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Updated National Implementation Plan for the Stockholm Convention 2012

On Persistent Organic Pollutants

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Updated National Implementation Plan for the Stockholm Convention 2012

Edited by:

Carsten Lassen, Helle Husum, Jesper Kjølholt, Erik Hansen og Christian Nyander Jeppesen, COWI A/S

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Foreword

Everything we do in life has consequences; some positive, some negative. Fortunately, we can make amends for many of the negative consequences. However, when we release substances like DDT and dioxins in nature, there is no turning back. They accumulate in plants, animals, and in humans – and remain in nature for many, many years.

In order to protect nature, and each other, we must try to limit the spread of these persistent organic pollutants as much as is absolutely possible. For our own sakes, and not least for the sakes of our children.

In Denmark, since the 1980s we have been working on phasing out and banning the production of harmful chemical substances. However, the environment knows no national borders and unfortunately, neither does pollution. If we are to reduce the toxic chemical substances in our environment, we must act globally.

It is vital that we remember the global agenda in chemicals management policy, as by far the majority of the goods on the Danish market are not actually produced in either Denmark or the EU.

Since 2004, DDT and dioxin, together with ten other toxic substances, have been regulated globally by the Stockholm Convention. Today there is a total of 22 Persistent Organic Pollutants (POPs) regulated globally.

In this National Implementation Plan, you can read about how Denmark will contribute to reducing POPs in the environment, including the 10 new substances. Denmark is just a small country, but we make a significant contribution to raising the global level of protection; both for the environment and for people – today and for future generations. For many years, we have made a strong impact globally and we will continue this work, under the Stockholm Convention and under the other global agreements in the chemicals area.

Minister for the Environment, Mrs Ida Auken
August 2012

Summary

The Stockholm Convention. The Stockholm Convention on Persistent Organic Pollutants (referred to as POPs) was adopted in May 2001 and entered into force on 17 May 2004. The overall objective of the Convention is to protect human health and the environment from POPs. To this end, it requires Parties to take measures to eliminate or reduce the release of POPs into the environment. The Convention initially encompassed 12 substances or substance groups (referred to as old POPs) and was later expanded by 10 new substances or substance groups (referred to as new POPs).

Denmark ratified the Convention on 17 December 2003 with a territorial exclusion in respect of Greenland and the Faeroe Islands where the Convention so far does not apply. The Faeroese reservation was lifted with effect from the second half of 2012.

Denmark's first plan for implementation of the Convention was prepared in 2006 and submitted to the Conference of the Parties. According to the Convention, all parties undertake to prepare an updated implementation plan five years after submission of the original plan.

This updated implementation plan provides a description of POPs issues in Denmark, particularly focusing on describing developments in the past six years with regard to the old POPs, as well as a description of the 10 new substances. The implementation plan also describes Denmark's new initiatives with a view to further implementation of the Convention.

Legislation on POPs. Regulation in Denmark of POPs and waste containing POPs is characterised by close interaction between European Union legislation and national law. Most legislation on POPs in Denmark is a consequence of Union legislation. In the EU, the Stockholm Convention is implemented through Regulation (EC) no. 850/2004 on persistent organic pollutants (the POP Regulation) with subsequent amendments and supplements as a consequence of new added substances. The POP Regulation is supplemented by a number of other regulations; the Danish Environmental Protection Act and the Danish Chemicals Act, as well as a number of statutory orders pursuant thereto. Generally, all legislation has been updated since the first implementation plan was prepared.

POP-related problems in Denmark. POP pesticides have not been used for many years, and today it is assessed that there are no stocks of old POP pesticides in Denmark. The assessment is that the presence of POP pesticides in food and drinking water is below the established toxicological limits of the acceptable/tolerable intake.

One of the initiatives in the 2006 implementation plan was deciding whether the results of a study, conducted at the time, of PCB in building materials were to be followed up by new initiatives in the area. This study as well as other studies carried out during the past period showed that PCB in building materials may cause seriously high levels of PCB concentrations in indoor air. Furthermore, the studies showed a need to develop remediation measures and methods to manage building materials containing PCB in connection with waste disposal.

Consequently, in 2011, the Danish Government published an Action Plan on Managing PCB in Buildings *("Handlingsplan for håndtering af PCB i bygninger").* The action plan describes 19 initiatives on the following subjects: PCB and health, identification of PCB in buildings, management and disposal of PCB, as well as easily accessible guidelines and information. The action plan is being implemented by a number of authorities; the Danish EPA, the Danish Working Environment Authority, the Danish Health and Medicines Authority, the Danish Energy Agency, the Ministry of

Housing, Urban and Rural Affairs and the Agency for Palaces and Cultural Properties, which have set up an intra-ministerial advisory group to monitor implementation of the plan. As part of the action plan, a national study on the presence of PCB in buildings and the relationship between PCB in building materials and indoor air will be carried out. Furthermore, a PCB website has been set up, with information for the public, construction companies, building owners and municipalities, as well as a hotline.

Parallel with these activities, there are comprehensive activities investigating PCB in building materials and the indoor air; initiated by building owners, including housing associations, private home owners, municipalities, regions and government institutions.

According to studies, residents in flats with building materials containing PCB have a higher concentration of PCB in their blood than residents in similar flats without PCB. According to an overall estimate by the Danish Health and Medicines Authority these residents are not exposed to any immediate health risks; however, more studies are recommended. In this context, the study states that the general level of PCB in Danes' breast milk/blood has dropped by three-quarters since the use of PCB was banned in the 1970s.

Releases of dioxins (PCDD/PCDF) from incineration plants and industry have decreased to below 5% of the level in the 1990s, and today, the most significant sources of dioxin releases are burning of biomass in wood-burning stoves and small combustion plants, as well as fires and bonfires. However, such releases have been determined on very uncertain grounds. Unfortunately, initiatives on reducing releases of particles and PAH from wood-burning stoves have proven to have no effect on dioxin releases. The content of dioxins in certain foods of animal origin is still high, and there is a ban on catching certain fish species in some areas of water with too high content of dioxins. Significant sources of dioxins in food are dioxins accumulated in nature as a result of previous releases and atmospheric deposition of dioxins transported over long distances.

In Denmark PFOS is still used for one of the uses that are acceptable under the Convention. According to a study examining the possibilities of replacing the PFOS compound being used, there are useful alternatives but these have not yet been taken into use. During 2012 a major analysis will be carried out of the use and presence of PFOS and other per- and polyfluorinated compounds for the purpose of assessing the need for new initiatives.

When they become waste, articles containing PFOS are typically disposed of through waste incineration. The same applies to articles containing the types of brominated flame retardants that are now covered by the Convention. There is some uncertainty about the effectiveness of destroying these substances in incineration plants for household waste. Denmark will encourage the European Commission to prepare a study of the effectiveness of destruction, and will monitor developments and decide whether there should be changes in waste treatment if new results prove that destruction of these substances is unsatisfactory.

New initiatives. On the basis of the present assessment it can be concluded that Denmark generally already meets the obligations of the Stockholm Convention.

On the basis of the initiatives from the current PCB Action Plan, Denmark is acting beyond its obligations under the Convention.
Other new initiatives are directed at waste management containing new POPs, unintentional formation of dioxins and other POPs, treatment of waste containing POPs as well as activities related to research, development and information. These initiatives are summarised in the table below.

The plan of implementation includes other initiatives that in various ways contribute to the fulfilment of the obligations under the Stockholm Convention. Denmark has a long standing tradition for closely studying POPs in the environment and their possible effects on human health and the environment. This work will continue, and will include new substances that exhibit POP properties. Denmark is positive towards including a number of new substances under the Convention that comply with the conditions for their inclusion, and will work with the EU work to ensure their inclusion.

Denmark will primarily assist developing countries and countries in transition through the financing mechanism of the Stockholm Convention, the Global Environmental Facility (GEF).

TABLE 1
NEW INITIATIVES AND ACTIVITIES FOR DENMARK'S FURTHER IMPLEMENTATION OF THE STOCKHOLM CONVENTION

Area	New initiatives and activities
Reduction of PCB releases	1. 19 initiatives in "Action Plan on Managing PCB in Buildings – Indoor Environment, Working Environment and Waste" see Table 9 2. A possible limit value for PCB in sludge, and soil quality standards for PCB 3. Examine the possibilities for identifying PCBs in shredder waste
Reduction of PFOS releases	1. Report on use of PFOS in Denmark 2. Notification of acceptable uses 3. Information to users of PFOS on acceptable uses in Denmark 4. Study of PFOS/PFOA as soil and groundwater contamination 5. Assessment of the presence of PFOS in household waste 6. Validation of destruction of PFOS 7. Possible requirements for separating household waste containing PFOS
Reduction of releases of PBB and PBDE	1. Validation of destruction of technical pentaBDE 2. Possible separation of household waste containing pentaBDE 3. Guidelines concerning non-recyclable mixtures and articles 4. Examine the possibilities of identifying pentaBDE in shredder waste
Reduction of releases of unintentionally formed POPs	1. Monitor developments in relation to releases of POPs from wood-burning stoves 2. Improved emissions inventories 3. Further development of technologies for treatment of flue-gas cleaning products
Listing of new chemical substances in Annexes A, B and C	Initiatives on inclusion of a number of new substances in the Annexes to the POP Protocol and the Stockholm Convention
Exchange of information and information to the public	Henceforth knowledge about POPs will be communicated via a number of fora, and new initiatives will be taken to the extent necessary
Research, development and monitoring	Continued support for research initiatives directed at examining the presence of POPs in the Arctic environment as well as their effects on humans and wildlife; both POPs covered by the Stockholm Convention and potential candidates
Technical and financial assistance to other countries	Contribution for the financing mechanism and any support for programme collaboration countries that prioritise the area

1. Introduction

1.1 Denmark's updated plan for implementation of the Stockholm Convention

1.1.1 Background and purpose of the implementation plan

The Stockholm Convention on Persistent Organic Pollutants was adopted in May 2001 and entered into force on 17 May 2004. The purpose of the Convention is to protect human health and the environment against persistent organic pollutants, also called POPs.

Denmark's instrument of ratification was deposited with the Secretary-General of the United Nations on 17 December 2003. Together with the deposit, a territorial declaration was made stating that, until further notice, the Convention will not cover the Faeroe Islands and Greenland. The Faeroese reservation was lifted with effect from the second half of 2012.

The Convention has been implemented in Denmark by Statutory Order no. 29 of 14 October 2004 of the Ministry of Foreign Affairs of Denmark.

In 2006 Denmark submitted a national implementation plan to the Conference of the Parties describing the POP situation in Denmark and plans to implement Denmark's obligations under the Convention.

According to the Convention, all parties undertake to prepare an updated implementation plan five years after submission of the original plan.

The European Community is also Party to the Convention and also submitted an implementation plan in 2006, and is planning to submit an updated implementation plan in 2012.

1.1.2 Preparation and adoption of the implementation plan

This updated implementation plan was prepared by the Danish EPA. The work was monitored by an advisory group comprising representatives from the Danish EPA, the Danish Veterinary and Food Administration, the Danish Health and Medicines Authority, the Danish Nature Agency, the Danish Society for Conservation of Nature, the Confederation of Danish Industries, the Ecological Council, Greenpeace and Aarhus University.

The work was managed and coordinated by a steering group from the Danish EPA with representatives from relevant centres at the Agency. The planning was assisted by a consultancy firm.

Work was carried out in the following steps:

- Preparation of introduction and country baseline,
- Preparation of a gap analysis,
- Compilation of strategy elements and action plans and completion of draft implementation plan,
- Consultation of a wide group of stakeholders,
- Completion of the final implementation plan.

As part of the implementation plan process, the consultant was commissioned by the Danish EPA to prepare a draft introduction, a country baseline (country description and status of POPs issues), as well as a gap analysis (analysis of any possible gaps in Danish legislation and other initiatives). The gap analysis was prepared in order to assess the need for further measures to ensure that Denmark meets the obligations under the Convention, and the parts of Regulation (EC) No 850/2004 on POPs that implement the Convention (also referred to as the POP Regulation).

The deliberations and conclusions of this process form the basis for preparing a draft implementation plan, including strategy elements and action plans. The draft national implementation plan (NIP) has been reviewed by the steering group of the Danish EPA as well as the advisory group, and after revision, the draft was sent to a wide group of stakeholders for consultation. This final updated implementation plan was completed after the consultation process.

1.1.3 Structure of the implementation plan

The updated implementation plan follows the same structure as the first implementation plan from 2006, which followed a structure proposed by the Secretariat of the Stockholm Convention.

After a short *introduction* which is primarily a reading guide describing why and how the implementation plan was prepared, *Chapter 2* describes the *country baseline*. The description is introduced by a country profile briefly describing Denmark for external readers. Compared with the 2006 implementation plan this part has been shortened; reference is made to the 2006 implementation plan for a further description. The following section describes the institutional, political and regulatory frameworks focusing on the individual institutions and their areas of responsibility in relation to POPs, as well as how the POP issues are connected to other environmental policy priorities. The subsequent sections describe other relevant international obligations and existing legislation on POPs.

Chapter 2 also reports the assessment of the POPs issues in Denmark which forms the basis for later strategy and action plan elements. Compared with the 12 old substances specified in detail in the previous plan, the current plan focuses on describing developments in the past six years. In relation to the new substances, the plan briefly describes releases and the presence of POPs in the environment, food, animal feed, waste and contaminated sites to give an impression of the extent of the problems. The plan also describes the activities of monitoring POPs and research in impacts on humans and the environment. Vulnerable population groups are mentioned in a short section.

Chapter 3 describes point-by-point *strategies and action plan elements* for compliance with Denmark's obligations under the Convention. Each section includes a summary of the provisions in the Convention text applicable for the relevant area, a brief description of current issues and a description of ongoing and planned new initiatives in the area.

1.2 The Stockholm Convention

The Stockholm Convention was adopted in May 2001 and entered into force on 17 May 2004. It promotes global action on an initial cluster of twelve POP substances, with an overall objective to protect human health and the environment from POPs and requires Parties to take measures to eliminate or reduce the release of POPs into the environment. As of August 2012, the Convention had been adopted by 178 parties.

At the fourth and fifth meetings of the Conference of the Parties in 2009 and 2011, respectively, a total of 10 new substances or substance groups were added to the Convention. An important part of this updated implementation plan relates to these new substances.

According to the Stockholm Convention, the parties are required to ban and/or take the legal and administrative steps necessary to eliminate production, import/exports and use of substances listed in Annex A of the Convention which today comprises 18 POPs. The parties are also required to limit production and use of the substances listed in Annex B of the Convention.

Furthermore, Parties are required to take measures to reduce, and if feasible, eliminate releases from unintentional formation of the substance groups listed in Annex C of the Convention (please note that the Danish version of the Convention applies the designation "unintentional production"). Releases of unintentionally formed POPs listed in Annex C are continuously to be minimised with the ultimate goal of completely preventing releases, where feasible.

The Stockholm Convention also foresees identification and safe management of stockpiles containing or consisting of POPs. Waste consisting of containing or contaminated by POPs should be disposed of in such a way that the POP contents are destroyed or irreversibly transformed so that they do not exhibit the characteristics of POP. Where destruction or irreversible transformation does not represent the environmentally preferable option or POP content is low, waste should be disposed of in an environmentally sound manner.

Disposal operations that may lead to recovery, recycling or direct reuse of POPs are explicitly forbidden. When transporting waste, relevant international regulations, standards and guidelines, including the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, must be taken into consideration.

The Convention stipulates a number of general obligations, including that Parties are to regularly update the implementation plan in accordance with the decisions adopted by the Conference of the Parties.

Furthermore, where appropriate, Parties must cooperate directly or through global, regional and sub-regional organisations. They must consult their national stakeholders, including women's groups and groups involved in the health of children, in order to facilitate the development, implementation and updating of their implementation plans.

Finally, Parties must endeavour to utilise and establish the means to integrate national implementation plans for persistent organic pollutants in their sustainable strategies where appropriate.

1.3 POPs covered by the Convention, the POP Protocol and the POP Regulation

POPs substances are chemical substances that persist in the environment, bioaccumulate through the food web, and pose a risk of causing adverse effects to human health and the environment.

Substances under the Stockholm Convention are divided into three groups which are listed in each their own Annex to the Convention:

Annex A:	Substances Parties must ban
Annex B:	Substances Parties must restrict
Annex C:	Substances formed unintentionally, the formation of which Parties must restrict or, if possible, eliminate

The EU has implemented the provisions of the Stockholm Convention in Regulation (EC) no. 850/2004 on persistent organic pollutants (the POP Regulation), which is mentioned in section 2.2.5. The POP Regulation implements all the provisions of the Convention together with other legislation which is also mentioned in section 2.2.5.

POPs are also covered by the POP Protocol which is a protocol to the 1979 Convention on Long-range Transboundary Air Pollution which is further described in section 2.2.4. The protocol covers a number of POPs of which most are the same as those covered by the Stockholm Convention. Like the Stockholm Convention, the provisions of the POP Protocol have been implemented in the POP Regulation, supplemented by other legislation.

Like the Stockholm Convention, the POP Protocol and the POP Regulation list substances in three annexes comprising elimination (Annex I), restriction (Annex II) and restriction or elimination of unintentional production (Annex III).

Table 2 provides an overview of the POPs covered by the Stockholm Convention, the POP Protocol and the POP Regulation, respectively. The substances are divided into old substances under the Stockholm Convention, new substances under the Convention and other substances which are only covered by the POP Protocol and the POP Regulation.

TABLE 2
SUBSTANCES COVERED BY THE STOCKHOLM CONVENTION, THE POP PROTOCOL AND THE POP REGULATION INDICATING THE ANNEXES IN WHICH THE SUBSTANCES ARE LISTED

Substance	CAS no.	The Stockholm Convention	The POP Protocol	The POP Regulation
Old substances				
Aldrin	309-00-2	A	I	I
Chlordane	57-74-9	A	I	I
DDT	50-29-3	B	I, II**	I
Dieldrin	60-57-1	A	I	I
Endrin	72-20-8	A	I	I
Heptachlor	76-44-8	A	I	I
Mirex	2385-85-5	A	I	I
Toxaphene	8001-35-2	A	I	I
Polychlorinated biphenyls (PCB)	Many different	A, C	I	I
Hexachlorobenzene (HCB)	118-74-1	A, C	I, II**, III	I, III
Polychlorinated dibenzo-p-dioxins	Many different	C	III	III
Polychlorinated dibenzofurans (PCDD/PCDF)	Many different	C	III	III
New substances				
Chlordecone	143-50-0	A	I	
Technical endosulfan and its related isomers	959-98-8 33213-65-9 115-29-7 1031-07-8	A (enters into force on 27 October 2012)	-	I***
α -HCH	319-84-6	A	I	I
β-HCH	319-85-7	A	I	I
Lindane (γ-HCH)	58-89-9	A	I	I
Hexabromobiphenyl (hexaBB),	36355-01-8	A		

Substance	CAS no.	The Stockholm Convention	The POP Protocol	The POP Regulation
Hexabromodiphenyl ether and heptabromodiphenyl ether	68631-49-2 207122-15-4 446255-22-7 207122-16-5 and others	A	I	I
Pentachlorobenzene	608-93-5	A, C		
Perfluorooctane sulfonic acid and its derivatives (PFOS), its salts, and perfluorooctane sulfonyl fluoride	Many different	B	I, II**	I Perflouroctane acid and its derivatives (PFOS)
Tetrabromodiphenyl ether and pentabromodiphenyl ether	40088-47-9 32534-81-9 and others	A	I	I
Other substances				
Short-chained chlorinated paraffins (SCCP)	85535-84-8	Under consideration	I *, II**	I***
Hexachlorobutadiene (HCBD)	87-68-3	Under consideration	I *	I***
Polychlorinated naphthalenes (PCN)	Many different	Under consideration	I *	I***
Polyaromatic hydrocarbons (PAH)	Many different	Not determined	III	III

* The substances have been added to the annexes but the supplement has not yet entered into force (May 2012).

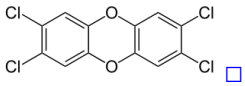
** The substances are listed in Annex II for specific uses exempt under certain conditions.

*** The substances are listed in Annex I to the POP Regulation. At the closing date for contributions in May 2012 the amendments had not yet entered into force.

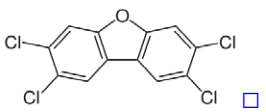
1.3.1 POPs covered by the Convention when it entered into force (old POPs)

Polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) are two groups of cyclic organochlorine compounds. The presence of chlorinated cyclic structures generally forms relatively stable, and as a result, persistent compounds. In Denmark the designations “dioxin” or “dioxins” have been jointly used for the two substance groups, and for readability, such designations are also used in this implementation plan.

PCDD



PCDF



Dioxins have never been intentionally produced in Denmark but are formed unintentionally through a series of industrial chemical processes and incineration processes.

Each substance group consists of a number of substances, so-called congeners which are characterised by the number of chlorine atoms and the location of chlorine atoms inside the molecule. The different congeners have different levels of toxicity, and to obtain an overall measure for the total effect of dioxin content in a sample, various systems to calculate the dioxin toxicity equivalents (TEQ) have been developed at international level. In this report, values are stated by use of units from two systems stated as I-TEQ and WHO-TEQ, respectively. The first system is often used for release inventories, whereas the WHO system is used for food and animal feed sample analysis for

example. The WHO system also has toxicity equivalency factors (TEF) for a number of the so-called dioxin-like (or coplanar) PCBs.

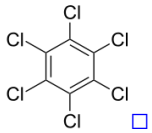
Polychlorinated biphenyls (PCB) are a group of chlorinated organic compounds, which, like dioxins, are structured around two cyclic structures. The so-called "dioxin-like PCBs" are similar in toxicity to dioxins.

PCB

PCB was previously produced for various technical purposes and is also formed unintentionally in the same way as dioxins. In the Statutory Order on PCB/PCT, PCB is regulated together with another substance group called polychlorinated terphenyles (PCT, with three ring structures). However, historically, compared with the use of PCB, the use of PCT has been very small, and currently, PCT is not covered by the Stockholm Convention.

Hexachlorobenzene (HCB) comprises one single cyclic structure with six chlorine atoms. HCB was previously widely used as a pesticide and chemical intermediate in production of other chemical substances, and HCB is still produced for these purposes in some countries. HCB is also unintentionally formed in thermal and certain chemical processes.

HCB



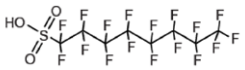
DDT is a chlorinated organic pesticide, which is commonly used in tropical areas, particularly as a means to combat malaria mosquitoes. Due to a lack of good alternatives to some uses of DDT, the substance has a special status compared with the other POP pesticides in the Stockholm Convention, as there are no elimination requirements for uses, merely restrictive requirements.

The remaining old Annex A substances are pesticides which have not been used in Denmark for many years. All substances include cyclic structures with chlorine atoms that give the substances a high stability. This includes the following substances: Aldrin, chlordane, dieldrin, endrin, heptachlor, mirex and toxaphene.

1.3.2 POPs listed in the Annexes to the Stockholm Convention in 2009 and 2011 (the new POPs)

PFOS is a substance group which includes perfluorooctane sulfonic acid, its salts, and perfluorooctanesulfonic fluoride (here collectively designated PFOS). These substances are all built up in a long chain with 8 carbon atoms fully fluorinated which give the substances their stability. There is a sulphur atom at the end of the chain which can link to various chemical groups. The gross formula of the substances covered by the POP Regulation is $C_8F_{17}SO_2X$, where X can be hydroxide, a metal salt, halogenide, amide, or other derivatives, including polymers. The Stockholm Convention does not state this gross formula, but provides examples of the group with a number of specific substances. Theoretically there could be a few substances which can be defined using the gross formula, but which are not covered by the definition in the Stockholm Convention. However in practice the two definitions are considered to cover the same substances.

PFOS



The Convention uses the abbreviation PFOS specifically for perfluorooctane sulfonic acid, while in the POP Regulation and in many other contexts, PFOS is used as an abbreviation for the whole group of PFOS substances. In this implementation plan, the term PFOS is used in the same way as the term is used in the POP Regulation, i.e. for the whole group of substances.

PFOS have previously had widespread use as surface-active substances (surfactants) in the impregnation of textiles, carpets, leather, paper and cardboard. The substances have also been used in paint, varnish, wax and cleaning agents. There are a number of uses which have been exempted from the restrictions under the Convention, and these are described in more detail below. Perfluorooctanesulfonic fluoride (PFOS-F) is used to manufacture the other PFOS substances.

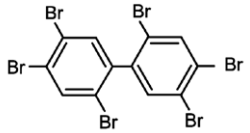
The PFOS substances make up a smaller part of a large group of per- and polyfluorinated substances and studies in Denmark have typically included PFOS and a number of other perfluorinated and polyfluorinated substances. On several occasions, the OECD has drawn up lists of per- and polyfluorinated substances and in the most recent list from 2007 almost 1,000 substances have been grouped in 17 main groups. The list contains 165 substances which the OECD considers as PFOS.

PFOS substances represent part of a broader group of perfluorinated alkylsulfonates, which the OECD calls PFAS. These substances can, for example, have a shorter or longer chain of carbon atoms than the eight in PFOS. In some contexts, however, the term PFAS is used as a synonym for perfluorinated alkyl substances (where S stands for ”substances).

Five brominated substances, which can be used as flame retardants, have also been included under the Convention. These are substances which are composed of two ring structures with varying numbers of bromine atoms, varying numbers of 4 (tetra), 5 (penta), 6 (hexa) and 7 (hepta), respectively. Like dioxins and PCB, for each of these substances there is a number of congeners. Congeners with the same number of bromine atoms are known as homologues.

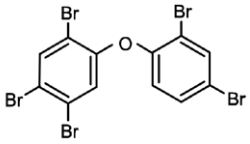
Hexabromobiphenyl (hexaBB) has been used as a flame retardant in plastic in electronic equipment and is in the group of polybrominated biphenyls (PBB). The substances are built up in the same way as PCB, but with bromine atoms instead of chlorine. Several types of PBB have been used, but only hexaBB is covered by the Convention. HexaBB has been used as a flame retardant in plastic; primarily in the 1970s. The technical compound which contained hexaBB was banned in North America and in the EU in 1973. All PBBs are covered by the RoHS Directive and have been restricted in electrical and electronic equipment since 2006.

HexaBB



Tetra- and pentabromodiphenyl ether make up the most important components of a technical mixture known as pentabromodiphenyl ether (technical pentaBDE or C-pentaBDE). Technical pentaBDE has especially been used as a flame retardant in polyurethane foam, which is used in mattresses, upholstery and in vehicles. Technical pentaBDE typically contained around 60% pentaBDE, 24-38% tetraBDE and 4-8% hexaBDE.

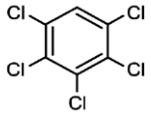
PentaBDE



Hexa- and heptabromodiphenyl ether make up important parts of the technical mixture octabromodiphenyl ether (technical octaBDE or C-octaBDE), which has especially been used as a flame retardant in ABS plastics in electronic equipment. Technical octaBDE typically contained around 10% hexaBDE and around 40% heptaBDE.

Pentachlorobenzene (PeCB) is composed of a single cyclic structure with five chlorine atoms and therefore it resembles HCB. Pentachlorobenzene has previously had widespread use as a pesticide and as a chemical intermediate product, and the substance is still produced for these purposes in some countries. Pentachlorobenzene is also formed unintentionally in the same way as HCB in incineration processes and in some chemical processes.

Pentachlorobenzene



The other new substances in Annex A are all pesticides which have not been used in Denmark for many years. These are the following substances: Alpha hexachlorocyclohexane (α-HCH), beta hexachlorocyclohexane (β-HCH), lindane (γ-HCH), chlordecone and endosulfan. Endosulfan was included under the Convention in April 2011 and the ban on production and use of endosulfan enters into force on 27 October 2012.

1.3.3 Other POPs covered by the POP Protocol or under consideration for uptake under the Stockholm Convention

There is a number of POPs in addition to the 22 covered by the Stockholm Convention. Under the UN Economic Commission for Europe (UNECE) a protocol was adopted in 1998 on the restriction

of use and emissions of a number of POPs. The POP Protocol is mentioned in section 2.2.3. In addition to the 22 substances covered by the Stockholm Convention, the POP Protocol covers one more substance group: polyaromatic hydrocarbons (PAH). Three substances, short-chained chlorinated paraffins (SCCP), hexachlorobutadiene (HCBD) and polychlorinated naphthalenes (PCN), have been included in the annex to the Protocol, but these amendments have not yet entered into force.

A party can submit a proposal to the Secretariat to include new chemical substances in Annexes A, B and/or C. The proposal must include information about the persistence of the substance, bioaccumulation, potential for transport over long distances in the environment, and harmful effects. If the Secretariat finds that the proposal includes the information stated, the proposal will be forwarded to the Persistent Organic Pollutants Review Committee under the Stockholm Convention, which first examines the proposal using screening criteria stated in the Convention. If it is then decided to go further, a risk profile and a risk management assessment will be prepared, before the Conference of the Parties decides whether the chemical substance can be included in one or more of the annexes.

The following substances are currently under review by the Persistent Organic Pollutants Review Committee in order to determine whether they are to be included in the list of substances under the Convention: Short-chain chlorinated paraffins (SCCP), hexabromocyclododecane (HBCDD or HBCD), hexachlorobutadiene (HCBD), polychlorinated naphthalenes (PCN) and pentachlorophenol (PCP).

2. Country baseline

2.1 Country profile

2.1.1 Geography and population

Denmark covers an area of 43,093 km² and comprises the peninsula Jutland and 406 islands of which Zealand is the largest. Denmark has 5.6 million inhabitants, which constitutes about 1.1% of the total EU population. Population density is about 123 per km². Denmark has a temperate coastal climate.

2.1.2 Political profile

Denmark's form of governance is parliamentary democracy with a royal head of state. The Danish Parliament (the *Folketing*) has the exclusive right to adopt legislation. The Folketing comprises 179 members, elected through proportional representation. 175 members are elected in Denmark, while Greenland and the Faeroe Islands each elect two members. Denmark is a member of the EU, but has opted out of the cooperation within a few areas. These include the common European currency, the euro, the military cooperation, legal and domestic affairs as well as EU citizenship.

2.1.3 Economy and business

Denmark's economy and business was described in the 2006 implementation plan. In 2010, Denmark's gross domestic product (GDP) in constant prices was DKK 1,536 billion corresponding to GDP per inhabitant of DKK 277,000. Whereas GDP per inhabitant was approx. 27% above EU average in 2010, the actual private consumption adjusted for price level changes was just 3% over the EU average.

2.1.4 The overall environmental situation in Denmark

The overall environmental situation in Denmark has not changed significantly since preparation of the 2006 implementation plan. The following has affected the Danish approach to regulating use and releases of chemical substances:

- Denmark has a high population density and high economic activity. Denmark is one of the countries worldwide with the highest consumption of goods, resources and energy per inhabitant. Through increasing consumption of consumer goods produced worldwide, the population is exposed to an extremely high number of chemicals despite the improvements achieved by prohibiting substances of concern.

- Forests and nature areas represent just 10% of the territory and Denmark is an island surrounded by vulnerable shallow-water marine areas. Thus, the environment's capacity for absorbing pollutants is relatively small.

- Whereas problems linked to discharges of hazardous substances from large point sources have generally been solved, focus has shifted to the environmental problems linked to modern lifestyle, private boilers and stoves and industrialised agriculture.

2.1.5 Central approaches and procedures

Like the situations described in the previous action plan, key approaches and procedures to ensure enforcement of relevant legislation on POPs are as follows:

- system for approval of pesticides,
- system for environmental permits for companies subject to authorisation,
- system for registration of marketed mixtures (chemical products) and their constituents,
- registration and approval system for waste treatment enterprises,
- registration system to monitor waste from enterprises and municipalities from "door to grave".

In addition, at EU level in connection with REACH, a comprehensive system is being developed with data for use in registering, assessing and approving chemical substances.

2.2 Environmental policy, statutory and institutional frameworks

2.2.1 Environmental policy, strategy for sustainable development and statutory frameworks

Denmark's environmental policy builds on a principle that Danish society should enjoy economic progress which can go hand in hand with social development and an improved environment. The objective is for Denmark to develop in a sustainable direction, e.g. through better integration between the environment and other social sectors, improve resource efficiency, and making businesses and consumers accountable.

The first national strategy for sustainable development was published in 2002 as part of the Danish contribution to the world summit in Johannesburg. The most recent strategy for sustainable development "*Vækst med omtanke*" *("Considered growth")* was published in March 2009. The Danish Government's strategy for sustainable development lays down goals and specific initiatives for nine areas:

- Globalisation for the benefit of the entire planet population
- Climate change - an enormous challenge
- Nature for the future
- Green innovation in production and consumption
- Living, healthy and well-functioning urban areas
- Improved health for everyone
- Knowledge, research and education in an innovative society
- Humans as a resource
- Responsible, long-term and durable economic policy.

Chemicals initiatives are mainly placed under improved health for everyone. The overall goal is that within one generation (2020) chemicals are only produced and used in ways that do not lead to a significant negative impacts on health and the environment. This goal has been are underpinned by the objective that substances which pose a danger to the environment and health must be banned, restricted or replaced.

The strategy for sustainable development is supplemented by a number of other environmental policy strategies, e.g. the Chemicals Action Plan, Strategy and Action Plan to Protect Public Health against Environmental Factors, the Waste Strategy 2009-2012, the PCB Action Plan, as well as a Resource Strategy which is currently being drawn up.

Chemicals Action Plan The most recent Chemicals Action Plan is from March 2010: "*The Danish Chemicals Action Plan 2010-2013: Safety in Denmark - International Cooperation*". The Action Plan prepares the ground for a significant and enhanced prioritisation of the chemicals area. The action plan also takes its starting point in the goal from the world summit in Johannesburg in 2002 on ensuring that by 2020 no products or goods are marketed with highly problematic effects on health and the environment. The Chemicals Action Plan focuses on strong efforts in the chemicals

area in Denmark, as well as an international effort. The Chemicals Action Plan was adopted by all parties in the Danish Parliament (the Folketing).

The action plan consists of two parts. The first part of the Chemicals Action Plan establishes a number of cross-sectoral efforts:

- Major focus on REACH
- Continuation and enhancement of efforts in the consumer field
- Improved international efforts
- More monitoring and inspection
- Continued prioritisation of the development of computer models and chemical substitutes.

The second part of the Chemicals Action Plan focuses on challenges in relation to special target groups or specific substances and groups of substances:

- Endocrine disruptors and cocktail effects
- Allergies
- Perfumes and allergies to chemical substances
- Biocides of concern
- Nanotechnology.

The 2012 Finance Act adopted strengthened efforts to combat chemicals; funds were allocated for the purpose of mapping all substances on the List of Unwanted Substances (LOUS, 2009) of the Danish EPA of which several are potential POPs. The aim is to review all substances on the list enabling the Danish EPA to subsequently assess for each individual substance or substance group the need for, for example, further regulation, substitution/phasing-out, classification and labelling, as well as waste management or information.

Waste strategy. The Danish Government issued the 1st part of the Waste Strategy 2009-12 on 18 March 2009. In June 2010 this was followed by Waste Strategy 2010 which is the second and last part of the Waste Strategy for the period 2009-12. The Danish Government's overall waste policy, prioritisation in the waste area and goals for managing total waste volumes is further described in the 1st part of Waste Strategy 2009-12. The waste policy encompasses three aspects: resource policy, climate policy and protection of the environment and health. The waste strategy will be replaced by a Resource Strategy which is currently being prepared.

The Waste Strategy 2010 includes several initiatives aimed at managing waste containing certain POPs. A number of initiatives are being launched to ensure higher quality in recycling of building and construction waste, which, pursuant to Danish law, must not contain substances dangerous to health and the environment, such as PCB. Therefore, an investigation will be initiated, among other things, examining whether requirements can/must be made to the amount of pollutants allowed in building waste for recycling, and whether certain criteria for "clean soil" may be used as an objective for determining when building and construction waste is to be considered pure.

Action Plan on Managing PCB in Buildings. In 2011 the Danish Government published the "Action Plan on Managing PCB in Buildings – Indoor Environment, Working Environment and Waste" . The action plan contains 19 initiatives which are further described in section 2.3.2.4.

Innovation partnership on shredder waste. In 2011 the Danish EPA set up an innovation partnership on shredder waste and thus put focus on better exploitation of the resources from waste, managing substances of concern (including POPs) and reducing the volumes for landfill. Through the 2011 Action plan to promote eco-efficient technology, the Danish EPA supported a project aiming at identifying potential substances of concern in shredder waste, as well as at exam-

ining the possibilities of using sensor-based technology to identify and separate materials containing these substances before or after the shredder process.

2.2.2 Roles and responsibilities of central government

The roles and responsibilities of public institutions which, in various ways, are involved in activities linked to carrying out the implementation plan are outlined below.

The Danish EPA under the Danish Ministry of the Environment administrates a number of acts, statutory orders and European Union acts, which relate to environmental protection, chemical substances and mixtures (chemical products), waste management and contaminated soil; all of which are areas where POPs occur together with many other substances of concern. The Danish EPA approves pesticides before they are placed on the Danish market. The Danish EPA is also responsible for approval of imports and exports of waste, including waste containing POPs. Finally, the Danish EPA performs supervisory and control functions. The Danish EPA Chemical Inspection Service supervises compliance with the POPs-related legislation and ensures that illegal situations are legitimised.

The Danish EPA collects knowledge and data about environmental impacts and monitors environmental developments. The Danish EPA initiates studies and research projects in the environmental area, participates in international cooperation in the environmental area and manages environmental studies in the Arctic. The Agency develops and operates about 60 environmental databases. New knowledge is communicated in guidelines and publications, through a comprehensive website packed with relevant and topical EPA information, as well as active press and media work. The website of the Danish EPA includes comprehensive information about POPs for use for citizens, enterprises and other authorities.

The Danish Nature Agency, which is also under the auspices of the Danish Ministry of the Environment, is responsible for the Danish Nature and Environmental Monitoring Programme, NOVANA (the National Monitoring and Assessment Programme for the Aquatic and Terrestrial Environment). The programme aims at generating knowledge about nature and environmental conditions in Denmark. This knowledge constitutes part of the basis for managing Danish nature and environment policy, and it forms part of the decision base for environmental policy initiatives. Data from the programme is also included in the documentation of effects on administrative initiatives for nature and the environment. Finally, Denmark uses this knowledge when reporting on directives and conventions. The programme covers the five-year period from 2011-2015 and comprises eight sub-programmes. The programme covers monitoring of a number of POPs which are further described in section 2.3.8.3.

The Danish Working Environment Authority under the Danish Ministry of Employment is the authority responsible for checking that PCB and POPs are managed appropriately in the working environment. In collaboration with the Danish EPA, the Danish Working Environment Authority manages the Product Register which lists the dangerous chemicals used professionally in Denmark. The Danish Working Environment Authority and the Danish EPA use information from the Product Register to establish how to prioritise their initiatives and regulate, perform checks, make risk assessments, monitor and prepare statistics. The Danish Working Environment Authority is responsible for the parts of the Danish Government's PCB Action Plan that concern the working environment.

The Danish Energy Agency under the Ministry of Climate, Energy and Building is responsible for making guidelines on PCB in building materials and indoor air, and for ensuring that building materials do not pose health-related problems, including that they do not pose a problem for the indoor climate. The Danish Energy Agency thus carries out the parts of the Danish Government's PCB Action Plan that concern PCB in building materials and indoor air.

The Danish Health and Medicines Authority under the Ministry of Health is ultimately responsible for health in Denmark. The Authority collaborates with the Danish EPA and a number of other institutions on analyses and carrying out initiatives on the impacts of POPs to human health. The Danish Health and Medicines Authority provides guidance on POPs and health, including PCB in the indoor climate, and also participates in implementing the Danish Government's PCB Action Plan.**The Advisory Scientific Committee on Environmental Health of the Danish Health and Medicines Authority** disseminates research results and communicates broadly on the environment and health, including POPs.

The Danish Veterinary and Food Administration under the Ministry of Food, Agriculture and Fisheries is responsible for monitoring and inspection of POPs in food and animal feed. The Danish Veterinary and Food Administration also negotiates limit values, etc. for POPs in food in the EU.

The Agency for Palaces and Cultural Properties under the Danish Ministry of Finance is responsible for studies of and management of PCB in buildings owned by the state.

The Ministry of Housing, Urban and Rural Affairs is responsible for regulating municipalities' obligations to supervise and act on homes and recreational rooms hazardous to health.

2.2.3 Role of municipal authorities

The municipalities are responsible for assignment of waste (except for recyclable commercial waste) generated in the municipality, including waste containing POPs. For recyclable commercial waste, enterprises can choose between approved recycling plants, and may also transfer responsibility for treatment of recyclable waste to an approved waste collector. Against payment, enterprises may use municipal recycling sites. The local councils must offer schemes for household waste and for commercial waste to be incinerated and landfilled. The schemes may be either assignment or collection schemes. Moreover, municipalities are required to draw up waste plans and regulations on the scope and operation of waste schemes. Municipalities also supervise and classify waste in the municipality.

2.2.4 International commitments in relation to POPs

Together with the other Nordic countries, for many years, Denmark has been in the forefront of promoting safe chemicals management globally. This is carried out, among other things, on the basis of research in the Arctic showing that chemical substances end up far from where they were produced and used.

In a global perspective, the chemicals area is undergoing explosive growth. Denmark will continue to work actively for promoting safe international chemicals management. It is about globally improving and standardising regulation on chemicals, as well as development and use of chemicals not hazardous to health. Effective implementation and further development of the agreements entered into is necessary, in addition to making new agreements within areas posing risks to the environment or health. Pursuant to the Chemicals Action Plan, the Danish Government will allocate resources for this.

In addition to the work carried out in connection with the Stockholm Convention, Denmark participates actively in further developing a number of related international and regional conventions on chemicals and waste:

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

- Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.
- UNECE's POP Protocol to the 1979 Convention on Long-range Transboundary Air Pollution on Persistent Organic Pollutants.
- Helsinki Convention on the Protection of the Marine Environment of the Baltic Sea Area (Pursuant to the Convention, the parties are required to ban final use of DDT and derived DDE substances as well as the use of PCB and PCT except for special purposes).
- The OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic the objective of which is to reduce emission of substances that are toxic, persistent and liable to bioaccumulate to the marine environment to a level where such substances are not harmful to humans and nature and aimed at completely eliminating such substances).

Under the auspices of the Nordic Council of Ministers, Denmark cooperates with the other Nordic countries on issues related to POPs. The cooperation of the Nordic ministers for the environment is based on four-year environmental action programmes. The 2009-2012 Environmental Action Programme contains two initiatives in relation to POPs in particular:

- Work on initiatives to strengthen existing international chemicals and waste conventions and other central agreements, as well as the global chemicals strategy SAICM.
- Promote synergies between chemicals, products and waste policies in order to improve recovery of waste.

Finally, under the auspices of the Arctic Council and the Arctic Environmental Protection Strategy (AEPS) - which form the basis for the national Danish environmental efforts in the Arctic, Denmark is working actively to protect the Arctic eco-system, preserve, reinforce and restore environmental quality and the sustainable exploitation of natural resources in the Arctic, monitor conditions in the Arctic environment as well as identify, reduce and as a final goal, to eliminate pollution. According to the AEPS the Arctic countries are committed to carry out measures to reduce or control the use of chlordane, DDT, toxaphene and PCB.

2.2.5 Legislation on POPs

2.2.5.1 Close interaction between European Union legislation and national law

Regulation in Denmark of POPs and waste containing POPs is characterised by close interaction between EU legislation and national law. Most legislation on POPs in Denmark is a consequence of EU legislation.

The Stockholm Convention is primarily implemented by Regulation (EC) no. 850/2004 on persistent organic pollutants (the POP Regulation) with subsequent amendments and supplements as a consequence of new substances. The Regulation was amended most recently by Commission Regulation (EU) no. 756/2010. According to Article 288 of the Treaty on the Functioning of the European Union, a Regulation is directly applicable in all Member States.

The POP Regulation restricts marketing and sets conditions for production, use and waste management of POPs which are covered by bans or restrictions pursuant to the Stockholm Convention and/or UNECE's POP Protocol. This applies in relation to POPs contents in mixtures and articles. The POP Regulation testifies to the ambition of moving further than prescribed by international obligations, for example in relation to chemical substances and waste management. Restrictions on marketing, production and use are included in Annexes I and II. Annex III includes the list of substances subject to release reduction provisions from unintentional formation of POPs. Requirements for waste management are laid down in Annexes IV and V.

The POP Regulation is supplemented by a number of EU regulations and directives which, together with the POP Regulation, implement all the provisions of the Convention. The following section describes applicable Danish legislation on POPs and waste containing POPs, including marketing

and bans and approval schemes, revaluation of existing chemicals for POP properties, as well as requirements on supervising and controlling compliance with the law. Legislation is described under the following subheadings which reflect Denmark's commitments under the Stockholm Convention:

- Ban on production, use and marketing of Annexes A and B pesticides.
- Ban on intentional production, use and marketing of PCB.
- Ban on production, use and marketing of PFOS.
- Ban on production, marketing and use of the substances hexabromobiphenyl, as well as tetra, penta, hexa and heptabromodiphenyl ether.
- Release reduction of unintentionally formed POPs.
- Releases from stocks.
- Management of waste containing POPs.

The country baseline in relation to legislation on POPs is concluded with a description of legislation concerning POPs in food and animal feed, which is one of the areas where Union legislation (and thus Danish legislation) is more specific than the Stockholm Convention.

The POP Regulation also includes general commitments built on the provisions of the Convention, including listing new chemical substances in Annexes A, B and C, exchange of information to the public, research, etc. These are not further described in this section but please refer to sections 2.3.9 to 2.3.13 under the POPs situation in Denmark and sections 3.3.7 to 3.3.10 concerning planned initiatives.

2.2.5.2 Ban on production, use and marketing of Annex A and B pesticides

Table 3 includes a list of the regulation of the 13 pesticides listed in Annexes A and B of the Stockholm Convention.

The POP Regulation bans production, marketing and use of the 12 POP pesticides covered by bans under the Convention, and DDT, which is restricted under the Convention alone. All pesticides in the POP Regulation are on the list of banned substances without specific exemptions.

At the fifth Conference of the Parties in April 2011, it was decided to include endosulfan in Annex A to the Convention upon recommendation from the EU. This amendment will enter into force on 27 October 2012. The ban on production and use of endosulfan has not yet been implemented in the POP Regulation, but technical endosulfan, its isomers, and endosulfan sulphate, are expected to be listed in Annex I, Part A, without specific exemptions for use - and entering into force from the same date as the amendments to the annex of the Convention.

According to Commission Decision 2005/864/EC, plant protection products which contain endosulfan have been banned in the EU since 31 December 2007, and from 3 December 2005, no approval or extended approval has been granted of plant protection products containing endosulfan.

The Chemical Substances and Products Act and the Statutory Order on POPs includes the bans in the POP Regulation in relation to old banned POPs. The Statutory Order on POPs thus bans marketing and use of the old eight banned pesticides.

TABLE 3
LIST OF THE REGULATION OF PESTICIDES LISTED IN ANNEXES A AND B OF THE STOCKHOLM CONVENTION

Chemicals legislation relevant for intentional use of POP pesticides	Provisions relevant for POPs
The POP Regulation **Regulation (EC) no. 850/2004**	Ban on production, marketing and use of aldrin, chlordane, dieldrin, DDT, endrin, heptachlor, mirex, toxaphene, α -HCH, β-HCH, lindane (γ-HCH), hexachlorobenzene, chlordecone and pentachlorobenzene.
Chemical Substances and Products Act **Act no. 878 of 26 June 2010** **The Statutory Order on POPs** **Statutory Order no. 820 of 29 September 2003**	Prohibition provision on old banned POPs.
The PIC Regulation **Regulation (EC) no. 689/2008**	Ban on exports of all Annexes A and B substances
The REACH regulation **Regulation (EC) no. 1907/2006**	The criteria for identification of persistent, bioaccumulative and toxic substances (PBT substances) and assessment of the P, B and T properties of a substance, Annex XIII.
Plant Protection Regulation **Regulation (EC) no. 1107/2009**	An active substance, a safener (substances that increase safety when using the pesticide) or synergists may only be approved if the substance is not considered a persistent organic pollutant (POP). Active substances which comply with two of the PBT criteria must be approved as candidates for substitution.

Sale, imports and use of the original eight banned pesticides and HCB are banned pursuant to the Statutory Order on POPs. The restatement of this provision in the Act and Statutory Order is exclusively based on practical concerns and does not influence the direct applicability of the Regulation in Denmark. Endosulfan is listed in Annex 7 to the Statutory Order on Pesticides (Statutory Order no. 702 of 24 June 2011) on active substances which the European Commission has decided not to include in Annex I to the Plant Protection Products Directive and which must no longer be sold or used. The ban on sale entered into force on 2 June 2006 and the ban on use entered into force on 2 June 2007.

The banning provision of the POP Regulation is supplemented by the Regulation on Marketing Plant Protection Products which stipulates that an active substance, a safener (substances that increase safety in use of the pesticide) or synergists may only be approved if the substance is not considered a persistent organic pollutant (POP).

Furthermore, the REACH Regulation and the Regulation on Marketing Plant Protection Products include provisions which help prevent production and use of substances with POP properties. The REACH Regulation includes the possibility of introducing new restrictions for production, use or marketing of substances as such, in mixtures or in products, by listing them in Annex XVII to the Regulation or admitting substances to Annex XIV of substances requiring approval.

The Danish EPA Chemical Inspection Service supervises compliance with the legislation and ensures that illegal situations are legitimised. This may mean that illegal mixtures and articles must be

withdrawn from the Danish market or in other ways must be legitimised. Violations of the regulations are liable to a fine, or in more serious cases, to imprisonment for up to two years.

A list of when the 12 POP pesticides were banned in Denmark is included in section 2.3.1.1.

2.2.5.3 Ban on intentional production, use and marketing of PCB

The commitments in the Stockholm Convention concerning PCB have been implemented in the POP Regulation as well as the Statutory Order on PCB/PCT implementing the PCB/PCT Directive to which the POP Regulation refers.

On 1 January 1977, the use of PCB was banned in Denmark with the exception of the use of PCB in certain electrical appliances, capacitors, heat exchangers, hydraulic fluids as well as base products or intermediates for products not containing PCB. All use of PCB was banned as at 1 November 1986 (Statutory Order no. 718 of 9 October 1986).

Large transformers and capacitors containing PCB (weight >1 kg or an effect of > 2 kVar) was banned on 1 January 1995. Small transformers and capacitors (weight up to 1 kg or output of up to 2 kVar) containing PCB may (still) be used until the end of their operational life. Statutory Order no. 925 of 13 December 1998 implemented regulations stipulating that large transformers and capacitors (weight >1 kg or an effect of >1 kVar) were to be discontinued no later than by 1 January 2000.

In some respects the current Danish legislation on PCB is stricter than in the directive.

- The Statutory Order on PCB/PCT includes stricter provisions than in the Stockholm Convention and the PCB/PCT Directive in connection with the date for decontamination and/or disposal of equipment containing PCB. The Statutory Order requires that large types of equipment must be decontaminated and/or disposed of as soon as possible and no later than 1 January 2000.

- The Statutory Order on PCB/PCT is also stricter than the PCB/PCT Directive in relation to disclosure requirements as well as the ban on refilling with PCB.

In addition to phasing-out PCB in equipment (for example transformers, capacitors or other containers containing fluids) pursuant to the Stockholm Convention, as mentioned above, since 1977, Denmark and the rest of the EU have banned PCB for “open uses”, i.e. paint, sealants, self-copying paper, etc. Except for the electrical and electronic equipment mentioned above, there are no requirements that products containing PCB taken into use before 1977 be discontinued.

According to the Statutory Order on PCB, the Danish EPA supervises and enforces the provisions of the Statutory Order on sale, imports, use, maintenance, storage, labelling and information.

2.2.5.4 Ban on production, use and marketing of PFOS

Generally, production, marketing and use of PFOS are banned according to the POP Regulation. The imports and exports restrictions described above also apply to PFOS. Unlike the Convention, the Regulation does not differentiate between specific exemptions and acceptable purposes but operates solely with specific exemptions. The Regulation lists five specific exemptions for production, marketing and use of PFOS, alone as well as included in preparations or products. Such exemptions correspond to some of the acceptable purposes listed in the Convention. The exemptions in the Regulation are thus limited compared with the Convention.

According to the POP Regulation production, marketing and use of PFOS, alone as well as contained in mixtures or articles, may only take place in compliance with the restrictions set forth in the annex.

Production, marketing and use of PFOS may thus only take place for:

1. PFOS occurring as an unintentional trace contaminant in substances, preparations in concentrations of PFOS of 10 mg/kg (0.001% by weight) or less.
2. PFOS occurring as an unintentional trace contaminant in semi-finished products or products or parts thereof, if the concentration of PFOS is lower than 0.1% by weight calculated with reference to the mass of structurally or micro-structurally distinct parts that contain PFOS, or for textiles or other coated materials, if the amount of PFOS is lower than 1 µg/m^2 of the coated material.
3. Use of products already in use before 25 August 2010 and containing PFOS as a constituent is allowed. Pursuant to Annex II and Article 4(2), 3rd paragraph, for this type of allowed PFOS uses, Denmark is required to inform the European Commission accordingly (immediately upon becoming aware of this)
4. Fire extinguishing foam placed on the market before 27 December 2006 may be used until 27 June 2011.
5. Until new information and safer alternative substances or technologies become available, if the quantity released into the environment is minimised, production and marketing is allowed for the following specific uses:

    a. until 26 August 2015: wetting agents for use in controlled electroplating systems
    b. photoresists or anti reflective coatings for photolithotography processes
    c. photographic coatings applied to films, papers, or printing plates
    d. mist suppressants for non-decorative hard chromium plating in closed loop systems
    e. hydraulic fluids for aviation

The specific exemptions in point 5 are conditional upon Denmark reporting to the European Commission every four years on developments in phasing out PFOS.

2.2.5.5 Ban on production, marketing and use of hexabromobiphenyl as well as tetra, penta, hexa and heptabromodiphenyl ether

As a general rule, production, marketing and use of hexabromobiphenyl as well as tetra, penta, hexa and heptabromodiphenyl ether listed in Annex A to the Stockholm Convention is banned according to the POP Regulation.

According to the POP Regulation, production, marketing and use of the four PBDEs covered may only take place in compliance with the exemptions in the annex. As an exemption, production, marketing and use of the following is allowed:

a) products and preparations containing one of the four PBDEs covered in a concentration below 0.1% by weight when produced partially or fully from recycled materials or materials from waste prepared for re-use, unless otherwise stated in b)

b) electrical and electronic equipment within the scope of the RoHS Directive. As at 1 July 2006, the RoHS Directive banned placing on the market of new electrical and electronic equipment containing polybrominated diphenyl ether (PBDE) but accepted a maximum content of PBDE in homogeneous materials of 0.1% by weight.

Finally, use of products already in use before 25 August 2010 and which have tetra, penta, hexa and heptabromodiphenyl ether as a constituent, are allowed in accordance with the Regulation. For this type of allowed uses, Denmark is required to notify the European Commission.

The Danish EPA Chemical Inspection Service supervises compliance with the legislation and ensures that illegal situations are legitimised.

2.2.5.6 Release reduction of unintentionally formed POPs

The POP Regulation requires Denmark and the other EU Member States to prepare and update lists of releases of dioxins, PCB, HCB and pentachlorobenzene which are included in the lists of the Convention and the POP Protocol on air, water and soil, respectively. Moreover, Denmark and the other EU Member States must prepare and implement national action plans which are to identify, describe and minimise releases of such substances.

Relevant legislation to minimise or prevent releases of unintentionally produced POPs and the categories of releases addressed by legislation are included in Table 4 below.

With regard to POPs formed unintentionally, EU legislation as well as Danish environmental protection legislation apply a number of instruments which help reduce release of such substances.

The most important release reduction measures are laid down in Directive 2008/1/EC concerning integrated pollution prevention and control (the IPPC Directive) which covers the largest stationary sources of unintentional formation of POPs. The IPPC Directive has been replaced by the new IE Directive (Industrial Emissions Directive, directive 2010/75/EU). The Directive entered into force on 6 January 2011 and will be implemented in Danish law by 6 January 2013 through amendments of acts and statutory orders.

The IPPC Directive has been implemented mainly through the Environmental Protection Act and the Statutory Order on Approval of Listed Activities (the Approval Order)). The Environmental Protection Act is based on the fundamental principle that total pollution of surroundings must be prevented or limited as much as possible. On the basis of this principle, the Environmental Protection Act requires individual enterprises to use the best available techniques (BAT) so that overall pollution is minimised. In association with the IPPC Directive, the EU prepares reference documents; BREFs, which describe the techniques considered as BAT. These reference documents are part of the foundation for approval and supervisory authorities' administration of the Environmental Protection Act.

The air guidelines of the Danish EPA from 2001 which are used for environmental approval of enterprises, include provisions on primary group I substances which are particularly hazardous substances, including POPs.

Provisions on waste incineration in the Statutory Order on Waste and the Statutory Order on Waste Incineration Plants (the Incineration Order) cover a very significant source of unintentional formation of POPs. According to the Statutory Order on Waste, burning of waste is only permitted in plants approved for the purpose. This provision should be seen in context with the provisions in the Statutory Order on Waste Incineration Plants on design and operation of incineration plants and co-incineration plants, including requirements for limit values for air emissions.

The Statutory Order on Waste Management in the form of Motor Vehicles and Derived Waste Fractions requires dangerous components to be removed from vehicles before the chassis is dismantled, and appropriate disposal of shredder waste. This requirement helps reduce emissions of POPs from shredder plants.

In addition, the Statutory Order on placing on the market of electrical and electronic equipment and management of waste electrical and electronic equipment (the WEEE Statutory Order) requires that components containing PCB in scrap electrical and electronic equipment must be removed from the

products and destroyed. This reduces the risk of forming dioxins in connection with waste treatment.

Finally, pursuant to the Water Framework Directive, PAH, hexachlorobenzene, hexachlorobutadiene and pentachlorobenzene are listed as priority hazardous substances which are subject to emissions control and environmental quality requirements.

With the PRTR Regulation (Pollutant Release and Transfer Register) coherent, integrated, national registers of releases and transfer of pollutants (PRTR registers) were established in the EU Member States. The registers cover all unintentionally formed POPs. It also covers inventories of releases from diffuse sources.

TABLE 4
INSTRUMENTS FOR RELEASE REDUCTION FROM UNINTENTIONAL FORMATION OF POPS

Instrument	Source categories affected by the instrument (with description of the source category according to Annex C of the Convention)	Strategy for release reduction
ANNEX C, Part 2 source categories		
Statutory Order on Waste Incineration Plants Statutory Order no. 1356 of 21 December 2011	a) Waste incineration plants	Stipulation of limit value for releases of dioxin of 0.1 ng I-TEQ/Nm^3 At plants which burn hazardous waste of more than 1% haloginated organic compounds, expressed as chlorine, temperature must reach a minimum of 1,100 °C for at least 2 seconds.
Statutory Order on Waste Statutory Order no. 1415 of 12 December 2011	a) Waste incineration plants	Limits on additions of PVC to incineration plants Limits on additions of waste oils for incineration. Requirements on establishing collection scheme for PVC waste
Danish Government Waste Strategy 2010-2012 and Waste Strategy 2010	a) Waste incineration plants	Limits on waste amounts
Environmental Protection Act Act no. 879 of 26 June 2010 Guidelines for industrial air pollution control Guideline no. 12415 of 1 January 2001	b) Cement kilns firing hazardous waste d, iii) Secondary aluminium production	Requirement to use best available techniques (BAT) with recommended limit value for releases for dioxin of 0.1 ng I-TEQ/Nm^3 and for PCB of 0.1 µg/Nm^3 (sum of PCB_6)
Statutory Order on Waste Statutory Order no. 1415 of 12 December 2011	b) Cement kilns firing hazardous waste	Requirements on establishing collection scheme for PVC waste
	b) Cement kilns firing hazardous waste	Requirement that waste oil >50 ppm PCB must not be used as fuel

Instrument	Source categories affected by the instrument (with description of the source category according to Annex C of the Convention)	Strategy for release reduction
ANNEX C, Part 3 source categories		
Environmental Protection Act **Act no. 879 of 26 June 2010** **Guidelines for industrial air pollution control** **Guideline no. 12415 of 1 January 2001**	b) thermal processes in the metallurgical industry not mentioned in Part 2 d) fossil fuel-fired power plants and industrial boilers e) large installations for incineration of wood and other biofuels g) crematoria i) destruction of animal carcasses l) degradation of copper cables	Requirement to use the best available techniques (BAT) with guiding limit value for emissions for dioxin of 0.1 ng I-TEQ/Nm^3 and for PCB of 0.1 µg/Nm^3 (sum of PCB_6
Statutory Order on Waste **Statutory Order no. 1415 of 12 December 2011** **Statutory Order on Waste Incineration** **Statutory Order no. 1356 of 21 December 2011**	m) waste oil refineries d) fossil fuel-fired power plants and industrial boilers	Requirement that waste oil >50 ppm PCB must not be used as fuel Waste gas from waste oils incineration of more than 10 ppm PCB/PCT must, for at least two seconds during incineration, be exposed to a temperature higher than 1,200°C in the presence of at least 6% by volume of oxygen in the waste gas.
Statutory Order on PCB/PCT **Statutory Order no. 925 of 13 December 1998**	m) waste oil refineries d) fossil fuel-fired power plants and industrial boilers	Ban on use of PCB/PCT
WEEE Statutory Order **Statutory Order no. 1296 of 12 December 2011**	k) shredder plants for treatment of end of life vehicles (shredding plant)	Requirement to remove capacitors containing PCB before dismantling electrical and electronic equipment in shredding plants
Statutory Order on Waste Management in the form of Motor Vehicles and Derived Waste Fractions **Statutory Order no. 1708 of 20 December 2006**	k) shredder plants for treatment of end of life vehicles (shredding plant)	Requirement to remove hazardous components from vehicles before dismantling the chassis and appropriate disposal of shredder waste
Statutory Order on ban on imports, sale, use and exports of products containing pentachlorophenol (PCP) **Statutory Order no. 854 of 5 September 2009**	a) Open burning of waste c) Residential combustion sources Releases of dioxin from PCP-treated wood	Ban on use of pentachlorophenol (PCP) Limit value for PCP in mixtures and products
Statutory Order on Landfilling **Statutory Order no. 719 of 24 June 2011**	a) Open burning of waste (Landfill fires)	Requirements for measures to eliminate risks of fire or explosion in stored waste

2.2.5.7 Releases from stocks

The provisions in the Convention on POP stocks have been implemented by the POP Regulation which determines that POPs must be identified and managed appropriately in terms of the environment.

Management of any stocks before they become waste is covered by applicable chemicals legislation.

2.2.5.8 Management of waste containing POPs

Legislation concerning management of waste containing POPs is summarised in Table 5. The requirements in the Convention on waste management were implemented by the POP Regulation (Article 7 with accompanying Annexes IV and V), which includes a number of specific waste management provisions and is supplemented by a number of EU Directives on management, including landfilling of waste. The management requirements are implemented by the Statutory Order on Waste, the Statutory Order on Waste Management in the form of Motor Vehicles and Derived Waste Fractions and the Statutory Order on Landfilling.

According to the POP Regulation, producers and holders of waste must make all reasonable efforts to avoid, where feasible, contamination of waste with POPs. In relation to waste already containing or contaminated with POPs, according to the POP Regulation, this waste must generally be removed or recovered through destruction or irreversible conversion.

As an exception to this general rule:

1) waste containing or contaminated with POPs listed in Annex IV may be otherwise disposed of or recovered (than through destruction or irreversible transformation), provided that the POP content in the waste is lower than the concentration limits in Annex IV. For most of the substances, concentration limits are set at 50 mg/kg. For dioxins, the limit value is 15 µg I-TEQ/kg.

2) waste with POP content between 0 and the concentration limits determined in Annex V may be deposited underground or in a landfill site for hazardous waste. However, it must be established that destruction or irreversible transformation of the content of persistent organic pollutants does not represent the environmentally preferable option. Furthermore, the competent authority must have authorised the alternative operation. Finally the other EU Member States and the European Commission must be notified about the permission to use the alternative operation. However, this operation is only possible for the waste fractions covered by Annex V. Please note that waste with a POP above the concentration limit in Annex V may be deposited underground.

Landfilling of waste must be according to the regulations in the Landfilling Directive with accompanying council decision and the Danish Statutory Order on Landfilling.

TABLE 5
LIST OF REGULATION OF MANAGEMENT OF WASTE CONTAINING POPS

Legislation relevant for management of waste containing POPs	Provisions relevant for POPs
The POP Regulation **Regulation (EC) no. 850/2004**	General rule: Waste containing or contaminated with POPs must be disposed of or recovered through destruction or irreversible conversion.
WEEE Statutory Order **Statutory Order no. 1296 of 12 December 2011**	Separate collection of waste electrical and electronic equipment. Plastic containing brominated flame retardants are extracted in selective treatment of waste electrical and electronic equipment. Requirement to remove capacitors containing PCB before dismantling electrical and electronic equipment in shredding plants (described in section 2.2.4.7 on release reduction).
Statutory Order on Waste Management in the form of Motor Vehicles and Derived Waste Fractions **Statutory Order no. 1708 of 20 December 2006**	Requirement to remove hazardous components from vehicles before dismantling the chassis, as well as safe disposal of shredder waste (described in section 2.2.4.7 on release reduction).
Statutory Order on Waste **Statutory Order no. 1415 of 12 December 2011**	Requirement to separate building and construction waste and separate building and construction waste containing PCB.
Statutory Order on Landfilling **Statutory Order no. 719 of 24 June 2011**	Regulation of landfilling.
The Shipment Regulation **Regulation (EC) no. 1013/2006**	Shipment of waste containing, including or contaminated with substances within the EU listed in the Stockholm Convention requires written notification and written consent. Restrictions on import and export of waste containing POPs to and from specific countries.
Statutory Order on Waste Incineration Plants **Statutory Order no. 1356 of 21 December 2011**	Waste oil used as fuel may not contain PCB/PCT in concentrations over 50 ppm. Waste gas from waste oils incineration of more than 10 ppm PCB/PCT must, for at least two seconds during incineration, be exposed to a temperature higher than 1,200°C in the presence of at least 6% by volume of oxygen in the waste gas.
Statutory Order on Residual Products **Statutory Order no. 1662 of 21 December 2010**	Lays down regulations on use of residual products and soil for building and construction and on use of separated uncontaminated building and construction waste from which sealant containing PCB must be separated.

Special aspects on managing building and construction waste containing PCB. The Statutory Order on Waste lays down requirements on separation of building and construction waste and separation of building and construction waste containing PCB. The provision states that enterprises producing waste must separate building and construction waste on site in the fractions listed in the provisions.

When enterprises producing waste separate their building and construction waste for further use they must be sure to separate everything except mortar and any reinforcement iron. This means that sealant material containing PCB and other material containing PCB must be identified and separated. Furthermore, double-glazed windows which may contain glue containing PCB, must be separated and destroyed or landfilled if they cannot be recycled, and this may be the case for window panes containing PCB.

The separation may be omitted if the total volume of waste from the relevant building and construction work does not exceed 1 tonne. In such case, waste is assigned for separation by the municipality. The enterprise producing waste must ensure that building and construction waste containing PCB is identified and separated and that double-glazed windows are separated.

Use of separated, uncontaminated building and construction waste may take place according to the regulations in Statutory Order no. 1662 of 21 December 2010 on use of residual products and soil for building and construction and on use of separated, uncontaminated building and construction waste, or according to the regulations in the Environmental Protection Act. Until a national limit value is determined for when building waste is to be considered uncontaminated in respect of PCB, the Danish EPA refers to the PCB guidelines from the City of Copenhagen [1]. Notwithstanding the guidelines from the City of Copenhagen, the Danish EPA emphasises that municipalities and developers are required to make their own assessments of whether building and construction waste is uncontaminated.

Management of building and construction waste containing PCB is regulated by the POP Regulation, which provides for landfilling of waste containing low concentrations of PCB. Landfilling of waste is otherwise regulated by the Danish Statutory Order on Landfilling. EU regulations (POP Regulation and the Landfill Directive) regulating management of waste containing PCB, are uncertain and in some cases, mutually contradictory, and the Danish EPA has informed the European Commission about this.

On the basis of the reply from the European Commission concerning the uncertainties and inconsistencies mentioned above, the Danish EPA has interpreted regulations on management of building waste containing PCB as follows: Waste containing PCB of more than 50 mg PCB/kg must be classified as hazardous waste and destroyed. In practice this means that waste must be destroyed in an installation licensed to incinerate hazardous waste containing PCB.

In special cases, waste containing more than 50 mg PCB/kg may be permanently stored underground, in cliff formations or in salt mines. This presupposes an assessment by the municipality that this is the best solution for the environment and that the Danish EPA subsequently approves this solution (and notifies the European Commission and the other EU Member States about the depositing). Waste containing more than 50 mg PCB/kg may not be deposited in surface plants for hazardous waste.

As a general rule, waste containing PCB of less than 50 mg PCB/kg must be destroyed. In practice, this means that building and construction waste such as sealant and cutaway concrete containing PCB must be destroyed in an incineration plant approved to destroy waste containing PCB. Building and construction waste not destroyed must be deposited. This applies to e.g. waste containing PCB which is difficult to manage (e.g. concrete) at incineration plants approved to destroy waste, and where it is consequently not appropriate to destroy the waste.

The Danish EPA recommends that waste containing PCB is landfilled in separate cells where it can subsequently be identified.

The new POPs. PFOS and the included brominated flame retardants are listed in Annex IV and V to the POP Regulation without indication of concentration limits for waste management. Limit values are established by an EU process. This means that until limit values have been established, as a general rule, waste containing PFOS or the included brominated flame retardants must be destroyed unless it can be proven that disposal can take place in some other way with due consideration for the environment. Landfilling of waste must be according to the regulations in the Landfilling Directive with accompanying council decision and the Danish Statutory Order on Landfilling.

According to the WEEE Statutory Order, plastic containing brominated flame retardants must be extracted in selective treatment of waste electrical and electronic equipment. Plastic containing more than 5 mg/kg of brominated flame retardants must be delivered to enterprises approved to manage waste containing bromine in accordance with section 33 of the Environmental Protection Act or similar legislation abroad. Plastic with a bromine content of less than 5 mg/kg may be delivered for reprocessing and recycling at enterprises approved under section 33 of the Environmental Protection Act or similar legislation abroad.

Transboundary movement. Transboundary movement of waste, including waste containing, including or contaminated with POPs, is regulated by the Regulation on shipment of waste. All shipment of waste containing, including or contaminated with substances listed in the Stockholm Convention presupposes written notification and consent within the EU. All export of waste containing POPs from the EU is banned. This ban does not apply to export of waste for disposal in EFTA countries which are also parties to the Basel Convention. With regard to imports into the EU, these will only be permitted if they are from EFTA countries or countries which are party to the Basel Convention.

2.2.5.9 Provisions for POPs in food and animal feed

Legislation concerning POPs in food is summarised in Table 6.

Provisions for dioxin and PCB in food. EU limit values for the content of dioxin and PCB in food have been set. The limit values are stated in Commission Regulation (EU) no. 1259/2011 as regards maximum levels for dioxins, dioxin-like PCBs and non dioxin-like PCBs in foodstuffs. In addition to limit values for dioxins and dioxin-like PCBs, this regulation also sets values for selected non dioxin-like PCBs. The WHO has revised TEF values (the toxicity equivalency factors) from 1998 to 2005 for the various substances. TEF values describe the toxicity of the individual dioxins and dioxin-like PCBs. These values are used to calculate toxicity of the total content of dioxins and dioxin-like PCBs in food. These values are set by the WHO and regularly revised when new knowledge about the toxicological effects of the substances emerges. The revision of the TEF values means that on the basis of new knowledge some substances are assessed to be more toxic and other substances less toxic. Overall this means that the sum of substances are assessed to be less toxic. Limit values for dioxin and dioxin-like PCBs have been recalculated according to the new TEF values which means that some of the values correspond to the old values whereas others have been lowered with the changes. The new limit values entered into force on 1 January 2012.

Commission Recommendation of 23 August 2011 on the reduction of the presence of dioxins and PCBs in feed and food lays down action levels for these substances in order to stimulate a pro-active approach to reduce the presence of dioxins and dioxin-like PCBs in food. The action levels are slightly lower than the limit values.

Due to high dioxin content in the Baltic Sea Denmark has introduced limits for fishing and sales of certain fish species from the Baltic Sea, see also Statutory Order no. 1256 of 15 December 2011 on bans against sale for human consumption of certain salmon and herring.

Requirements for methods of sampling and analysis are laid down in Commission Regulation (EU) no. 252/2012 of 21 March 2012 laying down methods of sampling and analysis for the official control of levels of dioxins, dioxin-like PCBs and non-dioxin-like PCBs in certain foodstuffs and repealing Regulation (EC) no. 1883/2006.

Provisions on dioxins and PCB in feed. In parallel with the amendments to regulations of foodstuff, the legislation for dioxin and dioxin-like PCBs in animal feed have also been amended. Directive 2002/32/EC on undesirable substances in animal feed include general rules on undesirable substances, whereas limit values are laid down in a regulation last amended by Commission Regulation (EU) no. 225/2012. This Regulation sets limit values in animal feed for 1) the sum of dioxins, 2) the sum of dioxins and dioxin-like PCBs and 3) certain non dioxin-like PCBs, respectively. The Regulation also sets action thresholds for dioxins and dioxin-like PCBs, respectively. For dioxins and dioxin-like PCBs, the general rules from the Directive on undesirable substances are implemented by Statutory Order no. 775 of 28 June 2011 on animal feed and animal feed companies which, among other things, determine that animal feed containing undesirable substances in larger volumes than the maximum content in Annexes I and II to Regulation 225/2012 may not be placed on the market or used as animal feed.

Requirements for methods of sampling and analysis for the official control of animal feed are regulated by Commission Regulation (EC) no. 152/2009 as amended by Commission Regulation (EU) no. 278/2012.

In addition to the regulations on limit values for dioxins, Regulation no. 183/2005 laying down requirements for feed hygiene establishes special regulations on approval of enterprises which market products for use as animal feed made from vegetable oils and fats, and on special requirements for manufacture, storage and transport of oils, fats and derivative products. Regulations also lay down the number of analyses that enterprises are required to make of dioxins in such products. The special provisions are laid down in Commission Regulation no. 225/2012.

The so-called rapid alert system for informing about direct or indirect health risks to humans due to food or feed (Rapid Alert System for Food and Feed, RASFF) ensures effective exchange of information between EU authorities on any presence of POPs in food and animal feed. The system was established by Regulation (EC) no. 178/2002 of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety, as well as Commission Regulation 16/2011 of 10 January 2011 laying down implementing measures for the Rapid alert system for food and feed.

Provisions on pesticide residue in food and feed. Furthermore, EU limit values have been set for the content of pesticide residue in food and animal feed. Limit values are laid down in Regulation (EC) no. 396/2005 of the European Parliament and of the Council on maximum residue levels of pesticide residue in or on food and feed of plant and animal origin. Maximum residue levels for pesticide residue (MRL) comprise specific maximum residue levels for a number of combinations of substances and crops. For all pesticide-crop combinations without specifically set maximum residue levels, the automatically set detection limit of 0.01 mg/kg applies as maximum residue level.

The goal is to ensure that the content of pesticide residues in food and feed do not represent an unacceptable risk for the health of consumers and animals.

TABLE 6
OVERVIEW OF REGULATION OF POPS IN FOOD AND FEED

Legislation concerning POPs in food and feed	Provisions relevant for POPs
Commission Regulation (EU) no. 1259/2011	EU maximum levels for dioxins, dioxin-like PCBs and non dioxin-like PCBs in foodstuffs.
Commission Recommendation of 23 August 2011 (2011/516/EU)	On the reduction of the presence of dioxins and PCBs in feed and food as well as action levels for dioxins and dioxin-like PCBs in feed and food.
Statutory Order on feed and animal feed enterprises Statutory Order no. 775 of 28 June 2011	Animal feed containing undesirable substances in larger quantities than maximum content (dioxins, PCB and pesticide residue) as stated in Annexes I and II of Regulation nos. 574/2011 and 277/2012 may not be placed on the market or used as animal feed.
Commission Regulation (EU) no. 252/2012 Commission Regulation (EC) no. 152/2009 as amended by Commission Regulation (EU) no. 278/2012	Requirements for methods of sampling and analysis of the content of dioxins, dioxin-like PCBs and non dioxin-like PCBs in food and animal feed.
Regulation (EC) no. 178(2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety.	Stipulates regulations for the so-called rapid alert system notifying direct or indirect health risks for humans due to food or animal feed (Rapid Alert System for Food and Feed, RASFF).
Statutory Order banning sale for human consumption of certain salmon and herring from the Baltic Sea. Statutory Order no. 1256 of 15 December 2011	Limits for fishing and sale of certain fish species from the Baltic Sea.
Regulation (EC) no. 396/2005 on maximum residue levels for pesticide residue in or on food and feed of plant and animal origin	Maximum residue levels for pesticide residue (MRL) comprise specific maximum residue levels for a number of combinations and crops. For all pesticide-crop combinations without specifically set maximum residue levels, the automatically set detection limit of 0.01 mg/kg applies as maximum residue level.
Commission Regulation (EU) no. 225/2012	Amending Annex II of Regulation (EC) no. 183/2005 of the European Parliament and of the Council as regards approval of companies which market products for use as animal feed made from vegetable oils and fats, and on special requirements for manufacture, storage, transport and dioxin testing of oils, fats and derivative products.

This Regulation is supplemented by Directive 2002/32/EC of the European Parliament and of the Council on undesirable substances in animal feed. For the substances aldrin, dieldrin, camphechlor, chlordane, DDT, endosulfan, endrin, heptachlor, hexachlorcyclohexan and hexachlorobenzene, the maximum residue levels in Commission Regulation 574/2011, Annex I, Part IV apply. The limit values are set in Commission Regulation (EU) no. 574/2011. Pursuant to Statutory Order no. 775 of

28 June 2011 on animal feed and feed, animal feed containing undesirable substances in larger quantities than the limit values, must not be placed on the market or used as animal feed.

2.3 The POP situation in Denmark

2.3.1 Annex A and B pesticides

Neither DDT nor the other pesticides covered by the Stockholm Convention are produced or used in Denmark. Therefore all Annex A and annex B pesticides are described together.

2.3.1.1 Historical use of POP pesticides

As far as is known only seven of the 15 POP pesticides have ever been used as pesticides in Denmark. These are DDT, as well as aldrin, dieldrin, endrin, heptachlor, lindane and endosulfan. Of these, only DDT, dieldrin, endosulfan and lindane have been extensively used, while the others have only been sold in small amounts and were removed from the market in 1963 (aldrin, endrin) and 1972 (heptachlor). Until they were banned in 1992, three substances, α-HCH, β-HCH and pentachlorobenzene may have occurred as impurities in lindane and the fungicide quintozene.

Years for entry into force of regulation of the banned POP pesticides in Denmark are listed in Table 7. The three most important instruments are the Statutory Order on Pesticides (No. 208 of 26 March 1992, as later amended) and the Statutory Order on POPs (No. 820 of 29 September 2003) and Commission Regulation (EU) No. 757/2010.

The historical use of the old POP pesticides was described in the 2006 implementation plan, and this should be referred to for a more detailed description. Focus in this implementation plan will be on the new POP pesticides under the Convention.

Lindane (γ-HCH) is an insecticide which has had a number of approved applications in Denmark of which the last was to combat ants (Midol ant poison) and as a dressing for rapeseed and other seeds of brassicaceae crops (Vitavax). Previously, lindane was also used as a spray on rape fields as well as on Christmas tree plantations and in cultivation of decorative greenery. Sale and use of lindane in Denmark was banned by Act no. 438 of 1 June 1994, which entered into force on 1 July 1995. The last recorded sales of lindane were in 1994 for 12,285 kg active substance, which was somewhat more than the previous two years.

Alpha-hexachlorocyclohexane (α-HCH) and beta-hexachlorocyclohexane (β-HCH) are intermediates in the production of lindane (γ-HCH). Since 1992 there has been a ban in Denmark on using HCH with less than 99.0% gamma isomer as the active substance in pesticides (i.e. there may be a maximum of 1% made up of α-HCH and β-HCH). It has not been possible to find any information about the presence of α-HCH and β-HCH in HCH used in Denmark before 1992.

Chlordecone has never been approved for use as a pesticide in Denmark.

Endosulfan has not been approved as a pesticide in Denmark since 1994. According to the Danish EPA pesticides statistics, technical endosulfan was sold in Denmark until 1994 as an acaricide (against mites) and insecticide. In the period 1991 to 1994 the amount fell from about 3 tonnes of active substance in 1991 to around 2 tonnes in 1994.

Pentachlorobenzene is an intermediate product in the production of the fungicide quintozene and it occurs as a technical impurity in this fungicide. Use of quintozene with a pentachlorobenzene content of more than 10 g/kg fungicide has been banned in Denmark since 1992. All sales of the active substance quintozene have been banned since 31 January 2002, and all use of this has been banned after 1 May 2002, cf. the Statutory Order on Pesticides.

TABLE 7
REGULATION OF POP PESTICIDES IN DENMARK

Substance	Year of entry into force	Regulation
Aldrin, chlordane, dieldrin, endrin, heptachlor, HCB, toxaphene	1992 2003	Ban on use as active ingredient in pesticides Total ban *
Chlordecone	- 2010	Chlordecone has never been approved for use as a pesticide in Denmark Total ban
DDT	1970 1984 2003	Ban on agricultural use as a pesticide Ban on use as active ingredient in pesticides Total ban *
Lindane (γ-HCH)	1995 2010	Ban on use as active ingredient in pesticides Total ban *
α-HCH and β-HCH	1992 2010	Ban on use of HCH with less than 99.0% gamma isomer as active substance in pesticides Total ban
Mirex	2003	Total ban *
Pentachlorobenzene	1992 2002 2010	Ban on use of Quintozene with a pentachlorobenzene content of more than 10 g/kg Ban on use of Quintozene as active substance in pesticides Total ban *
Endosulfan	1994 2007	Not approved as active substance in pesticides Total ban *

* **'Total ban' means a ban on import, sale and use, except for unintentional trace contaminants and use as a reference material on laboratory scale**

2.3.1.2 POP pesticides in food

The Danish monitoring programme for food also contains measurements of a number of POP pesticides. The results of the monitoring programme for 1998-2003 are reported in a Food Report from 2005 *("FødevareRapport 2005:1")* [2]. On the basis of the measurements, the total average intake of the substances (excluding fruit and vegetables) is estimated as follows:

- ∑Chlordan: 0.11 µg/day
- ∑DDT: 0.27 µg/day
- Dieldrin: 0.13 µg/day
- HCB: 0.09 µg/day
- ∑Heptachlor: 0.05 µg/day
- Lindane: 0.06 µg/day
- α-HCH: 0.04 µg/day
- β-HCH: 0.04 µg/day
- Endosulfan A: 0.03 µg/day

Daily intake has decreased significantly for all the substances over the past 20 years. The Danish Veterinary and Food Administration concludes that, on the basis of the estimated intake compared

with the ADI (acceptable daily intake) or TDI (tolerable daily intake), the content of POP pesticides in food does not give grounds for health concerns. An updated statement is under preparation and this is due to be completed at the end of 2012.

2.3.1.3 POP pesticides in the environment

A number of chlorinated pesticides, including DDT/DDE, HCB, lindane and chlordane, are included in the ongoing monitoring of pollutants in the environment and in emissions from point sources. In general there are decreasing concentrations of POP pesticides.

The concentration of xenobiotic substances in mussels and fish in the marine environment has been assessed, among other things in relation to the ecotoxicological assessment criteria (EAC) drawn up by the OSPAR Commission and the background assessment criteria (BAC). In the most recent NOVANA report for the marine environment of 2010, all tests for HCB in mussels were less than the BAC, while only 56% of the samples were below the BAC for gamma-HCH (lindane) [3]. With regard to chlorinated pesticides an EAC has only been set for gamma-HCH, which was exceeded by 13% of samples in 2010. The degradation product of DDT, p,p'-DDE, was not included in the 2010 study, but in 2009 100% of samples were less than the BAC.

As the environmental and health risks are today primarily linked to the presence of other POPs, the POP pesticides will not be mentioned further here.

2.3.2 Intentional use of PCB

This section covers the presence of PCB as the result of intentional use of PCB, while unintentional formation of PCB is dealt with in section 2.3.5.

The 2006 implementation plan stated that there should be an assessment of whether there is a need for further action in relation to PCB in building materials. In 2005, the Danish EPA initiated a survey of the presence of PCB in building sealants and an assessment of the health impacts of this. The survey showed that PCB is still found in soft sealants and in seal for double-glazed windows in a number of Danish buildings which were erected between 1950 and 1976 and that evaporation from the sealants in certain buildings may comprise an increased health risk.

Further to the results of the survey, and additional surveys, it has been demonstrated that PCB in building materials, (sealants) can cause higher concentrations of PCB in the indoor climate, and as mentioned in the following, in 2011 the Danish Government published the PCB Action Plan. The action plan contains 19 initiatives which are further described in the following.

2.3.2.1 Historical use of PCB.

PCB has never been produced in Denmark. However, as in the rest of the world, for a period Denmark used PCB for various products and equipment for technical applications. The first full inventory of PCB consumption in Denmark was made in 1983. Table 8 shows an overview of the historical consumption of PCB in Denmark. The table shows estimated consumption up to 1981. In the period 1981-1986, small amounts of PCB may also have been used in electrotechnical equipment, so that total consumption was slightly larger than the table indicates. However, no data are available for this period.

In the late 1960s and the early 1970s, it became clear that PCB spreads and accumulates in the environment, and that it may occur in food at levels that give rise to concern. Therefore, a number of regulatory measures were taken, see section 2.2.4.

TABLE 8
CONSUMPTION OF PCB IN DENMARK IN ACCORDANCE WITH A STUDY FROM 1983 (BASED ON [4])

Use	Approx. period in which products containing PCB were supplied for the use	Estimated total consumption in Denmark in 1950-1981 * Tonnes PCB
Large capacitors	1950 - 1981 *	450 – 750
Small capacitors	1950 - 1980	175 – 325
Transformers for high voltage	1950 - 1982 *	30 – 100
Paint	1955 - 1973	130 – 270
Sealants	1967 - 1974	80 - 120
Seal for double-glazed windows	1967 - 1974	86 - 100
Plastic, printing ink and wax	1950(?)- 1981	<15
Self-copying paper	1960 - 1973	150 - 250
Heat transmission liquids, hydraulic oil, cutting oil, immersion oil etc.	1950(?)- 1967	<10
Component in paper, animal feed etc.	Whole period	<60
Total (rounded)		1,100 - 2,000

* **Small amounts of PCB may have been used in equipment in large capacitors and transformers up to 1986 when the ban was introduced, and total consumption may therefore have been slightly larger than indicated in the table.**

2.3.2.2 PCB in electrotechnical equipment

PCB in electrotechnical equipment has been regulated for many years and is described in more detail in the 2006 implementation plan. Remaining issues are linked primarily to small capacitors weighing less than 1 kg and which may be used until the end of their operational life.

The most important quantities remaining of small capacitors containing PCB are assumed to be in sockets for fluorescent tubes. These capacitors usually contain 10-30 g pure PCB. There is no current estimate of the remaining amounts of PCB in these capacitors.

According to the WEEE Statutory Order (Order No. 1296 of 12 December 2011), capacitors containing PCB must be removed through selective treatment of waste electrical and electronic equipment.

Capacitors containing PCB, which are not disposed of in accordance with the regulations can end up in shredding plants and thus in shredder waste. Through the 2011 Action plan to promote eco-efficient technology, the Danish EPA supported a project aiming at identifying potential substances of concern in shredder waste, including PCB, as well as examining the possibilities of using sensor-based technology to identify and separate materials containing these substances before or after the shredder process.

2.3.2.3 PCB in building materials and indoor air

PCB in buildings is one of the most topical issues in relation to POPs in Denmark.

As stated in Table 8, PCB was used until 1974 in sealants and seal for double-glazed windows. In addition, a certain amount is used in paint and flooring, although there are no historical inventories

for this use. The total amount of PCB in building materials used in Denmark is estimated at 300-490 tonnes. Based on the technical specifications for these materials, their durability is generally expected to be shorter than the at least 36 years that have passed since they were installed [5]. However, in fact it has become apparent that the materials last for longer than expected.

It has previously been estimated that from around 2010 less than 10 tonnes of PCB will remain in Danish buildings [5], but the continued presence of PCB indicates that previous assessments have underestimated the durability of PCB in materials and thus how long PCB is likely to be found in buildings which were built or renovated between 1950 and 1977.

In the health assessment of building sealants containing PCB (”*Sundhedsmæssig vurdering af PCB-holdige bygningsfuger*”), published by the Danish EPA in 2009, the total residual amounts of PCB in Danish building sealants was estimated with great uncertainty at between 6 and 21 tonnes [6]. In addition to this are residual amounts of PCB in double-glazed windows, paint and flooring, which have not been estimated. The study also showed that there is a clear relationship indoors between concentrations of PCB in sealants, the air and surface dust. It also seemed that there was some relationship between PCB levels in the external sealants and in the soil near the house, but in this context the relationship was weaker. The study concluded that PCB in building sealants in the buildings examined could, to a certain extent, contribute to human exposure to the most toxic, dioxin-like PCB congeners, which primarily comes from ingestion of food. The results of the study also showed that the most important contribution to exposure to the more volatile non-dioxin-like PCBs will typically be the PCB content in the air inside buildings with sealants containing PCB and that the levels in the indoor air can lead to an inappropriately reduced safety margin in relation to the health impacts. The study only covered 10 buildings and therefore it is not possible to accurately assess how widespread PCB actually is in Danish buildings, and in what concentrations it could occur. The study also indicated that it should be assumed that building waste containing high levels of PCB had not been disposed of in accordance with the regulations, and that there was a need to spread knowledge about the requirements, problems and possibilities in connection with identifying and managing building waste containing PCB.

As follow-up to the above study, in 2009 the Danish Enterprise and Construction Authority, the Danish EPA and the Danish Working Environment Authority initiated a study of PCB in detached and semi-detached houses. The study concluded that the extent of PCB in detached and semi-detached houses in Denmark is unknown, but it is expected that building materials containing PCB have also been used in this type of house [7].

The studies have focused on the presence of PCB in building materials and indoor air and a number of studies initiated by municipalities and housing companies over the past five years have demonstrated PCB in building materials in a large number of buildings. In many cases, PCB has been demonstrated in the indoor air in the buildings containing building materials with PCB.

In the studies, PCB has been found in concentrations of typically 3-10% in sealant between wall elements and facade elements, or around windows and doors in many buildings, including blocks of flats, schools, childcare institutions and industrial buildings.

Despite the studies and screenings completed regarding PCB in building materials and indoor air, the estimate of the remaining amounts of PCB in materials and indoor air in Denmark is still uncertain. In practice there is also uncertainty on how the preliminary screening and risk assessment of the content of PCB in buildings is to be approached and there have been indications that the current regulations on building waste containing PCB are not always complied with in practice.

2.3.2.4 Action Plan on Managing PCB in Buildings - Indoor Environment, Working Environment and Waste

As a result of the increasing awareness of the need for more knowledge about the presence of and possible health impacts of PCB in buildings, and in order to enhance the basis for managing PCB in the indoor climate, in occupational safety and health and in building waste, in 2011 the Danish Government issued the "Action Plan on Managing PCB in Buildings – Indoor Environment, Working Environment and Waste". The objective of the PCB Action Plan is described in the following figure.

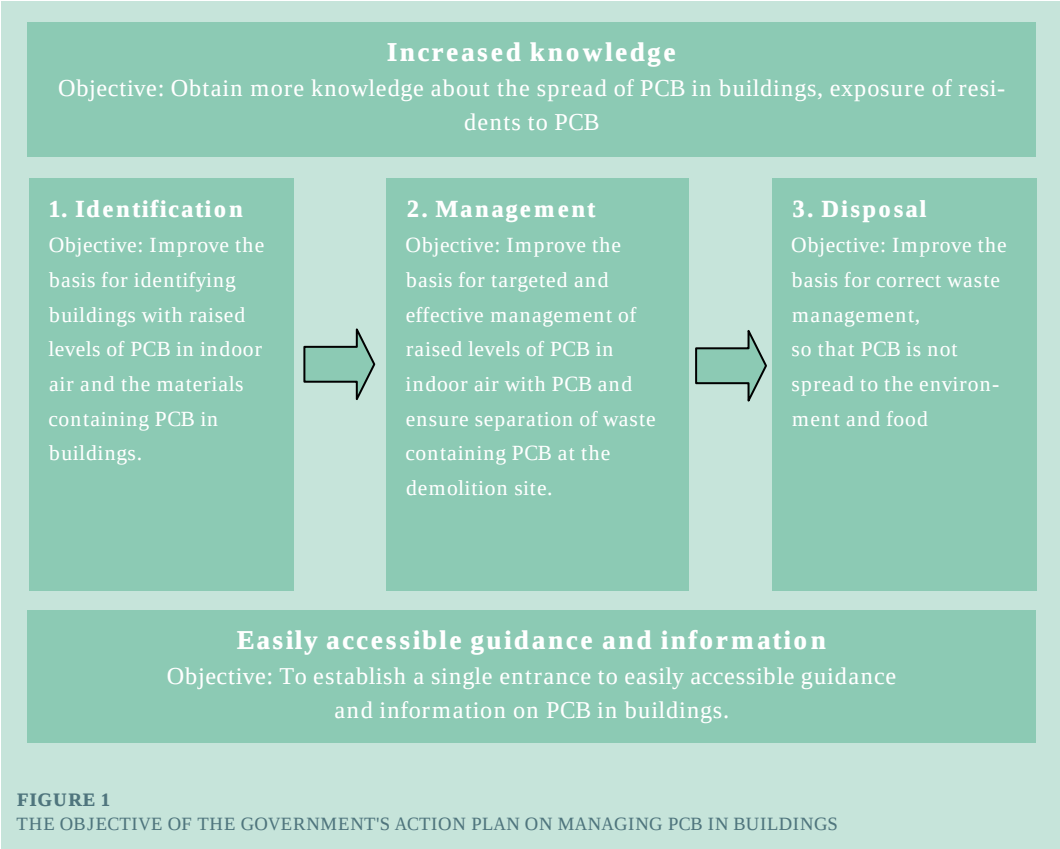


FIGURE 1
THE OBJECTIVE OF THE GOVERNMENT'S ACTION PLAN ON MANAGING PCB IN BUILDINGS

The action plan contains 19 initiatives which are described in more detail in the table below.

TABLE 9
INITIATIVES UNDER THE DANISH GOVERNMENT'S PCB ACTION PLAN

Focus area		Initiative	Status May 2012
PCB and health	1	Investigation of the PCB contribution from indoor air compared with the contribution from diet. Includes measurements of PCB in residents in flats with and without PCB building materials, respectively	Completed
	2	Assessment of recommended action values for PCB in indoor air. Reassessment of the current recommended action values of, respectively 300 and 3,000 ng/m^3 PCB in indoor air.	Expected in 2013

Focus area		Initiative	Status May 2012
Identification of PCB in buildings	3	Elucidation of the spread of PCB in different types of building, building materials and the indoor air. Nationwide, inter-ministerial study of PCB in building materials and the indoor air analysed by blocks of flats, office and institutional buildings and detached and semi-detached houses. Study of secondary contamination in building materials. (prepared in parallel with a mapping of PCB in buildings owned by the Danish Defence).	In progress - expected completion in 2013
	4	Tool to assess the risk of PCB in buildings.	The tool is expected to be ready in 2013
Management	5	Recommendations to mitigate PCB in the indoor air. The study will gather experience with mitigation measures from all of Denmark and neighbouring countries.	Completed - recommendations published
	6	Trials with PCB mitigation	In progress - expected completed in 2013
	7	Preparation of Danish Building Research Institute guidelines on PCB renovation.	The guidelines will be completed in 2013
	8	Assessment of whether it is possible and appropriate to order consultancy with regard to PCB.	Under preparation
	9	Thematic training on PCB for inspectors.	Completed
	10	Training for the Danish Working Environment Authority call centre on PCB.	Completed
	11	Preparation of information on occupational safety and health and PCB.	Completed - information available in the PCB guide
Disposal of waste containing PCB	12	Set limit values for PCB in building waste.	In progress
	13	Updated guidelines on separation of waste containing PCB, including separation of concrete containing PCB.	In progress - expected completed in 2012
	14	Establishment of an overall coordinated mapping and reporting scheme for renovation and demolition of certain buildings.	In progress - expected completed in 2012
	15	Selective demolition projects and ensuring qualified execution of these demolition projects.	In progress. Completion expected 2012
	16	Technical investigation of hazardous substances in building waste. Investigation of the presence of hazardous substances in concrete and tiles from building and construction, as well as the presence of waste insulation materials with ozone layer depleting substances.	In progress - expected completed in 2012
Easily accessible guidance and information	17	Establishment of PCB website www.pcbguiden.dk	Has been established
	18	Inter-ministerial “step-by-step" guidelines on PCB in buildings.	Have been completed and issued via the PCB guide - updated regularly as new knowledge becomes available
	19	Establishment of inter-ministerial PCB helpdesk	Has been established in association with the PCB guide

The PCB Action Plan is to be implemented by a number of authorities which share the areas of responsibility as follows:

- Danish EPA – guidelines on waste management for PCB
- Danish Working Environment Authority – occupational safety and health in connection with PCB
- Danish Health and Medicines Authority – health and recommended action values
- Danish Energy Agency - guidelines on PCB in building materials and the indoor air
- Ministry of Housing, Urban and Rural Affairs - regulations for housing and rooms harmful to health
- Agency for Palaces and Cultural Properties - government buildings

2.3.2.5 PCB in the indoor environment - recommended action values

A large number of studies in recent years have shown that PCB in building materials can result in raised concentrations of PCB in the indoor environment. The building owner is responsible for ensuring that a building is not harmful to health to live in or to be in, but many building owners have been uncertain about what concentrations could be linked to a health risk and what they should do.

The Danish Health and Medicines Authority has therefore drawn up recommendations regarding action values for PCB in the indoor air for building owners, municipalities, and residents.

Exceeding 3,000 ng/m^3 (measured as total PCB) in the indoor air is assessed by the Danish Health and Medicines Authority, on the basis of current knowledge, to be linked to a significant health risk for exposures over time. It is recommended to intervene without undue delay and that evacuation should usually take place within six months.

On the basis of current knowledge, the Danish Health and Medicines Authority also assesses that levels of between 300 and 3,000 ng/m^3 can be harmful to health for exposures over a longer period of time (years). Therefore, the Danish Health and Medicines Authority advises municipalities to complete a plan for reduction of the level to less than 300 ng/m^3 without undue delay.

The recommended introductory procedures, after PCB has been ascertained in the indoor climate, is to ventilate/increase ventilation and to intensify cleaning; then repeat measurements of PCB in the indoor climate in order to ascertain the effect of removing secondary sources (dust and other accumulated sources), and to estimate evaporation and the actual exposure of people in the building.

If the level continues to exceed 300 ng/m^3, the Danish Health and Medicines Authority advises that options to reduce the level of PCB be investigated and that the municipality stipulates a time limit for reducing PCB. The municipal council should determine a time limit for reducing PCB to below 300 ng/m^3.

The recommended action values will be further assessed as part of the Action Plan on Managing PCB in Buildings.

At the moment, there is no overview of the extent of concentrations above the two action values, but this will be investigated as part of the action plan.

2.3.2.6 PCB in the blood of residents in homes with PCB in building materials

To implement initiative 1 of the PCB Action Plan, in collaboration with Bispebjerg Hospital, the Danish Building Research Institute and Erlangen University Hospital in Germany, the Danish Health and Medicines Authority has carried out a survey of PCB in the indoor climate and blood of residents in the blocks of flats in *Farum Midtpunkt*. High concentrations have previously occurred in some of the flats in Farum Midtpunkt where PCB was used in internal sealants.

Results of the survey shows that the blood content of total PCB/non dioxin-like PCBs is nearly three times higher in exposed residents compared with non exposed residents in *Farum Midtpunkt*, and that men have twice as high concentrations as women (probably due to higher body fat percentage in women). The total amounts of dioxin-like PCBs is about twice as high for exposed residents compared with non exposed residents. On the basis of the survey it was not possible to assess any effects on health from the PCB exposure.

Indoor climate results show an average of about 860 ng/m^3 of PCB_7 in the indoor air in flats with PCB in building materials. These measurements were made after mitigation measures to reduce the current exposure considerably compared with the initial level. Residents have also all been instructed on what they can do themselves to reduce exposure in the flats (increased ventilation, vacuuming/drying and cleaning) until such time that renovation can take place.

According to assessments by the Danish Health and Medicines Authority, there are generally no acute health risks from PCB in the amounts measured in the building; the overall estimate by the Danish Health and Medicines Authority is that residents are in no imminent danger to their health. The mitigation measures used, the recommendations residents have received on more cleaning and ventilation, as well as the estimate that PCB in the amounts measured do not pose acute health risks are part of the above assessment.

PCB measurements over time show that the general level of PCB in breast milk/blood in Danes has decreased by about three-quarters since the ban on use of PCB in the 1970s; the PCB content in human blood was thus significantly higher 20-30 years ago. According to the Danish Health and Medicines Authority, the Farum results must be assessed in this context. In the period 1982 to 1993/94, the content of total PCB fell by about 60% for instance [8].

The Danish Health and Medicines Authority has concluded that based on the results from the Farum survey, more surveys must be carried out taking into account indoor climate as well as blood analyses, with a view to examining the current results in a national context. Blood analyses of individuals taken from large surveys are not recommended as these will be difficult to interpret. After an inter-ministerial assessment of the national PCB Action Plan, supplementing the planned material and indoor climate measurements with blood studies is being considered.

2.3.2.7 Measurement of PCB in indoor air

Further to determining recommended action values for PCB in indoor air, it has been necessary to establish how to measure PCB in indoor air, as the measured concentrations largely depend on the conditions under which PCB in indoor air is measured. Accordingly, in 2010, the Danish Business Authority published recommendations for measuring PCB in indoor air. The recommendations describe how measurements of PCB should be made when building owners wish to compare PCB levels in indoor air with the recommended action values of health authorities.

2.3.2.8 Secondary contamination and mitigation measures.

Studies have shown that PCB in building materials may spread to other building materials and furniture inside the buildings. The spread of PCB in building materials will be further described in the current mapping of PCB in buildings.

The examples best describing the spread of PCB are studies of PCB in blocks of flats in *Farum Midtpunkt*. In 2009, high levels of PCB concentrations were ascertained e.g. in sealants around doors and joints between concrete elements in 295 out of 1,645 homes. PCB in the sealants had migrated to the surrounding concrete, and, through indoor air, contaminated other materials in the homes. After several pilot trials using different methods trying to remove the building materials containing PCB, the housing company found a suitable renovation method in spring 2011. The method involves removing the sealants together with at least 3 cm of the surrounding concrete and that all wooden floors and kitchens, which have absorbed PCB from the air, be replaced by new ones. After the renovation, the homes are heated to 40 degrees for a period in order to remove the remaining amounts of PCB. Preliminary calculations show that the renovation, including expenditure on e.g. rehousing and loss of rents amounts to about DKK 140 million. As there are probably quite a lot of housing areas with similar concentrations of PCB in the materials, experience from Farum illustrates that total expenditure on PCB renovation in Denmark may easily amount to several billion Danish kroner.

2.3.2.9 Management of building waste containing PCB

The Danish use (materials recovery) of building and construction waste is substantial and has thus ensured a high degree of resource savings. The initiatives in the PCB Action Plan are to contribute to a continued high degree of recovery of building and construction waste, as well as a high degree of certainty that there is no unacceptable spread of PCB in the environment.

It is important to separate waste containing PCB in the demolition and renovation phase and that no building and construction waste contaminated with PCB is delivered for reuse, recycling or materials recovery. This will be through initiatives strengthening guidance efforts as well as the technical and administrative basis for identifying and separating building and construction waste containing PCB.

2.3.2.10 PCB in food

The Danish food monitoring programme has monitored PCB in food since the programme started in 1983 [2] A general decrease in the content of PCB was observed in the period from 1983 to 1998 whereas significant decreases have not been ascertained in the period after 1998.

On the basis of recent results for control and monitoring of the content of PCB and chlorinated pesticides in animal products, farmed fish, as well as herring and cod liver, the Danish Veterinary and Food Administration has ascertained that levels generally correspond to the levels established in previous years, and no transgression of limit values or the recommended level requiring action has been proven (data concerning dioxin-like PCBs is included under dioxins) [9].

Average daily intake by Danes in the period 1998-2003 is estimated at 0.9 µg/day for the sum of 10 indicator PCBs [2]. Estimates for individuals with relatively high intake of the substances (0.95 fractile) show that they consume approx. twice the amount consumed by the average Dane. However, intake levels of individuals with special patterns of intake, for instance because they eat substantial amounts of cod liver or cod liver oil, are expected to be be even larger. The largest amounts of chloro-organic compounds come from fish, meat and dairy products. Children have a higher intake from milk and dairy products, and a lower intake from fish than adults. There are no recent calculations of intake, but since levels in food have been relatively unchanged, intake today largely corresponds to the calculated level for the period 1998-2003.

An updated statement is under preparation and this is due to be completed at the end of 2012.

2.3.2.11 PCB in the environment

As described in the 2006 implementation plan, PCB in the environment in Denmark has been monitored for several decades, and generally, there has been a considerable drop compared with the levels in the 1970s and 1980s.

The most recent summary report from 2011 from the NOVANA environmental monitoring programme ascertains that the content of most PCB congeners was considerably lower than the background assessment criteria (BAC) in samples tested of mussels, fish and sediment. Some PCB congeners were, however, discovered in concentrations above the ecotoxicological assessment criteria (EAC) which means that there may be an effect of these substances at the stations in questions. The content of one of the PCB congeners, PCB#118 was higher than the EAC in 44% of the samples of mussels tested. The same compound was also found in concentrations above the EAC in fish.

2.3.3 PFOS

This substance group, which is among the new substances included in the Convention, includes perfluorooctane sulfonic acid and its salts as well as the substance perfluorooctanesulfonic fluoride, PFOS-F. Generally, studies in Denmark on the uses of PFOS in society, human exposure or PFOS in the environment have included several substance groups of per- and polyfluorinated substances.

The Stockholm Convention as well as the POP Regulation lists a number of exemptions from the general limitations of use. Therefore, problems are linked to the current consumption of PFOS as well as the historical consumption which means that PFOS may occur in products accumulated in society and in articles in the waste stream.

2.3.3.1 Manufacture in Denmark

PFOS is not manufactured in Denmark.

2.3.3.2 Historical use of PFOS in Denmark

There are no specific calculations of the historical use of PFOS in Denmark.

The most important uses of polyfluorinated substances in Denmark were analysed in a study from 2001 [10]. The study included 22 classes of polyfluorinated compounds grouped by the OECD (later changed to 17 groups) of which PFOS substances only represented a small part, broken down by several classes. The study did not involve a specific statement of PFOS. Overall Danish use of the 22 classes of fluorinated substances was estimated at 5-50 tonnes/year. This consumption primarily included use of the substances in mixtures and did not include import in for example carpets, textiles or paper. A total of 75 CAS numbers from 17 of the classes on the OECD's list were registered in the Product Register broken down by 89 different product codes. The total sales registered of all the fluorinated substances were 8-16 tonnes. The calculations only provide a very incomplete picture of the amounts of PFOS sold with articles which would primarily be textiles, carpets, and leather, and cardboard.

A survey and environmental and health assessment of fluorinated compounds in impregnated articles and impregnating agents published in 2008 [11] includes updated extracts from the Product Register for all uses. In 2007 a total of 92 fluorinated substances were registered, of which ten were on the OECD list as PFOS-related and three substances were PFOS/PFAS-related. The total registered consumption of the 92 registered fluorinated compounds was 16.5 tonnes, of which 2.1 tonnes was PFOS. The survey did not specifically indicate the usage of these 2.1 tonnes.

2.3.3.3 Historical use of PFOS in the EU

As knowledge about historical use is important for determining where and in what amounts PFOS occurs in articles in use today, and in the waste stream, in the absence of specific estimations of the

historical use of PFOS in Denmark, here is referred to a study prepared in 2011 for the European Commission. The results of this study are stated in Table 10.

According to the study [12], generally there was a considerable drop in the use of PFOS in the EU in the period from 2000 to 2004 where many uses of PFOS ceased. Articles in use in society will therefore primarily be articles with relatively long lifetime such as leather furniture and carpets of synthetic fibres. The EU study calculates specific amounts in the waste stream of leather furniture and carpets. The study indicates that use of PFOS for the two product groups ceased in 2002.

According to the EU study, in the years up to 2002, an estimated 146 tonnes of PFOS per year were used for production of carpets in the EU27, and the average concentration of PFOS in PFOS impregnated carpets was 88 mg/kg. It is also estimated that about 146 tonnes per year of PFOS will be disposed of in the period from 2012 to 2016 in a waste volume of 1.9 million carpets (both with and without PFOS) with an average content of 75 mg/kg. If a corresponding amount per capita is disposed of in Denmark, around 1-2 tonnes of PFOS will be disposed of annually with carpets in the coming years.

The survey also estimates that every year up to 2002, about 6 tonnes of PFOS were used in the EU27, and that in 2010 a corresponding amount was disposed of with leather furniture in a total waste volume of about 71,000 tonnes of upholstered furniture (both with and without PFOS) with an average content of PFOS of 2.4 mg/kg. Calculations in the study assume PFOS concentrations in leather furniture of typically around 80 mg/kg. Calculations in the study also assume an average lifetime of 10 years for the articles and that everything will have been disposed of by 2012. Considering the uncertainty of their lifetime and the fact that these are rather expensive leather articles, there may still be amounts to be disposed of in 2012 and the following years. If these amounts also apply to Denmark, an estimated maximum of 50-100 kg PFOS will be disposed of with leather furniture in 2012, and the amounts will quickly drop.

Certain types of fire extinguishing foam produced before 2002 may contain PFOS. Based on information on operational life of fire extinguishing foam, the EU study estimates that the amounts of PFOS in fire extinguishing foam stored in the EU fell from 122 tonnes in 2004 to about 84 tonnes in 2011, and that at the cut-off date on 27 June 2011, between 54 and 87 tonnes of PFOS in fire extinguishing foam were still being stored. After this date, the fire extinguishing foam containing PFOS, must be destroyed.

In 2005, all fire extinguishing foam containing PFOS from DONG's offshore installations in Denmark was destroyed. In a letter of 16 May 2011, the Danish EPA has informed the Danish Emergency Management Agency, the safety industry and the largest dealers of fire extinguishing foam that PFOS, after 27 June 2011, must no longer be found in fire extinguishing foam, and has asked to have this information further communicated to customers and collaboration partners together with information that the municipality must classify waste and provide instructions as to where to dispose of the waste.

TABLE 10
PFOS IN ARTICLES IN USE AND IN WASTE IN THE EU (BASED ON [12])

Articles	Amounts used in the EU	Lifetime	Amounts in articles in use in the EU in 2012	PFOS concentration in waste	PFOS amounts in waste in the EU in 2012
Carpets	Before 2002, 146 tonnes of PFOS were used annually in 1.7 million tonnes of carpets, i.e. the average content of PFOS in these carpets was 88 ppm.	14 years	About 584 tonnes of PFOS in 2012, corresponding to 4 years consumption in the period up to 2002.	It is assumed that the concentration of PFOS in the total amount of carpets disposed of is 75 ppm as not all carpets contain PFOS	About 146 tonnes of PFOS in a total waste fraction of 1.9 million tonnes of carpets (will continue at this level until 2016).
Leather upholstery in furniture and car interiors	Until 2002, about 5.7 tonnes of PFOS in 71,342 tonnes of leather upholstery were used annually (3% of the market for leather upholstery). Leather furniture is assumed to represent 50% whereas vehicles make up the remaining 50%.	10 years	0 tonnes (assuming that everything is disposed of by 2012).	PFOS represents about 0.04% of the used leather, and leather represents 20% of upholstery, i.e. PFOS represents 80 ppm in leather upholstered articles treated with PFOS	0 tonnes (assuming that everything is disposed of by 2012).
Other textiles, cardboard and paper	It is assumed that PFOS has been used for these but the volumes are not indicated.	Paper: 1 year Textile: 4 years	0 tonnes (assuming that everything is disposed of in 2012).	Not stated.	0 tonnes (assuming that everything is disposed of in 2012).
Fire extinguishing foam	About 18 tonnes/year until 2006. About 144 tonnes were accumulated in the EU in 2006.	15 years	0 tonnes (requirement that all stocks be destroyed as at 27 June 2011).	Typically 0.5-1.5% in the foam but there are also examples of concentrations up to 10%.	0 tonnes (requirement that all stocks be destroyed as at 27 June 2011).

2.3.3.4 Current PFOS use

The production and marketing of PFOS for a number of specific uses have so far been allowed in the EU under certain conditions. These conditions are stated in section 2.2.4.

The study from 2011, carried out for the European Commission, estimates the current PFOS uses allowed in the EU as follows: surface treatment in the metals industry (6.5 tonnes); film, paper and plate in the photographic industry (0.6 tonnes); semiconductor industry (9 kg); and hydraulic fluids in the aviation industry (0.7 tonnes).

Of these uses, there is specific knowledge about the use of PFOS in non-decorative hard chromium plating in Denmark. Around the year 2010, 10-28 kg of PFOS was used annually in hard chromium

plating in Denmark. In hard chromium plating, a thin layer of chromium is applied electrochemically to the surface of metals. The PFOS substances were used to limit the formation of Cr (VI) aerosols, which are considered of concern in terms of both occupational health and safety and the environment. The most commonly used PFOS substance for this purpose was tetraethylammonium perfluorooctanesulfonate (CAS no. 56773-42-3). This chemical substance is typically found in preparations with a concentration of 5-10%; e.g. Fumetrol® 140. PFOS is still being used for this purpose by about 5 enterprises in Denmark (May 2012), and there are currently no plans to phase out PFOS. PFOS is used in recirculating systems without wastewater drainage outlet. The substances are decomposed gradually in the baths and the baths are subsequently disposed of by *Kommunekemi* (a treatment plant for hazardous waste).

In a project under the programme *"Miljøeffektiv Teknologi – Substitution af problematiske kemikalier*" (environmentally effective technology - substitution of chemicals of concern) [13] feasible chemical and physical alternatives to PFOS were developed with support from the Danish EPA in 2009-2011. The environmental performances of these are currently being evaluated.

Previous Danish inventories do not contain specific data on the use of PFOS in Denmark for other allowed uses. Extracts from the Product Register in April 2012 confirm the use of PFOS in hard chromium plating.

A survey of the chemical substances in cleaning products for ovens, cookers and ceramic hobs from 2010 (Survey 106/2010) did not find any contents of PFOS in the mixtures analysed.

2.3.3.5 PFOS in food

Until 2011, analyses of PFOS in food have not been included in the Danish monitoring programme for organic pollutants in food from environment and industrial processes. In a recommendation of 17 March 2010 on monitoring of perfluoroalkyl substances in food, the European Commission recommends that Member States monitor the presence of perfluoroalkyl substances in food in 2010 and 2011.

In 2011, Denmark has analysed for PFOS (perfluorooctanesulfonate) in 43 samples, of which 8 samples of farmed fish (4 from land-based trout farms, and 4 from marine trout farms) and 35 other samples of animal origin (4 beef, 3 chicken and 28 pork) [9]. No concentrations of PFOS above the detection limit of 0.5 ng/g wet weight were found in the 35 samples of animal meat.

PFOS was found in a concentration of 0.53 ng/g wet weight (just above the detection limit) in a sample of farmed trout (from a marine fish farm), however the other samples from fish did not reveal any PFOS contents. Samples were also taken from wild fish, where PFOS was detected in all samples but at low concentrations far below the action level. [14]

2.3.3.6 Total human exposure

There are no surveys available on the total intake of PFOS with food in Denmark.

According to an overall health assessment of chemical substances in indoor climate from selected consumer products, carried out as part of the Danish EPA's survey of chemical substances in consumer products (no. 75/2006), adults are primarily exposed to PFOS through inhalation, while children are primarily exposed through dust [15]. On the basis of body weight, children ingest far more than adults (5-10 times). Indoor climate therefore seems to be the most significant source of exposure to these substances. With a dust intake of 100 mg/day, the daily exposure for a child will, on average be 200-2,000 ng/PFAS/day and maximum 8-50 µg PFAS/day, or 0.8-5 µg PFAS/kg lgv/day (there are no specific data for PFOS). The Acceptable Daily Intake (ADI) for perfluoroalkyl compounds is 3 µg/kg lgv/day. Intake is only unacceptable in incidents of maximum exposure.

However, the survey concludes that our knowledge about the toxicological properties of PFAS is limited.

Surveys of the 1,076 Danish pregnant women published in 2008 (as part of studies into the effect of PFOS and PFOA on the foetus) showed an average mean content of PFOS in blood plasma, at the start of the pregnancy, of 35 ng/ml. The level of PFOS in the blood was relatively stable throughout the pregnancy and correlated positively with the intake of red meat, animal fats, and snacks (e.g. popcorn and crisps), whereas the level correlated negatively with the intake of vegetables and poultry. This suggests that intake from food, at least previously, has been a significant source of PFOS intake in Denmark. [16]

A study from 2011 of 652 Danish males on the connection between exposure to PFOS and PFOA and the risk of cancer, found only intake of eggs to correlate positively with the level of PFOS in the blood plasma [17]. In overall terms, these results suggested that diet is not the primary source of exposure in Denmark. The results also suggested a geographical variation in the source of exposure in Denmark, in that people residing in Aarhus had significantly higher levels of PFOS in their blood plasma than people residing in Copenhagen.

2.3.3.7 PFOS substances in the environment

A number of studies exist of the presence of PFOS and other perfluorinated substances in the environment in Denmark.

A NOVANA screening survey from 2007 of PFOS and other perfluorinated compounds in the environment, as well as discharges from point sources, has identified the presence of a number of different PFAS compounds near point sources, and in freshwater and marine environments in Denmark.

Increased concentrations of PFOS locally in eel, e.g. from the Silkeborg Lakes and Odense Fjord, testify that local sources can impact on the environment.

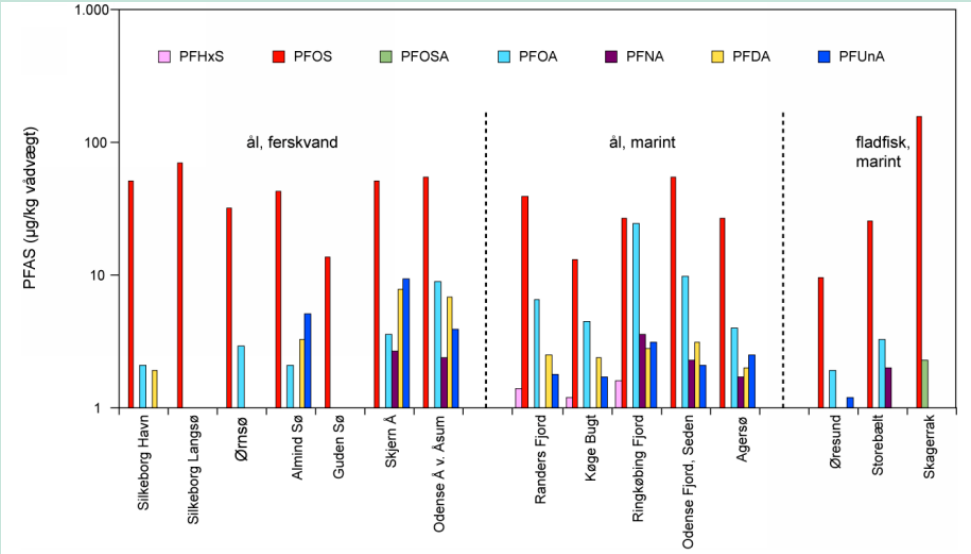


FIGURE 2
MEDIAN CONCENTRATIONS OF PFOS AND OTHER PERFLUORINATED COMPOUNDS IN THE LIVER OF FISH FROM MARINE AND FRESHWATER RECIPIENTS (µG/KG WET WEIGHT) [18]. ÅL, FERSKVAND = EELS, FRESHWATER; ÅL MARINT = EELS, SALTWATER; FLADFISK, MARINT = FLOUNDERS, MARINE

In point sources such as wastewater treatment plants, industrial plants and landfills, significant differences in concentration levels have been observed between the different facilities. This suggests that wastewater treatment plants can be local sources of PFOS substances, as these substances were found not only in inlet water and sludge, but also in outlet water. By far the highest concentrations of PFOS were found in the outlet water from an industrial facility. However, in all cases, concentrations of PFAS in the outlet water were below the critical value where it presents a risk to aquatic organisms.

With regard to aquatic recipients, PFAS compounds were only detected in fish, and not in sediments and mussels from freshwater and marine environments.

The survey assesses the level of PFOS to represent an environmental risk especially to fish-eating birds and mammals at the highest trophic levels of the food chain, as most of the fish samples exceed the PNEC value of 17 µg/kg (predicted no-effect concentration) for PFOS in animal food. It should, however, be noted that only the liver and not the entire fish was analysed in the survey.

Studies of PFOS in the liver of seals, summarised by HELCOM in 2010, showed relatively high concentrations of PFOS in the Kattegat and inner Danish waters, compared with levels found in the Baltic Sea. The concentrations of PFOS in the liver of seal from Danish waters were in the interval 565 to 977 µg/kg. For herring, levels were more uniform across the region.

2.3.4 Hexabromobiphenyl, and tetra-, penta-, hexa- and heptabromodiphenyl ether

Among the new substances covered by the Convention are five substances from the group of brominated flame retardants.

2.3.4.1 Historical consumption in Denmark and the EU

In the survey of brominated flame retardants from 1999, total Danish consumption of PBDEs was estimated at 30-120 tonnes. More or less all of the PBDEs were imported in articles. The report does not include individual estimates for the three types of technical PBDE. On the basis of the general global consumption of these three types of PBDEs, it will have to be assumed that by far the majority of these were technical decaBDE. In 2001, a total of 7,500 tonnes of technical pentaBDE, 3,790 tonnes of technical octaBDE, and 56,100 tonnes of technical decaBDE were used globally.

It appears from the inventory of brominated flame retardants that considerable import and export of articles are taking place, and that around 90% of the brominated flame retardants in articles sold in Denmark were imported in finished articles. It must be assumed that the consumption pattern in Denmark reflected the general consumption pattern in the countries from which the articles were imported.

Since knowledge of historical consumption is significant for our understanding of where and in what quantities the brominated flame retardants covered are present in articles that are used today, as well as in the waste stream, and since no specific inventories are available of the historical consumption of these substances in Denmark, reference will be made to a study performed in 2011 for the European Commission [12]. The results of this study are summarised in Table 11.

Technical pentaBDE. According to the inventory by the European Commission, total consumption of technical pentaBDE in the EU, including imports of articles fell from around 1,100 tonnes in 1994 to 200-250 tonnes in 2000, and subsequently ceased altogether in 2004. Around 95% of the technical pentaBDE was used in the EU in polyurethane foam in mattresses and upholstered furniture. Around half was used in vehicles: in the seats, dashboard, steering wheel, roofs, sound insulation and door panels. Concentrations in polyurethane foam varied from around 2-18%. The remaining 5% was used in other plastics (in electronics in particular), and in rubber, paints and varnish, textiles, and hydraulic oils. With regard to the part of the consumption linked to vehicles, there is no

basis for assuming that Danish consumption figures vary significantly from those of the other EU countries.

The accumulated consumption of technical pentaBDE in the EU is estimated at around 15,000 tonnes. Of these, around 8%, or around 320 tonnes, are estimated still to be in use in 2010. If consumption and disposal patterns for technical pentaBDE in Denmark correspond to the European average, there should be around 3 tonnes of technical pentaBDE left in articles that have been used in Denmark. This estimate is based on the assumption that quantities per inhabitant are the same in Denmark as in the rest of the EU. Around three-quarters of these are in vehicles produced before 2004, and around one-quarter is in polyurethane foam which was previously used in mattresses and upholstered furniture. Although this is an uncertain estimate, it gives us an idea of the order of magnitude of quantities. The study carried out for the European Commission assesses that more or less all of the technical pentaBDE in vehicles in the EU will be disposed of by 2016. Since cars are used for relatively longer periods of time in Denmark, it will probably take somewhat longer before all technical pentaBDE has been disposed of in Denmark.

Technical octaBDE. According to the study carried out for the European Commission, in 1999 consumption in the EU, including imports of articles, was around 1,800 tonnes. From 1970 to 2005, the accumulated consumption in the EU was at around 17,000 tonnes, of which an unknown quantity was exported. Globally, around 95% of technical octaBDE are used in ABS plastics, which are typically used in cabinets for electrical and electronic equipment. The remaining 5% are used in other types of plastic, also used in electrical and electronic equipment. Technical octaBDE was typically used in concentrations of 10-18%.

As the articles in which octaBDE has been used have a relatively short lifetime, it is assumed that the majority of the quantity in circulation has been disposed of today. At EU level, in 2010, it was estimated that around 128 tonnes of waste electrical and electronic equipment (WEEE) was disposed of, and that more or less everything will have been disposed of by 2012. Since the technical octaBDE present in Denmark is primarily in imported electrical and electronic equipment, there is no basis for assuming that consumption in Denmark has been considerably different from consumption in the EU. It will therefore have to be assumed that a few tonnes of the remaining technical octaBDE will be disposed of over the next couple of years.

Hexabromobiphenyl (hexaBB). According to a report on the circulation of brominated flame retardants in Denmark in 1999, the only polybrominated biphenyl (PBB) used with certainty was technical decaBB (with ten bromine atoms). According to data from the OECD, the technical decaBB did not contain hexaBB. Considering that hexaBB has not been used since the 1970s, it is likely that only an insignificant number of articles containing hexaBB remain.

TABLE 11
TECHNICAL penta- AND octaBDE IN PRODCTS AND IN WASTE, IN THE EU (BASED ON [12])

Articles	Amounts used in the EU	Assumed life time	Amounts in articles in use in the EU in 2012	Concentrations in waste	Quantities of waste in the EU
Polyurethane foam	Total consumption of pentaBDE in the EU in the period 1970-2000: about 15,000 tonnes. Of these, 95% for polyurethane foam. Of this, around 60% in upholstered furniture and mattresses, 36% in vehicles, and 4% for other uses. Polyurethane foam typically contains 2-18% pentaBDE.	Vehicles: 12 years Upholstered furniture 10 years	Car interiors: in 2012 around 97.4 tonnes accumulated pentaBDE, decreasing to zero tonnes in 2016. Upholstered furniture: in 2012 around 112 tonnes accumulated pentaBDE, decreasing to zero tonnes in 2014.	2-18% pentaBDE in polyurethane foam. Calculations are based on an average of 4% for car interiors and 3.8% for upholstered furniture. The maximum content per vehicle is stated at 150 g pentaBDE.	Car interiors: around 12 tonnes pentaBDE in 2012. Upholstered furniture: around 75 tonnes pentaBDE in 2012.
Electrical and electronic equipment	Around 4% of the 15,000 tonnes of total consumption of pentaBDE in the period 1970-2000. The uses shown include printed circuit boards.	9-15 years	Not stated.	Not stated.	Not stated.
Electrical and electronic equipment	Total accumulated consumption in the EU in the period 1970-2005: 16,590 tonnes octaBDE. Around 95% of octaBDE was used in ABS plastics in concentrations of 10-18%. The remaining 5% was used in other plastic types. More or less all plastics containing octaBDE were used in electrical and electronic equipment.	9 years	Around 128 accumulated tonnes octaBDE in 2012. It is assumed that all will be disposed of by 2012.	10-18% in plastic components containing octaBDE.	128 tonnes octaBDE in 2010; zero tonnes in 2012 (it is assumed that all octaBDE will disposed of by 2012).

2.3.4.2 PBB and PBDE in food

Analyses of PBDE in food are part of the Danish monitoring programme for organic pollutants in food from the environment and industrial processes. In 2010, samples of beef (54 samples), pork (46 samples), milk (10 samples), egg (7 samples) and lamb (4 samples) were examined for contents of PBDE [19]. All samples had contents just below the recommended tolerance level of 100 ng/g fat determined by the Danish Veterinary and Food Administration. The same was the case for all samples analysed in 2009.

The content of PBDE in food and the risk to the population have been assessed in several studies e.g. in Scandinavia and Germany. The most important conclusions have been summarised as follows by the Danish EPA: Intake of PBDE is through fatty foods such as fish and dairy products. The estimated intake of PBDE from dairy products is 0.09–0.17 µg per person per day. The estimated intake of PBDE from fish is 0.1–0.36 µg per person per day. For food in general, the preliminary estimate of total intake is 0.2–0.7 µg PBDE per day. For a person weighing 60 kg, this corresponds

to an intake of 3–12 ng/kg of body weight. This level is assessed to be far below the limit for risk of harmful effects.

2.3.4.3 Total human exposure

To some extent, PBB and PBDE evaporate to indoor air, and people using rooms in which these substances are present, will be exposed to the substances.

In an overall health assessment of chemical substances from selected consumer products in indoor climate, carried out as part of the Danish EPA's survey of chemical substances in consumer products (no. 75/2006), the calculated exposure to PBDE is compared with a reference dose (RfD) 2, 3 and 10 µg/kg/day for deca-, octa- and pentaBDE, respectively [15]. According to the assessment, only breastfeeding babies can reach exposures close to the reference doses. Therefore, on the basis of current knowledge, there are no health-related problems for babies from exposure through indoor climate. This exposure is probably the most important source of the mother's exposure and thus also of the contents of PBDE in breast milk.

An exposure study from 2009 of pregnant women and their unborn children, which included measurement of PBDEs in house dust as well as in maternal and umbilical cord plasma, placental tissue, and breast milk from 51 pregnant women in the greater Copenhagen area, showed that the total internal exposure to PBDEs is of the same order of magnitude in Denmark as in other European countries, and of around one order of magnitude lower than in North America [20]. Another finding was that PBDEs were present in all of the umbilical cord samples, which suggests the substances are transported via the placenta resulting in exposure to PBDEs of the foetus. This transport, as well as the general distribution in the body, was found to depend on the degree of bromination of the PBDEs. The lower-brominated PBDEs are transported most efficiently. Direct correlations between the levels of PBDEs in house dust and the various biological matrices indicated that house dust is a significant source of PBDE exposure in Denmark.

2.3.4.4 PBDE and PBB in the environment

In Denmark, the most commonly used PBDEs have been found in sediments, mussels, and fish. A study from 2000 showed that the highest levels in sediments and mussels were to be found at stations near harbours and waste disposal sites, as illustrated in the figure below.

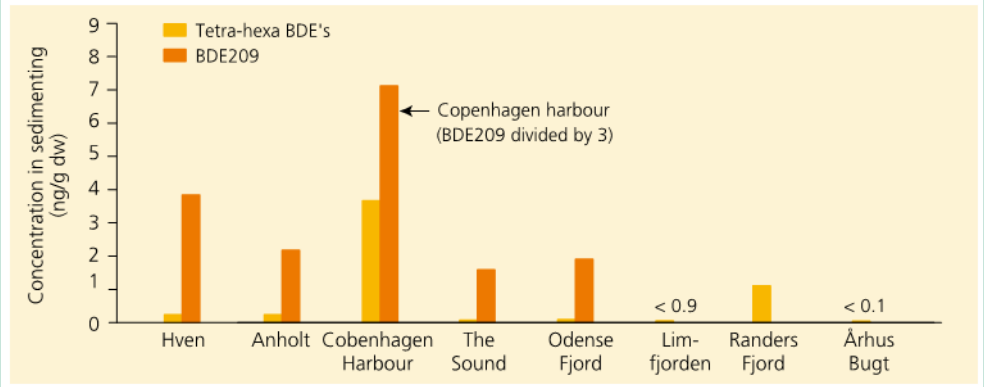


FIGURE 3
CONCENTRATIONS OF PBDE IN MARINE SEDIMENTS IN DENMARK. BDE 209 IS decaBDE. [21]

The results from the NOVANA monitoring in 2009 revealed that the substances BDE#47 (tetraBDE congener), BDE#99 (pentaBDE congener), and BDE#154 (hexaBDE congener) were the most frequently found substances of the brominated flame retardants studied in mussels, fish, and sediments in marine waters. BDE#47 was found in around 75% of the samples examined.

A survey of 25 Danish lakes in 2008 showed that, in the majority of the samples examined, of both mussels and sediments, BDE#47 (tetraBDE), BDE#99 (pentaBDE), and BDE#100 (pentaBDE) were present at levels at or below the detection limit.

No environmental criteria for PBDEs have yet been established within the context of OSPAR. Only one of the substances, BDE#47 is subject to a quality criterion within the Norwegian classification system, and the Danish results will be assessed on the basis of this. In around 4% of the samples of mussels examined, the content of BDE#47 was at a level corresponding to the classification "moderately polluted". BDE#47 and BDE#99 were observed in around half of all sediment samples in 2008, however in all samples the concentrations were low. [22]

2.3.5 Unintentional formation of dioxins, HCB, PCB, and pentachlorobenzene

2.3.5.1 Emissions of dioxins

So far, focus has been on inventories and limitations of dioxin releases (PCDD/PCDF). With regard to incineration processes, measures to limit the formation and release of dioxins will also have an impact on the formation and release of the other unintentionally formed POPs.

The trend from 1990 to 2010 in total releases of dioxins (PCDD/PCDF) to the air is illustrated in Figure 4 and is based on national inventories submitted to UNECE.

Denmark incinerates waste with energy recovery, and waste incineration plants are therefore included with other energy production. In the period 1990 to 2010, total emissions from this category fell from 31 g I-TEQ/year in 1990 to 1.2 g I-TEQ/year in 2010 (4% of the 1990 level). The emissions factors applied for waste incineration are based on actual measurements at Danish incineration plants, summarised in a 2010 survey of emissions from district heating plants. The large reduction in emissions is a result of tightened emission limit values, which means that all waste incineration plants today have dioxin treatment technology.

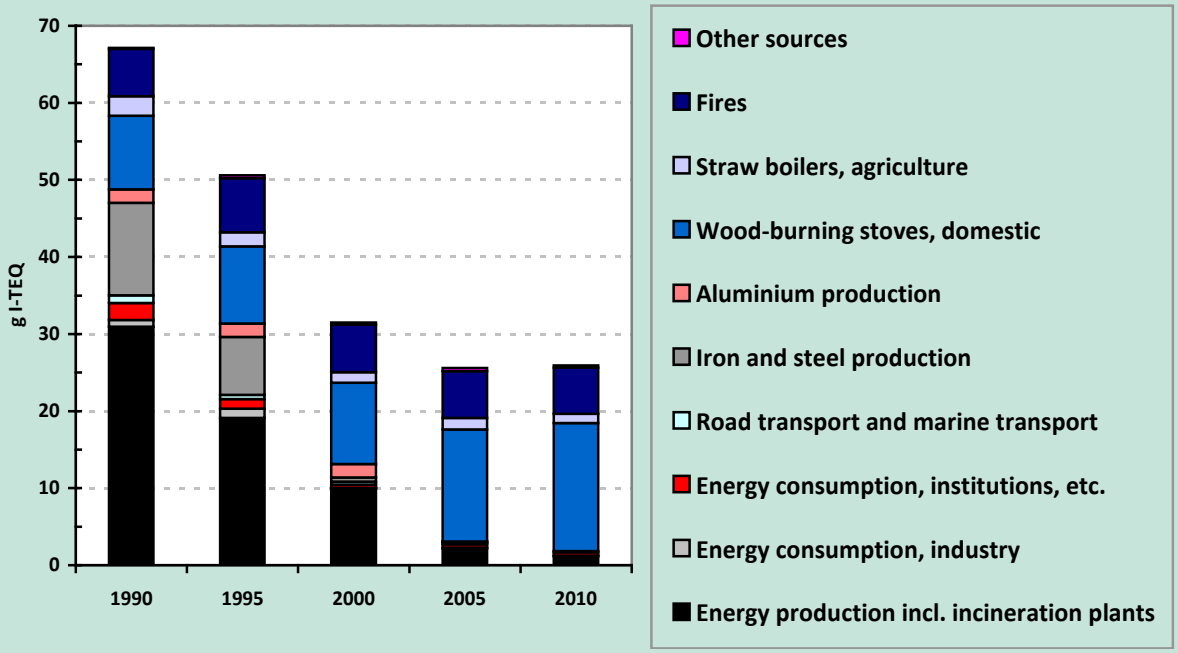


FIGURE 4
THE TREND IN EMISSIONS OF DIOXINS (PCDD/PCDF) TO THE AIR FROM 1990 TO 2010. SOURCE: DEPARTMENT OF ENVIRONMENTAL SCIENCE, AARHUS UNIVERSITY.

Emissions from the production of iron, steel and aluminium fell in the period from a total of 14 g I-TEQ/year to zero. In 1990, this source category accounted for 20% of total emissions to the air. The recent drop is due to the fact that remelting aluminium, iron and steel has ceased in Denmark. Steel plates are still being produced in Denmark, however they are being produced from steel blocks cast in Russia.

In 2010, the largest source category was wood-burning stoves and other boilers in private households (64% of total emissions), straw burners and similar on agricultural properties (5% of the total figure), and fires (23% of the total figure).

The estimate for emissions from fires is very uncertain. The national inventories are based on statistics of the number and the size of fires, however the emissions factors applied, which are general for inventories for UNECE, are highly uncertain.

2.3.5.2 Residential sources - continued studies

Part of in the 2006 implementation plan was to carry out continued studies on emissions of dioxin and other pollutants from wood-burning stoves and smaller boilers with the aim of identifying possible measures to reduce emissions.

Wood-burning stoves and small straw boilers on agricultural properties were previously assessed to be the most significant sources of dioxin and HCB emissions in Denmark. The continued efforts within this area have included further studies of the emission of dioxin, PAH and particles from wood-burning stoves (National Environmental Research Institute, 2005), as well as identification and testing of flue-gas cleaning and/or improved combustion technologies for retrofitting on existing wood-burning stoves and boilers in Denmark (Environmental Project 1393/2011). Furthermore, in 2007 a Statutory Order was issued regulating air pollution from wood-burning stoves and similar, smaller fixed installations with a rated thermal input below 300 kW. (Statutory Order no. 1432 of 11 December 2007). This Statutory Order sets the emission limit values for particles.

Studies of emissions from wood-burning stoves have shown large variations in emissions of dioxins, but no clear answers to whether there is any correspondence between the size of emissions, on the one hand, and on the other hand, type of installation, firewood and consumer habits. Similarly, there is no clear correspondence between emissions of dioxin and emissions of PAH and particles, which presumably is due to differences in formation processes. It must therefore be expected that good combustion with excess oxygen and high temperatures will promote the formation of dioxins, but minimise the emission of PAH and particles, whereas poor combustion with lack of oxygen and low temperatures will promote the formation of PAH and particles and minimise the formation of dioxin.

A study of flue-gas cleaning and improved combustion technologies for wood-burning stoves included small electrostatic filters and in addition, for example, a catalytic converter system. Identification of the technologies included in the study was found by invitation to manufacturers of relevant equipment throughout the EU. The study concluded that none of the technologies in the study were able to reduce emissions of dioxins. [23]

A study of emissions from wood-fired stoves and boilers from 2010 took a closer look at emissions factors and consequently proposed differentiated emission factors of 800 ng, 300 ng and 150 ng I-TEQ/GJ respectively for old stoves, modern stoves, and ecolabelled (i.e. with the Nordic Ecolabel) modern stoves [24].

A clarification process is ongoing with regard to the emissions factors applied and their significance for national inventories of dioxins from wood-burning stoves and other smaller boilers.

2.3.5.3 Flue-gas cleaning at crematoria

In the action plan from 2006, emissions of POPs from crematoria were to be limited through a requirement for mercury removal from flue gas.

Statutory Order no. 1481 of 12 December 2007 introduced a requirement for all crematoria in Denmark to be equipped with filters that remove mercury etc. from the flue gas. By 1 January 2011 these filters had been fitted at all crematoria. The filters in question use activated carbon in the flue-gas cleaning process, which also prevents the majority of dioxins and other unintentionally formed POPs from being emitted into the air. The effectiveness of the filters in terms of dioxins has not been measured, however experts estimate that using the technology in question reduces emissions by at least 90%. The estimated emissions in 2000 were 0.04 g I-TEQ, which means that even before the new filters were fitted, crematoria constituted only a small source of dioxin releases.

2.3.5.4 Diffuse burning of waste

Incineration of combustible waste is only allowed at installations approved for this purpose, see section 46 of the Danish Statutory Order on Waste. Furthermore, as a general rule it is prohibited to burn waste in the open.

However, under the municipal commercial waste regulations, the municipal council can lay down provisions that allow for the burning of garden waste etc. from nurseries, nature management activities, etc. Furthermore, under the municipal household waste regulations, the municipal council can lay down provisions that citizens and land owners may, in limited circumstances, burn garden waste such as the burning of garden waste on bonfires to celebrate midsummer.

As a general rule, straw or similar agricultural by-products may not be burned off in fields or on untilled land, see Statutory Order on a ban on field burning of straw etc. *("bekendtgørelse om forbud mod markafbrænding af halm m.v.")*. A few exemptions from the ban exist in the Statutory Order, e.g. for straw used to cover beet etc.; smaller amounts of straw waste; wet straw bales; etc.

2.3.5.5 Unintentional formation and emissions of PCB and HCB

The 2006 implementation plan included an action to assess whether there are any overlooked sources of emissions of unintentionally formed HCB and PCB into air, water or soil in Denmark.

It has been recognised in recent years that in most processes in which dioxins are formed via *de novo synthesis*, unintentional formation of other substances such as PCB and HCB also takes place.

A study performed under the auspices of the Nordic Council of Ministers, with participation from the Danish Centre for Energy and Environment [25], estimates emissions of PCB to the air in Denmark at around 84 kg per year. This study identifies energy production (coal) and road transport as probably the most important sources of the emission of unintentionally formed PCB to the air in Denmark.

Similarly, emissions of HCB to the air in Denmark have been estimated at around 15 kg per year, and wood-burning stoves (energy production, diffuse sources) and waste incineration plants have been identified as probably the most important sources of emissions of HCB to the air in Denmark (see Figure 5). It is therefore apparent that the most important source of emissions of HCB is wood-burning stoves, as is also the case for dioxins.

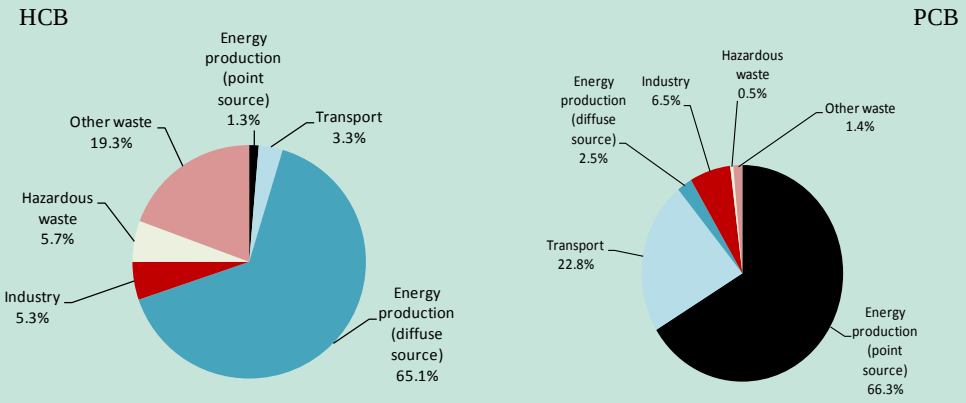


FIGURE 5
BEST ESTIMATE OF EMISSIONS OF UNINTENTIONALLY FORMED HCB AND PCB IN DENMARK, IN 2005 (BASED ON [25]).

It should be stressed that the statistical basis for these estimates is incomplete, and that, with the current knowledge, it is not possible to prepare a complete inventory of existing unintentional emissions of PCB and HCB. Thus, no estimates have so far been produced of the emission of these substances into water and soil, and the available estimates for emissions into air can only be considered a rough estimate of the probable size of emissions. The study concludes that the knowledge basis is insufficient for any official reporting on emissions into air, water or soil.

A study under the sixth EU framework programme [26] estimates the total emissions of HCB in the EU27 to be at around 10 tonnes annually. Seen in relation to population figures, this estimate is the same as the estimate in the study mentioned above carried out for the Nordic Council of Ministers.

The national inventories for UNECE only contain HCB emissions from some of the source categories, for which emissions factors have been established. Total emissions in 2010 were 0.61 kg. The largest of the sources for which inventories are available, is energy production, including waste incineration, which was estimated at 0.41 kg. There are no inventories for wood-burning stoves and smaller combustion plants, chemical industry and fires.

The national inventories for UNECE do not contain inventories of emissions of PCB.

2.3.5.6 Formation of pentachlorobenzene

It must be assumed that unintentional formation of pentachlorobenzene (PeCB) takes place in most processes in which dioxins and HCB are formed. There have been no specific studies in Denmark aimed at identifying the relevant processes and estimating the quantities in question. Therefore, no knowledge exists about the formation and emission of pentachlorobenzene to the environment in Denmark. The national inventories for UNECE do not contain statements of emissions of pentachlorobenzene.

2.3.5.7 Dioxins and dioxin-like PCBs in food and animal feed

The content of dioxins and dioxin-like PCBs in food and animal feed is subject to regular monitoring. Studies of food have included both products of animal origin (mainly fats), egg, fish, and vitamins as stated in Table 12 below. Non-dioxin-like PCBs in food are covered in section 2.3.2.10.

New limit values for content of dioxins and dioxin-like PCBs have been established per 1 January 2012. The results mentioned from the different projects have been assessed against the limit values which applied at the time of their measurement. The table consequently provides both the limit values in force when the samples were analysed and the new limit values.

There continue to be issues with regard to too high a content of dioxins in certain food products. By far the majority of measurements are below the limit values, however a few exceed the values. In the cases in which limit values have been exceeded, the Danish Veterinary and Food Administration, partly in cooperation with the Danish AgriFish Agency (now the Danish Veterinary and Food Administration) and the Danish EPA, has followed up on measurements and have endeavoured to identify the cause of the exceeded values and to rectify it.

Similar efforts have also been carried out in several cases, if measurements have exceeded the so-called action levels. Action levels is a concept which has been introduced by the EU along with the actual limit values. Action levels reflect concentrations for which the EU recommends that more detailed studies are performed to identify the source of contamination and to take measures for its reduction or elimination. Action levels have been defined separately for dioxins and for dioxin-like PCBs, and are somewhat lower than the actual limit values.

For example, in September 2009 dioxin values were observed which were near, but not exceeding, the action level for eggs from free-range organic hens. The Danish AgriFish Agency inspected the farm and took three samples. No observations were made of excess contents of dioxins or dioxin-like PCBs in the animal feed. However, a new analysis of eggs from the same stock showed the same pattern of high contents of dioxins. The Danish EPA was involved in the matter and analysed several soil samples from different sites on the farm. The content of dioxins in the soil was not particularly high, however the samples from the chicken run showed the same distribution of dioxin congeners as were found in the contaminated eggs. The conclusion was that the background level of dioxins in the soil was the source of the high content in the eggs [27].

It is a known issue that the content of dioxins and dioxin-like PCBs in horses and sheep (liver) may be at high levels. In 2011, the Danish Veterinary and Food Administration issued dietary recommendations warning against excessive consumption of horse meat.

Since 2004, there has been a ban on fishing for herring for human consumption in all of the Baltic Sea east of longitude 16°. Measurements of herring from 2009-2011 show that limit values are being complied with. As of 1 January 2012, fishing for herring for human consumption is once more allowed. This applies for the part of the Baltic Sea east of Bornholm which is termed ICES 25. However, there is still a ban on fishing for herring for human consumption in the parts of the Baltic Sea that lie east and north of ICES 25, i.e. the offshore areas termed ICES 26-32.

Moreover, there are limitations on the use of salmon harvested from the Baltic Sea. These limitations apply for all of the area east of Zealand and Falster, i.e. ICES 24-32. These limitations mean that salmon of more than 5.5 kg cannot be sold for human consumption, whereas smaller salmon of between 2-5.5 kg may only be sold after all visible fat has been removed. The measurements of salmon from 2011 (from the eastern part of the Baltic Sea), which are shown in the table, confirm the necessity of maintaining these limitations.

Parallel to the control of food, controls are also carried out for animal feed. Annually, around 50 samples are taken, which are checked for contents of dioxin and PCB.

TABLE 12
MEASURED CONTENTS OF THE SUM OF DIOXINS AND DIOXIN-LIKE PCBS (TOTAL WHO-TEQ) IN DANISH FOOD SAMPLES FROM 2009-2011. THE VALUES STATED ARE MEAN VALUES [28].

Products from	Year	No. of samples	Sum of dioxins and PCB–TEQ (mean values) pg/g fat or fresh weight	Limit value in force when samples were analysed pg/g fat or fresh weight**	Limit value as of 1 January 2012 Pg/g fat or fresh weight
Sheep fat	2009	3	2.2 (fat)	4.5	4.0
Chicken fat	2009/10	6/5	0.35/0.53 (fat)	4.0	3.0
Milk, raw	2009/10	20/20	0.60/0.52 (fat)	6.0	5.5
Beef fat	2009/10	99/102	0.91/0.88 (fat)	4.5	4.0
Pork fat	2009/10	100/98	0.24/0.24 (fat)	1.5	1.25
Eggs, yolk	2009/10	21/20	1.25/1.1 (fat)	6.0	5.0
Trout, land-based fish farms	2009/10	5/5	0.27/0.46 (fresh weight)	8.0	6.5
Salmon	2009	5	0.71 (fresh weight)	8.0	6.5
Flounder	2009	4	0.75 (fresh weight)	8.0	6.5
Tuna	2009	2	1.2 (fresh weight)	8.0	6.5
Eel	2009	3	4.4 (fresh weight)	12	10
Herring (from eastern Baltic Sea)	2009/10	10/23	2.7/3.8 (fresh weight)	8.0	6.5
Fish oil	2009/10	6/6	0.93/0.94 (fresh weight)	10	6
Cod liver	2009	2	17 (fresh weight)	8.0	20.0
Retail fish (monkfish, salmon, pangasius, tilapia, halibut, shark, and others)	2010	18	0.18 (fresh weight)	8.0	6.5
Cod liver, smoked	2010	1	11 (fresh weight)	8.0	20.0
Salmon, smoked	2010	2	0.85 (fresh weight)	8.0	6.5
Sheep liver	2010	4	20 (fat)	12	10
Horse fat	2010	2	11 (fat)	3.0	4.0
Eggs - from battery hens	2010	6	0.51 (fat)	6.0	5.0
Eggs free-range	2010	6	0.76 (fat)	6.0	5.0
Eggs - organic	2010	8	1.7 (fat)	6.0	5.0
Eggs - sold at farm	2010	7	3.6 (fat)	6.0	5.0
Egg powder - imports	2010	6	0.6 (fat)	6.0	5.0
Vitamin products, containing vitamin A palmitate	2010	4	0.11 (fat)	- *	- *
Herring (from eastern Baltic sea - large)	2009-2011	31	3.6 (fresh weight)	8.0	6.5
Salmon (from eastern Baltic sea - > 5 kg, visible fat removed)	2011	12	8.1 (fresh weight)	8.0	6.5
Salmon (from eastern Baltic sea - 2-3 kg)	2011	3	8.5 (fresh weight)	8.0	6.5

*** There are no limit or action values for vitamins.**

****Commission Regulation (EC) No 1881/2006 setting maximum levels for certain contaminants in foodstuffs (not in force)**

The EU has a well developed control system as well as an alert system, in which the authorities in the individual Member States cooperate. When problems are detected, the information is quickly shared with the other countries. This was the case e.g. in connection with the dioxin incident in January 2011, in which a Danish producer of chicken eggs for breeding had bought animal feed from Germany which was suspected of containing too much dioxin [29]. The Danish Veterinary and Food Administration received information via the EU alert system and could therefore contact the relevant Danish producer so as to limit any harmful consequences. Later studies however revealed that, in the Danish case, there had been no problems with the imported animal feed. The level of dioxins of was not too high.

2.3.5.8 Intake of dioxins and dioxin-like PCBs in the population

In the 2006 implementation plan, it was estimated that the exposure to dioxins and dioxin-like PCBs in the general Danish population was high. No more recent estimates of total intake of dioxins are available, but the National Food Institute is in the process of preparing a new statement expected to be published by the end of 2012.

In the most recent estimate from 2004, for adult Danes, the average intake of dioxins and dioxin-like PCBs was calculated to be between 5.6 and 7.7 pg WHO-TEQ/kg body weight/week [30]. The average value for the 5% of the population that had the highest intake (the 95% percentile) was between 12.6% and 25.9 pg WHO-TEQ/kg body weight/week.

If intake from fish is excluded, the estimated average intake was 7.7 pg WHO-TEQ/kg body weight/day for children aged between 4 and 14 years, and 10.5 pg WHO-TEQ/kg body weight/day for children aged between 4 and 6 years. The 95% percentile for the two groups of children was 14.0 pg and 16.8 pg WHO-TEQ/kg body weight/day, respectively, corresponding to 100% and 120% of TWI, respectively. For children who eat fish, the level was deemed to be even higher.

It was estimated that more than 90% of the dioxin exposure was through food, of which 80% food of animal origin.

As mentioned above, a new estimate will be published towards the end of 2012, which can clarify whether there has been a decrease in the intake of dioxins and dioxin-like PCBs in the Danish population.

2.3.5.9 Dioxins and dioxin-like PCBs in breast milk

The 2006 implementation plan showed the trend in the content of dioxins and dioxin-like PCBs in breast milk from 1986 to 2004. Overall, the period from 1986 to 1993 saw a clear decrease in the content of dioxin and dioxin-like PCB. From 1993 up to 2004 there was a decrease of 48% for dioxin, 67% for dioxin-like PCB and 58% for the sum of dioxin and dioxin-like PCB.

Since phasing-out the use of PCB began in the 1980s, a reduction in human exposure to PCB has been observed. Because dioxin-like PCB is part of overall PCB levels, the fall in dioxin-like PCB must be seen primarily as a consequence of the general fall in PCB levels stemming from the phase-out of the use of PCB. The fall in exposure to dioxins must be ascribed to efforts to reduce emissions of dioxins both at Danish and international levels.

The amount of dioxin in breast milk can be considered as an indicator of the actual exposure of the population, and it should be noted that, despite the significant drop in emissions in Denmark, in 2004 the level was still around 50% of the level in 1986, which was very high. No more recent studies are available to clarify developments since 2004.

2.3.5.10 Dioxins in the environment

The presence of dioxins in the environment is being monitored on an ongoing basis, and the 2006 implementation plan included an in-depth description of the presence. The following therefore only includes a brief description of some of the main conclusions from recent years' monitoring.

In 2010 significant differences in the presence of malformations in eelpout fry were observed. Most of the areas in which the increased presence of malformations was observed were coastal areas influenced by anthropogenic urban and industrial activities. It is therefore likely that the increased presence is due to the impact of hazardous substances, including dioxins, PAH or heavy metals. Other studies of different types of impact on eelpout have revealed that the relationship between cause and effect is less clear when comparing the degree of impact from PAH and dioxin-like substances to the effects observed in the different areas. The likely explanation is that the observed signs in eelpout cannot be attributed exclusively to specific substance groups. Rather, these effects are due to impacts from complex mixtures of hazardous substances that can occur in the marine environment. None of the substances or effects in eelpout examined correlated directly with the levels of malformations or other forms of maldevelopment in the fry. The chemical analyses showed that all of the eelpout populations examined were negatively affected by dioxin-like substances as well as PAH.

Classification of the presence of hazardous substances in connection with monitoring is based on a Norwegian classification system. Using this classification system, 71% of the samples examined from mussels in 2008 was at a level corresponding to “background level” or "slightly contaminated"; and in 29% of samples, contents corresponded to the "moderately contaminated" level. In sediments, the content of dioxins in all samples was at a level corresponding to "in a very good state". More or less the same values were observed in the other years.

The geographic distribution of dioxins and dioxin-like (coplanar) PCBs in mussels is shown in Figure 6. The figure only shows small variation in total TEQ between the stations.

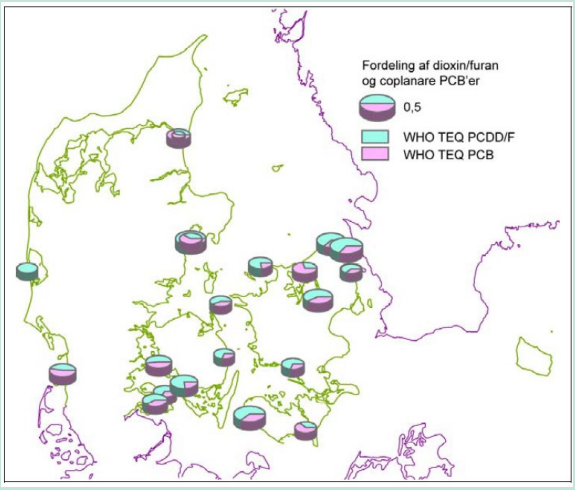


FIGURE 6
GEOGRAPHIC DISTRIBUTION OF DIOXINS AND DIOXIN-LIKE PCBS IN MUSSELS IN 2008, STATED AS THEIR TOXICITY EQUIVALENTS FOR PCB AND DIOXINS/FURANS, RESPECTIVELY, IN MUSSELS. CONCENTRATIONS OF UP TO 0.43 ng/kg WET WEIGHT OF THE SUM TOTAL-TEQ. [31]

2.3.5.11 Transboundary movement

As stated above, there are still problems with too high contents of dioxins in fish from the Baltic Sea. The 2006 implementation plan contained an action to improve our understanding of the circu-

lation of dioxins in the Baltic Sea. Studies of the presence of dioxins in the Baltic Sea, and of the continuous new additions of dioxins, are being carried out under the auspices of HELCOM, as well as by the individual countries of the region. According to inventories from HELCOM, there has been a general drop in the atmospheric deposition of dioxins over the past 10 years [32]. One of the issues addressed has been how quickly we can expect to see a decrease in the concentrations of dioxins in the pelagic zone as well as in biological organisms. Since dioxins are persistent, throughout the years large quantities have accumulated in the sediments.

Swedish studies in 2009 reported that atmospheric deposition continues to be the most significant source of dioxins in the Baltic Sea [33]. These studies also conclude that the atmospheric deposition is large enough to explain the current levels of dioxins in the pelagic zone. Some dioxins are released from the sediments, however the studies show that the primary source of dioxins in the sediments is atmospheric deposition. The studies under HELCOM have revealed that the largest contribution to atmospheric deposition of dioxins in the Baltic Sea originates from Poland and Russia. Continued Swedish studies under the research programme BalticPOPs will further elucidate the circulation of dioxins and other POPs in the Baltic Sea, as well as analyse sources of the current atmospheric contributions of dioxins.

2.3.6 Stocks, waste and contaminated sites

2.3.6.1 POP pesticides in waste and repositories

There has been no systematic monitoring of POP pesticides in waste products in Denmark except for in sewage sludge from public treatment plants. Up to and including the year 2003 the substances aldrin, dieldrin and endrin were included in the point source programme under NOVA2003. According to the point source report for 2003 there had been no observations of the three substances in either discharge or sludge from the treatment plants examined. Therefore it was decided to omit POP pesticides from the new monitoring programme when NOVA2003 was replaced by the NOVANA programme.

In 1961 the Ministry of Agriculture instigated a national collection of pesticide waste and pesticide residues which were deposited in Cheminova's "*Høfdedepot*" a repository on Harboøre Tange. It is uncertain which exact substances were deposited from the collection, but POP pesticides may have been included. Throughout the years, a number of actions have been undertaken to minimise discharges from the repository, and activities are ongoing to remove pollutants (primarily parathion) from the 22,000 m^2 area.

It is unlikely that there are stocks of old POP pesticides in Denmark today.

2.3.6.2 PCB in waste

The amounts of waste containing PCB are inventoried in the Danish EPA's Waste Information System ISAG. ISAG is based on reports from Danish waste treatment plants. Six waste codes specifically cover waste containing PCB.

The period from 1997 to 2004 saw a decreasing trend in amounts of waste containing PCB, however since 2004 amounts have been rising. The fact that amounts are increasing is deemed to be due to greater awareness about the existence of PCB in waste.

Almost all waste containing PCB is sent to *Kommunekemi* for incineration. The trend in the amounts of capacitors, transformers, and waste oils containing PCB which are disposed of at *Kommunekemi* is illustrated in Figure 7. Since 2004, no transformers have been disposed of at *Kommunekemi*. There is a gradual drop in the amount of capacitors throughout the period 1995 to 2005, however after this period amounts have been constant at a level corresponding to an average of 7 tonnes per year over the past 5 years. These figures indicate that there is still some capacitors left in circulation. Within the past 4 years there has been an increase in the amount of waste oils contain-

ing PCB, i.e. "waste oil containing PCB and <10% water", which is imported to Denmark for destruction.

The size of the capacitors does not appear from the figure, however the use of capacitors with a weight of more than 1 kg have been banned since 1995. A survey from 2000 of the amounts of PCB remaining in electrical equipment was launched with a view to finding out whether transformers and large capacitors had been disposed of by 1 January, as required. The report assumes that a modest amount of large equipment containing PCB was in use, and that some PCB may still be in use in small capacitors [34].

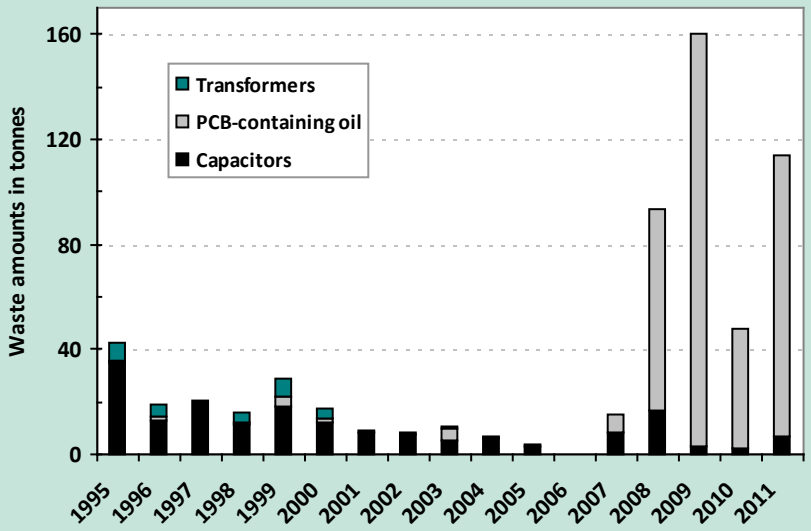


FIGURE 7
AMOUNTS OF CAPACITORS, TRANSFORMERS AND WASTE OILS CONTAINING PCB DELIVERED TO *KOMMUNEKEMI* 1995-2011. OILS CONTAINING PCB REGISTERED FOR THE PERIOD 2007-2011 ARE IMPORTED WASTE. SOURCE: THESE DATA HAVE BEEN MADE AVAILABLE BY *KOMMUNEKEMI*.

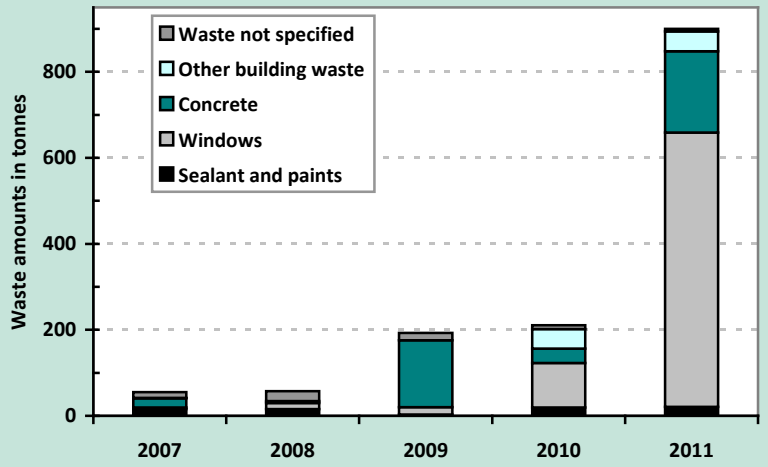


FIGURE 8
AMOUNTS OF BUILDING WASTE AND OTHER WASTE CONTAINING PCB, DISPOSED OF TO *KOMMUNEKEMI*-
SOURCE: THESE DATA HAVE BEEN MADE AVAILABLE BY *KOMMUNEKEMI*

The amounts of building waste containing PCB, shown in Figure 8, clearly illustrate the increased focus on disposing of building waste containing PCB as hazardous waste. From a level at around 50 tonnes annually in 2007 and 2008, by 2011 the level had increased to around 900 tonnes, of which wiondows containing PCB constituted the greatest waste fraction. The number of single deliveries illustrates the same trend. In 2007, for all waste types containing PCB, there were 23 deliveries. In 2011, this figure had increased to 223.

2.3.6.3 Transformer oils with less than 50 mg/kg PCB

Transformer oils with less than 50 mg/kg PCB are treated at two facilities in Denmark. One facility reprocesses the oil together with lubricants to make new lubricants, whereas the other facility burns the oil. Furthermore, some waste oil is exported for reprocessing in Germany. Here, the oil is tested for its content of PCB, and if the content exceeds 50 mg/kg, the oil is sent to *Kommunekemi* for disposal. According to information from one of these enterprises, which also manages old transformers for recycling, it sometimes happens that the waste oils contain more than 50 mg/kg, but around 0.1% of the transformers they receive have increased levels of PCB. The other enterprise has registered only a single instance of increased PCB in recent years.

2.3.6.4 Emissions of PCB from shredding plants

Shredding plants are a source of PCB emissions to the air. According to a study from 2008 by Force Technology of PCB emissions from a Danish shredding plant, there was an average concentration in air outflow from the plant of 12.3 µg/m^3 PCB_6, corresponding to emissions of around 0.8 g per hour from the plant [35]. The sources of the emissions of PCB from shredding plants were presumably articles containing PCB, such as small capacitors, or paints containing PCB. Small PCB capacitors are used in fluorescent lamp ballasts, and there could be ballasts from private households which, although it is against regulations, are being disposed of in the containers for metal at recycling stations.

Measurements of PCB in waste from shredding plants performed in 2009 showed that PCB does occur in the waste. Measurements of PCB in three samples of shredder waste revealed concentrations of PCB_7 of <0.2-0.6 mg/kg dry matter, corresponding to a total PCB of <0.9-3.1 mg/kg dry matter. [36]

2.3.6.5 PFOS in waste

PFOS waste from non-decorative hard chromium plating is disposed of at *Kommunekemi*.

Since the use of PFOS in most consumer products ceased in around 2002, PFOS will only be present in waste in mixtures and articles that have an operational life of more than nine years. On the basis of general EU estimates, the largest sources of PFOS in waste are estimated to be carpets (the most important source) and leather furniture. As described in section2.3.3.3, in 2012 and beyond, only very small quantities of leather furniture will be disposed of.

It is assessed that in Denmark all of these articles will be disposed as waste for incineration.

2.3.6.6 Brominated flame retardants in waste electronic equipment

The brominated flame retardants octaBDE, and to a lesser extent pentaBDE, will be present in flame retardant plastic components in waste electrical and electronic equipment (WEEE). According to the *WEEE Statutory Order* no. 1296 of 12 December 2011, components with more than 5 mg/kg (ppm) of brominated flame retardants must be removed selectively and disposed of at an enterprise which has been approved to manage waste containing bromine.

By far the majority of WEEE is exported for reprocessing in other EU countries. According to the statistics on WEEE and BAT from the DPA system, which administrates Danish producer responsi-

bilities, in 2010, around 70% of the waste was treated in Denmark, however this seems to refer primarily to pre-treatment; whereas actual reprocessing of the waste takes place abroad.

To the extent the equipment is taken apart in Denmark, plastic components with brominated flame retardants (not octaBDE specifically) will be disposed of via waste incineration.

2.3.6.7 Technical pentaBDE in polyurethane foam waste

There is no specific estimate of the presence of technical pentaBDE in articles in Denmark. 90% of brominated flame retardants were imported to Denmark as part of finished articles. It is therefore presumed that Danish consumption of technical pentaBDE is reflective of the general consumption pattern in the countries from which the articles were imported.

According to the information received, around 95% of pentaBDE in the EU countries was used as flame retardants in polyurethane foam applied to mattresses and upholstery. Concentrations of pentaBDE in the polyurethane foam varied from around 2-18%. The remaining 5% of the brominated flame retardants were used in plastics (in electronics in particular), and in rubber, paints and varnish, textiles, and hydraulic oils.

If consumption and disposal patterns for technical pentaBDE in Denmark correspond to the European average, there should be around 3 tonnes of technical pentaBDE left in articles used in Denmark. Around half of these will be linked to vehicles produced before 2004, and around half will be linked to polyurethane foam which was used in mattresses and furniture upholstery.

Based on the information available, it is therefore assessed that technical pentaBDE in waste from households will occur primarily in polyurethane foam which was previously used in mattresses and furniture upholstery, and that remaining quantities are in the order of 1 tonnes of pentaBDE.

Typically, flame retardant polyurethane foam from upholstered furniture will be disposed of at an incineration plant. As mentioned, octaBDE is almost entirely decomposed in the incineration plants, and the same is likely for pentaBDE.

Polyurethane foam in vehicles will end up in the light waste fraction from shredding plants previously deposited. A new innovation partnership on shredder waste is to address this issue, e.g. by focussing on exploiting the resources available in the waste more optimally, and on treating the substances of concern (including POPs) and reducing the amounts for landfilling. Through the 2011 Action plan to promote eco-efficient technology, the Danish EPA supported a project aiming at identifying potential substances of concern in shredder waste, as well as at examining the possibilities of using sensor-based technology to identify and separate materials containing these substances before or after the shredder process.

In the Waste Strategy 2009-2012, the Danish EPA has identified shredder waste as a waste type that requires special initiatives. Focus is on improving the treatment of waste from shredding plants, as well as the possibilities for developing new techniques for treatment, so that depositing the waste in landfills can be avoided, if environmentally and economically appropriate.

There are no studies of pentaBDE or other PBDEs in shredder waste in Denmark. According to DAKOFA, a total of 185,000 tonnes of shredder waste were generated in Denmark in 2008, however the volume has been decreasing due to the economic crisis and has been stable at around 150,000 to 160,000 tonnes in recent years. Assuming that around 1 tonne of technical pentaBDE is disposed of every year (the actual figure is probably lower), the average content in waste will be around 6 mg/kg. This is significantly less than at EU level, for which the estimate is an average of 70 mg/kg technical pentaBDE in shredder waste, however calculated on the assumption of a far smaller volume of shredder waste.

Formation of brominated dioxins during incineration of PBB and PBDE. Polybrominated dioxins and furans (PBDD/PBDF) can form during incineration of PBB and PBDE, or when chlorine is present concurrently, dioxins and furans with a mixture of chlorine and bromine are formed. Brominated dioxins and furans are not covered by the Stockholm Convention and are not under consideration.

Part of the Danish Dioxin Action Plan is that in 2003 flue gas from the incineration facilities *Vestforbrænding* and *Kommunekemi* was measured. The total emissions of brominated dioxins from two kiln lines in a waste incineration plant were 10-100 times less than emissions of chlorinated dioxins, while the levels from *Kommunekemi* were more or less the same for brominated as for chlorinated dioxins. Measurements of soil in the area surrounding the incineration plants revealed concentrations of brominated dioxins that were higher than the background level. This could be indicative of local contamination with PBDD/PBDF, although such contamination cannot with certainty be ascribed to the waste incineration plants.

2.3.6.8 POP-contaminated sites

There are Danish soil quality standards for the following POPs covered by the Stockholm Convention: DDT+DDE (0.5 mg/kg) and lindane (0.5 mg/kg).

There are no Danish soil quality standards for PCB, dioxins, PFOS, or the brominated flame retardants covered by the Convention, and it is therefore up to the individual region and municipality to decide on the concentration levels that will occasion remediation measures.

PCB is the most topical concern about contamination of soil with POPs.

The Danish EPA has embarked on work to define soil quality standards for PCB. In recent years, studies have examined PCB-contaminated soil in order to improve the data basis for assessing the expected level of concentrations of PCB in soil from buildings. These studies have been carried out with support from the technology programme for soil and groundwater contamination under the Danish cleaner technology programme. The preliminary results suggest that the concentrations of PCB that migrate from buildings into the soil are generally low. The studies have not yet been completed, and the final results will be assessed against a future Danish soil quality standard. A planned action in connection with the Action Plan on Managing PCB in Buildings is to evaluate the need for soil quality standards for PCB.

Soil contamination incidents are registered by the Danish regions, and the Danish Nature & Environment Portal has developed a common public soil contamination database (DKJord) which stores soil contamination data from all Danish regions. Drawing on data from e.g. DKjord, the most recent data on soil contamination can be seen in *Arealinformation* (a portal presenting environmental data by geographical area, etc.). In 2012 a total of 5 soil contamination incidents have been registered which involve PCB; one involving PCB in groundwater. The five incidents had been registered in 1992, 1998, 2004/2011, 2005 and 2006, respectively, and all are at locations in the greater Copenhagen area.

2.3.6.9 Dioxins in residues from waste incineration

During flue-gas cleaning, a large proportion of the dioxins formed will end up in the flue-gas cleaning products.

On the basis of measurements of dioxin concentrations in flue gas and residues, the most recent substance-flow analysis for dioxins estimates that a total of 58-436 g I-TEQ/year were formed in the period 2000 to 2002 at Danish incineration plants. Of these, it was estimated that 50-402 g I-TEQ ended up in the flue-gas cleaning products. The large uncertainty linked to total figures is

attributable to the very large variation in measurements of dioxins in the flue-gas cleaning product. For example, 21 measurements at different plants varied from 135 to 35,566 ng I-TEQ/kg dry matter. The average for dioxins in the flue-gas cleaning products was 4,162 ng I-TEQ/kg.

In Danish waste incineration plants, the activated carbon blown in to reduce the quantities of dioxins in the flue gas is captured with the remaining flue-gas cleaning products. Depending on the type of flue-gas cleaning, the activated carbon is subsequently added and incinerated along with the waste or treated along with the remaining flue-gas cleaning products. By far the majority of flue-gas cleaning products are deposited in Norway or Germany. In Norway, the residual products are mixed with acid-containing wastes (e.g. sulphuric acid) and hydrated lime whereby the residual products are neutralised and stabilised. The resulting plaster is used for filling a former limestone quarry on the island of Langøya in the Oslo fjord. In Germany the residues are mixed with a series of added materials to form a concrete-like mass, which is built into old salt mines.

2.3.6.10 POPs in residues from energy generation

The 2006 implementation plan provides data for dioxins in fly ash from Danish power plants and in ashes from small combustion plants firing on biomass.

In 2002, the National Environmental Research Institute carried out measurements of the dioxin contents in 23 samples of bio ash from a number of small straw boilers (7 samples); from a number of small district heating plants primarily using wood chips (2 samples) or straw (2 samples); as well as a number of chip boilers exclusively using wood chips (12 samples). [37]

The results of the study revealed that the ashes from the straw boilers had an average content of dioxin of 3.7 ng/kg I-TEQ, varying from 0.2-12 ng/kg I-TEQ. The estimated annual production of ashes from this type of straw boilers in Denmark is 1 million tonnes, corresponding to total national emissions of around 3.7 g I-TEQ. Ashes from the small district heating plants had a significantly lower average dioxin content, 0.6 ng/kg I-TEQ, varying from 0.03-1.4 ng/kg I-TEQ. Ashes from the chip boilers had an average dioxin content of 18 ng/kg I-TEQ, which is considerably higher than for the straw boilers, and with far greater variations, i.e. from 0.02-74 ng/kg I-TEQ.

There are no more recent measurements available of dioxins or other POPs in the types of residual products mentioned.

2.3.6.11 Leachate from landfills

As part of the Dioxin Action Plan in force at the time, in 2002, samples taken of leachate from seven landfills were analysed [38]. Concentrations varied from 0.01 to 0.11 pg I-TEQ per litre. For comparison, concentrations in rainwater measured at five different locations were 0.7-3.0 g I-TEQ per litre, i.e. up to 30 times higher. Leachate from landfills is considered to be considerably less important than rainwater with regard to negative effects on watercourses and groundwater.

In studies of PFOS in leachate from landfills, in the context of NOVANA, in 2004-2005 leachate from 2 landfills were analysed for PFOS and a number of perfluorinated substances [18]. PFOS was found in a concentration of 3.8 ng/l in a single sample of leachate from Stige landfill. All other measurements performed only revealed concentrations of PFOS that were below the detection level of 1.5 ng/l.

2.3.6.12 POPs in sewage sludge

The Statutory Order on use of waste for agricultural purposes (Statutory Order no. 1650 of 13 December 2006) sets out limit values or cut-off values for a number of heavy metals, as well as for the organic pollutants LAS (a detergent), DEHP (phthalate, plastic softener), PAH, and nonylphenol. With regard to POPs, limit values have been established only for PAH (which is covered by the POP

Protocol but not by the Stockholm Convention), i.e. a limit value of ∑PAH in 3 mg/kg dry matter. As mentioned above, the Danish EPA established guiding limit values for PCB in 2010.

Pesticides. So far, there has been no systematic monitoring of all POP pesticides in waste products in Denmark, however the substances aldrin, dieldrin, endrin and lindane were included in the point source programme under NOVA2003 up till, and including, 2003. According to the point source report for 2003 there had been no detections of the three substances in either discharge or sludge from the treatment plants examined. Therefore it was decided to omit POP pesticides from the new monitoring programme when NOVA2003 was replaced by the NOVANA programme [39].

PCB. Limit values have been determined for hazardous substances in sludge on the basis of risk considerations and a comprehensive report from the mid 1990s. At that time, PCB was observed in low quantities in up to half of twenty treatment plants examined, whereas no PCB was measured in sludge from the remaining 10 plants [40]. The observed average concentrations were below 10 µg/kg dry matter for the individual PCB congeners (individual components) and the highest concentration of PCB measured at that time was 39 µg/kg. Against this backdrop, a decision was made not to establish a limit value for PCB.

Due to new knowledge about the possible effects of PCB, in 2010, the Danish EPA stipulated a recommended limit value, i.e. 0.08 mg/kg dry matter for the sum of seven PCB congeners (PCB_7). The Danish EPA is in the process of assessing whether an actual limit value PCB in sludge is to be established.

The point source programme for 2003 examined 37 facilities for 10 PCB congeners [39]. Mean concentrations for the congeners that were above the detection limit were in the interval 1.7-4.2 µg/kg dry matter, while the 95% fractile was in the interval 8-18 µg/kg dry matter. The sum of the seven congeners was not calculated, however on the basis of the values measured, the mean value is estimated at 1 µg/kg dry matter and the 95% fractile at around 84 µg/kg dry matter. The 95% fractile is therefore at a level equal to the recommended value. The point source programme for 2004 detected PCB in sludge from seven facilities. The concentrations for all congeners measured were below 0.01 µg/kg dry matter.

PCB is not included in the regular monitoring of sludge, and there are no more recent studies from the point source programme.

PFOS. In 2007, a thematic report was published on PFOS and other PFAS in sewage sludge [41]. Measurements were carried out at 9 municipal treatment plants and PFOS was found in the sludge from all 9 facilities, in concentrations ranging from 4.8-74.1 µg/kg dry matter and with an average of 8.6 µg/kg dry matter. Concentrations of PFOS in the sludge were considerably higher than concentrations of other fluorinated substances. Inflow concentrations at the municipal waste treatment plants averaged 3.4 ng/l (variation <1.5-10.1 ng/l), while outflow concentrations averaged 4.5 ng/l (<1.5-18.1 ng/l).

In 2004, a Nordic study found concentrations of PFOS ranging from 316 to 1,041 µg/kg dry matter in sludge from 3 Danish treatment plants [42].

PBDE. In 2001, a project to develop a methodology for measurements of PBDE in wastewater and sludge carried out analyses for the following congeners: BDE#17, #28, #47, #49, #66, #85, #99, #100, #153, #154, #183, and BDE#209 [43]. The first 11 congers in this list belong to the substances tri- and heptaBDE. The sum of these substances was determined at 238(±23) µg/kg. The concentration of BDE#209 (decaBDE) was determined at 248(±81) µg/kg.

Measurements of BDE#47 (tetraBDE congener), BDE#99 (pentaBDE congener), and BDE#209 (decaBDE) in discharges from small treatment plants are included in the NOVANA programme, however, as of yet, no results are available.

2.3.7 Future intentional production of POPs and need for exemptions

There are no plans for future intentional production of POPs and there is no need for exemptions.

2.3.8 Programmes for monitoring releases, health risks and emission statements

2.3.8.1 Monitoring of POPs in food and health risks

The content of dioxins and dioxin-like PCBs, indicator PCB, and chlorinated pesticides in food is monitored continually as part of the Danish monitoring programme for food. Control of PCB and chlorinated pesticides is carried out as part of the control of animal products in accordance with EU Directive 96/23/EC, and as part of the control of other food products to provide an idea of the levels in selected food products which contribute significantly to human intake of chlorinated pesticides and PCB.

Control of dioxins and dioxin-like PCBs is also carried out to ensure that the limit values for dioxins and dioxin-like PCBs in food, which are set out in Regulation 1881/2006/EC (with later amendments), are not exceeded.

The monitoring programme for food is maintained by the Danish Veterinary and Food Administration.

The results of this monitoring are reported periodically and are available to the public on the Danish Veterinary and Food Administration website (www.fvst.dk).

2.3.8.2 Monitoring of POPs in animal feed

Each year the Danish Veterinary and Food Administration takes random samples of feed in order to check for contents of dioxin compounds and PCB compounds. In 2011 a total of 65 samples were taken. Of these, 46 were taken as targeted random samples at animal feed companies, while the remainder was taken at farms in connection with investigations. The samples from the animal feed companies included a consignment of vegetable fats from the Netherlands which exceeded the limit value considerably by 1.5 ng/kg. This was the first time since the introduction in 2006 of the EU limit values for dioxins and dioxin-like PCBs that concentrations were found to have been exceeded in animal feed.

The results of the other samples were in line with previous years' results.

The Rapid Alert System for Food and Feed (RASFF) is used in situations where animal feed may constitute a serious and acute risk to consumers. The Danish Veterinary and Food Administration is the Danish national point of contact for RASFF. Thus, the Danish Veterinary and Food Administration receives warnings when prohibited or undesirable substances are discovered in feed, e.g. when a maximum value for an undesirable substance is exceeded. The Danish Veterinary and Food Administration assesses whether follow-up in Denmark is required. Similarly, Denmark is required to warn other Member States through RASFF of any observed risks associated with the feed.

2.3.8.3 Monitoring of POPs in the environment

Monitoring of POPs in the environment is part of the National Programme for Monitoring of the Aquatic Environment and Nature, NOVANA. Monitoring of nature and environmental conditions in Danish inlets and marine areas is carried out in a collaboration between the Danish Nature Agency and the Danish Centre for Environment and Energy, Aarhus University. The Danish Nature Agency performs most of the sampling and the quality assurance of data, while the Danish Centre for Envi-

ronment and Energy, through the marine specialist data centre, is responsible for national data processing and reporting. The results of the point source programme build extensively on reports from Danish municipalities, enterprises and the Danish Nature Agency.

The NOVANA programme includes measurements of the following POPs in the marine monitoring programme:

Substances	Sample type	Number of stations	Year in the period 2011-0215	Number of sub-samples/frequency
PCBs, dioxins, PFOS, PBDE, OC pesticides*.	Flounder, eelpout, mussels	5 12 7	5	1
Dioxins	Marine sediment	100	1	2

* **OC pesticides, which are a broad group of organochlorinated pesticides, include a number of POP pesticides.**

The measurement programme for surface water covers lindane in sediments in connection with soil contamination.

The measurement programme for point sources includes the following:

- PFOS in discharges from small and large treatment plants
- BDE-47 (tetraBDE), BDE-99 (pentaBDE), BDE-209 (decaBDE) in discharges from small treatment plants

None of the POPs are included in the regular monitoring of freshwater, air quality, and atmospheric deposition, soil water, and drainage water, however they may be included in specific studies.

None of the POPs are included in the continuous groundwater monitoring carried out by GEUS, which is the specialist data centre for groundwater and borings. Since 2003, no measurements have been carried out of POP pesticides in groundwater. No POPs were found in measurements in 2003.

The results of the monitoring are reported annually and are made available to the public at the Danish Centre for Environment and Energy website (www.dmu.au.dk).

2.3.8.4 Monitoring of emissions of dioxins from incineration plants and other point sources

Incineration plants, which incinerate household waste and hazardous waste, continuously monitor their emissions of dioxins. The Danish EPA's reference laboratory for measuring emissions to the air, which is housed by Force Technology, until 2006 registered measurements of emissions of dioxins from incineration plants in a database. Today, there is no reporting or collected registration of emissions from incineration plants.

2.3.8.5 Emissions of POPs from enterprises

In 2006, the European Parliament and the Council adopted a regulation (Regulation no. 166/2006) concerning the establishment of a European Pollutant Release and Transfer Register (the PRTR Regulation). The register which are termed E-PRTR contain data on emissions from 28,000 enterprises in Europe.

Denmark has implemented the PRTR Regulation, e.g. using environmental data from the green accounts of Danish enterprises, and reported for the first time to the E-PRTR for the year 2007.

The PRTR Regulation contains 91 substances, including the following substances which are also covered by the Stockholm Convention (when emissions exceed the difed emission thresholds): Aldrin, chlordane, chlordecone, DDT, dieldrin, diuron, endosulfan, endrin, 1,2,3,4,5,6-hexachlorocyclohexane (HCH), lindane, mirex, PCDD + PCDF (dioxins + furans), pentachlorobenzene, polychlorinated biphenyls (PCBs), toxaphene, brominated diphenyl ethers (total of penta-, octa- and decaBDE), and hexabromobiphenyl.

The above information is available at the website of the common European Pollutant Release and Transfer Register, E-PRTR (European Pollutant Release and Transfer Register): (http://prtr.ec.europa.eu/PollutantReleases.aspx)

The register contains only very few data on Danish sources, which could be because Danish emissions are generally below the threshold values.

2.3.8.6 Atmospheric emissions

The Danish Centre for Environment and Energy, Aarhus University, is responsible for preparing the official annual inventories of Danish emissions to the atmosphere. The Danish Centre for Environment and Energy reports the total estimated emissions of dioxins to the EU and the UNECE under the Convention on Long-range Transboundary Air Pollution (CLRTAP) from 1979.

These inventories are available to the public at the European Environment Agency website (www.eea.europa.eu).

2.3.9 Information for the public and information exchange with other parties to the Convention

2.3.9.1 Information for the public

Communication about issues relating to POPs takes place at many levels and in many fora. The public is provided information about POPs primarily as part of more general information on health and hazardous substances, which, in addition to POPs, include endocrine disruptors in general, heavy metals, sensitizing substances, and solvents.

In the following are a few examples of communication about POPs specifically.

The PCB guide. An inter-ministerial PCB guide and helpdesk have been established (www.pcbguiden.dk) as one of the first initiatives under the Action Plan on Managing PCB in Buildings. This guide is targeted at four groups of consumers: The general public, construction companies, building owners and municipalities. The guide provides information to the general public about the health risks associated with PCB and what you can do if you suspect PCB in your home or at your workplace. The guide contains step-by-step instructions for construction companies and building owners on how to identify PCB and manage building materials and waste containing PCB.

A PCB hotline has also been established which the public can contact with questions about PCB.

The guide was established jointly by the Agency for Palaces and Cultural Properties, the Ministry of Social Affairs and Integration (the responsibility has since been moved to the Ministry of Housing, Urban and Rural Affairs), the Danish Business Authority, the Danish EPA, the Danish Health and Medicines Authority, and the Danish Working Environment Authority.

What you should know about PCB (*"Det bør du vide om PCB"*) – information for the public, building companies, building owners and municipalities. From www.pcbguiden.dk.

Environment and health. The Advisory Scientific Committee on Environmental Health of the Danish Health and Medicines Authority publishes the public-information magazine "*Miljø og Sundhed*" (environment and health). The magazine is published 3 times a year. Nearly every article of the magazine contains articles on issues related to POPs.

Dioxins and dioxin-like PCBs in food. The Danish Veterinary and Food Administration website "*Alt om kost - smag for livet*" (all about diet — a taste for life; at www.altomkost.dk) provides information about dioxins and dioxin-like PCBs in food, about harmful effects and what type of food is especially likely to contain the substances. Amongst other things, the website recommends only eating horse meat occasionally and no more than once a week. Horses accumulate concentrations of dioxin and PCB in greater quantities than, for example, pigs and poultry.

DAKOFA. As part of the work to clarify issues about PCB in building materials and building waste, a number of initiatives have been carried out under DAKOFA, the Danish Competence Centre on Waste, in the form of conferences and meetings.

Teaching materials. Over the past 5 years, various teaching materials have been published, which concentrate on teaching about POPs. This includes teaching material on the ecotoxicology of PCB, brominated flame retardants, and chlorinated solvents and on WEEE and exports of hazardous waste. The EMU portal, a common portal for the educational world in Denmark, contains a series of topic sections on POPs and up-to-date teaching material for the 13-16-year-olds, called Chemical Days. Chemical Days (2008) is a teaching material for 14-15 year-olds which includes information about POPs.

Videnskab.dk. The website *Videnskab.dk*, which is funded by a number of government agencies and research councils, contains a large number of articles on POP-related topics.

Information about POPs in the environment, food, and animal feed is disseminated via the Internet by the relevant agencies and institutions.

2.3.9.2 Information exchange with other parties to the Convention

Through reports to the UNECE, Denmark annually exchanges information on emissions of certain POPs with those parties to the Convention which are also parties to the POP Protocol.

Under the Nordic Environmental Action Plan, Nordic working groups have been set up for the various substance areas, which exchange information and instigate studies.

Through its membership of the EU, Denmark regularly exchanges information on a number of points regarding POPs with other Member States.

Danish research institutions cooperate with research institutions in other Member States on a number of EU-funded research projects concerning POPs.

As a participant in the Rapid Alert system, Denmark also exchanges information with the other EU countries about POPs in food and animal feed.

2.3.10 Activities by NGOs

The Information Centre for Environment and Health (www.forbrugerkemi.dk), an independent information centre, is funded by the Danish Ministry of the Environment. The Centre communicates about POPs-related issues in a wide range of articles, including on the effects of PFOS and brominated flame retardants in consumer products; dioxins in food; and PCB in homes.

In recent years the social partners have focused on PCB in building materials. In 2010, *Dansk Asbestforening*, Danish asbestos association; a sector association of Danish asbestos removal companies, prepared a report including guidelines for removal of PCB.

2.3.11 Technical infrastructure for POP assessment, measurements, analyses, and research and development

2.3.11.1 Laboratories with capacity to measure POPs

There is a number of laboratories in Denmark and Sweden which are accredited to analyse for POPs. The following laboratories have been designated to analyse POPs in one or more media under the NOVANA monitoring programme, but more laboratories may have the capacity:

- PCB: Danish Centre for Environment and Energy (Roskilde), Eurofins (Vallensbæk), Milana (Elsinore);
- HCB: Danish Centre for Environment and Energy (Roskilde);
- DDT/DDE: Danish Centre for Environment and Energy (Roskilde);
- Aldrin, dieldrin, endrin: Eurofins (Vallensbæk/Vejen), Lantmännen AnalyCen (Lidköping, Sweden), Milana (Humlebæk);
- Dioxins: Danish Centre for Environment and Energy (Roskilde), Lantmännen AnalyCen (Lidköping, Sweden), the Danish Veterinary and Food Administration also measures dioxins;
- PCDD/PCDF: Danish Centre for Environment and Energy (Roskilde), Alcontrol (Sweden), Lantmännen AnalyCen (Lidköping, Sweden).
- Lindane (γ-HCH): Danish Centre for Environment and Energy (Roskilde) Lantmännen AnalyCen (Lidköping, Sweden), Eurofins (Vallensbæk/Vejen), Milana (Humlebæk),
- BDE 47, 99, 100, 153, 154, 183, 209: Danish Centre for Environment and Energy (Roskilde), Eurofins (Vallensbæk).
- Pentachlorobenzene: Eurofins (Vallensbæk/Vejen), Lantmännen AnalyCen (Fredericia).
- PFOA, PFOS: Danish Centre for Environment and Energy (Roskilde), Lantmännen AnalyCen (Lidköping, Sweden), Eurofins (Vallensbæk).

At least 3 Danish laboratories measure dioxins in flue gases: Force Technology, Eurofins and the Danish Technological Institute.

A large number of laboratories offer to measure PCB in materials and indoor air.

2.3.11.2 Research into the presence and effects of POPs

POPs are included in a number of research programmes at a large number of Danish research institutions.

Much of this research concern POPs in the Arctic and is a part of work under the Arctic Monitoring and Assessment Programme, AMAP. The Danish EPA is responsible for Danish participation in

AMAP in consultation with an inter-ministerial coordination group, which includes representatives from the Government of Greenland and the Home Government of the Faroes. Denmark's participation in the environmental work of the Arctic Council is being funded via *Miljøstøtteordningen for Arktis* (the environmental support scheme for the Arctic).

The following institutions are working on issues related to the presence and effects of POPs:

- The Danish Centre for Environment and Energy at Aarhus University has several departments which have research projects linked to impacts from POPs on the environment, and the Arctic environment in particular.
- The Institute of Public Health at the University of Southern Denmark is carrying out research into e.g. harmful effects of perfluorinated substances and other POPs, focussing in particular on development and reproduction. This research includes the effects of exposure to PFOS and PCB. For many years now, the Institute has been carrying out epidemiological studies of the effect of POPs in the Faeroe Islands.
- The Centre for Arctic Environmental Medicine at Aarhus University is associated with the AMAP Human Health Assessment Group (HHAG). The research activities of the Centre are epidemiological and include: monitoring and assessing the effects of heavy metals and organochlorine compounds on human health in Greenland, organochlorine compounds and the neonatal sex ratio; and assessing the correlations between environmental toxins, their impact on humans and breast cancer.
- The Environmental Health section of the Department of Public Health at the University of Copenhagen is researching e.g. the significance of POPs and other environmental toxins for pregnancy and child development.
- The department for occupational and environmental medicines at Bispebjerg Hospital is working on a range of research projects to examine the effect of POPs and other environmental toxins on semen quality in men; the effect of brominated flame retardants and other environmental toxins on the reproductive ability and on the development and health of newborns; the effect of PCB on the birth weight of newborns; and the effect of PCB in indoor air in homes and in the blood of residents.
- Most recently, the National Food Institute at the Danish Technical University has examined the presence of polyfluorinated substances in food packaging.
- The Danish Building Research Institute is working on studies concerning remediation of PCB-related problems in indoor climate.

Other research units which have published research results in recent years concerning POPs include the Department of Growth and Reproduction at Rigshospitalet and the Danish Cancer Society Research Center.

Furthermore, Danish research institutions exchange new knowledge about fluorinated substances with other Nordic institutions in the NordFluor network (http://nordfluor.nilu.no/). This network consists of 22 Nordic research institutions and is being funded by the Nordic Council of Ministers through Nordforsk.

2.3.12 Particularly exposed population groups

2.3.12.1.1 Greenland and the Faeroe Islands

The populations of Greenland and the Faeroe Islands are particularly exposed to POPs through their large intake of fish and marine mammals. However, since Greenland and the Faeroe Islands are not covered by this implementation plan, a description of this issue has not been included.

2.3.12.1.2 Women of childbearing age and women who are breastfeeding

Pollution with dioxins and other POPs still poses a particular risk for girls and women of childbearing age, as well as pregnant and breastfeeding women. In the pamphlet "*Når du er gravid. Råd om*

mad og motion" (During you pregnancy. Advice on food and exercise), the Danish Veterinary and Food Administration recommends that pregnant women's intake of salmon from the Baltic Sea should not exceed 125 g a month due to the very high content of dioxin in these salmon. The same advice is given to women, who are breastfeeding, on the website of the Danish Veterinary and Food Administration under "food and diet".

2.3.12.1.3 Socio-economic impacts

The previous implementation plan described how fishermen are provided compensation if catches have too high contents of dioxins. There are no new data on socio-economic impacts on particularly exposed population groups.

2.3.13 Systems for assessment and inclusion of new substances under the Convention

Within the EU, Denmark is collaborating with the other Member States on assessing new POPs, on regulating these substances within the EU, and on nominating substances under the POP Protocol and the Stockholm Convention.

Denmark is contributing through a range of study programmes to demonstrate the presence of persistent organic pollutants in the marine environment and in the Arctic environment. In recent years, studies have thus been carried out covering the 4 substances that are under consideration for possible inclusion in the Stockholm Convention: The substances in question are hexabromocyclododecane (HBCDD), polychlorinated naphthalenes (PCNs), short-chain chlorinated paraffins (SCCPs), and hexachlorobutadiene (HCBD).

Furthermore, studies are being carried out on the presence of the following brominated flame retardants: decabromodiphenyl ether (decaBDE); tetrabromobisphenol A (TBBPA); 1,2-bis(2,4,6-tribromophenoxy)ethane (BTBPE); , hexabromobenzene (HxBBz); pentabromoethylbenzene (PBEB); pentabromotoluene (PBT); and 1,2-dibromo-4-(1,2-dibromoethyl)cyclohexane (TBECH).

3. Strategy and action plan elements

3.1 Policy statement

Actions against harmful chemicals have been given high priority in Denmark for many years. As stated in the Danish strategy for sustainable development "*Vækst med omtanke*", the goal is that in 2020 no products or goods on the market should contain chemicals that lead to a significant negative impact on health or the environment.

In order to meet the objective of the Stockholm Convention to protect human health and the environment from POPs, it is important to work towards having substances which meet the POP crtiteria regularly added to the Convention and regulated under it. An important signal is that substances are now regulated and banned which are still in use, so that focus is not only on the sins of the past. The first substances to be regulated under the Convention had very limited use globally. Since the implementation plan in 2006, 10 new POPs have been included under the Convention, several of which were being used extensively globally, and Denmark supported inclusion of these substances.

The updated national implementation plan reports that Denmark lives up to the obligations under the Convention and therefore the plan only contains few new initiatives. These aim in particular at PFOS, unintentional production of POPs as well as managing waste containing POPs.

Denmark will continue to work actively to raise the level of protection and minimise the environmental and health impacts of POPs, nationally as well as in international fora.

3.2 Implementation strategy

Denmark has been intensifying efforts in the chemicals area since the 1980s. The objective is to reduce risks to human health and the environment from use of chemicals. This is being done e.g. through strong international collaboration (including Nordic collaboration); regulation; control and sanctions; and through providing the public and enterprises with more knowledge about chemicals.

POPs today are an integral part of existing systems and strategies for regulation, approval, monitoring and waste management in relation to chemicals. In the context of the implementation of the Stockholm Convention, it has therefore not been necessary to strengthen the institutional or regulative framework for managing and monitoring POPs in Denmark. However, the requirements of the Convention have helped highlight POPs and have been a driving force for new activities.

Implementation of the Stockholm Convention's requirements for POPs, and for waste containing POPs, are moreover characterised by a close interplay between EU regulation and measures, on the one hand, and on the other hand national regulation and measures. To a great extent, Denmark is implementing the requirements of the Stockholm Convention through existing legislation, strategies and programmes. For several of the new substances, PFOS and the brominated flame retardants, the Stockholm Convention's requirements are, however, more strict than Danish requirements

so far, and the Danish national implementation plan therefore includes a number of new initiatives in relation to these new substances.

The Danish implementation plan has been prepared by the Danish EPA. The Danish EPA will be reviewing and updating the plan regularly as required.

3.3 Activities, strategies and action plans

Below is an outline of new initiatives to implement the Convention. Each section is introduced by referring to key provisions of the Convention - for a full description of these provisions, please see the Convention. Furthermore, a series of issues are mentioned which have significance for the new initiatives. Naturally, exposure of the public and the environment to POPs is an issue in relation to all of the substances, however information about human and/or environmental exposure is only mentioned where the extent of the exposure to the substances in question is especially high in Denmark.

3.3.1 Measures to reduce or eliminate the release of POP pesticides

3.3.1.1 Provisions of the Convention

As party to the Convention, Denmark is required to ban, and/or take the necessary legal and administrative steps to ban the production, use, import and export of aldrin, chlordane, chlordecone, dieldrin; endrin, heptachlor, hexachlorobenzene (HCB), hexachlorocyclohexane (HCH) including lindane, mirex, pentachlorobenzene, and toxaphene. Denmark is also required to limit the production and use of DDT. Furthermore, endosulfan will be included in Annex A of the Convention on 27 October 2012.

3.3.1.2 Status

Implementation legislation. The requirements of the Convention have been implemented in the POP Regulation, the prohibition provision of which is stricter than that of the Convention. The ban on production and use of endosulfan has not yet been implemented in the POP Regulation, but technical endosulfan, its isomers, and endosulfan sulphate, are expected to be listed in Annex I, Part A, without specific exemptions for use - and entering into force from the same date as the amendments to the annex of the Convention.

3.3.1.3 Planned initiatives

As a result of the low or non-existent presence of these substances in food, waste, the environment, and groundwater, no further initiatives will be taken for POP pesticides in Denmark.

3.3.2 Measures to reduce or eliminate the release of PCB originating from intentional uses

3.3.2.1 Provisions of the Convention

As party to the Convention, Denmark is required to ban, and/or take the necessary legal and administrative measures to eliminate the production, use, import and export of PCB according to more detailed provisions. The Parties are also required to make special efforts to identify, label, and withdraw from use equipment containing PCB, as well as to dispose of equipment containing or contaminated with PCB by no later than 2028. Finally, Denmark is required to carry out efforts to identify other types of articles containing more than 0.005% PCB (such as cable casing, sealants, and painted objects), and to manage these in accordance with the Convention's provisions on waste. The Danish EPA assesses that this obligation has been met with the ban on the use of PCB in open applications, i.e. in sealants and in paints etc. since 1977, and with the follow-up efforts currently underway to identify and manage materials containing PCB in the existing building stock.

For applications other than electric and electronic equipment, there are no specific requirements that articles containing PCB be taken out of use before the end of their operational life.

The Convention stipulates that stocks which contain or consist of POPs must be identified and managed safely. Waste that contains or is contaminated with POPs must be disposed of in a way which ensures the content of POPs is destroyed or converted irreversibly so that the substances no longer have the properties characteristic of persistent organic pollutants. However, if this option is not preferable from an environmental perspective, or if the content of POPs is low, the waste may be disposed of by other environmentally appropriate means.

The parties must endeavour to develop appropriate strategies to identify areas that are contaminated with chemicals which are listed in Annexes A, B or C, and to ensure that any decontamination of these areas is environmentally appropriate.

3.3.2.2 Status

Implementation legislation. The commitments under the Stockholm Convention relating to PCB have been implemented in Article 3(1) of the POP Regulation and in the Statutory Order on PCB/PCT which implements the PCB/PCT Directive and to which the POP Regulation refers. Danish regulation on PCB contains requirements that are more stringent than what follows from the Stockholm Convention and the PCB/PCT Directive as referred to in 2.2.5.3. The Convention's requirements for waste management have been implemented in the POP Regulation and are supplemented by a number of EU Directives on management, including landfilling/depositing waste. These Directives and the Danish provisions implementing them in Denmark are described in section 2.2.5.8.

Current issues. The current issues relating to PCB in Denmark are primarily linked to the presence of PCB in building materials and indoor climate; management of PCB in waste from building and construction; as well as sites potentially contaminated by PCB.

With the Danish Government's PCB Action Plan from 2011, which is described in more detail in 2.3.2.4, 19 initiatives have been launched which relate to building knowledge to help identify and manage PCB in indoor climate, health and safety at work, and in waste, as well as provide guidance to the public, the authorities and enterprises on these matters. The purpose of some of the initiatives is to build more knowledge, and these initiatives may be followed by new initiatives if necessary. For example, the action plan includes the launch of an inter-ministerial survey of PCB in building materials and in indoor air in Danish buildings. The objective is to clarify the scope of this problem and to improve the basis for providing guidance on how to manage waste containing PCB and problems with indoor climate. Once this survey has been completed, there will be an assessment of whether the results give rise to further initiatives on management of waste containing PCB.

In association with the issues linked to PCB in building materials, there is now also greater focus on potential contamination of land around buildings from building materials containing PCB. This has occasioned a need to be able to asses, by the use of soil quality standards, the degree to which the contamination is dangerous.

3.3.2.3 Planned new initiatives

Some of the 19 initiatives in the Danish Government's PCB Action Plan have not yet been set in motion. See the description in section 2.3.2.4 and Table 9 about the status on work to implement the Action Plan on Managing PCB in Buildings.

TABLE 13
NEW INITIATIVES IN RELATION TO PCB

No.	Initiative	Description	Responsible institution	Time frame
1	Action Plan on Managing of PCB in Buildings	19 initiatives in "Action Plan on Managing PCB in Buildings – Indoor Environment, Working Environment and Waste"	See Table 9	
2	A possible limit value for PCB in sludge, and soil quality standards for PCB	In parallel with the activities under the PCB Action Plan, it will be assessed whether a limit value should be established for PCB in sludge. It will also be assessed whether a soil quality standard should be defined.	Danish EPA	2012-2013
3	Examine the possibilities for identifying PCB in shredder waste	In 2011, the Danish EPA established an innovation partnership for shredder waste (waste from the shredding of automobiles and major household appliances) and thus put focus on better exploitation of resources from waste, managing substances of concern (including POPs) and reducing the amounts for landfilling, e.g. by establishing treatment requirements for shredder waste. Through the Danish Action Plan for Promoting Eco-efficient Technology -, the Danish EPA has supported several projects on shredder waste, including a project aimed at identifying potential substances of concern in shredder waste (e.g. PCB) and investigating the possibilities of using sensor-based technology to identify and separate materials containing these substances, before or after the shredder process. The results from these projects are included in the work of the innovation partnership.	Danish EPA	Not set

3.3.3 Measures to reduce or eliminate the release of PFOS

3.3.3.1 Provisions of the Convention

Production and use. In accordance with the Convention, Denmark is required to take legal and administrative measures necessary to limit the production, use, import and export of perfluorooctane sulfonic acid and its derivatives (in the following termed PFOS). The Convention makes it possible to continue producing and using PFOS for certain acceptable purposes listed in the Convention, including the use of PFOS for decorative hard chrome plating. The Convention also contains a number of specific exemptions concerning the use of PFOS and the use of PFOS as an intermediate in chemical production.

Furthermore, Denmark is required to take appropriate measures to ensure that any production or use pursuant to such exemptions or acceptable purposes takes place in a way that prevents or minimises human and environmental exposure. If applications pursuant to exemptions or acceptable purposes will typically entail intentional releases to the environment, such releases should be limited as far as possible, taking current standards in to account. Furthermore, Denmark is subject to

an obligation to provide notification if it wishes to make use of the possibility of producing or using PFOS for acceptable purposes. Finally, as part of reporting pursuant to Article 15 of the Convention, Denmark is required to submit a report every four years to the Conference of the Parties on its progress in phasing out PFOS.

Stocks, waste and contaminated sites. The provisions of the Convention relating to release of PFOS from stocks, waste and contaminated sites are the same as outlined above for PCB.

3.3.3.2 Status

Implementation legislation. The requirements of the Convention have been implemented in the POP Regulation, which is described in more detail in section 2.2.5.4 concerning the use of PFOS, and in section 2.2.5.8 concerning waste.

The limit values in Annexes IV and V of the POP Regulation on management of waste containing PFOS are currently being determined in an EU process.

Current issues. PFOS is used solely for decorative hard chrome plating in Denmark.
On the basis of available data on the use of PFOS in a number of EU countries, it is assessed that PFOS in waste from households primarily will occur in carpets treated with PFOS, as the most dominant fraction, as well as in leather furniture treated with PFOS.

There is no selective waste collection of articles containing PFOS taken into use prior to the ban. In Denmark today, carpets, textiles, upholstered furniture, and other articles that may be surface-treated with PFOS, are disposed of via waste incineration with energy recovery.

If the use of PFOS in Denmark corresponds to the use in a number of EU countries, up to 2016, in the order of 1-2 tonnes of PFOS will be disposed of annually with carpets, with an average concentration of around 75 mg PFOS/kg. Similarly, it is assessed that there may be smaller quantities of PFOS that will be disposed of with leather furniture, containing an average concentration of around 80 mg PFOS/kg.

In summary, studies show that PFOS is effectively destroyed at 1,000°C, and the studies available suggest that this will also be the case at a temperature of 850°C, which means that PFOS compounds would be destroyed through burning in waste incineration plants for household waste. However, this is less certain. On the other hand, there are no studies which document clearly that destruction is incomplete at 850°C. Denmark will ask the European Commission to launch a validation of whether PFOS compounds are properly destroyed in ordinary waste incineration, if this is not clarified in the Commission's current investigation in connection with the determination of limit values for management of waste that contains the new POPs, including PFOS.

If it turns out that PFOS compounds are not properly destroyed in waste incineration plants for household waste, on the basis of a survey of the presence of PFOS in mixtures and in articles in Denmark, the Danish EPA will assess whether there is a basis for establishing separation of the most significant waste fractions (carpets) with a view to destruction at special plants.

Waste containing PFOS may not be reused or recycled if the content of PFOS exceeds certain set limit values for unintentional trace contamination and/or limit values that will be determined in Annex IV of the POP Regulation.

3.3.3.3 Action plan for PFOS

The following table indicates the new initiatives that will be taken in relation to the release of PFOS throughout the substances' life cycle.

TABLE 14
ACTION PLAN FOR REDUCTION OF PFOS IN DENMARK

No.	Initiative	Description	Responsible institution	Time frame
1	Report on use of PFOS in Denmark	PFOS is included in the Danish EPA list of undesirable substances (LOUS). In the period 2012-2015 all substances in LOUS will be surveyed with a view to assessing the possible need for further regulation, labelling, information or phasing-out. In step with these endeavours, a detailed investigation will be carried out of the different uses of PFOS and other per- and polyfluorinated substances in Denmark, as well as their possible substitutes.	Danish EPA	2012
2	Notification of allowed uses	Notify the uses that are being allowed and report to the Secretariat of the Stockholm Convention on the development of work to phase out PFOS.	Danish EPA	2012/ 2016
3	Information to users of PFOS on acceptable uses in Denmark	Inform users of PFOS for hard chromium plating about the provisions of the POP Regulation. Inform other possible users of PFOS via sector organisations. Prepare a register of users of PFOS.	Danish EPA	2012-2013
4	Study of PFOS/PFOA as soil and groundwater contamination	PFOS/PFOA has been used in fire extinguishing foam, and cases have been observed in both Denmark and abroad of soil and groundwater having been contaminated with PFOS at fire drill sites due to the repeated use of fire extinguishing foam. An investigation will be launched under the technology programme for soil and groundwater contamination. The project is to investigate e.g. whether there are other sources of contamination of soil and groundwater with PFOA/PFOS, and to clarify whether PFOS/PFOA contamination of soil and groundwater in connection with fire drills is a generally occurring phenomenon.	Danish EPA	2012-2014
5	Assessment of the presence of PFOS in household waste	On the basis of a survey under Initiative 1, an assessment will be carried out of the presence of PFOS in waste from households.	Danish EPA	2012-2013
6	Validation of destruction of PFOS	Encourage the European Commission to carry out a survey to validate whether PFOS can be adequately destroyed in ordinary waste incineration processes. The results will form the basis for assessing to what extent a change in current treatment methods for waste containing PFOS in Denmark is required.	Danish EPA	Not set
7	Possible separation of household waste containing PFOS	Depending on the results of Initiative 6, requirements will possibly be prepared for separation of certain significant fractions of household waste containing PFOS.	Danish EPA	Not set

No.	Initiative	Description	Responsible institution	Time frame
8	Guidelines concerning articles which must not be reused and recycled	Prepare guidelines concerning articles which must not be reused or recycled because they contain PFOS in concentrations that exceed the set limit values.	Danish EPA	Not set

3.3.4 Measures to reduce or eliminate releases of hexaBB and tetra, penta, hexa and heptaBDE

3.3.4.1 Provisions of the Convention

As Party to the Convention, Denmark is required to ban and/or take the legal and administrative measures necessary to ban manufacture, use, import and export of hexabromobiphenyl as well as tetra, penta, hexa and heptabromodiphenyl ether. The Convention includes a number of specific exemptions for continued use of the four polybrominated diphenyl ethers (PBDE). There are no exemptions for hexabromobiphenyl. See section 1.3.2 for a description of the relationship between the individual substances and technical mixtures with the same name.

The provisions of the Convention concerning releases of the relevant brominated flame retardants from stocks, waste and contaminated sites are the same as described above for PCB and PFOS.

3.3.4.2 Status

Implementation legislation. The requirements of the Convention have been implemented by the POP Regulation. Until the amendments in the POP Regulation enter into force, marketing and use of pentaBDE and octaBDE have been restricted by virtue of Annex XVII to the REACH Regulation with a maximum concentration limit of 0.1% by weight.

Limit values in Annexes IV and V of the POP Regulation for management of waste containing hexaBB as well as tetra, penta, hexa and heptaBDE are being determined in an EU process.

According to the WEEE Statutory Order, plastic containing brominated flame retardants must be extracted in selective treatment of waste electrical and electronic equipment. Plastic containing brominated flame retardants must be delivered to enterprises approved to manage waste containing bromine in accordance with section 33 of the Environmental Protection Act or similar legislation abroad.

Plastic with a bromine content of less than 5 mg/kg may be delivered for reprocessing and recycling at enterprises approved under section 33 of the Environmental Protection Act or similar legislation abroad.

Current issues. The most important problems concerning brominated flame retardants are linked to the presence of substances in waste which are further described in sections 2.3.6.6 and 2.3.6.7.

Technical octaBDE and to a lesser extent, technical pentaBDE, may occur in electrical or electronic equipment already in use. The substances are mainly used in moulded components made of ABS plastics typically used in cabinets for conventional CRT TVs and computer screens, as further described in section 2.3.4.1. Most electronics waste is exported for reprocessing in other EU countries. With regard to the part of the waste reprocessed in Denmark, plastic components with brominated

flame retardants are disposed of (all types of brominated flame retardants) in waste incineration plants.

Technical pentaBDE in household waste primarily occurs in polyurethane foam used in mattresses and in upholstered furniture. The remaining quantity will be around 1 tonne technical pentaBDE in total. This waste is typically disposed of in waste incineration plants.

Technical pentaBDE in polyurethane foam in vehicles will end up in the light fraction of waste from shredding plants which is generally landfilled. A study carried out for the European Commission (mentioned in section 2.3.4.1) assesses that basically all technical pentaBDE in vehicles in the EU will be disposed of in 2016. As the fleet of vehicles in Denmark is relatively old, it may be a little longer before everything is disposed of in Denmark, but there are no calculations stating the amounts currently remaining.

With regard to disposal of brominated flame retardants in waste incineration plants, there are two problems. One problem concerns the effectiveness with which the substances are destroyed while the other one concerns the risk of forming brominated dioxins or mixed chlorinated/brominated dioxins. Waste incineration plants in Denmark comply with the BAT requirements laid down in the BREF notes and are all equipped with specific treatment for dioxins which will also capture any brominated dioxins formed.

Plastic components with brominated flame retardants are incinerated at temperatures of at least 850 °C for a minimum of 2 seconds. The EU risk assessment for octaBDE states that the substance will be almost 100% broken down and that releases of octaBDE in practice will be zero.

A review of a number of studies concerning destruction of brominated flame retardants and the production of brominated dioxins ascertains that there are no clear indications that incineration in an ordinary waste incineration plant with dioxin treatment will be in conflict with the obligations under the Convention.

Denmark will request the European Commission to launch a validation of whether technical pentaBDE is sufficiently destroyed in typical waste incineration processes, and of whether an unacceptable production of brominated dioxins occurs, if this is not clarified in the current assessment by the Commission in connection with setting limit values for management of waste containing the new POPs, including the relevant brominated substances.

If the destruction of technical pentaBDE proves insufficient in installations that incinerate household waste, or if an unacceptable production of dioxin occurs, the Danish EPA will assess the possibilities of separating mattresses and upholstered furniture containing polyurethane foam with a content of technical pentaBDE for destruction at special installations.

Waste containing technical pentaBDE must not be reused or recycled if contents exceed certain set limit values for unintentional trace contamination and/or limit values when such are set by Annex IV of the POP Regulation.

On the basis of the current information on the presence of technical pentaBDE, the Danish EPA will prepare guidelines on the articles most likely to contain technical pentaBDE and which consequently must not be reused and recycled if the concentration exceeds set limit values.

3.3.4.3 Planned initiatives

The following table describes new initiatives to be taken in order to reduce releases of relevant brominated compounds from the overall life cycle of the substances.

TABLE 15
PLANNED INITIATIVES TO REDUCE RELEASES OF PBB AND PBDE IN DENMARK

No.	Initiative	Description	Responsible institution	Timeframe
1	Validation of destruction of technical pentaBDE	Encourage the European Commission to prepare a study to validate whether technical pentaBDE is sufficiently destroyed in ordinary waste incineration. On the basis of the results, the need for treatment of waste containing pentaBDE in Denmark will be assessed.	Danish EPA	Not set
2	Possible separation of household waste containing pentaBDE	Depending on the results of Initiative 1, any requirements for separating important fractions of household waste containing pentaBDE will be prepared.	Danish EPA	Not set
3	Guidelines concerning articles which must not be reused and recycled	Prepare guidelines concerning articles which must not be reused and recycled as a consequence of a content of pentaBDE exceeding the set limit values.	Danish EPA	Not set
4	Examine the possibilities of identifying pentaBDE in shredder waste	In 2011, the Danish EPA established an innovation partnership for shredder waste and thus put focus on better exploitation of resources from waste, managing substances of concern (including POPs) and reducing the amounts for landfilling, e.g. by establishing treatment requirements for shredder waste. Through the Action plan to promote eco-efficient technology, the Danish EPA has supported several projects on shredder waste, including a project aimed at identifying potential substances of concern in shredder waste (e.g. pentaBDE) and investigating the possibilities of using sensor-based technology to identify and separate materials containing such substances before or after the shredder process. The results from these projects are included in the work of the innovation partnership.	Danish EPA	Not set

3.3.5 Notification requirements for exemptions concerning production and use of POPs covered by Annexes A and B

On acceding to the Convention, Denmark did not register for specific exemptions regarding production and use of the old substances for which exemption provisions exist. Denmark is not planning to apply for exemptions regarding production and use of the new substances.

In Denmark, the PFOS are used for hard chromium plating which is one of the acceptable uses, and use will be notified as an acceptable use.

3.3.6 Action plan for release reduction from unintentional formation of dioxins, PCB, HCB and pentachlorobenzene

3.3.6.1 Provisions of the Convention

The Parties to the Convention undertake to reduce, and if possible, eliminate, releases from unintentional formation of the substance groups polychlorinated dibenzo-p-dioxins and dibenzofurans (referred to as dioxins), PCB, HCB and pentachlorobenzene.

The Parties must:

- Promote the use of measures that can quickly give a realistic and meaningful release reduction or eliminate sources,
- Promote the development of and require use of alternative or modified materials, products and methods to prevent production and release,
- Promote and require use of the best available techniques (BAT) and the best environmental practice (BEP),
- Possibly set release limit values or performance standards in order to fulfil commitments for the use of BAT,
- Promote the development of and, where deemed appropriate, require the use of substitute or modified materials, products and processes to prevent the production and release of the chemicals listed in Annex C.

3.3.6.2 Status

Implementation legislation. Requirements of the Convention on preparing national action plans to reduce unintentional formation of POPs have been implemented by the POP Regulation. The existing legislation and the associated strategies for limiting releases of unintentionally formed POPs are summarised in section 2.2.5.6.

The POP Regulation requires Denmark and the other Member States to prepare and update inventories of releases of dioxins, PCB, HCB and pentachlorobenzene which are in the lists of the Convention and the POP Protocol on air, water and soil, respectively. Moreover, Denmark and the other EU Member States must prepare and implement national action plans which are to identify, describe and minimise releases of such substances.

Current issues. Atmospheric releases of dioxin in Denmark have been markedly reduced, as stated in 2.3.5.1. In 2005, total Danish releases from point sources were reduced to 6% of the 1990 level, and in 2010, these were further reduced to 3.5% of the 1990 level. In 1990, incineration of waste in waste incineration plants was the largest source of dioxin pollution, however, new requirements of better incineration and treatment of the flue-gas have meant that releases dropped by 94% despite the fact that the amount of incinerated waste has more than doubled. In industry, releases have dropped by 99%, partly due to industry adapting to lower limit values, and partly, because Denmark is no longer remelting aluminium, iron and steel. Therefore, the assessment is that there is no longer a need for new initiatives to limit dioxins from point sources.

Preliminary calculations of releases into air of HCB and PCB indicate that no sources in the chemical industry or the metals industry in Denmark give rise to particular releases of these substances.

However, certain releases of PCB from shredding plants deriving from PCB in waste lead back to the plants.

The use of effective flue-gas cleaning means that most of the dioxin and other POPs end up in flue-gas cleaning products which have until now been landfilled outside Danish borders. According to the 2010 Waste Strategy of the Danish Ministry of the Environment, based on a number of environmental projects, much indicates that resources in flue-gas cleaning products may be used more appropriately. Therefore, further development work will be carried out and in future, landfilling is likely to cease.

Efforts from industry and waste incineration plants have meant that the smoke from firing with biomass in private households and agriculture is now the greatest national source of dioxin contamination of the Danish environment. Combustion of wood and other biomass in small installations in private households and in agriculture represented 71% of the total Danish dioxin releases in 2010. Fires are the second-largest source today representing 23% of total Danish releases. However, the calculation of releases from fires is very uncertain.

Initiatives taken to reduce releases of particles and PAH from wood-burning stoves have proved to have a very poor effect on limiting dioxin releases. Initially focus was on reducing particle releases as the health impacts from particle releases from wood-burning stoves are assessed to be more substantial than the health impacts of dioxin releases. With the current knowledge there are no simple methods to further reduce releases of dioxin from wood-burning stoves as there are already bans on burning waste in the stoves.

The most important intake of dioxin comes from food where the intake is still high. Important sources of dioxin in food are dioxin accumulated in the environment from historical releases and atmospheric deposition of dioxin from sources outside Denmark.

In relation to the requirements of the Convention and the requirements in the POP Regulation, the release inventories for PCB, HCB and pentachlorobenzene are still incomplete. This is partly because no usable emission factors for all sources of use in calculating emissions to the atmosphere under UNECE have yet been developed. For one single year, very uncertain calculations of PCB and HCB releases into air have been made, however, the ongoing emissions inventories only include releases from selected sources. There are no inventories of releases of pentachlorobenzene. No regular inventories of releases to water and soil are made for any of the unintentionally formed POPs, and there are no valid emission factors.

3.3.6.3 Action plan

Planned new initiatives regarding releases of unintentionally formed POPs are provided in the following table.

TABLE 16
ACTION PLAN ON REDUCING PRODUCTION AND RELEASE OF UNINTENTIONALLY FORMED POPS

No.	Initiative	Description	Responsible institution	Timeframe
1	Monitor developments in relation to releases of POPs from wood-burning stoves	Releases from wood-burning stoves, including dioxin, are monitored by the Danish EPA. If new knowledge about the possibilities of reducing releases from the stoves emerges, any new initiatives will be considered.	Danish EPA	Continually
2	Improved emissions inventories	Work will be carried out regularly on improving emissions inventories for POPs into air.	Danish EPA	Continually
3	Development of technologies for treatment of flue-gas cleaning products	Further development of technologies for treatment of flue-gas cleaning products from waste incineration plants. As new technologies are developed, it will be considered whether changes should be made to the legislation on disposal of flue-gas cleaning products.	Danish EPA	Continually

3.3.7 Listing of new chemical substances in Annexes A, B and C

3.3.7.1 Provisions of the Convention

Addition of new substances in Annexes A - C follows the procedures in Article 22(4). Pursuant to Article 22 of the Convention, Annexes A, B and/or C may be amended by a decision at the Conference of the Parties which enters into force on the expiry of one year from the date of the communication by the depositary of the adoption thereof, except the Parties which have opted out of amendment of the annex.

3.3.7.2 Status

Implementing provisions. The procedures for incorporation of new substances to the POP Regulation are described in Article 14 of the Regulation on amending the annexes. Work to identify and investigate new substances for listing under the POP Protocol and the Stockholm Convention primarily takes place within the EU in interplay between the Member States and the Commission.

3.3.7.3 Current issues.

Denmark generally supports relevant POPs to be covered by international regulation. Denmark welcomes inclusion of the five substances currently under consideration in the annexes to the Stockholm Convention and will, together with the EU, work to have the substances included in the lists of substances.

The five substances under consideration and their uses are briefly described in the following table.

TABLE 17
SUBSTANCES UNDER CONSIDERATION FOR INCLUSION UNDER THE STOCKHOLM CONVENTION

Substance	CAS no.	Use of the substance	Use in Denmark
Polychlorinated naphthalenes (PCN)	25586-43-0 28699-88-9 1321-65-9 1335-88-2 1321-64-8 1335-87-1 32241-08-0 2234-13-1	Transformer oils and capacitor oils, flame retardants, additives for plastic and rubber, sealants, fungicides, etc. Formed unintentionally in connection with waste incineration and other processes.	PCN is probably not used intentionally anywhere in the world today. Formed unintentionally in connection with incineration processes. No knowledge about any articles with PCN in use in Denmark. The same applies at EU level
Short-chained chlorinated paraffins (alkanes with chain length 10-13 carbon atoms) (SCCP)	85535-84-8	Cooling/cutting agents, paint, sealants, flame retardant in rubber, leather protection cream, etc.	Banned for metal working and greasing of leather since 2003. May occur in rubber, sealant, glue, paint and varnish, and textiles
Hexachlorobutadiene (HCBD)	87-68-3	By-product in the production of certain chlorinated substances, intermediate in certain chemical processes, insecticides.	Processes where HCBD is formed as a by-product are probably not taking place in Denmark - not registered in the Product Register.
Hexabromocyclododecane (HBCDD)	25637-99-4 3194-55-6	Flame retardants in EPS/XPS foam and in textiles	Included as flame retardant in XPS which is used for building and construction. May occur in textiles, for example, upholstery in vehicles.
Pentachlorophenol (PCP)	87-86-5	Was used some places in the world for impregnation of wood and other biocide uses	Import, sale, use and export of articles containing PCP or its salts and esters in a concentration of 5 mg/kg or more is banned. May occur in impregnated wood taken into use before the ban.

3.3.7.4 Planned new initiatives

Denmark will regularly assess whether more substances should be proposed to be included on the substance lists of the POP Protocol and the Stockholm Convention.

The Danish EPA's List of Undesirable Substances (LOUS) includes two of the substances/substance groups which are currently under consideration for inclusion under the Stockholm Convention; HBCDD and short-chained chlorinated paraffins. Furthermore, the list includes a number of related substances such as the brominated flame retardants decaBDE and TBBPA as well as medium-chained chlorinated paraffins. The list also includes PFOA substances which are related to FPOS

substances. In the period 2012-2015 all substances on the list will be reviewed in order to assess the need for further regulation, labelling, information or phasing-out, e.g. through the EU.

There are several potential candidates, for example, other perfluorinated substances or brominated flame retardants which will continue to be included in Danish studies of the presence of new environmental pollutants in the environment or exposure of humans to these substances. These studies help generate the knowledge necessary for inclusion of new substances under the Convention.

3.3.8 Exchange of information and information to the public

3.3.8.1 Provisions of the Convention

The Convention includes two provisions on exchange of information between the countries, information to the public and public access to information (Articles 9 and 10).

3.3.8.2 Status

The provisions of the Convention on exchange of information, information to the public, etc. are incorporated into Article 10 of the POP Regulation. Current activities regarding information to the public and exchange of activities are described in section 2.3.9.

3.3.8.3 Planned initiatives

Denmark will also in future continue to exchange information with the other Nordic countries and participate in the ongoing exchange of information with the other EU Member States.

Also in future, Danish research institutions will continue to cooperate with research institutions in other Member States on a number of EU-funded research projects related to POPs.

Knowledge about POPs will be communicated through a number of fora in future. Knowledge about POPs will primarily be communicated together with knowledge about other substances hazardous to health and the environment. All results of monitoring of POPs in the environment and in food and animal feed, emissions inventories, and reviews, investigations and studies on POPs will continue to be published on the websites of the relevant institutions, and, thus, be available to the public.

3.3.9 Research, development and monitoring

3.3.9.1 Provisions of the Convention

Under Article 11 of the Convention, the Parties undertake, both at national and international level, to encourage and/or undertake research, development, monitoring and cooperation regarding POPs, their alternatives as well as candidates for new substances under the Convention. The Parties undertake to support national and international efforts to strengthen scientific and technical research capabilities, particularly in developing countries and countries in transition, and to promote access to, and the exchange of, data and analyses.

3.3.9.2 Status

Current monitoring initiatives are described in section 2.3.8. Current research activities are described in section 2.3.11.2. Research is carried out with funds from many different sources.

3.3.9.3 Planned new initiatives

The Danish Nature Agency, the Danish Centre for Environment and Energy (DCE),,Aarhus University will also monitor POPs in the environment in future.

The Danish EPA will continue its work to support research initiatives taken to investigate the presence of POPs in the Arctic environment, and their impact on animals and humans. Investigations

include POPs already covered by the Stockholm Convention, as well as potential candidates for inclusion under the Convention.

Monitoring and research activities will, to a great extent, be carried out in cooperation with other Parties to the Convention.

3.3.10 Technical and financial assistance to other countries

3.3.10.1 Provisions of the Convention

Provisions concerning technical assistance are described in Article 12 of the Stockholm Convention. According to this Article, the parties will cooperate on providing appropriate technical assistance to parties in developing countries and countries in transition to assist them in developing and strengthening their capacity to meet their obligations.

Aspects concerning financial resources and mechanisms are contained in Article 13 of the Convention. According to this Article, within possible frameworks, the parties are required to provide funding and incentives for national activities aimed at realising the goals of the Convention in pursuance of their national plans, prioritisations and programmes. Parties from the developing countries are also required to ensure new and additional financial resources so that parties in the developing countries and countries in transition are able to cover the approved total extra costs of implementing the Stockholm Convention.

3.3.10.2 Status

Implementation legislation: The provisions on technical assistance are incorporated into Article 11 of the POP Regulation which includes the general obligation of the Commission and Member States to provide technical assistance to developing countries and countries in transition. This assistance may also be provided through non-governmental organisations.

Technical assistance provided so far: Danish assistance for POP-related activities will primarily be channelled through the Global Environmental Facility, GEF, which for the time being, has been appointed as the financial mechanism for the Stockholm Convention. In the period from 2006-2010 Denmark has contributed DKK 310 million, of which DKK 104 million are voluntary supplementary contributions. GEF has six main focus areas: climate change, biodiversity, international water systems, soil exhaustion, POPs and deterioration of the ozone layer.

In addition, Denmark has contributed to the operation of the secretariat of the Stockholm Convention and the general trust fund for the Convention; the amount for 2011 was USD 42,587.

In the period 2004-2008, Denmark contributed DKK 15 million for the comprehensive Africa Stockpiles Programme which is implemented by the World Bank and FAO. The programme is about disposal of stocks of POP pesticides and other pesticides in a number of African countries.

Through Danish trust fund resources in the World Bank, funding has been provided, among other things, for development of a GEF-financed “full-size” POPs project in Moldova.

Assistance for implementing regulation of POPs may to a limited extent be included in general assistance for capacity building in environmental authorities in Denmark's programme collaboration countries, if the countries prioritise this. In the past five years, funding has been given to mapping out PCB in the mining sector in Bolivia and for preparing a PCB management plan for the sector.

Denmark provides support through its commitments in NEFCO, Nordic Environment Finance Cooperation, projects in Russia, Ukraine and the Baltic countries involving among other things, PCB, dioxin and disposal of POP pesticides.

Through its general contributions to the EU budget, Denmark also contributes to EU environment work in developing countries and countries in transition, of which some deal with POP problems.

3.3.10.3 Planned new initiatives

Danish assistance for POP-related activities will continue to be primarily channelled through GEF, which is the appointed financial mechanism for the Stockholm Convention. Furthermore, Denmark will contribute to the operations of the Stockholm Convention secretariat.

Assistance for implementing regulation of POPs may, to a limited extent, be included in general assistance for capacity building for environmental authorities in Denmark's programme collaboration countries, if the countries prioritise this.

3.4 Costs

Additional costs relating to Denmark's accession to the Stockholm Convention are considered to be linked primarily to Denmark's contribution to the functioning of the Convention (contribution to the secretariat), as well as the financing mechanism (GEF).

This is due to the fact that the majority of the measures required to meet the commitments under the Convention have already been taken, and further, that for many years POPs have had high priority, and form an integral part of current monitoring and research programmes.

Major elements of costs relating to ongoing POP-related activities are: (including activities that go beyond the requirements of the Convention):

- Implementing the Danish Government's PCB Action Plan,
- Further mapping of PCB in buildings an indoor air (costs primarily paid by public and private building owners),
- Mitigation measures to reduce PCB concentrations in indoor air (costs primarily paid by public and private building owners),
- Disposal of waste containing PCB and any decontamination of sites contaminated with PCB (costs primarily paid by public and private building owners),
- Establishing installations to reduce releases of dioxin and other unintentionally formed POPs at new incineration plants,
- Maintenance and operation of installations to reduce emissions of dioxin and other unintentionally formed POPs, and disposal of residues from flue-gas cleaning,
- Monitoring of POPs in emissions, in the environment, in foodstuffs, and in animal feed,
- Ban on fish with excessive levels of dioxin,
- Programmes to investigate the presence and impacts of substances with POP properties on humans and in the environment.

The largest costs in the coming years will probably be linked to remediation measures of PCB in indoor air and disposal of PCB in building materials of which overall costs in the coming years are estimated by several parties to be several billion DKK.

If systems are to be set up for selective disposal of certain types of waste containing PFOS or technical pentaBDE, these will also result in considerable costs.

3.5 Timetable

The implementation plan will be carried out according to the timetable below.

TABLE 18
TIMETABLE FOR IMPLEMENTING NEW INITIATIVES

Area	Initiatives	Time frame
Reduction of PCB releases	1. 19 initiatives in "Action Plan on Managing PCB in Buildings – Indoor Environment, Working Environment and Waste", see Table 9 2. A possible limit value for PCB in sludge and soil quality standards for PCB 3. Examine the possibilities for identifying PCB in shredder waste	2012-2013
Reduction of PFOS releases	1. Report on use of PFOS in Denmark 2. Notification of acceptable uses 3. Information to users of PFOS on acceptable uses in Denmark 4. Study of PFOS/PFOA as soil and groundwater contamination 5. Assessment of the presence of PFOS in household waste 6. Validation of destruction of PFOS 7. Possible requirements for separating household waste containing PFOS	2012 2012/2016 2012-2013 2012-2014 2012-2013 To be determinedTo be determined To be determined
Reduction of releases of PBB and PBDE included in the Convention	1. Validation of destruction of technical pentaBDE 2. Possible separation of household waste containing pentaBDE 3. Guidelines concerning non-recyclable mixtures and articles 4. Examine the possibilities of identifying pentaBDE in shredder waste	To be determined To be determined To be determined To be determined
Reduction of releases of unintentionally formed POPs	1. Monitor developments in relation to releases of POPs from wood-burning stoves 2. Improved emissions inventories 3. Further development of technologies for treatment of flue-gas cleaning products	In progress In progress To be determined
Listing of new chemical substances in Annexes A, B and C	Initiatives on inclusion of a number of new substances in the Annexes to the POP Protocol and the Stockholm Convention	In progress
Exchange of information and information to the public	In future, knowledge about POPs will be communicated via a number of fora, and new initiatives will be taken to the extent necessary	In progress
Research, development and monitoring	Continued support for research initiatives directed at examining the presence of POPs in the Arctic environment as well as their effects on humans and wildlife; both POPs covered by the Stockholm Convention and potential candidates	In progress
Technical and financial assistance to other countries	Contribution for financing mechanism and any support for programme collaboration countries prioritising the area	In progress

4. Abbreviations and measurement units

4.1 Abbreviations

AMAP	Arctic Monitoring and Assessment Programme
BAT	Best available techniques
BDE#47	# Used for notation of congeners where congeners are numbered according to international nomenclature
GDP	Gross domestic product
BREF	BAT Reference (...documents)
DAKOFA	The Danish Competence Centre on Waste
DDE, DDD	Degradation products of DDT
DDT	1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane
DecaBDE	Decabromdiphenyl ether (used for both a substance and a technical compound)
Dioxins	Used as abbreviation for polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
DPA-system	Danish Producer Responsibility System
EC	European Community
E-PRTR	European Pollutant Release and Transfer Register
EU	European Union
HCB	Hexachlorbenzene
HCH	Hexachlorcyclohexan, three forms: α, β and γ
HeptaBDE	Heptabromodiphenyl ether
HexaBDE	Hexabromobiphenyl ether
ISAG	Information System for Waste and Recycling
NOVANA	The national programme for monitoring the aquatic environment and nature
OctaBDE	Octabromodiphenyl ether (used for both a substance and a technical compound)
The OECD	Organisation for Economic Cooperation and Development
PAH	Polyaromatic hydrocarbons
PBDE	Polybrominated diphenyl ether
PCB	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzo-p-dioxins
PCDF	Polychlorinated dibenzofurans
PCT	Polychlorinated terphenyles
PentaBDE	Pentabromodiphenyl ether (used for both a substance and a technical compound)
PFAS	Perfluoroakyl sulfonic acids/sulfonate (and its derivatives)
PFC	Per- and polyfluorinated compounds
PFDA	Perfluorodecanoic acid
PFHxS	Perfluorohexansulfonate
PFNA	Perfluorononanoic acid
PFOA	Perfluorooctanoic acid (and its derivatives)
PFOS	Perfluorooctane sulfonic acid/sulfonate (and its derivatives) (in the Stockholm Convention, PFOS only covers perfluorooctane sulfonic acid)
PFOSA	Perfluoroctansulfonamide

PFUnA	Perfluoroundecanoic acid
PIC	Prior informed consent (refers to the principle laid down in the Rotterdam Convention on prior informed consent)
POP	Persistent organic pollutant
PRTR	Pollutant Release and Transfer Register (register of releases and transfer of pollutants)
RASFF	Rapid Alert System for Food and Feed
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RoHS	Restriction of Hazardous Substances (...in electrical and electronic products)
SCCP	Short chained chlorinated paraffins
TDI	Tolerable Daily Intake
TEF	Toxicity equivalency factor (for dioxins and dioxin-like PCBs)
TEQ	Dioxin toxicity equivalents (for dioxins and dioxin-like PCBs)
TetraDBE	Tetrabromodiphenyl ether
TWI	Tolerable Weekly Intake
WEEE	Waste Electrical and Electronic Equipment

4.2 Units of measurement

I-TEQ	Unit expressing total toxicity of dioxins in a sample weighted on the basis of the "international" toxicity-weighting system for toxicity of individual types of dioxin
Total-TEQ	Unit corresponding to WHO-TEQ
WHO-TEQ	Unit expressing total toxicity of dioxin and dioxin-like PCBs in a sample weighted on the basis of the WHO toxicity-weighting system for toxicity of individual types of dioxin
Total-PCB	Usually calculated as 5 x PCB_6 or 5 x PCB_7
PCB_7	The sum of 7 indicator PCB: PCB#28, PCB#52, PCB#101, PCB#118, PCB#138, PCB#153 and PCB#180
PCB_6	The sum of 6 indicator PCB: PCB#28, PCB#52, PCB#101, PCB#138, PCB#153 og PCB#180
mg	milligram = 10^{-3} g
µg	microgram = 10^{-6} g
ng	nanogram = 10^{-9} g
pg	picogram = 10^{-12} g
Nm^3	Normal cubic metre

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Updated National Implementation Plan for the Stockholm Convention 2012

The Stockholm Convention on Persistent Organic Pollutants (POPs) entered into force on 17 May 2004. The Convention aims to protect human health and the environment from POPs. National implementation plans (NIPs) are part of the Danish reporting obligations under the Convention. Denmark's first NIP was submitted in 2006 and covered the 12 substances or groups of substances included under the Convention. Since then 10 new POPs have been added to the Convention, and the updated implementation plan describes the situation of the new POPs in Denmark and follows up on priority actions of the last NIP, e.g. for PCBs. The implementation plan also contains a description of the new initiatives Denmark will take to further implement the Convention. The new initiatives are described in an action plan. These are especially targeted the substance PFOS, unintentional formation of dioxins and other POPs and management of waste containing POPs.

Miljøministeriet
Miljøstyrelsen

Strandgade 29
DK - 1401 Copenhagen K
Tel. +45 72 54 40 00

www.mst.dk