DANISH MINISTRY
OF THE ENVIRONMENT

National Implementation Plan

Stockholm Conventionen on Persistent Organic Pollutants

Contents

PREFACE

The protection of human health and the environment from hazardous chemicals is a very important issue for the Danish Government. With the increasing globalization we face these years, international regulations become a central instrument.

It is well documented, that persistent organic pollutants are dispersed throughout the entire globe through the air, with migrating animals and through trade. It is therefore crucial, that all countries contribute with an active effort to limit them.

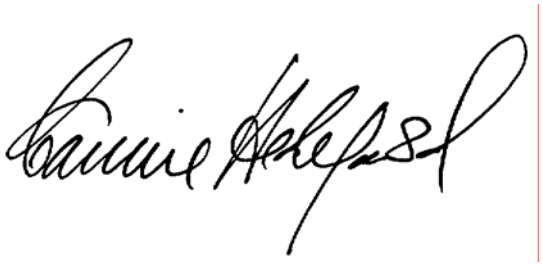
The national implementation plans, which all Parties to the Stockholm Convention must elaborate, are very important. The plans will constitute the basis for the national efforts in the coming years. They must specify how the countries will phase out production and use and reduce emissions of the 12 chemicals covered by the convention. The Danish contribution is this implementation plan.

It is not difficult for Denmark to comply with the immediate obligations regarding the phase out of production and use of the chemicals covered by the Convention. We have since long prohibited their use. The challenge for us therefore pertains to the unintentional production and emissions, first and foremost those related to combustion processes. Through recent years we have undertaken a substantial mapping of the persistent organic pollutants, especially dioxin. We are in the midst of following up on the results of the mapping, and we have succeeded in substantially reducing the emissions of dioxin. This implementation plan describes the measures we will prioritize in the coming years.

Denmark was at the forefront of the endeavours to establish international regulation on persistent organic pollutants. The 12 substances covered I see as only the beginning. The end goal must be for the Convention to cover all problematic persistent organic pollutants.

The national implementation plans have the potential of becoming a valuable tool, for the Parties themselves as well as for the attainment of the objectives of the Convention as a whole. With their substantial content of information they can be of use as inspiration for Parties to the Convention as well as for other states, thereby contribution to solving the problem globally.

I hope that this implementation plan will contribute.



18 May 2006

Executive Summary

Denmark ratified the Stockholm Convention on 17 December 2003, five months before the entry into force of the Convention on 17 May 2004. The ratification was made with a territorial exclusion in respect of the Faroe Islands and Greenland, and therefore the Convention does not apply in the Faroe Islands and Greenland at this time.

The Stockholm Convention covers a number of obligations that Denmark has assumed in other fora, including obligations under the UNECE Protocol on Persistent Organic Pollutants, the Helsinki Convention and the OSPAR Convention. Furthermore, Denmark has endorsed the Nordic strategy on Sustainable Development and the Arctic Environmental Protection Strategy (AEPS). Partly as a consequence of this, Denmark has already taken a number of substantial measures in the area of persistent organic pollutants.

Legislation on POPs in Denmark

Regulation in Denmark of persistent organic pollutants (POPs) and waste containing POPs is characterised by a close interaction between EU legislation and national legislation. Most regulation on POPs is a consequence of EU regulation.

In the EU, the Stockholm Convention is implemented through Regulation 850/2004 on persistent organic pollutants. This regulation is supplemented by a Regulation on export and import of dangerous chemicals and a Regulation on the supervision and control of shipments of waste. Nationally, this regulation is supplemented by the Danish Environmental Protection Act, the Act on Chemical Substances and Products and a number of Statutory Orders under these acts, including the Statutory Order nr. 820 of 29 September 2003 on Persistent Organic Pollutants.

Under this set of regulations import, export, use and intentional production of the substances covered by the Stockholm Convention is banned.

POPs-related problems in Denmark

The intentionally produced substances constitute a very limited problem in Denmark. None of the substances covered by annex A of the Stockholm Convention have been intentionally procuced in Denmark. Only DDT, aldrin, dieldrin, endrin and heptachlor have been used in Denmark. Of these only DDT and dieldrin have been subject to widespread use. It is assessed that there are no stockpiles of POPs waste in Denmark.

The registered occurrence of POPs pesticides in foodstuffs do not raise cause for concern for human health, and measurements of POPs pesticides in groundwater during 1993 – 2003 have not led to findings of the substances.

The levels of PCB in the environment have been decreasing substantially over the last 30 years, but it cannot be excluded that PCB can still affect some organisms. The levels of PCB in foodstuff do not give cause for concern for human health.

PCB has never been produced in Denmark. For a time PCB was used for different technical purposes, for example in equipment, and also in products such as paint, sealing material and self-copying paper. It is likely that there is still a limited number of capacitors containing PCB in use or stocked in companies, even though a ban has been in place for many years. As concerns waste containing PCB, only a small and declining number of capacitors is disposed of. A study is currently looking into the occurrence of PCB in building materials in older buildings.

Denmark's problems with POPs are mainly related to unintentionally produced dioxins. The emissions from a number of sources have been reduced markedly over recent years. However, it is estimated that approximately 5 per cent of the Danish population has an intake that exceeds the tolerable daily intake.

The emissions of dioxin have been estimated for 1995 and 2000-2002, but comparison is hampered by the fact that emissions from a number of sources were not included in the estimations for 1995, and the methods for estimation differ. Consequently it is not possible to make a precise evaluation of the decline in emissions, even though it is known that the emissions from incineration plants and industrial plants have decreased substantially. A revised assessment of emissions in 1990 and 2004 is currently being undertaken, and new figures will be presented later this year.

Today, after the entry into force of new emission standards for incineration plans, the largest contributions to the overall emissions of dioxin to air are, in decreasing order:

(i) energy transformation, especially the use of wood burning stoves and burning biomass in smaller and larger plants

(ii) treatment and disposal of waste, especially burning of household waste and landfill sites

(iii) miscellaneous other activities, especially fires and bonfires.

Industrial processes are estimated to constitute a minor part of the overall emissions of dioxin, due to extensive flue gas purification.

Prioritised target areas

On the basis of the present assessment it can be concluded that to a high extent Denmark complies with the provisions of the Stockholm Convention. This plan of implementation therefore contains a limited number of new measures.

The new measures are mainly directed towards unintentional production of dioxins and treatment of waste containing POPs and towards activities related to research, development and information. The measures are listed in the table below.

The existing measures have been successful in limiting emissions from the major sources, but for some sources, for example wood burning stoves, readily useable solutions do not exist. At the outset, initiatives will therefore focus on obtaining better knowledge. The formation of residues from flue gas purification also gives rise to further consideration.

In relation to PCB, initiatives will await the results of the ongoing study on PCB in building materials. The need for additional measures will subsequently be assessed.

The plan of implementation includes measures 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 pollutants that exhibit POPs characteristics. Denmark is positive towards including a number of pollutants under the Convention and will strive for their inclusion in the annexes of the Convention.

Denmark will primarily assist developing countries and countries with economies in transition through the financial mechanism of the Convention, namely the Global Environment Facility, GEF, to which Denmark has increased its contributions in recent years.

New initiatives and activities for the implementation of the Stockholm Convention

AREA	NEW INITIATIVES AND ACTIVITIES
Areas related to specific POP- substances	
Annex A (part II) substance: Intentional use of PCB	See below under "stockpiles, waste and contaminated sites".
Annex C substances: Unintentional emissions of PCDD/PCDF (dioxins and furans), PCB and HCB	Continuations of studies on emissions of dioxin and other pollutants from wood burning stoves and smaller combustion plants with the aim of identifying possible measures to reduce emissions. A study will be undertaken to assess whether there are sources for the emissions of unintentionally produced HCB or PCB in Denmark that have been overlooked. If this appears to be the case, an assessment of emissions will be made if possible, and the need for further measures will be considered. Requirement for flue gas purification for mercury, which will also limit the emissions of POP substances.
Stockpiles, waste and contaminated sites	An ongoing study is looking into the content of PCB in building materials in older buildings. When the results are known, it will be decided whether new initiatives in the area are called for. Continuing efforts to de-couple growth in waste from economic growth. Further efforts to limit the amount of PVC in waste incineration Denmark expects to take a decision on the future treatment of residue from flue gas purification in 2006.
Listing of new chemical substances in annex A, B and C	Denmark is positive towards the listing of a number of new substances on the annexes to the UNECE POP Protocol and the Stockholm Convention and will work for their listing.
Other areas	
Exchange of information and information to the public	Existing relevant teaching material on chemicals, especially directed at adolescents, will be expanded and updated regarding POP substances. Continuing use of campaign material to promote the reduction of emissions from wood burning stoves and similar.
Research, development and monitoring	Regular consideration whether there is a need for further studies on dioxin in mothers' milk, in order to follow the development in the burden on the population from dioxin. The conversion of dioxin in the Baltic Sea will be studied, in order to establish to what extent dioxin, which is presently accumulated in fish, originates from atmospheric deposition or is due to remobilization of dioxin from the seabed. Investigation into the sources of dioxin in organic farming. Further support to research initiatives investigating the presence of POP substances in the Arctic environment and their effects on humans and animals. POP substances covered by the Stockholm Convention as well as potential candidates are anticipated as subjects for further studies.
Technical and financial assistance to other countries	Continue to support POP related activities channelled through the GEF. Support to the establishment of regulation on POP substances may to a lesser extent be possible in connection with general support for capacity building for environment authorities in countries that Denmark has programme cooperation with, if prioritized by the countries.
Efficiency evaluation	Denmark will await further decisions of the Conference of the Parties on which data needs to be reported and in which format. If the existing monitoring data regarding the occurrence of the POP substances do not satisfy the future data requirements of the Convention, the necessary further monitoring will be established.

1 Introduction

1.1 Denmark's plan for implementation of the Stockholm Convention

1.1.1 Background and purpose

According to the Convention, all Parties must develop and seek to implement a plan for the implementation of their obligations according to the Convention and send it to the Conference of the Parties, in practice the secretariat, within two years from the date of the entry into force of the Convention for the Party in question

Denmark's instrument of ratification was deposited on 17 December 2003 with the General Secretary of the United Nations. In connection with the deposition a territorial declaration was made, stating that the Convention until further notice will not cover the Faroe Islands and Greenland. The Convention is notified in Denmark by Act no. 29 of 14 October 2004 of the Ministry of Foreign Affairs. Since the Convention did not enter into force until after the Danish ratification, the Convention entered into force for Denmark on the date of the entry into force of the Convention. Consequently Denmark must finalise its implementation plan by 17 May 2006.

1.1.2 Elaboration and adoption of the implementation plan

This implementation plan has been elaborated by the Ministry of the Environment, the Environmental Protection Agency. A group of stakeholders, a monitoring group, has been involved including the Danish Society for Nature Conservation, the Confederation of Danish Industries, the Ecological Council, Greenpeace, the Women's Council in Denmark and the World Wildlife Fund.

The elaboration has been guided and coordinated by a steering group from the Environmental Protection Agency with representatives from the units with expertise in the substance matter. A consultancy firm has assisted the elaboration.

The task was carried out in the following steps:

- Elaboration of introduction and country baseline;
- Elaboration of a "gap analysis";
- Compilation of strategy elements and action plans and finalisation of draft implementation plan;
- Hearing amongst a wide group of stakeholders;
- Finalisation of the final implementation plan.

The consultant has drafted the first drafts for introduction, country baseline, and gap analysis – an analysis of possible shortcomings in Danish legislation and initiatives. The gap analysis has been elaborated to assess the need for further measures in order for Denmark to live up to its obligations under the Convention and the parts of the EU regulation that implement the Convention, including reporting requirements regarding polyaromatic hydrocarbons, PAH. The draft was discussed by the steering group and the monitoring group.

The deliberations and conclusions of this process have constituted the basis for elaboration of a draft implementation plan, including strategic elements and action plans. This draft was examined and adjusted by the steering group from the Environmental Protection Agency and subsequently sent out to a wide hearing of stakeholders. After the hearing, the final implementation plan was finalised.

1.1.3 Structure of the implementation plan

The implementation plan follows the structure suggested in the ”Interim guidance for developing a national implementation plan for the Stockholm Convention”.

After this short introduction, chapter 2 presents a country baseline, describing the situation in Denmark. The description is introduced by a short country profile, followed by a description of the institutional, political and regulatory frameworks. This section describes who does what, and how POPs issues are connected to other priorities in Danish environmental policy. In the subsequent sections other international obligations and the existing regulation regarding POP substances are described, followed by a description of the POP situation in Denmark.

Emissions and the prevalence of POP substances in the environment, foods, animal feed, waste and contaminated sites are described. Activities undertaken regarding monitoring of the POP substances and research into their effects on humans and the environment are also described. Vulnerable groups are mentioned in a short section.

Chapter 3 goes over the strategies and action plan elements for the fulfilment of Denmark’s obligations under the Convention. For dioxin and other unintentionally produced POP substances a separate action plan has been elaborated, in accordance with the provisions of the Convention. Due to the size of the action plan it is placed in a separate annex to the plan of implementation, annex 1.

1.2 The Stockholm Convention

The Stockholm Convention was adopted in May 2001 and the Convention entered into force on 17 May 2004.[1] The purpose of the Convention is to protect the environment and human health from persistent organic pollutants.

The Stockholm Convention obliges the Parties to ban and/or take legal and administrative measures necessary to eliminate production, import/export and use of the substances listed in annex A to the Convention, which encompasses the 9 POP substances aldrin, chlordan, dieldrin, endrin, heptachlor, mirex, toxaphene, hexachlrobenzene (HCB) and polychlorinated biphenyls (PCB). The Parties must furthermore limit production and use of the substances listed in annex B, which currently only covers DDT.

Furthermore, Parties must take measures to reduce – an if possible eliminate – emissions from unintentional production listed in annex C, which covers polychlorinated dibenzo-p-dioxin and dibenzofurans (PCDD/PCDF), PCB and HCB. The substances are produced unintentionally in connection with a number of chemical and thermal processes. In every-day terms polychlorinated dibenzo-p-dioxin and dibenzofurans are often called ”dioxin and furans” or just ”dioxin”. In the remainder of this implementation plan, the term ”dioxin“ will be used for both groups of substances, since in practice they are denoted together

The Convention also requests, that stockpiles that contain or are made up of POP substances be identified and handled in a safe manner.

1.3 The POP substances

The POP substances are characterized by being difficult to degrade, by spreading in the environment and accumulating in humans and animals, and by having a number of undesirable effects on organisms.

Twelve POPs are regulated under the Stockholm Convention, but there is a number of other substances with the same characteristics. Some of these are covered by other international agreements or are being assessed with a view of future international regulation.

[1] This date is 90 days after 50 states or regional organisations became parties to the Convention.

The substances listed in the Stockholm Convention are divided into three groups:

Annex A, Elimination:	Aldrin, chlordan, dieldrin, endrin, heptachlor, mirex, toxaphen, polychlorinated biphenyls (PCB) og hexachlorobenzene (HCB).
Annex B, Restriction:	DDT.
Annex C, Unintentional production:	Polychlorinated dibenzo-p-dioxin and dibenzofurans (PCDD/PCDF), PCB and HCB.

Annex A and B substances have all, except for PCB, been used as pesticides, but HCB and mirex have also been used as industrial chemicals.

Other POP substances

There is a number of POP substances apart form the 12 substances 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 emission of a number of POP substances. The POP Protocol is mentioned in section 2.2.3. The POP Protocol covers 4 substances in addition to those covered by the Stockholm Convention: polyaromatic hydrocarbons (PAH), chlordecone, hexabromobiphenyl and hexachlorocyclohexan (HCH). These substances are also covered by the EU Regulation on POPs, and several of them are being assessed under the Stockholm Convention for possible future listing in the Stockholm Convention annexes. This is the case for HCH (lindane), chlorodecone, hexabromobiphenyl, PFOS and pentaBDE.

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. Just under one-fifth of these islands are inhabited. The total coastline is 7,031 km. Denmark is connected to Germany with a 69 km land border. Since 1 July 2000, Denmark has also had a fixed link with Sweden via a bridge of almost 16 km across the Sound between Copenhagen and Malmø.

Denmark has 5.4 million inhabitants, which constitutes just over 1.4 per cent of the total EU population. The population density is approx. 123 pr. km². The population is relatively evenly distributed, but there is a greater concentration in the Copenhagen region with its approx. 1.7 million. Denmark has just over 3 million economically active inhabitants, while the group of young people under the age of 17 and the group of elderly people over the age of 60 both constitute just over 1 million. The average life expectancy is 79 years for women and 75 years for men.

Denmark has a temperate maritime climate. The climate is influenced by the country's proximity to large maritime areas and its position in a mild zone of western wind. This position means that, in the summer, the temperature lies around 20°C and that the mean temperature in the winter is around freezing point. Precipitation is fairly evenly distributed over the year, but with more in the autumn months.

2.1.2 Political profile

Denmark's form of governance is parliamentary democracy with a royal head of state. The 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 Faroe Islands each elect two members. Denmark is a member of the EU, but has decided to stay out of the cooperation within a few areas. These include the common European currency, the euro, and military cooperation.

2.1.3 Economy and business

Historically, Denmark was an agricultural country, but in the past few decades, its business sector has become more complex and is now dominated by a large, export-oriented industry and a well-developed service sector.

The number of agricultural establishments has fallen steadily, and in 2002, it was down to 50,500 farm units. This sector now represents less than 5 per cent of the total value added in society and employs less than 4 per cent of the

employed population. Despite this, agriculture represented approx. 11 per cent of Denmark's total exports in 2004.

Industry represents about 16 per cent of Denmark's annual value added, as much as 75 per cent of exports (2004), and just over 15 per cent of the employed population. Some of the most important product and service areas are foodstuffs, furniture and clothes, design and interior design, maritime transport, wind turbines, pharmaceuticals and medical devices, equipment for automatic cooling and heating, sensitive measuring equipment, and IT and communication.

Business in Denmark is characterised by many small and medium-sized enterprises, and workplaces with 1-19 employees constitute more than 90 per cent of the total.

Table 2.1
The economic sectors' gross value added*, employment and distribution of enterprises by size

	Gross value added 2003 (DKK billion)	Employ-ment 2004 (1000 persons)	Total no. of work-places	Total no. of workplaces, analysed by size (2001)		
				1-19 em-ployees (%)	20-99 em-ployees (%)	100+ - em-ployees (%)
Column	1	2	3	4	5	6
Agriculture, fisheries and development of raw materials	60.1	94	46,529	99.2	0.8	0.0
Industry	190.0	418	21,629	80.1	15.7	4.2
Energy and water supply	27.7	15	2,132	93.7	4.8	1.5
Building and construction enterprises	62.0	167	27,224	93.4	6.1	0.5
Trade, hotels and restaurants	168.3	489	72,074	92.5	7.0	0.5
Transport, mail and telecommunications	97.8	171	15,396	89.0	9.3	1.7
Financing, etc., business service	302.6	369	57,893	94.9	4.4	0.7
Public and private services	333.5	969	54,215	82.1	15.0	2.9
Not indicated		14	614	100.0	-	-
Indirectly measured financial services	-43.8					
Total	1,198.0	2,706	297,706	91.1	7.6	1.3
of which general government	275.7					

*Gross value added is calculated as the value of production less the value of consumption in production. This corresponds to gross domestic product (GDP) less (product taxes less product subsidies).

Source: Statistics Denmark: Denmark in Figures 2005 (column 1), Statistical Yearbook 2005 (column 2) and DS figures from the end of November 2001 reproduced in the Ministry of Science, Technology, and Innovation: www.workindk.dk/Virksomheder (columns 3-6).

2.1.4 The overall environmental situation in Denmark

The overall environmental situation in Denmark is subject to a number of special characteristics. Denmark has a high population density and high economic activity. Forests and natural areas only constitute about 10 per cent of the territory, and Denmark is an island nation surrounded by sensitive shallow-water marine areas. Thus, the environment's capacity for taking up pollutants is relatively small, and a reduction of discharges has been on the political agenda for many years.

Through extensive regulation and close cooperation between the different social players, Denmark has come a long way in the last fifty years toward solving a number of environmental problems. For example, this has been done through cleaning of wastewater, putting filters in chimneys, banning the use of the most hazardous chemical substances, protecting natural areas, using less fertilizer and less toxic pesticides in agriculture, and introducing environmental labels and other initiatives to support organic and other environmentally friendly production and consumption. Now that the 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 and industrialised agriculture.

Denmark is among the countries in the world with the highest consumption of goods, resources and energy per capita. The agricultural area constitutes about 65 per cent of the total area. Although discharges of nutrients from agriculture have been reduced considerably in recent years through targeted initiatives, many water bodies still receive too large additions of nutrients. Through increased consumption of consumer goods produced throughout the world, people are subjected to a large amount of chemical substances, despite the improvements achieved through bans of the most problematic substances.

Increasing traffic causes pollution with particles and noise, and the high consumption of fossil fuels entails that Denmark has relatively high emissions of greenhouse gases per capita despite intensive promotion of renewable energy sources. A high degree of wealth and a modern lifestyle result in increased resource consumption, and this constitutes a challenge as regards waste and derived environmental effects.

A decoupling of the increases in resource consumption, energy consumption and waste generation from economic growth is an environmental policy priority, and particularly in the energy area, the link between growth and pollution has been successfully decoupled. Decoupling will continue to be one of the major priorities in environmental policy.

2.2 Environmental-policy, legislative and institutional framework

2.2.1 Environmental policy, strategy for sustainable development and legislative framework

The starting point of Denmark's environmental policy is that the country should be a society where economic progress 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, improved resource efficiency, making businesses and consumers take responsibility, and through support of local Agenda 21 initiatives.

Denmark's strategy for sustainable development should therefore also be seen as the country's response to the challenge of Agenda 21, which was adopted at the UN General Assembly in Rio in 1992, to prepare national strategies for sustainable development. The Danish vision of sustainable development is based on eight targets and principles:

- The welfare society must be developed and economic growth must be decoupled from environmental impacts;

- There must be a safe and healthy environment for everyone, and we must maintain a high level of protection;
- We must secure a high degree of biodiversity and protect the ecosystems;
- Resources must be used more efficiently;
- We must take action at the international level;
- Environmental considerations must be taken into account in all sectors;
- The market must support sustainable development;
- Sustainable development is a shared responsibility and we must measure progress.

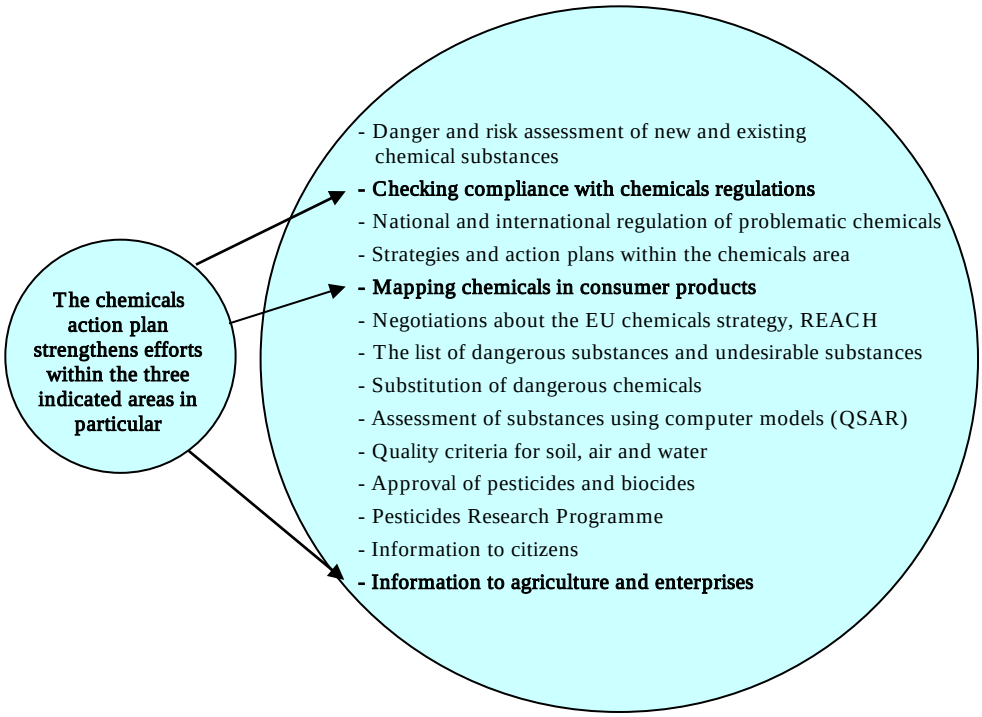
The strategy is built up around a number of ***sectors***: foodstuff production, forestry, industry, transport, energy, urban and housing development in addition to ***intersectoral action:*** climate change, biodiversity, environment and health, resources and resource efficiency, knowledge and policies and measures, the global dimension and public participation. Chemicals initiatives are placed under environment and health, and the overall objectives are the generation goal in the Nordic strategy on sustainable development which states that emissions of chemicals that pose a threat to the environment and health are to cease within a generation, and that no products or goods on the market in 2020 may contain chemicals that have highly problematic effects on health or the environment. These objectives have subsequently been supplemented by the chemicals objective from the World Summit in Johannesburg that in 2020 chemicals must be used and produced in ways that lead to the minimization of significant adverse effects on human health and the environment.

Chemicals action plan

Through the 1980s and 1990s, Denmark enhanced its efforts within the chemicals area. The purpose is to reduce the environmental and health risks connected to the use of chemicals. Primarily, this is done through strong international cooperation, separate Danish regulation, control sanctions, and by providing the public, enterprises and agriculture with greater knowledge of chemicals.

In the autumn of 2005, the government presented the latest chemicals action plan ”Styr på kemikalier - Regeringens handlingsplan for en styrket kemikalieindsats 2006 - 2009” (control the chemicals – the Government's action plan for enhanced efforts to control chemicals 2006-2009).

Specifically, the Danish efforts within the chemicals area today include the following initiatives:



The government has decided to prioritise its efforts for particularly three areas in the period 2006- 2009. Focus on these areas together will ensure that Danes and the Danish environment are better protected: (i) more control, (ii) greater focus on products for consumers and (iii) better communication with enterprises.

The chemicals action plan is supplemented by the government's Waste Strategy 2005-2008.

Waste Strategy 2005-2008

In 2003, the government published its Waste Strategy 2005-2008 as an important element of its overall strategy for sustainable development. The Strategy has three purposes: to describe the government's waste policy until 2008, to outline the framework for municipalities' local waste planes and their implementation, and to draw up a national waste plan in accordance with EU obligations in the area.

According to the Strategy, efforts are to be made to prevent the loss of resources and environmental impacts from waste. Moreover, growth in waste must be decoupled from economic growth, and improved cost-effectiveness of environmental policies must be ensured.

The Waste Strategy is one strategic element that works in synergy with the Government's other environment policy strategies, inlcuding (i) the chemicals strategy - important for efforts to reduce the levels of contaminants in waste, (ii) the product-oriented environment strategy - with respect to the prevention of waste, (iii) the "Environment and health are closely related" strategy, and (iv) ”Making Markets Work for Environmental Policies - Achieving Cost-effective Solutions”.

2.2.2 Roles and responsibilities of public institutions

Below is a description of the public institutions involved in the activities related to the implementation plan in various ways.

The Folketing
The Folketing – the Danish parliament - adopts bills and resolutions, and it is the task of the Folketing to check the government's administration and policy by means of notifications to the standing committees, questions to the ministers, or consultations.

The Folketing's Environment and Regional Planning Committee is one of many committees of the Folketing whose work is primarily linked to processing of bills and resolutions and parliamentary checks and balances of the government. The areas of the Environment and Regional Planning Committee include environmental protection, nature conservation, forestry and spatial planning as well as gene technology, hunting, game administration, acquisitions for recreational activities, listing of procetced nature areas, raw materials in the soil and seabed, etc.

Ministry of the Environment
The Ministry of the Environment takes care of administration and operation tasks within spatial planning, environmental protection, environment-related health protection, nature and forest administration, surveying and mapping. Largely, these tasks are carried out by a number of agencies and institutes. Moreover, the Ministry carries out a number of studies and sector research tasks within environment and nature, forests and landscapes and geology. The Ministry prepares environmental strategies for a number of areas.

The Department, including the Minister's secretariat services the Minister and attends to political and strategic functions. It also has a co-ordinating role regarding the EU and the horizontal international level, including UNEP and CSD.

The Danish Environmental Protection Agency (the Danish EPA) manages environmental legislation, prepares draft legislation, policies and strategies, engages in EU and international negotiations and advises the Minister for the Environment. The Danish EPA handles the state tasks for which the Minister for the Environment is responsible within the following areas: environmental impacts on water, air and soil and on human health. It collates and processes knowledge about the development of the environment and about connections between environmental impacts and environmental effects. Moreover, the Danish EPA is responsible for summarising and assessing research and monitoring results as well as environment inspection and control results, etc. The Danish EPA initiates studies and research projects within the environment area, participates in international cooperation on environmental protection, and manages environmental subsidy schemes for the EU's new neighbours and for the Arctic area.

The Danish EPA is the authority responsible for approval of pesticides and control and supervision of compliance with the Act on Chemical Substances and the Statutory Order on Pesticides. The Danish EPA Chemical Inspection Service is thus responsible for supervision and control of compliance with the regulations in the Act on Chemical Substances which, amongst other things, bans marketing or use of the POP pesticides covered by the Stockholm

Convention. The Danish EPA is also responsible for supervising and enforcing compliance with the regulations in the Statutory Order on PCBs.

The Danish Forest and Nature Agency manages nature legislation, prepares draft legislation, policies and strategies, engages in EU and international negotiations and advises the Minister for the Environment. The Danish Forest and Nature Agency handles the state tasks for which the Minister for the Environment is responsible within the following areas: nature conservation and nature management, national planning, environmental conditions of agriculture, forestry, hunting and game administration, gene technology, outdoor recreation, raw materials management as well as environmental assessments and local Agenda 21.

The National Environmental Research Institute of Denmark (NERI) is a sector research institution under the Ministry of the Environment. NERI's tasks include preparing and strengthening the scientific basis for environmental policy priorities and decisions, carrying out data collection, consultancy and communication, and developing tools and methods to ensure coherent and consistent prioritisation.

Since 2000, NERI has been working with the Danish EPA on a number of studies of emissions from known dioxin sources and on estimating the extent of dioxin pollution in Denmark in general. Further to this, it is the responsibility of NERI to prepare official Danish annual inventories of emissions into the atmosphere and report the total dioxin emissions to the EU and UNECE. NERI monitors pollutants in the Arctic environment, e.g. in connection with the Arctic Monitoring and Assessment Programme (AMAP) and participates in the monitoring of conditions for nature and the environment in Danish fjords and marine areas in cooperation with the regional authorities.

The Centre for Corporate Management is the Ministry of the Environment's administrative centre responsible for the Ministry's tasks as regards personnel, organisation, financial administration, IT services, practical information and building services.

The Geological Survey of Denmark and Greenland (GEUS) is an independent sector research institute under the Ministry of the Environment. GEUS carries out scientific tasks in connection with parts of the legislation managed by the Ministry of the Environment, e.g. within water supply, raw materials, hydrocarbon resources and subsurface areas. Moreover, GEUS participates in national and international research programmes and carries out environment and energy tasks on contract terms. In relation to POPs, GEUS has been involved in a number of studies of POPs in ice cores from Greenland.

Ministry of Food, Agriculture and Fisheries

One of the main objectives of the Ministry is to ensure that the foodstuffs produced and sold to consumers are healthy and of high quality, and to ensure that the level of information on foodstuffs is high. The Ministry carries out planning and development tasks as well as regulatory, administrative and control functions. It has tasks related to the EU cooperation and other international relations significant to the agriculture, fisheries and foodstuff sectors. For example, the Ministry is involved in an initiative to enhance efforts to reduce human exposure to dioxin in cooperation with the Ministry of the Environment and the Ministry of Family and Consumer Affairs. This

cooperation includes the Dioxin Action Plan aimed at both foodstuffs and animal feed.

Ministry of Family and Consumer Affairs

The Ministry takes care of the interests of families in a broad sense, including consumer protection and food safety, as well as nutrition, livestock diseases and food inspection. As mentioned above, the Ministry of Family and Consumer Affairs cooperates with the Ministry of the Environment and the Ministry of Food, Agriculture and Fisheries to reduce human exposure to dioxin. The Danish Veterinary and Food Administration under the Ministry is responsible for development, coordination and drawing up regulations within the veterinary and foodstuff areas and carries out food inspection and supervision of veterinary matters. The Danish Veterinary and Food Administration is also responsible for measuring dioxin in breast milk.

Ministry of Employment

The Ministry of Employment is responsible for worker protection and is managing a Product Register of chemical products used professionally in Denmark. The Danish Working Environment Authority and the Danish EPA are using the Register to get information about which chemical substances are being used in Denmark.

The Product Register contains information about approx. 38,000 chemical products and approx. 140,000 chemical substances. The Product Register contains information about the content of chemical substances in chemical products used professionally in Denmark. The Danish Working Environment Authority and the Danish EPA use the data to achieve an overview of the use of chemicals in Denmark. The legislative background for the Register is the Ministry of Labour Executive Order no. 466 of 14 September 1981 and Executive Order no. 559 of 4 July 2002 on Special Duties of Manufacturers, Suppliers and Importers, etc. of Substances and Materials pursuant to the Danish Working Environment Act with subsequent amendments.

The Product Register was established in 1979. The Register contains information about chemical products reported by Danish and foreign enterprises. The Register contains information about the products' trade name, composition, danger labelling, use (where they are used and what they are used for) and imported/produced amounts.

Enterprises that produce, import or change trade names of chemical products used for commercial purposes are required to report these products to the Product Register.

Municipalities

Today, Denmark is divided into 271 municipalities. From 1 January 2007, the municipal structure will be changed to 98 larger municipalities. The main service areas are social services, childcare, schools, after-school services, services for the elderly. Within the waste area, the municipalities are responsible for management of all waste generated in the municipality. The municipalities are required to establish schemes ensuring that the waste generated within the municipality is managed in an environmentally acceptable way. 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 etc. of waste schemes. They also have a number of supervisory tasks as regards waste. Municipalities are also responsible for operation of incineration plants, often through inter-municipality waste

enterprises. The new large municipalities will take over most of the nature and environment as well as spatial planning task currently under the counties.

Counties
Today, Denmark is divided into 13 counties. Three municipalities – Copenhagen and Frederiksberg as well as the Bornholm Regional Municipality – function as both counties and municipalities. From 1 January 2007, the county structure will be replaced by five new regions.

In addition to a number of other areas, the counties have a number of areas within nature and environmental protection until the restructuring. These areas include supervision of heavily polluting enterprises, water quality control, mapping and clean-up of contaminated sites, planning of water abstraction and mineral resources exploitation as well as nature conservation. The counties also prepare regional plans for spatial planning. The counties participate in monitoring of nature and environment conditions in Danish fjords and marine areas.

Regions
After the restructuring, most environmental tasks will lie with either municipalities or the state. Within nature and the environment, the new regions will have a right of consultation and an opportunity to give input to state planning proposals. The regions will also have a coordination role and a mediating function in relation to the municipalities. The regions will also be responsible for some of the tasks relating to mineral resources exploitation and soil contamination

2.2.3 International commitments in relation to the POP area

Besides the Stockholm Convention, Denmark also has a number of other international commitments on POPs through participation in international or regional environmental conventions and cooperation. Denmark is also subject to EU regulation where the agreements have been implemented into EU legislation. These are reviewed below.

UNECE's POP Protocol
This Convention covers the countries of the UN Europe region. Denmark ratified the POP Protocol in 2001.

Basel Convention
Global convention. Denmark ratified the Basel Convention in 1994.

Rotterdam Convention
Global convention. Denmark ratified the Rotterdam Convention in 2004.

Helsinki Convention and HELCOM
The Convention covers the Baltic Sea, Øresund (the Sound), the Little Belt and the Great Belt as well as the Skagerrak up to a line from the Skaw to Gothenburg. Besides the EU, all countries bordering on the Baltic Sea, including Denmark, have acceded to the Convention. The Helsinki Commission, referred to as HELCOM is the governing body for the work under the Convention. Denmark has ratified both the original Convention and the updated 1992 Convention.

OSPAR

The 1992 Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) forms the framework for international cooperation on the protection of the marine environment of the North-East Atlantic. Denmark ratified the Convention in 1995.

Nordic Council of Ministers

Under the auspices of the Nordic Council of Ministers, Denmark cooperates with the other Nordic countries on problems related to POPs. The cooperation of the Nordic environment ministers builds on four-year environment action programmes. Amongst other things, the Environmental Action Plan 2005-2008 contains initiatives in relation to POPs in the joint follow-up to international conventions on hazardous substances, including POPs and work on initiatives to strengthen the Stockholm Convention and the POP Protocol as preparation of dispersion models for heavy metals and POPs.

Strategy for sustainable development in the Nordic countries

In 1998, the Nordic prime ministers commissioned the Nordic Council of Ministers to prepare a cross-sectoral-based sustainable development strategy for the Nordic countries and their neighbouring areas. This work resulted in the strategy ”Sustainable Development - New Bearings For Nordic Countries” which entered into force at the beginning of 2001. The strategy focuses on the areas where joint Nordic efforts to implement sustainable development have high priority. These include climate, biodiversity and genetic resources, the sea, chemicals and food safety.

In accordance with the strategy, the Nordic countries will contribute to effective international implementation of the global conventions: the Montreal Protocol, the PIC Convention, the Stockholm Convention and the international agreement on the use of TBT on ships. The Nordic countries will also work to get more substances with undesirable properties covered by these conventions.

According to AEPS the Arctic countries agree to inter alia to carry our measures to reduce or control the use of chlordane, DDT, toxapen and PCB. These substances are now covered by the Stockholm Convention.

AEPS and the Arctic Council

In 1991, Denmark joined the international Arctic Environmental Protection Strategy (AEPS) which forms the basis for the national Danish environmental efforts in the Arctic. The Arctic Council was formed in 1996 as an inter-state forum consisting of the eight Arctic states' governments and seven indigenous peoples. The Council works with cases of a common interest for countries and peoples in the Arctic.

According to the AEPS, the Arctic countries undertake to introduce measures to reduce or control the use of chlordane, DDT, toxaphene and PCB. The agreement between the countries regarding these substances has subsequently been covered and specified in the Stockholm Convention.

2.2.4 Legislation on POPs

Close interplay between EU legislation and national regulation
Regulation of POPs and POP waste in the Stockholm Convention is characterised by a close interplay between EU and national regulation. The majority of the Danish regulations for POPs are a consequence of EU legislation.

The Stockholm Convention has been implemented in the EU in Regulation (EC) no. 850/2004 on persistent organic pollutants (the POP Regulation). The Regulation applied immediately as a Regulation automatically becomes part of Danish law.

The Regulation implements the most important provisions of the Stockholm Convention and the UNECE Protocol on Persistent Organic Substances by banning manufacture, use and marketing of the substances on the annexes. In order to achieve a high level of protection for health and the environment, the Regulation has not made use of the possibilities allowed for in international agreements to continue, to a limited extent, manufacturing, placing on the market and using some of the substances on the list.

The requirements of the Regulation on identification and characterisation of releases, and on preparation and implementation of national action plans are more specific on some points than those stipulated in the Convention.

Besides the provisions on control measures, the Regulation also includes general obligations, which build on the provisions of the Convention and the Protocol. Finally, the Regulation contains provisions on stockpiles and waste which are stricter that the provisions of the Convention.

The POP Regulation is supplemented by Regulation (EC) no. 304/2003 of the European Parliament and of the Council of 28 January 2003 on export and import of dangerous chemicals (the PIC Regulation) and Council Regulation no. 259/93 of 1 February 1993 on supervision and control of shipments of waste within, into, and out of the European Community (the Transport Regulation). This is described in more detail below under waste management.

The POP Regulation is further supplemented by the Danish Environmental Protection Act and the Danish Chemicals Act, as well as a number of statutory orders issued pursuant to these. Moreover, there are EU regulations for dioxins and PCBs in animal feed and foodstuffs.

The following briefly describes the current Danish legislation for POPs and POP waste, including bans on placing on the market and use, as well as approval schemes for pesticides and requirements on supervision and enforcement of the rules.

The ten POPs for intentional use
Marketing and use of the ten pesticides and industrial chemicals has been banned in Denmark for several years. Table 2.2 lists when the bans on the ten substances took effect in Denmark.

The bans in the POP Regulation are supplemented by the Chemicals Act[2], the Statutory Order on Pesticides[3] and the Statutory Order on POPs.[4]

PCB

- PCB is regulated in accordance with the Danish Environmental Protection Act and the Chemicals Act, including the Statutory Order on PCBs.[5]

- In 1977 "open" use was banned in Denmark, i.e. in paint, fillers, self-copying paper etc.

- Sales and imports of PCB as well as equipment or chemical products containing PCB have been banned in Denmark since 31 October 1986.[6] Existing apparatus containing PCB could still, however, be used for a transition period up to 1995 for the largest and most important types of equipment. Since 1 January 1995, use of PCB-containing capacitors and transformers above a certain weight (total weight > 1 kg or output > 2 kW) has been banned.

- It has been permitted to use equipment containing small amounts of PCB, primarily small capacitors, for the rest of the equipment's useful life. The most recent statutory order of December 1998, which implements the EU PCB/PCT Directive, introduces supplementary requirements for larger equipment containing PCB, including transformers with a concentration of PCB of more than 0.05 percent by weight, to be disposed of or decontaminated as soon as possible, and before 1 January 2000, irrespective of whether or not it is in use.

- The Statutory order on PCB contains stricter regulations than those in the Stockholm Convention and the EU PCB Directive (96/59/EC) with regard to the date for decontamination and/or disposal. In the Stockholm Convention, decontamination and/or disposal must be no later than 2028 and in the Directive no later than 2010. Small capacitors and transformers may be used until the end of their useful economic life.

Supervision and enforcement is carried out by the Danish EPA with regard to the regulations in the Statutory Order on PCB on sale, import, use, maintenance, storage and labelling of PCB and apparatus containing PCB, as well as regarding compliance with regulations on reporting information.

The nine banned substances

The Chemicals Act bans placing on the market or use of aldrin, chlordane, dieldrin, DDT, endrin, heptachlor, hexachlorobenzene (HCB), mirex, and toxaphene in pesticides or groups of these (cf. annex 2, list B in the Act).

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[2] Consolidated Act no. 21 of 16 January 1996 from the Ministry of Environment and Energy on Chemical Substances and Products with subsequent amendments
[3] Statutory Order no. 533 of 18 June 2003 with subsequent amendments
[4] Statutory Order no. 820 of 29 September 2003 on certain persistent organic compounds
[5] Statutory Order no. 925 of 13 December 1998 with subsequent amendments
[6] Cf. section 3 of Ministry of Environment and Energy Statutory Order No. 718 of 9 October 1986 on limiting the use of PCB and PCT. The Statutory Order was replaced by the Statutory Order on PCB (no. 925 of 13 December 2000), cf. section 28

Other sale, import and use of aldrin, chlordane, dieldrin, DDT, endrin, heptachlor, hexachlorobenzene (HCB), mirex, and toxaphene are banned under the Statutory Order on POPs.

The Danish EPA Chemical Inspection Service supervises and checks compliance with the rules.

Approval scheme and reassessment of existing chemicals for POP properties

Approval of pesticides is laid down in the Chemicals Act (part 7) and the Statutory Order on pesticides[7] (part 2). The Danish EPA is the competent authority for approval of pesticides and supervision of compliance with the Act and the Statutory Order. Danish legislation implements Directive 91/414/EC on plant protection products and Directive 98/8/EC on biocides.

A plant protection product must not be imported, sold or used in Denmark, unless the product has been approved by the Danish EPA. Applications for approvals of plant protection products are submitted on a special form to the Danish EPA by the person wishing to import or market a plant protection product in Denmark. The application should be accompanied by all the information necessary for a complete assessment of the active substance and the product. More detailed regulations on the content of applications are in the Statutory Order on pesticides.

Reduction of releases of unintentionally formed POPs

With regard to POPs arising unintentionally, a number of instruments in EU legislation and in Danish environmental protection legislation will help reduce releases of these substances. The most important measures to limit releases are in Directive 96/61/EC (the Directive on "Integrated Pollution Prevention and Control" - IPPC), which covers the largest stationary sources of POPs formed unintentionally. The IPPC Directive has been implemented via the Danish Environmental Protection Act and the Approval Order.

The Danish Environmental Protection Act is based on the fundamental principle that overall pollution of the surroundings should be prevented or limited as much as possible. On this basis, the Environmental Protection Act requires individual enterprises to use the best available techniques (BAT), so that overall pollution is a little as possible.

The regulations on incineration of waste in the Statutory Order on Waste and in the Statutory Order on installations which incinerate waste[8] cover a very important source of unintentionally formed POPs. The Statutory Order on Waste states that incineration of waste is permitted in plants approved for the purpose. This provision links with the regulation in the Statutory Order on installations which incinerate waste concerning design and operation of incineration plants and combined incineration plants, including limit values for air emissions. The current emission limit value for air emissions from incineration plants and combined incineration plants is 0.1 ng I-TEQ/Nm^3.

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[7] Statutory Order no. 533 of 18 June 2003 on pesticides with subsequent amendments

[8] Statutory Order no. 162 of 11 March 2003. The Statutory Order implements a number of provisions in the Directive on the incineration of waste (Directive 2000/76/EC)

The Statutory Order on management of waste in the form of motor vehicles and derived waste fractions[9] 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 car-breakers.

Finally, the WEEE Statutory Order requires that components containing PCB in scrap electrical and electronic equipment must be removed from the products and destroyed.

The Commission Decision 2000/479/EC introduces a European Pollutant Emission Register (EPER), which is a register of the most important emissions and sources of pollution. It covers all unintentionally formed POPs, except PCB. The list of registered pollutants will be extended in 2007, partly as a result of the Stockholm Convention, and also because PCB will be included in the list. In future the list will also include inventories of emissions from diffuse sources.

Stockpiles

Management of stockpiles before they become waste, is covered by the current chemicals legislation.

Management of POP waste

Many of the provisions on waste management in the Convention are already in the Statutory Order on Waste and the "bekendtgørelser for særlige fraktioner af affald" (statutory order on special waste fractions), which implement EU waste legislation.

Municipalities are responsible for all waste collection and management, cf. section 45(1)-(3) of the Environmental Protection Act. Therefore the local council has an obligation to assign waste disposal facilities, undertake collection and disposal of waste, and to prepare waste plans and regulations on the scope and organisation of waste schemes etc.

Waste containing PCB and any other POP waste is hazardous waste. The management requirements are laid down in part 9 of the Statutory Order on Waste. The provision in section 54 of the Statutory Order on Waste (no. 619 of 27 June 2000 with subsequent amendments) applies for apparatus containing PCB, and this states that the local council must establish collection-at-source schemes for hazardous waste, including waste containing PCB and any other POP waste.

Besides the general provisions on collection of hazardous waste, electrical and electronic products must also be collected separately and capacitors containing PCB and oil must be taken out. This waste must be delivered to enterprises approved under part 5 of the Environmental Protection Act to dispose of hazardous waste, and which at all times must comply with the relevant regulations on disposal of PBC. This regulation is included in a new Statutory Order no. 664 of 27 June 2005 on management of waste electrical and electronic equipment (the WEEE Order), which also introduces producer liability.

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[9] Statutory Order no. 480 of 19 June 2002. The Statutory Order implements a number of provisions in Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of-life vehicles

The Statutory Order on Waste stipulates (section 58a), that waste containing the substances aldrin, chlordane, dieldrin, DDT, endrin, heptachlor, hexachlorobenzene, mirex, toxaphene, polychlorinated dibenzo-p-dioxin and polychlorinated dibenzofuranes must be disposed of in such as way that they no longer possess the properties of POPs. If technically possible, the local council may, however, allow the waste to be disposed of in some other environmentally appropriate manner.

Furthermore, after application, the Danish EPA can allow the waste to be managed in another environmentally appropriate manner, provided there is a low content of POPs.

Transboundary transport of waste is dealt with in the Council Regulation (EEC) no. 259/93 on the supervision and control of shipments of waste within, into and out of the European Community. This regulation is the most important instrument for implementation of the Basel Convention in Community legislation. Wastes consisting of, containing or contaminated with POPs are also covered by the Regulation.

Today, shipment of this type of waste within the EU is covered by a procedure based on advance written notification and written consent. With regard to exports from the Community, the Regulation stipulates that exports for disposal are completely banned, while exports for recovery are only permitted, if treatment is in an OECD country. Imports into the Community are permitted, provided they are from EFTA countries or countries which are parties to the Basel Convention, or – if the waste is for recovery – from other OECD countries.

The Regulation has been under revision. There is political agreement to the proposal, and final adoption by the Council of the European Union is expected before July 2006. The proposal states that shipments of waste consisting of, containing or contaminated with substances listed in the Stockholm Convention are covered by the same provisions as shipments of waste for disposal. In reality this will mean that shipments within the Community are still covered by the requirement for written notification and written consent, and that all exports from the Community are banned. With regard to imports into the Community, these will only be permitted if they are from EFTA countries or countries which are party to the Basel Convention. Adoption of the POP Regulation in 2004 did not set common EU levels for concentrations of POPs in waste. The Commission forwarded three proposals for amendments to annex IV (list of substances covered by the provisions on waste management in article 7) and annex V (waste management) for vote by the Technical Adaption Committee (TAP) on 25 January 2006, but the three proposals were not adopted by the TAP. Therefore, the Commission must submit the matter to the Council of the European Union.

Regulations for dioxins and dioxin-like PCBs in foodstuffs

EU limit values (maximum levels) for the dioxin content in foodstuffs have been set. These appear in the Commission Regulation (EC) No. 466/2001 of 8 March 2001 setting maximum levels for certain contaminants in foodstuffs, most recently amended by the Commission Regulation (EC) No. 199/2006 of 3 February 2006.

Besides maximum levels for dioxins, Regulation 199/2006 introduces maximum levels for the sum of dioxins and dioxin-like PCBs, and action

levels for dioxin-like PCBs in addition to the existing values for dioxins. The regulations enter into force on 4 November 2006.

Because of the high dioxin content in the Baltic Sea, Denmark has introduced limits for fishing and sales of certain fish species from the Baltic Sea.

The new maximum levels and action levels are compared with levels found in Danish foodstuffs in section 4.3.4.

Requirements for sampling and analysis methods are laid down in the Commission Directive 2002/69, which was implemented by Denmark in Statutory Order no. 194 of 21 March 2005 on certain contaminants in foodstuffs.

Regulations for dioxins and dioxin-like PCBs in animal feed

In parallel with the amendments to the regulations on foodstuffs (Regulation 199/2006), the regulations for dioxin and dioxin-like PCBs in animal feed were also amended. The limit values for dioxins are unchanged. The Directive[10] introduces maximum values for the sum of dioxins and dioxin-like PCBs (total TEQ). A new aspect is the introduction of maximum values for dioxins and total TEQ in trace substances (additives category microminerals) and mixtures. Furthermore, the Directive contains action levels for dioxins and dioxin-like PCBs. The amendments have not yet been implemented in Danish legislation.

2.2.5 Central approach and procedures

The central approach and procedures to ensure enforcement of the relevant legislation for POPs are as follows:

- System for approval of pesticides;
- System for environmental approval of listed activities;
- System for registration of chemical products and their constituents placed on the market;
- Registration and approval system for waste treatment enterprises;
- Registration system to follow waste from enterprises and municipalities from door to grave.

2.3 The POP situation in Denmark

2.3.1 Annex A and B substances (excl. PCBs)

Neither DDT nor the other pesticides covered by the Stockholm Convention: aldrin, chlordane, dieldrin, endrin, heptachlor, mirex and toxaphene, are used

[10] Commission Directive 2003/100/EC of 31 October 2003 amending annex I of European Parliament and of the Council Directive 2002/32/EC of 7 May 2002 on undesirable substances in animal feed

in Denmark. Therefore all annex A and annex B pesticides are described together.

As far as is known only five of the nine POP pesticides have ever been used as pesticides (insecticides) in Denmark. These are DDT, aldrin, dieldrin, endrin and heptachlor. Of these, only DDT and dieldrin have been extensively used, while the others have only been sold in small amounts and left the market in 1963 (aldrin, endrin) and 1972 (heptachlor). Therefore, the following only describes the two first substances in detail.

Years for entry into force of regulation of the banned POPs in Denmark appear in table 2.2. The two most important instruments are the Statutory Order on Pesticides (No. 208 of 26 March 1992) and the Statutory Order on POPs (No. 820 of 29 Sept. 2003).

Table 2.2
Regulation of annex A and B substances in Denmark

Substance	Year of entry into force	Regulation
Aldrin	1992	Ban on use as active ingredient in pesticides
	2003	Total ban *
Chlordane	1992	Ban on use as active ingredient in pesticides
	2003	Total ban *
DDT	1970	Ban on agricultural use as pesticide
	1984	Ban on use as active ingredient in pesticides
	2003	Total ban *
Dieldrin	1992	Ban on use as active ingredient in pesticides
	2003	Total ban *
Endrin	1992	Ban on use as active ingredient in pesticides
	2003	Total ban *
Heptachlor	1992	Ban on use as active ingredient in pesticides
	2003	Total ban *
Hexachlorobenzene	1992	Ban on use as active ingredient in pesticides
	2003	Total ban *
Mirex	2003	Total ban *
Toxaphene	1992	Ban on use as active ingredient in pesticides
	2003	Total ban *
PCB	1977	Ban on sale of PCB for "open" uses
	1986	Ban on sale of PCB and products containing PCB
	1995	Ban on use of equipment containing PCB with a total weight of more than 1 kg
	2000	Ban on use and storage of equipment containing PCB with a total weight of more than 1 kg

* "Total ban" means a ban on import, sale and use except for unintentional trace contaminations and use as reference material at laboratory level cf. Statutory Order no. 820 of 29 September 2003.

DDT

Sales of DDT on the Danish market were first recorded in 1956, and as far as is known this was also the first year sales of pesticides were officially recorded

in Denmark. In 1956 consumption was already 39 tonnes active substance. Therefore there is reason to believe that at that time the substance had already been in use for some years. DDT was used for several pesticide purposes up to the final ban in 1984. Over the 27 years the substance was on the market, a total of 530 tonnes was sold, calculated as active substance. The highest consumption in a single year was 43 tonnes in 1959, but in general between 1956-1969 annual consumption was 35-40 tonnes active substance.

Up to and including 1969, DDT was used as an insecticide on agricultural crops, primarily on cruciferous crops such as oil seed rape and mustard. Direct agricultural use was banned from and including 1970, and consumption fell as a result to an annual average of about 1,100 kg in the period from 1970 to when the final ban entered into force in 1984.

From 1970-1983 DDT could be used for indoor treatment of young conifers, but the substance was also contained in an insecticide for furniture and woodwork.

Dieldrin

Dieldrin also first appears in Danish statistics from 1956, but only with consumption of 179 kg active substance. Over a few years consumption rose somewhat and the average annual sales for the 29 years the substance was on the market in Denmark were 863 kg. Dieldrin was banned in Denmark in 1988.

Dieldrin has never been used for agricultural purposes in the open countryside in Denmark. The substance has had two main uses, partly as a coating against insects, but only in places where it would not come into contact with foodstuffs, and partly (like DDT) against pests in wood. However, the substance could not be used in premises for production or storage of foodstuffs, cereals or animal feed and not in stables, hen houses and similar.

Industrial use of HCB

From 15 October 2003, import, sale and use of HCB and chemical products and other goods containing HCB has been banned. However, the ban does not apply when the substance is used as a reference material or in research at laboratory level. On the basis of information that consumption in Denmark for laboratory purposes was 100 kg HCB in 1992, a study at screening level in 1995 estimated that the total annual emissions from intentional use would only be around 20 kg. It is unlikely that the substance is used intentionally in Denmark.

Industrial use of mirex

Mirex has been used internationally as a flame retardant in plastics etc. Just as for HCB, import, use and sale of mirex has been banned since 15 October 2003. The substance is not recorded in the Product Register and it is unlikely that the substance is used intentionally in Denmark.

POP pesticides in foodstuffs

The Danish monitoring programme for foodstuffs also contains measurements of a number of pesticides, including chlordane, DDT, dieldrin, HCB, and heptachlor. The results of the monitoring programme for 1998-2003 are reported in ***FødevareRapport 2005:1*** (only in Danish). On the basis of the measurements, the total average intake of the substances is estimated as follows:

ΣClordan:	0.11 µg/day
ΣDDT:	0.27 µg/day
Dieldrin:	0.13 µg/day
HCB:	0.09 µg/day
Heptachlor sum:	0.05 µg/day

Daily intake has fallen 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 found does not give grounds for health concerns.

POP pesticides in the environment

A number of chlorinated pesticides, including DDT/DDE, HCB and chlordane, are included in the ongoing monitoring of pollutants in the environment and in emissions from point sources. The substances have been monitored over a number of years and there is a lot of data. The most recent monitoring report for marine areas, which includes data on chlorinated pesticides in mussels and fish, concludes that the concentration of chlorinated pesticides is at a level which is not deemed to be a risk to the environment. In the period 1993-2003 a number of measurements were taken of all the POP pesticides in the groundwater (25-70 measurements per substance) without finding the substances.

As the environmental and health risks are today primarily linked to PCBs and dioxins, POP pesticides will not be mentioned further here.

2.3.2 Annex B substances - DDT

DTT, which at the moment is the only Annex B substance, is treated together with the other pesticides in section 2.3.1. DDT is not used in Denmark.

2.3.3 Intentional use of PCB

Historical uses of PCB

PCB has never been produced in Denmark. However, as in the rest of the world, Denmark has for some periods been using PCB for various products and equipment for technical applications. The first overall study of the consumption of PCB in Denmark was made in 1983, and presents a fairly good picture of historical consumption of PCB in Denmark, see table 2.3. The table shows 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, data are not available for this period.

Table 2.2
Consumption of PCB in Denmark in accordance with a study from 1983

Applications	Approx. period in which PCB-containing products were supplied for the application	Estimated total consumption in Denmark in 1950-1981 * Tonnes PCB
Electrotechnical applications:		
Large capacitors	1950 - 1981 *	450 - 750
Small capacitors	1950 - 1980	175 - 325
Transformers for high-voltage	1950 - 1982 *	30 - 100
Total, electrotechnical (rounded figures)		650 - 1.200
Softeners in:		
Paint	1955 – 1973	130 - 270
Fillers	1967 – 1974	80 - 120
Glue for double-glazing	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
Impurity in paper, animal feed etc.	Whole period	<60
Total (rounded figures)		1,100 – 2,000

* Small amounts of PCB may have been used in equipment for 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.

Source: Based on: Hansen, E. et al. 1983. ***PCB/PCT-forurening - En udredning om forbrug, forurening og transportveje for PCB og PCT i Danmark. (PCB/PCT contamination – a study of consumption, contamination and pathways of PCB and PCT in Denmark).***

In the late 1960s and the early1970s, it became clear that PCB spreads and accumulates in the environment, and that it may occur in foodstuffs at levels that give rise to concern. Therefore, a number of regulatory measures were taken, see section 2.2.4.

PCB in electrotechnical equipment

From 1998, when the Statutory Order was prepared, an extensive questionnaire study was made in order to ensure that potential holders of equipment were aware of the requirements and took care of the disposal of the equipment. In this study, 19 enterprises stated that they were still holding PCB-containing equipment, and the equipment was subsequently disposed of. Overall quantities identified during the study were 3.3 tonnes. A single enterprise, that was in possession of PCB-containing transformers and capacitors, accounted for 2.5 tonnes.

The study concluded that small numbers of PCB-containing large capacitors for power factor compensation and that perhaps also a few transformers might still be used in small enterprises. However, it was not possible to identify such equipment in practice. The study underlined that the electronics industry should maintain focus on old electronic equipment, and make sure that PCB-containing equipment could be disposed of in a safe manner.

Small PCB-containing capacitors have been used mainly in household appliances and fluorescent tubes. Today, capacitors have been disposed of together with the products, but small amounts may still be used, especially in old tubes. According to the Danish WEEE Order, fluorescent tubes, like other waste electrical and electronic equipment, are subject to special regulations on disposal.

PCB in building materials

As stated in table 2.3, PCB was used until 1974 in fillers and glue for double-glazing window panes. Based on the technical specifications for such products, their useful economic life is generally expected to be shorter than the 30 years that have passed since they were installed.

In connection with the Ministry of the Environment Waste Strategy 2005-2008, a study will be made on potential risks for health and the environment from the use, restoration and demolition of buildings containing PCB. Therefore, in 2005, the Danish EPA launched a study of PCB in building materials in old buildings. However, the results are not yet available. Further, from studies made by the City of Copenhagen it appears that PCB can be found in building materials in a number of buildings.

PCB in foodstuffs

In connection with the Danish foodstuffs monitoring programme, the content of PCB in foodstuffs has been monitored since the programme started in 1983.

The latest results are presented in reports covering the monitoring period 1998-2003. Developments over time for the content of chloro-organic pesticides and indicator PCB in fish were monitored in this and three preceding monitoring periods. A general fall in the content of PCB was observed for the period 1983-1998, whereas falling amounts have not been ascertained in the latest period (1998-2003).

The fall from 1986 to 2005 is illustrated in figure 2.1, which shows developments of PCB contents in cod liver. PCB levels were significantly higher in the 1970s. However, changes of analysis methods prevent exact comparison of developments in the period.

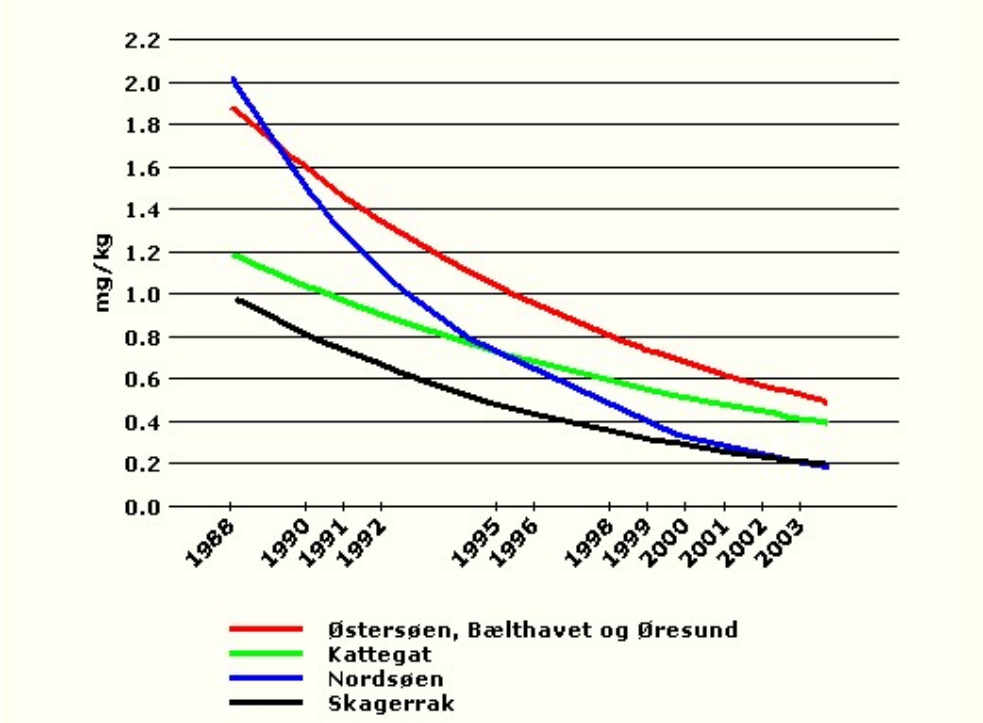


Figure 2.1
PCBs in cod liver from Danish waters

Translation of text in figure
Østersøen, Bælthavet og Øresund = The Baltic Sea, the Belts, and the Sound
Kattegat = Kattegat
Nordsøen = North Sea
Skagerrak = Skagerak

Source: Danish EPA Indicators for sustainable development, based on the foodstuffs monitoring programme. Regression lines based on logarithmic transformation of basic data. (http://www.mst.dk/indikator/BU/ShowIndi.asp?Indikator_ID=196&Sprog_ID=1&Produkt_ID=1)

Average daily intake by Danes in the period 1998-2003 is estimated at 0.9 µg/day for the sum of 10 indicator PCBs. 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 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.

The assessment of impacts on human health from PCB is particularly complicated, because we are dealing with a mixture of congeners with different toxicological properties and modes of action. Most toxicological studies were made with the original commercial products, which are not representative of the mixtures accumulating in the food chains. Besides, toxicological studies regarding PCB are also subject to a number of other uncertainties.

Based on a number of assessments, the Danish Veterinary and Food Administration has fixed a tolerable daily intake (TDI) for total PCB of 0.1 µg/kg bodyweight/day.

The Veterinary and Food Administration concludes that – comparing estimated intake with TDI – the levels that have been found do not give rise to health concerns. Average intake for children amounts to 25 per cent of TDI, and for adults, 13 per cent of TDI.

PCB in the environment

PCB in the Danish environment has been monitored for several decades. PCB became an area of considerable concern in the mid 1970s, when suspicion arose that the substance contributed to reducing populations of seal in the Baltic Sea – a suspicion that was later confirmed. According to HELCOM, populations, when lowest, counted approx. 2,000 individuals. Today, the number has increased to about 10,000. It is less clear whether contamination in Danish waters with xenobiotic substances such as POP substances has been sufficient to cause evident reduction of Danish seal populations. However, NERI has observed improved health of seal in Danish waters, at the same time as PCB levels in the marine environment have been decreasing.

PCB is also considered to contribute to the reduced numbers of otters in Denmark in the last half of the 20th century. PCB has many different toxic effects, for instance it disturbs the degradation of vitamin A in the body. Tests with mink and seal show that poisoning with PCB affects reproduction. Moreover, the animals suffer from vitamin deficiency, resulting in negative impacts on the immune system. Therefore, animals poisoned with PCB are more likely to become ill. Falling levels of PCB in otters caught in Danish waters in the period 1980-1990 have been found. Around 1990, contamination with PCB in Denmark was still big enough to cause low levels of vitamin A in a small number of animals. According to NERI, today PCB contamination in Denmark appears not to be at a level causing negative impacts on the Danish population of otters.

The latest report, dating from 2004, from the Danish water and nature monitoring programme 2004-2009, NOVANA, concluded that concentrations of PCB in mussels and sediment were generally still at a level where effects on the marine environment cannot be excluded, although the concentration of PCB has been falling during the last centuries.

Concentrations in mussels of PCB and the chlorinated pesticides DDT and HCH are shown in figure 2.2. In all areas, the concentration was above the lower EAC threshold value (based on ecotoxicological assessment criteria) which means that there may be impacts on the environment caused by the concentrations of PCB.

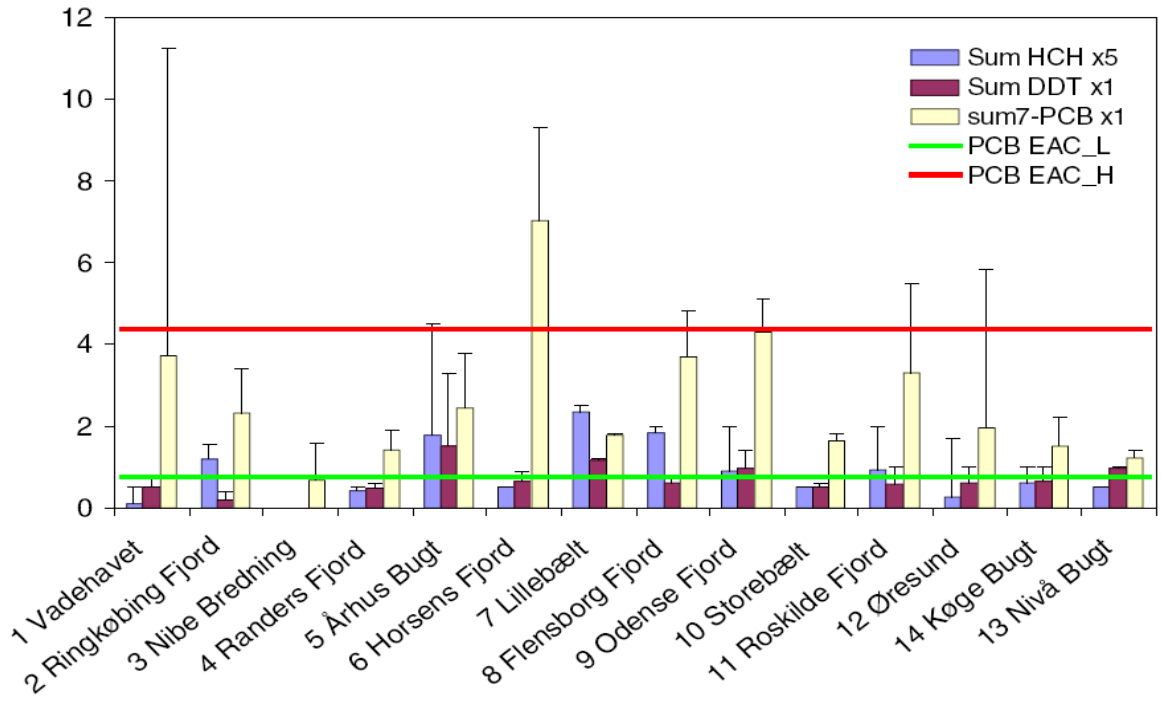


Figure 2.2

Concentrations of chlorinated pesticides and PCB in mussels (mean value and maximum), compared to limit values based on ecotoxicological assessment criteria (EAC). Unit: µg kg^{-1} wet weight. Note other scaling factor for HCH.[11]

Translation of text: same as Danish except: Vadehavet = The Wadden Sea; Lillebælt = The Little Belt; Storebælt = The Great Belt; Øresund = The Sound

Extensive material on concentrations of PCB in water, sediment and a large number of organisms is compiled in the report "Kortlægning af dioxinforurening samt kilder til dioxinforurening i Østersøen " (Mapping of dioxin contamination and sources of dioxin contamination in the Baltic Sea).

2.3.4 Unintentional production of dioxin, HCB and PCB

Following the Seveso accident in 1976, where the environment was contaminated with extensive dioxin pollution, a working group set up by the Danish EPA in 1977 prepared the first investigation aiming at assessing the potential occurrences of dioxin in products marketed in Denmark and at assessing production of dioxin in various processes.

At that time, focus was primarily on the presence of dioxin in chemical products. Denmark had introduced a limit value for dioxin in the plant protection product 2,4,5-T, one of the ingredients in the defoliant known as Agent Orange. The working group recommended that a maximum limit value be introduced for dioxin in pentachlorophenol (PCP), and that various precautions be taken in using the wood preserving product sodium

[11] Source: Ærtebjerg et al. 2002. *Marine områder 2001 - Tilstand og udvikling i miljø- og naturkvaliteten*. NOVANA. (Marine areas 2001 – state and development of the quality of environment and nature).Technical report, NERI, no. 419, National Environmental Research Institute.

pentachloro-phenolate (na-PCP) and other metal salts of chlorinated phenols. Further, the working group recommended that considerations were to be made on a ban on burning impregnated wood.

The ban on the use of pentachlorophenol and preserving agents based on the substance has now been in force for a number of years. However, as shown in a study by the Danish EPA in 2003, dioxin still occurs in wood treated with PCP-containing agents in the mid 1970s.

During the 1980s regulation was introduced on the use of dioxin-containing chemicals, and focus was on unintentional production of dioxin during incineration processes. In this period, development in the incineration sector was intense all over Denmark, and it became increasingly clear that these installations were the source of substantial releases of dioxin, and that better cleaning was required.

In 1990-1992 and 1997, more extensive studies were made. Later, in order to get an overview of the flow of dioxin in Danish society, two mass flow analyses were made, describing the situation in 1998/99 and in 2000-2002.

Following the dioxin scandal in Belgium in 1999, where contaminated fat in animal feed caused unacceptable contamination of foodstuffs, international focus was directed towards issues of food security and dioxin and similar substances in foodstuffs. On the basis of the scandal in Belgium, Denmark and other EU Member States initiated intensified efforts to reduce the pressure on humans from dioxin. In Denmark, such efforts took the form of coordinated cooperation between the Ministry of Food, Agriculture and Fisheries, the Ministry of Family and Consumer Affairs, and the Ministry of the Environment.

Reports have been published on measurements of dioxin emissions from private wood stoves, on measurements of dioxin in soil, compost, bio-ash, percolate from landfills, cow's milk and breast milk, air, water, sediment, deposition monitoring (atmospheric depositions of dioxin), and of brominated dioxin in flue gases from waste incineration plants. The results are available in a number of status reports. Some of the main results are presented below.

The Ministry of Family and Consumer Affairs (Danish Veterinary and Food Administration) and the Ministry of Food, Agriculture and Fisheries (Danish Plant Directorate) have contributed to efforts in the dioxin area with the dioxin action plan, which addresses both animal feed and foodstuffs. The main results of the action plan, which was published in 2005, are presented later in this chapter.

There are no inventories of unintentional production of PCB and HCB in Denmark. None of the processes known to contribute significantly to unintentional HCB production, such as production of certain chemicals, electrolytic production of aluminium and production of magnesium, take place in Denmark.

As regards monitoring of substances in foodstuffs, animal feed and the environment, PCB and HCB are also included in the monitoring programmes, but the starting point of such efforts has been intentional uses of the substances. Measurements of HCB and PCB are therefore presented in sections 2.3.1 and 2.3.3, intentional uses.

In the following, focus is on dioxin and dioxin-like PCB.

Sources of dioxin pollution

Inventories of dioxin emissions to soil, air and water are given in the action plan for reduction of releases of unintentionally formed POP substances, see annex 1. Discussions on sources and efforts regarding selected sources are also presented in the annex.

In 2004, the most important sources were incineration of waste, burning of biofuels (wood, wood waste, straw), production of cement, and transport processes.

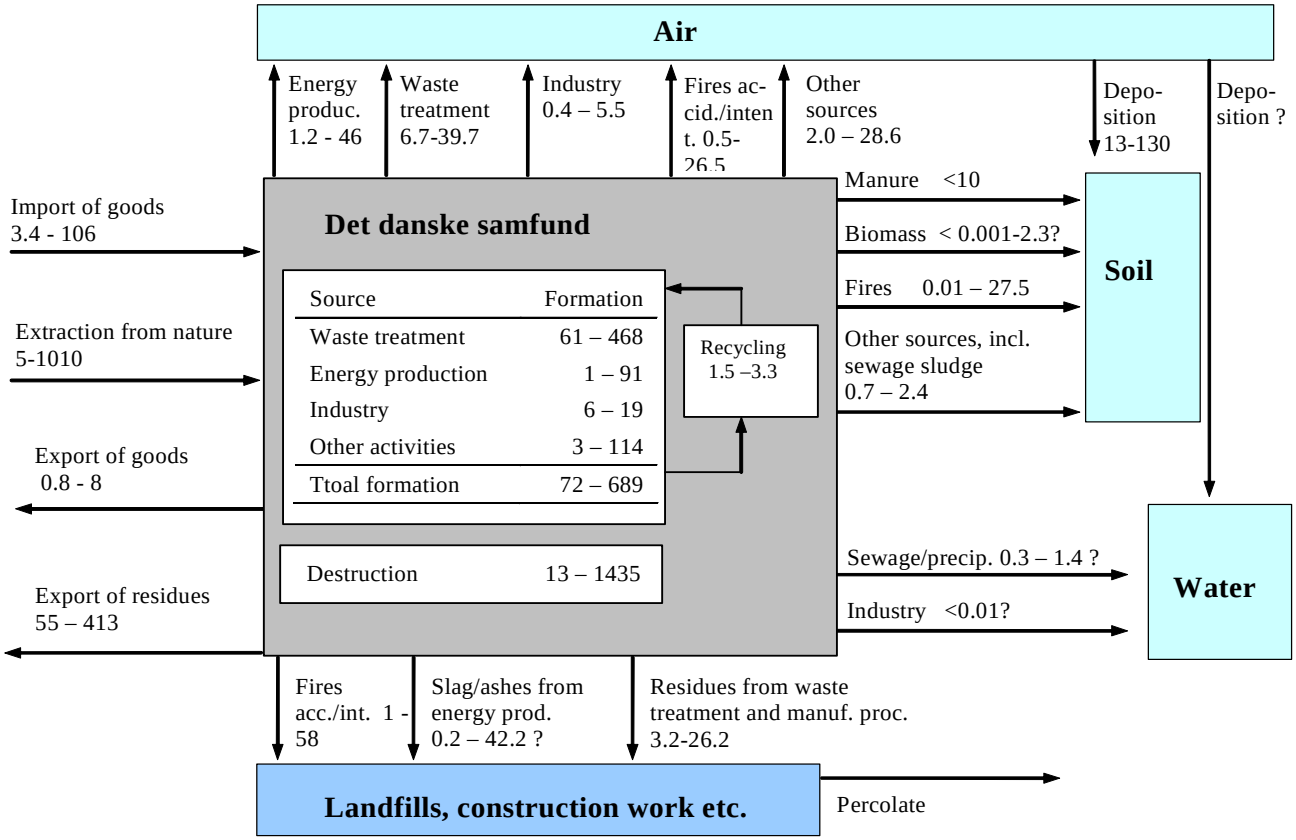
In order to get an overall overview of the production and emissions of dioxin to all media and waste deposits, two mass flow analyses have been made. Figure 2.3 shows that the overall ***production*** of dioxin in various processes in Denmark around 2002 is in the order of 72-689 grammes I-TEQ/year, i.e. much larger than overall emissions. The reason is that large parts of the production of dioxin end up in residues from flue gas purification. Estimates are subject to great uncertainty, because the content of dioxin in residues varies, and the number of measurements is limited.

Since the elaboration of the mass flow analyses, new regulation has entered into force, which has led to a substantial reduction in the emissions from incineration plants. In the Act on incineration plants a threshold value of 0,1 ng I-TEQ/Nm³ for the emission of dioxin from incineration plants has been set. The threshold value has been in force for new plants since 24 March 2003. For existing plants the value has been in force since 28 December 2005. If all plants comply with the threshold value, the total emissions on dioxin can be estimated to no more than 2,2 g I-TEQ/year, comprising approximately 7 per cent of the total emissions from incineration plants in 1990.

It should be noted that the figures for dioxin emissions are being revised, and that the figures given cannot be used directly.

A number of the plants where a destruction of dioxins takes place, are at the same time amongst the most important sources of production of dioxins. This is especially the case for incineration plants, where the amount formed is considerably larger than the amount destroyed. The dioxin is captured in the flue gas purification process.

Figure 2.3
Overall flow of dioxin in Denmark 2000-2002, in grammes I-TEQ/yr [12]



Dioxin in products

As mentioned in the introduction to this chapter, a ban on PCB has been in force for many years in Denmark. However, PCBs may occur as preserving agents in imported wood, textiles and leather, because the substance is still used in certain parts of the world. Based on measurements, the overall content of PCB in import of textiles and leather is estimated at 1 g I-TEQ/yr. New studies confirm that single-use pallets imported from countries in Southern Europe may contain PCB, but below the current limit value of 5 mg/kg.

Dioxin and dioxin-like PCB in food, breast milk and animal feed

As mentioned above, the Ministry of Family and Consumer Affairs, and the Ministry of Food, Agriculture and Fisheries contribute to cooperation on dioxins, i.a. by the dioxin action plan, focusing on animal feed as well as foodstuffs. The latest results of work with the action plan were presented in 2005.

The EU has fixed limit values for the content of dioxin in foodstuffs, which entered into force on 1 July 2002.[13] The Regulation underlines that measures based on limit values for dioxin and dioxin-like substances in foodstuffs are

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[12] Source: Based on Hansen et al. 2003. ***Substance Flow Analysis for Dioxin 2002***. Environmental Project no. 811. Danish EPA, Copenhagen.

[13] Commission Regulation no. 466/2001 of 8 March 2001 setting maximum levels for certain contaminants in foodstuffs as regards dioxins and dioxin-like PCBs, as last amended by Commission Regulation (EC) no. 199/2006 of 3 February 2006.

not sufficiently effective to reduce human exposure to dioxins. If so, limit values should be so low that large parts of foodstuffs would have to be declared unsuitable for human consumption. The EU therefore recognises that the desired reduction of dioxin levels cannot be immediately achieved, but must be aimed at with measures taking place over a period of some years. The strategy involves a gradual reduction of limit values.

The EU also operates with two other sets of ”limit values”, known as action levels and target values, combined with measures to reduce emissions.

Action levels are tools which can be used by competent authorities and business to identify cases where it is relevant to examine the source of pollution in more detail, with a view to possible measures to reduce or remove it. Not only in case of violation of the Regulation, but also in cases where dioxins are ascertained in foodstuffs at levels which are substantially above normal background values.

Target values are the levels to be achieved in order to ultimately reduce the major part of human exposure to the tolerable weekly intake (TWI) set by the EU Scientific Committee for Foodstuffs.

Data on occurrences of PCB-like dioxin are limited, and therefore, to begin with, limit values were set only for dioxin.

As outlined in section 2.2.4 on legislation, limit values were introduced recently, regulating the sum of dioxin and dioxin-like PCBs (total TEQ) and specifying action levels for dioxin-like PCBs which go beyond existing action levels for dioxin. The rules are set out in Commission Regulation no. 199/2006 of 3 February 2006.

As of 4 November 2006, both existing limit values for dioxin, and the stricter limit value for total TEQ, must be observed.

The new limit values for total TEQ are presented in figure 2.4, together with levels found in Danish foodstuffs. More results and more detailed discussion of the measurement results can be found in the latest report from the monitoring programme for foodstuffs, and in the final reporting of the dioxin action plan.

Special attention has been directed towards dioxin in eggs. In other countries, higher dioxin concentrations have been found in organic eggs than in eggs from conventional farming. In 2005 the Danish EPA launched a study of sources of dioxin in organic farming in Denmark.

Studies of the content of dioxin in Danish foodstuffs show that, generally, levels are below prescribed values for total TEQ, except for certain fish species.

With the new limit values for the sum of dioxin and dioxin-like PCB, it is expected that – besides higher values in salmon from the Baltic Sea and in herring form the Baltic Sea north of Bornholm – limit values will also be exceeded for sea trout from the areas offshore Bornholm, and in eel from the Sound (Figure 2.4).

Based on the results of mapping, and in accordance with current limit values for dioxin, the Danish Veterinary and Food Administration issued a ban in

2004 on fishing and sales of herring from the eastern part of the Baltic Sea, and for salmon above 4.4 kg (fresh weight) from all of the Baltic Sea.

Later, the Veterinary and Food Administration and the Nordbornholms Røgeri (smokehouse) carried out a number of tests to remove adipose fat from salmon through trimming, in order to reduce the content of dioxin. As a result of these studies, and in accordance with Statutory Order no. 851 of 15 September 2005, large salmon can now be sold, provided they have been subject to trimming to remove adipose fat in a process specified in a branch code that is approved by the Veterinary and Food Administration.

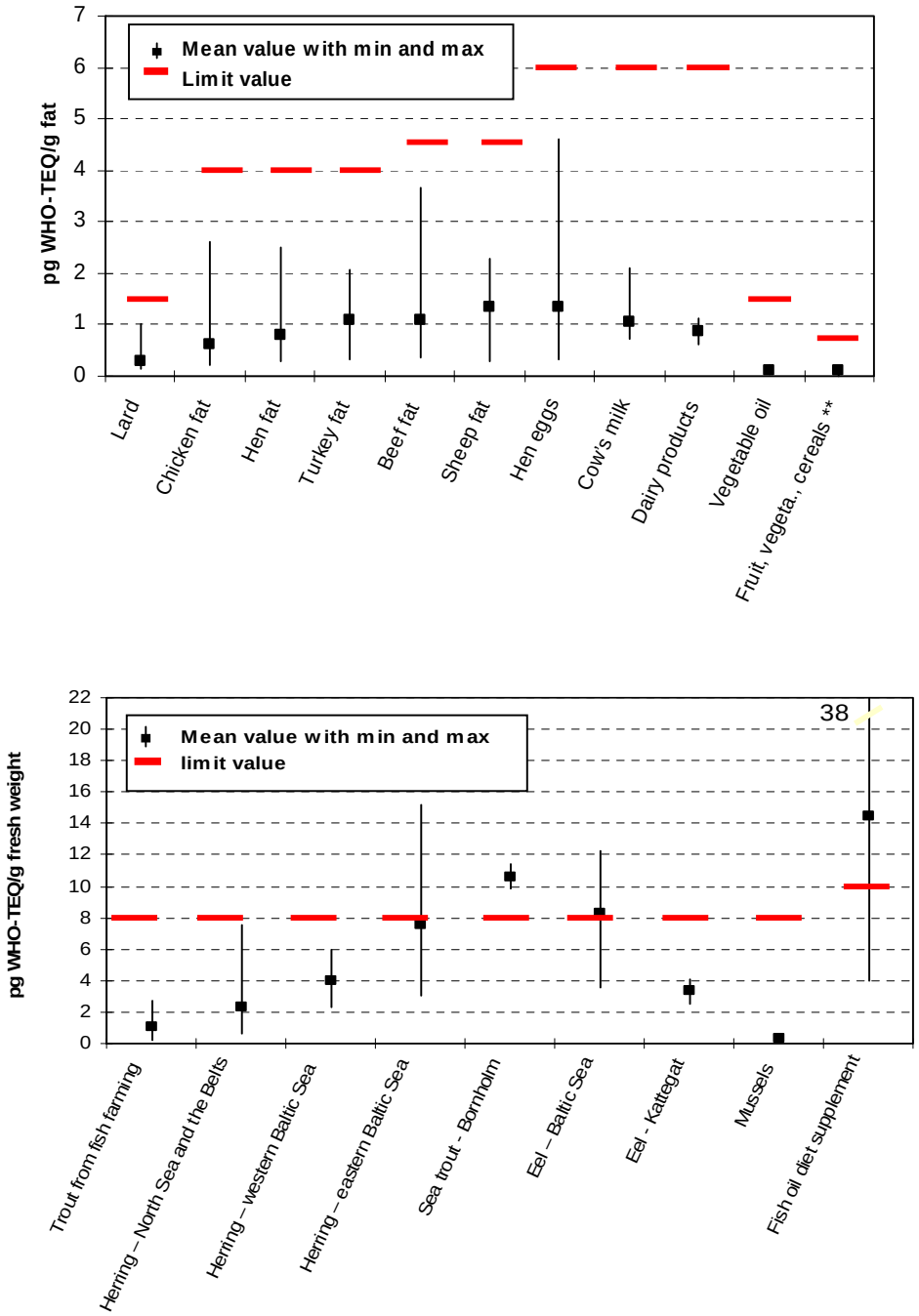

Figure 2.4
Measured sum of dioxin and dioxin-like PCB (total TEQ) in samples of Danish foodstuffs 2000-2004. Note the different scales and units in the two figures.

Contents measured are stated in mean values and the interval from lowest to highest measured value. The maximum limit values proposed are indicated with red horizontal lines. ** For fruit, vegetables and cereals, there are no maximum limit values, and the sum of action levels for dioxin and dioxin-like PCB are stated instead. [14]

Human intake of dioxin and dioxin-like PCB

On the basis of an overall estimate, levels of intake of dioxin and dioxin-like PCB by part of the Danish population are considered to be too high.

In 2001, the EU Scientific Committee for Food (SCF) fixed a tolerable weekly intake (TWI) of dioxin and dioxin-like PCB for humans of 14 pg WHO-TEQ/kg body weight/week.

Mean intake of dioxins and dioxin-like PCB by Danish adults is calculated at between 5.6 and 7.7 pg WHO-TEQ/kg body weight/week. Average values for the 5 per cent Danes with the highest intake (95 per cent fractile) are between 12.6 and 25.9 pg WHO-TEQ/kg body weight/week.

Disregarding intake from fish, the mean intake for children between the age of 4 and14 years is estimated at 7.7 pg WHO-TEQ/kg body weight/day, and between the age of 4 to 6 years it is 10.5 pg WHO-TEQ/kg body weight/day. The 95 per cent fractile for the two groups of children is 14.0 and 16.8 pg WHO-TEQ/kg body weight/day, corresponding to 100 per cent and 120 per cent of TWI. For children eating fish the level will be even higher.

It is estimated that more than 90 per cent of the dioxin exposure originates from foodstuffs – approx. 80 per cent from animal food. The percentage distribution of the mean intake of dioxins and dioxin-like PCB from all foodstuffs is between 30-40 per cent from milk and dairy products, 3-4 per cent from eggs, 13-18 per cent from meat, and 38-55 per cent from fish.

It should be noted that studies of human diet show that the Danes do not eat enough fish, and that the average Dane eats only half the amount of the dietary recommendation. If the consumption of fish is increased to the recommended level, dietary recommendations underline the importance of basing intake on a variety of fish, and not only on fatty fish from contaminated waters. Moreover, it is recommended to eat both fat and low-fat fish species from different areas. The bigger the consumption of fish with a high dioxin and PCB content, the more Danes will be close to or exceeding the TWI.

Dioxin and dioxin-like PCB in breast milk

When planning the dioxin action plan, emphasis was placed on including beast milk sampling in order to monitor the impact of dioxins and dioxin-like PCBs on humans. As more than 90 per cent of dioxin consumption by humans stems from food, analyses of the contents of dioxins and dioxin-like PCBs in for example breast milk will give us a picture of the overall human exposure to these substances.

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[14] Source: Based on: *Statusredegørelse for indsatsen mod dioxiner* (Status report on measures against dioxins). Ministry of the Environment, Ministry of Family and Consumer Affairs, and Ministry of Food, Agriculture and Fisheries, 25 May 2005.

The samples, which were part of the action plan, were taken at the breast-milk centres at Hvidovre and Skejby hospitals. The breast milk sampled originates from first-time mothers between the age of 25 and 29, and was milked primarily between 3 and 8 weeks after giving birth. The sampling was standardardised and can therefore be compared to previous surveys of breast milk in Denmark.

Figure 2.5 shows average values from analyses for the years 1999, 2002 and 2004. The figure also shows the results from previous Danish surveys in 1986 and 1993. There is a clear fall in the content of dioxins and dioxin-like PCBs. From 1993 to 2004 there is a fall of 48 per cent for dioxins, and of 67 per cent for dioxin-like PCBs, as well as a fall of 58 per cent for the sum of dioxins and dioxin-like PCBs together.

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

The amount of dioxins in breast milk can be seen as an indicator for the actual impact on the population, and it is worth noticing that the level in 2004 was still at around 50 per cent of the level in 1986, which was a very high level, despite the substantial falls in emissions in Denmark.

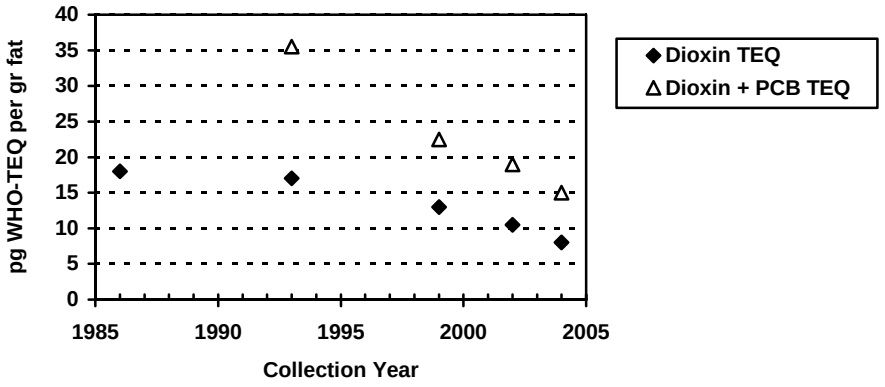

Figure 2.5
Contents of dioxins and the sum of dioxin and dioxin-like PCB content in Danish breast milk. The figure shows average content in breast-milk samples collected in the years 1986, 1993/94, 1999, 2002 and 2004. [15]

Dioxins and dioxin-like PCBs in animal feed

As part of the dioxin action plan, Danish animal feed were sampled annually in the period 2000 to 2004. Samples were analysed for contents of dioxins and dioxin-like PCBs and indicator PCBs. A total of 460 animal feed samples were taken in the period 2000 to 2004 under the dioxin action plan for the

[15] Source: Danish Institute for Food and Veterinary Research. *"Dioxinhandlingsplan 2000-2004. Slutrapport" (Dioxin action plan 2000-2004. Final report; only available in Danish)*. Ministry of Family and Consumer Affairs, Danish Insitute of Food and Veterinary Research.

purpose of analysis. In 43 cases, the content of dioxins was above the limit values which entered into force on 1 July 2002. However, only one out of the 84 samples taken from animal feed in 2004 had a content of dioxins exceeding the limit value. In general, the content of dioxins and both types of PCB was slightly higher in feedingstuffs including contents of fish (fish oil, fishmeal, fish fodder and fur-animal feed). In feeding fats (both animal and vegetable) the content of dioxins, but not the content of dioxin-like PCBs and indicator PCBs, was relatively high (for dioxins, almost at the same level as fishmeal). In the other feed mixes, contents were low for both dioxins and for both types of PCB.

The limits for maximum levels of dioxin in animal feed entered into force on 1 July 2002[16] and were amended by Commission Directive 2003/57/EC with regard to minerals and binders especially. The new Directive, which amends Appendix 1 of the Directive 2002/32/EC, establishes maximum levels for dioxin-like PCBs and indicator PCBs, adjusts the existing action levels for dioxins, and introduces action levels for dioxin-like PCBs.

Dioxins in the environment

As a part of the dioxin action plan, sediments, soil, air and deposition have been sampled for dioxins. Moreover, from 2005, dioxins and dioxin-like PCBs have been included under Denmark's national nature and water-monitoring programme, NOVANA.

Dioxins in sediments

Samples of sediments have been taken from the bottom of 18 fjords and lakes throughout Denmark, and from the Sound and the Kattegat. The content of dioxins varied considerably, from 0.6 to 24 ng/kg I-TEQ. In general, dioxin levels were lower in Jutland than on Zealand, but otherwise sampling showed no obvious link between dioxin-levels and geographic location, or any consistent difference between city and countryside. The great variation and the height of the levels indicate that water-born pollution plays an important role. Based on measurements of the atmospheric deposition, one should expect levels between 0.2 – 1.2 ng/kg, which accords with the lowest sediment results. Dioxin concentrations measured in sea sediments were at the same level as concentrations measured in sediments from fjords and lakes.

Dioxins in soil

In 2002-2003 a national survey of dioxins in soil was carried out. Samples were taken from 32 locations. The majority of dioxins in soil are present 0-10 cm from the surface. Dioxin levels in samples from unpolluted arable reference areas and other rural areas reached 0.7 ± 0.2 ng/kg I-TEQ (average ± variation). In samples from exposed rural areas downwind from cities, industrial areas and larger point sources, dioxin levels also reached 0.7 ± 0.2 ng/kg I-TEQ. Thus, there is no observable increase in dioxin levels in soil from exposed land. On the other hand, the content of dioxins in garden and park soil from cities is considerably higher: 6.2 ± 5.6 ng/kg I-TEQ in samples from the cities of Copenhagen and Nyborg.

In 2003-2004 the survey was followed up with extra sampling of garden and park soil from a number of cities, and of soil from a rural zone in Southern

[16] Directive 2002/32/EC of the European Parliament and the Council of 7 May 2002 on undesirable substances in animal feed.

Jutland. The survey showed that the content of dioxins in soil samples from Copenhagen parks and gardens varies from 1.6-34 ng/kg I-TEQ, whereas dioxin contents in soil from provincial parks varied from 1.5-2.5 ng/kg I-TEQ. The overall data material showed falling levels of dioxins, from south to north in Denmark. This is a consequence of the greater atmospheric transport of dioxins from south to north, than from north to south in Denmark.

Dioxin deposition

As part of the dioxin action plan, a measurement programme was launched in 2001 which covered measurements of dioxins in the air and in atmospheric deposition. Dioxins were measured in bulk deposition at three forest stations in western Jutland (Ulfborg), northern Zealand (Fredensborg) and on Bornholm, as well as in an urban area (Copenhagen). In Fredensborg, measurements were also taken of dioxins in deposition under pine forest canopy (drip through). The concentration of dioxins in the air was measured in Fredensborg and Copenhagen, as well as in a village (Gundsømagle) with many wood-burning stoves. The programme ended in 2005 and the results have been described in a recent report. Below is a brief account of the main results.

Deposition of dioxins from the air is decisive for the transfer of dioxins from sources to the land and the sea. Depositions are a direct measure of the intensity of exposure associated with a geographical area, which is directly linked to the dioxin amounts the area receives.

The surveys revealed a regular seasonal variation in concentrations of dioxins in the air, with maximum levels in the wintertime. Atmospheric concentrations in northern Zealand and Copenhagen followed each other closely and synchronously, which indicates that long-range transport is a significant contribution to dioxins in the atmosphere. In the village, the winter maximum was especially high - the highest measured in the programme – and must be interpreted as caused by emissions from wood-burning stoves during the heating season.

As a consequence of the seasonal variation in the atmospheric concentrations, the deposition of dioxins is greater in the winter than in the summertime, although this is more pronounced in some stations than others. Depositions tend to be higher above Bornholm (the Baltic Sea) than above Ulfborg (the North Sea), as expected according to model calculations of atmospheric transport of dioxins in the region. The total geographical variation from Copenhagen to Ulfborg is not big, but constitutes a factor of 2.1.

Measurement programmes have also examined whether there is a relationship between regional differences in deposition and the concentrations of dioxins in soil and sediments.

Depositions can account, more or less, for the content of dioxin in soil from rural areas. However, the concentrations in soil samples from Copenhagen are far too high to be explained by deposition. The concentrations in the sediments from all but a few lakes are too high to be attributed to depositions alone. This applies to sea sediments as well. The Danish EPA launched a survey in 2005 on the basis of the measurements in order to examine the relationship between dioxin concentrations in the water, atmospheric deposition and the release from sediments in the Baltic Sea.

Depositions on the surface of the sea in the western part of the Baltic Sea are estimated at 1.3 mg I-TEQ/km^2/yr., which corresponds to more than 200 times the amount that is collected annually per km^2 in fatty fish such as herring and salmon. Depositions contribute to dioxins to the Baltic Sea which are available for uptake in the food chain. Therefore, deposition on the surface of the sea is a significant source of the population's intake of dioxins through fish many years ahead.

The deposition measurements made it possible to calculate the annual deposition of dioxins more precisely than the 13-130 g I-TEQ stated in the flow diagram in figure 2.3. On the basis of the measurements, the annual deposition on Danish land has been calculated at around 40-90 g I-TEQ, which indicates that, in net terms, Denmark receives more dioxin from other countries.

Long-range transboundary air pollution
The EMEP programme (Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air pollutants in Europe) under the Convention on Long-range Transboundary Air Pollution (LRTAP) makes calculations of how much pollution the individual European country receives from and imposes on other countries.

EMEP publishes a range of regular reports with calculations for the individual country, including Denmark. For dioxin, these calculations include calculations of emissions; atmospheric deposition; concentrations in air, soil and vegetation; as well as exchange of dioxin between Denmark and major European countries. Naturally, the calculations are subject to some uncertainties, because they depend on the individual country's submission of correct emission inventories to the EMEP. Moreover, the models applied are also prone to considerable uncertainty.

According to the latest status report with model calculations for 2003, about half of total air emissions from Danish sources were deposited in countries on the European continent, including Denmark. The remainder was deposited in the sea outside Europe or degraded in the atmosphere. Of the half that was deposited in Europe, about 30 per cent was deposited in Denmark. The major recipient countries of dioxins from Danish sources were Sweden, Russia and Poland which received 19, 14 and 7 per cent respectively.

Of the amounts deposited in Denmark in 2003, more than half came from Danish sources, whereas 8 per cent came from the United Kingdom, and 7 and 4 per cent, respectively, came from Germany and Poland.

These figures only tell us about depositions over land and therefore do not give us an idea of the countries of origin of dioxins in fish, which is a significant source of human exposure to dioxins.

2.3.5 Stockkpiles, waste and contaminated sites

POP pesticides in waste products and depositories
There has been no systematic monitoring of POP pesticides in waste products in Denmark apart from in sewage sludge from public treatment plants, where the substances aldrin, dieldrin and endrin were included in the point source programme under NOVA2003 until, and including, the year 2003.

According to the point source report for 2003 there had been no detections made 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 a previous survey of the environmental impact of waste treatment plants, DDX (i.e. DDT/DDD/DDE) was included in the analysis programme for xenobiotic substances in waste products and emissions from selected waste incineration plants, composting plants and landfills, however it was not detected in any of samples taken.

In 1961 the Ministry of Agriculture instigated a national collection of pesticides waste and pesticide residues which were deposited in a repository on Harboøre Tange (an offshore bar at Ringkjøbing Fjord). It is uncertain which exact substances were deposited from the collection, but POP pesticides may have been included. Part of the repository was washed out into the North Sea as early as February 1962 during a storm, leading to extensive fish mortality in the area. The repository was later remediated but work to reduce leaking of dangerous substances from remaining waste is still going on. However, none of the substances which have been detected are POPs.

It is likely that uncontrolled and inappropriate depositing of pesticide residues took place before there were any actual rules and regulation for the disposal of hazardous waste, although the most common practice was to incinerate residues and packaging locally at farms. For many years, pesticide residues and packaging have been disposed of via municipal delivery schemes. The waste the municipalities receive is transported to Danish municipalities' own treatment facility, Kommunekemi, for destruction or final depositing.

According to assessments, there are no stockpiles of obsolete POP pesticides in Denmark today.

PCBs in waste products

The amount of waste which contains PCBs and PCTs (polychlorinated terphenyls) is calculated in the Danish EPA ISAG system which calculates information on waste and recycling based on reports from Danish waste treatment plants. The period from 1997 to 2004 has seen a falling trend in the amounts of PCB-containing waste, as can be seen in figure 2.6. The large figure for 2000 is due to the disposal of a large single load of PCB-contaminated soil.

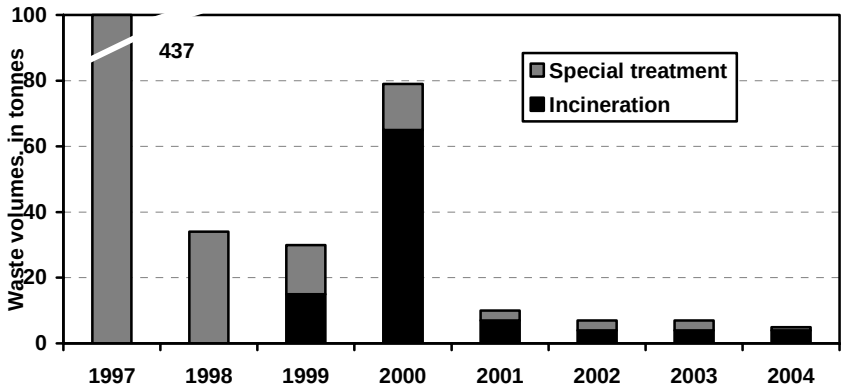

Figure 2.6
Amounts of PCB/PCT-containing waste registered in the ISAG.

PCB/PCT-containing waste is for the major part sent to Kommunekemi. Trends in the amounts of the most important categories of PCB/PCT-containing waste that is sent to Kommunekemi are illustrated in figure 2.7. Please note that waste amounts are stated in tonnes. PCBs make up about one-third of the total weight in capacitors and transformers. These two waste fractions show a regular fall in the period 1995 to 2005. In 2005, a total of 3.4 tonnes of capacitors was disposed of in 13 deliveries. Assuming they are large capacitors, this corresponds to around 1 tonne of PCB in 70-150 capacitors. Results confirm that there is a small quantity of PCB-containing equipment still in use which will not be revealed until the equipment is disassembled.

Apart from the fractions illustrated, a total of 44 kg of waste fell under the category of "Miscellaneous" in 2005. Furthermore, in the period before 2000 large amounts of soil, landfilled waste and groundwater were disposed of on occasion.

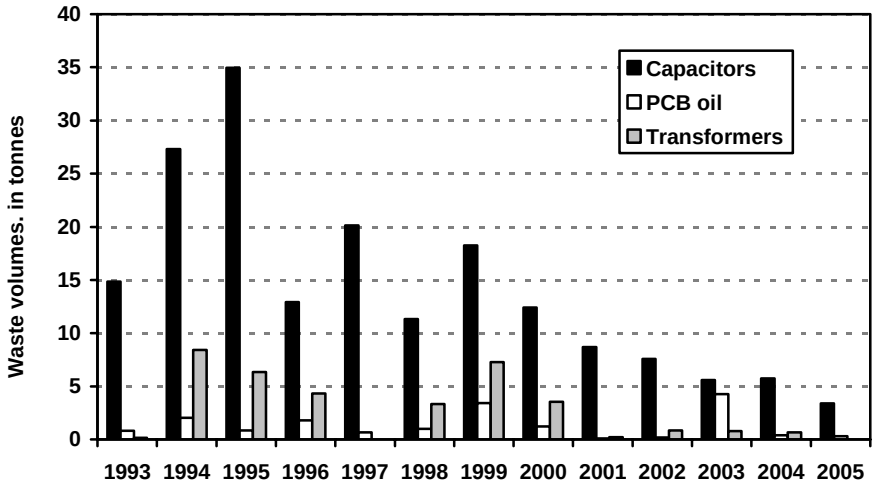

Figure 2.7
The amount of the three major fractions of PCB/PCT-containing waste delivered to Kommunekemi 1993-2005. Based on information from Kommunekemi.

PCB-contaminated sites

There are no Danish quality criteria for PCBs or dioxins in soil, and it is therefore up to the individual county to decide which concentrations should trigger remediation measures.

Incidents of soil contamination are registered by Danish counties, which report annually to the Danish EPA. The incidents are registered in the Danish EPA database register of contaminated sites, ROKA. From the start of registration in ROKA to 2004, a total of three contamination incidents have been registered which involve PCBs as a contaminant. The three incidents were registered in 1989, 1998 and 2002.

There have been many examinations for PCBs in soil at power and transformer stations but no findings of significant amounts of PCBs have been made.

The Danish electricity company NESA conducted surveys in 2003-2004 examining the soil under capacitor batteries in 11 of the company's 65 main transformer stations. PCBs were used previously in capacitors at main transformer stations, whereas, by and large, PCB-containing transformers have not been used in the supply grid. In the soil under two out of the eleven capacitor batteries examined, elevated concentrations of PCB were found. Concentrations were of up to 3.5 mg/kg (a total of 10 PCB congeners). The sites have subsequently been remediated.

Dioxins in residues from waste incineration

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

On the basis of measurements of dioxin concentrations in flue gas and residues, the latest mass-flow analysis estimates that 58-436 g I-TEQ are formed annually from incineration at Danish incineration plants. Of these, an estimated 6.4-28.9 g I-TEQ were emitted to the air, 2-5 g I-TEQ ended up in slag, while the remaining 50-402 g I-TEQ ended up in flue-gas cleaning products (please note that waste treatment in figure 2.3 also covers other waste treatment). The considerable uncertainty regarding total amounts is due to very large variation in the dioxin concentrations measured in the flue-gas cleaning products. For example, 21 measurements at different plants varied from 135 to 35,566 ng I-TEQ per kg dry matter. The average for dioxins in the flue-gas cleaning products was 4,162 ng I-TEQ/kg.

It should be noted that during waste incineration some of the dioxins are destroyed. Waste disposed of through normal waste incineration has an estimated total content of 9-310 g I-TEQ/year, according to the mass-flow analysis. Using European average figures for dioxins in waste[17], the total amount can be estimated at 107 g per year. This amount would end up in landfills if the waste was deposited instead of incinerated, and in a net statement it would cancel out some of the dioxins which are formed during waste incineration.

In two of the plant types used at Danish incineration plants, part of the dioxins are captured together with activated carbon, forming a separate product, which can then be incinerated destroying the captured dioxins in the process. These plant types have bag filters with activated carbon placed after the other flue-gas cleaning, or they utilise the so-called ADIOX process where the dioxin bonds with a glass fibre material with embedded activated carbon, which after filling (typically following several years) can be sent to destruction/incineration. In the other plant types, the activated coal blown in is captured with the remaining flue-gas cleaning products.

Whereas the slag from waste incineration is used mainly for plant-internal purposes, almost all flue-gas cleaning products are sent to landfills in Norway or Germany. In Norway, the residues are stabilised with iron sulphate and sulphuric acid, a waste product from Norwegian industries. The resulting plaster is filled into an old stone quarry on the island of Langøya in the Oslo Fjord. In Germany the residues are mixed with concrete and other added materials to form a concrete mass that is built into old salt mines.

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[17] BIPRO. 2005. *Study to facilitate the implementation of certain waste-related provisions of the Regulation on Persistent Organic Pollutants (POPs).* European Commission, Brussels.

Dioxins in residues from energy generation
No measurements of dioxins in fly ash from Danish power plants exist, and due to the lack of up-to-date measurements, the mass-flow analysis estimates, however with great uncertainty, that the total content of dioxins in the fly ash is 0.3-40 g I-TEQ/year. A more recent report from the EU estimates the total amount of dioxins in fly ash from coal incineration in Denmark to be 17 g I-TEQ/year, based on European average figures.

Dioxins in bio ash
Surveys of dioxins in ash from incineration of biofuels were carried out as a part of the dioxin action plan. A total of 23 ash samples were taken. Of these, seven samples came from small straw-fired farm burners, four came from small heating plants (of which two were straw-fired and two wood-chips-fired), and twelve samples from burners fired exclusively on wood chips. Finally, a sample from a household wood-burning stove was included. Sampling results showed that the ash from straw-fired farm burners contains an average of 3.7 ng I-TEQ dioxins per kg, varying from 0.2-12 ng/kg I-TEQ. The estimated total amount of dioxins in ash is estimated at 0.005 – 0.1 g I-TEQ/year, according to the latest mass-flow analysis. This ash is widely applied to farmland, but due to the small quantities the dioxin content is not considered to go against using the ash for this purpose.

The ash from the small heating plants had a significantly smaller average dioxin content, 0.6 ng I-TEQ per kg of ash, varying from 0.03-1.4 ng I-TEQ/kg. The ash from the wood-chip burners had an average dioxin content of 18 ng I-TEQ/kg, which is considerably higher than for the straw-fired burners. They also showed greater variations, as the values measured range from 0.02 to 74 ng I-TEQ/kg. The lone sample taken from a household wood-burning stove had a very low dioxin content of 0.03 ng I-TEQ/kg.

Compared to flue-gas cleaning products from waste incineration, where the average was at around 4,000 ng I-TEQ/year, bio ash contains about 1,000 times less dioxins per kg.

Dioxins in percolated water from landfills
As a part of the dioxin action plan, samples were taken of percolated water from seven landfills. 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 pg I-TEQ per litre, i.e. up to 30 times higher. Water which has percolated from landfills is therefore at present considered to be of significantly less importance than rainwater to dioxin impacts on groundwater and watercourses.

2.3.6 Future intentional production of POPs and need for exemption

There is no intentional production or use of POPs, and there is therefore no need for specific exemptions.

2.3.7 Programmes for monitoring releases, health risks and emissions inventories

Monitoring POPs in foodstuffs and health risks
The content of dioxin and dioxin-like PCB, indicator PCBs, chlordane, DDT, endrin, dieldrin, heptachlor and HCB in food is monitored continually as part of the Danish monitoring programme for food. The monitoring

program is conducted by the Danish Institute for Food and Veterinary Research under the Ministry of Family and Consumer Affairs.

On the basis of the values found the intake with food is calculated, and the estimated intake is compared with the recognised tolerable daily or weekly intake.

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

Monitoring POPs in animal feed

In the period 2000-2004, as part of the national dioxin action plan, the Danish Plant Directorate examined a total of 491 samples of animal feed for dioxin, dioxin-like PCBs and indicator PCBs (control samples and monitoring samples). Since 2005, the Danish Plant Directorate has been part of an EU harmonised mapping, monitoring and control programme for dioxins, dioxin-like PCBs and PCBs in animal feed. The Danish Plant Directorate reports data regularly to the Commission.

Monitoring POPs in the environment

Monitoring 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 fjords and marine areas is carried out in collaboration between the regional authorities and the National Environmental Research Institute of Denmark (NERI). In general, the regional authorities are responsible for monitoring fjords and coastal waters, while NERI is responsible for open waters. Implementation of the point source programme builds to a large extent on existing wastewater supervision by counties and municipalities, as well as enterprises' own internal controls.

The NOVANA programme includes measurements of the following POPs:

Mussels:	Basic programme: PCBs (10 indicators), DDT/DDE, HCB. Extended programme: dioxins and dioxin-like PCBs.
Fish:	PCBs (10 indicators), DDT/DDE and HCB.
Sediment:	DDT/DDE, HCB, PCBs (10 indicators), dioxins and dioxin-like PCBs.
Point sources:	PCBs, HCB, dieldrin, endrin, aldrin.

POPs in the air, atmospheric deposition, soil, etc. are not included in continuous monitoring, but have been covered by special studies.

None of the POPs are included in the continuous groundwater monitoring carried out by GEUS, which is the reference centre for groundwater and borings. In the period 1993-2003, GEUS took a number of measurements of all the POP pesticides in the groundwater (25-70 measurements per substance) without finding the substances.

The results of monitoring are reported annually and are available to the public on NERI's website (www.dmu.dk).

Monitoring dioxin releases from incineration plants and other point sources
The Danish EPA reference laboratory for measurement of emissions into the air is at Force Technology (previously DK-Teknik), and it has built up a database of measurements of emissions of dioxins. The database is primarily based on registration of measurements at incineration plants for waste and hazardous waste, but it is also possible to register emissions measurements from other types of installations.

There is a spreadsheet for using the database which incineration plants can use for reporting. Reporting is voluntary, and so far only a limited number of installations submit reports.

The database makes it possible to extract the necessary data, for example to calculate emissions factors, annual emissions, dioxin patterns or I-TEQ rates. It is hoped that all emissions measurements of dioxins, both enterprises' own internal controls and controls by the authorities will be reported to the dioxin database. The data in the database is planned to be available directly on the reference laboratory's website (www.ref-lab.dk), but as yet it is unknown when the database will be developed to this level.

Emissions of POPs from installations
The Danish EPA register on the environmental situation of installations contains information about releases from Danish installations subject to the IPPC legislation. In 2004 the register contained information on about 7,000 installations subject to approval, including releases from 158 large Danish installations into the air and water. The register contains information on 50 priority substances, including dioxin, HCB and "haloginated organic compounds". The register is based on annual information which installations issue in their green accounts.

The register is under development as it will be expanded to a "Pollutant Release and Transfer Register" - PRTR register – and contain information on diffuse sources and emissions into the soil. Information in the register is used by NERI in preparation of national inventories of releases into the air. The information is available on the Danish EPA website (https://secure.mim.dk/mst/simi/) and on the website for the common European Pollutant Emissions Register, EPER (http://eper.cec.eu.int/eper/default.asp).

Emissions into the atmosphere
NERI is responsible for preparation of the annual official Danish inventories of emissions into the atmosphere. NERI reports the total estimated emissions of dioxins to the EU and the Convention on Long Range Transboundary Air Pollution (CLRTAP). The inventories are available to the public on the website for the EU databank (Central Data Repository at http://cdr.eionet.eu.int/).

2.3.8 Information to the public and exchange of information with other parties to the Convention

Problems associated with POPs are communicated at many levels and in many fora. In most cases, information on POPs will be in a slightly broader context when it is included with other hazardous substances.

Only a few examples of information dealing more specifically with POPs will be mentioned here.

Dioxin reports

As part of the dioxin action plan, in recent years a number of dioxin reports have been developed, see above, and these are available (in Danish) to the public on the Danish EPA website at http://www.mst.dk/kemi/02280000.htm.

A sensible stove for "pure" enjoyment

The primary source of POPs pollution from the public is through burning waste and using wood burning stoves.

In 2000/2001, the Danish EPA launched the campaign "Fyrer du med skrald ryger miljøet" (heating with waste scolds the environment), and in 2004 this was followed up in association with Foreningen af Danske Producenter af Pejse og Brændeovne (an association of Danish stove manufacturers) with the campaign "Fyr fornuftigt - og få ren hygge" (a sensible stove for pure enjoyment) (see annex 3). The aim of the campaign was to prevent smoke from stoves from containing hazardous substances, including POPs, because of using incorrect fuel. The folder for the campaign encourages people to use clean wood and to avoid using advertisements, magazines, milk cartons, cardboard, or treated or painted wood. The campaign folder was distributed in shops selling stoves and other places. A Danish website was set up for the campaign with good advice and information about environmental aspects and atmospheric pollution: http://www.fyrfornuftigt.dk/.

Some years ago, the former Bygge- og boligstyrelsen (National Building and Housing Agency) prepared a booklet (in Danish) "Korrekt fyring. Sådan udnyttes brændslet bedre" (Correct heating. How to use firewood better), which encouraged people to use only clean and untreated wood. The booklet has now been updated and is distributed via the Local Government Denmark (LGDK) website (http://www.kl.dk/).

Stove and fuel dealers, as well as many municipalities and supply companies refer to the booklet on their websites.

Say goodbye to PVC waste and impregnated wood

In 2002 the Danish EPA launched a campaign to tell the public that products containing PVC should not be thrown away with ordinary waste. The reason was to prevent PVC waste from being sent for waste incineration, primarily to avoid formation of the large amounts of residues caused by PVC. As stated in the government Waste Strategy 2005-2008, the chlorine content in the waste can also cause production of dioxins on incineration. As PVC waste is a source of chlorine, there is a likely spin-off benefit when this waste is kept away from waste incineration plants to the extent possible. The folder is still available in Danish on the Danish EPA website (http://www.mst.dk.).

Dioxins and dioxin-like PCBs in foodstuffs

The Danish Veterinary and Food Administration (DVFA) website "Alt om kost - smag for livet" (all about diet – a taste for life) (www.altomkost.dk) provides information about dioxins and dioxin-like PCBs in foodstuffs, harmful effects and what type of food is especially prone to containing the substances. The 2003 report "Helhedssyn på fisk og fiskevarer" (an overall view of fish and fish products) by the DVFA includes information about a number of POPs in fish and fish products, including dioxins and dioxin-like PCBs.

DAKOFA

Because waste incineration has been the most important source of dioxin emissions into the atmosphere in Denmark, within the framework of the Dansk Komite for Affald (DAKOFA), a stakeholder organization on waste, a number of initiatives have been completed in conferences and meetings to inform about and discuss the possibilities to reduce emissions of dioxin from waste incineration plants.

Information exchange with other parties to the Convention

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

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

Similarly information on POPs is regularly exchanged through Nordic involvements.

2.3.9 Activities by non-public stakeholder organisations

WWF informs about POPs on their website (http://www.wwf.dk), and POPs are an integrated part of the organisation's work to tighten chemicals legislation in the EU.

Greenpeace does work in relation to the Stockholm Convention and studies implementation as well as shares information on implementation with the international NGO network IPEN – International POPS Elimination Network. In Denmark the organisation focuses especially on cleaner technology and on enterprises emitting dioxin and their environmental approvals. Greenpeace also provides information about POPs on their website.

The Information Centre for Environment and Health is an independent information centre on environment, health and consumption, and it is funded by the Ministry of the Environment. The Centre has issued a large number of articles about the problems associated with POPs, especially dioxins in food.

2.3.10 Technical infrastructure for POP assessments, measurements, analyses, research and development

Laboratories competent to measure POPs

There are 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:

- ***Dioxin:*** NERI (Roskilde), DVFA ;
- ***PCB:*** NERI (Roskilde), Eurofins (Aalborg), Eurofins (Vallensbæk), Milana (Elsinore);

- ***HCB:*** NERI (Roskilde), Eurofins (Aalborg), AnalyCen (Fredericia), Eurofins (Vallensbæk), Steins (Brørup);

- ***DDT/DDE:*** NERI (Roskilde), Eurofins (Aalborg);

- ***Aldrin, dieldrin, endrin***: Eurofins (Aalborg) AnalyCen (Lidköping, Sweden), Milana (Elsinore), Eurofins (Vallensbæk/Viborg), Steins (Brørup);

Three Danish laboratories measure dioxins in flue gases: Force Technology, Eurofins and the Danish Technological Institute. These laboratories collect the samples, while the actual analyses are usually conducted by German laboratories.

Research into occurrence and effects of POPs
POPs are part of a number of research programmes at Danish research institutions. Current POP-related research programmes at the institutions are described in more detail in section 3.3.9 under strategy elements.

Much research aims at POPs in the Arctic and is part of work under the Arctic Monitoring and Assessment Programme, AMAP, funded through the Danish EPA programme, Danish Cooperation for Environment in the Arctic (DANCEA).

The following institutions work with the problems linked to the occurrence and effects of POPs:

- NERI, Department of Arctic Environment;

- The research unit for Environmental Medicine at the Institute of Public Health at the University Of Southern Denmark, Odense;

- Centre for Arctic Environmental Medicine at the Institute of Public Health, Aarhus University;

- The research group for ecotoxicology at the Institute of Biology of the University Of Southern Denmark, Odense.

The Department of Atmospheric Environment at NERI, which has completed a large number of studies aimed at revealing the link between sources of dioxin and occurrences in the environment.

2.3.11 Particularly exposed population groups

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. As Greenland and the Faeroe Islands are not covered by this implementation plan, the problem will not be described in more detail here.

Women of child-bearing age
Pollution from dioxin and other POPs represents a particular risk for women of child-bearing age as well as pregnant and nursing mothers. The DVFA recommends on their website ”alt om kost”, for example, that women of

child-bearing age, and pregnant and nursing women eat no more than one portion of salmon from the Baltic Sea per month. Children who eat a lot of fish could exceed the maximum recommended intake.

Socio-economic effects – fishing from Bornholm

The existing limit values for dioxin in fish have particularly dire economic consequences for fishermen on Bornholm. The ban on catching salmon weighing more than 4.4 kg, before cleaning, for the entire Baltic Sea and the ban on herrings from the eastern Baltic has affected the industry. 25 Bornholm salmon fishermen have been affected by the ban on salmon weighing more than 4.4 kg and have received compensation from the Ministry of Food, Agriculture and Fisheries. As herring from the western Baltic may still be caught, the ban on catching fish from the eastern Baltic has not affected the total amount of fish that can be landed, as the same quota has been maintained.

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

In Denmark a number of reports have been completed in recent years which describe the use of a number of persistent organic pollutants in Denmark and the opportunities of limiting their use. A report on brominated flame retardants (including PBDE, PBB, TBBPA and HBCD) siloxanes, perfluorooctane acid (PFOA) and perfluorooctane sulfonates (PFOS) as well as related substances and selected PBT substances (persistent, bioaccumulative and toxic substances) and vPvB substances (very persistent and very bioaccumulative substances).

Within the EU, Denmark is working with the other Member States on assessment of new POPs, regulation of these within the EU, and nominating substances under the POP Protocol and the Stockholm Convention.

3 Strategy and action plan elements

3.1 Political letter of intent:

The effort against harmful chemicals has since many years been a high priority for Denmark. The objective is, in accordance with the Danish national strategy on sustainable development from 2002 ***A shared future - balanced development***, that we towards 2020 continuously abolish chemicals that have harmful effects on human health and the environment. The high priority is reflected in the fact that all the substances listed under the Stockholm Convention that are subject to intentional production are banned in Danmark, and for the most part have been so for a number of years.

The remaining challenge for Denmark concentrates on the unintentionally produced POP substances and international regulation of further POP-substances uder the Convention. The efforts in this regard will be continued.

The Government will continue to work for the minimization of the burden on human health and the environment from POP substances, nationally as well as in international fora, on the basis of the precautionary principle and the principle of substitution.

3.2 Implementation strategy:

Denmark has since the 1980'ies continuously intensified the efforts in the chemicals area. The purpose is to reduce the risks to human health and the environment that are connected with the use of chemicals. This is especially done through efforts at the international level, Danish regulation, enforcement sanctions and by providing citizens and enterprises with greater knowledge on chemicals.

POP substances today comprise an integrated part of the existing systems and strategies for regulation, approval, monitoring and handling of waste in relation to chemicals. In implementing the Stockholm Convention, it is therefore not necessary to strengthen the institutional or regulative framework for the handling and monitoring of POP substances in Denmark.

The implementation of the obligations of the Stockholm Convention on POP substances and POPs waste is also characterised by a close interplay between EU regulation and measures on the one hand and national regulation and measures on the other.

The Stockholm Convention is implemented by Regulation no. 850/2004 on persistent organic pollutants, which supplements the already considerable EU legislation on POPs. The regulation is automatically a part of Danish law.

Denmark to a high extent implements the obligations of the Stockholm Convention through existing regulation, strategies and programmes, and the implementation plan therefore contains relatively few new initiatives.

The Danish implementation plan has been elaborated by the the Danish Environmental Protection Agency under the Ministry of the Environment. The unit on Chemicals Conventions and Pesticides, which has also been appointed focal point for exchange of information in accordance with article 9 under of the Convention, will on a regular basis and in accordance with the recommendations under the Convention review and revise the plan.

3.3 Activities, strategies and action plans

The following section presents a number of activities, strategies and action plans which describe how Denmark is implementing the Stockholm Convention. Each substance area topic follows more or less the same structure:

- Reference to the provisions in the text of the Convention applicable for the area in question;
- Status of manufacture and use of the relevant POPs, or the current situation in the area affected, including the relevant implementation legislation and the occurrence of the substances in food, nature etc.;
- Initiatives in progress (activities, projects, programmes etc.) in the area;
- Planned new initiatives in the area.

The section on reduction of releases from unintentional production of dioxins and furans, PCB and HCB deviates from this structure, as a reference is made to the separate action plan on this issue in annex 1.

3.3.1 Measures to reduce or eliminate releases from intentional production and use of POPs covered by annex A and annex B

Convention provisions
Article 3 of the Stockholm Convention supplemented by annex A (part 1) and annex B.

Status
Implementation legislation. The requirements of the Convention have been implemented in article 3(1) of the POP Regulation. The bans in the Regulation are stricter than in the Convention as the Regulation bans manufacturing, placing on the market and using the nine POPs covered by the ban in the Convention and DDT, which is only limited under the Convention, as well as three of the other four substances covered by the POP Protocol. The bans in the POP Regulation are supplemented by the Danish Chemicals Act, the Statutory Order on Pesticides, and the Statutory Order on POPs.

The Chemicals Act bans placing on the market and use of the nine pesticides in plant protection products, while sales, imports and other uses of the substances are banned under the Statutory Order on POPs.

Production and use. As mentioned in section 2.3, only DDT, aldrin, dieldrin, endrin and heptachlor have been used in Denmark. Of these, only DDT and dieldrin have been used extensively. The other substances have only been sold in small amounts and quickly fell out of the market. None of the substances have been marketed for many years.

New initiatives and initiatives in progress

As a result of the low or non-existent occurrences of substances in foodstuffs, waste products, the environment and the groundwater (see section 2.3.1), no further initiatives will be taken in the area of POP pesticides.

3.3.2 Measures to reduce or eliminate releases from intentional production and use of annex B substances (DDT)

For the sake of simplicity, annex B substances (DDT) have been mentioned with other pesticides in the section above.

3.3.3 Measures to reduce or eliminate releases from intentional production and use of PCB (annex A substances)

Convention provisions

Article 3 and annex A, parts 1 and 2 of the Stockholm Convention, including the commitment to dispose of equipment containing or contaminated with PCB by no later than 2028.

Status

Implementation legislation. The commitments in the Stockholm Convention have been implemented in article 3(1) of the POP Regulation and in the Statutory Order on PCB (see section 2.4). The Statutory Order on PCB contains stricter regulations than those in the Stockholm Convention with regard to 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.

Production and use. PCB has never been produced in Denmark. PCB was used for a period for various technical purposes and in equipment. In 1977 use of PCB was banned for "open uses", i.e. paint, fillers, self-copying paper etc. In 1986 a total ban was introduced on selling PCB and apparatus and other products containing PCB. Existing apparatus containing PCB could still, however, be used for a transition period up to 1995 for the largest and most important types of equipment.

Initiatives in progress

In 2005, the Danish EPA initiated a study on the occurrence of PCB in building materials. The results of the study are not yet available.

Planned new initiatives

When the results of the above study are concluded, the necessity for further measures in the area will be considered.

3.3.4 Specific exemptions regarding production and use of POPs covered by annexes A and B

Convention provisions
Article 3 and annex A, parts 1 and 2 of the Stockholm Convention

Status and plans on registration of exemptions
Implementation legislation. The very limited general exemptions from the provisions on production, placing on the market and use in article 3(5) and annexes A and B of the Convention have been implemented in article 4 of the POP Regulation. There is a general exemption for amounts of substances used for research at laboratory level or as reference standards, or occurring as unintentional trace contaminants in products and articles.

Except for the general exemption for amounts of substances used for research at laboratory level or as reference standards, Denmark does not apply the exemptions in the Convention or the Regulation.

Plans. On acceding to the Convention, Denmark did not register for specific exemptions regarding production and use of the substances for which exemption provisions exist. There are no plans to register such exemptions in the future.

3.3.5 Action plan for reduction of releases from unintentional production of dioxin, PCB and HCB

An action plan for reduction of releases from unintentional production of dioxin, PCB and HCB is placed in annex 1 to this implementation plan.

3.3.6 Measures to reduce or eliminate releases from stockpiles, waste and contaminated sites

Convention provisions
Article 5 of the Stockholm Convention.

Status
Implementation legislation. The provisions in the Convention on POP stockpiles have been implemented in article 5 of the Regulation, which follows from article 6(1)(a)-(c) of the Convention and states that stockpiles of POP must be identified and managed in an environmentally appropriate manner, see also section 2.2.4.

The requirements in the Convention for waste management have been implemented in article 7 and annex V of the Regulation, which contain a number of specific waste-management provisions, see also section 2.2.4.

Management of POP waste: Waste containing PCB and any other POP waste is hazardous waste. Management requirements have been stipulated in the Statutory Order on Waste and the WEEE Order, which are described in more detail in section 2.2.4.

Transfrontier shipments of waste are covered by Council Regulation (EEC) no. 259/93 on the supervision and control of shipments of waste within, into and out of the European Community, see also section 2.2.4.

Stockpiles: It is unlikely that there are stockpiles of obsolete POP pesticides in Denmark.

Initiatives in progress
As mentioned earlier, the Danish EPA has initiated a study of the occurrence of PCB in building materials. The results of the study are not yet available.

Planned new initiatives
Denmark expects to decide how flue gas purification waste is to be managed in the future.

When the results of the current study on PCB mentioned above are available, the necessity for further work in the area will be considered.

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

Convention provisions
Addition of new substances in annexes A - C follows the procedures in article 22(4).

Status
Implementation provisions: The procedures for incorporation of new substances to the Regulation are described in article 14 of the Regulation on amending the annexes.

Proposal for Council Decision on incorporation of new substances: 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 Member States and the Commission.

In 2004, the Commission prepared a proposal for a Council Decision on a proposal to nominate nine new substances for listing under the POP Protocol and the Stockholm Convention. In 2005 the proposal was changed to a Council Decision which included the following five substances for listing under the POP Protocol: hexachlorobutadien, polychlorinated naphthalenes, octabromodiphenyl ether, pentachlorobenzene and short-chained chloroparaffins. Most recently, a Council Decision on nominating three substances for the Stockholm Convention was adopted, which covers the three latter substances covered by the Council Decision on nominations under the POP Protocol.

Sweden has nominated perfluorooctanyl sulphonate (PFOS) for the Stockholm Convention.

Initiatives in progress
Denmark would generally like to see relevant POPs covered by international regulation. Denmark welcomes inclusion of relevant substances in the annexes to the POP Protocol and the Stockholm Convention and will work to have the substances included in the lists of substances.

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

Table 3.1
Substances considered in proposals for new substances in the POP Protocol and the Stockholm Convention

Substance	Cas No.	Original proposal for the Stockholm Convention Annex:	To the POP-Protocol Annex:	Use of substance	Applications in Denmark
Pentabrom diphenylether (penta-BDE)	32534-81-9	A		Flame retardant. Belongs to the group PBDE.	Banned in products >0.1% since 2004.
Octabrom diphenylether (octa-BDE)			I	Flame retardant Belongs to the group PBDE.	Banned in products >0.1% since 2005.
Hexabromobiphenyl	36355-01-8	A	Is included.	Flame retardant Belongs to the group PBB.	Banned in textiles since 1983 Banned in electronics from 1 July 2006. Probably not produced anywhere in the world today.
Chlordecon	145-50-0	A	Is included.	Broad-spectered insecticide	Has never been approved as a pesticide in Denmark.
Hexachlorocyclohexane (HCH)	608-73-1 58-89-9	A	Is included.	One of 8 possible isomers, γ-HCH used as a pesticide under the name lindane.	Banned since 1994
Polychlorinated naphthalenes (PCN)		A, C	I, III	Transformer and capacitor, flame retardant, plastic and rubber additive, fillers, fungicide, etc. Formed as unintentional product during waste incineration and other processes	PCN is probably not used intentionally anywhere in the world today – not recorded in the Product Register.
Perfluorooctane sulfonates (PFOS)			Relevant annexes	Impregnation of leather, textiles, carpets, paper and cardboard, detergents, paint/varnish, fire extinguishing foam, etc.	In general use for the purposes specified
Short-chained chlorinated paraffins (alkanes with chain length 10-13 carbon atoms)		B	II	Cooling/cutting agents, paint, fillers, flame retardant in rubber, leather protection cream etc.	Banned for metal working and greasing of leather since 2003.
Hexachloro butadiene (HCBD)	87-68-3		I	By-product in the production of certain chlorinated substances, intermediate in certain chemical processes, insecticide.	Processes are probably not taking place in Denmark - not recorded in the Product Register.
Pentachlorobenzene	608-93-5		I	Flame retardant, intermediate for pentachloronitrobenzene.	Regulation of contents of pentachlorobenzene in the pesticide quintozen – not recorded in the Product Register.

Beside the studies on the 10 substances indicated above, Denmark has also carried out a number of investigations in recent years, describing applications of a number of persistent organic substances in Denmark, and the possibilities for limiting uses of the substances. Investigations have been made of brominated flame retardants (including the substances/substance groups PBDE, PBB, TBBPA and HBCD), siloxanes, perfluoro-octane acid (PFOA) and perfluoro-octane sulfonates (PFOS), and related substances and selected PBT substances (persistent and bioaccumulative toxic substances and vPvB substances (very persistent and very bioaccumulative substances).

Planned new initiatives
Denmark will carry out regular assessments on whether new substances should be proposed for inclusion in the POP Protocol and the Stockholm Convention substance annexes.

3.3.8 Exchange of information and public information

Convention provisions
Articles 9 and 10 of the Stockholm Convention.

Status
Implementation legislation: Provisions of the Convention on information exchange, public information etc. are incorporated in article 10 of the Regulation.

Information exchange: Information on problems relating to POPs is disseminated at many levels and in many fora.

In most cases, information on POPs forms part of broader initiatives including other dangerous substances.

New initiatives and initiatives in progress
Intentional use of POPs included in the Stockholm Convention has been banned for all substances for a number of years, and it is not considered necessary to give special information to the public on the use and disposal of these substances.

All results of monitoring of POPs in the environment and in foodstuffs, emissions inventories, and reviews, investigations and studies on POPs will continue to be published on the website of the relevant institutions, and, thus, be available to the public.

Under the Nordic environmental action programme, Nordic working groups have been set up for the various substance areas. The groups exchange information and initiate studies, for instance on the costs in EU countries in relation to the use of PCB. Through membership of the EU, Denmark is taking part in information exchange with the other Member States on a continuous basis on a number of issues involving POPs.

Measures will be taken to update and extend information on POPs in existing relevant educational material on chemicals, targeted in particular towards young people.

3.3.9 Research, development and monitoring

Convention provisions
Article 11 of the Stockholm Convention.

Current monitoring initiatives
POPs are included in ongoing monitoring programmes for environmentally dangerous substances and releases from point sources carried out by NERI. The Department of Arctic Environment at NERI also monitors pollutants in the Arctic environment, e.g. in connection with the Arctic Monitoring and Assessment Programme (AMAP).

Current monitoring of POPs in foodstuffs and assessment of possible risks to health is in the hands of the Danish Institute for Food and Veterinary Research. Current monitoring of dioxin and dioxin-like PCB in animal feed is in the hands of the Danish Plant Directorate, and from 2005, the Plant Directorate has taken part in a harmonised EU programme on mapping, monitoring and control of dioxin, dioxin-like PCB and PCB in animal feed.

Emissions of POPs from industrial installations are recorded on a continuous basis in the Danish EPA register of the environmental situation of installations, which forms part of the joint European Pollutant Emission Register, EPER.

Current research initiatives
Denmark is engaged in extensive research in connection with the occurrence of POPs and their impact on the environment, animals and humans. Much of this research addresses the effects of POPs in the Arctic environment, and takes place within the international work under AMAP (Arctic Monitoring and Assessment Programme). Some of the initiatives are financed by the Danish EPA Arctic assistance programme, DANCEA. Denmark takes part in the AMAP biological time trend programme, which monitors the development of concentrations of POPs in a number of species.

POPs are included in a number of investigations at NERI, Department of Arctic Environment, for instance on the occurrence of ”new” POPs in the Arctic marine environment. Monitoring focuses on brominated flame retardants, polychlorinated naphthalenes (PCN), perfluorooctane sulfonate (PFOS) and synthetic musk compounds, and analyses of samples of air to determine long-range transport of polybrominated diphenyl ethers (PBDE)) and polychlorinated naphthalenes to the Arctic.

The Environmental Medicine research unit at the Institute of Healthcare Research, University of Southern Denmark, is carrying out a research project ”Children’s Health and the Environment in the Faeroes”. The project is investigating the presence of PCB and chloroorganic pesticides (including dieldrin, DDT/DDE and HCB) in children in the Faeroe Islands. The research unit is also studying possible effects of exposure to PCB.

The Center for Environmental Medicine of the University of Aarhus is carrying out experimental and epidemiological studies of the effects of a number of environmental toxins, including PCB in the Arctic. Epidemiological studies include monitoring of human impacts from PCB in Greenland as part of the AMAP programme. The Center also acts as the secretariat for the AMAP Human Health Expert Group, and is chairman of the group.

The research group for ecotoxicology at the Biological Institute, University of Southern Denmark deals with methods of screening chemicals with endocrine effects. A number of the POPs have other undesired effects, including a documented endocrine-disrupting effect.

So far, ongoing initiatives regarding monitoring of POPs are considered sufficient to ensure assessment of the pressure on humans and the environment on a continuous basis.

Planned new initiatives
The Danish EPA will continue work to support research initiatives taken to investigate occurrences of POPs in the Arctic environment, and their impact on animals and humans. Investigations include POPs covered by the Stockholm Convention, as well as potential candidates for inclusion under the Convention.

The Danish EPA is studying the degradation of dioxins in the Baltic Sea, aiming at determining the degree to which dioxins accumulated in fish originate from atmospheric depositions, or whether they are due to dioxins being remobilised and released from the seabed.

Finally, the Danish EPA will investigate sources of dioxins in organic farm units.

3.3.10 Financial and technical assistance to other countries

Convention provisions
Article 12 of the Stockholm Convention.

Status
Implementation legislation. Provisions on technical assistance are set out in article 11 of the POP Regulation. This article establishes the Commission's and the Member States' general obligation to provide technical assistance to developing countries and countries with economies in transition. Assistance may also be provided through non-governmental organisations.

Technical assistance provided so far. Since 1989, Denmark has provided assistance for enhancement of the environment in the new democracies in Central and Eastern Europe. The main objective of assistance has been to contribute to protecting the environment in Eastern Europe, by supporting accession candidate countries in their efforts to implement EU regulation on the environment, and international environmental conventions. Further, Denmark has helped CIS countries and other non-EU-applicants reduce human exposure to pollution, reduce transboundary pollution, and protect nature and biodiversity.

Assistance has been provided primarily as bilateral assistance, but some of has been channelled through the Arctic Monitoring and Assessment Programme (AMAP) and the Arctic Council Action Plan to Eliminate Pollution of the Arctic (ACAP), UNEP and NEFCO.

Assistance in the POPs area has targeted projects relating to pesticides, PCB and dioxins. Assistance has been provided for mapping and managing pesticides, including disposal of POP pesticides and obsolete stocks of pesticides. For PCB, assistance has focused on mapping PCB consumption and management, action plans for collection, storage and disposal of PCB,

and studies of alternatives to PCB. Assistance has also been provided for mapping dioxin emissions in several countries, and to a technical, environmental and socio-economic review of alternative disposal technologies. The bilateral support to new EU members has been phased out in step with their accession to the EU in 2004.

Denmark has provided bilateral assistance to environmental work in the developing countries, besides via the EU, see also the section below on current initiatives.

Financial assistance. The Global Environment Facility (GEF) is financing projects and programmes within biodiversity, climate change, marine pollution, ozone depletion, desertification and POPs. In the period 2001-2004, GEF has financed POP projects with support amounting to more than USD 141 mill. with co-financing amounting to USD 91 mill. The large majority of funds were used to finance preparation of action plans in the developing countries and countries with economies in transition. In recent years, Denmark has increased its contribution to GEF. Denmark contributes through its general GEF contributions, which,cover a number of POP projects. Denmark has in recent years increased its contributions to the GEF.

Current initiatives

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

To supplement efforts made via the EU and GEF, Denmark has allocated approx. DKK 850 mill. for the years 2004-2007 towards an overall Danish neighbourhood initiative in the new EU Eastern neighbours, focussing especially on the Baltic Sea region and the Balkans. Of this amount, DKK 81 mill. will cover projects primarily in Eastern Europe. Assistance is granted primarily to Russia, and also to Ukraine, Rumania, and Bulgaria.

A detailed strategy for spending the funds in these countries has not yet been prepared. However, it is expected that some of them will address activities relating to POPs. An overall study is currently being carried out in order to identify possible projects on POPs, heavy metals and other hazardous substances in Russia, Ukraine and China. Further, a project is being carried out in Russia, in Leningrad, Oblast and St. Petersburg, on collection and storage of PCB-containing electrical equipment, and another project on environmentally safe management of obsolete stocks of pesticides in Pskov and Vologda Oblast's. It is expected that these two projects will be completed in a couple of years.

For a number of developing countries, Danish assistance is directed towards enhancement of the environment. In some countries it has also included POP-related problems, such as mapping and disposal of obsolete stocks of pesticides in southern Africa. Activities are supported primarily through contributions to the extensive African Stockpiles Programme implemented by the World Bank, with a total budget of USD 250 mill. Denmark has contributed DKK 15 mill. In addition, assistance is being provided to Malaysia for the development of regulatory capacity regarding hazardous chemicals, including implementation of chemicals-related environmental conventions.

Planned new initiatives
In the future, Danish assistance to POP-related activities will primarily be channelled through GEF, which for the time being is appointed financial mechanism for the Stockholm Convention. Estimates are not available today on the scope of resources to be provided by industrial countries to the financial mechanism in order to assist developing countries and countries with economies in transition in their efforts to meet the requirements under the Convention. Therefore, there is no indication of the funds to be reserved for implementing the Stockholm Convention under GEF. It should be noted that specific national contributions are not charged for the financial mechanism under the Convention.

Further, Denmark contributes to the Stockholm Convention secretariat. The size of contributions depends on the number of parties to the Convention, calculated at USD 44,879 in 2006, and USD 32.210 in 2007, when more countries are expected to have ratified the Convention.

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 cooperation countries, if the countries prioritise this.

3.3.11 Effectiveness evaluation

Convention provisions
Article 16 of the Stockholm Convention.

It is most likely that the schemes will be implemented by the Parties on a regional basis in accordance with their technical and financial capabilities, using existing monitoring programmes and mechanisms as far as possible. Results of the monitoring activities on a regional and global basis must be reported to the Parties to the Convention.

The Parties to the Convention have also invited relevant organisations to cooperate on this task, by providing data for the evaluation. Moreover, the secretariat has been asked to test the schemes at national and regional levels, and to present the results of the test at the third meeting of the Parties to the Convention.

New initiatives and initiatives in progress
As described in this implementation plan, Denmark is engaged in various monitoring activities on POPs in foodstuffs, animal feed, waste products, groundwater, and the environment in general. Moreover, through AMAP, Denmark is monitoring POPs in the Arctic environment. Denmark will await the decisions of the Parties to the Convention on which data to be reported and on other elements to be included in the evaluation of effectiveness, and will adjust initiatives to such decisions.

3.4 Institutional and regulatory strengthening and prioritised areas

There is not considered to be any need for strengthening the institutional and regulatory framework for managing and monitoring POPs in Denmark.

Since problems with POP pesticides and PCB are assessed to be either solved or fairly limited in Denmark, highest priority is given to the following areas in order to meet the commitments under the Convention:

- Further reduction of releases of dioxin and other unintentionally formed POPs, and improved inventories of emissions of unintentionally formed POPs, as stated in annex 1, the action plan;

- Studies of other substances with POP properties, with a view to nominating substances for inclusion in the annexes to the Convention;

- Continued studies of impacts of POPs in and on the environment, animals and exposed population groups, focusing in particular on the Arctic.

Activities within these areas can be carried out within existing institutional structures.

3.5 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 secretariat, and to 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 POPs have for many years ranked high on the agenda, and form an integral part of current monitoring and research programmes.

Major elements of the costs relating to ongoing POP-related activities are:

- Maintenance and operation of installations to reduce emissions of dioxin and other unintentionally formed POPs, and disposal of residues from flue gas purification;

- Monitoring of POPs in emissions, in the environment, in foodstuffs, and in animal feed;

- Destruction of PCB-containing equipment and clean-up of PCB-contaminated sites;

- Ban on fish with excessive levels of dioxin. This measure does not implement provisions of the Stockholm Convention, but EU regulation;

- Programmes to investigate the occurrence and effects of substances with POP properties on humans and in the environment;

- Programmes to assess the possibilities of reducing emissions from burning biomass;

- Technical assistance to POP-related activities to party countries with economies in transition, and to developing countries.

3.6 Timetable

The implementation plan will be realised on the basis of the following timetable, not including, however, measures regarding unintentional substances according to annex C of the Convention. These substances are covered by the action plan in annex 1.

Table 3.2 Timetable for new initiatives

Area	Initiative	Timeframe
Reduction of emissions of annex C POP substances – unintentional production	See the action plan in annex 1	
Stockpiles, waste and contaminated sites	PCB in building materials in older buildings. Considerations of whether new initiatives in the area are called for	Fra 2006
	Decision on the future treatment of residue from flue gas purification in 2006	2006
Listing of new chemicals in annex A, B and C	Efforts to list a number of new substances on the annexes to the UNECE POP-Protocol and the Stockholm Convention	Continuously
Exchange of information and information to the public	Existing relevant teaching material on chemicals, especially directed at adolescents, will be expanded and updated regarding POP substances	2006-2008
Research, development and monitoring	Regular considerations on whether there is a need for further studies on dioxin in mothers' milk	Continuously
	Study on the conversion of dioxin in the Baltic Sea	2006-2007
	Investigation into the sources of dioxin in organic farming	2006-2007
	Further support to research initiatives investigating the presence of POP substances in the Arctic environment and their effects on humans and animals	Continuously
Technical and financial assistance to other countries	Continue to support POP related activities channelled through the GEF	Continuously
	To a lesser extent, bilateral support in programme cooperation countries, if prioritized	Continously
Effectiveness evaluation	If necessary, further monitoring	Awaits COP decisions

4 Abbreviations and measurement units

Abbreviations

AEPS	Arctic Environmental Protection Strategy
AMAP	Arctic Monitoring and Assessment Programme
BAT	Best available techniques
BEP	Best environmental practice
DDE, DDD	Degradation products of DDT
DDT	1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane
Dioxin	The term covers polychlorinated dibenzo-p-dioxin and polychlorinated dibenzofuran
EPER	European Pollutant Emission Register
HCB	Hexachlorobenzene
HCH	Hexachlorocyclohexane
PAH	Polyaromatic hydrocarbons
PCB	Polychlorinated biphenyles
PCDD	Polychlorinated dibenzo-p-dioxin
PCDF	Polychlorinated dibenzofuranes
POP	Persistent organic pollutant
PRTR	Pollutant Release and Transfer Register
TDI	Tolerable Daily Intake
TEF	Toxicity factor
TEQ	Toxicity equivalent
TWI	Tolerable Weekly Intake

Measurement units

I-TEQ	Toxicity equivalence: Unit expressing total toxicity of dioxin 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 PCB in a sample weighted on the basis of the WHO toxicity-weighting system for toxicity of individual types of dioxin.
mg	milligram = 10^{-3} g
μg	microgram = 10^{-6}
ng	nanogram = 10^{-9} g
pg	picogram = 10^{-12} g
Nm^3	Normal cubic meter

Annex 1
Action plan for reduction of emissions from unintentional production of dioxin, PCB and HCB

CONTENTS

1 Introduction

This action plan deals specifically with measures to reduce releases of unintentionally formed dioxines/furanes, PCB and HCB.

Inventories of releases of PCB and HCB are not available in Denmark. Therefore, data presented in the plan cover only releases of dioxin.

The action plan is prepared in accordance with the Stockholm Convention, article 5 a), which specifies the following elements:

i) An evaluation of current and projected releases, including the development and maintenance of source inventories and release estimates, taking into consideration the source categories identified in Annex C;

ii) An evaluation of the efficacy of the laws and policies of the Party relating to the management of such releases;

iii) Strategies to meet the obligations of this paragraph, taking into account the evaluations in (i) and (ii);

iv) Steps to promote education and training with regard to, and awareness of, those strategies;

v) A review every five years of those strategies and of their success in meeting the obligations of this paragraph; such reviews shall be included in reports submitted pursuant to Article 15 of the Convention on reporting;

vi) A schedule for implementation of the action plan, including for the strategies and measures identified therein.

For dioxin, an action plan was carried out in Denmark in the period 2000-2004. This was done in cooperation between the Ministry of the Environment, the Ministry of Family and Consumer Affairs, and the Ministry of Food, Agriculture and Fisheries. The dioxin action plan focused broadly on dioxin, and aimed at dioxin in animal feed as well as foodstuffs as sources of dioxin pollution of the environment in general. The results of the action plan were presented by the three ministries in their report from 2005. Further, the results of the action plan are included in the relevant sections of the description of the country baseline, see chapter 2 of the national implementation plan.

2 Convention commitments

The parties to the Convention undertake to take steps to reduce – and if possible eliminate - releases from unintentional production of the substance groups polychlorinated dibenzo-p-dioxins and dibenzofurans (here referred to as dioxins), PCB and HCB. The specific requirements for a reduction of releases of dioxin are found in Article 5 and Annex C of the Stockholm Convention. In relation to the commitments, Annex C of the Convention contains two lists of source categories; Parts II and III respectively. The two lists are reproduced in table 1 below.

Part II source categories are indicated to have a potential for comparatively high production and release to the environment of unintentional POPs. The commitments in relation to these categories are more stringent than for source categories in Part III.

In the following review of the sources, the sources will be described in accordance with this categorisation.

Table 1
Source categories according to Annex C of the Stockholm Convention

Annex C, Part II	Annex C, Part III
a) Waste incinerators, including co-incinerators of household, hazardous or medical waste or of sewage sludge.	a) Open burning of waste, including burning of landfill sites.
b) Cement kilns firing hazardous waste.	b) Thermal processes in the metallurgical industry not mentioned in Part II.
c) Production of pulp using elemental chlorine or chemicals generating elemental chlorine for bleaching.	c) Residential combustion sources.
d) The following thermal processes in the metallurgical industry: i) Secondary copper production ii) Sinter plants in the iron and steel industry iii) Secondary aluminium production iv) Secondary zinc production.	d) Fossil fuel-fired utility and industrial boilers. e) Firing installations for wood and other biomass fuels. f) Specific chemical production processes releasing unintentionally formed persistent organic pollutants, especially production of chlorophenols and chloranil. g) Crematoria. h) Motor vehicles, particularly those burning leaded gasoline. i) Destruction of animal carcasses. j) Textile and leather dyeing (with chloranil) and finishing (with alkaline extraction)). k) Shredder plants for the treatment of end of life vehicles. l) Smouldering of copper cables. m) Waste oil refineries.

The Convention commitments are summarised below. Please refer to the Convention text, primarily article 5 b) – g), for the precise formulation.

The parties must:

- Promote the application of measures that can expeditiously give a realistic and meaningful level of release reduction or source elimination;

- Promote the development and require the use of substitute or modified materials, products and processes to prevent production and release;

- Promote and require the use of best available techniques (BAT) and the best environmental practices (BEP); initially with special emphasis on new sources and source categories identified in Part II of Annex C;

- Possibly set release limit values or performance standards in order to fulfil commitments for the use of BAT;

- Promote the development 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 Evaluation of current releases

3.1 Evaluation of current releases of dioxin

The trend in releases of dioxin into the air from 1995 to 2000-2002 is shown in table 2. A comparison is complicated by the fact that the inventory from 1995 does not contain information about a number of sources and that the estimation methods in the two inventories are different. Therefore, an inventory with comparable figures is under preparation.

The inventory for 2000-2002 (in table 2) contains an attempt at an estimate of releases for all sources, even the sources for which there are no reliable measurements. As can be seen from the table, there are very wide uncertainty intervals for many of the source categories. This is because releases may vary substantially, even from the same source, and because it requires a very large number of measurements to determine total releases with great certainty. In addition, for some source categories, there are only very limited data available, both in Denmark and in other countries. For example, this applies to releases from accidental and intentional fires, which may potentially be significant sources.

The inventory of the emissions of dioxin which is currently under preparation points towards total emissions of dioxin around 20 – 25 g for 2004.

Table 2
Releases of dioxin into the air, analysed by source categories, in 1995 and 2000-2002 [18].* See note.

Activity	Release (g I-TEQ/yr)	
	1995	2000-2002
Industrial processes		
Chemicals production	not determined	0.001 - 0.007
Secondary steel production	7.5	0.1 - 2.4
Secondary aluminium production	not determined	<0.001 - 0.79
Other metallurgical industry	not determined	0.02 - 0.5
Production of cement and quicklime	0.08 - 1.5	0.2 - 1.4
Other industrial production	0.1	0.04 - 0.1
Energy transfer		
Burning of coal	2	0.1 - 3.2
Burning of other fossil fuels	0.02	0.4 - 1.3
Wood-burning stoves	1.1	0.4 - 22
Combustion of biomass in other small plants	} 0.07 - 6.6	0.3 - 15
Combustion of biomass in larger plants		0.03 - 4.4
Use of products		
PCP-treated wood	not determined	0.5 - 26
Other PCP-treated materials	not determined	<0.05
Miscellaneous activities		
Accidental fires	not determined	0.5 - 20
Intentional fires	not determined	0.03 - 6.5
Traffic	0.2	1.3 - 1.7
Crematoria	0.16	0.01 - 0.1
Other activities	not determined	0.1 - 0.2
Treatment and disposal of waste		
Recovery of cable waste	0.13	0.03 - 0.2
Car-breakers	not determined	<0.001 - 0.079
Incineration of waste oil	0.03	<0.001 - 0.17
Incineration of hazardous waste	0.23	0.004 - 0.03
Incineration of municipal waste	25	6.4 - 29
Incineration of medical waste	5	<0.001 - 0.35
Incineration of sewage sludge	0.072	0.002
Landfill fires	not determined	0.25 - 10
Total	38 - 45	11 - 163

*Please note that the figures are being revised. New figures for 1990 and 2004 will be available before the end of 2006.

Releases of dioxin into water and soil, analysed by source categories, are shown in table 3. A question mark next to a source category indicates that the

[18] Source: Based on Hansen et al. 2003. *Substance Flow Analysis for Dioxin 2002*. Environmental Project no. 811. Danish EPA, Copenhagen.

releases may be significant, but that there is no basis for estimating the volume.

The most significant source of discharges to the aquatic environment is discharges from wastewater treatment plants and storm water discharges. Discharges into wastewater, which is subsequently treated in wastewater treatment plants, are not listed in the table. The most important sources of dioxin in wastewater, and thus sources of discharges from wastewater treatment plants, are estimated to be PCP-treated materials (0.2 g I-TEQ/yr), chlorine bleaching (<0.5 g I-TEQ/yr) and, not least, atmospheric deposition (0.4-4 g I-TEQ/yr).

Table 3
Releases of dioxin into the air and soil, analysed by source categories in 2000-2002 (same source as previous table).

Activity	Release (g I-TEQ/yr)	
	Water	Soil
Industrial processes		
Chemicals production	<0.001	<1
Secondary steel production		
Secondary aluminium production		
Other metallurgical industry		?
Production of cement and quicklime	?	
Other industrial production	<o.o1	?
Energy transfer		
Wood-burning stoves		<0.001 - 2.2
Combustion of biomass in other small plants		<0.001 - 0.09
Use of products		
Animal feed (manure)	?	<10
Miscellaneous activities		
Accidental fires		?
Intentional fires		0.o1 - 27.5
Cremation		?
Other activities	?	?
Treatment and disposal of waste		
Incineration of hazardous waste	<0.001	
Wastewater and storm water discharges	o.4 - 1.4	
Sewage sludge		0.7 - 1.3
Other activities		0.01 - 0.1
Total	0.4 - 1.4 (+?)	0.7 - 42 (+?)

3.1.1 Annex C, Part II source categories

a) Waste incineration plants

On the basis of the Danish EPA's first measuring programme for dioxin in flue gas from incineration plants in 1986-1989, the average release from the plants was estimated at 19.5 µg N-TEQ per tonne waste, and the total

releases were calculated at 34 g N-TEQ per year (N-TEQ is an older unit, corresponding largely to I-TEQ). Since then, volumes of incinerated waste have increased significantly, but at the same time, better flue gas purification has been installed. As can be seen from table 2, total releases from incineration of municipal waste and medical waste in 1995 were estimated at 30 g I-TEQ.

In 2000-2002, total releases were calculated at 6.4 - 29 g I-TEQ/yr, of which the main part came from plants that did not already have dioxin removal equipment.

There are currently around 30 incineration plants in Denmark, and in 2004, they incinerated a total of 3.4 million tonnes of waste. From 28 December 2005, all plants have been required to stay within a limit value of 0.1 ng I-TEQ per Nm^3 flue gas, corresponding to releases of about 0.65 µg I-TEQ per tonne of waste. Total releases can be calculated at a maximum of 2.2 g I-TEQ/yr if all plants stay within the limit value. Releases per tonne of waste have thus fallen to about 1/40 of the level at the end of the 1980s. These high levels of cleaning have been achieved by developing and applying filters to clean the flue gas, so that the dioxin created forms a bond to activated carbon, which is retained during the flue gas purification process.

b) Cement kilns firing hazardous waste
There is one cement factory in Denmark. The enterprise generally does not incinerate hazardous waste, but is licensed to incinerate oily sludges from cleaning up waste oil. Oily sludges only constitute a very modest part of the energy raw materials in the production of cement. The total release of dioxin from the production of 2.6 million tonnes of cement is estimated at 0.2 – 1.4 g I-TEQ/yr.

c) Production of pulp using chlorine or chemicals generating elemental chlorine for bleaching
Chlorine is not used for production of pulp in Denmark.

d) The following thermal processes in the metallurgical industry: i) secondary copper production; ii) sinter plants in the iron or steel industry; iv) secondary zinc production
These source types are not found in Denmark.

d, iii) Production of secondary aluminium
One enterprise carries out production of secondary aluminium from aluminium scrap. Measurements at the enterprise commenced at the beginning of 2000 showed very high releases of dioxin, and the enterprise has subsequently taken special measures to limit dioxin. In the most recent inventory, total releases have been calculated at <0.001 – 0.79 I-TEQ/yr, cf. table 2.

3.1.2 Annex C, Part III source categories

If nothing else is mentioned, the releases mentioned below are into the air.

a) Open burning of waste
According to the Statutory Order on Waste, burning of waste is only permitted in plants approved for the purpose. Approved plants are not necessarily waste incineration plants, but may be e.g. district heating plants

that have achieved environmental approval to use specified waste types as fuel. Municipal councils are authorised to lay down regulations permitting burning of garden waste and certain similar types of waste.

Burning of painted or pressure-impregnated wood is regarded as waste incineration. Open burning of this type waste is thus prohibited. According to the mass-flow analysis, there may be a certain amount of waste wood in intentional fires, which has a significant influence on the generation of dioxin. Due to uncertainties as to emission factors as well as wood composition, the emissions in the most recent mass-flow analysis have been determined at 0.03-6.5 g I-TEQ/yr with a very large uncertainty factor. Thus, it is currently not possible to say whether intentional fires contribute significantly to total releases.

b) Thermal processes in the metallurgical industry not mentioned in Part II

Other thermal processes in the metallurgical industry comprise iron and metal foundries as well as hot-dip galvanising. Total dioxin releases from these processes have been calculated at 0.02-0.5 g I-TEQ/yr.

Production of secondary steel from scrap was previously an important source, but from April 2006, remelting of steel scrap is no longer being carried out in Denmark, because Dansteel A/S (formerly Danish Steel Works) now merely processes steel slabs imported from Russia.

c) Residential combustion sources

Wood-burning stoves contribute significantly to total dioxin releases. Total releases from wood-burning stoves in Denmark were calculated at 0.4-22 g I-TEQ/yr in 2000-2002. On the basis of further measurements, the uncertainty in the calculation has become less significant, and total emissions were most recently calculated at 2-4 g I-TEQ/yr.

The extent to which waste, including painted or treated wood, is burned in wood-burning stoves and wood furnaces in individual households is uncertain. This contributes to uncertainty as to the total releases from households. Burning of painted and impregnated wood in wood-burning stoves and furnaces is prohibited, as mentioned above, but probably takes place to a certain extent.

Since the first studies of dioxin releases from wood-burning stoves in 1990, a large number of studies have been carried out to understand the mechanisms behind generation of dioxin in wood-burning stoves and how this dioxin generation can be reduced. It is clear that burning of waste in wood-burning stoves increases dioxin generation. Therefore, the Danish EPA has carried out several campaigns to inform the general public of the problems of burning waste in wood-burning stoves.

Measurements have shown a clear connection between dioxin generation and the size of the installation. Burning of straw and wood in larger boilers generates very low dioxin emissions, while burning in smaller installations such as farm installations, small wood pellet boilers and wood-burning stoves generates emissions that are up to several hundred times larger. Dioxin concentrations in the flue gas from wood-burning stoves and smaller farm installations are typically around ten times the limit value of 0.1 ng I-TEQ/m^3, which applies to incineration plants and industrial installations.

In connection with measurements of emissions from wood-burning stoves in a small village (Gundsømagle), we see a possible connection between the size of emissions and the type of chimney. Thus, emissions seem to be smaller from houses with steel chimneys. Currently, studies are being carried out to find out whether this is a general phenomenon and which mechanism lies behind it.

In the most recent study of emissions from wood-burning stoves, where simultaneous measurements have been made of particles, PAH and dioxin, no connection was found between emissions of dioxin and particles or between emissions of dioxin and PAH. There is a clear tendency towards newer wood-burning stoves having lower dioxin emissions; emissions from older wood-burning stoves vary from 5.1-17.7 ng I-TEQ/kg wood, while emissions from newer wood-burning stoves (< 3 years) lie at 0.2-3 ng I-TEQ/kg wood.

The concentration of dioxin in flue gas from wood-burning stoves and farm installations for burning straw generally lies above the concentrations seen in flue gas from incineration plants and industrial installations.

d) Fossil fuel-fired utility and industrial boilers

Total emissions from coal-fired power plants and other energy generation based on fossil fuels are calculated at 0.5-4.5 g I-TEQ/yr. Emissions from Danish coal-fired power plants were estimated with very large uncertainty in the most recent mass-flow analysis, but in any case, total emissions are relatively small, and the concentrations in flue gas are many times lower than the 0.1 ng I-TEQ/m^3 that apply for incineration plants and industrial installations. Emissions from burning coal in industrial boilers have not been studied to the same extent, but emissions per tonne of coal are estimated to be higher than from coal-fired power plants.

e) Firing installations for wood and other biomass fuels

In Denmark, there are many small installations for burning wood chips, wood pellets, wood waste and straw. The installations are very different and so is the degree of releases of dioxin. Generally, small farm installations without flue gas purification have much higher emissions than for example combined heat and power plants with full flue gas purification. Total emissions from burning of biomass, excluding wood-burning stoves have been calculated at 0.3-19.4 g I-TEQ/yr in the mass-flow analysis, and the small installations represent the overall majority.

f) Specific chemical production processes releasing unintentionally formed POPs

This source type does not exist in Denmark.

g) Crematoria

Measurements from Danish crematoria show relatively low dioxin emissions, and total dioxin emissions have been calculated at 0.01-0.1 g I-TEQ/yr.

h) Motor vehicles, particularly those burning leaded gasoline

For many years, the use of leaded gasoline in motor vehicles has been banned in Denmark. Total emissions from motor vehicles have been calculated at <0.2 g I-TEQ/yr, while total emissions from other transport processes have been calculated at 1.3-1.5 g I-TEQ/yr which is mainly attributable to shipping and train transport.

i) Destruction of animal carcasses

Destruction of animal carcasses through incineration only takes place to a limited extent in Denmark and mainly constitutes animal carcasses from veterinary practices and residue from the normal destruction method. In the mass-flow analysis, emissions from treatment of animal carcasses are assessed to be marginal.

j) Textile and leather dyeing (with chlorine) and finishing (with alkaline extraction)

In Denmark, there is no ban against the use of chloranil, but the substance is classified as carcinogenic, toxic and environmentally dangerous. The Product Register for chemicals has recently been updated, and it shows that there is currently no registered use of chloranil in Denmark.

k) Shredder plants for the treatment of end-of-life vehicles

In the most recent mass-flow analysis, dioxin emissions from car breakers in Denmark are assessed to be marginal. Since PCB-containing capacitors have not been used for the last 20 years, not many of the white goods scrapped today will contain these capacitors. According to the WEEE Order, PCB-containing capacitors must be removed before the equipment is treated further.

l) Smouldering of copper cables

Thermal smouldering of certain types of cables containing oil was previously carried out by a single enterprise. One measurement referred to in the most recent mass-flow analysis is below the limit value of 0.1 ng I-TEQ/Nm^3 in the Guidelines for industrial air pollution control, and total emissions in 2000 were estimated at <0.00002 g I-TEQ/yr. Subsequently, the enterprise has stopped its thermal treatment of cables, which are now exported for treatment abroad.

Private burning of cables is prohibited, and is not assessed to take place to any noticeable extent.

m) Waste oil refineries

Refining of waste oil is carried out at one enterprise in Denmark. Discharges from this process are, however, assessed to be marginal in relation to discharges from burning waste oil, and in recent years, measurements have been taken for dioxin emissions from a number of installations that burn either unrefined or re-refined waste oil. The most recent mass-flow analysis estimates dioxin emissions from burning of waste oil in Denmark at <0.17 g I-TEQ/yr.

3.1.3 Other source types not mentioned in Annex C of the Convention

Other industrial high-temperature processes

In recent years, measurements have been made in Denmark for a number of other high-temperature processes such as production of tiles, lime burning and production of insulation materials. Analyses confirm that these processes only contribute modestly to total emissions. Total emissions from other industrial high-temperature processes have been calculated at 0.04 – 0.1 g I-TEQ/yr.

Fires

Among the remaining dioxin sources, accidental and intentional fires may be significant sources, but it is, however, very difficult to determine their extent.

In order to be better able to assess the risk of dioxin pollution from fires, the Danish EPA published a manual on the assessment of spreading of dioxin and other environmentally harmful substances from uncontrolled fires (”Håndbog om vurdering af spredning af dioxin og andre miljøskadelige stoffer fra ukontrollerede brande”) in 2004.

Studies of dioxin contents in soil and fallen soot around fire sites have shown slightly increased values of dioxin, but it has not been possible to determine the amount of dioxin generated from the incidents on the basis of the studies. Studies of dioxin in the proximity of large fires, where large amounts of PVC have been burned, show that substances emitted from a fire spread over a large area and will only very rarely lead to pollution of the surrounding areas to an extent that can affect the health of the local population. Releases from fires can primarily be reduced by limiting the use of substances and materials that are particularly prone to developing dioxin. Bans against the use of substances like PCB and PCP have thus largely been intended to limit the risk of generation of dioxin in fires. A general reduction in the use of materials containing chlorine, including PVC, is also expected to lead to a reduction in the generation of dioxin from fires.

Total emissions from fires have been calculated at 0.5-20 g I-TEQ/yr, which indicates that fires, despite uncertainties, should be regarded as a significant source of releases of dioxin into the air.

Dioxin in wood treated with pentachlorophenol (PCP)
In Denmark, pentachlorophenol contaminated with small amounts of dioxin was used for impregnation of wood in the period 1950-1978. Some of this wood is still in use. Moreover, PCP may still be in disposable pallets from southern Europe. When the treated wood is used, part of the dioxin may be released into the air. A recent study by the Danish EPA showed that wood treated with PCP still contains dioxin, and that disposable pallets from southern Europe contain PCP, albeit in concentrations below the 5 mg/kg set in the "bekendtgørelse nr. 420 af 21. april 1996 om begrænsning af salg og anvendelse af pentachlorphenol" (statutory order no. 420 of 21 April 1996 on limiting the sale and use of pentachlorophenol). On the basis of these studies, total releases of dioxin into the air have been estimated at 0.03-5 g I-TEQ/yr, i.e. releases from PCP-treated wood may be significant, but it is doubtful.

3.2 Release of unintentionally formed HCB and PCB

As mentioned in the introduction, there is no inventory of releases of unintentionally formed PCB and HCB into soil, air or water for Denmark. Industrial processes known to be particularly prone to forming HCB do not occur in Denmark.

The source categories are assumed the same as for dioxin. Measures to reduce releases of dioxin are therefore also expected to reduce releases of the other substances.

On the basis of the results from an EU study that is expected to be completed in mid-2006, a study will be made to evaluate if there are hitherto overlooked sources in Denmark that may form unintentional POPs, focusing on HCB and PCB. The study will cover emissions to air, water and soil. If this appears to be the case, an estimation will be attempted, taking into account the need

for comparable data In the EU and internationally. Also, it will be considered whether there is a need for further measures.

3.3 Maintenance of release inventories

In Article 5, the parties undertake to develop and maintain source inventories and release estimates.

This obligation was implemented via Article 6(1) of the POP Regulation, which directs Denmark and the other EU Member States to develop and update inventories of releases of dioxin, furan, PCB, HCB and PAH into air, water and soil respectively.

The Danish EPER register, which is managed by the Danish EPA, will be extended due to the implementation of the PRTR Protocol. The register contains information on releases into the air and water from point sources and will also, in time, contain information on releases to soil as well as information on diffuse sources. However, this information is not expected to be sufficiently complete in the near future to allow overall inventories of releases of POPs from Danish sources to be drawn from the register.

NERI prepares annual inventories of dioxin releases into the air, which are reported to UNECE and the European Environment Agency. Inventories of releases into soil and water have been made in connection with mass flow analyses. So far, no inventories have been made for releases of HCB and PCB.

4 Evaluation of the effectiveness of existing legislation and policies

A number of instruments in EU legislation and Danish environmental protection legislation help bring down releases of POPs formed unintentionally.

The following section evaluates the existing legislation and strategies for each source category in relation to the Stockholm Convention commitments.

The main strategies in the Convention to reduce releases of unintentionally formed POPs are the requirements to use best available techniques (BAT) and best environmental practices (BEP) as well as the requirement to promote the development and, where it is deemed appropriate, require the use of substitute or modified materials, products and processes.

In Denmark, the main initiatives giving rise to significant reductions in releases of dioxin have been:

- Establishment of systems to remove specifically dioxin from flue gases at incineration plants and industrial installations with high emissions of dioxin;
- Establishment of improved flue-gas cleaning systems at large installations for combustion of fossil fuels and biofuels (not specifically aimed at dioxin);
- The ban on using PCPs;
- The ban on private burning of waste;
- The strategy to limit burning of PVC at incineration plants.

Requirement to use BAT for large sources

The Danish Environmental Protection Act is based on the fundamental principle that overall pollution of the surroundings should be prevented or limited as much as possible. On this basis, the Environmental Protection Act, in accordance with the principles in the Stockholm Convention, requires individual enterprises to use BAT, so that overall pollution is minimised. In order to assess what actually is the best available techniques, priority should be primarily on preventing pollution by using cleaner technology. In addition to this, unavoidable pollution should be limited as far as possible using pollution mitigation measures, including best possible decontamination/remediation.

The Guidelines for industrial air pollution control, which are applied in the administration of the Environmental Protection Act, contain a description of how air pollution from enterprises is to be regulated. The Guidelines stipulate that emissions should be limited in order to reduce releases of dioxin if the annual mass flow of dioxin is greater than 0.01 g I-TEQ, and that releases of dioxin should be minimised. According to the Guidelines, the limit value for

emissions should be set at 0.1 ng I-TEQ/Nm^3. However, for technical or financial reasons, it may be necessary to accept a limit value of 0.2 ng I-TEQ/Nm^3 for some types of enterprise. The Guidelines also set a limit value for emissions of PCB at 0.0001 mg/Nm^3, but no limits have been set for HCB.

The Danish EPA reference laboratory for measurement of emissions into the air has prepared a report (in Danish) "Måling af dioxinemissionen fra industrielle anlæg" (measurement of dioxin emissions from industrial installations). The report is helping the supervisory authorities assess and determine whether and how measurements of dioxin emissions at industrial installations are to be carried out, and it is helping them establish a framework so that control measurements are conducted correctly and the results are correctly assessed.

For the majority of the industrial processes in Denmark, the requirements on use of BAT will result in dioxin emissions below the recommended limit value in the Guidelines. At many types of source, for example power stations, releases of POPs are limited as a result of flue gas purification, the primary objective of which has been to reduce emissions of particles and acidic flue gases.

The requirement to use BAT is a core element in the IPPC Directive, which covers the largest stationary sources of POPs formed unintentionally. The IPPC Directive has been implemented in Denmark via the Danish Environmental Protection Act and the Statutory Order on Approval of Listed Activities. In association with the IPPC Directive, EU-level work is being conducted on BREF notes, which describe the techniques considered as BAT. These notes are part of the foundation for supervision authorities' administration of the Environmental Protection Act.

The techniques considered as BAT will change over time as a result of technological development, and the Danish EPA is continuously assessing whether the specific requirements placed on heavily polluting enterprises are in line with developments in BAT.

The Environmental Protection Act and the statutory orders issued pursuant to the Act (e.g. Statutory Order on Approval of Listed Activities (the Approval Order)) form the legislative foundation for meeting the obligations in the Stockholm Convention commitments for large stationary sources. Preparation of guidelines for the supervisory authorities ensures that they have the required knowledge to implement the provisions effectively.

Diffuse sources

With regard to diffuse sources, the most important instrument is the Statutory Order on Waste. The requirements in the Statutory Order on waste collection systems and that waste should be collected and treated at approved installations, prevent almost all uncontrolled burning and the resulting releases. The Statutory Order also stipulates that waste may only be incinerated at approved installations.

The existing legislation and the associated strategies for limiting releases of unintentionally formed POPs are summarised in table 4.

Table 4
Existing legislation and strategies for limiting releases of unintentionally formed POPs

Instrument	Source category affected by the instrument (with description of the source category according to annex C of the Convention)	Strategy for limiting releases
Annex C, part 2 source categories		
Statutory Order on installations which incinerate waste, no. 162 of 11 March 2003	a) Waste incineration plant	Stipulation of limit value for releases of dioxin of 0.1 ng I-TEQ/Nm^3
Statutory Order on Waste, no. 619 of 27 June 2000	a) Waste incineration plant	Limits on additions of PVC to incineration plants
Government Waste Strategy 2005-2008	a) Waste incineration plant	Limits on waste amounts
Environmental Protection Act, no. 753 of 25 August 2001 Air Guidelines, 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 emissions for dioxin of 0.1 ng I-TEQ/Nm^3
Statutory Order on Waste, no. 619 of 27 June 2000	b) Cement kilns firing hazardous waste	Requirement that waste oil with >50 ppm PCB must not be used as fuel
Annex C, part 3 source categories		
Environmental Protection Act, no. 753 of 25 August 2001 Air Guidelines, no. 12415 of 1 January 2001	b) Thermal processes in the metallurgical industry not mentioned in Part II d) Fossil fuel-fired utility and industrial boilers e) Large firing installations for wood and other biomass fuels g) Crematoria (i) Destruction of animal carcasses; (l) Smouldering of copper cables;	Requirement to use best available techniques" (BAT) with recommended limit value for emissions for dioxin of 0.1 ng I-TEQ/Nm^3
Statutory Order on Waste, no. 619 of 27 June 2000	a) Open burning of waste c) Residential combustion sources; (i) Destruction of animal carcasses; (l) Smouldering of copper cables;	Ban on burning waste at non-approved installation Implementation of effective waste collection schemes
Statutory Order on Waste, no. 619 of 27 June 2000	m) Waste oil refineries. d) Fossil fuel-fired utility and industrial boilers;	Requirement that waste oil with >50 ppm PCB may not be used as fuel; waste oil with >10 ppm PCB, must be exposed to a temperature of more than 1200° C for at least 2 seconds under incineration
PCB/PCT Statutory Order, no. 925 of 13 December 1998	m) Waste oil refineries. d) Fossil fuel-fired utility and industrial boilers;	Ban on use of PCB/PCT
The WEEE Order, no. 664 of 27 June 2005	k) Shredder plants for the treatment of end of life vehicles;	Requirement to remove capacitors containing PCB before dismantling electrical and electronic equipment
Bekendtgørelse nr. 807 af 2. december 1986 om begrænsning af motorbenzins indhold af blyforbindelser og benzen ("Statutory Order on restricting the quantities of lead compounds and benzene in gasoline," Danish-language only)	h) Motor vehicles, particularly those burning leaded gasoline;	Ban on use of leaded gasoline in motor vehicles
PCP Statutory Order, no. 480 of 19 June 2002	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 products and dioxin in PCP
Statutory Order on Landfills, no. 650 of 29 June 2001	a) Open burning of waste (landfills)	Requirement for measures to eliminate risks of fire or explosion in stored waste

4.1 Evaluation of existing legislation and policies in relation to individual source categories

4.1.1 Annex C, part II

a) Incineration plants

The Statutory Order on incineration plants sets a limit value for emissions of dioxin from incineration plants of 0.1 ng I-TEQ/ Nm^3. The limit value has applied to new installations since 24 March 2003. The limit value has applied since 28 December 2005 for existing installations. The limit value corresponds to emissions of about 0.65 µg I-TEQ per kg waste for incineration of domestic waste. If all installations comply with the limit value, the total emissions will be a maximum of 2.2 g I-Teq/yr, corresponding to about 7 per cent of the total emissions from incineration plants in 1990.

The existing limit value is deemed to correspond to the currently attainable value using best available techniques (BAT) and therefore it meets the requirements of article 5 of the Stockholm Convention regarding use of BAT for new sources within annex C, part 2 categories of sources, when applying article 5(g) of the Convention on use of limit values.

In order to ensure that incineration plants comply with the limit values, they make regular control measurements. The inspection authorities as well as the Danish EPA will regularly assess the need for tighter supervision and control.

Over the past decade, waste arisings discarded through incineration have risen from 2.2 million tonnes to 3.4 million tonnes; a trend which, if it continues, could also result in increasing amounts of dioxin emissions. The increase in the amount of waste is particularly a result of increased economic activity in society. Decoupling the growth in waste from economic growth is therefore one of the three fundamental principles in the Government's waste policy for 2005-2008.

All waste suitable for incineration in Denmark must be incinerated at incineration plants with energy recovery. This practice minimises the risk of dioxin being formed by unintentional fires at waste sites. However, there is a ban on burning impregnated wood at waste incineration plants, except for wood treated with creosote. This is primarily to avoid additions of heavy metals to incineration plants.

Most of the dioxin formed in incineration processes ends in waste products. The composition of the input waste has a significant impact on the volume and quality of residues. As a result of the previous waste plan, Waste 21, requirements have been introduced stipulating that a number of waste fractions containing environmental contaminants must, as far as possible, be prevented from reaching waste incineration plants. Examples of these fractions include impregnated wood, electronic equipment, and PVC. Reduction of the production of POPs has not been the main reason for separating these waste fractions, but a side benefit will probably be reduction of unintentional production of dioxin and other POPs in the incineration process.

The Danish EPA will regularly assess the effectiveness of the various measures in order to ensure that, as far as possible, waste fractions containing environmental contaminants do not end in incineration plants.

b) Cement kilns firing hazardous waste
Emissions from the only Danish cement factory are estimated at 0.2-1.4 g I-Teq/yr, based on measurements which show concentrations in flue gas varying between <0.0006 and 0.15 ng I-TEQ/Nm^3. Oil sludge constitutes a very small fraction of the energy raw material for cement production, and it is not considered a significant source of chlorine. It is deemed that the flue-gas cleaning technology applied corresponds to BAT, and there are no plans to place requirements for specific dioxin cleaning.

d, iii) Secondary aluminium production
Three measurements in 2000 of dioxin emissions from the only Danish company manufacturing secondary aluminium showed concentrations in flue gas of 183, 113 and 14 ng I-TEQ/Nm^3 respectively. A concentration of 183 ng I-TEQ/Nm^3 corresponds to annual releases of about 60 g I-Teq/yr. In 2001 the company was therefore ordered to reduce the releases and has subsequently established dioxin cleaning equipment using activated carbon.

In the most recent inventory from 2000-2002, total releases were calculated at <0.001-0.79 I-TEQ/yr. The most recent measurements are in accordance with the recommended limit value in the Guidelines for industrial air pollution control of 0.1 ng I-TEQ/Nm^3, and the total releases will be 0.03 g I-Teq/yr. The requirements of the Environmental Protection Act have thus been an effective instrument in reducing dioxin releases.

At EU level an assessment is being carried out of the possibilities of setting limit values for releases of POPs from metallurgical processes, and Denmark is awaiting the results of this work.

4.1.2 Annex C, part III

a) Open burning of waste
According to the Statutory Order on Waste, burning waste is only permitted in approved plants. Open burning of waste and burning waste in stoves and boilers is banned under all circumstances. Burning painted or impregnated wood is also considered waste incineration.

Burning painted and impregnated wood in stoves and boilers does seem to happen to a not inconsiderable extent, despite the ban, but no studies of the scope of the problem have been made. There are well-developed waste schemes throughout Denmark, and with the existing schemes there is no general financial incentive for private citizens to burn waste, except for using the calorific value of the waste. Private burning is probably more attributable to some people considering this method of disposal as the easiest for some types of waste.

Over the past five years, a number of campaigns have been completed to urge people to stop burning painted wood and other waste, including in private stoves.

The Danish EPA considers that there is still a need to tell the public not to burn waste and is planning to continue the use of the campaign materials.

b) Thermic processes in the metallurgical industry not mentioned in part 2
The requirements in the Environmental Protection Act that individual enterprises use best available techniques (BAT) is deemed effective in reducing releases from other thermal processes in the metallurgical industry.

As stated in table 2, releases from manufacturing secondary steel amounted to 7.5 g I-Teq/yr in 1995. The enterprise has subsequently stopped production from smelting scrap steel, and this was the only part of the enterprise's activities causing releases of dioxin.

c) Residential combustion sources

As mentioned above, a number of studies have demonstrated that dioxin releases from stoves and farm installations which burn straw can be considerable, and they are related to the size of the installation.

There are no requirements at present for flue gas purification from stoves, but a labelling system has been introduced for new stoves, which is intended to promote the use of clean-burning stoves with high energy efficiency.

In recent years the Danish EPA has conducted a number of studies in order to achieve a better understanding of the mechanisms around production of dioxin in stoves and boilers in order to prescribe methods which can reduce production and releases of dioxin.

As mentioned earlier, recent studies indicate that modern stoves lead to less dioxin production than old stoves, and that the type of chimney may have an effect. A follow-up study of dioxin pollution from stoves is underway.

Total emissions could be reduced with a ban on burning biomass in small installations without flue gas purification, but such an initiative could have undesirable effects in the context of the goals to reduce total CO_2 emissions, and it would be hard to enforce. The area will be closely monitored and there will be regular considerations of what can be done as better knowledge comes to light.

d) Fossil-fuel-fired utility and industrial boilers

The most recent mass-flow analysis estimates emissions from Danish coal-fired power plants with great uncertainty, but at all events total emissions are relatively small. The concentrations in flue gas are many times lower than the 0.1 ng I-TEQ/Nm^3 applying to incineration plants and industrial installations. The emissions from burning coal in industrial boilers have not been studied to the same extent and are thought to be higher than from coal-fired power plants, although still less than the 0.1 ng I-TEQ/Nm^3. Limiting atmospheric pollution from coal-fired power plants has primarily been based on a desire to reduce emissions of dust and sulphur and nitrogen compounds, while limiting dioxin emissions has been a welcome side effect. Danish coal-fired installations are considered to meet BAT with regard to dioxin emission, and there are no plans for further initiatives to limit dioxin releases from this type of source.

e) Installations burning wood and other biomass fuels

In Denmark there are a number of small installations burning wood chips, wood pellets, wood residues and straw. There are great differences between the installations and the degree of dioxin emissions. Large installations, for example district heating plants, are regulated by the Environmental Protection Act and equipped with well developed flue-gas cleaning systems. These live up to the BAT requirement.

The problem is primarily the small farm installations without flue gas purification, which have far higher emissions than for example combined heat and power stations. The total releases from burning biomass, of which the

small installations account for the majority, are considered to comprise a considerable proportion of Denmark's total releases of dioxin.

As for private sources, the area will be monitored closely and there will be regular considerations of what can be done as better knowledge comes to light.

f) Crematoria

As mentioned above, measurements from Danish crematoria show relatively low dioxin emissions, with dioxin emissions below the recommended limit value in the Guidelines. The low emissions are attributable to good incineration at high temperatures, as required in the Danish EPA environmental guidelines "Begrænsning af forurening fra forbrændingsanlæg. Vejledning nr. 60.273 af 01/01/1993 ("Limitation of pollution by incinerator plant. Guideline No. 60.273, of 1st January, 1993"). The Danish EPA is preparing a sector annex for crematoria, to be finished in mid-2006, in which there will be requirements that crematoria take measures to limit emissions of mercury. The measures aimed at reducing mercury will also reduce releases of unintentionally formed POPs as a positive side effect, as has been documented in measurements at two Danish crematoria. There are no plans for further requirements to limit dioxin releases from crematoria.

g) Motor vehicles, particularly those burning leaded gasoline

For many years, the use of leaded gasoline in motor vehicles has been banned in Denmark, except for a modest use by propeller aircraft, where bromine-containing additives are also used. The Danish EPA is currently considering whether there are possibilities for further reductions in the use of leaded gasoline for this purpose.

Much work is going on to reduce particle pollution from diesel motors, and a side effect of this will probably be reductions in dioxin emissions from diesel-powered motor vehicles.

The Danish EPA does not consider that there is a need to take further steps to reduce releases of dioxin from transport processes.

h) Shredder plants for the treatment of end-of-life vehicles

The requirement to remove capacitors containing PCB from white goods and other electronic equipment before dismantling means that a significant source of production of dioxin in the process has been removed. Today, Danish car-breaking installations are also fitted with equipment to decontaminate exhaust air from the installation. The Danish EPA has no plans for further initiatives to limit dioxin releases from this source.

Not mentioned in the annexes to the Convention

Accidental fires

There remains great uncertainty as to the extent fires add to the total releases of dioxin in Denmark. Formation of dioxin requires the presence of chlorine, but it is still uncertain how much building materials and fittings containing chlorine, e.g. in PVC, increase the amount of dioxin formed in fires.

Dioxin in wood treated with pentachlorophenol (PCP)

The size of releases from wood treated with pentachlorophenol is uncertain. As mentioned above, pentachlorophenol seems mainly to appear in disposable pallets from southern Europe.

5 Strategies to meet the obligations of the Convention

Large point sources

The assessment is that with existing legislation and strategies for large point sources, Denmark meets the obligations under the Stockholm Convention for these categories of source.

Today, the challenge for incineration plants is to prevent increasing amounts of waste, in so doing reducing the risk of increasing releases, and the amount of residues which must be deposited.

Further initiatives will therefore involve decoupling the increases in the amounts of waste from economic growth and further efforts to limit additions of PVC to waste incineration plants. PVC leads to the production of large quantities of residues. It is not clear the extent to which less PVC will result in less production of dioxin, but it is likely to be a positive side benefit.

As mentioned above, the new requirements for crematoria on reducing releases of mercury will also result in side benefit of reducing releases of dioxin.

Wood-burning stoves and boilers burning biomass

Once emissions from waste incineration plant and industrial installations have been reduced, it is clear from table 1 that burning biomass potentially represents the largest source of releases of dioxin in Denmark. There is still great uncertainty regarding the size of the total releases.

In addition to releases of dioxin, these sources also make considerable contributions to Denmark's total releases of PAH and particles. There is no immediate simple solution to this problem, which Denmark is likely to share with a large number of other countries burning biomass at smaller installations. Therefore, there is a need to study further how the releases of pollutants from these installations can be reduced.

The Danish EPA will continue examining the mechanisms behind production of dioxin in stoves and small boilers.

The Danish EPA considers that there remains a need to urge the public not to burn waste and about good stove practice, and it plans to continue using the campaign material already developed and available on the Internet.

The new initiatives to meet Denmark's commitments under the Convention are summarised in table 5.

Table 5
New initiatives to reduce releases of unintentionally formed POPs

Sourcecategories	Initiative
ANNEX C, part II	
a) Waste incineration plants	Continuing efforts to de-couple growth in waste from economic growth. Further efforts to limit the amount of PVC in waste incineration
ANNEX C, PART III	
c) Private sources of combustion	Continuations of studies on emissions of dioxin and other pollutants from wood burning stoves and smaller combustion plants with the aim of identifying possible measures to reduce emissions. Continuing use of campaign material to promote the reduction of emissions from wood burning stoves and similar.
g) Cematoria	Requirement for flue gas purification for mercury, which will also limit the emissions of POP substances.
Other initiatives	
Emissions of HCB og PCB	A study will be undertaken to assess whether there are sources for the emissions of unintentionally produced HCB or PCB in Denmark that have been overlooked. If this appears to be the case, an assessment of emissions will be made if possible, and the need for further measures will be considered.

6 Measures to promote knowledge, teaching, education and information

6.1 Promotion of knowledge on sources of production and degradation of dioxin and dioxin-like PCB

In future years, and further to the activities already implemented, the Danish EPA will promote knowledge about sources of production and degradation of dioxin and dioxin-like PCB.

The activities in the study, as mentioned above, will include:

- A study of the degradation of dioxin in the Baltic Sea with a view to determining the extent to which dioxin, which is currently accumulating in fish, arises either from current atmospheric deposition or from remobilisation of dioxin bound to the seabed. The study will elucidate how much of the dioxin in fish is the result of "sins of the past".

- A study of the sources of dioxin in organic agriculture.

- Continued studies of the emissions of dioxin and other pollutants from wood-burning stoves and small boilers and the measures to be initiated to reduce emissions from these sources.

- On the basis of the results of an EU study, expected completed in mid-2006, the extent of overlooked sources in Denmark of unintentionally formed dioxin, PCB and HCB will be assessed. If it appears that there are overlooked sources, an assessment of the emissions will be made to the extent possible, and the need for further measures will be considered.

6.2 Education and information

Authorities and enterprises
In 2003 the Danish EPA issued a report on measurement of dioxin emissions from industrial installations, which helps the supervisory authorities assess and determine whether emissions measurements must be carried out, and it helps place the right requirements so that control measurements are performed correctly and the results are interpreted correctly. The report also acts as information for the enterprises involved.

The public
The public contribute primarily to unintentional production of POPs through burning waste and using problematic burning practices.

The campaign materials already prepared to limit private waste combustion and promote use of proper heating techniques in wood-burning stoves and small boilers are being distributed effectively by the relevant enterprises and organisations.

Teaching at schools

In connection with updating of relevant teaching materials for young people on chemicals, there will be more focus on POPs, and the need for targeted materials will be examined.

7 Update of the action plan

In accordance with the provisions in the Convention, the existing strategies and new initiatives in this action plan shall be evaluated five years after the adoption of this action plan, and every five years thereafter. The results of the evaluations will be included in the reports to be submitted in accordance with article 15 of the Convention.

8 Time Schedule

The action plan will be implemented in accordance with the time schedule below.

Table 6
Time schedule for the action plan

Type of initiative/directed at	Initiative	Timeframe
Incineration Plants	Continuing efforts to de-couple growth in waste from economic growth Further efforts to limit the amount of PVC in waste incineration	Continually Continually
Private sources of combustion. Information.	Continuing use of campaign material to promote the reduction of emissions from wood burning stoves and similar	Continually
Crematoria	Requirement for flue gas purification for mercury, which will also limit the emissions of POP substances	From 2009
Improving knowledge	Continuations of studies on emissions of dioxin and other pollutants from wood burning stoves and smaller combustion plants	From 2006
Improving knowledge	Study on whether there are sources for the emissions of unintentionally produced HCB or PCB that have been overlooked and follow up to the results	2006-2008
Teaching, education and information	Expansion and update of existing relevant teaching material on chemicals, especially directed at adolescents	2006-2008

Annex 2
Members of the monitoring group

The elaboration of the implementation plan has been monitored by a group consisting of the following persons.

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Jacob Hartmann, Greenpeace

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Hans Nielsen, The Ecological Council

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Mette Boye, Women's Council in Denmark

Carsten Lassen, COWI

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Annex 3
Example of information material