dioxins and furans, polychlorinated biphenyls, hexachlorobenzene and pentachlorobenzene. Also, known as unintentional by-products, these POPs may be formed inadvertently as a result of processes such as backyard burning of waste.

[1] List of Acceptable Purposes: http://chm.pops.int/Implementation/Exemptions/AcceptablePurposes/tabid/793/Default.aspx

As required under the Stockholm Convention, Ireland updated its Inventory of releases of unintentional POPs to the environment for the time series 1990 to 2016. The Inventory shows a decline in dioxin emissions[2] for all environmental media except for an increase of emissions to land and soil, with over 90% of the emissions to land attributed to accidental fires. Total emissions of dioxins to all five vectors (air, water, land, products and residue), have almost halved since 1990, decreasing from 109 g-ITEQ[3]/y to 49 g-ITEQ/y. In 2015, dioxin releases to air accounts for 52% of the total, followed by emissions to residue 25%, land (19%), product (4%) and, finally, negligible emissions to water (Del Vento, et al., 2017). Further information on trends in releases of dioxins are presented in Section 4.

As part of the inventories update, PCB emissions to water and residue[4] have been added to the inventory for the first time. Total annual PCB emissions have decreased substantially from 265 kg/y in 1990 to just over 32 kg/y in 2015.

For Hexachlorobenzene, emissions peaked at 40 kg/y between 1990 and 1996 associated with the use of the hexachloroethane (HCE)-based cover gas in the secondary aluminium process. After the ban of HCE-based cover gas entered into force in 1996, emissions dropped substantially. The current emissions to air, water and land reflects the import and use of the Chlorothalonil, a pesticide containing HCB as a contaminant present from the manufacturing process[5].

Progress Assessment on 2012 NIP's Action Plan

Summary key achievements include:

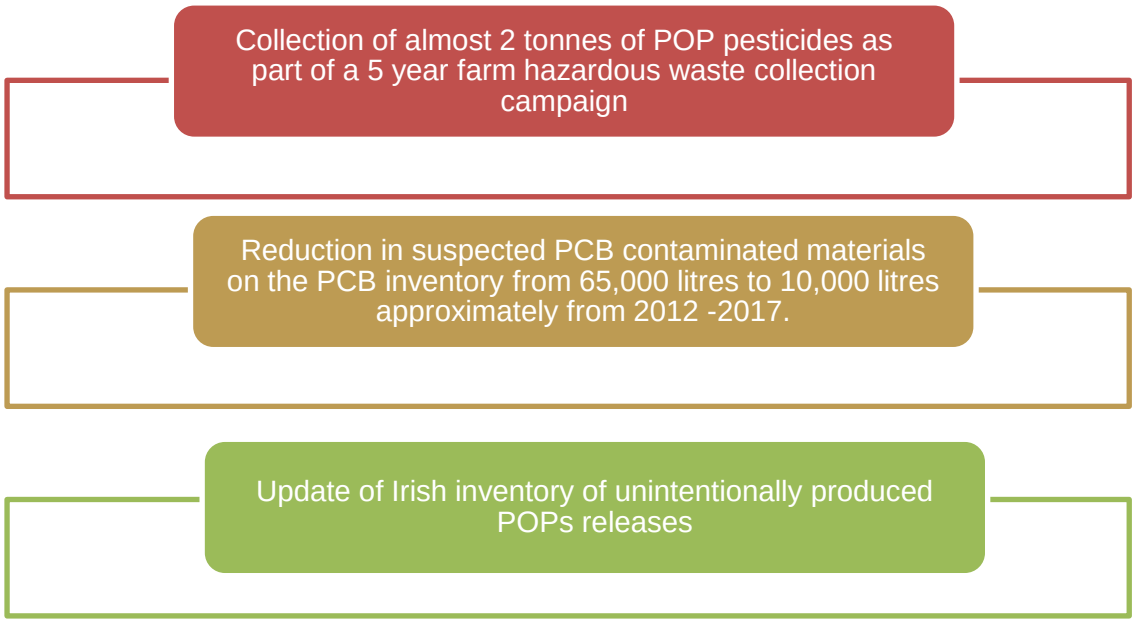


Figure 1 Key achievements between 2012-2018

[2] EPA Air Quality report, 2016
[3] ITEQ: International Toxic Equivalency Quotient
[4] Residue; including certain liquid wastes, sludge, solid residues, which are handled and disposed of as waste (UNEP Toolkit for Identification, Quantification of releases of Dioxins, Furans and other unintentional POPs, 2013)
[5] http://www.fao.org/fileadmin/templates/agphome/documents/Pests_Pesticides/Specs/Chlorothalonil_2015.pdf

Considerable progress has been made on the implementation of the 2012 National Implementation Plan for POPs. Areas to note include:

- Regulation and control
  - The implementation of a ban on the burning of bituminous-based fuels in residential dwellings in specified areas to complement the existing ban on the marketing, sale and distribution of bituminous fuel, leading to reduction in the release of unintentional POPs.
  - The quantity of residual waste disposed to landfill decreased as did the number of operational landfills. In Ireland, five (5) landfills in 2017 were accepting municipal waste compared to twenty-five (25) in 2010. Additional waste-to-energy capacity is now available in Ireland with a second municipal waste incinerator operational at full capacity.
  - Control and monitoring of POPs in authorisations issued to IED/Waste/IPC licensable activities.
  - Reduction in suspected PCB contaminated materials on the PCB inventory from 65,000 litres to 10,000 litres approximately from 2012 -2017. The National PCB Inventory work led by the EPA under the PCB Directive has been the main monitoring focus for POP stockpiles.
  - Collection of 2 tonnes of identified POPs pesticides collected and properly managed through 46 pilot farm hazardous waste collection events over a five-year period (2013-2017). This collaborative initiative was led by EPA working with a cross government team including Teagasc, Department of Agriculture, Food and the Marine (DAFM), Department of Communications, Climate Action and the Environment (DCCAE) and local authorities.

- Monitoring and surveillance
  - Animal feed testing by the Department of Agriculture, Food and the Marine (DAFM) for POP pesticides (aldrin, chlordane, dieldrin, endrin, heptachlor, toxaphene, DDT, endosulfan and hexachlorobenzene). In the period 2010 to 2016 there was no detection of any of the POP pesticides analysed.
  - On-going monitoring of food programme by the Food Safety Authority of Ireland (FSAI) to protect human health. The control programme includes food originating from Ireland, other EU Member States and countries outside the EU and incorporates the following food groups:
    - food of plant origin (fruit and vegetables),
    - cereals;
    - food of animal origin (fat, milk, honey, eggs and dairy produce);
    - food of non-marine origin; and
    - infant formulae.
  - Implementation of the Marine Strategy Framework Directive-descriptor 9 (contaminants in seafood) monitoring programme. This programme sampled and tested 129 portions of commercially important fish species landed at major Irish fishing ports for trace metals, organochlorine compounds, indicator and dioxin like PCBs, dioxins and furans and brominated flame retardants. (Results are included in the relevant food sections of this report).

- Public awareness and guidance
  - Implementation of several media campaigns led by the EPA in relation to backyard burning and bonfires in addition to a campaign highlighting the health and environmental dangers of burning waste in domestic appliances.

- EPA have developed PCB-related guidance documents including guidance for organisations who hold potentially PCB-contaminated equipment to assist with PCB site surveys and guidance for the appropriate disposal and decontamination of PCB-contaminated equipment and remediation of PCB-contaminated land.

- Inventories and research
  - EPA led research programmes on treatment options for specific waste streams containing flame retardant chemicals (HBCD; PBDE's).

The 2012 action plan can be accessed in Appendix 1.

Proposed Future Priority Actionsbelow:

Table 1 sets out the priority actions on enforcement, regulation & control, research and awareness & guidance. These targeted areas link the actions to relevant POP substances and the owner(s) assigned the responsibility under legislation.

In terms of potential and/or emerging risks, some more recently listed POPs could potentially pose complex challenges not only to human health and the environment, but also, in many cases, to the attainment of non-toxic materials cycles essential for the Circular Economy. For example, the final agreement on Annex 1 of the EU POPs Regulation regarding provisions for limits for flame retardant DecaBDE may impact the recycling rate for plastics previously used in electrical & automotive equipment. Similarly, HBCD contained in insulation products in construction and demolition wastes will demand greater care in the management of this waste stream. Where required, the Action Plan advocates both research and enforcement/surveillance activities. This approach strives to ensure that environmentally sound management takes place while reducing the risks of re-introducing POPs into material cycles.

Implementation of priority actions will involve considerable and continued collaboration for all stakeholders across industry, government departments, local authorities etc. to map out specific measures which are aligned with the Plan and to chart work programmes, to fulfil these specific measures.

Action plan

Article 5 of the Stockholm Convention requires parties to outline measures to reduce or eliminate releases from unintentional production of POPs. However, intentional POPs have been included in this action plan to assess and mitigate against risks posed by these substances to human health and the environment. Future priority target areas and actions to support existing work in relation to POPs are listed below:

Table 1 Action Plan for Intentional & Unintentional POPs

Priority areas for NIP Implementation				
Plan actions	Tasks	Industry(I)/ Agriculture(A)/ Unintentional(U)	Applicable substances	Owner(s)
Enforcement	Continued enforcement of the prohibition of unauthorised use of waste oils for space heating.	U	PCDD/PCDF, PCBs, HCB, PCN	Local authorities
	Compliance with Air Pollution Act (Marketing, Sale, Distribution and Burning of Specified Fuels) Regulations 2012	U	PCDD/PCDF & PCBs	Local authorities, EPA
	Pesticide control	A, I, U	POP Pesticides	Department of Agriculture, Food & Marine
	Market surveillance (POPs, REACh & RoHS)	I	POP-BDE, HBCD, HCBD	EPA
	Backyard burning	U	PCDD/PCDF, PCBs, HCB, PCN	Local authorities
	Conditions included in Waste & IED authorisations (including promotion of BAT & BEP)	I, U	PCBs, HCB, POP-BDE, HBCD, HCBD	EPA & Local authorities
Regulation, Control & Waste Management	Stockpile identification and waste management	I, A, U	PCBs, HCB, POP Pesticides, POP-BDE, HBCD, HCBD & PFHXSs	EPA, Local authorities, Department of Agriculture, Food & Marine &holders of materials confirmed or suspected of containing POPs
	Nature & extent study for specific POPs (Irish context)	I	POP-BDE, HBCD, HCBD, PCBs, PCN	EPA
	New & Candidate POPs included into relevant monitoring programmes	I	New & Candidate POPs (e.g. Perfluoroalkyls)	EPA, Department of Agriculture, Food & Marine, Marine Institute, Food Safety Authority of Ireland Department of Housing, Planning and Local Government (DPHLG), Irish Water, Institute of Fire Engineers & DCCAE
	Risk assessments for certain POPs for relevant environmental media	A, I, U	POP Pesticides, POP-BDE, HBCD, HCBD, PCN	EPA

	Circular Economy and POPs waste interface	I	POP-BDEs, HBCD, HCBD	EPA and Department of Communications, Climate Action and Environment
Information, Research and Reporting	Participation in relevant International/EU/National/Internal working groups on POPs and exchange of information with relevant stakeholders	A, I, U	All POPs	All relevant public bodies
	PCB inventory maintenance and reporting	I	PCBs	EPA
	Inventories of intentional and unintentional POPs	A, I, U	All POPs	EPA
	Evaluate/consider revised reporting arrangements under the recast of the 2004 EU POPs Regulation	A, I, U	All POPs	All relevant public bodies
	Information gathering regarding the actions foreseen within Ireland's National Clean Air Strategy.	A, I, U	Selected POPs, including PAH's	All relevant public bodies
	Align information and reporting obligations with the EU Waste Framework Directive amendment (2008/98/EC) requirements	A, I, U	All POPs	All relevant public bodies
	Compilation and generation of POPs reports	A, I, U	All POPs	All relevant public bodies
	Presentation of appropriate information/guidance on chemicals to the public through various communication media	A, I, U	All POPs	All relevant public bodies
Awareness & Guidance	Sectoral guidance and information	A, I, U	Selected POPs	EPA, Department of Communications, Climate Action and Environment, Department of Housing, Planning and Local Government and all relevant public bodies
	Design and implement communication plan for POPs NIP implementation.	A, I, U	All POPs	EPA
	Ensure all relevant information is made available to the policy makers, public and relevant bodies	A, I, U	All POPs	EPA, All relevant public bodies

SECTION 1

1 Introduction

1.1 Background and Purpose

Persistent Organic Pollutants (POPs) are organic substances that are characterised by a combination of physical and chemical properties such that, once released into the environment, they remain relatively stable for long periods of time and are toxic to both humans and wildlife.

The Stockholm Convention on POPs is a global treaty aimed to protect human health and the environment from the threats posed by POPs. The Stockholm Convention entered into force on 17th May 2004 and is administered by the United Nations Environment Programme (UNEP). The Convention supplements another international agreement regarding POPs known as the Protocol to the 1979 UNECE Convention on Long-Range Transboundary Air Pollution (LRTAP) on Persistent Organic Pollutants (referred to as the POPs Protocol) which also aims to reduce and eliminate the production, use and releases of POPs. Further information on releases under the LRTAP can be found in Section 5.

Substances that are listed under the Convention are subject to a ban or severe restriction on production, import, export and use. Measures are also required to eliminate or reduce releases from stockpiles and the environmental sound disposal of waste containing POPs.

The Convention requires Parties[6] to implement a national plan for the implementation of its obligations under the Convention and to review and update the national implementation plans on a periodic basis to include the taking of measures to eliminate or reduce the release of POPs into the environment.

The Conference of the Parties (COP) was established under Article 19 of the Convention. The COP is the governing body of the Stockholm Convention and is composed of governments of countries that have accepted, ratified or acceded to it. The implementation of the Convention is progressed through the decisions reached at the COP meetings. It considers and adopts, as required, amendments to the Convention and its annexes, e.g. to list new chemicals.

For a substance to be classified as a POP, it must undergo an assessment to determine that it is persistent, bioaccumulative, toxic and can undergo long-range environmental transport. If they are subsequently classified as POPs, they are then listed under the annexes of the Stockholm Convention as follows (see Figure 2);

[6] Countries or signatories that have ratified the Stockholm Convention.

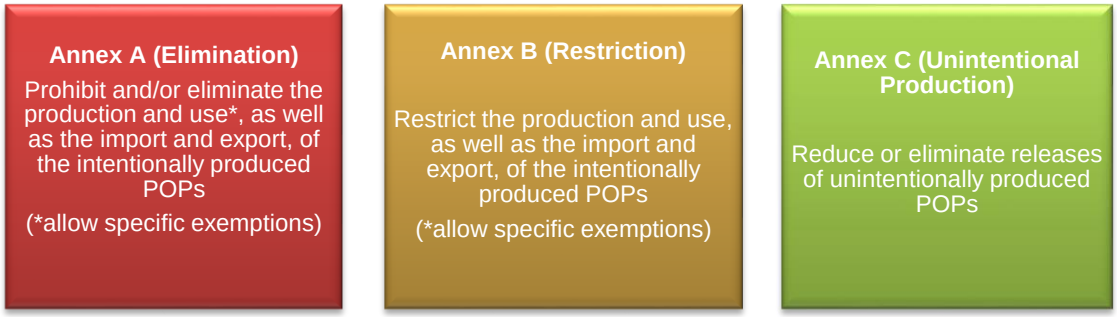


Figure 2 Annex A, B & C of the Stockholm Convention

To date there have been 26 substances or groups of substances that have been listed under the Annexes of the Stockholm Convention and these can be divided into three main categories; pesticides, industrial chemicals, and unintentional POPs. Table 2 lists the POP substances currently listed under the Convention. A description of each POP as described under the Stockholm Convention is provided in Appendix II.

Table 2 Substances listed under Stockholm Convention

Substance name	Pesticide[7]	Industrial	By-product[8]	Listed in Annex	Year banned or restricted[9]
Aldrin	✓			A	1998
Chlordane	✓			A	1992
Dieldrin	✓			A	1981
Endrin	✓			A	1981
Heptachlor	✓			A	1981
Mirex	✓			A	Never authorised for use in IE
Toxaphene	✓			A	1985
DDT	✓			B	1985
Lindane (and Alpha and Beta hexachlorocyclohexane)	✓			A	1981
Chlordecone	✓			A	1992
Technical endosulfan and related isomers	✓			A	2005
Hexabromodiphenyl ether and heptabromodiphenyl ether		✓		A	2010
Tetrabromodiphenyl ether and pentabromodiphenyl ether		✓		A	2010
Hexabromobiphenyl		✓		A	2010
Perfluorooctane sulfonic acid, its salts and perfluorooctane		✓		B	2010

[7] Pesticide use when describing POPs applies to several different applications such as use in agricultural and forestry applications, and insecticide use in veterinary and human applications.

[8] By-products are unintentionally produced because of chemical and thermal processes (e.g. dioxins from backyard burning

[9] Ireland (IE) became a party to the Convention after the adoption and / or entry into force of the amendments; the date indicated is therefore the date of entry into force of the Convention for IE. Note: some of the dates listed refer to bans and restrictions made under other legislation, such as Biocide Regulations, prior to IE becoming a party to the Stockholm Convention.

Substance name	Pesticide[7]	Industrial	By-product[8]	Listed in Annex	Year banned or restricted[9]
sulfonyl fluoride					
Pentachlorobenzene	✓	✓	✓	A, C	Never authorised for use in IE
Hexachlorobenzene	✓	✓	✓	A, C	1981
Polychlorinated biphenyls (PCBs)		✓	✓	A, C	2004
Hexabromocyclododecane (HBCD)*		✓		A	2013
Polychlorinated Naphthalenes*		✓		A, C	2015
Hexachlorobutadiene (HCBD)*		✓		A, C	2015/2017
Pentachlorophenol and its salt and esters (PCP)*		✓		A	2015
Polychlorinated dibenzo-p-dioxins			✓	C	2010
Polychlorinated dibenzofurans			✓	C	2010

*Newly-listed POPs.

For POPs that are formed and released unintentionally because of chemical and thermal processes, there are requirements to reduce, minimise and, where feasible, eliminate their release. These substances include polychlorinated dibenzo-p-dioxin (PCDD or dioxins), dibenzofurans (PCDF or furans), polychlorinated biphenyls (PCBs), hexachlorobenzene and pentachlorobenzene. As dioxins and furans are frequently formed by the same processes, e.g. uncontrolled combustion, for practical reasons they may sometimes referred to as "dioxins" only.

1.2 Listing of new POPs

There are a number of other chemicals currently being evaluated for possible future listing under the annexes of the Stockholm Convention. As more chemicals are listed, Ireland's National Implementation Plan will be updated in accordance with the requirements of the Convention. At its eighth COP in 2017, Annexes A and C of the Stockholm Convention were amended to list the following substances (see table 3):

Table 3 Substances agreed for listing at COP 8, 2017

Substance name	Use & Description	Sector	Listed in Annex
Hexachlorobutadiene (HCBD)	Most commonly used as a solvent for other chlorine-containing compounds.	Industrial	C[10]
Decabromodiphenyl ether (commercial mixture, c-DecaBDE) in (with specific exemptions).	Vehicles, aircraft, textile, additives in plastic housings etc., polyurethane foam for building insulation	Industrial	A

[10] Hexachlorobutadiene has been recently listed in Annex C in addition to Annex A.

Substance name	Use & Description	Sector	Listed in Annex
Short-chain chlorinated paraffins (with specific exemptions)	Additives in transmission belts, rubber conveyor belts, leather, lubricant additives, tubes for outdoor decoration bulbs, paints, adhesives, metal processing, plasticizers.	Industrial	A

In addition, the following substances are now under review with a view to future listing under the Stockholm Convention:

Table 4 Substances under review

Substance name	Use & Description
Dicofol	Organochlorine pesticide chemically related to DDT. The substance is a miticidal pesticide and acaricide used in many countries around the world on a wide variety of fruit, vegetables, ornamental and field crops.
Pentadecafluorooctanoic acid (PFOA, perfluorooctanoic acid), its salts and PFOA-related compounds	PFOA-related substances have been widely used for the production of fluoroelastomers and fluoropolymers, with polytetrafluoroethylene (PTFE) being the most important fluoropolymer. PFOA-related substances are used in fire-fighting foams, wetting agents and cleaners. The side-chain fluorinated polymers have been employed to provide water and grease protection for textiles and leather, paper and cardboard (e.g. food packaging). These substances have also been incorporated into paints and lacquers. Other applications for these chemicals include those relating to non-woven medical garments, floor waxes and stone/wood sealants, thread sealant tapes, pastes and adhesives. Fluorotelomers are mainly used in textiles and apparel, in carpets and carpet care products and coatings including those for paper products.
Perfluorohexane sulfonic acid (PFHxS), its salts and PFHxS-related compounds	Members of the perfluoroalkyl substance (PFAS) group, PFHxS and PFHxS-related compounds have been widely used as surfactants, to make fluoropolymers and as water- and stain-protective coatings for carpets, paper and textiles. PFHxS is present in some fire-fighting foams, paper, water proofing agents and textiles treatments and other products (Herzke, et al., 2012). PFHxS and its salts and precursors have also been used as raw materials to produce PFAS-based products such as surfactant and surface protection products but are also unintentionally produced during industrial processes.

Note: this plan update will specifically address substances as agreed for listing during the Conference of Parties (COP) meetings 6 & 7.

1.3 Integration of National Implementation Plan and update

The National Implementation Plan and any periodic updates are required to be considered and integrated into national sustainable development strategies. A Framework for Sustainable

Development for Ireland was published in 2012 (DoECLG, 2012)[11]. It states that, as a member of the EU, Ireland will continue to engage proactively with the various international chemical regimes to ensure that hazardous substances that have been identified as being of global concern can be addressed rapidly through agreed processes. The plan update was prepared in consultation with public authorities, national stakeholders and the public. Ireland is a party to the Rotterdam, Stockholm and Basel Conventions respectively and will continue to implement its obligations under these agreements and their associated EU regulations.

1.4 Structure of Updated National Implementation Plan

The Stockholm Convention Guidance for developing a National Implementation Plan for the Stockholm Convention (UNEP, 2017) and the European Union Community Implementation Plan (EU Commission, 2014) were consulted when developing Ireland's National Implementation Plan. **Error! Reference source not found.** outlines the structure of the plan.

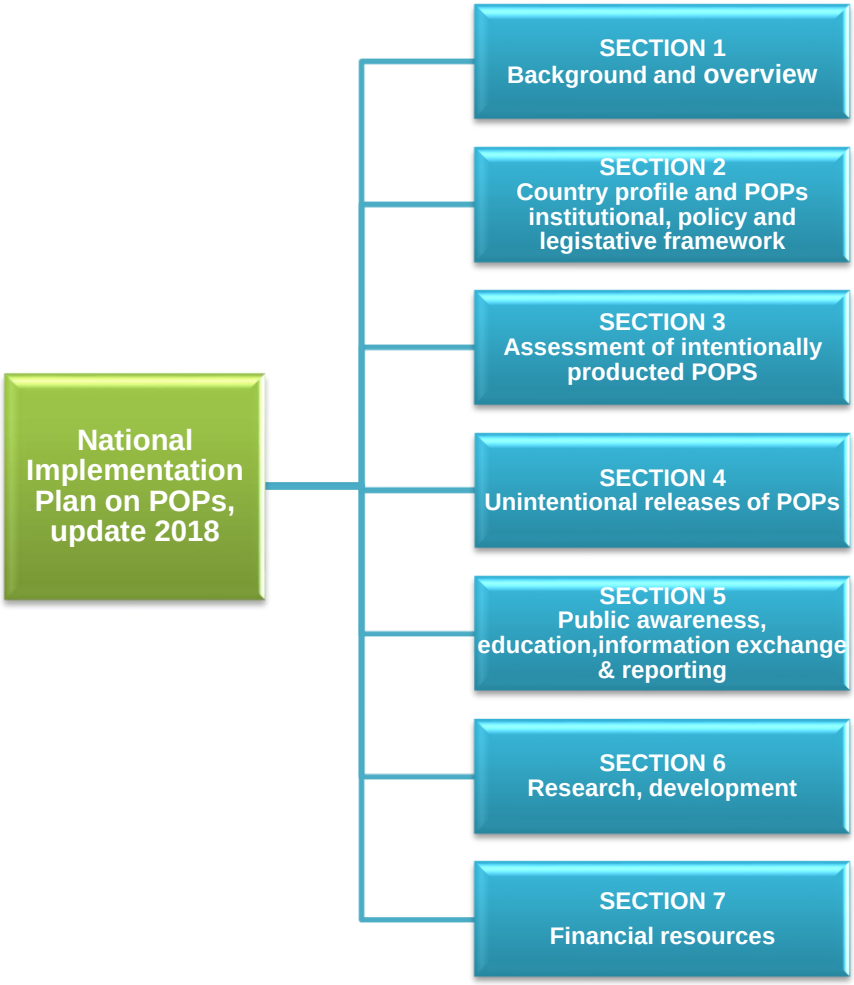


Figure 3 Structure of the National Implementation Plan

Also, the following colour coding has been developed to display the types of environmental media relevant for each of the substances/substance group included in the plan; including air, aquatic &

[11] Formerly DoECLG, now Department of Communications, Climate Action & Environment (DCCAE) following change in Government.

marine, food, waste and other. Information presented includes all associated monitoring, research or enforcement carried out for that substance/substance group.

AIR
MARINE & AQUATIC ENVIRONMENT
SOIL & LAND
FOOD
WASTE
OTHER (Not falling into one specific category as listed above)

SECTION 2

2 Country Profile

2.1 Geography and population

The Republic of Ireland (Ireland) occupies 70,282 square kilometres of the island of Ireland and is located in the north-west of Europe lying between 51° and 55° north latitude and 5° and 10° west longitude (Nolan, 2011). Agricultural lowlands make up a significant portion of the land area and inland waters comprise a much higher percentage of total area in Ireland compared to many other European countries. The extended, heavily indented coastline (over 7,000 km) and large expanse of territorial waters have contributed to its marine diversity (Nolan, 2011).

The dominant influence on Ireland's climate is the Atlantic Ocean. Consequently, Ireland does not suffer from the extremes of temperature experienced by many other countries at similar latitude. The warm North Atlantic Drift has a marked influence on sea temperatures. This maritime influence is strongest near the Atlantic coasts and decreases with distance inland. The hills and mountains, many of which are near the coasts, provide shelter from strong winds and from the direct oceanic influence. Winters tend to be cool and windy, while summers, when the depression track is further north and depressions less deep, are mostly mild and less windy. Over the last 30 years or so rainfall amounts have increased by approximately 5%. There are also indications of an increase in the number of very wet days (days with rainfall >20mm). Most of the eastern half of the country gets between 750 and 1000 mm of rainfall annually. Annual rainfall in the west generally averages between 1000 and 1400 mm. Climate projections for rainfall have greater uncertainty than for temperature, and indicate that overall rainfall amounts in Ireland might decrease slightly; summers are likely to become drier while winters may be wetter especially in the west and north (Met Eireann, 2017).

Ireland has a relatively sparse density of population with 70 inhabitants per square kilometre (Central Statistics Office, 2017). The population census of 2016 revealed that Ireland's population has increased 3.7% since 2011, according to preliminary results from the census. The population has now grown to 4.76 million people (CSO, 2016). Most of Ireland's population live in urban centres with 44% of the State's total urban population living in Dublin, while 11% living in Cork. Life expectancy at birth in Ireland is 78.4 years for males and 82.8 years for females, which are reasonably close to the EU average (CSO, 2015) In the period 2010-2012, Irish male life expectancy ranked in joint 10th place with Germany while Irish female life expectancy ranked 17th within the EU.

2.2 Policy & Legislation

Ireland is a parliamentary democracy. The National Parliament (Oireachtas) consists of the President and two Houses: Dáil Éireann (House of Representatives) and Seanad Éireann (the Senate) whose functions and powers derive from the Constitution of Ireland. The Dáil, or the principal chamber of the parliament, is composed of 158 members while the Seanad, or upper house, has 60 members (Oireachtas, 2017). Parliamentary elections are held every five years. Ireland joined the European Union (then known as the European Economic Community) in 1973.

2.3 Economy

Ireland has a small, open, trade-dependent economy. Its openness is reflected in the international mobility of its labour and capital, demonstrated by strong migratory flows and high levels of foreign direct investment (ESRI, 2011). However, as an open economy, Ireland is more influenced by changes in international trading and taxation. Employment has recovered to its pre-fiscal crisis levels in the

early part of 2018 (EU Commission, 2018) and currently has an unemployment rate of close to 6%. The ESRI's Quarterly Economic Commentary, published in September 2018 states that Ireland's GDP is expected to grow by 4.7 per cent in 2018, followed by 3.9 per cent growth in 2019. Unemployment is expected to decline to 5.6 per cent in 2018 and 5.0 per cent in 2019 (ESRI, 2018). However, the forecasts are somewhat uncertain with the impending departure of UK from the EU (OECD, 2018).

2.4 The Irish environment

The EPA's State of the Environment report 2016, identifies many positive aspects associated with the Irish environment. Air quality is generally classified as good relative to other EU countries (EPA, 2016a), however, according to the EPA's 2016 air quality report, maintaining this standard is becoming a challenge. The quality of Ireland's surface waters has remained relatively static since 2007–2009 and improvements, planned for under the first river basin management cycle, have not been fully achieved. Nationally, 91% of groundwater bodies, 57% of rivers, 46% of lakes, 31% of transitional (estuarine) waters and 79% of coastal waters are achieving either good or high status under the Water Framework Directive (WFD) (EPA, 2017b).

Ireland is achieving EU waste legislative targets for recovery and recycling of specific waste streams such as packaging, waste electrical and electronic equipment, batteries & accumulators and the diversion of biodegradable municipal waste from landfill. Continuing the upward trend in the reuse, recycling and recovery of ELVs in recent years, Ireland achieved the 2015 ELV Directive reuse and recycling target in 2016, however, the reuse and recovery target was not achieved (EPA, 2018).

Ireland is at a crossroads as to how it addresses the global environmental challenge of climate change. In the longer term, national greenhouse gas (GHG) emissions have increased when measured against 1990 levels; this is at odds with the overall achievements of the EU, where GHG emissions have decreased (EEA, 2016). According to Ireland's Provisional Greenhouse Gas Emissions report 2018, the total national greenhouse gas emissions are estimated to be 60.75 million tonnes carbon dioxide equivalent (Mt CO_2 eq) which is 0.9% lower higher (0.53Mt CO_2 eq) than emissions in 2016. However, whilst there has been a reduction in emissions in 2017, the decreases are mainly due to mild weather conditions which is evident in residential heating and increase renewables in electricity generation. (EPA, 2018)

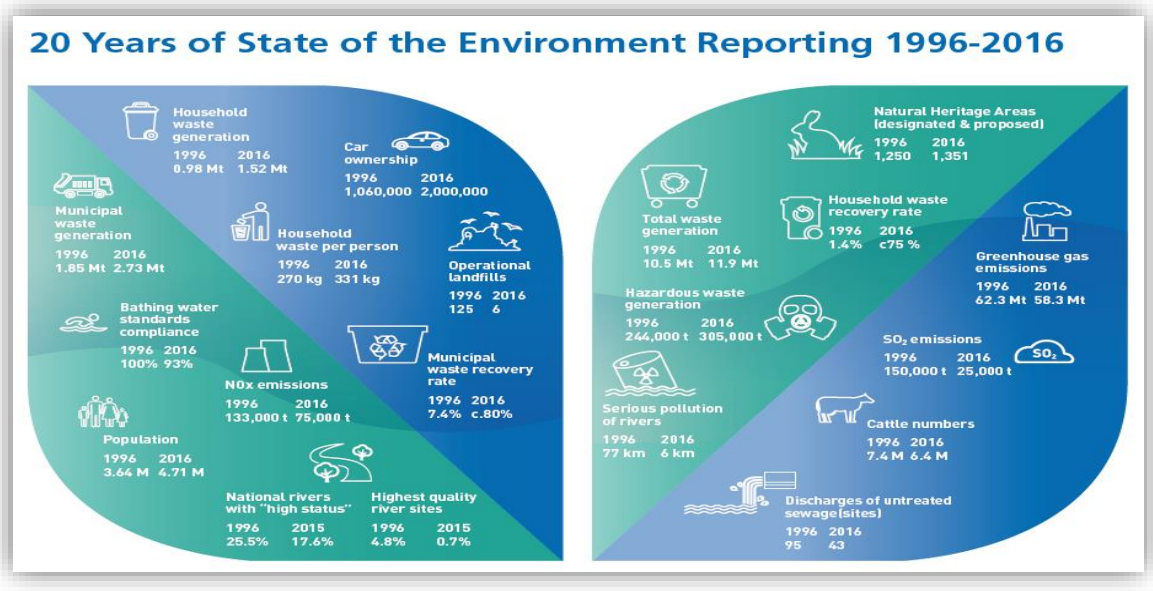


Figure 4 State of Environment infographic (1996-2016)

2.4.1 Air

Ireland's air quality currently is good relative to other EU Member States, but maintaining this standard is a growing challenge. While monitoring, stations show Ireland continues to meet all EU air quality standards, localised air quality issues do arise. During 2016, the WHO guideline values[12] were exceeded at several monitoring sites for particulate matter (PM_{10} and $PM_{2.5}$), ozone, SO_2 and NO_2.

The 2016 dioxin survey shows that concentrations of dioxins and similar pollutants remain at a consistently low level in the Irish environment (EPA, 2016a). The latest EPA air quality report 2016 outlines plans to carry out a new ambient air monitoring programme which will assist in assessment of air quality at a more local level together with the introduction of the Irish Government's 'National Clean Air Strategy'.

The introduction of the Irish 2012 Solid Fuel Regulations (S.I. No. 326 of 2012) consolidate and update the existing provisions of the Air Pollution Act (Marketing, Sale and Distribution of Fuels) Regulations 1998-2011 into a single piece of legislation, replacing and revoking the pre-existing regulations. The Regulations introduce, for the first time, a ban on the burning of bituminous-based fuels in residential dwellings in specified areas to complement the existing ban on the marketing, sale and distribution of bituminous coal. Detailed mapping of the specified areas is available on the Department of Communications, Climate Action and Environment (DCCAE) website[13]. The Regulations require that bags of solid fuel sold in specified areas where the ban applies must be sealed and have a printed notice in accordance with Schedule 3 of the regulations. The Regulations require inter alia that all bituminous ('smoky') coal supplied for residential heating outside specified areas (i.e. ban areas) must have sulphur content not greater than 0.7% by weight and there are specific requirements for the marking and marketing of smoky coal.

2.4.2 Water

Ireland has abundant surface water resources, with over 70,000 km of river channel, 12,000 lakes, 850 km^2 of estuaries and 13,000 km^2 of coastal waters. Groundwater is also abundant and provides over 20% of water supplies nationally.

In response to the increasing threat of pollution and the increasing demand from the public for cleaner rivers, lakes and beaches, the EU developed the Water Framework Directive (WFD)[14]. This Directive establishes a framework for the protection of all waters including rivers, lakes, estuaries, coastal waters and groundwater, and their dependent wildlife/habitats under one piece of environmental legislation.

During the first cycle of the WFD, the EPA was assigned many tasks under the European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003), which come under the category of "coordination and oversight" of the Irish WFD programme. Groundwater, rivers, lakes, transitional and coastal waters are the four water categories of the aquatic monitoring and assessment programme that the EPA and Ireland report on when assessing whether the environmental objectives of the WFD are being met (EPA, 2018).

[12] WHO (World Health Organisation), 2005. Air Quality Guidelines – Global Update, WHO, Geneva
[13] http://www.environ.ie/en/Environment/Atmosphere/AirQuality/SmokyCoalBan/#maps.
[14] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

The first cycle of River Basin Management Plans (RBMPs) and associated Programme of Measures concluded in 2014. The second cycle plan 2018-2021[15] published in early 2018 contains another extensive programme of measures using a more coordinated framework for improving the quality of Irish waters, aiming to protect public health, the environment, water amenities and to sustain water-intensive industries, including agri-food and tourism, particularly in rural Ireland.

2.4.3 Soil and Land

The most recent assessment in 2012 shows that agriculture is the primary Land Use & Land Cover (LULC) type within Ireland (67.4% national land cover), followed by wetlands (15.6%) and forestry (9.4%). In the absence of an EU Soils Directive and associated national soil legislation, the challenge remains to ensure a consistent approach to protecting and managing our limited soil resource, in the context of supporting environmentally sustainable economic and population growth (EPA, 2017a). A national working group is implementing a co-ordinated national mapping programme. This programme will be essential to monitor, report and assess the environmental impacts of different land cover and land uses in the future.

2.4.4 Nature and biodiversity

Due to Ireland's geographic isolation and recent geological history it has a lower diversity of non-marine flora and fauna than is found on continental Europe. Nevertheless, Ireland's aquatic systems and wetlands support internationally significant populations of birds, fish and invertebrates. Ireland's marine environment is particularly diverse and is among Europe's richest for cetaceans (whales, dolphins and porpoises). It supports large seabird breeding colonies, a great range of invertebrate species, and its cold-water coral communities are of particular note, supporting a diverse array of associated fauna.

In addition, Ireland has a significant number of internationally important habitats including limestone pavements, machair, turlough and active peatlands (EPA, 2016a). Ireland is a signatory to the UN Convention on Biological Diversity (CBD) and is committed to the biodiversity goals and targets set out in the Convention's Strategic Plan for Biodiversity 2011-2020 (Biodiversity Ireland, 2018).

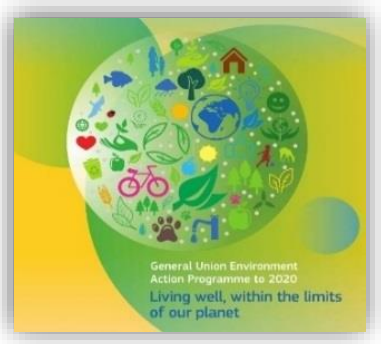
2.4.5 Waste

Irelands' average household waste generation per capita was 580kg in 2016[16], The amount of residual waste exported for energy recovery has increased significantly in recent years. At the same time, the quantity of residual waste disposed to landfill decreased as did the number of operational landfills. Five landfills are accepting municipal waste in 2018 compared to 25 in 2010. Additional waste-to-energy capacity is now available in Ireland with a second municipal waste incinerator operational at full capacity (EPA, 2018).

Ireland's Waste Prevention Programme (administered and led by the EPA since 2004) continues to fund and support multiple programmes in line with the ambitions of the 7th EU Environment Action Programme[17] towards attainment of a circular economy.

[15] http://www.housing.gov.ie/water/water-quality/river-basin-management-plans/river-basin-management-plan-2018-2021.
[16] http://www.epa.ie/nationalwastestatistics/indicators/
[17] Decision No 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 'Living well, within the limits of our planet'.

2.5 Institutional, policy and regulatory framework for POPs



Article 5 of the Stockholm Convention requires an evaluation of the laws and policies of the Party relating to the management of unintentional POP releases. Controls on unintentionally released POPs are typically driven by European Union and national legislation and policies. The United Nations Environment Programme (UNEP)'s report on the sound management of chemicals and wastes set the context regarding the delivery of specific Sustainable Development Goals under Agenda 2030 and the clear linkages with the mandate of Stockholm, Rotterdam and Basel Conventions.

As a Member State of the European Union (EU), Ireland's environmental legislation is predominantly driven by European legislation which includes the control of chemicals including POPs. In 2013, the European Parliament and Council adopted the 7th EU Environmental Action Programme, which takes a broad look at the environmental challenges and provides a strategic framework for the Commission's environmental policy up to 2020. This programme identifies three priority areas:

- 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 programme also sets an objective "that chemicals are produced and used in ways that lead to the minimisation of significant adverse effects on human health and the environment".

There are other related measures particularly at European and national level that are referenced throughout this plan which are relevant to the control of POPs such as legislation concerning chemicals, pesticides and biocides, food safety and environmental quality. Appendix 2 also outlines key EU legislation concerning dioxins, furans and PCBs.

The first EU Community Implementation Plan was published and submitted to the Stockholm Secretariat in March 2007 and addressed the Convention as entered into force in 2004. The second Union Implementation plan was published and submitted in June 2014 which addressed the amendments to the Convention adopted at the 4th and 5th Conferences of the Parties. The preparation of the next revision of the Union Implementation Plan, which will address the amendments to the Convention adopted at the 8th Conference of the Parties held in 2017 is underway.

The Waste Framework Directive EU 2018/851 of 30th May 2018, which amends the 2008/98/EC Directive, introduces a stricter regime for the traceability of substances within the supply chain and a general reduction in the hazardousness of mixtures and articles in line with the 7th EU Environmental action programme as outlined above.

2.6 Roles and responsibilities of relevant bodies for obligations under EU POPs Regulation

Organisations that are considered to have a key role in the fulfilment of obligations under the EU POPs Regulation[18] and the Stockholm Convention are listed in the national POPs regulations. This list is not exhaustive and there are other organisations that may also have a role to play in the monitoring and control of POPs. A description of the organisations and their main responsibility in relation to POPs referred to in the national POPs regulations is provided in Table 2 below.

Table 5 Main roles of organisations listed under the national POPs regulations

Organisation	Main responsibilities related to POPs
Department of Communication, Climate Action and Environment (DCCAE)	National policy and regulations concerning POPs
Environmental Protection Agency (EPA)	• Competent Authority for the purposes of the EU POPs Regulation. • Monitoring, permitting, licensing or enforcement systems concerning licensable activities under the EPA Acts and activities under the Dumping at Sea Acts. • Surveillance of products regarding content of POPs.
Health and Safety Authority (HSA)	• Administrative functions required under the EU Prior Informed Consent Regulation for POPs that are listed within this Regulation • Provision of relevant information to the EPA, as appropriate. • Lead competent authority for the REACh Regulation in Ireland.
Department of Agriculture, Food and the Marine (DAFM)	• Ensure that POPs intended for use as pesticides are not marketed or used. • Monitoring of primary food and feed for the presence of POP pesticides. • Cooperate with the EPA in the identification of any person who produces, places on the market or uses relevant substances containing POPs. • Provision of data to the EPA resulting from monitoring, inspections, checks, examinations and investigations concerning POPs. • Carry out the administrative functions required under the EU Prior Informed Consent Regulation for POPs that are listed within that Regulation and the provision of relevant information to the EPA, as appropriate. • Participate in the ECHA PBT (Persistent, Bioaccumulative and Toxic) Expert Group.
Health Products Regulatory Authority (HPRA) Formerly Irish Medicines Board	• Ensure that medicinal products for human or veterinary use that are authorised for the Irish market do not contain POPs. • Cooperate in the identification of any person who produces, places on the market or uses relevant substances containing POPs. The provision of data to the EPA resulting from monitoring, inspections, checks, examinations and investigations concerning POPs.

[18] Regulation (EC) No 850/2004 of the European Parliament and of the Council of 19 April 2004 on persistent organic pollutants and amending Directive 79/117/EEC as amended.

Organisation	Main responsibilities related to POPs
Food Safety Authority of Ireland (FSAI)	• Monitoring and investigations relating to food and foodstuff containing POPs. • Provision of data to the EPA resulting from monitoring, inspections, checks, examinations and investigations concerning POPs.
Marine Institute (MI)	• Monitor levels of chemical substances in finfish and shellfish to underpin the quality and safety of seafood produced and landed in Ireland in conjunction with the Sea Fisheries Protection Authority (SFPA) and the FSAI. • Completion of one-off surveys and research projects (where relevant with other national and international agencies), for instance investigations into occurrence of contaminants not included in regular monitoring.
Health Service Executive (HSE)	• Food sampling, analysis and investigation of POPs in foodstuffs and public awareness of public health issues in consultation with the EPA.
Revenue's Customs Service	• Control at point of importation of specified POPs to be based on criteria agreed with the EPA regarding the identification of consignments of interest to the EPA. • Cooperate, by means of post clearance data exchange in the identification of relevant importations. • Assigned specific responsibilities for the purposes of the EU Prior Informed Consent Regulation in respect of certain hazardous chemicals.
Local Authorities	• Monitoring, permitting or enforcement systems within their functional areas regarding POPs and relevant requirements under the Waste Management, Water Pollution and Air Pollution Acts. • Cooperate in the identification of any person who holds a stockpile or waste containing POPs or who produces, disposes or recovers POPs containing wastes. • The provision of data to the EPA resulting from monitoring, inspections, checks, examinations and investigations concerning POPs.

Control, management and monitoring of POPs are actively considered on an on-going basis in several specific areas e.g.: monitoring under the Water Framework Directive, Marine strategy Framework Directive, licencing, enforcement and research. There are other organisational and national groups established in this area to further the exchange of information regarding POPs and other chemicals of emerging concern. Such groups will continue to contribute to the implementation of the plan.

- National Aquatic Chemistry Group
- REACh Interdepartmental/Interagency Group
- National Pesticides and Drinking Water Action Group
- National Waste Enforcement Steering Committee.

The EPA has established an internal cross office working group (Chemicals Cross Office Team (CHEM-COT)) to coordinate efforts regarding POPs and the wider area of chemicals in the environment. The group includes representation from thematic areas including Licensing, Enforcement, Air, Water & Research and Chemicals. The team acts as a forum for the discussion and co-ordination of the EPA position and roles in relation to POPs and chemicals control. An accessible and efficient data/information exchange will be established to ensure successful implementation of the plan.

SECTION 3

3 Intentional POPs

3.1 General assessment of POPs used in agriculture and industry in Ireland

Intentionally produced POPs are substances which are or were manufactured for specific purposes. These include specified chemicals for use in agricultural, forestry, human health and/or veterinary applications. Other intentionally produced POPs include PCBs e.g. for use as an electrical insulator, POP brominated flame retardants and PFOS e.g. for use as a water repellent on fabrics. While the manufacture and use of most of these substances has been banned under the Stockholm Convention, some exemptions apply for specific applications.

This section describes the situation in Ireland for each of the intentionally produced POPs listed under the Stockholm Convention, including uses and measures in place to prohibit or restrict them (if applicable), waste management issues and their presence in food and the environment based on available monitoring information.

Due to the potential serious risks, both to human health and the environment, posed by POPs, many of these substances are included in monitoring programmes related to air, water (both the aquatic and marine environments respectively), soil, food and others e.g. relevant waste streams. The following paragraphs provide more information on POPs monitoring programmes for air, water, soil and waste, pertaining to the Irish environment.

3.2 Monitoring programmes

AIR

Ireland participates in the Global Atmospheric Passive Sampling (GAPS) programme which includes monitoring of POPs. The GAPS programme aims to determine spatial and temporal trends in air; screen for and identify new chemicals in air; and contribute useful data for assessing regional and global long-range atmospheric transport (Government of Canada, 2010). Samples are taken at regular intervals and tested for specific POPs. The GAPS network, consists of a sampling network covering more than 60 sites on 7 continents around the world including a station at Malin Head, Co. Donegal in North West Ireland.

The EPA carries out on-going monitoring on the levels of certain POPs, including dioxins, PCBs and POP-PBDEs in the environment based on the sampling and analysis of cows' milk. Cows tend to graze over relatively large areas with the likelihood they will ingest POPs deposited from the atmosphere onto grass and so these programmes provide indications of the levels of the POPs in air. The EPA also conducts annual ambient air quality monitoring (including for PAH's)[19]. Furthermore, specific monitoring requirements of atmospheric emissions are included within relevant IED permits, such as those issued to cement kilns for the co-incineration of waste.

[19] http://www.epa.ie/air/quality/monitor/

AQUATIC & MARINE ENVIRONMENT

Extensive monitoring has been carried out in Irish lakes, rivers, coastal and transitional waters respectively and groundwater as part of screening and surveillance programmes under the Water Framework Directive (WFD). POP pesticides, including hexachlorobenzene, pentachlorobenzene, dieldrin, DDT, lindane and endrin, were detected during a WFD screening programme during 2005 and 2006. Following the initial WFD screening, the EPA undertook a surveillance programme in between July 2007 and 2009 which included monitoring of approximately 250 river and lake sites. The list of substances measured included priority substances determined at EU level.[20] and other pollutants determined during the screening programme.

Between 2010-2012 another similar surveillance programme was carried out which included testing samples taken from groundwater, rivers, lakes, canals, transitional waters and coastal waters. The programme drew on work carried out by Local Authorities, Inland Fisheries Ireland, the Marine Institute, the Sea Fisheries Protection Authority, the Irish Coast Guard and the EPA (EPA, 2015a). POPs monitored in either or both the 2007-2009 and 2010-2012 programmes respectively included aldrin, C_{10}-C_{13} chain chloroalkanes, DDT, endrin, endosulfan, dieldrin, hexachlorobenzene, hexachlorobutadiene, hexachlorocyclohexane, pentachlorobenzene and pentachlorophenol.

The Water Quality in Ireland Report (2010-2015), includes details on monitoring undertaken between 2010-2015 (EPA, 2017b). The report includes information collated from several national monitoring programmes undertaken by the EPA, Local Authorities, the Marine Institute, Inland Fisheries Ireland and Waterways Ireland. Reports available for individual water bodies and monitoring stations can be accessed on Ireland's catchment website: www.catchments.ie.

Similar monitoring and surveillance programmes are carried out in the marine environment in Ireland. Such programmes are required to be carried out under the Shellfish Waters Directive (SWD)[21], Marine Strategy Framework Directive (MSFD)[22] and Commission Regulation 1881/2006. The Marine Institute in conjunction with the Sea Fisheries Protection Authority (SFPA) and the Food Safety Authority of Ireland (FSAI), monitor levels of chemical substances in finfish and shellfish for a range of POPs which include PCBs, POP-PBDE, and organochlorine compounds which include aldrin, chlordane dieldrin, DDT (and metabolites), endrin, heptachlor, hexachlorobenzene and hexachlorocyclohexane which underpin the quality and safety of seafood produced and landed in Ireland (McGovern, 2011).

During 2014 the Marine Institute carried out analysis of shellfish samples from 56 designated Shellfish Waters. The programme also met the Water Framework Directive's Transitional and Coastal Waters monitoring requirements (Marine Institute, 2017a). Furthermore, in 2013-2015, the Marine Institute, under the Marine Strategy Framework Directive-descriptor 9 (contaminants in seafood) monitoring programme sampled and tested 129 portions of commercially important fish species landed at major Irish fishing ports for trace metals, organochlorine compounds, indicator and dioxin like PCBs, dioxins and furans and brominated flame retardants, the results of which are included in the relevant food sections of this report.

[20] Decision No 245/2001/EC of the European Parliament and of the Council of 20 November 2001 establishing the list of priority substances in the field of water policy and amending Directive 2000/60/EC.
[21] Directive 2006/113/EC of the European Parliament and of the Council of 12 December 2006 on the quality required of shellfish waters.
[22] Directive 2008/56/EC framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) (Descriptor 9-contaminants in seafood).

Additionally, the Marine Institute, under the National Residues Control Plan (NRCP) monitors chemical residues for aquaculture to ensure farmed fish are acceptable for human consumption. Samples of farmed fish were taken during 2012 (12 samples), 2013 (10 samples), 2014 (10 samples) and 2015 (10 samples) and tested for a variety of organochlorine pesticides which included aldrin, dieldrin, DDT (and DDT degradation product DDE), chlordane (α- and γ-forms), heptachlor (and heptachlorepoxide), hexachlorobenzene, hexachlorocyclohexane and pentachlorobenzene. All samples tested below Guideline Values (Marine Institute, 2015) and (Marine Institute, 2017b).

SOIL & LAND

The extent of POPs monitoring in soil in Ireland is relatively low compared to that for other environmental media. To date, only two programmes in Ireland have included POPs within their monitoring remit. The EPA have recently concluded a small-scale study to propose options on how best to establish a statistically sound baseline for POPs in Irish soils. Study conclusions will be considered as part of the nature and extent studies outlined in the action plan.

During the late 1990's Teagasc, the Irish Agriculture and Food Development Authority, carried out a study on heavy metals and certain organic pollutants, including POPs (hexachlorobenzene, hexachlorocyclohexane and DDT) in soils in the south-eastern region of Ireland. The sampling area represents approximately 22% of the land area of the country (McGrath & McCormack, 1999). The project included testing 295 soil samples for hexachlorobenzene, hexachlorocyclohexane and DDT. Table 6 details the range of levels of the POPs detected in the soil samples.

Table 6 Concentration levels of POPs pesticides monitored in soils in the SE of Ireland

Substance	Range (µg kg^{-1})
Gamma Hexachlorocyclohexane (Lindane)	0.0 - 78.3
Hexachlorobenzene	0.0 - 0.63
Sum DDT	0.0 - 101.0

More recently, in 2012, the Geological Survey of Ireland published a report on a baseline survey of heavy metals and organic chemicals (including PCBs), in topsoil in the greater Dublin area. Sample locations were chosen randomly to give an overview of baseline conditions in the city. Of the 1058 samples taken, a subset of 194 samples were analysed for PCBs. The results indicate isolated, low level detections of PCBs in Dublin, mainly in the city centre. The PCB compositions in soils indicate that contamination is probably associated with historical industrial sources and old paint rather than modern active sources (Glennon, et al., 2012).

Irish Water, Ireland's national water utility organisation, has undertaken to monitor for POPs under their National Wastewater Sludge Management Plan, based on the requirements of the Code of Good Practice for Use of Biosolids in Agriculture.

FOOD

Pesticide residues in food are regulated in Ireland through the implementation of European legislation[23] which establishes maximum residues levels for all pesticides in fruit and vegetables, cereals and in food of animal origin for human consumption. The Food Safety Authority in conjunction with the DAFM carry out the monitoring of food to protect human health. The control programme includes food originating from Ireland, other EU Member States and countries outside the EU and incorporates the following food groups:

- food of plant origin (fruit and vegetables),
- cereals;
- food of animal origin (fat, milk, honey, eggs and dairy produce);
- food of non-marine origin; and
- infant formulae.

Where a maximum residue level as set out in EU legislation is exceeded, a dietary intake calculation is carried out to determine if the residue presents a risk to consumers[24], both adults and children. The results of these evaluations are independently verified by the FSAI. Where a risk to health is determined by the FSAI, the DAFM takes appropriate enforcement action. This may involve removal of the produce concerned from the market and its subsequent destruction. Offenders may also be prosecuted or fined.

POP pesticides have generally been detected at very low levels in fruit, vegetables, cereals and food of animal origin as indicated in Table 6 for the period 2010-2016.

Table 7 POP Pesticide monitoring in food (2010-2016)

POP Pesticide[25]	2010	2011	2012	2013	2014	2015	2016
No of Samples	1,315	1,518	1,540	1,582	1,461	1,157	1,143
Aldrin	0	0	0	0	0	0	0
Dieldrin	1	0	0	0	0	1	0
Endrin	0	0	0	0	0	0	0
Chlordane	0	0	0	0	0	0	0
DDT	0	0	0	0	0	0	0
Heptachlor	0	0	0	0	0	0	0
Hexachlorobenzene	0	0	0	0	0	0	0
Mirex	0	0	0	0	0	0	0
Lindane	0	0	0	0	0	0	0
Endosulfan	0	1	0	0	0	0	0

Source: Data from DAFM 2010-2016.

Note: The exceedance for dieldrin in 2010 was found in a marrow sample of Irish origin. Further tests on produce from the same source detected no exceedance. The exceedance for endosulfan in 2011 was observed in bean (with pod) samples from Morocco. The exceedance for dieldrin in 2015 was found in a summer squash sample of South African origin.

[23] Regulation (EC) No 396/2005 of the European Parliament and of the Council of 23 February 2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin and amending Council Directive 91/414/EEC.
[24] Further information on maximum residue levels is available at: http://ec.europa.eu/food/plant/pesticides/eu-pesticides-database/public/?event=pesticide.residue.selection&language=EN
[25] Toxaphene, Chlordecone and Pentachlorobenzene not included in the residue control programme.

From 2012-2014 the FSAI carried out a Total Diet Study designed to measure the dietary exposure of the population to particular chemicals that may pose a risk to health if ingested in excessive amounts. Foods were tested for pesticides, including POP pesticides. The study found that the very limited occurrence of pesticide residues indicated that the exposure of the Irish population to pesticides in their diet is extremely low (FSAI, 2016).

The DAFM test animal feed for POP pesticides (aldrin, chlordane, dieldrin, endrin, heptachlor, toxaphene, DDT, endosulfan and hexachlorobenzene). In the period 2010 to 2016 there was no detection of any of the POP pesticides in samples analysed.

WASTE

The Stockholm Convention requires Parties to develop appropriate strategies to identify stockpiles, products and articles in use and wastes consisting of, containing or contaminated with POPs substances listed under the Convention. Such stockpiles and wastes are required to be managed in an environmentally sound manner. These requirements have been implemented in Article 7 and Annex IV and V of the EU POPs Regulation which set out specific waste management provisions. Low POPs concentration limits (LPCLs) are specified in Annex IV of the EU POPs Regulation. Wastes containing a POP above the relevant LPCL are required to be managed as POPs wastes[26]. These limits are included in Table 8 Low POPs Concentration Limits specified in Annex IV of the EU POPs Regulation below:

Table 8 Low POPs Concentration Limits specified in Annex IV of the EU POPs Regulation

Substance	Low POPs Concentration Limit
Aldrin	50mgkg^{-1}
Chlordane	
Chlordecone	
Dieldrin	
DDT (1,1,1-trichloro-2,2-bis (4-chlorophenyl)ethane)	
Endosulfan	
Endrin	
Heptachlor	
Hexabromobiphenyl	
Hexabromocyclododecane	1000mgkg^{-1} *(subject to review by the European Commission by 20.04.2019)*
Hexachlorobenzene	50mgkg^{-1}
Hexachlorobutadiene	100mgkg^{-1}
Hexachlorocyclohexanes, including lindane	50mgkg^{-1}
Mirex	50mgkg^{-1}
POP-Polybrominated diphenyl ethers: Tetrabromodiphenyl ether Pentabromodiphenyl ether Hexabromodiphenyl ether Heptabromodiphenyl ether	Sum of concentrations: 1000mgkg^{-1}
Pentachlorobenzene	50mgkg^{-1}
Perfluorooctane sulfonic acid and its derivatives (PFOS)	50mgkg^{-1}
Polychlorinated Biphenyls (PCB)	50mgkg^{-1}

[26]Waste management for waste containing a POPs above the LPCL requires that the waste is disposed of in such a way that the POP content is destroyed or irreversibly transformed so it no longer exhibits the characteristics of POPs (Article 6, Stockholm Convention)

Substance	Low POPs Concentration Limit
Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDF)	15TEFμgkg^{-1}
Toxaphene	50mgkg^{-1}

Permitted disposal and recovery operations are set out in Annex V of the EU POPs Regulation. The LPCL under consideration for DecaBDE[27] will influence the rate of recycling of materials containing the substance.

The EPA has carried out several projects regarding potential releases of POPs to the environment including monitoring of POPs in certain waste streams and sewage sludge. The results confirmed the presence of POPs in low quantities and significantly lower than the specific LPCLs.

The EPA monitors the management of PCB stockpiles under the National PCB Inventory activities. Further information is contained in Section 3.4.1.

Between 2013 and 2017 the EPA, in conjunction with Teagasc, Bord Bia[28], farming representative organisations, Local Authorities and waste management operators, held a total of 46 pilot farm hazardous waste collection events. The collections were geographically spread throughout the State and resulted in approximately 2 tonnes of identified POP pesticides collected and properly managed.

Further information on specific measures for reducing or eliminating release from stockpiles and wastes containing the POPs are outlined under each of the POPs described in this plan including work carried out regarding the National PCB Inventory and the piloted Farm Hazardous Waste Collection campaigns.

3.3 Agriculture - POP Pesticides

SUMMARY ASSESSMENT OF POP PESTICIDES IN IRELAND

All POP pesticides listed under the Stockholm Convention are banned for use in Ireland. Information gathered for environmental media suggest that such POPs maybe detected in food and the Irish environment, but in very low concentrations. However, there is limited monitoring information available for such POPs in soil. POP pesticides may continue to show up in low concentrations in the environment as a result of their past use and persistent nature.

Safeguards are in place to ensure the POPs pesticides do not make their way into the environment in particular because of importation or being present in food imported from countries where such pesticides may still be used. Measures such as routine monitoring of food undertaken by the Department of Agriculture, Food and the Marine are central in ensuring that associated legislative requirements are complied with. Currently there is a high probability that stockpiles of unused POP pesticides, from former use, still exist on farms. Inspections of farm chemicals under existing farm inspection programmes will assist in identifying and raising awareness of such stockpiles.

[27] Note: Yet to be decided at the time of compilation of this document, the LPCL for DecaBDE will likely be consistent with other that set out in other similar legislation, e.g. Directive 2011/65/EU (RoHS Directive).
[28] Irish Food Board.

Fifteen of the POP substances listed under the Stockholm Convention are pesticide-related. POP pesticides are prohibited under the EU POPs Regulation and most have been banned for plant protection use since the 1980s and 1990s.

Pesticide residues, including those from POPs, are routinely monitored by the Department of Agriculture, Food and the Marine (DAFM) in food of plant and animal origin from domestic and imported produce. Monitoring information to date indicates residues of POP pesticides in food is generally low and not of concern (please see Section POPs Monitoring – Food).

Waste pesticides

The DAFM destroyed its strategic reserve of pesticides, including DDT, during the early 1990s. This was followed in 2001 by a campaign to clear out old chemicals from agricultural shops and co-operatives which were subsequently sent for waste disposal.

From 2013-2017, the EPA, in collaboration with the DAFM, Teagasc, Local Authorities, the DCCAE, waste management operators, farming organisations and other stakeholders initiated a pilot scheme for the collection of farm hazardous wastes, including pesticides. There were 46 one day collections in operation between 2013-2017, where over 9,000 farmers safely disposed of nearly 1,000 tonnes of hazardous waste including legacy chemicals.

Over 70 tonnes of waste pesticides were collected over the 5-year campaign, of which 2 tonnes were POPs. POPs collected included DDT, 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), Gamma HCH/HBH Lindane, Endosulfan and Dieldrin.

Article 5 of the EU POPs Regulation requires holders of stockpiles which consists of or contain any substance listed in Annexes I or II for which no use is permitted to manage that stockpile as a POPs waste. The DAFM ensure farm inspections include awareness of the possible presence of and disposal requirements for POP pesticide stockpiles.

3.3.1 Cyclodienes pesticides

Aldrin, dieldrin and endrin belong to a group of chemicals called cyclodiene pesticides[29]. Aldrin may be converted to dieldrin within the environment. The main applications for these cyclodienes were as insecticides. Cyclodienes are highly toxic to human health and the aquatic environment. Aldrin, dieldrin and endrin were some of the first substances to be listed as POPs under the Stockholm Convention. There are still residues in the environment, but the levels have been steadily declining. The European Food Safety Authority outline that levels of cyclodiene pesticides in food samples are below 10% of these found in samples 20 years ago. (EFSA, 2005).

[29] Chlordane belongs to the cyclodiene pesticide family, however for grouping purposes, it is treated separately-refer to section 3.3.2 for further information.

AIR

Dieldrin can occur in air due to volatilisation of the pesticide applied to land. Dieldrin was included as one of the parameters in the 2004 GAPS programme. Table 9 provides the Dieldrin concentrations measured in samples taken at Malin Head during each of the four monitoring periods of the programme (Pozo, et al., 2009).

Table 9 Dieldrin concentrations measured at Malin Head, GAPS programme, 2004

Dieldrin Concentration (pgm^{-3})			
Period[30] 1	Period 2	Period 3	Period 4
n.d.	21	36	38

Source: Pozo et al, 2009.

AQUATIC & MARINE

While Aldrin, Dieldrin and Endrin are not listed as priority substances in the Water Framework Directive, AA EQS for these substances for Inland and Other surface waters respectively are included in Directive 2013/39/EU[31]. The screening programme involving the monitoring of Irish lakes, rivers and groundwater carried out under the Water Framework Directive in 2005 and 2006 detected several POP pesticides including hexachlorobenzene, pentachlorobenzene, dieldrin, DDT, lindane and endrin (TNO, 2008a) and (TNO, 2008b).

During the follow-on 2007-2009 WFD monitoring programme samples from a total of 180 river sites and 74 lakes were tested for aldrin, dieldrin and endrin. None of the samples exceeded an EQS (either AA or MAC) (EPA, 2015a).

Samples taken under the Marine Institute's monitoring programmes under both the Shellfish Waters Directive and fish food safety programmes were tested for aldrin, dieldrin and endrin. Table 10 provides concentration ranges for these cyclodienes measured in shellfish and fish samples from designated shellfish waters during the Marine Institute's monitoring campaigns 2012-2015 (Marine Institute, 2017a).

Table 10 Concentration ranges of Aldrin, Dieldrin and Endrin in shellfish

Substance	Shellfish Concentration Range (μgkg^{-1})32
Aldrin	0.009-0.08
Dieldrin	0.008-0.13
Endrin	n.d.

Source: (Marine Institute, 2017 (in preparation))

SOIL & LAND

There is no verified data available for monitoring of cyclodiene pesticides in soil and land in Ireland.

[30] Period (1-4): Four consecutive three-month periods
[31] Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy.
[32] Above Limit of Detection (LoD).

FOOD

The allowable range for residues in food is from 0 to 0.1 ppm depending on the type of food product. The DAFM includes monitoring of aldrin, dieldrin and endrin in certain foods within its pesticide residue control programmes. Table 11 provides the reported concentrations or concentration ranges of these three parameters measured in foods for the years 2010 to 2016.

Table 11 Reported concentration ranges of Aldrin, Dieldrin and Endrin in food samples

POP Pesticide	Report concentrations or concentration range ($mgkg^{-1}$)						
	2010	2011	2012	2013	2014	2015	2016
Aldrin	n.d.	n.d.	n.d.	0.014	n.d.	n.d.	n.d.
Dieldrin	0.03-0.05	0.01-0.04	0.01-0.03	0.021	0.01	0.005-0.54	0.008
Endrin	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

Source: DAFM 2010-2016.

Substance	Fish Concentration range (μgkg^{-1})[34]
Aldrin	n.d
Dieldrin	0.081 - 1.03
Endrin	<0.19

The Marine Institute tested a total of 42 farmed finfish for Aldrin, Dieldrin and Endrin under its 2012-2015 NRCP. All samples tested compliant with the Guideline Values (Marine Institute, 2015) and (Marine Institute, 2017b).

WASTE

There is no verified data available for the monitoring of cyclodiene pesticides in waste. in Ireland.

The Marine Institute tested a total of 129[33] commercial fish species landed at Irish ports and have found that levels are relatively low and consistently comply with the standards applied in various other European countries.

3.3.2 Chlordane

Chlordane was used as a broad-spectrum insecticide. It is a suspected carcinogen and is highly toxic to human health and the environment. Chlordane was one of the initial 12 substances designated as a POP under the Stockholm Convention. It's presence in the environment is declining, but still detectable in low concentrations due to its persistence. Chlordane has been included in environmental monitoring programmes primarily under the WFD.

Table 12 Concentration ranges of Aldrin, Dieldrin and Endrin in fish samples 2013-2015

AIR

Both α- and γ-Chlordane were included in the GAPS monitoring programme. Table 12 provides the concentrations of both Chlordane forms detected in samples taken at Malin Head in 2004.

[33] Sample sizes:2013 (n=38), 2014 (n=42) and 2015 (n=49).
[34] Marine Institute, EnvRep 2017-002 (in preparation).

Table 13 Concentrations of α- and γ-Chlordane, GAPS programme, 2004

Sampling Period	Concentration (pgm^{-3})			
	Period 1	Period 2	Period 3	Period 4
α-Chlordane	2	2	3	3
γ-Chlordane	0.3	1	1	1

Source: (Pozo, et al., 2009).

AQUATIC & MARINE

Chlordane is listed as one of the River Basin Specific Pollutants (RBSP) for determination of the ecological status of surface water bodies under the WFD.

The Marine Institute monitored Chlordane levels in shellfish within shellfish designated waters during its 2014 campaign. The following two tables provide the concentration ranges for both α-Chlordane and γ-Chlordane measured in the samples during both monitoring campaigns.

Table 14 α-Chlordane and γ-Chlordane concentration ranges in shellfish samples

	Shellfish Concentration Range (μgkg^{-1})[35]
α-Chlordane	0.005 – 0.13
γ-Chlordane	0.011– 0.1

SOIL & LAND

There is no verified data available for monitoring of Chlordane in soil and land in Ireland.

FOOD

The DAFM includes testing for levels of Chlordane in its pesticide residues monitoring programme for food. Chlordane was not detected in any food samples tested under the National Pesticide Residue Control programmes for 2010 to 2016.

The Marine Institute tested a total of 42 farmed finfish for α-Chlordane and γ-Chlordane under its 2012-2015 NRCP and 129 samples under the MSFD during 2013-2017. (Marine Institute, 2015) and (Marine Institute, 2017 (in preparation)). Very low concentrations were detected as indicated in table 15 below.

Table 15 α-Chlordane and γ-Chlordane concentration ranges in fish samples

Isomer	Fish Concentration Range (μgkg^{-1})
α-Chlordane	0.099 – 1.14
γ-Chlordane	0.246

WASTE

There is no verified data available for monitoring of Chlordane in waste in Ireland

[35] Above LoD.

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3.3.3 DDT (1,1,1-trichloro-2-(2-chlorophenyl)-2-(4-chlorophenyl) ethane)

DDT was used as an insecticide to prevent the spread of insect-borne diseases. Long term human exposure to DDT is associated with some chronic health effects. DDT poses serious threats to bird populations, particularly birds of prey, due to its link with egg shell thinning effects. DDT was one of the initial 12 substances designated as a POP under the Stockholm Convention and is listed in Annex B (Restriction). DDT continues to be applied against mosquitoes in several countries to control malaria.

DDT and one of its primary breakdown products, 2,2-Bis(4-chlorophenyl)-1,1-dichloroethylene, also known as pp'-DDE or 4,4'-DDE have been included in air and water monitoring programmes and to a more limited extent soils studies.

AIR

pp'-DDT (a main component of commercial DDT) and pp'-DDE were included in the GAPS monitoring programme, 2004 (Pozo, et al., 2009). Table 16 provides the concentrations of both compounds detected during the programme.

Table 16 Concentration of pp'-DDT and pp'-DDE measured at Malin Head, GAPS programme, 2004

	Concentration (pgm^{-3})			
Sampling Period	Period 1	Period 2	Period 3	Period 4
pp'-DDT	36	n.r.[36]	n.r.	n.r.
pp'-DDE	6	3	5	6

Source: (Pozo, et al., 2009).

AQUATIC & MARINE

While DDT and its by-products are not listed as priority substances in the Water Framework Directive, Environmental Quality Standard (EQS) for these substances are included in the Priority Substance Directive[37]. DDT (p,p') and its by-products o,p'-DDD, p,p'-DDD, o,p'-DDE and p,p'-DDE are listed as river basin specific pollutants for determining of the ecological status of surface water bodies.

During the 2007-2009 WFD surveillance programme samples from a total of 180 river sites and 74 lakes were tested for DDT (pp'). None of the samples exceeded an EQS (either AA or MAC) (EPA, 2015a).

The Marine Institute monitored DDT (pp'-DDT and op'-DDT) and its breakdown products 2,2-Bis(4-chlorophenyl)-1,1-dichloroethylene (pp'-DDE) and 2,2-(2-chlorophenyl-4'-chlorophenyl)-1,1-dichloroethene (op-DDE) during its 2014 shellfish monitoring campaign. Table 17 provides the measured concentration ranges of DDT and the relevant breakdown products in these samples.

[36] Not reported.
[37] Priority Substance Directive[37] 2013/39/EU

Table 17 Measured concentration ranges of DDT and breakdown products in shellfish samples

	Shellfish Concentration range (µgkg^{-1})	Fish Concentration range (µgkg^{-1})
op-DDT	0.004 – 0.39	<0.172– 0.584
pp'-DDT	0.04 – 0.2	0.22– 1.04
op-DDE	0.004 – 0.06	0.14
pp'-DDE	0.03 – 5.13	0.070–8.98

Source: (Marine Institute, 2017a)

SOIL & LAND

There is no verified data available for monitoring of DDT in soil and land in Ireland.

FOOD

The DAFM includes monitoring of DDT and its breakdown products in certain foods under its pesticide residue control programmes. Table 18 provides the reported concentrations or concentration ranges of these substances measured in foods for the years 2010 to 2016.

Table 18 Reported concentrations or concentration ranges of DDT and breakdown products in food samples

POP Pesticide	Report concentrations or concentration range (mgkg^{-1})						
	2010	2011	2012	2013	2014	2015	2016
DDT	n.d.	n.d.	0.01-0.02	n.d.	n.d.	n.d.	n.d.
o,p'-DDT	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
p,p'-DDT	n.d.	n.d.	0.01	n.d.	n.d.	0.005	n.d.
o,p'-DDD	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
p,p'-DDD	n.d.	n.d.	n.d.	n.d.	0.017	n.d.	n.d.
o,p'-DDE	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
p,p'-DDE	0.006-0.026	0.02-0.07	0.01-0.02	0.005-0.033	0.005-0.018	0.008-0.013	0.006-0.007

Sources: DAFM 2010-2016

The Marine Institute tested a total of 42 farmed finfish for o,p'-DDD, p,p'-DDD, o,p'-DDT, p,p'-DDT, o,p'-DDD and p,p-DDE. under its 2012-2015 NRCP and 129 samples of seafood monitored in accordance with various EU legislation, (including Commission Regulation 1881/2006 and Directive 2008/56/EC (Marine Strategy Framework Directive Descriptor 9 – contaminants in seafood)), and other service agreements. All samples tested compliant with the Guideline Values (Marine Institute, 2015) and (Marine Institute, 2017 (in preparation)).

Table 19 Seafood concentration ranges for DTT breakdown products in farmed finfish

POP pesticide	Fish Concentration range (µgkg^{-1})
op-DDT	<0.172– 0.584
pp'-DDT	0.22– 1.04
op-DDE	0.14
pp'-DDE	0.070–8.98

WASTE

There is no verified data available for monitoring of DTT in waste in Ireland.

3.3.4 Endosulfan

Endosulfan (and its related isomers and compounds) is a broad-spectrum pesticide used for crop protection and the control of parasites. Endosulfan is toxic to humans and is harmful to aquatic and terrestrial organisms. Exposure to Endosulfan has been linked to congenital disorders and mental retardation. In May 2011, Endosulfan was listed in Annex A of the Stockholm Convention (with certain exemptions permitted). Both α- and β-forms of Endosulfan and Endosulfan Sulphate have been included in environmental monitoring programmes for air and water.

AIR

Both α- and β-forms of Endosulfan and Endosulfan Sulphate were included in the GAPS monitoring programme. Table 17 provides the concentrations of both Endosulfan isomers and Endosulfan Sulphate detected during the programme.

Table 20 Concentrations of α-Endosulfan, β-Endosulfan and Endosulfan Sulphate, GAPS programme, 2004

	Concentration (pgm^{-3})			
Sampling Period	Period 1	Period 2	Period 3	Period 4
α-Endosulfan	29	31	52	54
β-Endosulfan	n.d.	1	2	2
Endosulfan Sulphate	n.d.	n.d.	0.2	n.d.

Source: (Pozo, et al., 2009).

AQUATIC & MARINE

Endosulfan is listed as a Priority Hazardous Substance in Directive 2013/39/EU. During the 2007-2009 WFD surveillance programme samples from a total of 180 river sites and 74 lakes were tested for Endosulfan. None of the samples exceeded an EQS (either AA or MAC) (EPA, 2015a).

SOIL & LAND

There is no verified data available for monitoring of Endosulfan in soil and land. in Ireland.

FOOD

The DAFM includes monitoring of endosulfan (α- and β-forms), endosulfan lactone, endosulfan ether and endosulfan sulphate in certain foods under its pesticide residue control programmes. Table 19 provides the reported concentrations or concentration ranges of these substances measured in foods for the years 2010 to 2016.

Table 21 Reported concentrations or concentration ranges of Endosulfan (Total)[38] in food samples

	Report concentrations or concentration range (mgkg-1)						
	2010	2011	2012	2013	2014	2015	2016
Endosulfan (total)	n.d.	0.03-0.09	n.d.	0.033-0.042	n.d.	n.d.	n.d.

Source: DAFM 2010- 2016.

The Marine Institute tested a total of 42 farmed finfish for α-Endosulfan and β-Endosulfan under its 2012-2015 NRCP. All samples were tested compliant with the Guideline Values (Marine Institute, 2015) and (Marine Institute, 2017b).

WASTE

There is no verified data available for monitoring of Endosulfan in waste in Ireland.

3.3.5 Heptachlor

Heptachlor was used mainly as a crop pesticide in Ireland. It has been linked with the decline of several bird populations and is classified as a possible human carcinogen. Heptachlor was one of the first substances listed in the Stockholm Convention. Heptachlor and/or cis-Heptachlorepoxide, a degradation product of Heptachlor, have been included in air and water monitoring programmes.

AIR

Both Heptachlor and cis-Heptachlorepoxide were monitored under the GAPS programme which commenced in 2004 (Pozo, et al., 2009). Table 22 provides the concentrations of both Heptachlor and cis-Heptachlorepoxide detected during the programme.

Table 22 Concentrations of Heptachlor and cis-Heptachlorepoxide measured at Malin Head, GAPS programme, 2004

	Concentration (pgm-3)			
Sampling Period	Period 1	Period 2	Period 3	Period 4
Heptachlor	n.d.	n.d.	n.d.	n.d.
cis-Heptachlorepoxide	n.d.	27	46	50

Source: (Pozo, et al., 2009).

AQUATIC & MARINE

Heptachlor and Heptachlorepoxide are listed as Priority Hazardous Substances in Directive 2013/39/EU. The Marine Institute monitored Heptachlor and cis-Heptachlorepoxide during its 2014 shellfish monitoring campaign (Marine Institute, 2017a). Table 23 provides the measured concentration ranges of both chemicals in the samples analysed

[38] Endosulfan (Total): Sum of α- endosulfan, β- endosulfan and endosulfan sulphate.

Table 23 Measured concentration ranges of Heptachlor and cis-Heptachlorepoxide in shellfish

	Concentration range ($\mu g kg^{-1}$)
Heptachlor	0.004 – 0.39
cis-Heptachlorepoxide	0.04 – 0.2

Source: (Marine Institute, 2017a).

SOIL & LAND

There is no verified data available for monitoring of Heptachlor in soil and land.

FOOD

The DAFM includes testing for levels of Heptachlor and Heptachlorepoxide in its pesticide residues monitoring programme for food. Neither Heptachlor or Heptachlorepoxide were detected above the LoD in any food samples tested during its campaigns for 2010 to 2016.

The Marine Institute tested a total of 42 farmed finfish for cis-Heptachlorepoxide under its 2012-2015 national residue control plan. All samples tested compliant with the Guideline Values (Marine Institute, 2015) and (Marine Institute, 2017b). Heptachlor was not detected in samples of fish tested under the MSFD campaign 2013-2015 (Marine Institute, 2017 (in preparation)).

WASTE

There is no verified data available for monitoring of Heptachlor in waste in Ireland.

3.3.6 Hexachlorobenzene (HCB)

HCB was widely used as a fungicide to control wheat bunt, for preservation of wood and in the manufacture of some dyes. HCB is highly toxic to some aquatic organisms and reasonably suspected as being carcinogenic to humans, targeting organs such as the liver and kidneys. HCB was added to Annexes A and C of the Stockholm Convention in May 2009.

While information on HCB levels in air is relatively scarce, HCB has been included in water monitoring programmes.

AIR

There is no information available on HCB monitoring in air in the Irish context.

AQUATIC & MARINE

HCB is listed as a priority hazardous substance under the WFD. During the 2007-2009 WFD surveillance programme samples from a total of 180 river sites and 74 lakes were tested for HCB. None of the samples exceeded an EQS (either AA or MAC) (EPA, 2015a).

Between 2010 and 2012 tests were carried out by the Marine Institute on samples of brown trout and perch collected from 21 lakes by Inland Fisheries Ireland for levels of HCB. Again, between 2013 and 2015 mussel samples were taken from 32 WFD target water bodies and tested for HCB. The table below provides the results for HCB found in the biota tested during both campaigns.

Table 24 Measured concentration ranges of HCB in biota

	Measured HCB Concentration ranges and means (µgkg^{-1})	
	2010-2012	2013-2015
Concentration Range	<0.02-0.23	0.1-0.49
Mean concentration	0.02	0.36
EQS (Biota)	10	

Source: (Marine Institute, 2017 (in preparation))

The Marine Institute monitored HCB during its 2014 shellfish monitoring campaign. Measured concentrations (above the LoD) ranged from 0.009 to 0.27µgkg^{-1} (Marine Institute, 2017a).

SOIL & LAND

There is no verified data available for monitoring of Hexachlorobenzene in soil and land in Ireland.

FOOD

The DAFM includes monitoring of HCB in certain foods under its pesticide residue control programmes. Table 25 provides the reported concentrations or concentration ranges of HCB measured in foods for the years 2010 to 2016.

Table 25 Reported concentrations or concentration ranges of HCB in food samples

Report HCB concentrations or concentration range (mgkg^{-1})						
2010	2011	2012	2013	2014	2015	2016
0.005	0.01	0.01	0.005-0.006	0.005-0.008	0.005-0.006	0.006-0.007

Sources: DAFM 2010-2016

The Marine Institute tested a total of 42 farmed finfish for HCB under its 2012-2015 NRCP. All samples tested compliant with the Guideline Values (Marine Institute, 2015) and (Marine Institute, 2017b). Information on hexachlorobenzene found in fish samples during the MSFD campaign is included in Table 26 below:

Table 26 Reported concentrations or concentration ranges of Hexachlorobenzene in fish samples

	Fish Concentration range (µgkg^{-1})
Hexachlorobenzene	<0.28 – 0.632

Source: (Marine Institute, 2017 (in preparation))

WASTE

There is no verified data available for monitoring of Hexachlorobenzene in waste.

3.3.7 Hexachlorocyclohexane (HCH)

Three forms of HCH, namely α-HCH, β-HCH and γ-HCH, also referred to as Lindane, have been used as pesticides. Both α-HCH and β-HCH are unintentional impurities in the manufacture of lindane. Lindane was also used as an anti-parasitic agent. α-HCH, β-HCH and Lindane are potentially carcinogenic to humans and adversely affects wildlife and human health. Lindane has shown immunotoxic, reproductive and developmental effects in laboratory animals and aquatic life. α-HCH, β-HCH and Lindane were listed in Annex A of the Stockholm Convention in May 2009.

α-HCH, β-HCH and γ-HCH (Lindane) have been included in air and water monitoring programmes in relation to Ireland's environment.

AIR

α-HCH and γ-HCH were measured in samples collected under the GAPS programme (Pozo, et al., 2009). Table 27 provides the concentrations of both isomers measured during the study.

Table 27 Concentrations of α-HCH and γ-HCH measured at Malin Head, GAPS programme,2004

	Concentration (pgm^{-3})			
Sampling Period	Period 1	Period 2	Period 3	Period 4
α-HCH	6	9	14	13
γ-HCH (Lindane)	6	12	19	18

Source: (Pozo, et al., 2009)

AQUATIC & MARINE

HCH is listed as a Priority Hazardous Substance in the Directive 2013/39/EU. During the 2007-2009 WFD Surveillance programme samples from a total of 180 river sites and 74 lakes were tested for HCH. None of the samples exceeded an EQS (either AA or MAC) (EPA, 2015a).

The Marine Institute monitored levels of α-HCH, β-HCH, Lindane and δ-HCH in shellfish samples during its 2014 shellfish monitoring campaign (Marine Institute, 2017a). Table 28 provides the measured concentration ranges of these HCH isomers in the samples taken during the campaign.

Table 28 Measured concentration ranges of HCH isomers detected in shellfish samples

	Concentration range (μgkg^{-1})
α-HCH	0.005-0.07
β-HCH	0.01-0.17
Lindane (γ-HCH)	0.006-0.15
δ-HCH	0.009-0.09

Source: (Marine Institute, 2017a)

SOIL & LAND

There is no verified data available for monitoring of Hexachlorocyclohexane in soil and land in Ireland.

FOOD

The DAFM includes testing for levels of Lindane in its pesticide residues monitoring programme for food. Only one sample from each of the 2011, 2012, 2015 and 2016 campaigns tested positive for lindane. Table 29 provides the reported concentrations of Lindane measured in foods for the years 2010 to 2016.

Table 29 Reported concentrations of Lindane in food samples

Reported Lindane concentrations or concentration ranges in Foods ($mgkg^{-1}$)						
2010	2011	2012	2013	2014	2015	2016
n.d.	0.01	0.01	n.d.	n.d.	0.012	0.01

Sources: DAFM 2010-2016

The Marine Institute tested a total of 42 farmed finfish for α-HCH, β-HCH, γ-HCH and δ-HCH under its 2012-2015 NRCP. All samples tested compliant with the Guideline Values (Marine Institute, 2015) (Marine Institute, 2017b). Information on hexachlorobenzene found in fish samples during the MSFD campaign is included in the following table.

Table 30 Measured concentration ranges of HCH isomers detected in fish samples

	Concentration range ($\mu g kg^{-1}$)
α-HCH	n.d
β-HCH	<0.16
Lindane (γ-HCH)	n.d
δ-HCH	n.d

Sources: (Marine Institute, 2017b)

WASTE

There is no verified data available for monitoring of Hexachlorocyclohexane in waste in Ireland.

3.4 Industry-POPs

POPs also include chemicals specifically produced for various industrial purposes. For example, Polychlorinated biphenyls (PCBs), an industrial chemical, commonly used in a variety of applications (e.g.: electrical transformers), have been banned in Ireland for use for a long time (since the 1980s) but due to the long life of associated equipment, including difficulties in their identification, they may still be present and are therefore subject to specific waste management requirements.

3.4.1 Polychlorinated biphenyls (PCBs)

SUMMARY ASSESSMENT OF PCBs IN IRELAND

PCBs are a significant POP in the Irish context and potentially pose risks to the environment and public health. PCBs may be found in long life electrical power management equipment such as transformers and capacitors. Relatively low levels of PCBs have been found in food and the Irish environment with some evidence of isolated elevated levels. While the overall trend in PCB concentrations in the marine environment is downward, their persistent nature will mean that PCBs will likely be detected in the environment for many years.

It remains a priority that waste management measures concerning PCB-containing waste are implemented in accordance with the relevant legislation with the aim of further reducing the presence of PCBs in Ireland. This includes the EPA and local authorities working actively with owners of PCB holdings on the national PCB inventory to ensure they are meeting their obligations for PCB disposal or decontamination.

PCBs are a group of aromatic chlorinated organic compounds with a common biphenyl molecular structure with the general chemical formula $C_{12}H_{10-x}Cl_x$. There are 209 possible PCB compounds and some have been commercially produced and sold as pure oil or in equivalent form from around 1929. Commercial PCBs were sold under a variety of different trade names. It is estimated that approximately one million tonnes of PCBs were produced worldwide (EPA, 2008b). Concern over the toxicity and persistence of PCBs led to restrictions on their marketing and use, particularly for open applications such as in special paints, in Europe and America in the early 1970s. However, the use of PCBs in closed systems was permitted up until the late 1970s in the USA and into the 1980s in Europe.

In the EU, the marketing and use of PCBs came under legislative control in 1989[39] which included the requirement that preparations, including waste oils, with PCB content higher than 0.005% by weight (50mgkg^{-1}) may not be used. PCBs were used in a wide range of applications due to their thermal and electrical insulation properties including:

- Open applications used as heat exchange fluids, hydraulic oils, lubricating oils and as additives in paints, plastics, solvents, adhesives and cements; and
- Closed applications: use as insulating fluid in electrical transformers, capacitors, power factor correction units, lighting ballasts, vacuum pumps and submersible pumps.

There is no information available on the quantities of PCBs imported into Ireland however equipment such as electrical transformers have previously been manufactured within the State.

As well as intentional production and use, PCBs may also be formed as unintentional by-products, specifically because of primarily uncontrolled combustion processes. Decachlorobiphenyl is an unintentional by-product in the manufacture of the fungicide Chlorothalonil. This is further discussed under Section 4 in relation to unintentional POPs.

AIR

PCBs were monitored under the GAPS programme which was started in 2004 (Pozo, et al., 2009). Table 31 provides the concentrations of PCBs[40] detected for each of the programme's sampling period.

Table 31 Concentrations of PCBs measured at Malin Head, GAPS programme, 2004

PCB Concentrations (pgm^{-3})			
Period 1	Period 2	Period 3	Period 4
29	16	37	74

Source: (Pozo, et al., 2009).

The EPA cows' milk studies involve testing for certain POPs which include Dioxin-Like PCB (DL-PCB) content. Samples are taken during Summer months and can be used as indicators for PCB exposure due to atmospheric deposition. DL-PCB concentrations found are considerably below the EU guide levels (2pgg^{-1}). Figure 4 shows the trends in overall mean for DL-PCB levels found in milk from 2010 to 2016.

[39] Council Directive 89/677/EEC of 21 December 1989 amending for the eighth-time 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.

[40] PCB-8, PCB-15, PCB-16/32, PCB-17, PCB-18, PCB-28, PCB-31, PCB-33, PCB-37, PCB-42, PCB-44, PCB-49, PCB-52, PCB-56/60, PCB-66, PCB-70, PCB-74, PCB-77, PCB-81, PCB-87, PCB-95, PCB-99, PCB-101, PCB-105, PCB-110, PCB-114, PCB-118, PCB-123, PCB-126, PCB-128, PCB-137/138, PCB-149, PCB-151, PCB-153, PCB-156, PCB-157, PCB-170, PCB-171, PCB-174, PCB-177, PCB-180, PCB-183, PCB-185, PCB-187, PCB-195, PCB-200, PCB-203, PCB-205 and PCB-206.

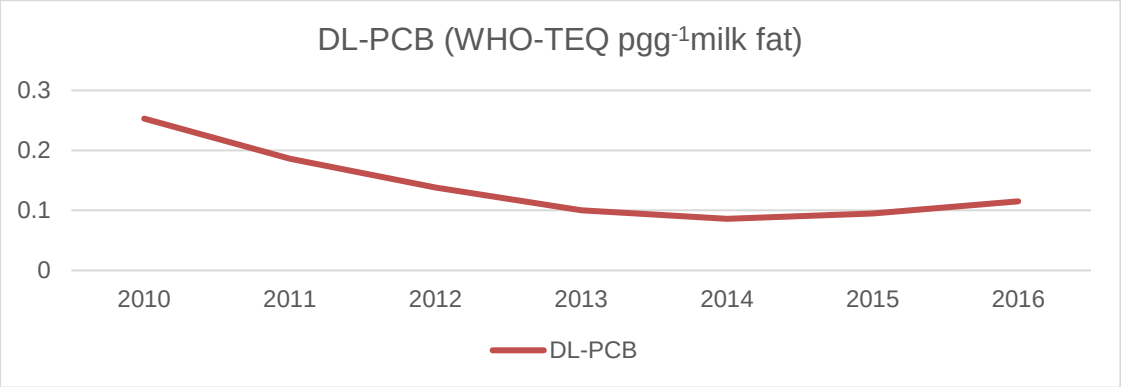


Figure 5 Mean Dl-PCB [41] (sum)concentrations (WHO-TEQpgg^{-1} milk fat) found in cows' milk 2010-2016.

Source: (EPA, 2012b), (EPA, 2014a) (EPA, 2014b), (EPA, 2015b), (EPA, 2016b), (EPA, 2016c).

The EPA's cows' milk study included testing samples for Non-Dioxin Like PCBs (NDL-PCB) for the first time in its Summer 2012 monitoring campaign. Table 32 provides the concentrations of PCBs detected for each of the programme's sampling period.

Table 32 Concentrations (total) of NDL-PCB[42] measured in cows' milk

Mean total NDL-PCB concentrations measured in Cows' Milk (pgkg^{-1})				
2012	2013	2014	2015	2016
447	397	381	369	395

Sources: (EPA, 2014a), (EPA, 2014b), (EPA, 2015b), (EPA, 2016b) and (EPA, 2016c).

AQUATIC & MARINE

PCBs[43] were monitored as part of the initial WFD screening programme which ran from 2005 to 2006 and concentrations were found to be low. NDL-PCB are not currently listed as Priority Substances under the WFD and so do not have associated EQS. 12 DL-PCB[44] are listed as Priority Substances under the WFD as dioxin-like compounds. 24 PCBs[45] are listed as river basin specific pollutant for determination of the ecological status of surface water bodies.

In general, PCB concentrations are low in Irish transitional and coastal waters. PCBs have not been detected in seawater samples.

The Marine Institute's assessment of hazardous substances for the monitoring and classification of transitional and coastal waters included an assessment of PCBs in seawater and shellfish. Different PCB congeners exhibit different toxicities and consequently Environmental Assessment Criteria have been established for individual PCB congeners (McGovern, et al., 2011a). Very low DL-PCB Environmental Assessment Criteria for shellfish have been established.

[41] PCB-77, PCB-81, PCB-105, PCB-114, PCB-118, PCB-123, PCB-126, PCB-156, PCB-157, PCB-167, PCB-169 and PCB-189.
[42] PCB-28, PCB-52, PCB-101, PCB-138, PCB-153 and PCB-180.
[43] Marker PCBs: PCB-28, PCB-52, PCB-101, PCB-118, PCB-138, PCB-153 and PCB-180.
[44] DL-PCB: PCB-77, PCB-8, PCB-105, PCB-114, PCB-118, PCB-123, PCB-126, PCB-156, PCB-157, PCB-167, PCB-169 and PCB-189.
[45] PCB-28, PCB-52, PCB-72, PCB-77, PCB-81, PCB-101, PCB-103, PCB-105, PCB-106, PCB-114, PCB-118, PCB-123, PCB-126, PCB-138, PCB-153, PCB-156, PCB-157, PCB-167, PCB-169, PCB-170, PCB-180, PCB-189, PCB-194 and PCB-209.

During the periods 2010-2012 and 2013-2015 the Marine Institute, as part of its monitoring programmes[46], included monitoring fish samples for a number of POPs including PCBs (EPA, 2017b). Table 33 provides the measured PCB concentrations from the programmes. PCB concentrations in fish samples were typically found to be higher in samples taken closer to urban/developed areas and to less developed regions.

Table 33 PCB concentrations (Sum marker PCBs) measured in fish samples

	2010-2012	2013-2015
PCB Concentration Range (µgkg-^{1}):	<0.01-1.4	0.004-1.05
Mean PCB Concentration (µgkg^{-1}):	0.13	0.146

Source: (EPA, 2017b).

During the period 2012-2014, the Marine Institute carried out tests on Irish farmed fish for several contaminants including PCBs (Marine Institute, 2015). Table 34 provides the results of the programme. None of the samples tested exceeded the maximum allowable PCB concentration of 75µgkg^{-1} wet weight.

Table 34 Results of Marine Institute 2012-2014 PCB[47] monitoring programme.

Number of samples	PCB Concentration Range (mgkg^{-1} wet weight)	Mean Concentration (upper bound) (mgkg^{-1} wet weight)	Median PCB Concentration (mgkg^{-1} wet weight)
60	1.5-20.1	7.61	7.59

Source: (Marine Institute, 2015).

The Marine Institute monitored levels of certain PCBs[48] in shellfish samples during its 2014 shellfish monitoring campaign. The total SUM 7 PCB marker concentrations obtained ranged from 0.19 to 3.19 µgkg^{-1} wet weight with the average concentration 0.78 µgkg^{-1} wet weight. All measured concentrations were considerably below the limit set out Commission Regulation (EC) No. 1881/2006 (75mgkg^{-1} for the six marker PCBs[49]).

Sediment data is collected where possible, under both a small-scale Temporal trend OSPAR program (Currently Dublin Bay only) and to the WFD program. Within this program, sediment samples (sieved to <63 µm) are collected from approximately 13 sediment (coastal/transitional) locations per annum. The program is designed to complete sampling annually at 6 or 7 locations that might be expected to be more impacted (e.g. urban/industrialised) in addition to at a further 6 or 7 sites where impacts are expected to be lower (every 3rd year). PCBs are included in the suite of analyses under WFD. The data from the current monitoring cycle indicates relatively low levels of PCBs in Irish transitional and coastal waters.

[46] Directive 2006/113/EC of the European Parliament and of the Council of 12 December 2006 on the quality required of shellfish waters.
[47] ICES PCB 6: Sum of PCB congeners PCB-26, PCB-52, PCB-101, PCB-138, PCB-153 and PCB-180.
[48] Sum of the marker PCB congeners 28, 52, 101, 118, 138, 153 and 180.
[49] Sum of the marker PCB congeners 28, 52, 101, 138, 153 and 180.

SOIL & LAND

Limited environmental monitoring of PCBs in soils in Ireland has been carried out. The study on pollutants in soils in the south-eastern region of Ireland (McGrath & McCormack, 1999) indicated that levels for PCBs in 73 soils examined were consistently low indicating no serious addition of this material by spillage to soil. The narrow range of measured values (1.2-6.8 μgkg^{-1}) during the project was consistent with PCB adsorption from the atmosphere.

The Geological Survey of Ireland completed a baseline survey of heavy metals and organic chemicals in topsoil in the greater Dublin area which included the analysis for PCBs. Sample locations were chosen randomly to give an overview of baseline conditions in the city. Of the 1058 samples taken, a subset of 194 samples were analysed for PCBs. The results indicated isolated, low level detections of PCBs in Dublin, mainly in the city centre. The PCB compositions in soils indicated that contamination is probably associated with historical industrial sources and old paint rather than modern, active sources (Glennon, et al., 2012).

FOOD

The DAFM's residue control programme includes the monitoring of certain PCBs in food of animal origin and in egg, milk and honey samples. Seven marker PCBs[50], which include one DL-PCB and six NDL-PCB, are used as indicators of the total PCB content representing commercial mixtures. Food of animal origin under the monitoring programme include bovine, equine, ovine, porcine, poultry and venison sources respectively. The number of detections for marker PCBs in the various food types reported by the DAFM are shown in table 35.

Levels of PCB-contamination in food in tests carried out between 2011 and 2016 were found to be generally low apart from isolated egg samples in 2012 0.01$mgkg^{-1}$ (PCB18). The reason for PCB-contamination is suspected to have been contaminated fish oil fed to the hens to increase the Omega 3 content of the eggs. Subsequent testing of the sample found dioxin concentrations of 1.17$ngkg^{-1}$ below the permitted MRL (2.5$ngkg^{-1}$). The 2013 PCB detection, 0.005$mgkg^{-1}$ (PCB180) relates to an equine fat sample. Additional information in relation to the sampling and analysis of the various food groups is available in FSAI publications and from their website (www.fsai.ie).

The DAFM also carries out an annual programme for the monitoring of PCBs and dioxins in animal feed. Generally, the occasional isolated cases where these substances are found are at concentrations below the maximum levels set out in EU legislation (Directive 2002/32/EC[51] as amended).

Table 35 Number of Detections of PCBs[52] found in main food groups

	2011	2012	2013	2014	2015	2016
Number of Samples	1,518	1,540	1,582	1,461	1,157	1,143
Food Group:						
Fruit & Vegetables	0	0	0	0	0	0

[50] PCB congeners 28, 52, 101, 118, 138, 153 and 180.
[51] Directive 2002/32/EC of the European Parliament and of the Council of 7 May 2002 on undesirable substances in animal feed.
[52] Sum ∑PCB congeners 28, 52, 101, 118, 138, 153 and 180 listed in EU Regulation No. 1259/2011.

	2011	2012	2013	2014	2015	2016
Cereals	0	0	0	0	0	0
Food of Animal Origin	0	1	1	0	0	0
Baby Food	0	0	0	0	0	0

Source: DAFM 2011- 2016.

Note: The cause of the 2012 PCB detection, in 2012 found in eggs, was suspected to be contaminated fish oil fed to the hens to increase the Omega 3 content of the eggs.

During 2006-2008, the FSAI had tests carried out on 102 samples of a variety of foods including carcass fat, liver and eggs, for a range of PCBs[53]. Table 36 shows the results obtained from the study (FSAI, 2010a).

Table 36 Summary of results for PCB concentrations in specific food types.

Sample type	Number of samples	Concentration Ranges ($ngkg^{-1}$ fat)
Carcass fat	38	0.28-5.01
Liver	12	0.41-6.26
Eggs	20	0.48-30.78
Milk	32	0.31-1.99

Source: (FSAI, 2010a).

The Marine Institute monitors marker PCBs in seafood produced in Ireland or landed at Irish ports and implement occasional surveys of DL-PCB. PCBs are routinely detected in fisheries products, with the highest levels in oily fish and long-lived fish. Levels measured consistently comply with limits for PCBs in seafood as set in EU Commission Regulation for maximum levels for dioxins, dioxin like and non-dioxin like PCBs[54] (McGovern, et al., 2011b).

WASTE

Controls on PCBs in the late 1980s resulted in significant amounts of PCBs sent for disposal in the early 1990s. The Waste Management (Hazardous Waste) Regulations 1998[55], implement provisions of the European PCB Directive[56], set out the requirements for the proper disposal and management of PCBs and registering holdings of PCB-contaminated materials and equipment.

The regulations require holders of PCBs or PCB-contaminated materials containing an aggregate volume of more than a total of 5 litres of PCB-contaminated materials (referred to as large PCB holdings) give notice to the EPA of such PCB holdings on an annual basis. Equipment contaminated by materials with total PCB concentrations greater than 500 mgkg-1 and containing an aggregate volume of more than 5 litres of such material were to be decontaminated or disposed of in an environmentally sound manner by their holders prior to 31st December 2010. Equipment contaminated by materials with total PCB concentrations between 50 mgkg-1 and 500 mgkg-1 can be retained in use but must be disposed of in an environmentally sound manner at the end of its useful life. Any equipment or materials which are reasonably suspected of containing PCBs are assumed to

[53] Study included testing for, among other parameters, PCB-28, PCB-52, PCB-101, PCB-118, PCB-138, PCB-153 and PCB-180.
[54] Commission Regulation (EU) 1259/2011
[55] Statutory Instrument No 163 of 1998
[56] Council Directive 96/59/EC of 16 September 1996 on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT).

contain PCBs unless otherwise proven and until such time, they are included in the national PCB inventory.

The regulations also require that the national inventory of PCB holdings be prepared by the EPA. The EPA has maintained this inventory since initial work undertaken in 2001 and has continued to complete PCB surveys and inspections that have formed the basis for creating and updating the National PCB Inventory. At its height, the total volumes of confirmed and suspected PCB-contaminated materials on the inventory stood at approximately 250,000 litres. At the time of compiling this plan there were approximately 12,570 litres on the inventory all of which can be used until the end of its useful life. Work is continuing to identify new holdings of equipment suspected to contain PCBs ensuring it is managed in a safe, efficient and environmentally sound manner in accordance with Annex A, Part II of the Stockholm Convention.

- Figure 4 illustrates the trend of the National PCB Inventory from 2010. The initial trend generally shows significant increases up to 2010 since the inventory was first compiled due to several reasons including:
- increased targeted PCB surveys by the EPA from 2007 onwards;
- an increased awareness of facilities in the identification of equipment with the potential to contain PCBs; and
- increased accuracy in estimating volumes of PCBs in suspected electrical equipment.

From 2010, there has been a significant decrease in the national PCB inventory, which is largely attributed to the 31st December 2010 deadline for certain PCB-contaminated equipment disposal or decontamination.

To date, the National PCB Inventory, work led by the EPA, under the PCB Directive, has been the main activity for monitoring of POP stockpiles. The EPA, in collaboration with Local Authorities, holders of PCB-containing wastes and other stakeholders have ensured known holdings with more than 5 litres of PCB-contaminated materials with total PCB-concentrations greater than 500mgkg^{-1} have been managed in an environmentally sound manner. Other PCB holdings on the Inventory are monitored to ensure such equipment is managed under the WEEE regime at the end of its useful life. Figure 5 below demonstrates the trends in suspected and confirmed holdings in Ireland from 2010-2017.

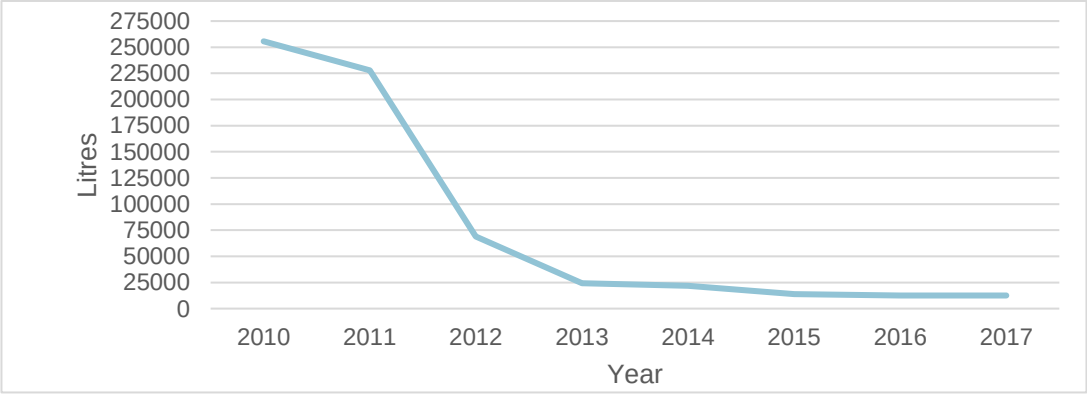


Figure 6 Trend in confirmed and suspect PCB holdings from 2010 to 2017

To assist organisations who hold potentially PCB-contaminated equipment, the EPA has developed guidance. The guidance aims to assist organisations to carry out on-site surveys and provides information on the appropriate disposal routes and decontamination of PCB-contaminated

equipment and remediation of PCB-contaminated land. Further information is available on the EPA website: http://www.epa.ie/waste/hazardous/pcb/

OTHER

Monitoring of Sewage Sludge

During 2015, as part of its POPs monitoring programme under the 2012 National Implementation Plan on POPs, the EPA collected 15 samples of municipal sludge from 5 waste water treatment plants to check for POPs including 12 DL-PCBs[57]. Details of PCB concentrations measured in the samples are shown in Table 37. All measured concentrations were considerably below the Low POP Concentration Level (LPCL) of 50mgkg^{-1} established under the EU POPs Regulation.

Table 37 Total Dl-PCB concentrations measured in municipal sludge samples.

Range (ngTEQkg^{-1}):	Average (ngTEQkg^{-1}):	Median (ngTEQkg^{-1}):
0.8 – 11.47	3.1	2.1

3.4.2 Polybrominated diphenyl ethers (PBDEs) - TetraBDE, PentaBDE, HexaBDE, HeptaBDE and DecaBDE

SUMMARY ASSESSMENT OF POP POLYBROMINATED DIPHENYL ETHERS (PBDEs) IN IRELAND

PBDEs are a group of flame retardants that have previously been used in many applications from automobiles to household upholstery. They have been banned for a number of years in the EU but may still be present in certain longer life applications such as vehicles and electrical equipment that have yet to enter the waste stream.

In general, PBDEs have not been found in significant concentrations in food or in the Irish environment however the fact that they are still in various consumer products that have not reached the end of their life means there is still a risk for release and emissions of PBDEs into the environment if they are not appropriately managed when they eventually enter the waste stream.

Monitoring of PBDEs in food and the environment will continue to be a priority due to their previous widespread use in certain products. Studies have been prepared at EU and national level to obtain a better understanding of the presence of PBDEs in various waste streams. Based on limited monitoring to date in Ireland, certain plastics in electronics (e.g. CRT plastics of TVs and monitors manufactured prior to 2003) and shredder residue resulting from the treatment of end of life vehicles contain PBDEs at certain concentrations.

Polybrominated diphenyl ethers (PBDEs) are a group of 209 brominated flame retardants with the general chemical formula $C_{12}H_{10}$-XBrXO. These substances have been used to reduce fire risk in various applications such as vehicles, upholstery, furniture, textiles and electrical and electronic equipment. PBDEs were typically produced in three commercial forms;

- pentabromodiphenyl ether (PentaBDE),
- octabromodiphenyl ether (OctaBDE) and
- decabromodiphenyl ether (DecaBDE).

[57] PCB congeners: PCB77, PCB81, PCB105, PCB114, PCB118, PCB123, PCB126, PCB156, PCB157, PCB167, PCB169 and PCB189.

Commercial PentaBDE and OctaBDE are both commercial mixtures of various brominated diphenyl ethers (BDEs) and were listed substances for elimination under Annex A of the Stockholm Convention in May 2009. As DecaBDE is frequently assessed and referenced with respect to other PBDEs it is included within the POP-PBDE section. DecaBDE was listed in Annex A of the Stockholm Convention in May 2017 (with exemptions for use in certain applications including aircraft, vehicles and textiles). The specific BDEs listed under the Stockholm Convention are Commercial PentaBDE, comprising of TetraBDE and PentaBDE, and Commercial OctaBDE comprising of HexaBDE and HeptaBDE.

Because of the 2009 listings under the Stockholm Convention, the BDEs were included under the EU POPs Regulation in August 2010. Under the EU POPs Regulation, without prejudice to electrical and electronic equipment within the scope of the Restriction of certain Hazardous Substances Directive[58], the production, placing on the market and use is allowed for articles and preparations containing concentrations below 0.1 % (1000 $mgkg^{-1}$) of each BDE listed by weight when produced partially or fully from recycled materials or materials from waste prepared for re-use. Also, the WEEE Directive[59] required any plastic components of WEEE containing brominated flame retardants to be separated out for selective treatment to ensure these substances do not re-enter the raw material supply chain.

AIR

PBDE-contaminated dust is likely to be the main source of air contamination by PBDE particularly indoors. As part of the dioxin monitoring programmes the EPA has pooled cows' milk samples tested for PBDE-contamination. Summary results of these campaigns are provided in Table 38. The main PBDE congeners detected were; BDE47 (TriBDE, not a POP) and BDE99 (HexaBDE) with lower concentrations of BDE153 (HexaBDE) observed. The results of the campaigns show PBDE levels detected in Irish milk samples are relatively low by international comparisons.

Table 38 PBDE concentrations measured in cows' milk

	2013	2014	2015
PBDE Concentration Range ($ngkg^{-1}$ fat)	34.3-277	40-83.4	65.4-90.7
Mean PBDE Concentration ($ngkg^{-1}$ fat)	87.5	60	80.6

Note, PBDE congeners: BDE17, BDE28, BDE47, BDE49, BDE66, BDE71, BDE77, BDE85, BDE99, BDE100, BDE119, BDE126, BDE138, BDE153, BDE154, BDE183 and BDE209.

Sources: (EPA, 2014a), (EPA, 2015b) and (EPA, 2016b).

AQUATIC & MARINE

TetraBDE, PentaBDE, HexaBDE and HeptaBDE are listed as Priority Substances under the WFD. The Marine Institute carried out two surveys on fish samples during the periods 2010-2012 and 2013-2015 which included testing samples for the six marker PBDE (EPA, 2017b). Table 39 shows the results from these campaigns.

[58] Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (recast).
[59] Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE) (recast).

Table 39 PBDE concentration (wet weight) observed in biota

	2010-2012	2013-2015
Concentration Range (μgkg^{-1})	<0.006-0.77	0.02-1.46
Mean Concentration (μgkg^{-1}):	0.12	0.156

Source: (EPA, 2017b)

The Marine Institute monitored levels of certain PBDE[60] in shellfish samples during its 2014 shellfish monitoring campaign under the SWD (Marine Institute, 2017a). Table 40 provides details of the results obtained during the campaign.

Table 40 Details on concentrations of total PBDE detected in shellfish samples

Results of Total PBDE Concentrations (μgkg^{-1} wet weight)		
Range:	Average:	Median:
0.11-0.8	0.32	0.25

Source: (Marine Institute, 2017a).

SOIL & LAND

There is no verified data available for monitoring of BDE's in soil and land in Ireland.

FOOD

The FSAI have concluded that the Irish populations' dietary exposure to PBDEs appears to be low and is similar to that observed in other EU countries. At present there are no EU Maximum Limits for BFRs in food. Tolerable daily intakes(TDIs) have not been derived, primarily due to limited toxicological data for BFRs and the associated uncertainties with such studies. The FSAI has carried out PBDE testing on a variety of food types. Table 41 provides the results of the campaigns from 2006-2008

Table 41 PBDE[61] concentration levels in various food groups

Food group	Concentration Range
Fish	0.03-2.4 μgkg^{-1} whole weight
Carcass fat	0.53-3.33 μgkg^{-1} fat weight
Liver	0.75-4.34 μgkg^{-1} fat weight
Milk	0.31-3.12 μgkg^{-1} fat weight
Eggs	0.66-4.43 μgkg^{-1} fat weight

Source: (FSAI, 2010a)

In 2010 and 2011 the FSAI, in collaboration with the Marine Institute, carried out a targeted surveillance study on a variety of seafood, including farmed and wild finfish, prawns and cultivated mussels available on the Irish market (FSAI, 2013). The campaign involved testing the samples for a variety of contaminants including some PBDE congeners. Table 42 Results of POP-BDE's in seafood samples; provides the results for the various POP-PBDE congeners measured in the samples during the campaign

[60] BDE-28, BDE-47, BDE-99, BDE-100, BDE-153, BDE-154 and BDE-183.
[61] *Note*: Range of upperbound sum of 16 BDE congeners measured in all surveys: BDE-17, BDE-28, BDE-47, BDE-49, BDE-66, BDE-71, BDE-77, BDE-85, BDE-99, BDE-100, BDE-119, BDE-126, BDE-138, BDE-153, BDE-154, BDE-183 and BDE-209.

Table 42 Results of POP-BDE's in seafood samples

FSAI/MI 2010-2011 monitoring campaign - POP-BDE Concentrations (µgkg^{-1} wet weight):						
	BDE-47	BDE-49	BDE-99	BDE-100	BDE-154	BDE-155
Range	0.002-0.79	0.001-0.177	0.002-0.173	0.002-0.194	0.002-0.147	0.002-0.097
Average	0.14	0.039	0.03	0.037	0.026	0.023
Median	0.053	0.011	0.003	0.015	0.006	0.008

Source: (FSAI, 2013).

Information on PBDE concentrations measured in fish samples during the Marine Strategy Framework Directive campaign is included in Table 43 below:

Table 43 Details on concentrations of total PBDE detected in fish samples

POP-BDE Concentrations (µgkg^{-1} wet weight):						
	BDE-28	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154
Range	0.0011-0.0057	0.0011-0.38	0.0012-0.058	0.0008-0.0092	0.0019-0.018	0.0011-0.097

Source: (Marine Institute, 2017 (in preparation)).

WASTE

Shredder Residue Study

In 2010 and 2011, the EPA organised limited sampling and analysis of Irish shredder residues to determine the presence of the BDEs that have been listed under the EU POPs Regulation. Most levels of BDEs measured in samples during the projects were found at very low concentrations or not detected.

The EPA licensing process includes the control and monitoring of POPs in authorisation issued to metal shredder facilities and the licensees are obliged to report on monitoring and control of POPs periodically.

Bulky Wastes Project

Waste arising from soft furnishings such as mattresses and upholstery, are typically managed as bulky waste at landfill or recovered as solid recovered fuel. In December 2011, the EPA organised a limited sampling and analysis study of bulky waste including carpets, mattresses, foam and upholstery (e.g. sofas) to identify the presence of BDEs. The study did not find any POP-BDEs over the limit of detection in the wastes sampled.

End-of-Life Vehicles (ELVs)

In 2013 the EPA had 50 samples from components taken from 22 ELVs[62] tested for a number of PBDEs included POP-PBDE. Samples were taken from dashboards, headrests, seats, door panels and bumpers. Results obtained from the study are provided in Table 44.

[62] ELVs selected for testing were registered prior to the year 2000

Table 44 Concentrations of POP-PBDE detected above the LoD in components of ELVs

PBDEs	Concentration Range ($mgkg^{-1}$)
TetraBDE	1.2-370
PentaBDE	1.6-130
HexaBDE	0.2-16.7
DecaBDE	100-200

Source(s): EPA internal studies/files.

In 2015, ELV Environmental Services CLG/Mayer Environmental/i2 Analytical Ltd., carried out an analysis of automotive shredder residue for end of live vehicles collected from the Republic of Ireland. The 201 ELVs were on average 15 years old. While many of the substances listed in Annex I were found to be below the limit of detection within samples, DecaBDE and HCBDD were detected[63].

OTHER

PBDE Monitoring - Product surveillance

Testing of products for PBDEs is undertaken by the EPA as part of product compliance checking under the RoHS Directive and REACH Regulation. To date no concentration levels of PBDE including POP-PBDE exceeding permitted levels have been found in samples tested. The EPA will continue to include PBDE testing of samples as part of its general internal market surveillance programmes into the foreseeable future.

PBDE Monitoring - Sludge

As part of the implementation of the first National Implementation on POPs, the EPA had samples of municipal sludge from selected waste water treatment plants serving a range of P.E. within the State tested for PBDE content during 2010, 2013 and 2015. The results obtained for the surveys are shown in Table 45.

Table 45 PBDE concentration ranges (μgkg^{-1}) observed in sewage sludge.

PBDE	2010	2013	2015
TetraBDE	1-16	<1-1	n.d.
PentaBDE	n.d.	<1-220	<1-41
HexaBDE	n.d.	n.d.	n.d
HeptaBDE	n.d.	<1-283	n.d.

Source: EPA internal studies/files.

3.4.3 Hexabromobiphenyl

SUMMARY ASSESSMENT OF HEXABROMOBIPHENYL IN IRELAND

Hexabromobiphenyl belongs to a group of flame retardants known as polybrominated biphenyls with the chemical formula $C_{12}Br_6H_4$ and was used in several products including electronics. Its production and use has ceased for several years and there are no known uses in Ireland. There is limited data on the levels of hexabromobiphenyl in food and the environment however limited information suggests that it is not present in significant amounts.

[63] Analysis report can be found on the Stockholm Convention website: http://chm.pops.int/TheConvention/POPsReviewCommittee/Meetings/POPRC11/POPRC11Followup/decaBDEInfoRequest/tabid/4867/ctl/Download/mid/15744/Default.aspx?id=0&ObjID=22055.

The EPA will continue to test for polybrominated biphenyls, including hexabromobiphenyl, in products/articles as part of its general market surveillance programmes. Hexabromobiphenyl will also be monitored in food and is subject to reporting under the EPRTR Regulations.

Hexabromobiphenyl (HBB) like other polybrominated biphenyls (PBBs) was mainly used as a flame retardant in the 1970s. From available information, the production of HBB ceased some decades ago in most countries and based on an expected lifetime of 5-10 years for electrical and electronic products it is expected that products containing HBB have already been disposed of (UNEP, 2007). HBB is banned for use in electrical and electronic equipment under the RoHS Directive. No data is available on production and use of HBB in Ireland. HBB was included under substances listed for elimination (Annex A) under the Stockholm Convention in May 2009.

There is very limited monitoring information available on HBB in the Irish environment. Potential HBB-contamination of the environment could arise from HBB-containing products currently in use or disposed of to landfill through generation of leachate. EU legislation concerning European Pollutant Release reporting[64] requires the reporting of HBB exceeding a limit of 0.1 kg/year separately to air, water and land.

AIR

There is currently no verified information regarding the monitoring of HBB in air in Ireland.

AQUATIC & MARINE

There is currently no verified information regarding the monitoring of HBB in the aquatic or marine environments in Ireland.

SOIL & LAND

There is currently no verified information regarding the monitoring of HBB in soil and land.

FOOD

During 2006-2008 the FSAI had tests carried out on 102 samples of a variety of foods including carcass fat, liver and eggs, for a range of PBB content including HBB (PBB-153). One sample, ovine liver, was found to contain PBB-153 (FSAI, 2010a). The EFSA released scientific opinion in 2010 concluding that the risk of exposure to the European population to Polybrominated Biphenyls through diet is of limited concern (EFSA, 2010).

WASTE

There is currently no verified information regarding the monitoring of HBB in waste.

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

OTHER

Internal Market Surveillance

Testing of products for PBBs has been undertaken by the EPA as part of product compliance checking under the RoHS Directive. To date no concentration levels of PBBs including HBB exceeding permitted levels have been found in electrical and electronic equipment. Additionally, the EPA includes PBB testing of samples in its general internal market surveillance programmes.

3.4.4 Perfluorooctane sulfonic acid and its derivatives (PFOS)

SUMMARY ASSESSMENT OF PFOS IN IRELAND

Perfluorooctane sulfonic acid (PFOS) and its salts are currently listed under the Stockholm Convention. PFOS and its derivatives are synthetically produced fluorinated organic substances with the general chemical formula $C_8F_{17}SO_2X$ (X = OH, Metal salt (O-M+), halide, amide, and other derivatives including polymers). In 2008 PFOS and three PFOS salts, namely, potassium perfluorooctane sulphonate, ammonium perfluorooctane sulphonate and perfluorooctane sulfonyl fluoride, were reported to be manufactured commercially (OECD, 2011). Many of the uses stopped between 2000 and 2004 due to a voluntary production phase out by one of its major producers (BiPRO, 2011). PFOS and its derivatives are part a larger group of chemicals known as Perfluorinated Organic Compounds (PFCs). They are industrial chemicals which have been used in several commercial applications such as coatings which resist heat, stains, grease and water and fire-fighting foams. The other members of the PFC group of chemicals include: perfluorooctanoic acid (PFOA) and perfluorohexane sulfonate acid (PFHxS).

The use of PFOS and its derivatives in firefighting foams poses potentially the greatest risk of environmental contamination and human exposure e.g. through contaminated surface and groundwater. It is still permitted for certain uses under the EU POPs Regulation however Ireland does not avail of any of the exemptions for use of these substances. PFOS has not been found in significant levels in food and the Irish environment based on available monitoring information. Very low concentrations of PFOS have been detected in municipal sludge. Its potential presence in certain consumer products which have yet to enter the waste stream may present a risk in terms of releases to the environment.

Monitoring of PFOS and its derivatives in the environment will continue to be a priority due its previous uses. Studies have been prepared at EU and national level to obtain a better understanding of the presence of PFOS in various waste streams.

As a result of the inclusion as substances listed for restriction (Annex B) under the Stockholm Convention in May 2009, PFOS was listed under the EU POPs Regulation in 2010. Prior to these amendments to the EU POPs Regulation, PFOS was controlled under chemicals legislation[65] with similar restrictions to those under the EU POPs Regulation. The EU has reviewed and withdrawn specific exemptions, namely those for the use of PFOS in etching agents, photo-imaging and aviation hydraulic fluids.

There is limited monitoring information available on PFOS in the Irish environment. Much of the available information relates to the aquatic and/or marine environments.

[65] Regulation (EC) No 552/2009 of 22 June 2009 amending Regulation (EC) No 1907/2006.

AIR

There is currently no information regarding the monitoring of PFOS in air in Ireland.

AQUATIC & MARINE

PFOS and its derivatives are listed as Priority Substances under the WFD. In 2016 as part of its ongoing WFD monitoring commitments the Marine Institute (using extremely sensitive analytical techniques) has enacted a monitoring programme for the measurement of PFOS in marine waters. While there is currently no Environmental Assessment Criteria for PFOS within OSPAR, the Priority Substance Directive has mandated low level environmental quality standard (EQS) for PFOS in both biota and (total) water. Perfluorinated compounds, including PFOS, while detected at extremely low levels, have been found to occasionally exceed the low level EQS for water. Typically, from available monitoring data, PFOS and PFOA concentrations in 4 mussel samples from the OSPAR trend stations and in a small number of wild fish samples were below the limits of quantification for the analytical method available.

SOIL & LAND

There is currently no information regarding the monitoring of PFOS in soil and land in Ireland.

FOOD

In 2010 the FSAI published an investigation into the levels of perfluoroalkylated substances (PFAS)[66] in 122 Irish food samples which included meat, offal, eggs, fish, milk and processed products. The EFSA derived Tolerable Daily Intake (DTI) for PFOS as 150ng/kg body weight per day. Table 46 provides the measured PFOS concentration ranges for the different food types during the study. Trace levels of PFOS was detected in a liver and fish samples.

Table 46 Concentration ranges[67] of PFOS found in food types

Sample type:	Number of samples:	Concentration Ranges (μgkg^{-1} fresh weight):
Liver	12	1-3
Fish	17	1-2

Source: (FSAI, 2010b)

The highest individual levels found were 3 µgkg-1 of PFOS in two liver samples. According to the FSAI, PFOS does not follow the pattern of other POPs by partitioning into fatty tissues but instead binds to proteins in the blood and the liver (FSAI, 2010b). The FSAI have concluded that the levels of PFAS found in this study indicate a low level of contamination in the Irish food chain and are comparable to other countries that have conducted similar studies.

WASTE

According to EU Commission study products with a short life time that have contained PFOS can be considered as historical uses. Products with a longer lifetime however may still be in use. (BiPRO,

[66] PFAS substances are the collective name for a very large group of fluorinated compounds which consist of neutral and anionic surface-active compounds with high thermal, chemical and biological inertness. This group of substances includes PFOS.

[67] Concentrations shown as 0 μgkg^{-1} indicates levels that were less than the Limit of Quantification (LOQ) of 1 μgkg^{-1}.

2011). Products include upholstery made of leather and carpets made of synthetic fibres. In Ireland waste carpets are typically managed as bulky waste and sent to landfill or recovered for solid recovered fuel. In December 2011, the EPA organised some limited sampling and analysis of bulky waste to identify the presence of PFOS in upholstery and carpets. The study found very low or undetected levels of PFOS in the sampled waste.

OTHER

PFOS Monitoring – Sewage Sludge

In 2011, 2013 and 2015 the EPA had some limited sampling and analysis of POPs, including PFOS, in sewage sludge from selected waste water treatment plants serving a range of P.E. within the State. Table 47 provides the findings of these surveys.Table 47 PFOS concentrations measured in Sewage Sludge

	2010	2013	2015
Number of Samples	9	15	15
Number of Detections (above LoD)	2	8	15
Concentration Range (µgkg-1) (dry weight)	1.4-2.1	2.6-6.4	1-9

Source(s): EPA internal studies/files

3.4.5 Hexabromocyclododecane (HBCD)

SUMMARY ASSESSMENT OF HBCD IN IRELAND

Hexabromocyclododecane (HBCD) is a polybrominated flame retardant with the chemical formula $C_{12}H_{18}Br_6$ and mainly found three isomeric forms, namely α- HBCD, β- HBCD and γ- HBCD. HBCD has been used in a wide range of applications from building insulation materials to fabrics.

Generally, HBCD has not been found in significant concentrations in food or in the Irish environment. However due to the nature of some of the past uses of HBCD and particularly its incorporation into insulating materials, the risk for release of HBCD into the environment is likely to remain for considerable time if current and future HBCD-containing wastes are not appropriately managed. It is therefore recommended in the Action Plan that HBCD-containing wastes are properly identified, segregated from other waste and managed appropriately.

Hexabromocyclododecane (HBCD) is a polybrominated flame retardant with the chemical formula C12H18Br6 and found in three isomeric forms, namely α- HBCD, β- HBCD and γ- HBCD. It is a white solid at room temperature. Commercially available HBCD generally consisted of 80-85% γ- HBCD, 8-9% α- HBCD and 6% β- HBCD (TemaNord, 2008). While it is incorporated into polymers it is not chemically bound to the polymer. Consumption of HBCD in the EU in 2001 to 2002 was estimated to be 9,500 tonnes (BSEF, 2003). The major volumes of HBCD (90%) were used in polystyrene applications including Expandable Polystyrene (EPS) for construction insulation boards and food packaging, Extruded Polystyrene (EPS) for construction insulations materials and High Impact Polystyrene (HIPS) for electrical equipment housings. HBCD was also used for coating fabrics (European Commission, 2008). HBCD was listed in Annex A of the Stockholm Convention in May 2013 with exemptions for continued use in expanded polystyrene and extruded polystyrene in buildings.

Direct release of HBCD is not considered to be a relevant contamination route (European Commission, 2008). HBCDD has been detected in bird eggs, polar bears and sea mammals. HBCD undergoes debromination under biodegradation process with α-HBCD appearing less influenced by an aerobic environment, e.g. soil, and exhibiting lower decay rates compared to β-HBCD and γ-HBCD isomers. This would indicate a potential for indirect exposure. Due to the historic uses of HBCD, releases of HBCD from landfill due to leaching may be expected.

The main sources of exposure to HBCD is through dermal contact with products containing HBCD (while HBCD is incorporated into products it is not generally chemically bound and so can migrate on contact) or through the environment by inhalation of vapour particles or oral routes such as contaminated food or water. It can be expected the activity with a high potential for release of HBCD into the environment is the demolition of buildings and certain packaging. The levels of HBCD releases are likely to depend on the method of demolition used through the generation of HBCD-containing dust.

AIR

There has been relatively little air monitoring for HBCD carried out in Ireland. As part of the EPA dioxin monitoring programme carried out in Summer 2012, cows' milk samples were tested for HBCD content. No HBCD was detected in any of the samples.

AQUATIC & MARINE

During 2004 the Marine Institute carried out a study on farmed salmon for brominated flame retardants contamination which included HBCD. The mean upper bound HBCD concentration found in the samples was 1.17 ±0.26µgkg^{-1} (Marine Institute, 2004). The levels found were comparable with those found in similar studies.

FOOD

In 2010, the FSAI carried out a targeted surveillance study which involved testing a variety of food samples for a range of parameters including HBCD (FSAI, 2010a). The main results of the study are shown in the Table 48. The percentage of samples in which HBCD was found above the LoD ranged from 83% (porcine fat) to 0% (bovine fat). The study concluded exposure to HBCD due to the food types tested is low and based on the then toxicological data would not likely to be of concern.

Table 48 HBCD concentration levels observed in various food groups

Food group	Concentration Range (µgkg^{-1} fat weight)
Fish	-
Carcass fat	0.087-6.1
Liver	1.4-6.7
Milk	0.77-7.2
Eggs	0.16-0.82

Source (FSAI, 2010a).

In 2010 and 2011 the FSAI, in collaboration with the Marine Institute, carried out a targeted surveillance study on a variety of seafood, including farmed and wild finfish, prawns and cultivated mussels available on the Irish market (FSAI, 2013). The campaign involved testing the samples for a

variety of contaminants including HBCD. Results obtained ranged from 0.03 µgkg^{-1} (Lemon Sole, Plaice and Ray samples respectively) to 0.55µgkg^{-1} for Salmon.

WASTE

There is currently no verified information regarding the monitoring of HBCD in waste in Ireland.

OTHER

Sewage Sludge

As part of the implementation of the 2012 National Implementation Plan, the EPA had samples of municipal sludge from selected waste water treatment plants[68] in the State tested for HBCD content during 2013 and 2015. HBCD was only detected in samples during the 2015 survey. The HBCD results obtained for the 2015 survey are shown in Table 49.

Table 49 PFOS concentrations measured in Sewage Sludge (Total HBCD content)

Concentration Range (µgkg^{-1})	Average Conc. (µgkg^{-1})	Median Conc. (µgkg^{-1})
10 - 686	321	292

Market Surveillance

The EPA as part of its internal market surveillance programmes tests several products from electrical and electronic equipment to general household items for a variety of POPs including HBCD. Concentration levels of HBCD found in samples were low and did not exceed permitted levels.

3.4.6 Hexachlorobutadiene (HCBD)

SUMMARY ASSESSMENT OF HCBD IN IRELAND

Hexachlorobutadiene (HCBD) is a polychlorinated compound which has been used in applications ranging from transformer dielectrics to aluminium production. The quantities of HCBD used within the State are unknown.

While the monitoring of HBCD has been limited to date, generally, HBCD has not been found in significant concentrations in food or in the Irish environment.

Hexachlorobutadiene (HCBD) is a chlorinated organic compound with the general chemical formula C_4Cl_6. It is a colourless liquid at room temperature. HCBD was used as a chlorine "scrubber" in the manufacture of rubber, in hydraulic and heat transfer fluids, transformer fluids and the manufacture of aluminium and graphite rods. It also had some plant protection applications. The intentional production of HCBD in Europe is thought to have ceased during the late 1970s however HCBD can be unintentionally produced during the manufacture of some chlorinated hydrocarbons such as perchloroethylene and trichloroethylene. HCBD was first listed in Annex A of the Stockholm Convention in 2015 and in Annex C in 2017.

There is limited monitoring information available on HCBD in the Irish environment. Much of the available information relates to the aquatic and/or marine environments.

[68] Serving a range of population equivalents (PE)

AIR

There is currently no information regarding the monitoring of HCBD in air in Ireland.

AQUATIC & MARINE

HCBD is listed as a Priority Hazardous Substance under the WFD.

The Marine Institute carried out monitoring programmes on biota during the periods 2010-2012 and 2013-2015 for a variety of contaminants including HCBD (EPA, 2017b). Table 50 provides the measured HCDB concentrations from the programmes.

Table 50 HCBD concentrations measured in biota

	Measured HCBD Concentration ranges and Means (µgkg-1)	
Programme	2010-2012	2013-2015
Concentration Range	0.06-0.34	0.02-0.15
Mean concentration	0.013	0.094
EQS (Biota)	55	

Source: (EPA, 2017b).

SOIL & LAND

There is currently no information regarding the monitoring of HCBD in soil and land in Ireland.

FOOD

There is currently no information regarding the monitoring of HCBD in food in Ireland. Preliminary indications from non-verified 2017 HBCD food monitoring data suggests the levels of HCBD in food is low.

WASTE

There is currently no information regarding the monitoring of HCBD in waste in Ireland.

OTHER

HCBD Monitoring – Sewage Sludge

In 2013 and 2015 the EPA had some limited sampling and analysis of POPs, including HCBD, in sewage sludge from selected waste water treatment plants serving a range of population equivalents within the State. HCBD was not detected in any of the samples above the LoD (10mgkg^{-1}).

3.4.7 Polychlorinated Naphthalenes (PCN)

SUMMARY ASSESSMENT OF PCN IN IRELAND

Polychlorinated Naphthalenes (PCN) are chlorinated compounds based on the Naphthalene structure. The main uses for PCN were in wood preservatives, dielectrics, engine oil additives and dyes. PCN can also be formed during uncontrolled combustion processes which are thought to be currently the main release sources. Other potential PCN contamination may be due to landfill leachate from disposal of PCN-containing waste.

There is little monitoring information regarding PCN in the Irish environment. However, limited monitoring in food for PCN have indicated relatively low concentrations.

Polychlorinated Naphthalenes (PCNs) are a group of 75 chemicals whose structure is based on that of Naphthalene where up to 8 of the hydrogen atoms has been replaced by chlorine with the general chemical formula $C_{10}H_{8-n}Cl_n$, where n=2-8. Production of PCN greatly reduced during the 1970s and ceased completely after 1983. PCN were used in applications varying from wood preservation, engine oil additives, dyes, refractive index oils and dielectrics in capacitors. Additionally, PCN have been detected in some PCB-based electrical insulation materials (UNECE, 2007). PCN may also be unintentionally produced during uncontrolled combustion processes. Some PCN can breakdown in sunlight while others are more persistent. Exposure of workers to PCN has been associated with cirrhosis of the liver (WHO, 2001). PCN were listed in the EU POPs Regulation in 2012 (as it was a listed POP under the UNECE POPs Protocol) and listed in Annex A (with specific exemptions) and Annex C of the Stockholm Convention in May 2015. There is very little information on monitoring of PCN in the environment.

AIR

There is currently no information on PCN monitoring in air in the Irish environment.

AQUATIC & MARINE

There is currently no information on PCN monitoring in both the aquatic and marine environments. PCN are not currently listed as Priority Hazardous Substances under the WFD.

SOIL & LAND

There is currently no verified information regarding the monitoring of PCN in soil and land in Ireland.

FOOD

Between 2007 and 2008, the FSAI, in collaboration with the DAFM and the Marine Institute, carried out a targeted surveillance programme to determine the levels of target Polychlorinated Naphthalene congeners[69] in certain foods (FSAI, 2010c). The study provided baseline information on the concentrations of PCN in various foods such as meat, fish, eggs, some dairy products, cereals and vegetables. Findings suggest the main source of PCN contamination in food was due to residual contamination arising from the commercial use of PCN. However, the levels of PCN found in foods did not raise concern. Table 51 below and Table 52 provide the concentration ranges for PCN in foodstuffs tested.

[69] Polychlorinated naphthalene congeners PCN 52, PCN 53, PCN 66/67, PCN 68, PCN 69, PCN 71/72, PCN 73, PCN 74 & PCN 75.

Table 51 PCN concentrations and concentration ranges observed in various foods

General sample type	Sample type	Number of samples	PCN (total) Concentration range ($ngkg^{-1}$ fresh weight)
Fish	Mackerel	3	5.9-12.9
	Salmon (farmed)	5	12.65-59.3
	Trout	3	2.08-7.47
	Oysters (Pacific)	5	0.18-2.34
Liver	Avian	3	0.18-.061
	Bovine	2	0.29-0.31
	Equine	2	0.53-0.57
	Ovine	3	1.34-4.26
	Porcine	2	0.28-0.37
Carcass fat	Avian	6	2.81-13.41
	Bovine	5	2.24-2.52
	Ovine	5	2.95-4.17
	Porcine	5	1.63-1.9
Eggs	Eggs	15	0.23-2.22
Dairy	Milk	15	0.09-0.38
	Butter	5	1.31-3.13

Table 52 PCN concentrations and concentration ranges observed in various foods contd.

Sample type	Number of samples	PCN (total) Concentration ($ngkg^{-1}$ fresh weight)
Ham	1	0.13
Sausages	1	0.54
Rice (Basmati)	1	0.25
Bread	1	0.42
Breakfast cereal	1	0.77
Oats	1	0.58
Cabbage	1	2.84
Tomatoes (vine)	1	0.19
Mushrooms	1	1.76
Potatoes	1	0.16
Potatoes (Rooster)	1	0.18
Sweetcorn	2	0.2
Tomato puree	1	0.25
Cheddar (red)	1	0.68

WASTE

There is currently no verified information regarding the monitoring of PCN in waste.

OTHER

During late 2013 the EPA had 15 samples of municipal sludge from 5 selected waste water treatment plants serving a range of population equivalents. within the State tested for a variety of parameters including PCN. PCN were not detected in any sample above the LoD.

3.4.8 Pentachlorophenol and its salts and esters (PCP)

SUMMARY ASSESSMENT OF PCP IN IRELAND

Pentachlorophenol and its salts and esters (PCP) have been used as a pesticide, wood preservative, in biocides in anti-fouling agents and in protective coatings on fabrics. European evidence would suggest the greatest use of PCP in Ireland was as a wood preservative. The main sources of releases of PCP to the environment are largely regarded to result from its use as a wood preservative and textile applications due to volatilisation to air and runoff to water and soil. While produced intentionally, PCP is also a transformation product of other POPs such as HCB and HCH. Pentachloroanisole (PCA) is a metabolite of PCP. PCP and PCA are highly toxic to humans and to aquatic life (UNEP, 2013a).

To date there has been no extensive monitoring of PCP in the environment except in the case of water (under the Water Framework Directive) and sludge however, information obtained from such investigations would indicate PCP does not pose a serious environmental threat. There is currently no information on PCP monitoring in food.

Other PCP applications included anti-fouling agents, protective coatings for fabrics. Pentachlorophenol and its metabolite Pentachloroanisole (PCA) are hepatotoxic, carcinogenic, immunotoxic, neurotoxic, reprotoxic and highly toxic to aquatic life (UNEP, 2013a). PCP was listed under Annex A of the Stockholm Convention in May 2015. There is limited monitoring information on PCP in the Irish environment. Much of the available information relate to the aquatic environment.

AIR

There is currently no verified information on PCP monitoring in air in the Irish environment.

AQUATIC & MARINE

PCP is listed as a Priority Substance in the Directive 2013/39/EU. During the 2007-2009 and 2010-2012 WFD Surveillance programme samples were tested for PCP. Out of 19 river samples, 2 were found to contain PCP with one sample exceeding the AA EQS. Both occurrences are thought to be isolated events (EPA, 2015a).

A study investigating the congener profiles of PCDD/Fs in eels, passive sampler and sediment extracts from the rural Burrishoole catchment in the West of Ireland were compared with potential PCDD sources. ∑PCDD/F levels in eels ranged from 2.9 to 25.9 pgg^{-1} which are elevated compared to other locations in Ireland. Results suggest residual PCDD contamination associated with historic use of a contaminated product in the catchment area, with pentachlorophenol suspected as a strong candidate (White, et al., 2014).

SOIL & LAND

There is currently no verified information regarding the monitoring of PCP in soil and land in Ireland.

FOOD

There is currently no verified information regarding the monitoring of PCP in food in Ireland.

WASTE

There is currently no verified information regarding the monitoring of PCP in waste in Ireland.

OTHER

Sewage Sludge

In 2013 and 2015 the EPA had some limited sampling and analysis of POPs, including PCP, in sewage sludge from selected waste water treatment plants serving a range of P.E. within the State. PCP was not detected in any of the samples above the LoD (10mgkg^{-1}).

SECTION 4

4 Unintentionally released POPs

4.1 General assessment of unintentionally produced POPs in Ireland

SUMMARY ON THE ASSESSMENT OF RELEASES OF UNINTENTIONAL POPS IN IRELAND

Unintentionally formed POPs, also referred to as unintentional by-products, are not specifically manufactured as commercial substances but may be formed accidentally as a result of certain processes or activities (e.g. combustion and chemical processes). Air is the main transport medium for unintentionally produced POPs. Many of substances may be formed in temperate climates and through the process of re-volatilization and condensing, also called the "grasshopper effect", can be carried thousands of kilometres from their sources.

Ireland has produced inventories of emissions for releases of many POPs to air, land and water while additional release estimates to residue and product have also been established for some other POPs. The most significant POPs in terms of potential sources of unintentional releases are Polychlorinated dibenzo-p-dioxins (PCDD or dioxins) and Polychlorinated dibenzofurans (PCDF or furans), PCBs and hexachlorobenzene. The main potential sources for these POPs are quite similar being open burning such as accidental burning of vehicles, buildings and backyard burning in addition to emissions from energy such as heat and power generation. For PCDD and PCDF it is estimated that circa 20% of emissions to air is attributed to open burning processes and 60% emissions from heat and power generation. Hexachlorobenzene is not considered to be a significant POP in Ireland and its main release is assumed, based on available information, to result from its presence as an impurity in the fungicide Chlorothalonil, all of which is imported into Ireland.

There is uncertainty with some of the data for certain sources and where releases relate to water, land, residue and product. For some substances, there is no information for POPs releases to residue and product.

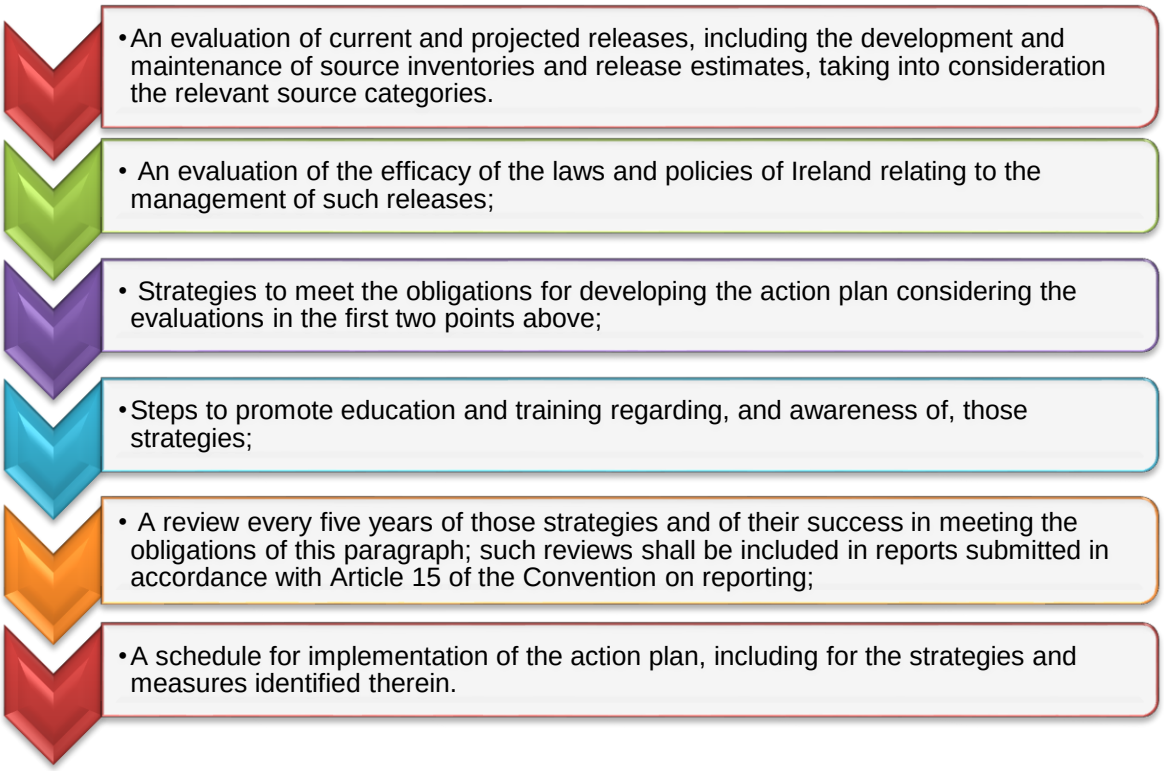
Under the Stockholm Convention unintentionally produced POPs are subject to measures to reduce or eliminate their releases. The chemicals listed as unintentionally produced POPs under the Stockholm Convention up to and including May 2015 are:

- Polychlorinated dibenzo-p-dioxins (PCDD) and dibenzofurans (PCDF) (dioxins & furans);
- Polychlorinated biphenyls (PCBs);
- Hexachlorobenzene (HCB); and
- Pentachlorobenzene (PeCB).

Because of their listing under the Stockholm Convention the chemicals referred to above were included for listing under the EU POPs Regulation as substances subject to release reduction measures. Certain polycyclic aromatic hydrocarbons (PAHs)[70] have also been included in the EU POPs Regulation as a result of being listed as unintentionally formed substances under the UNECE POPs Protocol. These substances are not discussed in this plan however measures to identify and mitigate the risks posed by these chemicals (along with POPs in general) will continue in the Irish context.

[70] Specifically, benzo(a)pyrene, benzo(b) fluoranthene, benzo(k)fluoranthene and indeno (1,2,3-cd) pyrene.

Article 5 of the Stockholm Convention requires Parties to develop an Action Plan designed to identify, characterise and address the release of unintentionally produced POPs. Ireland's Action Plan is outlined at the beginning of this report. Specific elements required for the Action Plan include:



Parties to the Stockholm Convention are further required to promote the application of available, feasible and practical measures that can give a realistic and meaningful level of release reduction or source elimination of unintentional POPs. Furthermore, the Convention requires Parties to promote the development and, where it deems appropriate, require the use of substitute or modified materials, products and processes to prevent the formation and release of unintentionally produced POPs considering the general guidance on prevention and release reduction measures in Annex C of the Convention and guidelines adopted under the Convention.

Parties are also required to ensure the use of best available techniques (BAT) and promote best environmental practices (BEP); for new sources within source categories within four years of entry into force of the Convention for it and promote BAT and BEP for existing sources listed under source categories and new sources. Parties may also set release limit values or performance standards to fulfil commitments for the use of BAT.

Article 5 of the Convention requires an evaluation of current and projected releases of unintentionally produced POPs including the development and maintenance of source inventories and release estimates. Every year the EPA produces an inventory of emissions for a wide range of air pollutants and other substances released into the atmosphere as a requirement of the UNECE Convention on Long Range Transboundary Air Pollution (CLRTAP). The inventory includes the reporting of releases to air of unintentionally produced POPs as listed under the Stockholm Convention (with the exception of PeCB) and the UNECE Protocol on POPs (e.g. certain PAH).

Unintentional releases of POPs are calculated using either of the following formulae:

Emission from source = Emission factor (EF) x Activity rate

Or

Emission from source = POP Concentration in emission x Operational Hours x flue gas volume per hour

To illustrate the current releases of unintentionally produced POPs for the National Implementation Plan and national reporting requirements under the Stockholm Convention, the releases of unintentionally produced POPs described in this document have been mapped and reported under the main source categories established in the UNEP Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases (UNEP, 2013b). The updated Irish inventory of POPs has been compiled in line with a new reporting format (NFR14). The use of the NFR source code contributes to the transparency of the information and facilitates national and international reviews. The NFR coding scheme, which was traditionally designed to help categorise emissions to air, has been utilised for allocating emissions to other vectors (e.g. residue and product). Appendix 3 contains a table matching the new NFR14 format against the NFR08 for comparison (Del Vento, et al., 2017).

In 2007 the EPA funded a project to develop an inventory of unintentionally produced POPs releases in Ireland which included emissions to air, land and water for the period 1990 to 2006. The emission estimates were calculated using data from measurements and research within Ireland, but are also supplemented by calculations using literature emission factors and available activity data such as industry information within the State (Creedon, et al., 2010). For the purposes of the first National Implementation Plan, the inventories for releases to land and water were updated for the years 2007, 2008, 2009 and 2010 in line with the air emission inventories which have been updated yearly to meet requirements under the CLRTAP and have subsequently been mapped to the main source categories listed under UNEP toolkit (Table 52).

The Irish inventory of unintentionally produced POPs releases was updated in 2017. The main objectives of the project were:

- Identification of sources of POPs emissions to air, land, water, product and residue in Ireland;
- Update of emission factors and collect activity data and emissions data for those sources through literature research and consultation with stakeholders within Ireland;
- Update and disaggregate of the previous inventories from three (air, land, water) to five vectors, including residues and products, where such data is available;
- Compilation of consistent emission inventories for the years 2007–2015 and generation of emission estimates for the period 1990-2015;
- Development a new source-based emission inventory for Pentachlorobenzene (PeCB) in Ireland; and
- Generation of recommendations for future work to improve POPs emission inventories.

It should be noted that limited data exists for several sources of POPs. The emission estimates to air, water, land, residue and products draw upon the most current data from measurements and research within Ireland, but are also largely derived from calculations using literature emission factors. In the establishment of the inventories, emission factors outlined in the UNEP 2013 Toolkit (UNEP, 2013b)

and EMEP/EEA Guidebook (EMEP/EEA, 2016) were used to address gaps in the Ireland-specific sources. Use of these emission factors may introduce an additional level of uncertainty due to potential differences in process technologies, operating conditions and practices and pollution control equipment employed. This is particularly relevant for industrial processes, where there is often a lack of knowledge about abatement systems used, and uncertainty on the year they were installed and the impact on emissions across different POPs. This is further detailed in the Update of Inventories of Persistent Organic Pollutants (POPs) in Ireland 2006 – 2015 report (Del Vento, et al., 2017).

Table 52 UNEP Toolkit Main Source Categories

Group	Main Source Categories
1	Waste Incineration
2	Ferrous & Non-Ferrous Metal Production
3	Heat & Power Generation
4	Production of Mineral Products
5	Transportation
6	Open Burning Processes
7	Production of Chemicals & Consumer Goods
8	Misc. (e.g. Crematoria, Dry Cleaning)
9	Disposal
10	Potential Hot-Spots (e.g. PCB-containing equipment)

Ireland does not currently have information on projected releases of all relevant POPs to air, land and water. It is intended that projections of such releases will be carried out as part of the Action Plan.

4.1.1 Polychlorinated dibenzo-p-dioxins (PCDD) and Polychlorinated dibenzofurans (PCDF)

SUMMARY ASSESSMENT OF PCDD/PCDF IN IRELAND

PCDD and PCDF, unlike other POPs, were not produced commercially. They can be unintentionally formed during certain activities, e.g. uncontrolled combustion, or as by-products in some manufacturing processes. There are 75 PCDD and 135 PCDF congeners respectively with 2,3,7,8-Tetrachlorodibenzo-p-dioxin generally regarded as the most toxic. Human exposure to PCDD/PCDF is associated with severe skin lesions (chloracne), general weakness, changes in liver enzyme activities, depression of the immune system and endocrine disruption. Other toxic effects linked to PCDD/PCDF exposure is an increased prevalence of diabetes. 2,3,7,8-T4CDD is suspected to be a potent multi-site carcinogen. PCDD and PCDF were some of the original substances listed under the Stockholm Convention.

PCDD and PCDF once released disperse throughout the environment. Some lower chlorinated PCDD/PCDF can vaporise in warm climates and then be deposited on vegetation. Due to their low water solubility and tendency to dissolve in fatty tissues, PCDD and PCDF bind to particulates, organic matter and sediments and can accumulate in biota.

PCDD and PCDF have been included in a limited number of monitoring programmes primarily relating to air (e.g. cows' milk studies) and food.

AIR

The previously mentioned phenomenon of atmospheric deposition of POPs on vegetation can be used to provide an indication of the levels of certain POPs in air. The EPA cows' milk studies include testing for PCDD and PCDF. Samples are taken during Summer months and can be used as indicators for dioxin like PCB exposure due to atmospheric deposition. Total PCDD/PCDF concentrations measured in the milk samples are considerably below the EU limit (2.5pgWHO-TEQgfat^{-1}). Table 53 provides the concentrations of PCDD/PCDF detected for each of the programme's sampling period.

Table 53 Concentrations (total) of NDL-PCB71 measured in cows' milk.

Mean total PCDD/PCDF concentrations found in Cows' Milk (WHO-TEQpgkg^{-1}fat)					
2011	2012	2013	2014	2015	2016
0.261	0.196	0.17	0.175	0.18	0.259

Sources: (EPA, 2014a), (EPA, 2014b), (EPA, 2015b), (EPA, 2016b) and (EPA, 2016c).

AQUATIC & MARINE

Specific[72] PCDD and PCDF are listed as priority hazardous substances under the WFD. There is currently no verified information on PCDD/PCDF monitoring in both the aquatic and marine environments.

FOOD

During 2006-2008 the FSAI had tests carried out on 102 samples of a variety of foods including carcass fat, liver and eggs, for a range of PCDD and PCDF[73]. Table 54 includes a summary of the results obtained from the study (FSAI, 2010a).

Table 54 Summary of results for total/sum PCDD/PCDF concentrations for Brominated and Chlorinated Pollutants in certain food types.

Sample type	Number of samples	Concentration Ranges (WHO-TEQngkg^{-1} fat)
Carcass fat	38	0.07-0.46
Liver	12	0.18-18.39
Eggs	20	0.13-0.52
Milk	32	0.11-0.27

Source: (FSAI, 2010a).

In 2010 and 2011 the FSAI, in collaboration with the Marine Institute, carried out a targeted surveillance study on variety of seafood, including farmed and wild finfish, prawns and cultivated mussels available on the Irish market (FSAI, 2013). The campaign involved testing the samples for a

[71] PCB-28, PCB-52, PCB-101, PCB-138, PCB-153 and PCB-180.

[72] 2,3,7,8-T_4CDD, 1,2,3,7,8-P_5CDD, 1,2,3,4,7,8-H_6CDD, 1,2,3,6,7,8-H_6CDD, 1,2,3,7,8,9-H_6CDD, 1,2,3,4,6,7,8-H_7CDD, 1,2,3,4,6,7,8,9-O_8CDD, 2,3,7,8-T_4CDF, 1,2,3,7,8-P_5CDF, 2,3,4,7,8-P_5CDF, 1,2,3,4,7,8-H_6CDF, 1,2,3,6,7,8-H_6CDF, 1,2,3,7,8,9-H_6CDF, 2,3,4,6,7,8-H_6CDF, 1,2,3,4,6,7,8-H_7CDF, 1,2,3,4,7,8,9-H_7CDF and 1,2,3,4,6,7,8,9-O_8CDF.

[73] 2,3,7,8-T_4CDD, 1,2,3,7,8-P_5CDD, 1,2,3,4,7,8-H_6CDD, 1,2,3,6,7,8-H_6CDD, 1,2,3,7,8,9-H_6CDD, 1,2,3,4,6,7,8-H_7CDD, O_8CDD, 2,3,7,8-T_4CDF, 1,2,3,7,8-P_5CDF, 2,3,4,7,8-P_5CDF, 1,2,3,4,7,8-H_6CDF, 1,2,3,6,7,8-H_6CDF, 1,2,3,7,8,9-H_6CDF, 2,3,4,6,7,8-H_6CDF, 1,2,3,4,6,7,8-H_7CDF, 1,2,3,4,7,8,9-H_7CDF and O_8CDF.

variety of contaminants including PCDD and PCDF[74]. Results obtained ranged from 0.04 μgkg^{-1} (Monkfish, Prawns, Ray and Whiting samples respectively) to 1.16μgkg^{-1} for Mackerel.

OTHER

Sewage Sludge

During 2013 and 2015 the EPA had 15 samples of sludge from selected waste water treatment plants serving a range of PE within the State tested for POPs, including PCDD and PCDF. Details of the total PCDD/PCDF concentrations measured in the samples are shown in Table 55. All measured concentrations were considerably below the Low POP Concentration Level (LPCL) of 15μgkg^{-1} established under the EU POPs Regulation.

Table 55 Total PCDD/PCDF concentration ranges measured in Sewage Sludge

	2013	2015
Concentration Range (WHO-TEQngkg^{-1}) (dry weight)	0.11-8.9	2.25-22.59

Source: EPA internal studies.

PCDD and PCDF releases

PCDD and PCDF are produced unintentionally mainly due to incomplete combustion processes such as the uncontrolled burning of waste and can also form during combustion of automotive fuels, peat, coal, and wood, particularly wood treated with chlorinated preservatives. They may also be unintentionally produced during the manufacture of some pesticides and other chlorinated substances. PCDD and PCDF are destroyed at incinerator temperatures above 800°C for sufficient residence times. The quantities of PCDD and PCDF emitted from commercial incinerators are regarded as low compared to the total amounts released annually.

[74] 2,3,7,8-T_4CDD, 1,2,3,7,8-P_5CDD, 1,2,3,4,7,8-H_6CDD, 1,2,3,6,7,8-H_6CDD, 1,2,3,7,8,9-H_6CDD, 1,2,3,4,6,7,8-H_7CDD, O_8CDD, 2,3,7,8-T_4CDF, 1,2,3,7,8-P_5CDF, 2,3,4,7,8-P_5CDF, 1,2,3,4,7,8-H_6CDF, 1,2,3,6,7,8-H_6CDF, 1,2,3,7,8,9-H_6CDF, 2,3,4,6,7,8-H_6CDF, 1,2,3,4,6,7,8-H_7CDF, 1,2,3,4,7,8,9-H_7CDF and O_8CDF.

Based on inventory emissions estimates in Ireland in 2015, total emissions of PCDD and PCDF to air, land, water, residue and product were 49g-ITEQ with releases to air accounting for about 52% of total emissions (Del Vento, et al., 2017). Figure 6 shows the estimated total PCDD/PCDF emissions for the years 1990 to 2015 inclusive.

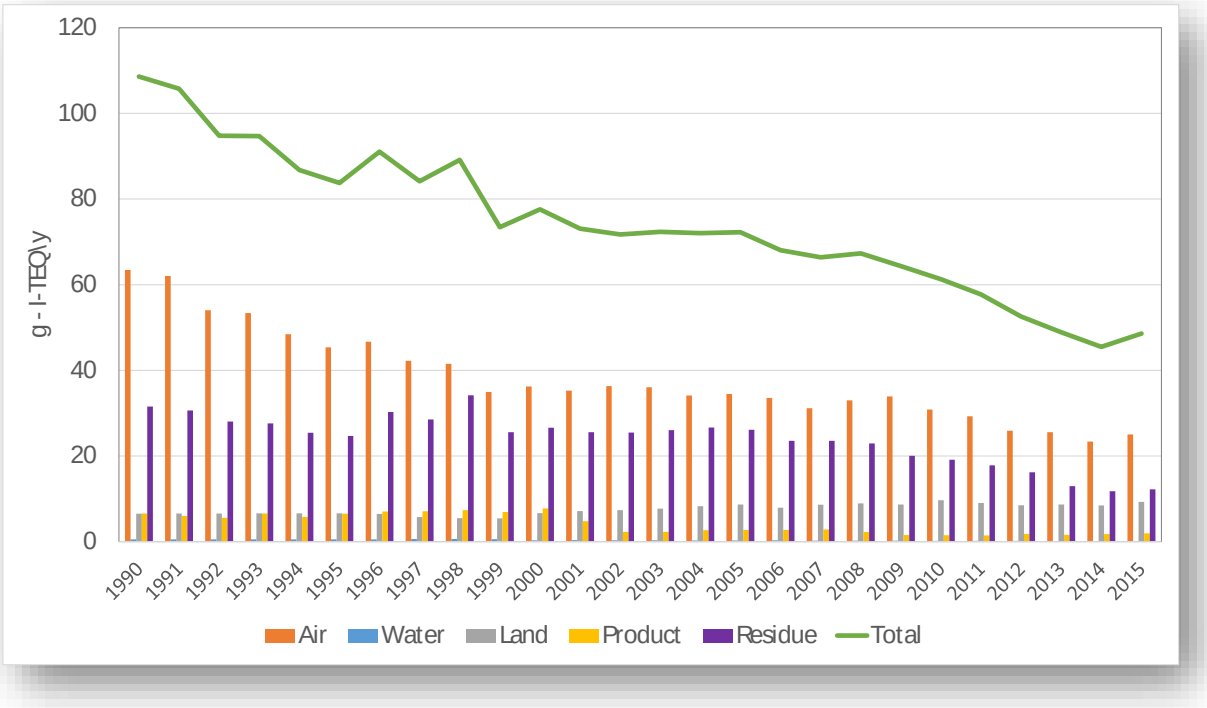


Figure 7 Estimated Total PCDD/PCDF Emissions (g-ITEQ/y) for 1990-2015.

ESTIMATED RELEASES TO AIR

Based on inventory emissions estimates in Ireland in 2015, total emissions of PCDD and PCDF to air in 2015 were estimated to be 25.14gI-TEQ (Del Vento, et al., 2017). Figure 7 shows the estimated total PCDD/PCDF emissions from all source sectors to air for the years 1990 to 2015.

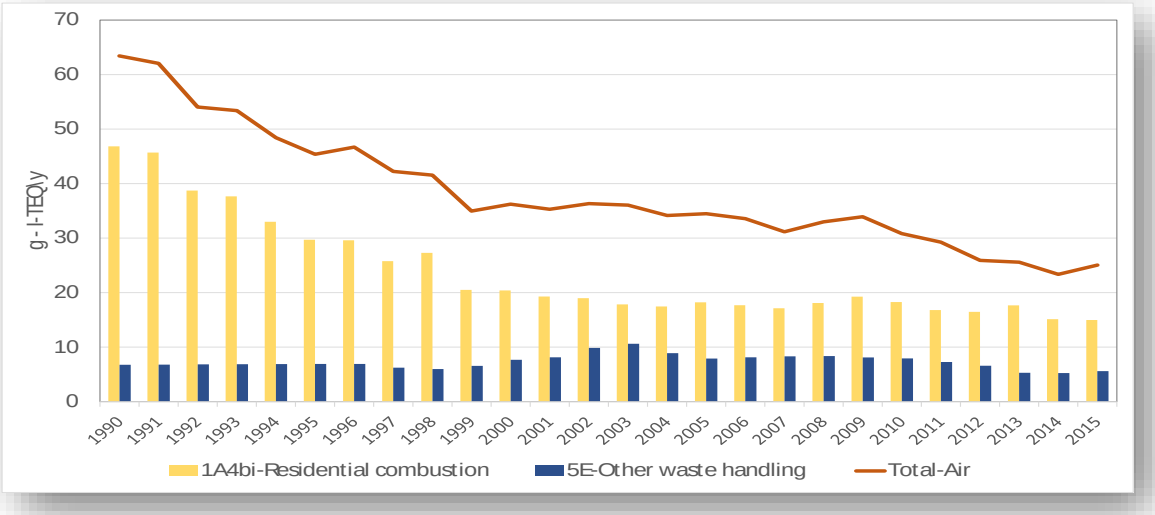


Figure 8 Estimated Total PCDD/PCDF emissions to Air (g-ITEQ/y) for 1990-2015.

During 2015 the major PCDD/PCDF emissions, approximately 60% of total, were attributed to Residential combustion–Stationary (1A4bi) followed by other waste handling (5E) (approximately 20% of total) which covers a variety of emission sources such as domestic bonfires, burning of household waste, open burning of wood on construction sites and accidental fires – vehicles and buildings. Other contributors to PCDD/PCDF emissions were Road Transport (1A3), Stationary combustion in manufacturing industries: Non-metallic minerals (1A2f), Public electricity and heat production (1A1a), Non-ferrous metal sector (2C) and Cement and lime production (2A1).

ESTIMATED RELEASES TO AQUATIC & MARINE

Total emissions of PCDD and PCDF to water in 2015 were estimated to be 0.14gI-TEQ (Del Vento, et al., 2017). Figure 8 shows the estimated total PCDD/PCDF emissions from all source sectors to water for the years 1990 to 2015.

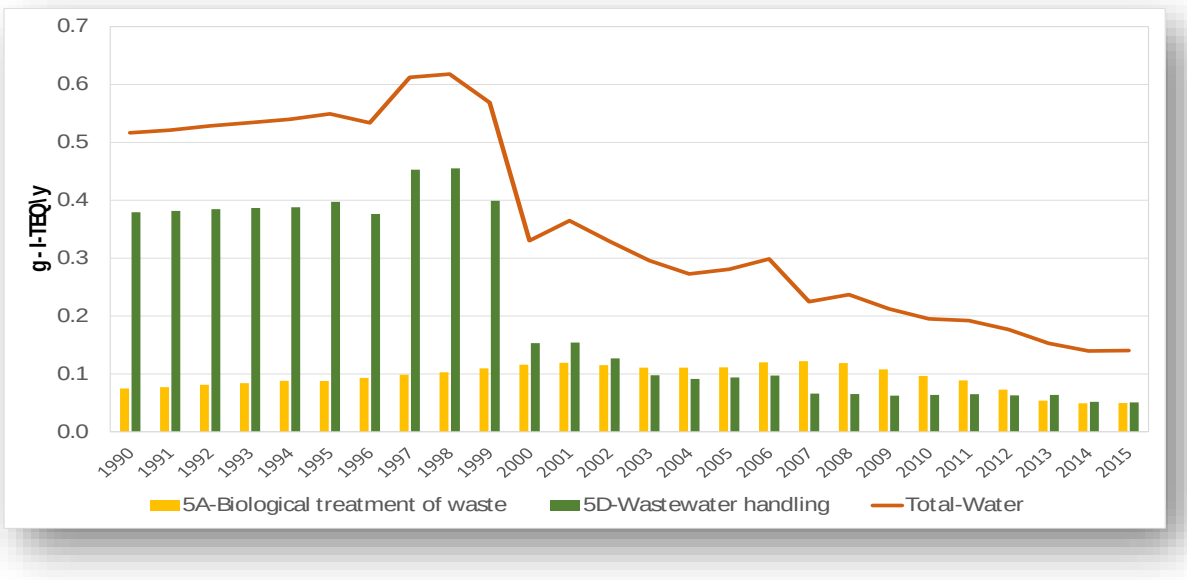


Figure 9 Estimated Total PCDD/PCDF emissions to Water (g-ITEQ/y) for 1990-2015.

The main contributions to total PCDD/PCDF emissions to water were from source sectors; Water treatment and sewage sludge treatment (5D wastewater handling) and Landfill leachate (5A Biological treatment of waste - Solid waste disposal on land) to groundwater. The sharp decline observed from 2000 is related to the ban of this practice and the introduction of the Dumping at Sea Act 1996 (S.I. No. 14 of 1996). Burning domestic waste in backyards and in household stoves and fires accounted for 20% of all dioxin emissions in Ireland[75].

[75] Update of Inventories of Persistent Organic Pollutants (POPs) in Ireland 2006 – 2015: 20% in 2015, covering a variety of emission sources: domestic bonfires, burning of household waste, open burning of wood on construction sites, accidental fires – vehicles, accidental fires – buildings.

ESTIMATED RELEASES TO SOIL & LAND

Total emissions of PCDD and PCDF to land in 2015 were estimated to be 9.28gI-TEQ (Del Vento, et al., 2017). Figure 9 shows the estimated total PCDD/PCDF emissions from all source sectors to land for the years 1990 to 2015.

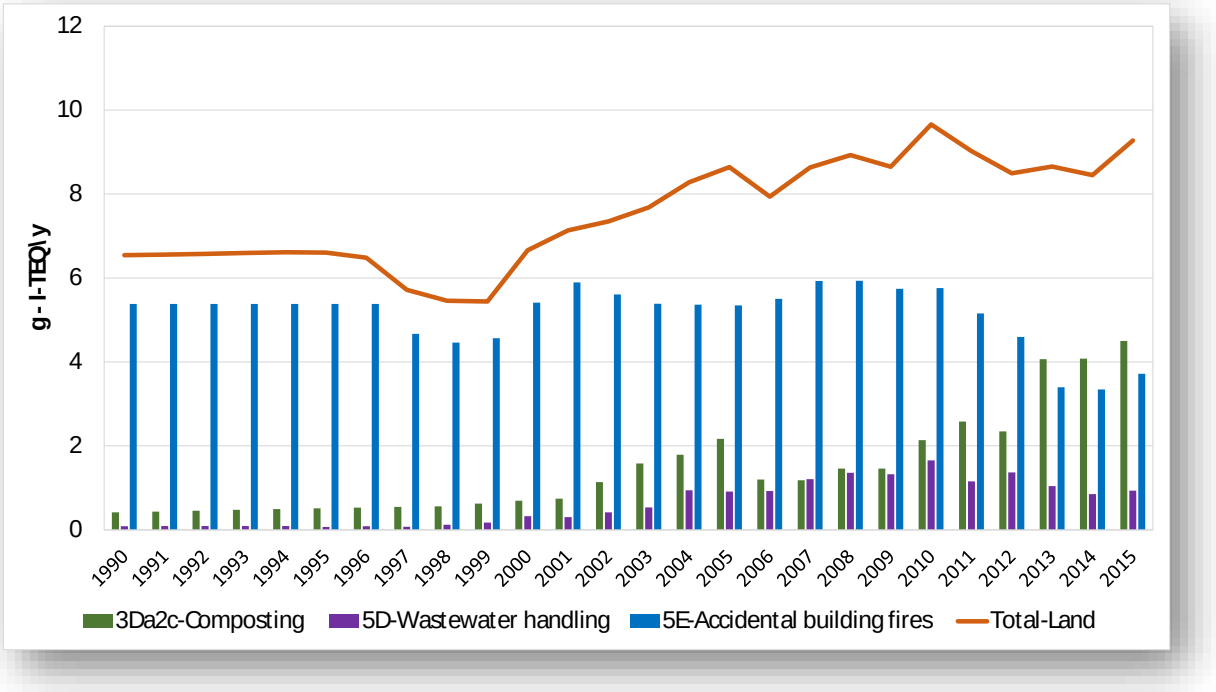


Figure 10 Estimated total PCDD/PCDF emissions to Land (g-ITEQ/y) for 1990-2015.

The main contributions to total PCDD/PCDF emissions to land were from source sectors;

- accidental fires
- buildings (5E)
- sludge spreading to land (5D) and
- composting (3Da2C).

ESTIMATED RELEASES FROM WASTE

Total emissions of PCDD and PCDF to residue in 2015 were estimated to be 12.2gI-TEQ (Del Vento, et al., 2017). Figure 10 shows the estimated total PCDD/PCDF emissions from all source sectors to residue for the years 1990 to 2015.

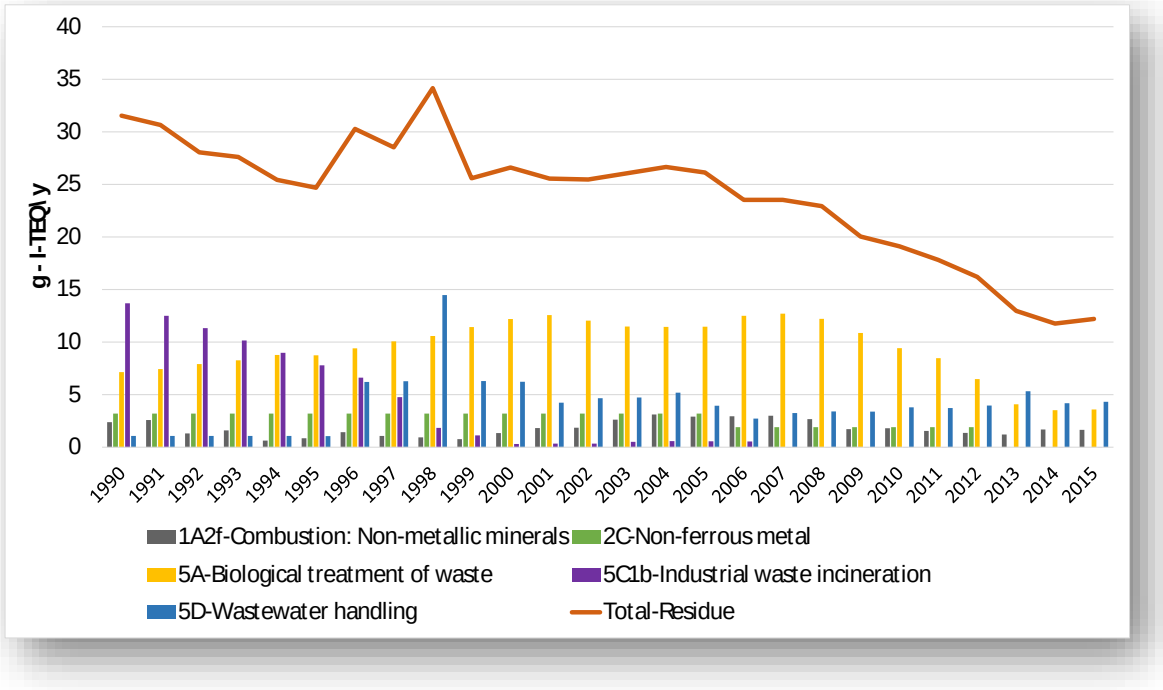


Figure 11 Estimated total PCDD/PCDF emissions to Residue (g-ITEQ/y) for 1990-2015.

The disposal of Municipal solid waste (MSW) (5A) plays a major role in PCDD/PCDF emissions to residue accounting for 29% of total releases. Other important contributors to PCDD/PCDF emissions to residue are MSW disposed of in landfill (5A) (29% of total) and Energy used in those manufacturing industries (1A2f) (14% of total).

OTHER

PCDD and PCDF releases to product

Total emissions of PCDD and PCDF to product in 2015 were estimated to be 1.92gI-TEQ (Del Vento, et al., 2017). Figure 11 shows the estimated total PCDD/PCDF emissions from all source sectors to product for the years 1990 to 2015.

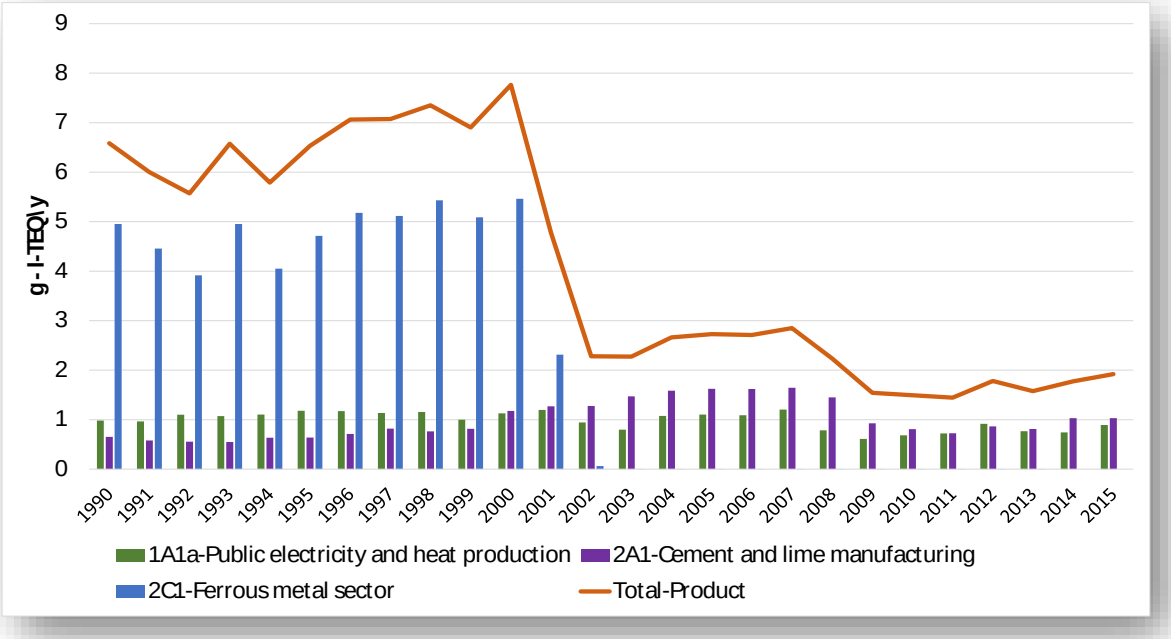


Figure 12 Estimated total PCDD/PCDF emissions to Product (g-ITEQ/y) for 1990-2015.

4.1.2 Polychlorinated Biphenyls (PCBs)

For a description of PCBs and monitoring of PCBs in the environment and food please see Section 3 under the relevant PCBs headings.

Like PCDD and PCDF, PCBs can be produced unintentionally mainly due to incomplete combustion processes such as the uncontrolled burning of waste and can also form during combustion of automotive fuels, peat, coal, and wood, particularly wood treated with chlorinated preservatives. PCBs may be released to soil, water or air at sites at which PCBs were present in products or during disposal until eventual destruction of the waste such as where PCB-contaminated soil, capacitors, transformers or other machinery are handled.

Based on inventory emissions estimates in Ireland from 2006- 2015, total emissions of PCBs to air, land, water, residue and product were 32kg with releases to land accounting for about 84% of total emissions (Del Vento, et al., 2017). Figure 12 shows the estimated total PCBs emissions for the years 1990 to 2015 inclusive.

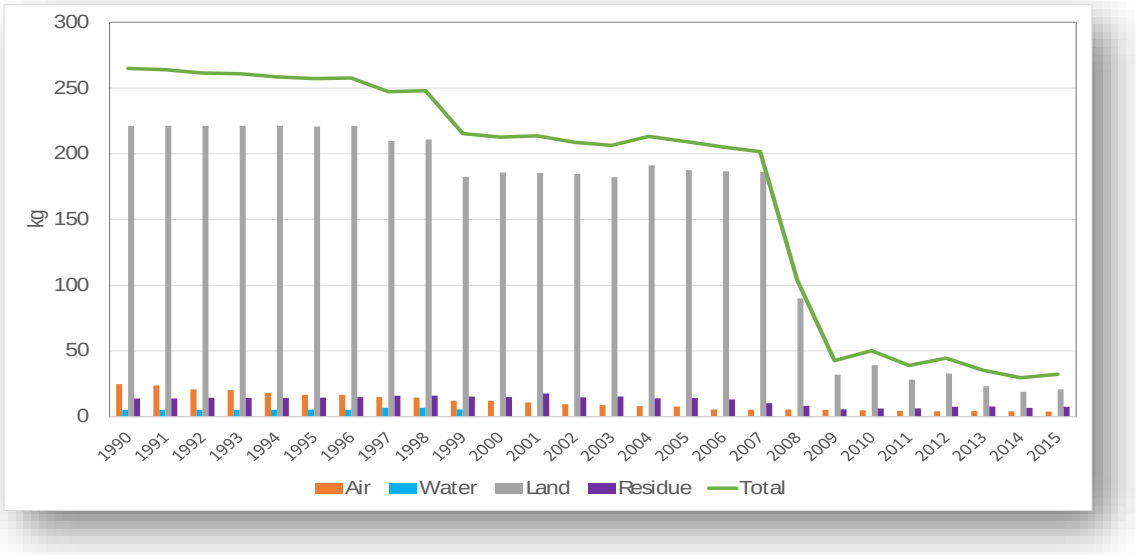


Figure 13 Estimated Total PCBs Emissions (kg) for 1990-2015.

ESTIMATED RELEASES TO AIR

Based on inventory emissions estimates in Ireland in 2015, total emissions of PCBs to air in 2015 were estimated to be 4kg (Del Vento, et al., 2017). Figure 13 shows the estimated total PCBs emissions from all relevant source sectors to air for the years 1990 to 2015 inclusive.

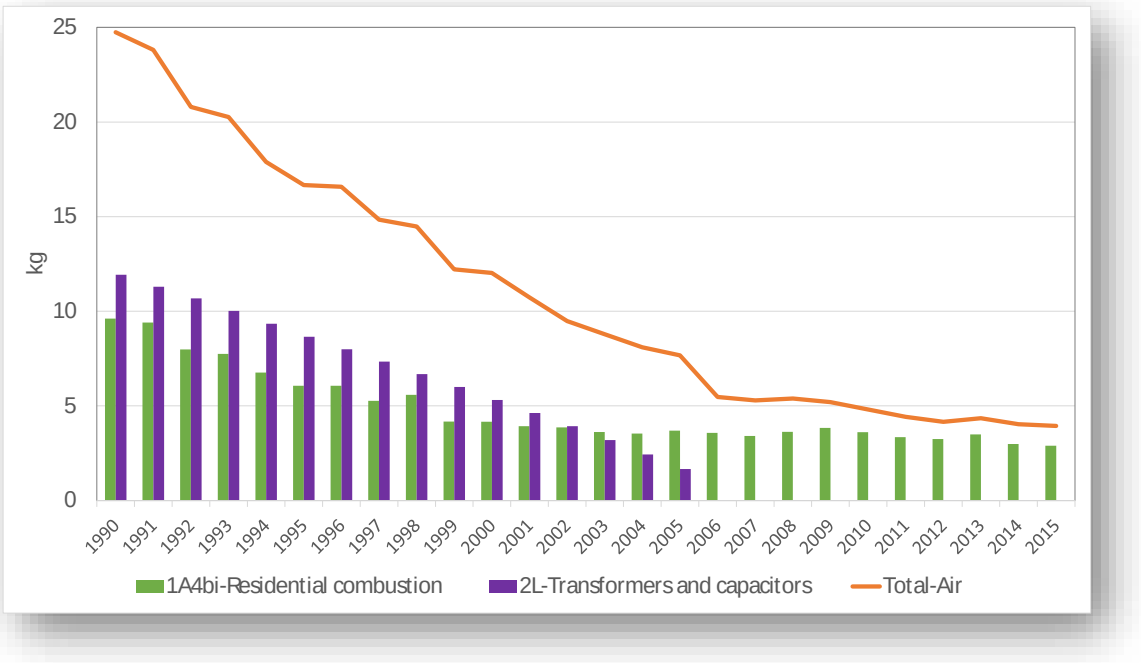


Figure 14 Estimated Total PCBs Emissions (kg) to Air for 1990-2015.

The two main sources contributing to total PCBs emissions to air are residential combustion–stationary (1A4bi), accounting for approximately 40% of the total emissions to air, and transformers and fragmentisers/shredders (2L). The sharp decline in the emissions apportioned to transformers and fragmentisers is largely attributed to changes in practice and policy which have largely removed the industrial emissions of PCBs to air, notably from capacitors of old electrical equipment. The shredding of end-of-life vehicles (ELV) is another operation that may result in the possible emissions of POPs. Currently, two companies operate ELV shredders at three locations in Ireland at IED licensed facilities.

ESTIMATED RELEASES TO AQUATIC & MARINE

Based on inventory emissions estimates in Ireland in 2015, total emissions of PCBs to water were zero in 2015. The sharp decline observed from 2000 is related to the ban of disposal of contaminated effluent from waste water treatment, untreated wastewater, and sludge dumped at sea and the introduction of the Dumping at Sea Act 1996 (S.I. No. 14 of 1996). (Del Vento, et al., 2017) Since 2000, there have been no emissions to water.

ESTIMATED RELEASES TO SOIL & LAND

Based on inventory emission estimates in Ireland, total emissions of PCBs to land in 2015 were 20.78kg (Del Vento, et al., 2017). Figure 15 shows the estimated total PCBs emissions from all relevant source sectors to land for the years 1990 to 2015 inclusive.

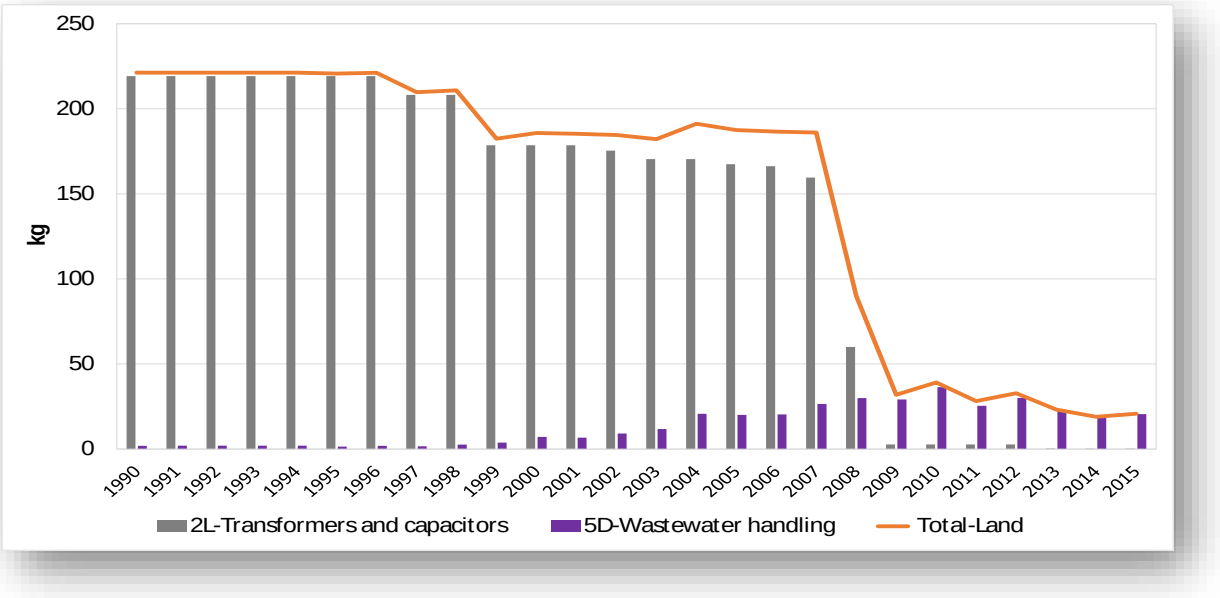


Figure 15 Estimated Total PCBs Emissions (kg) to Water for 1990-2015.

Leakage of PCBs from electrical equipment such as transformers and capacitors (2L) were regarded as the main sources of releases of PCBs to the environment. However, such emissions have decreased from an estimate of 219 kg/y in 1990 to 0.23 kg/y in 2015. The sharp decline in estimated releases of PCBs to land is chiefly attributed to the proper management of considerable quantities of PCB-contaminated equipment during the period. Emissions from the only other source, domestic combustion (1A4bi), are regarded insignificant (0.04 kg in 2015).

PCB releases to land through the disposal of sludge to agricultural land (sector 5D) is considered significant in the Irish context. Current total PCBs emissions estimates (calculated from data obtained from National Urban Waste Water Reports) was 20.6 kg in 2015.

ESTIMATED RELEASES - OTHER

PCBs releases to residue

Based on inventory emissions estimates in Ireland, total emissions of PCBs to residue were 7.54kg in 2015 (Del Vento, et al., 2017). Figure 16 shows the estimated total PCBs emissions from all relevant source sectors to residue for the years 1990 to 2015 inclusive.

Water treatment and sewage sludge treatment (5D wastewater handling), which includes disposal of sludge to landfill, has been the main source sector contributing to PCBs releases to residue with this sector responsible for approximately 81% of such emissions in 2015.

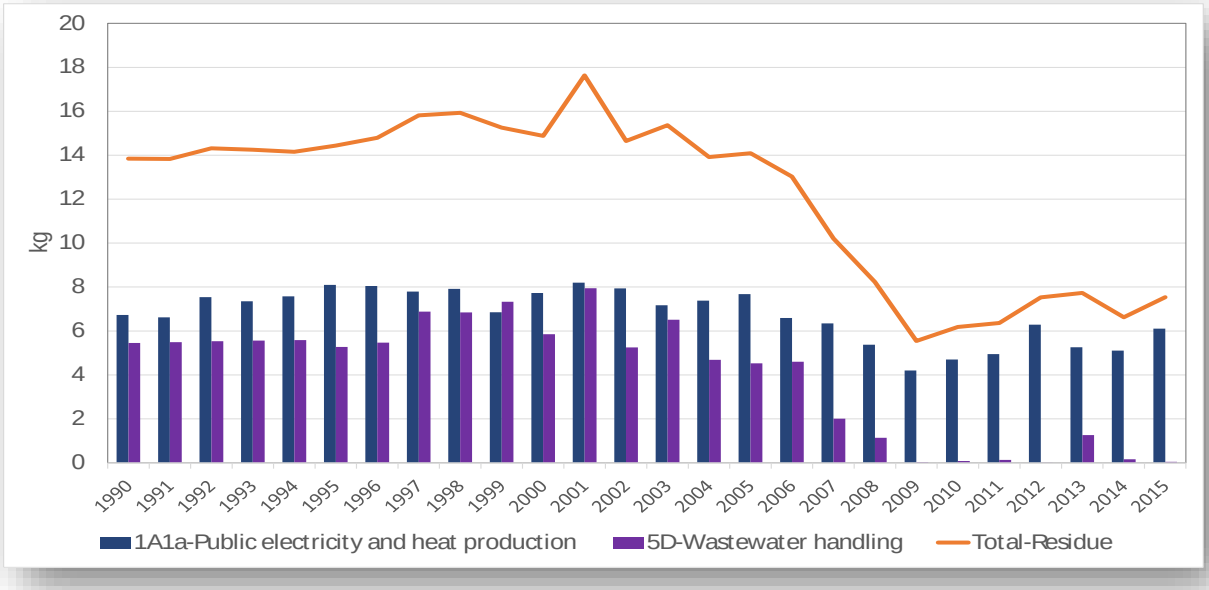


Figure 16 Estimated Total PCBs Emissions (kg) to land for 1990-2015.

4.1.3 Hexachlorobenzene (HCB)

For a description of HCB and monitoring of HCB in the environment and food please see the Section 3 under the relevant HCB headings.

HCB can be formed by employing hexachloroethane (HCE)-based as a cover gas in the secondary aluminium process which was formerly the major contributor the HCB releases to the environment. Additionally, HCB is an unintended by-product/contaminant in the manufacture of the fungicide Chlorothalonil. Emissions of HCB due to the use of contaminated pesticides is now a main source of HCB environmental contamination. Based on inventory emissions estimates in Ireland in 2015, total emissions of HCB to air, land, water, residue and product were 1.8kg in 2015 with emissions to air accounting for approximately 84% of

total emissions (Del Vento, et al., 2017). The sharp decrease in HCB emissions between 1996 and 1997 was due to the ban on the use of HCE-based cover gases for secondary aluminium processing (1996). Figure 17 shows the estimated HCB emissions for the years 1990 to 2015 inclusive.

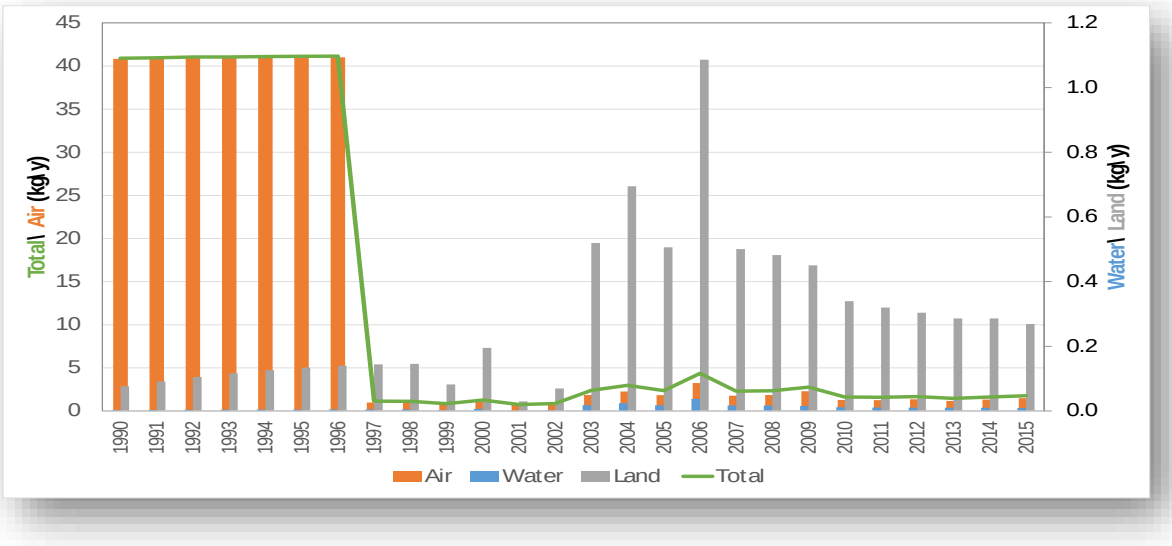


Figure 17 Estimated Total HCB Emissions (kg) for 1990-2015.

ESTIMATED RELEASES TO AIR

Based on inventory emissions estimates in Ireland in 2015, total emissions of HCB to air in 2015 were estimated to be 1.5kg (Del Vento, et al., 2017). Emissions dropped substantially after the ban of HCB-based cover gas entered into force in 1996.Figure 18 shows the estimated total HCB emissions from all relevant source sectors to air for the years 1990 to 2015 inclusive.

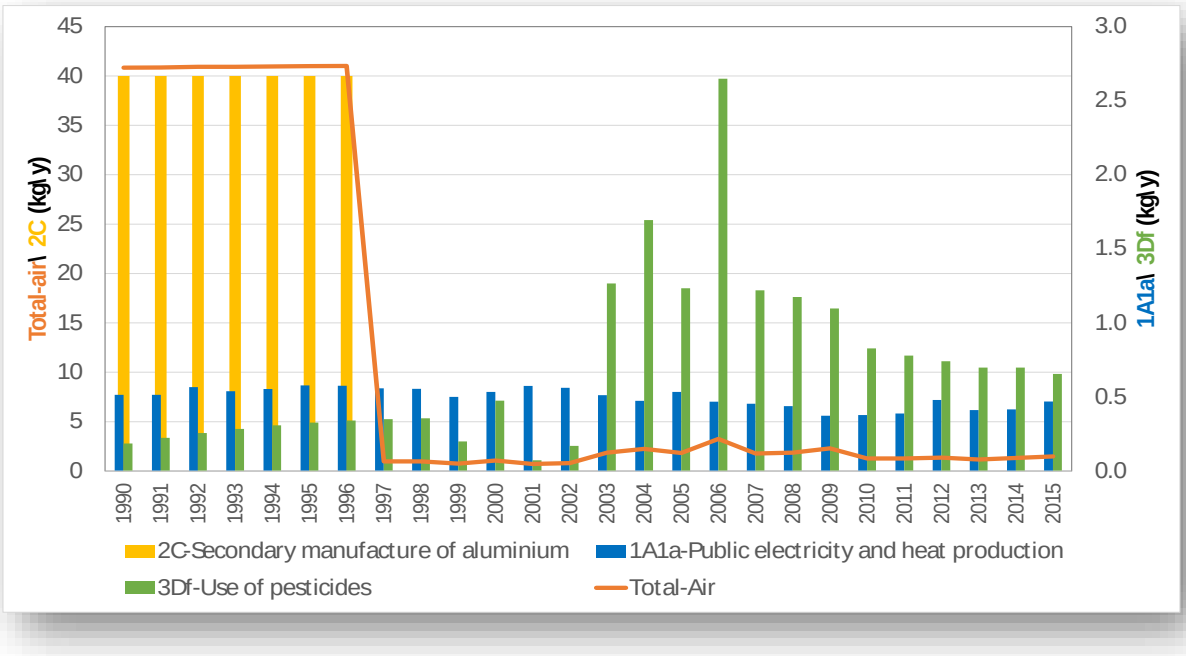


Figure 18 Estimated Total HCB Emissions (kg) to Air for 1990-2015.

Note: Total air emissions and from sector 2C are displayed on the left-hand side Y-axis, while emissions from sectors 1A1a and 3Df are displayed on the right-hand side Y-axis.

Currently the main contributing source sector for HCB releases to air are the use of pesticides (3Df) which accounted for approximately 44% of total HCB emissions to air in 2015. Much of emissions from pesticide, primarily Chlorothalonil, usage (3Df) are reported to air, due to the spraying application and subsequent volatilisation of POPs from the surface of plants. The variation between years is expected as it reflects that the usage of the Chlorothalonil active substance is weather dependent.

The other significant source sector for HCB releases to air is public electricity and heat production (1A1a) contributing approximately 31% of 2015 total HCB air emissions.

ESTIMATED RELEASES TO AQUATIC & MARINE

Based on inventory emissions estimates in Ireland, total emissions of HCB to water in 2015 were estimated to be 0.009kg (Del Vento, et al., 2017). Figure 19 shows the estimated total HCB(kg) to water across the time series.

HCB was an impurity in pesticides Lindane and Quintozene, however as both Lindane and Quintozene were banned in 2001, the use of Chlorothalonil, is now considered the only source of releases of HCB to the aquatic environment. The relatively sharp increase in HCB releases during the period 2003-2004 and again in 2006 is due to increased use of Chlorothalonil.

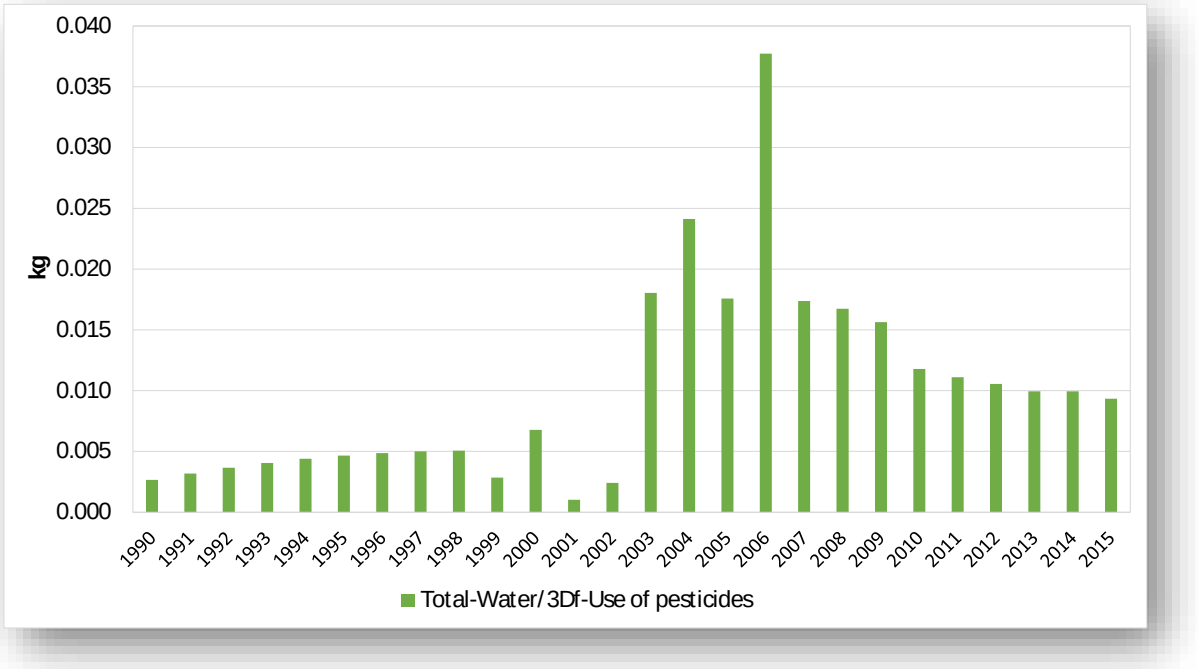


Figure 19 Estimated Total HCB Emissions (kg) to Water for 1990-2015.

ESTIMATED RELEASES TO SOIL & LAND

Based on inventory emissions estimates in Ireland in 2015, total emissions of HCB to land in 2015 were estimated to be 0.269kg (Del Vento, et al., 2017). Figure 19 shows the estimated total HCB emissions from all relevant source sectors to land for the years 1990 to 2015 inclusive.

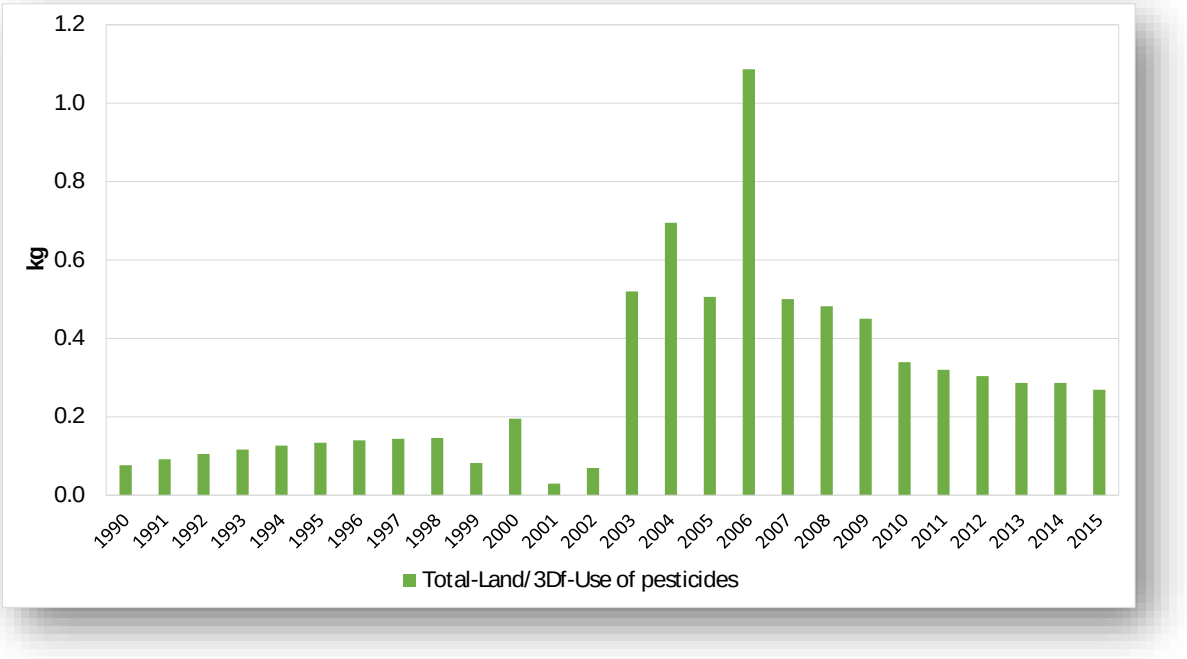


Figure 20 Estimated Total HCB Emissions (kg) to Land for 1990-2015.

Use of pesticides is the only source sector responsible for releases of HCB to land. As with HCB emissions to water, the relatively sharp increase in HCB releases during the period 2003 and 2004 and again in 2006 is due to increased use of Chlorothalonil.

ESTIMATED RELEASES - OTHER

HCB releases to residue

There is no verified information on HCB releases to residue. These releases are considered negligible, not occurring or no emission factors available.

HCB releases to product

There is no verified information on HCB releases to product. These releases are considered negligible, either not occurring or no emission factors available.

4.1.4 Pentachlorobenzene (PeCB)

SUMMARY ASSESSMENT OF PeCB IN IRELAND

PeCB is a chlorinated aromatic hydrocarbon with 5 chlorine atoms substituting hydrogen atoms on the benzene ring. PeCB has been used in PCB oils, dyestuff carriers and as a chemical intermediate in the production of the fungicide Quintozene which is now banned. PeCB is considered as moderately toxic to humans but very toxic to aquatic life. PeCB is listed as a Priority Hazardous Substance under the Water Framework Directive. Currently it is thought the main source of PeCB contamination is through incomplete combustion processes.

There is relatively little environmental monitoring data regarding PeCB in the Irish context. Most of the available information on PeCB in the Irish environment relates to water and food and, while limited, indicates PeCB contamination does not pose a serious threat to human health and the environment. While PeCB was used as a dyestuff carrier, it has been and is now predominantly found as an unintentional by-product in mixtures such as pesticides and PCB oils. PeCB has been used in the production of Quintozene (fungicide) and tetrachloroethylene (PERC) used for dry cleaning. Currently,

it is thought the main sources of PeCB-contamination are uncontrolled combustion processes, e.g. backyard burning of wastes. PeCB is moderately toxic to human health but highly toxic to the aquatic environment. PeCB was listed in Annex A (without specific exemptions) and Annex C of the Stockholm Convention in May 2009. While there is an absence of information on PeCB levels in air, the substance has been included in water and food (fish) monitoring programmes respectively.

AIR

There is no verified information on PeCB monitoring in air in the Irish context.

AQUATIC & MARINE

PeCB is listed as a Priority Hazardous Substance under the WFD. During the 2007-2009 WFD surveillance programme samples from a total of 180 river sites and 74 lakes were tested for PeCB. None of the samples exceeded an EQS (either AA or MAC) (EPA, 2015a).

FOOD

The Marine Institute tested a total of 42 farmed finfish for PeCB under its 2012-2015 NRCP. All samples tested compliant with the Guideline Values (Marine Institute, 2015) and (Marine Institute, 2017b).

OTHER

PeCB monitoring – Sewage sludge

During 2015, as part of its POPs monitoring programme under the previous National Implementation Plan on POPs, the EPA had 15 samples of municipal sludge from 5 waste water treatment plants tested for various POPs which included PeCB. PeCB was not found in any sample above the LoD ($10 \mu g kg^{-1}$).

PeCB releases

While past releases of PeCB were attributed to the substance being present as a by-product in mixtures ranging from fungicides to PCB dielectric oils, currently it is thought the main source of PeCB-contamination to the environment arises from its formation during incomplete combustion processes. Total emission of PeCB were estimated at approximately 14kg (Del Vento, et al., 2017).

Figure 21 shows the estimated PeCB emissions for the years 1990 to 2015 inclusive.

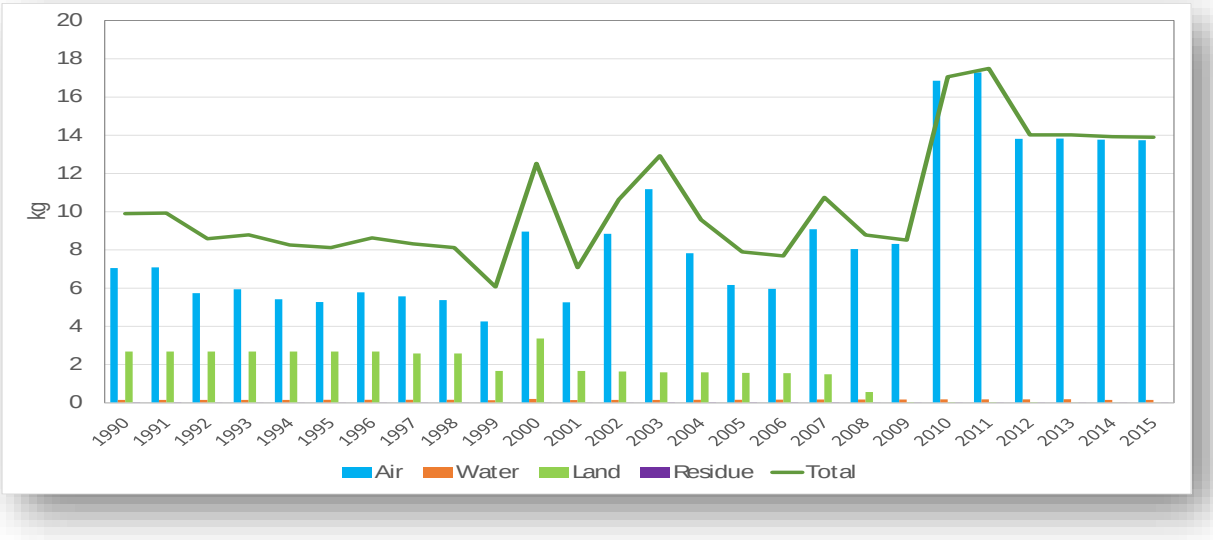


Figure 21 Estimated Total PeCB Emissions (kg) for 1990-2015.

ESTIMATED RELEASES TO AIR

Based on inventory emissions estimates in Ireland in 2015, total emissions of PeCB to air in 2015 were estimated to be approximately 14kg or about 97% of total emissions and primarily attributed to uncontrolled burning processes76 (Del Vento, et al., 2017). Figure 21 shows the estimated total PeCB emissions from all relevant source sectors to air for the years 1990 to 2015 inclusive.

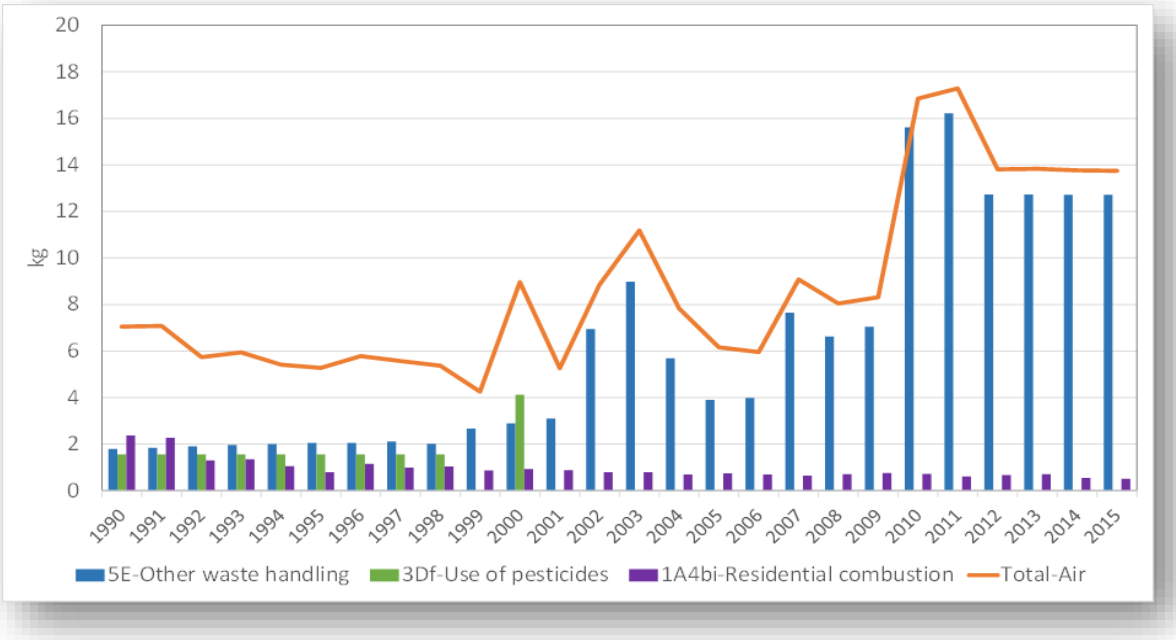


Figure 22 Estimated Total PeCB Emissions (kg) to Air for 1990-2015.

[76] Sources category 5E – uncontrolled burning of household waste, domestic bonfires and accidental fires.

The reduction in PeCB emissions to air due to residential combustion is largely attributed to the decline in the use of coal for domestic heating.

ESTIMATED RELEASES TO AQUATIC & MARINE

Based on inventory emissions estimates in Ireland in 2015, total emissions of PeCB to water in 2015 were estimated to be approximately 0.15kg, 99% of which is attributed from the discharge of treated effluent at waste water treatment plants (Del Vento, et al., 2017). PeCB releases to water due to pesticide use ceased after 2000 due to the banning of quintozene. Figure 22 shows the estimated total PeCB emissions from all relevant source sectors to water for the years 1990 to 2015 inclusive.

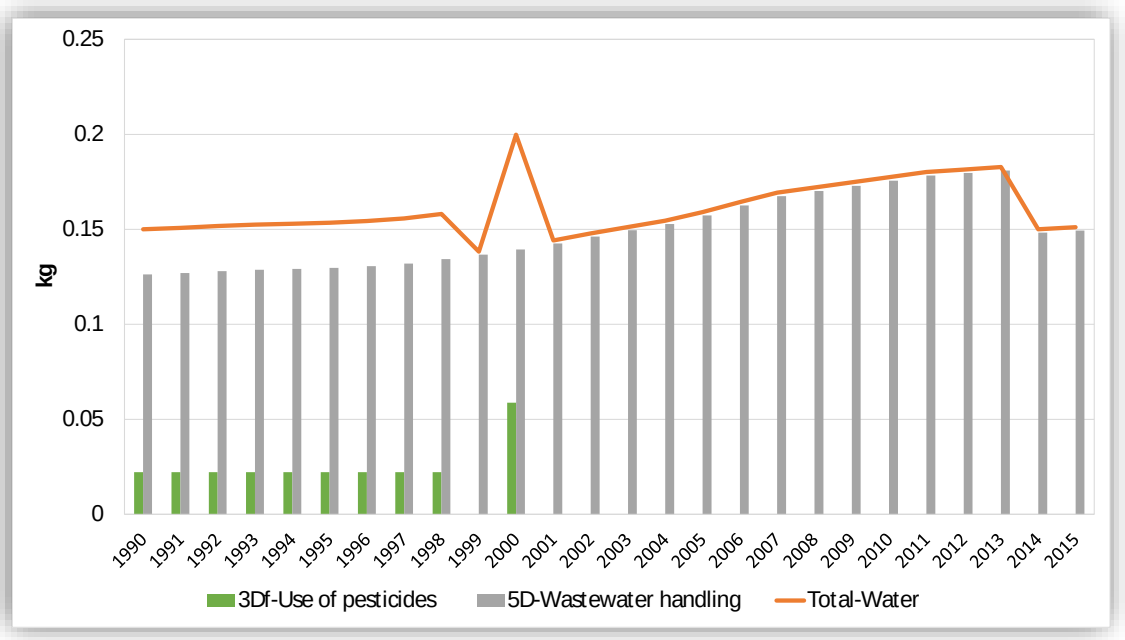


Figure 23 Estimated Total PeCB Emissions (kg) to Water for 1990-2015.

ESTIMATED RELEASES TO SOIL & LAND

Based on inventory emissions estimates in Ireland in 2015, total emissions of PeCB to land in 2015 were estimated to be approximately 0.002kg (Del Vento, et al., 2017). Leakage from electrical equipment such as transformers and capacitors (2L) dominate the release of PeCB to land. PeCB releases to land due to pesticide use ceased after 2000 due to the banning of quintozene. Figure 23 shows the estimated total PeCB emissions from all relevant source sectors to land for the years 1990 to 2015 inclusive.

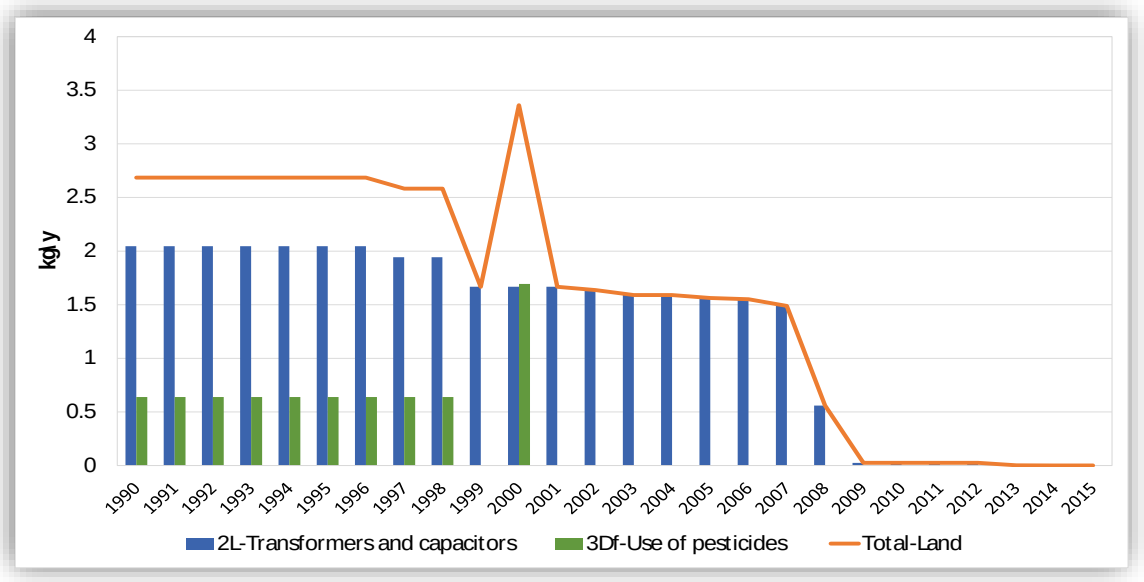


Figure 24 Estimated Total PeCB Emissions (kg) to Land for 1990-2015.

ESTIMATED RELEASES - OTHER

PeCB releases to residue

The principal sources of emissions of PeCB in residues is PeCB in ash from combustion processes in non-metallic minerals manufacturing industries and in food processing, beverages and tobacco and manufacturing industries and account for approximately 0.1% of total PeCB emissions (Del Vento, et al., 2017). Figure 24 shows the estimated total PeCB emissions from all relevant source sectors to residue for the years 1990 to 2015 inclusive.

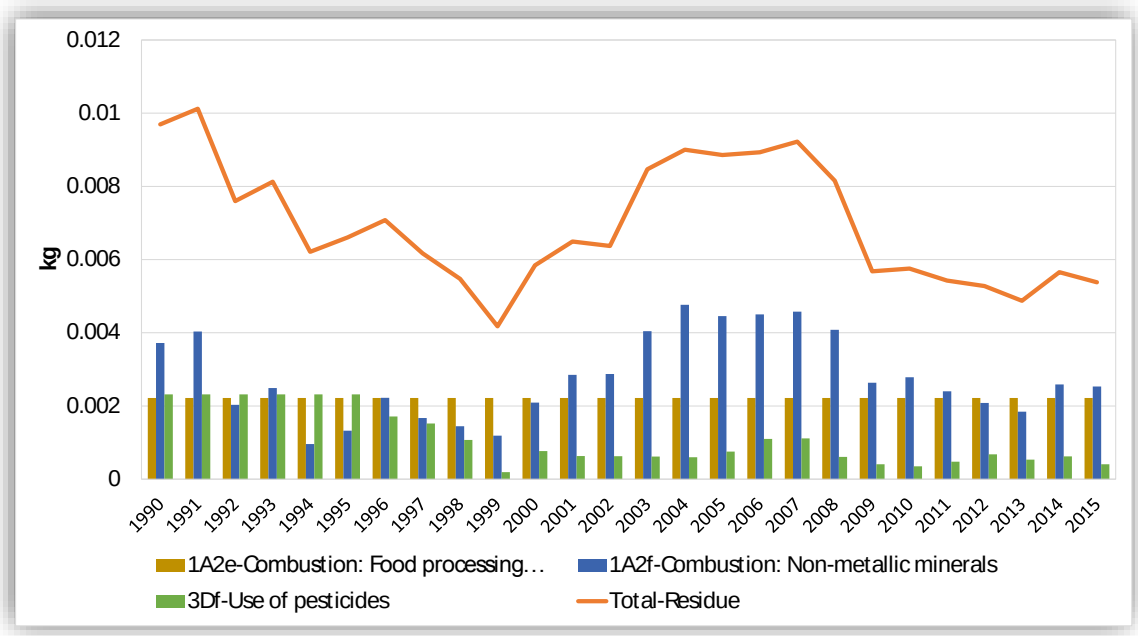


Figure 25 Estimated Total PeCB Emissions (kg) to Residue for 1990-2015.

SECTION 5

5 Public awareness, education, information exchange and reporting

This section outlines the measures put in place in order for Ireland to meet requirements under the Stockholm Convention with respect to public awareness, education, information exchange and reporting.

5.1 Exchange of information, public awareness and education

Awareness will continue to be raised about the risks associated with stockpiles of old pesticides (which may include POP pesticides) on farms and associated disposal requirements as part of farm inspections carried out by the Department of Agriculture, Food and the Marine. The EPA, local authorities and other relevant bodies will continue to raise public awareness and provide guidance, where appropriate, regarding harmful POP emissions associated with domestic burning practices. The EPA will provide input and guidance to future national plans and programmes that may help to reduce or prevent unintentional POP releases.

The requirements of Article 10 of the Convention regarding public information and participation, awareness and education are also addressed in Articles 8 & 10 of the EU POPs Regulation. Parties are required to encourage industry and professional users to facilitate the provision of information. Requirements on industry regarding the provision of information on chemicals is addressed in a number of pieces of EU legislation such as REACH legislation, Plant Protection Products Regulations, the PCB Directive and in particular regulations concerning Classification, Labelling & Packaging of substances and mixtures. The regulations are directly applicable to all Member States.

Pollutant Release and Transfer Registers are inventories of pollution from industrial sites and other sources. Ireland has brought into force regulations concerning the establishment of a European Pollutant Release and Transfer Register. Annual releases of pollutants (including some POPs) are reported to the European Pollutant Release and Transfer Register.

Article 10 of the EU POPs Regulation implements the requirements of the Stockholm Convention regarding information exchange. Relevant information is shared between relevant stakeholders for collation and compilation of the Plan updates, implementation of action plan and EU reporting obligations. The EPA attends EU POPs Competent Authority Meetings which are held generally twice a year which provide an opportunity for information exchange. Other exchange mechanisms include meetings, teleconferences and email communications. The Stockholm Convention requires a national focal point for each Party to the Convention for the exchange of information. An official from the Department of Communications, Climate Action & Environment[77] is Ireland's national focal point.

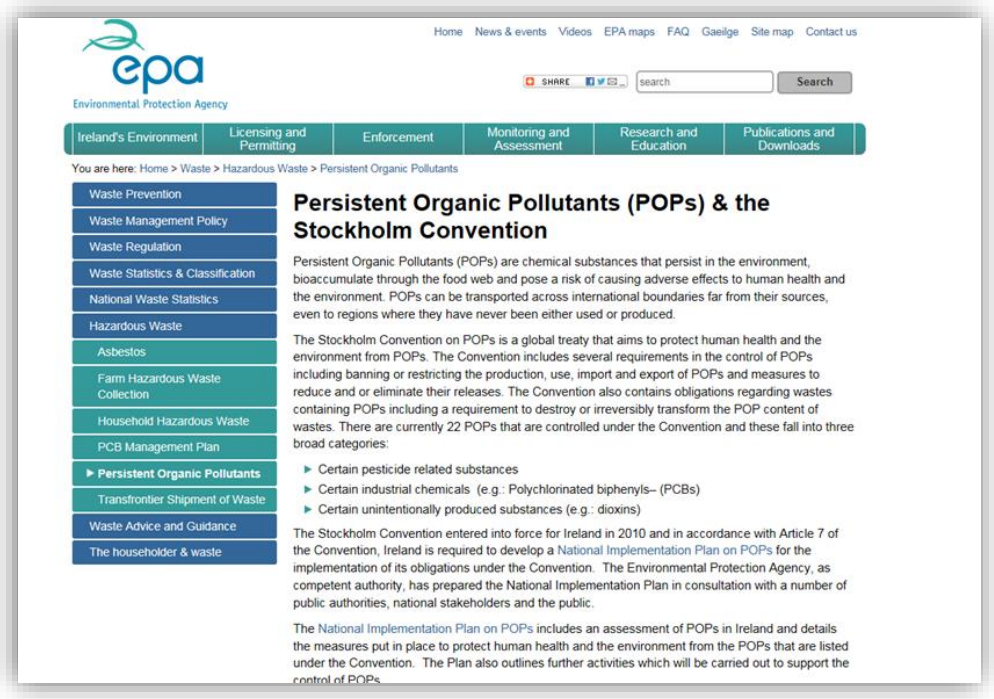
Requirements on confidentiality and non-confidentiality of information are included in Article 10 of the EU POPs Regulation without prejudice to EU Directive on public access to information. This EU Directive has been transposed into Irish law as Statutory Instrument 235 of 2010.

There are number of other specific examples how public information and awareness has been carried out in relation to POPs including:

[77] Formerly Department of the Environment, Community and Local Government.

Website information

The EPA and the Department of Communications, Climate Action & Environment has established a dedicated POPs webpage; www.pops.ie, which informs the public about POPs, the POPs regulations, Ireland's National Implementation Plan consultation, etc.:



The EPA maintains a dedicated webpage relating to PCBs and regularly updates the national PCB holdings inventories: www.pcbs.ie.

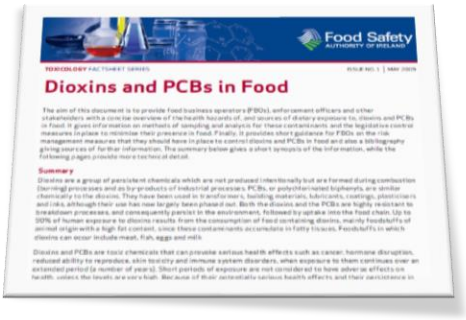
The Irish EPA published a report 'Focus on Local Authority Environmental Enforcement – 2014-2016 Performance Report (EPA, 2017b). The report details the environmental outcomes achieved by the environmental enforcement activities of the local authorities and the EPA including illegal waste activities. In addition, the EPA regularly provides information on its website, through BAT Guidance Notes, PRTR reports, emissions inventories, monitoring and various environmental status reports which include POPs-related information:

http://www.epa.ie/waste/householder/burn/

http://www.epa.ie/downloads/pubs/

Ireland has a dedicated website for information on Pollutant Release and Transfer Register. Quantities of pollutant releases (including some POPs) to air, water and waste water as well as off-site transfers of waste are available online:

http://prtr.epa.ie/



The FSAI produces a Toxicology Factsheet Series which includes documents on POPs. The aim of the documents is to provide food business operators, enforcement officers, and other stakeholders with a concise overview of health hazards and regulations concerning contaminants in food.

Factsheets and POPs in food related studies are available at:

http://www.fsai.ie/resources_publications.html

The Marine Institute publishes reports relating to the monitoring for contaminants in the marine environment including POPs:

https://www.marine.ie/Home/site-area/areas-activity/marine-environment/marine-pollutants

The Department of Agriculture, Food and the Marine publish reports on pesticide residues in food including results of certain POP pesticides detected:

http://www.pcs.agriculture.gov.ie/aboutus/whatareourresponsibilities/specialistareas/persistentorganicpollutantspops/

Media campaigns

There have been several media campaigns carried out by the EPA in relation to backyard burning and bonfires in addition to a public awareness campaign highlighting the health and environmental dangers of burning waste in fireplaces and stoves. "SEE IT? SAY IT!" is a leaflet produced by the Environmental Enforcement Network, to make it easier for members of the public to make an environmental complaint. Instances such as illegal burning of waste, illegal dumping and water pollution are examples of where the public can assist by reporting problems to the relevant authorities. Figure below provides an example of a recent animation to highlight the dangers of backyard burning:

https://www.youtube.com/watch?v=rh17hDY8EBM

Networking and capacity building

The EPA facilitates training in relation to POPs. Since 2009, the EPA carried out Regional Training Events for Local Authorities on how to complete PCB Surveys. The EPA also facilitates training through attendance at conferences, meetings with relevant stakeholders and attendance at competent authority meetings.

A Network for Ireland's Environmental Compliance and Enforcement (NIECE) provides a useful mechanism for information exchange between public authorities. The Network harnesses the collective resources and expertise available nationally to co-ordinate a consistent and more effective approach to the enforcement of environmental legislation in Ireland.

The HPRA periodically hold information days for marketing authorisation holders and for manufacturers and wholesalers of human and veterinary medicines and publishes a quarterly newsletter. In 2010 an information day included a presentation on the national POPs regulations.

Reporting

Article 15 of the Stockholm Convention requires Parties to report on their implementation of the Convention. Ireland will continue to report on the implementation of the Stockholm Convention as required.

SECTION 6

6 Research, development and circular economy

6.1 Research

The EPA has a dedicated research programme which facilitates and funds research on a variety of environmental issues. Research and monitoring information are regularly published on the relevant websites and are made publicly available. The EPA's environmental research programme has funded the following projects: relating to POPs in the environment. The following research projects are ongoing:

Identification and Treatment Options for Waste Streams of Certain Bromine Containing Flame Retardants (WAFER)

This aims to address identification and treatment options for waste streams containing certain flame-retardant chemicals. This project is due to be completed in late 2018. Applicable waste streams include:

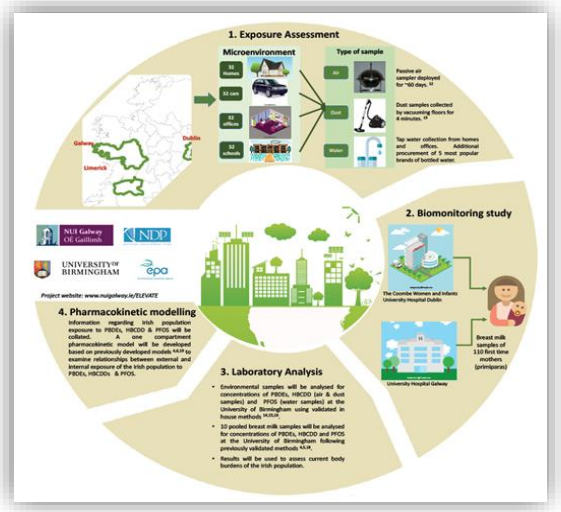
- Construction & Demolition wastes containing Hexabromocyclododecane (HBCD).
- Waste Electrical & Electronic Equipment (WEEE), waste upholstery and End of Life Vehicle (ELV) foams containing Polybrominated diphenyl ethers (PBDEs).

http://www.wafer-research.com/

Note: The WAFER research is complete and the final report and publication is due for publication in late 2018. The draft report suggests that ~2200 t/year of waste generated in Ireland exceeds "Low POP Concentration Limits" (LPCLs) set by the European Commission, of 1000mg/kg of PBDEs (BDE-209 excluded) and HBCDD – collectively referred to as POP-BFRs. Waste articles containing concentrations exceeding the LPCL values require special treatment to remove POP-BFRs before they can be recycled. Waste articles exceeding LPCLs consist primarily of expanded polystyrene used as building insulation (44%), waste furniture foams and fabrics (41%), with waste electrical and electronic equipment (WEEE) accounting for 13% and end of life vehicle waste contributing 1.7%.

The recent listing of Deca-BDE under the Stockholm Convention means that a similar LPCL for its principal congener (BDE-209) is likely. Provisional data shows that enforcement of an LPCL of 1000 mg/kg for BDE-209 would result in a further 1650 t/year of waste articles requiring special treatment. Data shows there to be 17,125 kg of POP-BFRs associated with waste polymers generated annually in Ireland. Enforcement of current LPCL values would prevent approximately 98% of these POP-BFRs from entering recycled goods.

The draft findings conclude that introduction and enforcement of a similar LPCL for BDE-209 would prevent 93% of the 15,518 kg/year of BDE-209 associated with Irish waste polymers from entering the recycling stream.



Elucidating Levels and Pathways of Human Exposure in Ireland to POP-BFRs and PFOS (ELEVATE): The project will elucidate the relative contributions of different exposure pathways (air, dust, diet & water) contributing to the presence of POP-BFRs & PFOS in the Irish population, and examine the impact of bans & restrictions on levels in Irish human milk. This project is due to be completed in 2019. This project also ran an outreach programme for schools participating in the research project: http://www.nuigalway.ie/elevate/

Furthering Understanding of Emissions from Landfilled Waste Containing Brominated Flame Retardants (BFRs) and Perfluorooctane Sulfonic Acid (PFOS) – the FUEL project. This project aims to quantify the degree of contamination by these chemicals from landfills in Ireland through three pathways: leaching into soil and groundwater; run-off into water basins; and volatilisation into the air. The project includes direct sampling and analysis from open and closed landfills in addition to laboratory-based simulations to determine the factors which influence the leaching of these chemicals from source items under landfill conditions. https://nuigalway.ie/fuel/

Hexabromocyclododecane (HBCDD) in polystyrene packaging: a downside of recycling?

Highlights of the study concluded that HBCDD present in 90% of Irish and UK polystyrene packaging samples.

- Concentrations of ∑HBCDD range between <0.7 $mgkg^{-1}$ to 5,900 $mgkg^{-1}$.
- HBCDD concentrations in 6 samples would prevent them being placed on EU market.
- Source of HBCDD in polystyrene packaging is recycled insulation foam (Abdallah, et al., 2018).

During the period 2013-2015, the EPA has also carried out studies on sampling and analysis of sewage sludge to determine the presence of new POPs (e.g. PBDEs, PFOS) and to gain knowledge on the experiences with such sampling and analysis. Information on such studies will assist with the understanding on the issues associated with the management of wastes potentially containing new POP substances.

Figure 26 Circular Economy, EPA 2017

6.2 Circular Economy & Non-toxic Waste Strategy

On 2 December 2015, the European Commission adopted a new Circular Economy Package which includes revised legislative proposals on waste to stimulate Europe's transition towards a circular economy which aims to boost global competitiveness, foster sustainable economic growth and generate new jobs. However, many articles products contain chemicals which are now restricted under the Stockholm Convention and which were used for the integrity or safety of the article or product. Under the proposed new EU POPs Recast; once the concentration of a POP in a waste is below the prescribed low POP content level, it may be recycled but the resulting recycled material must satisfy another threshold known as the 'unintentional trace contaminant'(UTC) threshold. The UTC limit value will apply to substances, mixtures and articles (specified in Annex I of the POPs Regulation)

The European Commission launched a new set of measures to further progress circular economy ambitions, including:

- An EU wide Strategy for Plastics in the Circular Economy. By 2030, all plastics packaging should be recyclable. The Strategy also highlights the need for specific measures, possibly a legislative instrument, to reduce the impact of single-use plastics, particularly in our seas and oceans.
- Discussions on the interface between chemical, product and waste legislation that assesses how the rules on waste, products and chemicals relate to each other.
- A Monitoring Framework on progress towards a Circular Economy at EU and national level. It is composed of a set of ten key indicators which cover each phase – i.e. production, consumption, waste management and secondary raw materials – as well as economic aspects – investments and jobs - and innovation.
- A Report on Critical Raw Materials and the Circular Economy that highlights the potential to make the use of the 27 critical materials in our economy more circular (EU Commission, 2018).

Ireland will explore the barriers and risks associated with the circular economy and the requirement to ensure the elimination of POPs within the context of the circular economy.

6.3 Technical assistance

Article 12 of the Stockholm Convention requires Parties to recognise that the provision of timely and appropriate technical assistance to developing country Parties and Parties with economies in transition is essential to the successful implementation of the Convention. This is further supported within the EU by Article 11 of the EU POPs Regulation, which places an obligation on the Commission and Member States to cooperate in providing appropriate and timely technical assistance to developing countries and countries with economies in transition to assist them, upon request and within available resources, and considering their needs in implementing their obligations under the Convention.

SECTION 7

7. Financial resources and mechanisms

7.1 Financial assistance

The principal route for providing assistance to developing countries in relation to POPs is through the Global Environment Facility (GEF). Ireland has maintained its level of contribution to the GEF over the most recent round of funding (GEF6: 2014-2017 of €5.73m) and will meet its funding pledges (€5.73m) during GEF7 which runs from 2018 to 2022. In addition, Ireland supports the activities of the Stockholm Convention Secretariat through its annual assessed contributions to the Convention General Trust Fund.

At national level, in respect of Article 13 of the Stockholm Convention regarding financial resources and mechanisms, the EPA is provided with financial support through the Environment Fund for enforcement and waste prevention activities. Under the provisions of the Convention, Ireland has an obligation to make annual assessed contributions to support the activities of the Secretariat and participation of developing countries.

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Appendix 1, Progress Assessment on Action Plan under the 2012 National Implementation Plan

Action	Responsibility	Status	Status of priority actions-comments
Continued enforcement of legislation	Local authorities, with assistance from the EPA, will continue to identify equipment suspected of containing PCBs and enforce requirements concerning disposal of PCBs and PCB-contaminated equipment.	☺	Work continuing to identify equipment suspected of containing PCBs and enforce requirements concerning disposal of PCBs and PCB-contaminated equipment. Legislation concerning unauthorised use of waste oils for space heating and the prohibition of waste disposal by burning will continued to be enforced.
Regulation and Control	EPA, local authorities and other public bodies	☺	Continue to assess activities, related to unintentional POP source categories, to facilitate the promotion and requirement of the use of Best Available Techniques and Best Environmental Practice. Relevant licenses include conditions relating to management of POPs where appropriate.
Monitoring and surveillance	EPA and other relevant public bodies	☺	EPA continue to assess current environmental monitoring programmes to determine the need for further monitoring of unintentional POPs. The EPA and other relevant authorities carry out required monitoring and surveillance as necessary.
New and candidate POPs	Department of Communications, Climate Action and Environment & EPA	☺	Continue to participate in Conference of Parties, Competent Authority, POP Review Committee and stakeholder meetings as required.
Inventories and research	EPA (Chemical and Research teams)	☺	EPA carried out an update of POPs inventories from 1990-2015. Emission factors updated for 5 vectors (land, air, water, products and residues).
Public awareness and guidance	Department of Agriculture, Food and the Marine, EPA, local authorities and other public bodies	😐	Work on public awareness will be prioritised for action in NIP update, 2018.
POPs working group	Department of Jobs, Enterprise & Innovation, Department of Agriculture, Food & Marine, Health & Safety Authority, Food Safety Authority of Ireland, Revenue, EPA	😐	Not yet established, however an interdepartmental, interagency national group on REACh facilitates information sharing on POPs. EPA have established a Chemicals Cross Office team, spanning across Research, licensing, water, air and enforcement units. Internal and external national groups in this area now established to further the exchange of information regarding POPs and other chemicals of emerging concern. Such groups will assist with the implementation of the plan. Consideration of the establishment of a dedicated POPs working group is ongoing.

Appendix 2, Legislation, Convention and Policy

POPs LEGISLATIVE FRAMEWORK

Stockholm Convention on Persistent Organic Pollutants

The Stockholm Convention on POPs is a global treaty requiring Parties to take measures to eliminate or reduce the release of POPs into the environment. The Convention entered into force on 17th May 2004 and is administered by the United Nations Environment Programme. The European Union ratified the Stockholm Convention on 16th November 2004. Ireland became a Party to the Convention on 3rd November 2010 and is required to submit a National Implementation Plan on POPs before 3rd November 2012.

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

The Executive Body to the UNECE Convention on Long Range Transboundary Air Pollutants (CLRTAP) adopted a Protocol on POPs on 24th June 1998. Known as the POPs Protocol this UNECE region specific treaty focuses on a list of POP substances subject to long range transboundary atmospheric transport. The Protocol bans or severely restricts the production and use of some chemicals most of which are covered under the Stockholm Convention. It includes provisions for dealing with wastes containing chemicals that are banned. The Protocol obliges Parties to reduce emissions of dioxins, furans, certain polycyclic aromatic hydrocarbons (PAHs) and hexachlorobenzene below their levels in 1990 (or an alternative year between 1985 and 1995). For certain processes, such as waste incineration the Protocol specifies specific limit values for releases of POPs.

As a Party to the Convention on Long-Range Transboundary Air Pollution (CLRTAP), Ireland is required to annually report emission data for a wide range of air pollutants and other substances released into the atmosphere. While Parties are required to report only on the substances and for the years set forth in Protocols that they have ratified, Ireland estimates and reports emissions for the full range of substances set down in Annex I to the Guidelines for Reporting Emission Data under the Convention on Long-Range Transboundary Air Pollution. This includes POPs covered under the POPs Protocol.

The European Union ratified the POPs Protocol on 30th April 2004.

EU legislation on Persistent Organic Pollutants

Regulation (EC) No 850/2004 on Persistent Organic Pollutants (EU POPs Regulation) is the principal European legal instrument for implementing the requirements of the Stockholm Convention and the UNECE Protocol on POPs in the EU. This Regulation is directly applicable in all Member States. It bans production, placing on the market and use (with some limited exemptions) of intentionally produced POP substances listed in the Stockholm Convention and the UNECE Protocol on POPs. It also specifies requirements regarding the management of stockpiles, the preparation and maintenance of release inventories for unintentional POPs and specific waste management measures for POPs waste.

National legislation on Persistent Organic Pollutants

In Ireland, the Persistent Organic Pollutant Regulations 201078 implement the EU POPs Regulation. These regulations designate the EPA as the competent authority for the purposes of the EU POPs Regulation. The EPA's responsibilities include the preparation and maintenance of release inventories and, in consultation with public authorities concerned and the public, the preparation of a national action plan and implementation plan setting out how Ireland is meeting its obligations under the Stockholm Convention. The national POPs regulations also set out the roles of public authorities concerned in relation to POPs including a general obligation to cooperate with respect to obligations concerning POPs. The EPA is responsible for reporting on certain aspects of implementation of the EU POPs Regulation both nationally and to the EU, while the Department of the Environment, Community and Local Government has responsibility for the remaining reporting requirements.

The national POPs regulations create offences for non-compliance with specific requirements of both the EU POPs Regulation and the national POPs regulations. Penalties for offences include:

- on summary conviction to a fine not exceeding €5,000 or to imprisonment for a term not exceeding twelve months, or at the discretion of the court to both such fine and such imprisonment;
- on conviction on indictment, to a fine not exceeding €500,000 or to imprisonment for a term not exceeding three years, or at the discretion of the court to both such fine and such imprisonment.

PCB Directive

Council Directive 96/59/EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls aims at disposing of PCBs and equipment containing PCBs as soon as possible, and for equipment containing more than 5 litres of PCB-contaminated materials with PCB concentrations greater than 0.05% before the end of 2010. It also sets requirements for the environmentally sound disposal of PCBs.

Member States are obliged to compile inventories, including specific data, of equipment with PCB volumes of more than 5 dm^3 (5 litres). The equipment and PCBs contained in the inventories were required to be decontaminated or disposed of by the end of 2010. Equipment on the inventory is subject to specific labelling requirements. 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 oil containing PCBs.

[78] Statutory Instrument 235 of 2010

Other relevant international agreements

The Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade

The Rotterdam Convention on Prior Informed Consent was established to allow countries to monitor and control the trade and use of certain hazardous chemicals including POPs. It puts in place a process where countries that are importing certain dangerous chemicals can refuse them or set out conditions for imported chemicals that must be met. The basic principle of the Rotterdam Convention is that the export of a banned or severely restricted chemical can only take place with prior informed consent of the importing Party. Ireland is a Party to the Rotterdam Convention, having acceded to it on 10th June 2005. Exports of POP substances are regulated by the EU Prior Informed Consent (PIC) Regulation (EC) No 649/2012 of the European Parliament and of the Council of 4 July 2012 concerning the export and import of hazardous chemicals) which implements the Rotterdam Convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade including POP substances.

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

The Basel Convention is a global environmental agreement on hazardous and other wastes. The Basel Convention entered into force in May 1992. The main principles of the Basel Convention are to:

reduce and minimise the generation of hazardous waste;

reduce transboundary movements of hazardous wastes to a minimum consistent with environmentally sound management; and

treat and dispose of hazardous wastes as close as possible to their source of generation.

Ireland is a Party to the Basel Convention which entered force for Ireland in 1994. In 1995, Decision III/1 (the export ban amendment) was adopted prohibiting transboundary movements of hazardous wastes from Parties listed in Annex VII of the Convention to all other countries (Annex VII includes all OECD member countries, the EU and Liechtenstein).

To date the export ban amendment has yet to enter into force due to the insufficient number of ratifications. However, it has been transposed by several OECD countries (the EU member states) into their national legislation.

The EU Transfrontier Shipment (TFS) Regulation79 on shipments of waste addresses the requirements of the Basel Convention on transboundary movement of wastes. In Ireland, the Waste Management (Shipments of Waste) Regulations 2007 addresses the administrative provisions to implement the EU TFS Regulation. All transfrontier shipments of waste originating in any local authority area in the State that are subject to the prior written notification procedures must be notified to and through Dublin City Council at the National TFS Office which was established to implement and enforce the 2007 Regulations.

London and OSPAR Conventions

[79] Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste.

The 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) is one of the first global conventions to protect the marine environment from human activities. Its objective is to promote the effective control of all sources of marine pollution and to take all practicable steps to prevent pollution of the sea by dumping of wastes and other matter. The Convention entered into force for Ireland on 19th March 1982.

The 1992 Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) forms the framework for international cooperation on the protection of the marine environment of the North-East Atlantic. Ireland is a Party to the Convention which entered into force on 25th March 1998.

In accordance with OSPAR guidelines, contracting Parties (including Ireland) have produced national guidance levels (including levels for various POPs) for assessing the suitability of dumping of dredged material at sea.

Kiev Protocol on Pollutant Release and Transfer Registers

The Kiev Protocol on Pollutant Release and Transfer Register is an international instrument on pollutant release and transfer registers. Its objective is to enhance public access to information through the establishment of coherent, nationwide pollutant release and transfer registers (PRTRs). PRTRs are inventories of pollution from industrial sites and other sources. Ireland has ratified the PRTR Protocol and has brought into force regulations concerning the establishment of a European Pollutant Release and Transfer Register80. Annual releases of pollutants (including POPs) are reported to the European Pollutant Release and Transfer Register.

Sustainable Development

The World Summit on Sustainable Development (WSSD), held in September 2002 in Johannesburg, agreed an Intergovernmental Plan of Implementation setting out what needs to be done to achieve global sustainable development. The plan of implementation included a number of chemicals related targets, including the implementation of existing chemicals conventions and the development of a Strategic Approach to International Chemicals Management (SAICM). SAICM is a policy framework to promote chemical safety around the world. SAICM has as its overall objective the achievement of the sound management of chemicals throughout their life cycle so that, by 2020, chemicals are produced and used in ways that minimize significant adverse impacts on human health and the environment. This '2020 goal' was adopted by the World Summit on Sustainable Development in 2002 as part of the Johannesburg Plan of Implementation and was reaffirmed at the recent 2012 UN Conference on Sustainable Development (Rio+20) in Rio de Janeiro.

The UN Conference on Sustainable Development held in 2012 was aimed at securing renewed political commitment for sustainable development, assessing the progress to date and the remaining gaps in the implementation of the outcomes of the major summits on sustainable development and addressing new and emerging challenges.

[80] European Communities (European Pollutant Release and Transfer Register) Regulations 2007, Pollutant Release and Transfer Register Regulations 2011.

Appendix 3 Conversion of NFR 08 to NFR 2014

NFR14	NFR Longname	NFR08
1A1a	Public electricity and heat production	1A1a
1A1b	Petroleum refining	1A1b
1A1c	Manufacture of solid fuels and other energy industries	1A1c
1A4ai	Commercial / institutional: Stationary	1A4ai
1A4bi	Residential: Stationary	1A4bi
1A4ci	Agriculture/Forestry/Fishing: Stationary	1A4ci
1A2a	Stationary combustion in manufacturing industries and construction: Iron and steel	1A2a
1A2b	Stationary Combustion in manufacturing industries and construction: Non-ferrous metals	1A2b
1A2c	Stationary combustion in manufacturing industries and construction: Chemicals	1A2c
1A2d	Stationary combustion in manufacturing industries and construction: Pulp, Paper and Print	1A2d
1A2e	Stationary combustion in manufacturing industries and construction: Food processing, beverages and tobacco	1A2e
1A2f	Stationary combustion in manufacturing industries and construction: Non-metalic minerals	1A2fi
2C1	Iron and steel production	2C1
2C3*	Aluminum production	2C3
2C2*	Ferroalloys production	2C2
2C4*	Magnesium Production	2C5
2C7a*	Copper production	2C5
2C5*	Lead production	2C5
2C6*	Zinc production	2C5
2A1	Cement production	2A1
2A3	Glass production	2A7d
2A6	Other Mineral products (Please specify the sources included/excluded in the notes column to the right)	2A7d
2A2	Lime production	2A2
2A6	Other Mineral products (Please specify the sources included/excluded in the notes column to the right)	2A3
2A5a	Quarrying and mining of minerals other than coal	2A7a
2D3f	Dry cleaning	3B
2D3g	Chemical products	3C
2G	Other product use	3D
2L	Other production, consumption, storage, transportation or handling of bulk products (Please specify the sources included/excluded in the notes column to the right)	2G
1A3bi	Road transport: Passenger cars	1A3bi
1A3c	Railways	1A3c
1A3eii	Other Transport	
1A3dii	National navigation (Shipping)	1A3dii
1A2gvii	Mobile Combustion in manufacturing industries and construction: (Please specify in the IIR)	1A3eii
5A	Biological treatment of waste - Solid waste disposal on land	6A
5C1bi	Industrial waste incineration	6C
5C2	Open Burning of Waste	6C
5D	Wastewater handling	6B
5E	Other waste handling (Please specify in IIR)	6D
3Df	Use of pesticides	4G
3Da2c	Other organic fertilisers applied to soils (including compost)	

*2C= Σ non-ferrous production

Appendix 4, POP substances as described under the Stockholm Convention on POPs

Substance	Typical Application / Use
Aldrin	Pesticide used to kill termites, grasshoppers, corn rootworm, and other insect pests.
Chlordane	Control of termites and as a broad-spectrum insecticide on a range of agricultural crops.
Dieldrin	Control of termites and textile pests and the control of insect-borne diseases and insects living in agricultural soils.
Endrin	Insecticide used on crops such as cotton and grains. It is also used to control rodents such as mice and voles.
Heptachlor	Used to kill soil insects and termites, cotton insects, grasshoppers, other crop pests, and malaria-carrying mosquitoes.
Hexachlorobenzene	Kills fungi that affect food crops. It was widely used to control wheat bunt. A by-product of the manufacture of certain industrial chemicals and exists as an impurity in several pesticide formulations.
Mirex	Insecticide used mainly to combat fire ants and against other types of ants and termites. It has also been used as a fire retardant in plastics, rubber, and electrical goods.
Toxaphene	Insecticide used on cotton, cereal grains, fruits, nuts, and vegetables. It has also been used to control ticks and mites in livestock.
DDT	DDT was widely used to control disease, and it was sprayed on a variety of agricultural crops, especially cotton. DDT continues to be applied against mosquitoes in several countries to control malaria.
Chlordecone	A synthetic chlorinated organic compound, which was mainly used as an agricultural pesticide. It was first produced in 1951 and introduced commercially in 1958. Currently, no use or production of the chemical is reported.
Lindane	This was used as an insecticide for seed and soil treatment, foliar applications, tree and wood treatment and against ectoparasites in both veterinary and human applications.
Alpha hexachlorocyclohexane	Although the intentional use of alpha-HCH as an insecticide was phased out years ago, this chemical is still produced as unintentional by-product of lindane. For each ton of lindane produced, around 6-10 tons of the other isomers including alpha- and beta-HCH are created.
Beta hexachlorocyclohexane	Although the intentional use of beta-HCH as an insecticide was phased out years ago, this chemical is still produced as unintentional by-product of lindane. For each ton of lindane produced, around 6-10 tons of the other isomers including alpha- and beta-HCH are created.
Hexabromobiphenyl	An industrial chemical that has been used as a flame retardant, mainly in the 1970s. According to available information, hexabromobiphenyl is no longer produced or used in most countries.
Polychlorinated biphenyls (PCBs)	These compounds are used in industry as heat exchange fluids, in electric transformers and capacitors, and as additives in paint, carbonless copy paper, and plastics. Of the 209 different types of PCBs, 13 exhibit a dioxin-like toxicity.
Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F)	PFOS is intentionally produced and an unintended degradation product of related anthropogenic chemicals. The current intentional use of PFOS is widespread and includes electric and electronic parts, use in semi-conductor manufacture, firefighting foam, photo imaging, hydraulic fluids and textiles.
Technical endosulfan and its related isomers	Insecticide used to control crop pests, tsetse flies and ectoparasites of cattle and as a wood preservative. As a broad-spectrum insecticide, endosulfan is currently used to control a wide range of pests on a variety of crops including coffee, cotton, rice, sorghum and soy.
Tetrabromodiphenyl ether and pentabromodiphenyl ether	Used to inhibit or suppress combustion in organic materials and therefore are used as additive flame retardants. Tetra and Penta BDE are the main components of commercial pentabromodiphenyl ether
Hexabromodiphenyl ether and	Used as a Flame Retardant. Hexa and hepta BDE are the main components of

heptabromodiphenyl ether	commercial octabromodiphenyl ether.
Pentachlorobenzene (PeCB)	Used in PCB products, in dyestuff carriers, as a fungicide, a flame retardant and as a chemical intermediate e.g. previously for the production of quintozene. It is also produced unintentionally during combustion, thermal and industrial processes. It is also present as an impurity in products such as solvents or pesticides.
Dioxins / Furans	Produced unintentionally due to incomplete combustion, as well during the manufacture of pesticides and other chlorinated substances. They are emitted mostly from the burning of waste, and can be produced from automobile emissions and the burning of solid fuels peat, coal, and wood.
Hexabromocyclododecane (HBCDD)	HBCD is used a flame retardant additive, providing fire protection during the service life of vehicles, buildings or articles, as well as protection while stored. The main uses of HBCD globally are in expanded and extruded polystyrene foam insulation while the use in textile applications and electric and electronic appliances is smaller.
Hexachlorobutadiene (HCB)	Hexachlorobutadiene occurs as a by-product during the chlorinolysis of butane derivatives in the production of both carbon tetrachloride and tetrachloroethene. These two commodities are manufactured on such a large scale, that enough HCBD can generally be obtained to meet the industrial demand.
Pentachlorophenol and its salts and esters (PCP)	PCP has been used as herbicide, insecticide, fungicide, algaecide, disinfectant and as an ingredient in antifouling paint. Some applications were in agricultural seeds, leather, wood preservation, cooling tower water, rope and paper mill system. Its use has been significantly declined due to the high toxicity of PCP and its slow biodegradation.
Polychlorinated naphthalenes (PCNs)	PCNs make effective insulating coatings for electrical wires. Others have been used as wood preservatives, as rubber and plastic additives, for capacitor dielectrics and in lubricants.

☐ Denotes POPs listed to the Stockholm Convention during COPs 6 & 7; 2013 & 2015 respectively.

Source: www.pops.int

Appendix 5 SC Conference of Parties- Listing of substances 2009-2017

At its **eighth** meeting held from **24 April to 5 May 2017**, Annexes A and C have been amended to list:

- Hexachlorobutadiene in Annex C.
- Decabromodiphenyl ether (commercial mixture, c-DecaBDE) in Annex A with specific exemptions.
- Short-chain chlorinated paraffins in Annex A with specific exemptions.

At its **seventh** meeting held from **4 to 15 May 2015,** Annexes A and C have been amended to list:

- 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).

The amendments were communicated by the depositary to all Parties on 15 December 2015.

At its **sixth** meeting held from **28 April to 10 May 2013,** Annex A has been amended to list:

- Hexabromocyclododecane in Annex A with specific exemptions (decision SC-6/13).

The amendment was communicated by the depositary to all Parties on 26 November 2013.

At its **fifth** meeting held from 25 to 29 May 2011, Annex A has been amended to list:

- Technical endosulfan and its related isomers in Annex A with a specific exemption (decision SC-5/3).

The amendment was communicated by the depositary to all Parties on 27 October 2011.

At its fourth meeting held from 4 to 8 May 2009, Annexes A, B and C have been amended to list:

- 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 perfluorooctanoic sulfonyl fluoride in Annex B with acceptable purposes and specific exemptions (decision SC-4/17)
- Tetrabromodiphenyl ether and pentabromodiphenyl ether in Annex A with specific exemptions (decision SC-4/18).

http://chm.pops.int/TheConvention/ThePOPs/TheNewPOPs/tabid/2511/Default.aspx

Appendix 6 Consultation submissions 2018

Submissions were made in relation to the following areas:

- Circular Economy and the consideration of repurpose material potentially containing POPs.
- Consideration of requirements for food grade certification for materials in contact with animals, food and feed.
- Global Atmospheric Passive Sampling (GAPS): Malin Head, how representative is the station compared to the rest of the country
- Consideration should be given to research into the accumulation of POPs in human tissue of Irish Population.
- Various concerns in relation to POPs such as adverse effects and possible contamination of surface and ground water, specifically in relation to fire fighting foams.
- Inclusion of definition of waste management of POP waste.