Stockholm Convention on
Persistent Organic Pollutants (POPs)

The 16 New POPs

An introduction to the chemicals added to the Stockholm Convention as Persistent Organic Pollutants by the Conference of the Parties

June 2017

UN environment

This booklet introduces basic information on the **16 chemicals** added to the **Stockholm Convention on Persistent Organic Pollutants (POPs)**.

In accordance with the procedure in **Article 8** of the Convention, the **Conference of the Parties**, taking due account of the recommendations of the **POPs Review Committee (POPRC)**, decided to list those chemicals in Annexes A, B and/or C to the Convention.

The results of the Committee's review are documented in detail for each chemical in **Risk Profiles** and **Risk Management Evaluations**, available for download from the Convention's website (http://chm.pops.int/tabid/2511/Default.aspx).

The decisions on amendments to Annex A, B and/or C to the Convention can be found in the reports of the meetings of the Conference of the Parties to the Stockholm Convention (http://chm.pops.int/tabid/208/Default.aspx).

Disclaimer

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Introduction

What are "POPs"?

Persistent organic pollutants (POPs) are organic compounds that are resistant to environmental degradation through chemical, biological, and photolytic processes.

POPs **persist** in the environment for long periods, are capable of **long-range transport**, **bioaccumulate** in human and animal tissue and **biomagnify** in food chains, and have **potentially significant impacts** on human health and the environment.

Exposure to POPs can cause serious health problems including certain cancers, birth defects, dysfunctional immune and reproductive systems, greater susceptibility to disease and even diminished intelligence.

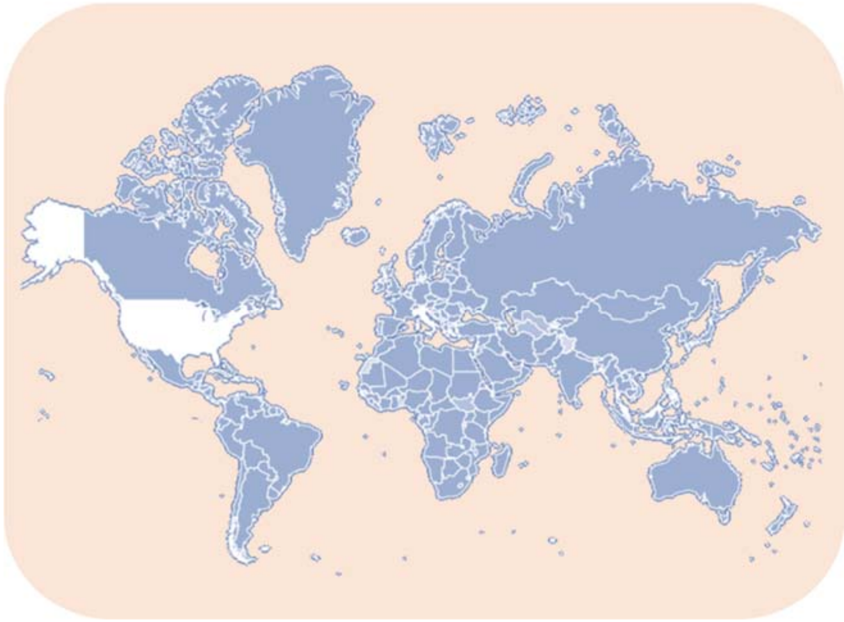
Stockholm Convention on POPs

The **Stockholm Convention** is an international treaty to protect human health and the environment from POPs. It was adopted in 2001 and entered into force in 2004 initially covering 12 chemicals. Currently, 16 additional POPs have been added by **181 Parties** as of 2017 to the Stockholm Convention.

POPs Review Committee (POPRC)

The **POPRC** consists of 31 government-designated experts in areas of chemical assessment or management from all UN regions. The Committee **reviews proposals** submitted by Parties to the Convention for listing new chemicals in accordance with **Article 8** of the Convention.

Status of ratification



The Stockholm Conventions has been ratified by 181 Parties as of May 2017. Information on the dates of entry into force of the amendments listing new POPs is available on the Convention website: (http://chm.pops.int/tabid/3486/Default.aspx)

For the newly listed chemicals, Parties need to:

- Implement control measures for each chemical (Article 3 and 4);
- Develop and implement action plans for unintentionally produced chemicals (Article 5);
- Develop inventories of the chemicals' stockpiles (Article 6);
- Review and update the National Implementation Plan (Article 7);
- Include the new chemicals in the reporting (Article 15);
- Include the new chemicals in the programme for the effectiveness evaluation (Article 16).

Acceptable purposes and specific exemptions

Acceptable purposes and specific exemptions for production and use of POPs

To enable Parties to the Convention to take measures to reduce or eliminate releases of POPs from intentional production and use, for which alternatives do not exist yet or are not readily available, the Convention allows Parties to register **specific exemptions** for a **specific period of time**. Annexes A and B to the Convention describe specific exemptions, as well as acceptable purposes, that are available with respect to the relevant POPs.

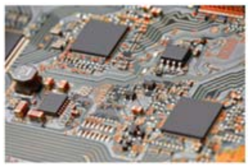
The implementation of these obligations on elimination and restriction of chemicals listed in Annex A and B may be subject to specific exemptions in accordance with **Article 4**. Parties that have notified the Secretariat for registration of a specific exemption are allowed to continue to use or produce a chemical for a particular purpose.

The information of specific exemptions and acceptable purposes are available on the Convention's website; (http://chm.pops.int/tabid/789/Default.aspx)

Sources of POPs

Pesticide ●

Industrial chemicals ▲



Unintentional production ■

The initial 12 POPs

Annex A: Parties must take measures to **eliminate** the production and use of the chemicals listed under Annex A. Specific exemptions for use or production are listed in the Annex and apply only to Parties that register for them.

Annex B: Parties must take measures to **restrict** the production and use of the chemicals listed under Annex B in light of any applicable acceptable purposes and/or specific exemptions listed in the Annex.

Annex C: Parties must take measures to reduce the **unintentional release** of chemicals listed under Annex C with the goal of continuous minimization and, where feasible, ultimate elimination.

Annex A (Elimination)

●Aldrin ●Chlordane ●Dieldrin
●Endrin ●Heptachlor ●/▲Hexachlorobenzene
●Mirex ●Toxaphene ▲PCB

Annex B (Restriction)

●DDT

Annex C (Unintentional production)

■Polychlorinated dibenzo-*p*-dioxins and dibenzofurans
■Hexachlorobenzene ■PCB

The 16 new POPs

Since its fourth meeting in 2009, The COP has decided to amend Annexes A, B and C to the Convention by adding the following chemicals:

Chemical	Annex	Specific exemptions/ acceptable purposes
Alpha hexachlorocyclohexane	A	**Production**: None **Use**: None
Beta hexachlorocyclohexane	A	**Production**: None **Use**: None
Chlordecone	A	**Production**: None **Use**: None
Hexabromobiphenyl	A	**Production**: None **Use**: None
Hexabromocyclododecane	A	**Production**: As allowed by the parties listed in the Register of specific exemptions **Use**: Expanded polystyrene and extruded polystyrene in buildings in accordance with the provisions of the Part VII of Annex A
Hexabromodiphenyl ether and heptabromodiphenyl ether (commercial octabromodiphenyl ether)	A	**Production**: None **Use**: Articles in accordance with the provisions of Part IV of Annex A
Hexachlorobutadiene	A and C	**Production**: None **Use**: None
Lindane	A	**Production**: None **Use**: Human health pharmaceutical for control of head lice and scabies as second line treatment
Pentachlorobenzene	A and C	**Production**: None **Use**: None
Pentachlorophenol and its salts and esters	A	**Production**: As allowed for the parties listed in the Register in accordance with the provisions of Part VIII of Annex A **Use**: Pentachlorophenol for utility poles and cross-arms in accordance with the provisions of Part VIII of Annex A
Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOSF)	B	**Production:** For the use below **Use:** Acceptable purposes and specific exemptions in accordance with Part III of Annex B
Polychlorinated naphthalenes	A and C	**Production**: For the use below **Use**: Production of polyfluorinated naphthalenes, including octafluoronaphthalene
Technical endosulfan and its related isomers	A	**Production**: As allowed for the parties listed in the Register **Use**: Crop-pest complexes as listed in accordance with the provisions of Part VI of Annex A
Tetrabromodiphenyl ether and pentabromodiphenyl ether (commercial pentabromodiphenyl ether)	A	**Production:** None **Use:** Articles in accordance with the provisions of Part V of Annex A
Decabromodiphenyl ether (Commercial mixture, c-DecaBDE)	A	**Production**: As allowed for the parties listed in the Register **Use**: Vehicles, aircraft, textile, additives in plastic housings etc., polyurethane foam for building insulation, in accordance with Part IX of Annex A
Short-chain chlorinated paraffins (SCCPs)	A	**Production**: As allowed for the parties listed in the Register **Use**: Additives in transmission belts, rubber conveyor belts, leather, lubricant additives, tubes for outdoor decoration bulbs, paints, adhesives, metal processing, plasticizers

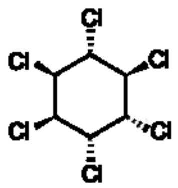
Alpha hexachlorocyclohexane and beta hexachlorocyclohexane

Listed in Annex A without specific exemptions

Chemical identity and properties

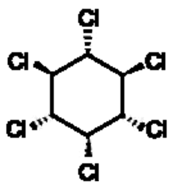
The technical mixture of hexachlorocyclohexane (HCH) contains mainly five forms of isomers, namely alpha-, beta-, gamma-, delta- and epsilon-HCH. Lindane is the common name for the gamma isomer of HCH.

alpha-HCH



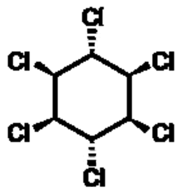
CAS No: 319-84-6

beta-HCH



CAS No: 319-85-7

Lindane (gamma-HCH)



CAS No: 58-89-9

POPs characteristics

Alpha- and beta-HCH are highly persistent in water in colder regions and may bioaccumulate and biomagnify in biota and arctic food webs. They are subject to long-range transport, are classified as potentially carcinogenic to humans and adversely affect wildlife and human health in contaminated regions.

Use and production

Use of alpha- and beta-HCH as insecticides was phased out years ago, but these chemicals have been produced as by-products of lindane. For each ton of lindane produced, around 6-10 tons of alpha- and beta-HCH are also produced. Therefore there are large stockpiles leading to site contamination.

Replacement

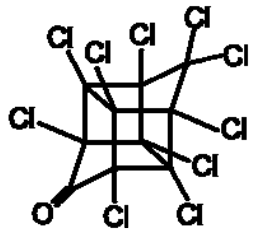
As there is no intentional use of alpha- and beta-HCH, it is not required to identify alternatives.

Chlordecone

Listed in Annex A without specific exemptions

Chemical identity and properties

Chlordecone is chemically related to Mirex, a pesticide listed in Annex A of the Convention.



CAS No: 143-50-0
Trade name: Kepone® and GC-1189

POPs characteristics

Chlordecone is highly persistent in the environment, has a high potential for bioaccumulation and biomagnification and based on physico-chemical properties and modelling data, chlordecone can be transported for long distances. It is classified as a possible human carcinogen and is very toxic to aquatic organisms.

Use and production

Chlordecone is a synthetic chlorinated organic compound, which was mainly used as an agricultural pesticide. It was first produced in 1951 and commercially introduced in 1958. Currently, no use or production of the chemical is reported, as many countries have already banned its sale and use.

Replacement

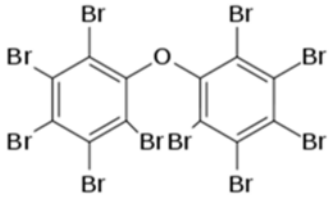
Alternatives to chlordecone exist and can be implemented inexpensively. Phasing out chlordecone further requires identifying and managing obsolete stockpiles and wastes.

Decabromodiphenyl ether (Commercial mixture, c-decaBDE)

Listed in Annex A with various specific exemptions in accordance with Part IX of Annex A

Chemical identity and properties

The commercial mixture consists primarily of the fully brominated decaBDE congener in a concentration range of 77.4-98 %, and smaller amounts of the congeners of nonaBDE (0.3-21.8 %) and octaBDE (0-0.04 %).



CAS No: 1163-19-5

POPs characteristics

The decaBDE is highly persistent, has a high potential for bioaccumulation and food-web biomagnification, as well as for long-range transport. Adverse effects are reported for soil organisms, birds, fish, frog, rat, mice and humans.

Use and production

DecaBDE is used as an additive flame retardant, and has a variety of applications including in plastics/polymers/composites, textiles, adhesives, sealants, coatings and inks. DecaBDE containing plastics are used in housings of computers and TVs, wires and cables, pipes and carpets. Commercially available decaBDE consumption peaked in the early 2000's, but c-decaBDE is still extensively used worldwide.

Replacement

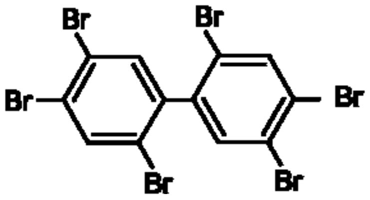
a number of non-POP chemical alternatives are already on the market for the substitution of c-decaBDE in plastics and textiles. Furthermore, non-chemical alternatives and technical solutions such as non-flammable materials and physical barriers, respectively, are also available.

Hexabromobiphenyl

Listed in Annex A without specific exemptions

Chemical identity and properties

Hexabromobiphenyl belongs to the group of polybrominated biphenyls, which are brominated hydrocarbons formed by substituting hydrogen with bromine in biphenyl.



CAS No: 36355-01-8
Trade name: FireMaster

POPs characteristics

The chemical is highly persistent in the environment, highly bioaccumulative and has a strong potential for long-range environmental transport. It is classified as a possible human carcinogen and has other chronic toxic effects.

Use and production

Hexabromobiphenyl is 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 due to restrictions under national and international regulations.

Replacement

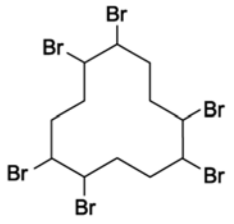
Alternatives to hexabromobiphenyl are available, so prohibiting its use and production is feasible and inexpensive.

Hexabromocyclododecane

Listed in Annex A with specific exemptions for expanded polystyrene and extruded polystyrene in buildings, in accordance with the provision in Part VII of Annex A

Chemical identity and properties

Commercially available hexabromocyclododecane is a white solid substance. Its structural formula is a cyclic ring structure with Br-atoms attached.



Hexabromocyclododecane
(CAS number 25637-99-4)
1,2,5,6,9,10-hexabromocyclododecane
(CAS number 3194-55-6)

POPs characteristics

HBCD has a strong potential to bioaccumulate and biomagnify. It is persistent in the environment, and has a potential for long-range environmental transport. It is very toxic to aquatic organisms. It is particularly harmful to human as neuroendocrine and developmental toxicity has been observed.

Use and production

HBCD has been widely used as a flame retardant additive on polystyrene materials in the 1980s as a part of safety regulation for articles, vehicles, and buildings.

Replacement

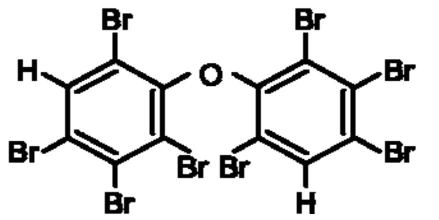
There are already available on the market chemical alternatives to replace HBCD in high-impact polystyrene (HIPS) and textile back-coating.

Hexabromodiphenyl ether and heptabromodiphenyl ether

Listed in Annex A with specific exemptions for use (recycling articles that contain these chemicals), in accordance with the provision in Part IV of Annex A

Chemical identity and properties

Hexabromodiphenyl ether and heptabromodiphenyl ether are the main components of commercial octabromodiphenyl ether.



CAS No: 68631-49-2
207122-15-4
446255-22-7
207122-16-5

POPs characteristics

The commercial mixture of octaBDE is highly persistent, has a high potential for bioaccumulation and food-web biomagnification, as well as for long-range transport. The only degradation pathway is through debromination and producing other bromodiphenyl ethers.

Replacement

Alternatives generally exist. However, it is reported that many articles in use still contain these chemicals.

Polybromodiphenyl ethers: Debromination and precursors

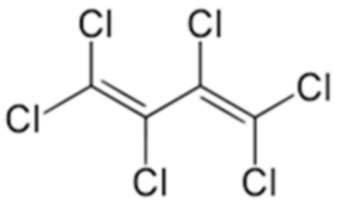
Polybromodiphenyl ethers can be subject to debromination, i.e. the replacement of bromine on the aromatic ring with hydrogen. Higher bromodiphenyl ether congeners may be converted to lower, and possibly more toxic, congeners. The higher congeners might therefore be precursors to the tetraBDE, pentaBDE, hexaBDE or heptaBDE.

Hexachlorobutadiene

Listed in Annex A without specific exemptions and in Annex C

Chemical identity and properties

Hexachlorobutadiene is a halogenated aliphatic compound, mainly created as a by-product in the manufacture of chlorinated aliphatic compounds.



CAS No: 87-68-3

POPs characteristics

HCBD is persistent, bioaccumulative and very toxic to aquatic organisms and birds. It can be long-range transported leading to significant adverse human health and environmental effects and it is classified as a possible human carcinogen.

Use and production

Most commonly used as a solvent for other chlorine-containing compounds. 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.

Replacement

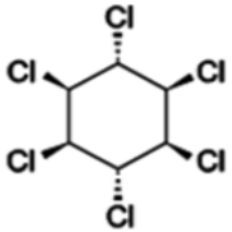
It seems that HCBD is no longer intentionally produced and used in the UNECE region including in the US and Canada; specific information on current intentional production and use and for the past 30 years is lacking. This indicates that substitution has taken place and alternatives are available.

Lindane

Listed in Annex A with a specific exemption for use as human health pharmaceutical for control of head lice and scabies as second line treatment

Chemical identity and properties

See alpha- and beta hexachlorocyclohexane section (p.10)



Lindane (gamma-HCH)
CAS No: 58-89-9

POPs characteristics

Lindane is persistent, bioaccumulates easily in the food chain and bioconcentrates rapidly. There is evidence for long-range transport and toxic effects (immunotoxic, reproductive and developmental effects) in laboratory animals and aquatic organisms.

Use and production

Lindane has been used as a broad-spectrum insecticide for seed and soil treatment, foliar applications, tree and wood treatment and against ectoparasites in both veterinary and human applications.

The production of lindane has decreased rapidly in the last few years, due to regulations in several countries (also concerning its use and monitoring). However, a few countries are still known to produce it.

Replacement

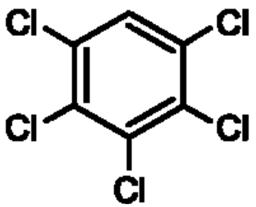
Alternatives for lindane are generally available, except for use as a human health pharmaceutical to control head lice and scabies.

Pentachlorobenzene (PeCB)

Listed in Annex A without specific exemptions and in Annex C

Chemical identity and properties

PeCB belongs to a group of chlorobenzenes that are characterized by a benzene ring in which the hydrogen atoms are substituted by one or more chlorines.



CAS No: 608-93-5

POPs characteristics

PeCB is persistent in the environment, highly bioaccumulative and has a potential for long-range environmental transport. It is moderately toxic to humans and very toxic to aquatic organisms.

Use and production

Previously, PeCB was used in PCB products, in dyestuff carriers, as a fungicide and a flame retardant. It might still be used as a chemical intermediate (e.g. for the production of quintozene). It is also produced unintentionally during combustion, thermal and industrial processes, and present under the form of impurities, in products such as solvents or pesticides.

Replacement

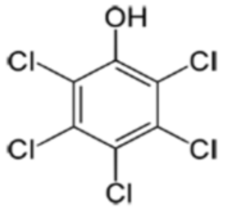
PeCB production ceased several decades ago in the main producing countries, as efficient and cost-effective alternatives became available. In order to significantly reduce the unintentional production of PeCB, Best Available Techniques and Best Environmental Practices need to be applied.

Pentachlorophenol and its salts and esters

Listed in Annexes A with a specific exemption for use in utility poles and cross-arms in accordance with Part VIII of Annex A

Chemical identity and properties

PCP can be found in two forms: PCP itself or as the sodium salt of PCP, which dissolves easily in water.



CAS No:
No: 87-86-5 (Pentachlorophenol)
No: 131-52-2 (sodium pentachlorophenate)
No: 27735-64-4 (as monohydrate)
No: 3772-94-9 (pentachlorophenyl laurate)
No: 1825-21-4 (pentachloroanisole)

POPs characteristics

PCP is detected in the blood, urine, seminal fluid, breast milk and adipose tissue of humans. PCP are likely, as a result of their long -range environmental transport, to lead to significant adverse human health and/or environmental effects .

Use and production

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. It is first produced in the 1930s, it is marketed under many trade names. The main contaminants include other polychlorinated phenols, polychlorinated dibenzo-p-dioxins, and polychlorinated dibenzo furans.

Replacement

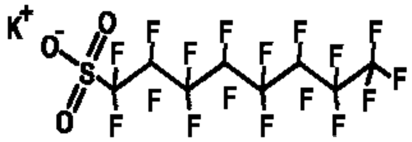
Both chemical and non-chemical alternatives exist for PCP within applications for utility poles and cross arms.

Perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride

Listed in Annex B with various acceptable purposes and specific exemptions

Chemical identity and properties

PFOS is a fully fluorinated anion, which is commonly used as a salt or incorporated into larger polymers. PFOS and its closely related members of the large family of perfluoroalkyl sulfonate substances.



CAS No: 1763-23-1
(Perfluorooctane sulfonic acid)
CAS No: 307-35-7
(Its salts perfluorooctane sulfonyl fluoride)

POPs characteristics

PFOS is extremely persistent and has substantial bioaccumulations and biomagnifying properties, although it does not follow the classic pattern of other POPs by partitioning into fatty tissues, but instead binds to proteins in the blood and the liver. It has a capacity to undergo long-range transport and also fulfills the toxicity criteria of the Stockholm Convention.

Use and production

PFOS is both intentionally produced and an unintended degradation product of related anthropogenic chemicals. The current intentional use of PFOS is widespread and includes: electric and electronic parts, fire fighting foam, photo imaging, hydraulic fluids and textiles. PFOS is still produced in several countries.

Replacement

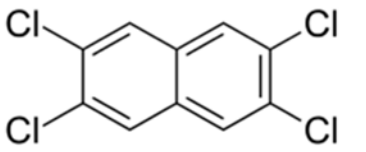
While alternatives to PFOS are available for some applications, this is not always the case in developing countries, where they still need to be phased in. For applications like photo imaging, use for semi-conductors or aviation hydraulic fluids, technically feasible alternatives to PFOS are not available to date.

Polychlorinated naphthalenes

Listed in Annex A with specific exemptions for use in the production of polyfluorinated naphthalenes, including octafluoronaphthalene and in Annex C

Chemical identity and properties

Commercial PCNs are mixtures of up to 75 chlorinated naphthalene congeners plus byproducts and are often described by the total fraction of chlorine.



CAS No: 70776-03-3

POPs characteristics

While some PCNs can be broken down by sunlight and, at slow rates, by certain microorganisms, many PCNs persist in the environment. bioaccumulation is confirmed for tetra- to hepta-CNs. Chronic exposure increases risk of liver disease.

Use and production

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. To date, intentional production of PCN is assumed to have ended. PCN are unintentionally generated during high-temperature industrial processes in the presence of chlorine.

Replacement of PCNs

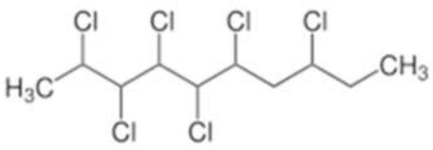
Within the UNECE region, the information on substitution and alternatives is extremely limited, as PCN are not in use anymore. The only available information is that, since the production of PCN has stopped in the 1970s and 1980s, PCN have been substituted by other chemicals. These chemicals have not been identified and described (UNECE 2007).

Short-chain chlorinated paraffins (SCCPs)

Listed is Annex A with various specific exemptions

Chemical identity and properties

Chlorinated paraffins (CPs) are complex mixtures of certain organic compounds containing chloride: polychlorinated n-alkanes. The chlorination degree of CPs can vary between 30 and 70 wt %.



CAS No: 85535-84-8

POPs characteristics

SCCPs are sufficiently persistent in air for long range transport to occur and appear to be hydrolytically stable. Many SCCPs can accumulate in biota. It is concluded that SCCPs are likely, as a result of their long range environmental transport, to lead to significant adverse environmental and human health effects.

Use and production

SCCPs can be used as a plasticizer in rubber, paints, adhesives, flame retardants for plastics as well as an extreme pressure lubricant in metal working fluids Chlorinated paraffins are produced by chlorination of straight-chained paraffin fractions. The carbon chain length of commercial chlorinated paraffins is usually between 10 and 30 carbon atoms. Short-chained chlorinated paraffins is between C10 and C13. The production of SCCPs has decreased globally as jurisdictions have established control measures.

Replacement

Technically feasible alternatives are commercially available for all

New POPs

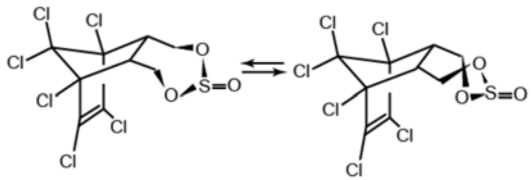
Technical endosulfan and its related isomers

Listed in Annex A with specific exemptions as pesticide in accordance with Part VI of Annex A

Chemical identity and properties

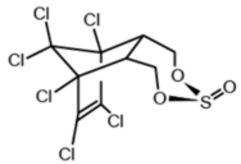
Endosulfan occurs as two isomers: alpha- and beta-endosulfan. They are both biologically active. Technical endosulfan (CAS No: 115-29-7) is a mixture of the two isomers along with small amounts of impurities.

alpha-endosulfan



CAS No: 959-98-8

beta-endosulfan



CAS No: 33213-65-9

POPs characteristics

Endosulfan is persistent in the atmosphere, sediments and water. Endosulfan bioaccumulates and has the potential for long-range transport. Endosulfan is toxic to humans and has been shown to have adverse effects on a wide range of aquatic and terrestrial organisms. The use of endosulfan is banned or will be phased out in 60 countries that, together, account for 45 per cent of current global use.

Use and production

Endosulfan is an insecticide that has been used since the 1950s to control crop pests, tsetse flies and ectoparasites of cattle and as a wood preservative. As a broad-spectrum insecticide, endosulfan is currently used to control a wide range of pests on a variety of crops including coffee, cotton, rice, sorghum and soy.

Replacement

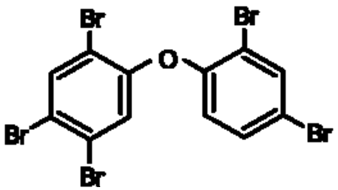
Chemical and non-chemical alternatives to endosulfan are available in many geographical situations both in developed and developing countries. Some of these alternatives are being applied in countries where endosulfan has been banned or is being phased-out.

Tetrabromodiphenyl ether and pentabromodiphenyl ether

Listed in Annex A with specific exemptions for use (recycling articles that contain these chemicals), in accordance with the provision in Part V of Annex A

Chemical identity and properties

Tetrabromodiphenyl ether and pentabromodiphenyl ether are the main components of commercial pentabromodiphenyl ether. They belong to a group of chemicals known as “polybromodiphenyl ethers” (PBDEs).



CAS No: 40088-47-9
32534-81-9

POPs characteristics

The commercial mixture of pentaBDE is highly persistent in the environment, bioaccumulative and has a potential for long-range environmental transport (it has been detected in humans throughout all regions). There is evidence of its toxic effects in wildlife, including mammals.

Use and production

Polybromodiphenyl ethers including tetra-, penta-, hexa-, and heptaBDEs inhibit or suppress combustion in organic materials and therefore are used as additive flame retardants. The production of tetra - and pentaBDEs has ceased in certain regions of the world, while no production of hexa- and heptaBDEs is reported.

Replacement

Alternatives are available and used to replace these substances in many countries, although they might also have adverse effects on human health and the environment. The identification and also handling of equipment and wastes containing brominated diphenyl ethers is considered a challenge.

Toward #Detoxified Future

2017 Triple BRS Conference of Parties

#DETOX project

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