Swiss Agency for Development and Cooperation SDC
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International POPs Elimination Project

Fostering Active and Efficient Civil Society Participation in Preparation for Implementation of the Stockholm Convention

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Persistent Organic Pollutants in the Czech Republic - Country Situation Report

What Was Lost on the Way to National Implementation Plan

Arnika Association - Toxics and Waste Programme

Czech Republic
February 2006

About the International POPs Elimination Project

On May 1, 2004, the International POPs Elimination Network (IPEN http://www.ipen.org) began a global NGO project called the International POPs Elimination Project (IPEP) in partnership with the United Nations Industrial Development Organization (UNIDO) and the United Nations Environment Program (UNEP). The Global Environment Facility (GEF) provided core funding for the project.

IPEP has three principal objectives:

- Encourage and enable NGOs in 40 developing and transitional countries to engage in activities that provide concrete and immediate contributions to country efforts in preparing for the implementation of the Stockholm Convention;
- Enhance the skills and knowledge of NGOs to help build their capacity as effective stakeholders in the Convention implementation process;
- Help establish regional and national NGO coordination and capacity in all regions of the world in support of longer term efforts to achieve chemical safety.

IPEP will support the preparation of reports on country situations, hotspots, policy briefs, and regional activities. Three principal types of activities will be supported by IPEP: participation in the National Implementation Plan, training and awareness workshops, and public information and awareness campaigns.

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Persistent Organic Pollutants in the Czech Republic - Country Situation Report

Foreword

A common part of the environment of humans, animals, as well as plants, is a number of hazardous substances endangering their existence, healthy development, or state of health. Many of them are formed in a natural way, but a high proportion of these substances would not be created at all without human activity. They either would not exist, or would not be formed in such amounts. This group includes the majority of substances ranking among persistent organic pollutants.

Persistent organic pollutants (designated by abbreviation as POPs) persist in the environment for decades. They bio accumulate in food chains and endanger human health and the environment by irreversible changes, specifically damaging the human hormonal system. Many POPs are carcinogenic and capable of causing a number of further health problems. Due to their properties, they can travel long distances and accumulate far from the place of their creation, or sources of pollution. Therefore, they became dangerous for the whole planet, and, because of that, it was decided to solve the pollution by these substances on the global level. After efforts lasting several years the Stockholm Convention on Persistent Organic Pollutants was formed in the Swedish capital.

Through its ratification, we have undertaken to eliminate 12 most important persistent organic pollutants or groups thereof. Dioxins, precisely two groups of chemical substances called polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), are formed only as by-products of chemical productions, or in combustion processes (for example, in waste incinerators or in metallurgy). Also hexachlorobenzene (HCB) and polychlorinated biphenyls (PCBs) can be formed similarly, but these substances were also produced intentionally, whereas dioxins were never produced intentionally except in very small amount in laboratories for research purposes.

The so-called toxic twelve includes eight further substances used as pesticides: aldrin, DDT, dieldrin, endrin, heptachlor, chlordane, mirex, and toxaphene. The Convention is looking at the possibility of including further substances. As a result further substances are now among the candidates for the list of substances which are subject to the regime of the Stockholm Convention: pesticides chlordecone and Lindane, and, further, technical substances hexabromobiphenyl, pentabromodiphenylether, and perfluoroctane sulphonane. Similarly as in the case of the first twelve substances, a battle will undoubtedly be fought as to whether these substances should or should not be included to the list by representatives of the industry, representatives of states, intergovernmental organisations and non-governmental organisations representing interests of the public.

It will depend on the practical implementation of the Stockholm Convention as to whether it will cope with toxic substances. It will depend for example, on what limits for contents of dioxins and further substances in wastes will be set, how technologies leading to the formation of further POPs will be phased out and a number of further specific measures. National Implementation Plans (hereinafter NIPs) should help to achieve this. Each of the countries which ratified the Convention must prepare a NIP and adopt it as obligatory within two years from the date of the Stockholm Convention coming into force. In the Czech Republic, the government approved the NIP on December 7, 2005.

The NIP for implementation of the Stockholm Convention was prepared by a team of experts led by Professor Ivan Holoubek of the Masaryk University in Brno. The proposal of this plan includes the inclusion of further information.[1] Its preparation was preceded by drawing up a still more comprehensive "National Inventory of Persistent Organic Pollutants in the Czech Republic".[2] The aim of our Report is not to repeat what is summed up in both the above-mentioned documents, although we cannot avoid quoting data from them. Our aim with the preparation of this Report was rather:

1) To complete information missing in the documents;

2) To point out possible shortcomings in the implementation of the Stockholm Convention to date; and

3) To describe in more detail the opinions of the informal "Stockholm Network", associating non-governmental organisations and representatives of self-government authorities established at the end of 2003.

The Report was prepared as a National Report on POPs for the Czech Republic within the framework of the global IPEP project (International POPs Elimination Project). The issue of POPs pesticides is handled in closer detail by a common study of the Czech Ecological Society and the Arnika Association.[3] More information on POPs in the Czech Republic may be found in both the above-mentioned documents (NIP Proposal[4] and National Inventory of Persistent Organic Pollutants in the Czech Republic[5]).

Contents

I. BASIC INFORMATION

1. Introduction

The Stockholm Convention was signed on May 22, 2001. It entered into force 90 days after signing thereof by the 50th state. This happened on May 17, 2004. The Czech Republic ratified the Convention on August 6, 2002.

Through its ratification we have undertaken to eliminate the 12 most important persistent organic pollutants. Namely, aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene (HCB), mirex, toxaphene, polychlorinated biphenyls (PCBs), polychlorinated dioxins and dibenzofurans (PCDD/Fs) [a]. This number of substances is not final and because of this we give additional information on further substances in this Study. Polyaromatic hydrocarbons (PAHs) rank among persistent pollutants. We further mention data concerning Lindane, endosulfan, polybrominated diphenylethers (PBDEs), perfluoroctane sulphonate (PFOS), polychlorinated naphthalenes (PCNs), and polychlorinated n-alkanes, also called short-chain chlorinated paraffin's (SCCPs).

2. Basic characteristics, occurrence, and use of the individual POPs obligations ensuing from the Stockholm Convention

Persistent organic pollutants may be chemical substances produced intentionally by the industry, for example, pesticides, or they may be formed as by-products of industrial processes or combustion. These substances do not dissolve in water and persist in the environment for a long time. They are characterised by the fact that they are very dangerous in trace concentrations. These substances accumulate readily in living organisms and their concentrations increases at each level of the food chain. They bind to fats and are capable of damaging the hormonal and immune systems of humans. Because of this capability it is necessary to strictly limit their presence in the environment as much as possible.

Hitherto, the Stockholm Convention has set conditions for the elimination of 12 POPs. Their basic characteristics, occurrence, and use in the Czech Republic, are contained in profiles of these substances in Annex 1.

According to the Stockholm Convention, seven pesticides, with the exception of DDT, should be fully eliminated, including old stocks (Annex A, part I). For DDT, specific exceptions are valid, which however, do not apply to the conditions of the Czech Republic (Annex B). Therefore, in practice, it is necessary that the Czech Republic should ban all eight pesticides, and ensure safe disposal of any stocks of these substances. In the case of PCBs, an obligation to stop their production and use in newly produced equipment has been established.

[a] In this Report, we follow the established custom to call polychlorinated dibenzo-p-dioxins and dibenzofurans, in a simplified fashion, dioxins. When using this term in the text, we always mean both the above-mentioned groups of chemical substances.

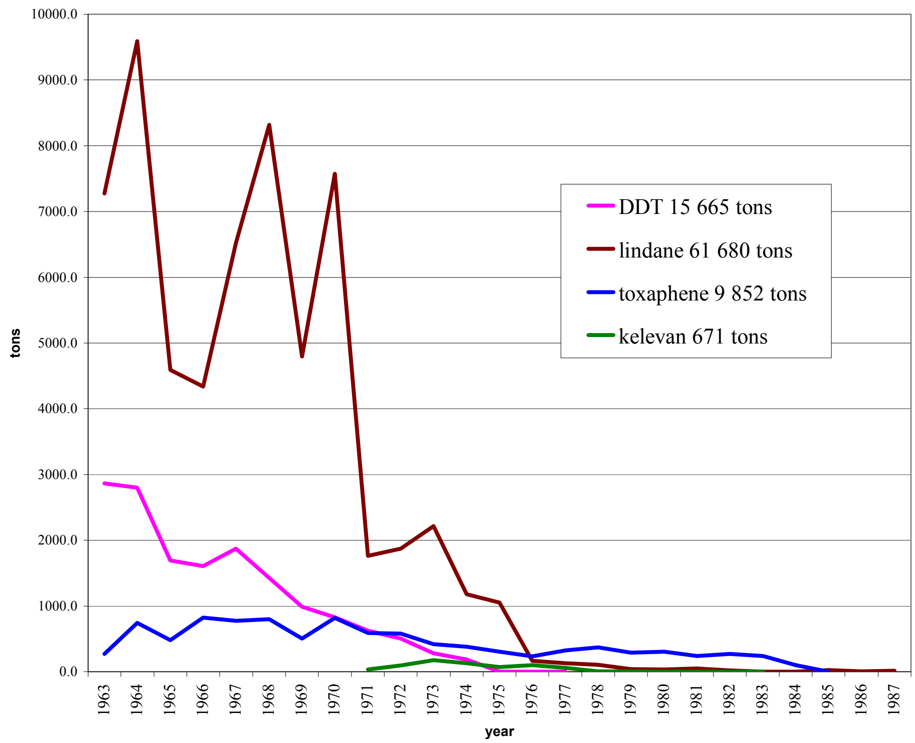
Annex A, part II of the Stockholm Convention defines a regime for management of PCBs in old equipment:

"Each Party shall:

- *Take action to the elimination of the use of polychlorinated biphenyls in equipment (e.g. transformers, capacitors or other receptacles containing liquid stocks) by 2025;*
- *Promote measures to reduce danger and risk when using polychlorinated biphenyls;*
- *Adopt measures to sound management of waste liquids and equipment contaminated with polychlorinated biphenyls having a PCBs content above 0.005 % as soon as possible but no later than 2028;*
- *Provide a report every five years on progress in eliminating polychlorinated biphenyls and submit it to the Conference of the Parties."*

The individual states could ask for specific exceptions from the set regime for substances listed in Annexes A and B. The Czech Republic did not ask for any exceptions.

Figure No. 1: Development of use of some POPs pesticides in the former Czechoslovakia. Source: I. Holoubek et al. 2004 [6]



In the case of substances listed in Annex C (polychlorinated dibenzo-p-dioxins and dibenzofurans, (dioxins),[b] and further, polychlorinated biphenyls and hexachlorobenzene) the states which ratified the Convention shall reduce their *"total releases derived from anthropogenic sources …with the goal of their continuing minimisation and, where feasible, ultimate elimination"*.[c]

A number of the eight pesticides present on the Convention list were never produced or used in the Czech Republic. A majority of them were banned during 1970s and 1980s. Development of the use of certain pesticides in the former Czechoslovakia is shown on a graph in Figure No. 1. More detailed information is contained in an older report prepared within the framework of IPEP.[7]

Polychlorinated biphenyls were produced in the former Czechoslovakia in Chemko Strážské in eastern Slovakia in between 1959 and 1984. In total 21,482 tones, (54 %) stayed in Czechoslovakia and the rest was exported. A comparison with production in the neighbouring countries of the Central and Eastern Europe is given in Table No. 1.

Companies in the Czech Republic used PCBs for production of heat-carrying, cooling, hydraulic, and dielectric liquids, as additives into paints, plasters and cements as sealing liquids or waxes etc. In the Czech Republic, there are still a number of transformers and capacitors containing oils with PCBs. According to a recent inventory of equipment with contents of PCBs, transformers and capacitors in the Czech Republic still contain demonstrably 487 tones of liquids with PCBs, and in the case of further 3,487 tones this is likely, but tests have not been carried out as yet.[8]

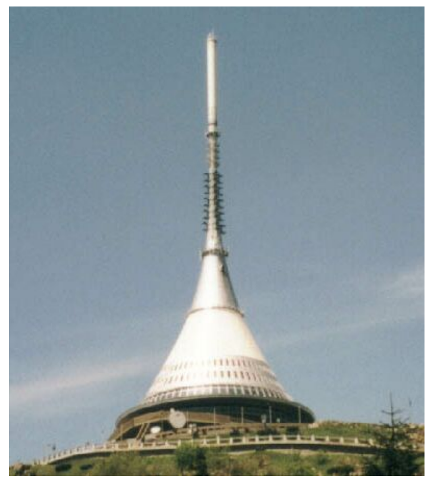


Photo No. 1: Liberec - Ještěd

In many places we find the contamination of soils by PCBs caused by leakage from transformers or the improper management of wastes containing these substances. For example, high concentrations of PCBs in the air were found on the top of the Ještěd Mountain (Photo No. 1) towering above the Liberec city in summer season of 2000[d]. When looking for the origin of this it was found to be an old painting on which paint containing PCBs had been used and which was being removed at the time of the measurement.[9]

PCBs are also formed as unintentional by-products. A big part of our Report is devoted to an inventory thereof, together with dioxins and hexachlorobenzene, as substances present on the list of Annex C of the Stockholm Convention (see Chapter 8).

[b] In this Report we follow the established custom to call polychlorinated dibenzo-p-dioxins and dibenzofurans, in a simplified fashion, dioxins. When using this term in the text, we always mean both the above-mentioned groups of chemical substances.

[c] Article 5 of the Stockholm Convention. Article 5 and Annex C further specify concrete measures which the Parties shall adopt in order to achieve the set goal for POPs formed as unintentional by-products.

[d] Specifically, 779 fg TEQ/m^3 PCB was measured in a sample taken on August 16 - 17, 2000.

The following substances were proposed to be included into the list of the Stockholm Convention, Annex A:

Pentabromodiphenylether, belonging into the group of polybrominated diphenylethers (PBDEs);
Chlordecon, used as pesticide;
Hexabromobiphenyl, belonging into the group of polybrominated biphenyls (PBB);
Lindane (gamma-hexachlorocyclohexane, γ-HCH), used as pesticide;
Perfluorooctane sulphonate (PFOS).

In the case of the Czech Republic, important harmful substances from the POPs family, formed in combustion and chemical processes, include polyaromatic hydrocarbons (PAHs), to which the POPs Protocol to the international LRTAP Convention applies.[e]

Detailed data on the individual substances which this Study concerns and listed in its introduction, are contained in their profiles in Annex 1.

Table No. 1: Overview of quantity of PCBs produced in the CEE countries

State	Quantity of produced PCBs (in tones)
Slovakia (former Czechoslovakia)	21,482 (+ 1,600 t PCBs in waste)
Poland (only Zaklady Azotowe – Mościce)	679
Russian Federation	180,000

Note: Structure of the PCBs production in the Russian Federation: savol – 53,000 t, saftol - 57,000 t, TCB – 70,000 t (AMAP 2000)

II. POPs IN THE ENVIRONMENT

3. Impact of POPs on human health and monitoring of the state of health of the Czech population

3.1 Impact of POPs on human health

One of the main disturbing features of persistent organic pollutants is their bioaccumulation in animal fats. This characteristic means that humans get more than 90 % of these substances in their food and as a result it is not easy to reduce the body burden of them except very slowly. An exception to this are mothers, who transfer a major part of their body burden of these substances to their children during pregnancy and when breast-feeding.

When losing weight these substances are liberated into blood and a reduction of their intake is one preventative measures to avoid unwanted health impacts.

[e] LRTAP is an abbreviation of the English title Long Range Transboundary Air Pollution. The Convention was signed on November 13 - 14, 1979 in Geneva. The POPs Protocol was then signed in 1998 in Aarhus.

In the case of by-products such as HCB, PCBs, and dioxins, this means to avoid foodstuffs with higher content of animal fats (for example, meat and dairy products).

Table No. 2: Health consequences of action of the toxic twelve. Source: Kotecha, Perry 1999[10]

	Immune system	**Hormones**	**Reproduction**	**Cancer**
aldrin	☻		☻	
chlordane	☻	☻		☻
DDT	☻	☻	☻	☻
dieldrin	☻		☻	
endrin	☻		☻	
heptachlor	☻	☻		☻
HCB	☻	☻	☻	☻
mirex	☻		☻	☻
toxaphene	☻	☻	☻	☻
PCBs	☻	☻	☻	☻
dioxins (PCDD/Fs)	☻	☻	☻	☻

In the case of pesticides, it is important to pay attention to the place of origin of the foodstuffs**.** Although the use of some pesticides has been banned they can still be found in foodstuffs due to their persistence. DDT (for example) was banned in the Czech Republic in 1974 (although its use continued until 1983) and it can still be found in foodstuffs and the environment which is highly contaminated by it.

For PCDD/Fs, the World Health Organisation (WHO) determined the maximum daily intake per 1 kg of body weight at the level of 1 to 4 pg WHO-TEQ. In the EU, a limit of tolerated weekly intake was adopted in the amount of 14 pg WHO-TEQ per 1 kg of body weight.

Concerning the further six substances (or groups of substances), their health impacts vary, and they are summed in the profiles of the individual substances in Annex 1.

3.2 Exposition of the population to POPs

In the Czech Republic exposure of the population to POPs is monitored from both foodstuffs and the outer environment. Because foodstuffs represent the decisive proportion of intake and exposure to POPs, we have incorporated the most important results of this monitoring into profiles of the substances in Annex 1.

In the long term, polychlorinated biphenyls, together with arsenic, have the highest share of a theoretical estimate of the probability of increase in the number of tumours in the Czech population due to annual exposition to selected chemical substances. This estimate was ca 65 cases in 2003.[11]

In 2003, PCBs, metabolites of DDT, gamma-isomer of HCH (Lindane), and HCB were the POPs most often found above detection limits in foodstuffs. Although these concentrations were low, this shows this area of contamination by these POPs persists, as stated in the updated assessment of dietary exposition to POPs in the National POPs Inventory. Estimate of the exposition dose of the substances with so-called 'dioxin effect'[f] represented in 2003 the level of ca 8.1 - 9.6 pg WHO-TEQ/kg of body weight/week. This represented 58 - 69 % of the tolerable weekly intake (EU). However, J. Ruprich states in the updated report that *"too high importance should not be attached to this relatively favourable result, having in view the very small number of results of analyses (4 per year)."* The share of PCBs on the dioxin toxicity is 55 - 65 %, the share of PCDFs is 30 - 34 %, and the share of PCDDs is 1 - 15 %.[12] These analyses do not reflect the burden of the population in the vicinity of places highly impacted by POPs pollution.

3.3 Biological monitoring of the Czech population

Biological monitoring of the Czech population is carried out by the National Institute of Public Health (SZÚ) in four cities. Namely Benešov u Prahy and Žďár nad Sázavou representing the less burdened regions. And Plzeň and Ústí nad Labem representing the regions with higher burden. Breast milk, subcutaneous fat, or blood serum is monitored. Selected PCB congeners (PCBs 138, PCBs 153, PCBs 180), and DDT and HCB from pesticides are monitored. Values of medians are shown in Figure No. 2 and Figure No. 3.

Photo No. 2: Spolek pro chemickou a hutní výrobu, a. s. (Spolchemie) in Ústí nad Labem is a large source of hexachlorobenzene (HCB) releases in the environment.

Higher concentrations were found in Uherské Hradiště and Ústí nad Labem, but they can also be expected in other industrial areas. People in the vicinity of old burdens areas may also be carrying a higher body burden. Generally, the recorded values are influenced by age, place of residence, professional exposition, or eating habits.[13]

Monitoring of PCDD/Fs monitors dioxin content in breast milk and subcutaneous fat. However, it is not carried out each year. Table No. 3 shows results obtained in 1998. In 1992 and 2000 the Czech Republic took part in a comparison study organised by WHO, monitoring the level/content of PCDD/Fs in breast milk in the cities of Kladno and Uherské Hradiště. In 2000 Liberec was included among the monitored localities in order to assess the possible impact of the municipal waste incinerator.

[f] WHO-TEQ for the sum of 29 toxic congeners of PCBs and dioxins.

Further results were obtained within the framework of a project of the Ministry of the Environment VaV 520/6/99.[14]

Figure No. 2: PCBs in breast milk. Median of the concentration - 1994 - 2003. Source: SZÚ 2005.

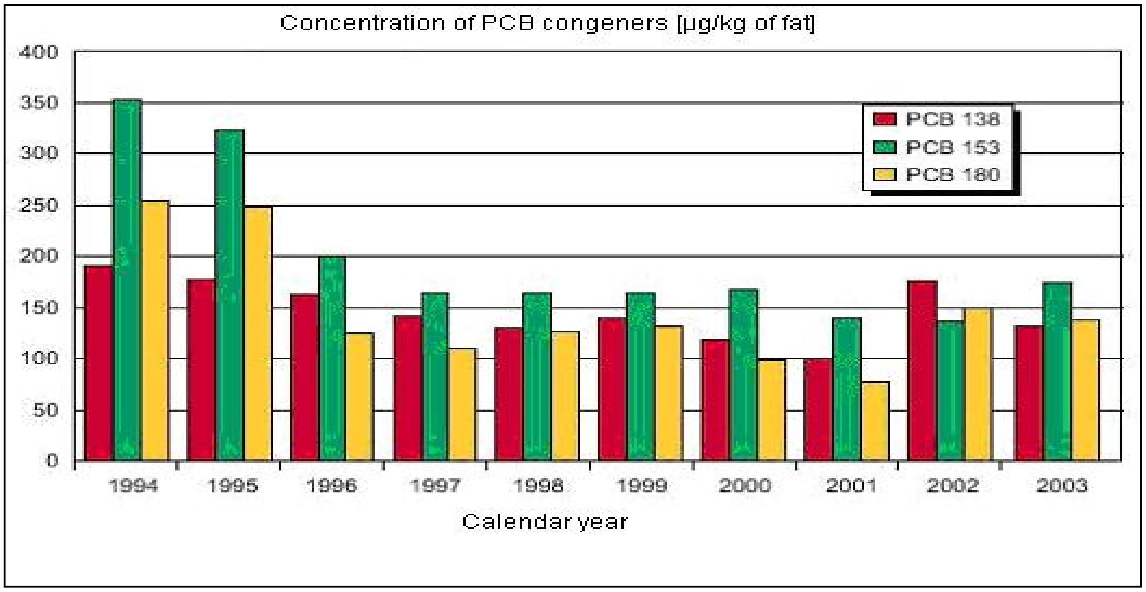


Figure No. 3: Content of HCB and DDT in breast milk. Median of the concentration - 1994 - 2003. Source: SZÚ 2005.

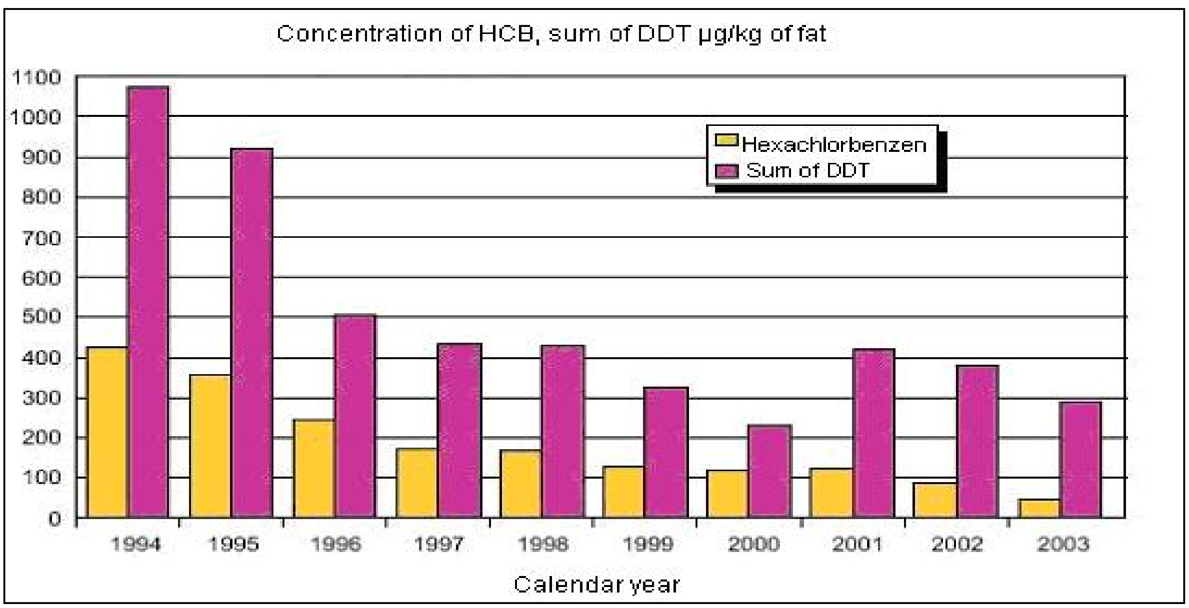


Table No. 3: Summary of results of analyses of the content of dioxins and PCBs in breast milk from various localities in the Czech Republic, WHO-TEQ (medians). Sources: WHO,[15, 16] SZÚ,[17] VaV 520/6/99[18].

Locality	Year	PCDDs	PCDFs	PCBs	Total	Source
Kladno	1992	3.7	9.37	18.28	31.4	WHO
Kladno	2000	2.4	5.03	15.23	22.7	WHO
Uherské Hradiště	1992	5.51	14.3	39.53	59.3	WHO
Uherské Hradiště	2000	3.32	7.41	28.47	39.2	WHO
Liberec	2000	2.74	5.04	14.32	22.1	WHO
Benešov u Prahy	1998	3.67	6.25	21.6	31.4	SZÚ
Žďár n. S.	1998	3.92	7.88	17.7	29.6	SZÚ
Plzeň	1998	4.08	6.64	21.5	32.2	SZÚ
Ústí n. L.	1998	4.34	8.48	22.5	35.3	SZÚ
Uherské Hradiště I	1999-2001	6.33	11.9	45	64.6	VaV 520/6/99
Uherské Hradiště II	1999-2001	4.14	8.94	28.3	39.9	VaV 520/6/99
Prague	1999-2001	10.7	12	23.9	45.5	VaV 520/6/99
Liberec	1999-2001	4.07	6.17	17.39	27.8	VaV 520/6/99
Kolín	1999-2001	6.52	8.43	25.7	40.3	VaV 520/6/99
Ústí n. L.	1999-2001	6.02	11.5	39	55	VaV 520/6/99
Telč	1999-2001	3.68	7.21	18	31.4	VaV 520/6/99
Kladno	1999-2001	4.84	6.97	19.9	31.2	VaV 520/6/99

A comparison with further European countries is given in Figure No. 4, based on three series of WHO monitoring studies (1988, 1993, and 2002). This shows a significant decrease of PCDD/Fs concentrations in breast milk. However, the results should be confirmed by a further study, because the project VaV 520/6/99 confirmed this result only partially. Nevertheless, it is obvious from the table that PCB congeners, acting similarly as PCDD/Fs, have a share on the POPs burden of breast milk. They have the share of approximately 60 % of the total burden. This is documented also by the graph on the Figure No. 5, based on measurements carried out in 2001 and 2002. From the graph, there follows certain similarity with the situation in Slovakia where PCBs were produced.

Figure No. 4: Substances with dioxin effect in breast milk in Europe. Source: ELICC[19]

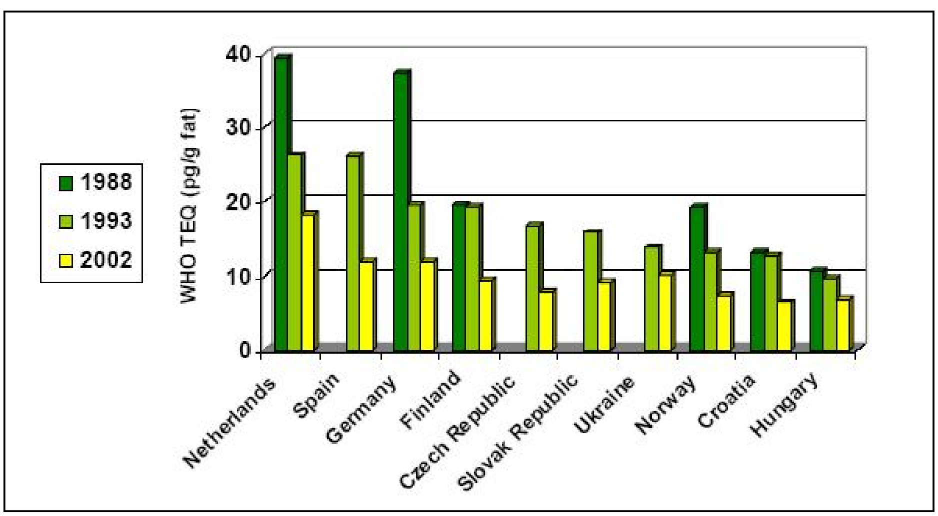


Figure No. 5: Contribution of PCDD/Fs and PCBs to the total WHO-TEQ in breast milk samples. Comparison of data from various European countries in 2001/2002. Source: Van Leeuwen, R. Malisch, R. 2002[20]

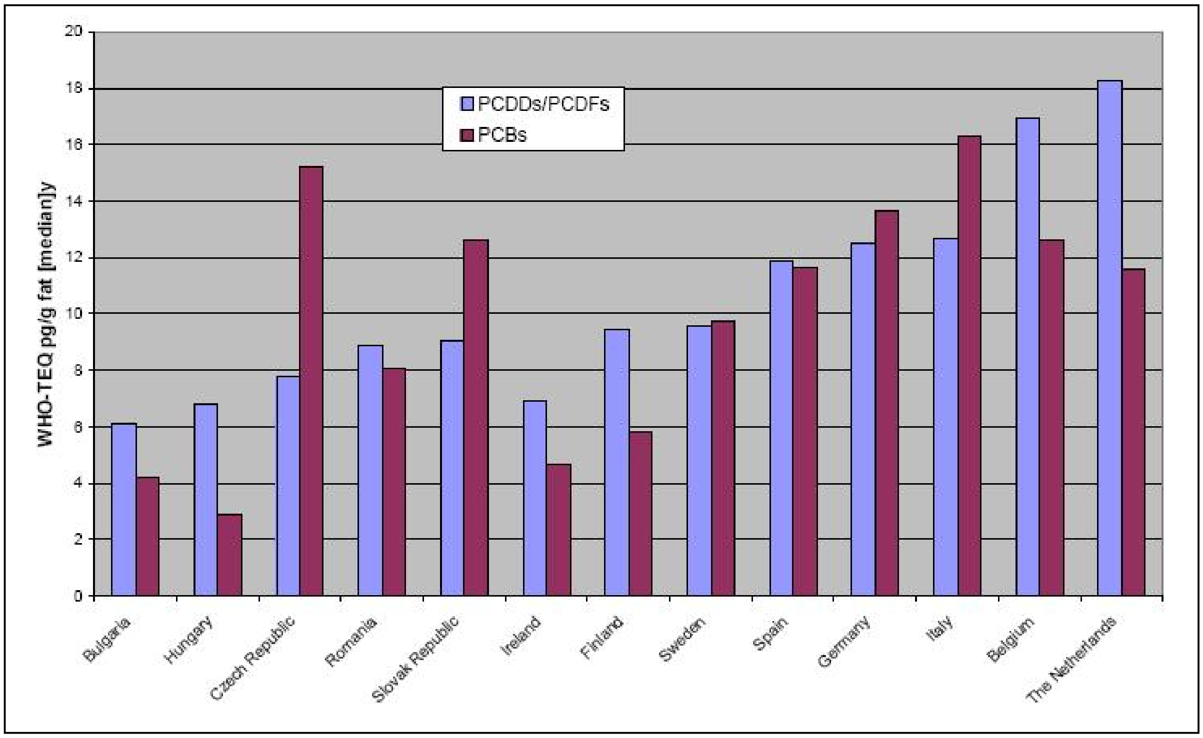


Figure No. 6: Relative proportion of PCDD/Fs and PCBs in the individual analyses of blood from various localities in the Czech Republic.

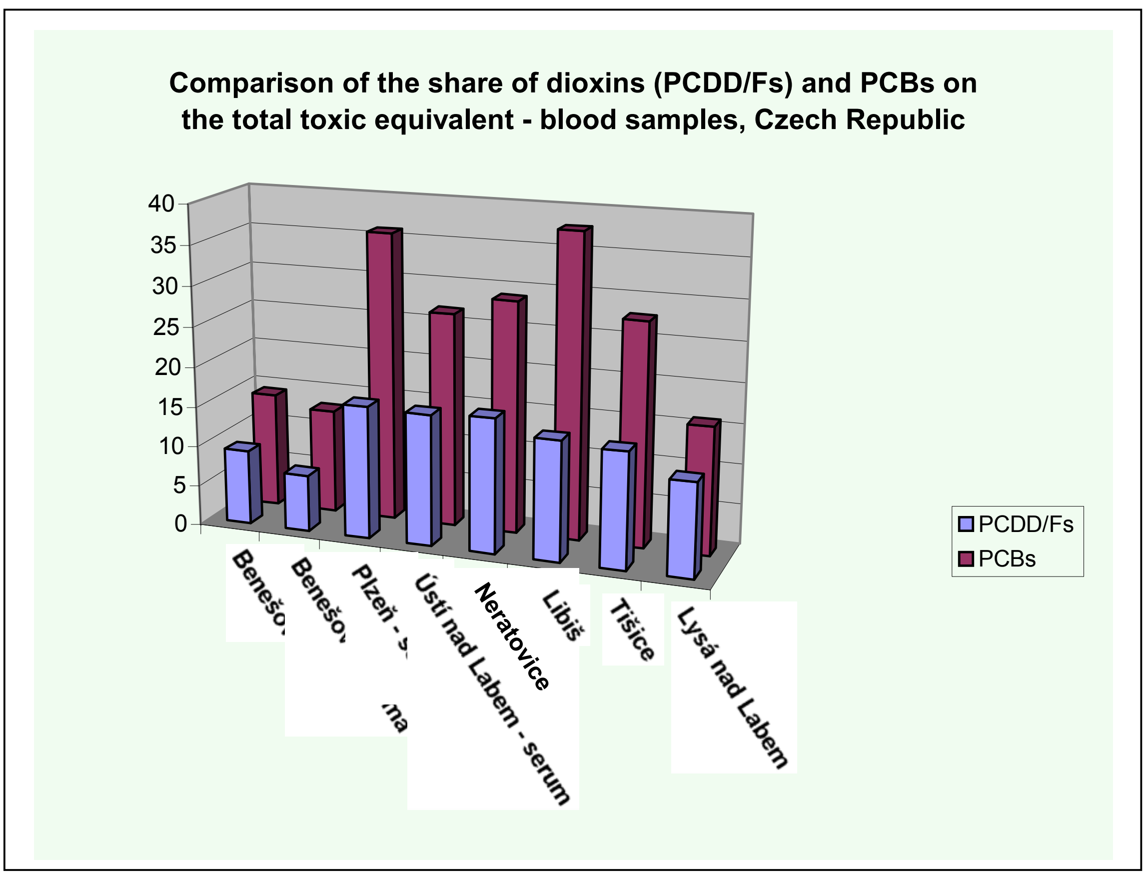


Table No. 4: Results of analysis of PCDDs, PCDFs, and PCBs with dioxin effect (pg/g of fat WHO-TEQ) in combined samples of serum, plasma, or blood of the Czech population within the framework of MZSO

Sample	TEQ-PCDDs	TEQ-PCDFs	TEQ-PCBs	TEQ sum
Benešov plasma	2.03	5.01	13.0	21
Plzeň serum	4.56	12.0	36	52
Ústí n/L serum	5.13	11.2	26.7	43
Benešov serum mixture I*	8.71	12.0	**	cannot be assessed
Benešov serum mixture II*	8.18	16.6	**	cannot be assessed
Ústí mixture serum I*	12.3	13.7	**	cannot be assessed
Ústí mixture serum II*	8.98	10.4	**	cannot be assessed
Lysá n. L. (median)	3.4	8.3	15.9	27.3
Benešov (median)	2.7	6.2	13.4	24

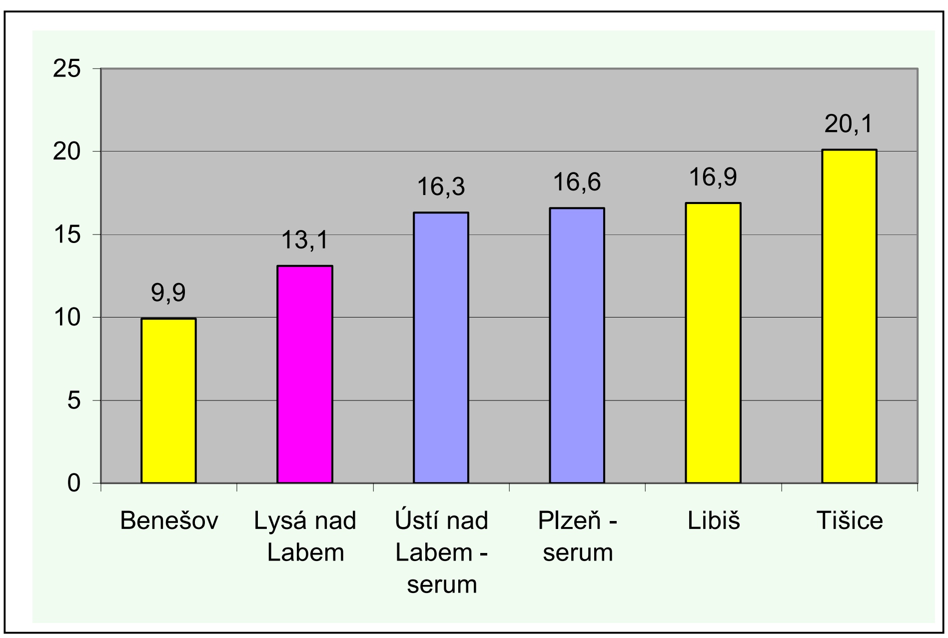
* Some congeners were under the detection limit; value = ½ LOD was used for the calculation

** Only non-ortho PCBs were analysed; the results showed clear prevalence of PCBs 126

In 2003, there were taken 103 samples of breast milk, in order to determine PBDEs concentrations in them. The average concentration was 1.43 ng/g of fat, lower than in Sweden (3.15 ng/f of fat, year 1998), but higher than in Japan (1.1 ng/g of fat, year 2000). From the individual congeners, BDE47 was found in all samples and congeners BDE99, BDE100, and BDE157 were found in the majority of samples. Decabromodiphenylether (BDE 209) was not analysed in the samples.[21]

In addition to breast milk, monitoring of PCDD/Fs and PCBs in blood is carried out in the Czech Republic. The results are listed in Table No. 4. The table also includes results of monitoring in Lysá nad Labem, where analyses commissioned by the Arnika Association found higher concentrations of PCDD/Fs and PCBs in eggs and poultry meat. High concentrations were also found in wild animals (pheasants, hares, and fish).[22] 2,3,4,7,8-PeCDF has the highest share on the total concentration of PCDD/Fs in Lysá nad Labem (23 % from the total WHO-TEQ value; 80 % from the TEQ value for PCDF). This congener is characteristic of the countries of Central Europe.
Graph in Figure No. 6 shows relation between PCDD/Fs and PCBs in the individual blood samples taken in various localities in the Czech Republic.

Figure No. 7: Average concentration of PCDD/Fs in blood samples from various localities in the Czech Republic (arithmetic mean) in pg WHO-TEQ/g of fat.

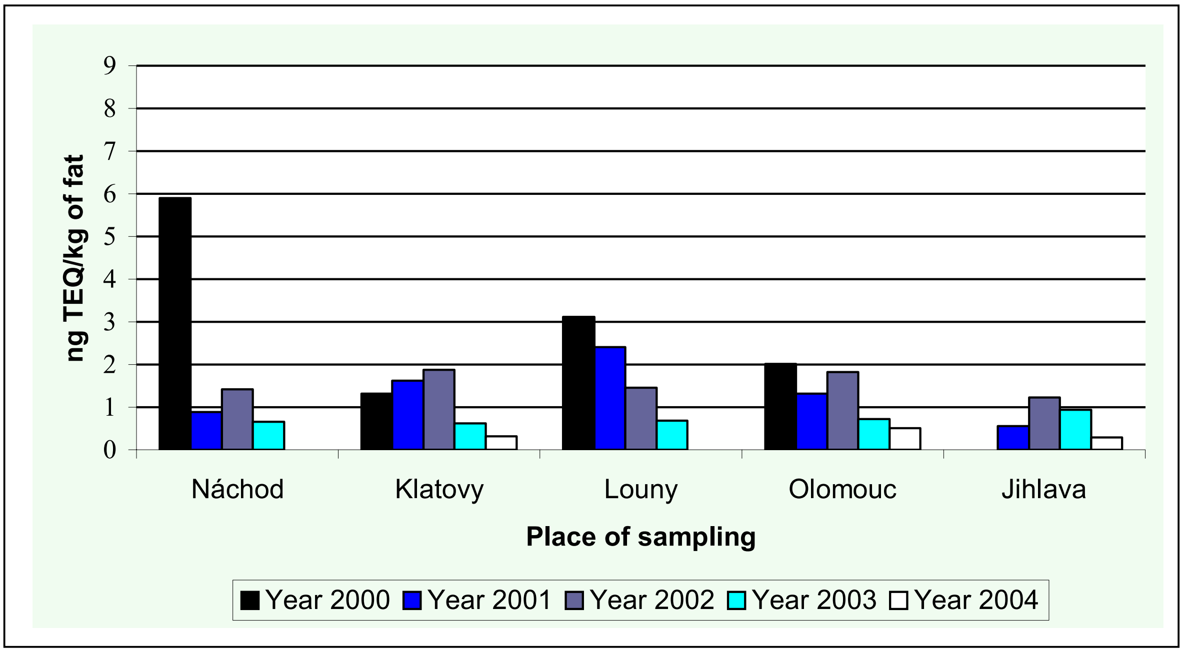


3.4 Contamination of foodstuffs

In the Czech Republic, the Ministry of Agriculture is responsible for the safety of foodstuffs. The Czech Agriculture and Food Inspection Authority (SZPI ČR) is in charge of checking foodstuffs. Monitoring of raw materials and foodstuffs of animal origin is a task of the State Veterinary Administration of the Czech Republic (SVS ČR). The National Institute of Public Health (SZÚ) is in charge of the assessment of health risks in the field of health safety of foodstuffs, and of communication with the public.

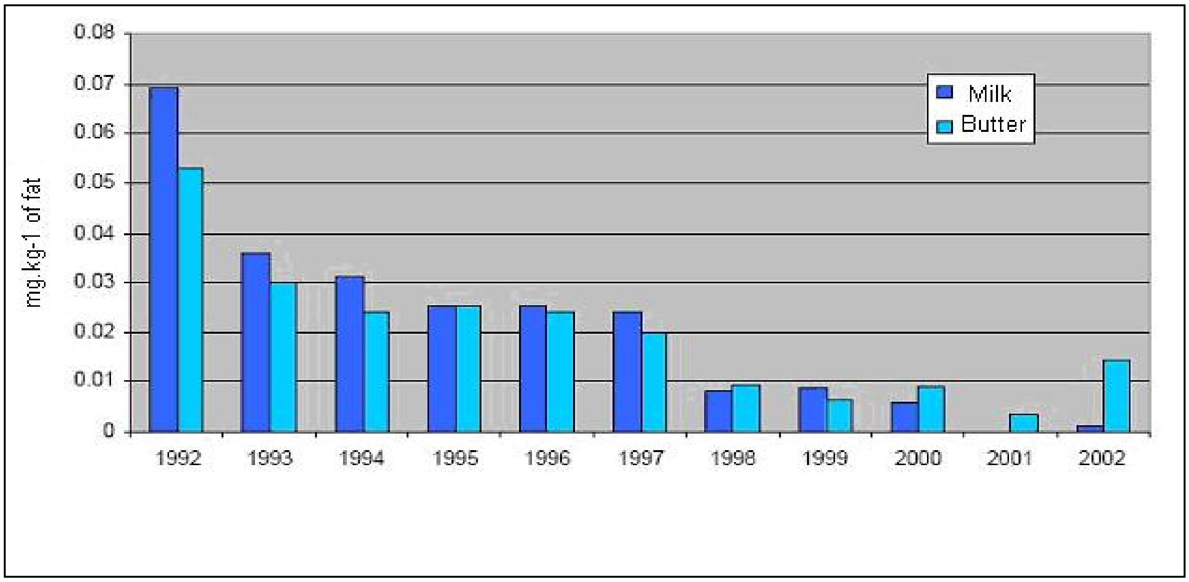
Since 2003, the Czech Republic has been participating in the system of quick warning (RASFF), which, among others, provides information on contamination of foodstuffs and animal feeds levels of the EU.

Figure No. 8: Results of monitoring of PCDD/Fs in butter (in WHO-TEQ). PMS = LOQ. Limit for content of PCDD/Fs in butter is 3 ng WHO-TEQ/kg of fat. Source: SVS ČR.[23]



Concerning the monitoring itself, SVS monitored DDT, HCB, HCHs, and PCBs till 1999. In 2000, after the dioxin scandal in Belgium monitoring of PCDD/Fs was introduced. According to data from Information Bulletin No. 1/2005 (content of PCDD/Fs was monitored in fat in butter, in eggs and cows), the valid limits were exceeded only in several exceptional cases in 2004 in the case of all monitored substances. This shows that possible pollution has only local character.

Figure No. 9: Development of DDT concentrations in milk and butter in 1992 - 2002. Source: National POPs Inventory.[24]



General contamination of foodstuffs by PCBs, with which the Czech Republic fought, was removed. However, old stocks of POPs still represent potential risk for the future.

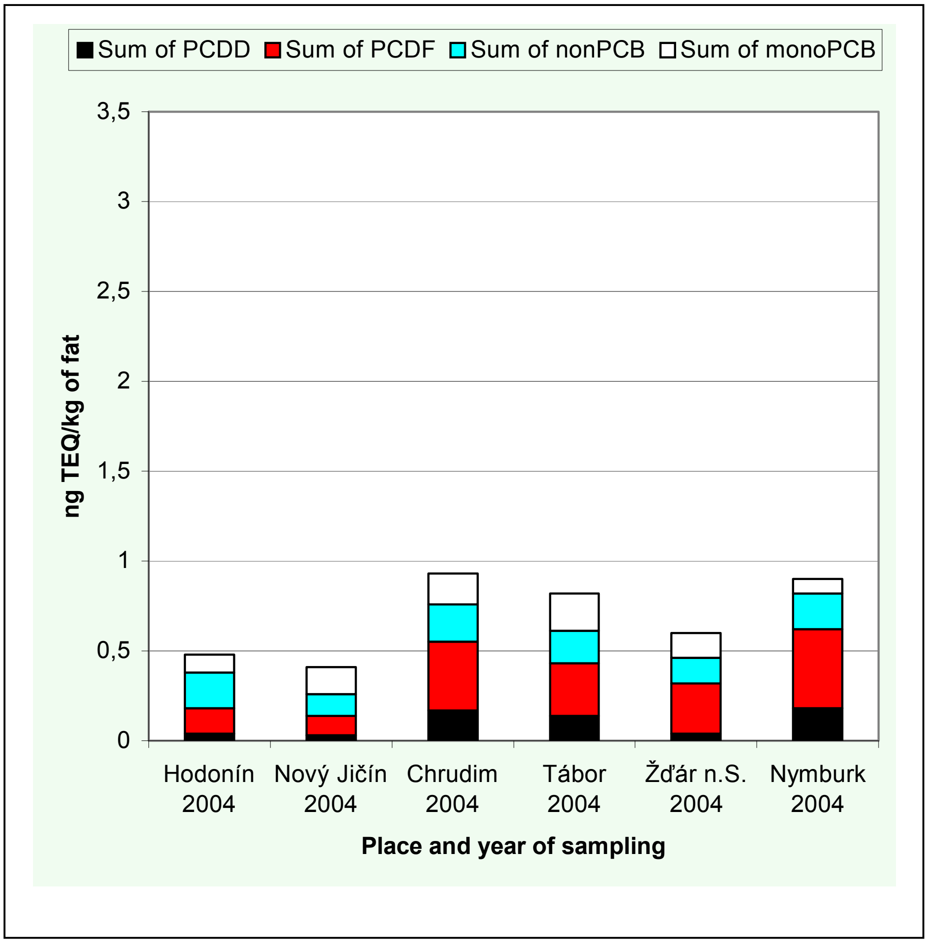
PAHs are monitored in selected meat products, smoked foods and sea fish. Valid limits for PAHs are often exceeded, especially in the case of smoked products.

In Figure No. 8, results of monitoring of PCDD/Fs in butter are shown. The decrease in 2003 was caused specifically by the adoption of a more precise method of measurement. Detailed results of the monitoring are available on internet - http://www.svscr.cz.

Picture No. 9 shows development of concentrations of DDT in milk and butter from 1992 to 2001. During this period, its concentrations decreased both in milk and butter.

General monitoring and checks cannot solve the issue of contamination of household farms. This can be achieved only through consistent reduction of potential sources and through better communications with citizens.

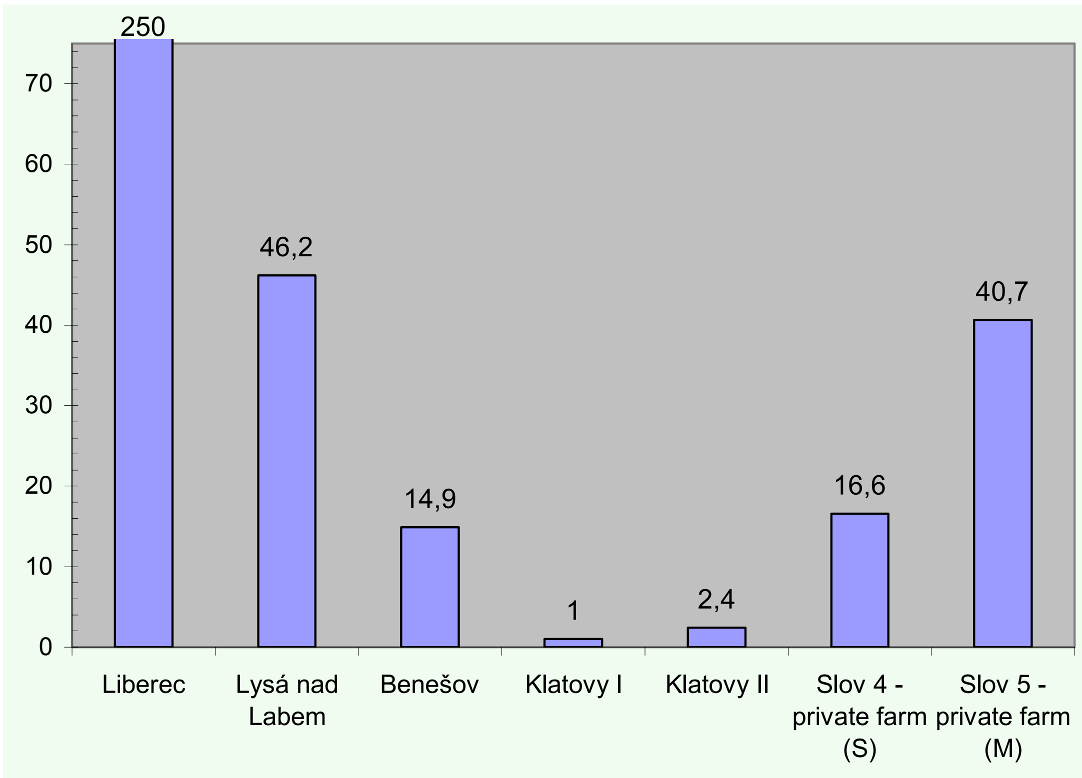
Figure No. 10: Concentrations of PCDD/Fs and PCBs in eggs from poultry large-capacity breeding farms (in WHO-TEQ). nonPCBs = non-ortho-substituted PCBs, monoPCBs = mono-ortho-substituted PCBs. Source: SVS ČR.[25]



In 2002, the Arnika Association revealed high concentrations of PCDD/Fs, and, especially, PCBs, in domestic poultry in the locality of Lysá nad Labem. Further research proved contamination was also present in wild animals. The origin of the pollution was not unequivocally proven although the hazardous waste incinerator in Lysá nad Labem, and long-term unprotected storing of waste containing PCBs in Milovice, is under suspicion. However, another reason for the contamination that cannot be excluded is (for example), the use of old paints with PCBs, unlawful waste incineration etc.

Concentrations of PCDD/Fs and PCBs in eggs from small breeders were 5 and 6.8 pg TEQ per g of fat in the case of PCDD/Fs, and 21.7 and 22.4 pg TEQ per gram of fat in the case of PCBs.[26] Still higher concentrations were found in eggs from small breeders in the neighbourhood of Spolana Neratovice in 2003 (after the floods). A further graph shows concentrations of PCDD/Fs and PCBs from large-capacity breeding farms (see Figure No. 10).

Figure No. 11: Concentrations of HCB found in various samples of chicken eggs from household farms in ng/g of fat. Klatovy I and II - samples from the year 2003,[27] Lysá nad Labem and Benešov - samples from the year 2004,[28] Liberec - sample taken in 2005.[29] Slov 4 and 5 - samples from Slovakia, S - Stropkov district, M - Michalovce district from the end of 1990s.[g, 30]



From organochlorine pesticides, hexachlorobenzene belongs to the most frequently found substances in monitored foodstuffs. In 2001, it was found by the State Agriculture and Food Inspection Authority in 11 from 21 tested samples of butter and in 4 from 20 analysed samples of milk[31] although the concentrations were very low.

[g] In the Michalovce district the factory Chemko Strážské is located. This facility produced PCBs for a part of the former socialist block.

In the case of foodstuffs from household production the situation is very different, as shown by the graph in Figure No. 11. The level of 250 ng of hexachlorobenzene per g of fat in a composite sample of chicken eggs from a household farm in Liberec is among the highest concentrations ever found in poultry eggs in the world.[32]

When monitoring contamination of foodstuffs, hexachlorobenzene is ranked among organochlorine pesticides, however, an important reason for its presence in the environment may be other sources emitting hexachlorobenzene as an unintentional by-product.

In the case of the sample from Liberec, the effort to find the source of contamination of the eggs was unsuccessful, however, some of the industrial sources in this city cannot be excluded.

4. POPs in ecosystems

4.1 Air

POPs concentrations in outside air is not a reliable indicator of the total burden in a given locality due to various factors. Concentrations change very quickly when the wind blows or changes direction. Despite this, measurements of these substances may provide an image of the situation in the given locality. Table No. 5 below comprises an outline of projects concentrating on POPs monitoring in outer air in the Czech Republic.

Table No. 5: Outline of projects concentrating on more extensive monitoring of POPs in outer air. Source: National POPs Inventory.[33]

Project	Period	Monitored area
Zephyr	1996-2000	Monitoring of long-range POPs transport. Sampling places were located on television transmitters.
Project GA 1582/94	1993-1996	Monitoring of heterogeneous organic substances on the territory of the capital city of Prague. In total, 47 measurements of PCDD/Fs, PCBs, and PAHs, were carried out on 13 different sites.
Project VaV 520/1/97	1997-1998	Research and development of scientific base data for quantification of air pollution in the Czech Republic. Measurement of PCDD/Fs, PCBs, and PAHs on 20 localities in northern, western, and southern Bohemia.
Project VaV 520/6/99	1999-2001	Study of occurrence of persistent organic pollutants in the air, and their deposition on the territory of the Czech Republic. Measurement of PCDD/Fs, PCBs, and PAHs on 21 localities in Prague, eastern Bohemia, and southern and northern Moravia.
Project VaV 340/2/00	2000-2001	Impact of complex mixtures of substances in polluted air on state of health of population groups at risk. Measurements were carried out in Teplice and on 2 localities in Prague.
Measurement of emission burden of Zlín region[34]	2002 - 2005	Zlín region

A further important project is the measurement of background POPs values in the Czech Republic by the observatory in Košetice. Czech Hydro-meteorological Institute (ČHMÚ), and the consortium RECETOX-TOCOEN & Associates participate in this project. In addition to monitoring of emissions, the quantities of PAHs, PCBs and DDT in rain (so-called wet deposition) is monitored. This has been carried out since 1985. Results of monitoring in this locality were published in the National POPs Inventory. In the present Report, graphs showing trends of development of medians for PCBs, DDT, and HCB in the air, taken over from the above-mentioned Inventory,[35] are shown in Figures Nos. 12, 13, and 14.

Figure No. 12: Trends of development of medians of regional background concentrations of PCBs, Košetice observatory, 1996-2001 (ng/m^3).

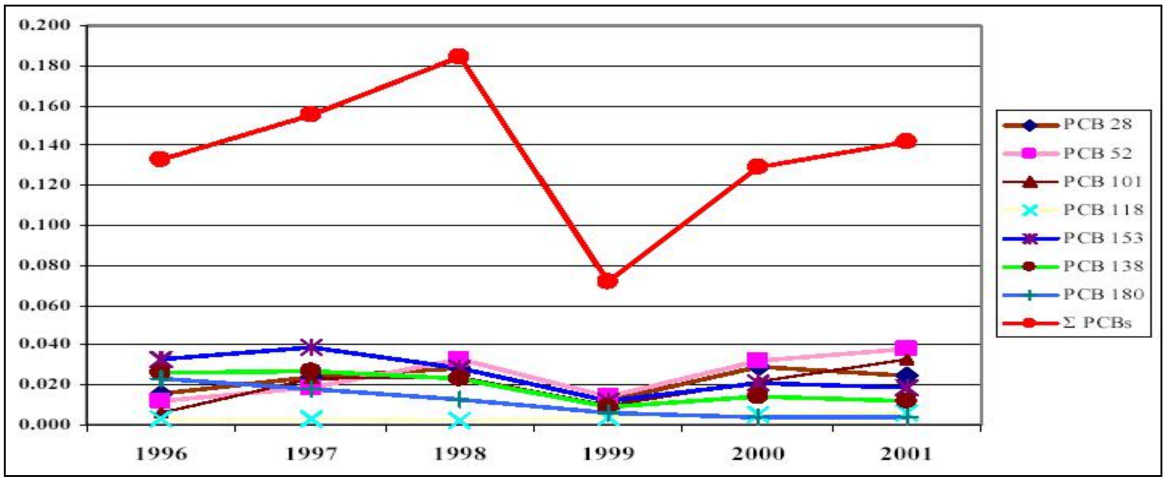


Figure No. 13: Trends of development of medians of regional background concentrations of DDTs (DDT, DDE, DDD), and HCB, Košetice observatory, 1996-2001 (ng/m^3).

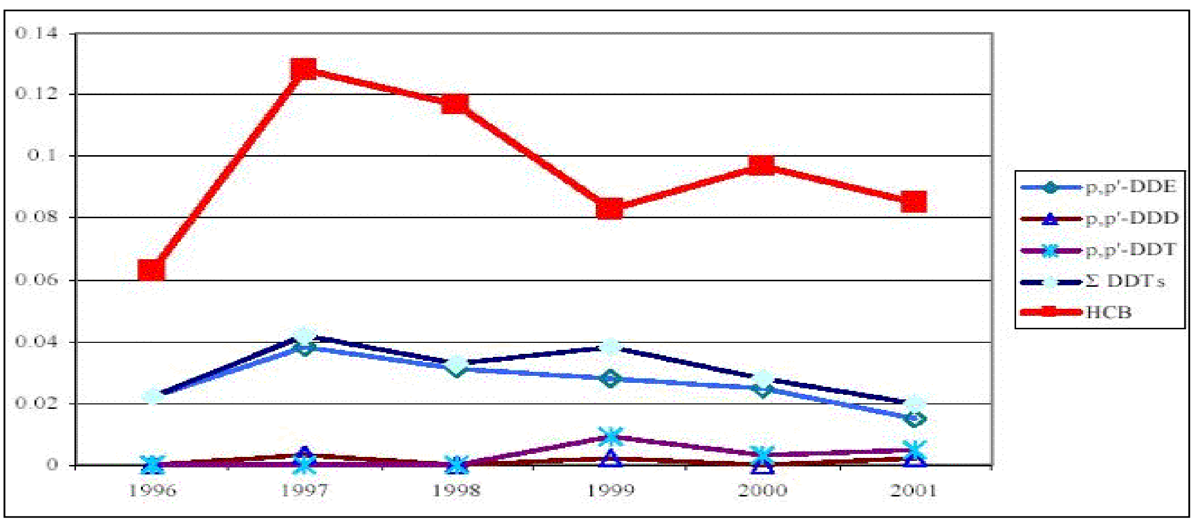
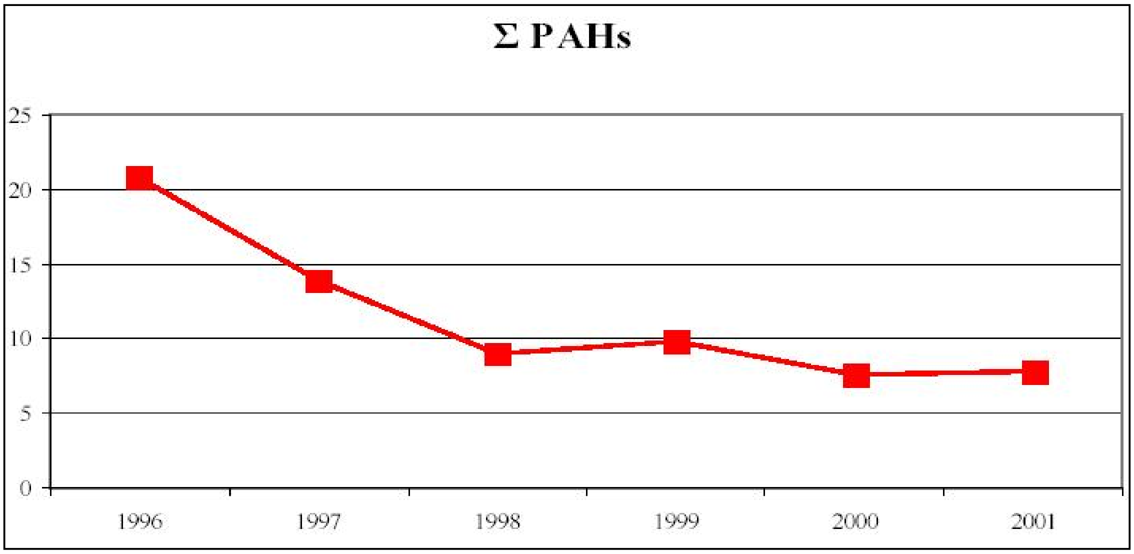


Figure No. 14: Trends of development of medians of regional background concentrations of PAHs, Košetice observatory, 1996-2001 (ng/m^3).



Since the adoption of the new Clean Air Act No. 86/2002 Coll., in 2002 ČHMÚ has been monitoring air pollution by POPs at 13 monitoring stations located around the Czech Republic. However, within the framework of this monitoring, it monitors only PAHs, for which an emission limit has been set in the Act. In 2003 the limit for benzo(a)pyrene was exceeded at 8 stations. The highest average year values were measured in Ostrava and Karviná regions with values of 7.8, and 6.4 ng/m^3, respectively. The lowest value from all 13 stations, amounting to 0.4 ng/m^3, was found in Košetice. The limit is 1 ng/m^3 plus tolerance limits until the end of 2009, and this has been in force since 2001. In 2003, the limit was increased by a tolerance limit, to the value of 8 ng/m^3. Substantially higher PAHs concentrations may be found in winter season.

PCDD/Fs values in the air were monitored in several projects. In Košetice, they were monitored as a background locality without any substantial impact of pollution. A value of 4.3 fg TEQ/m^3 was found in 1997. In the Czech cities, values in 1997-99 were in the order of tens to hundreds of fg TEQ/m^3. In Ústí nad Labem and in Prague, even the values in the order of thousands of fg TEQ/m^3 were found. The highest value in the Zlín region in the period 2002 - 2004 was measured in the vicinity of Technoplast Chropyně[h] in June 2003, namely 454.8 fg I-TEQ/m^3.[36]

Concentrations of PCDD/Fs and PAHs in the air increase several times in the winter season. These increases are usually explained by increased emissions from heating. However, formation of the

[h] In the area of Technoplast Chropyně, hazardous waste incinerator is under operation. The company itself produces, among others, packaging materials from plastics, including PVC.

high concentrations is aided by winter conditions which affect the diffusion of pollution, and by the reduction of photolytic degradation of PAHs in the atmosphere. In the summer PCBs concentrations in the air increase showing that an important source of PCBs in the air is their evaporation from soil.

4.2 Soil

Monitoring of POPs burden of soils is one of important activities for their protection. Soil is irreplaceable, and can be easily endangered. The majority of emitted POPs ends up in soil.[37] Soil can well reflect sources of pollution in the given locality, and the level of transport of POPs to the given place by atmosphere. Also in places with low POPs concentrations, increased amounts may be found in animals, including those on household farms.

Research Institute of Ameliorations and Soil Conservation (VÚMOP) was mapping burden of specifically selected soils in 30 districts of the Czech Republic in 1993 to 2001. The monitoring was carried out on arable land, meadows, and pastures. The purpose was to assess the burden of soils in industrial areas; in intensively agriculturally utilised areas; in close vicinity of villages; in areas with higher altitude; in the Elbe basin; and where sewage sludge has been applied in the long term.

The soil contents of PAHs, HCB, DDT, and PCBs were measured. In 1999 to 2001 they also included PCDD/Fs. Results were compared with reference values, which should represent the upper limit of background values from all monitored regions.[38,39, 40]

Concerning PCDD/Fs, soils could be divided into 3 categories:

- **14 – 1.6 pg TEQ/g** – soils in the vicinity of highly polluted watercourses, soils with high dioxin releases burden, and soils with long-term repeated application of sewage sludge;
- **1.3 – 0.5 pg TEQ/g** – soils from areas with mixed burden, as well as from relatively clean areas (especially in higher altitudes);
- **0.4 – 0.1 pg TEQ/g** – for the most part, soils from clean areas, but sometimes also from industrialised areas.

From a total of 60 soil samples, there was determined, (as 90% percentile), a "background value" of I-TEQ PCDD/Fs in soils - 2.5 pg/g.[41]

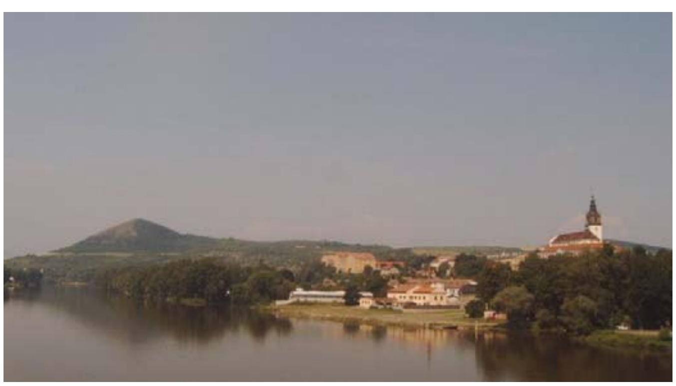


Photo No. 3: Town Litoměřice is surrounded by agricultural land and forests. In this district was found one of the highest DDT values in soil.

In the case of chlorinated pesticides, area contamination was not proved; increased concentrations show a character of point occurrence. HCB concentrations were found in the interval from 1 to 8.73 ng/g (geometric means of the individual districts). Majority of localities are on the lower limit of burden. Higher values were found in the districts Ústí nad Labem (487 ng/g), Litoměřice (337 ng/g) and Sokolov (230 ng/g). DDT concentrations are in the interval 1 - 5.62 ng/g (geometric means of the individual districts). The more heavily burdened districts include Kladno, Prague - west, Jičín, Benešov, and Karlovy Vary, with the highest value found in the districts Prague - city (1054 ng/g), Cheb (167 ng/g), Jablonec nad Nisou and Jičín (159 ng/g), and Teplice (146 ng/g).

The PCBs concentrations were in the interval from 1.19 to 20.11 ng/g (geometric means of the individual districts). The lowest concentration was found in the district of Ostrava, which is burdened by PAHs above average. Other results from the areas most heavily burdened by PAHs show that PCBs concentrations are not connected with combustion processes. The highest measured values were in the districts Děčín (530 ng/g), Prague - city (450 ng/g), Kladno (218 ng/g), and Karlovy Vary (140 ng/g).

Table No. 6: Reference values of PAHs in agricultural soils in ng/g.

FLU	PZR	PHE	Bbf	BaA	ANT	BaP	INP	BkF	BPE	CHR	NAP
300	200	150	100	100	50	75	50	50	50	50	50

Table No. 7: Reference values of PCBs and OCPs in agricultural soils in ng/g.

PCBs	HCB	DDT	DDE	DDD	Σ
50	20	15	10	10	50

The study came to the conclusion that accumulation of PAHs takes place especially in the vicinity of their sources. A clear source of increased burden of soils is the emission burden of a given locality. High values were found in the vicinity of industrial centres, but higher values may also be found near villages in the country. From this, there follows that imperfect combustion of solid and fossil fuels is an important source. High values may be found also in mountain areas, where these substances are absorbed from the air more intensively.

The highest concentrations of PCDD/Fs were found in the vicinity of polluted watercourses. The highest values were found in the vicinity of the Elbe and Vltava. The burden is connected with discharge of industrial waters. In the vicinity of Dyje, which is not polluted by industry, such burden was not found, and, to the contrary, concentrations of PCDD/Fs in its vicinity were similar to values found in relatively clean Vysočina region. Increased concentrations were found in soils in clean areas in close vicinity to industrial plants. For example, in the vicinity of Hostinné, in the vicinity of a wood-working plant near Jihlava, in the vicinity of a plant for production of glued veneers near Rousínov, or at the locality Trhové Dušníky near Příbram. Concentrations were in the range from 1.1 to 2.4 pg I-TEQ/g. Soils with higher burden included agricultural soils where sewage sludge was repeatedly applied (2.5 pg I-TEQ/g). In the places where the sludge was applied moderately, such burden was not found (0.5 pg I-TEQ/g).

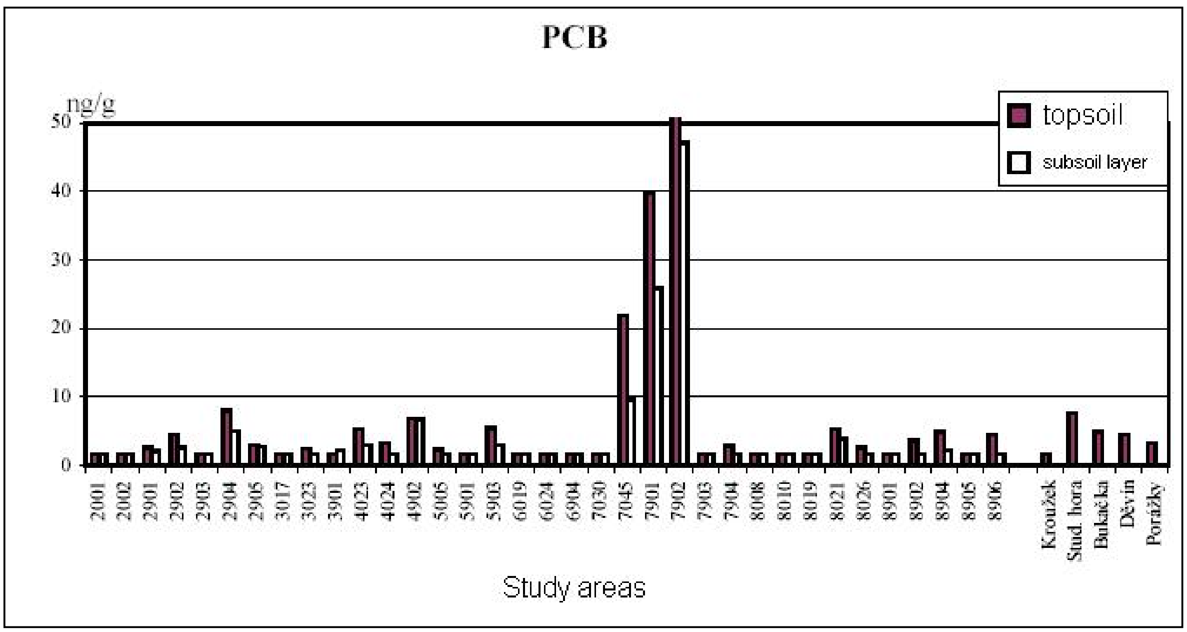
Systematic monitoring of soil is carried out by the Central Institute for Supervising and Testing in Agriculture (ÚKZÚZ) in Brno. It monitors 45 places, five of which form part of protected landscape areas. Arable land, hop-gardens, grasslands and subsoil layers are monitored. Sampling is carried out once a year before the harvest. PCBs, DDT, HCB, PAHs, and HCHs are the substances monitored.[42]

Results of measurements of PCBs contents in soils in protected landscape areas (CHKO) were published by Prášková and Provazník in 2004.[43] Samples of soil were taken in CHKO Kokořínsko, Giant Mountains National Park, CHKO Orlické hory, CHKO Pálava, and CHKO Bílé Karpaty. The values found should represent background values for soils in the Czech Republic. Values of medians for arable lands do not differ from medians for soils from protected areas.

According to the Decree No. 13/1994 Coll., the current limit of PCBs content in soils is 10 µg/kg. But in 2002 and 2003, the limit was exceeded in the case of 3 samples of topsoil and 3 samples of subsoil layer of arable land (the highest value in 2002 exceeded 50 µg/kg). After floods in 2002, the highest value of seven indicator congeners of PCBs amounting to 323.8 µg/kg was found in the vicinity of Spolana Neratovice.[44]

Results of monitoring of PCBs in 2002 are documented by a graph in Figure No. 15.

Figure No. 15: Contents of PCBs in topsoil and subsoil layers (surface and sub-surface horizons) in monitoring areas BMP and in protected areas in 2002 (ng/g of dry matter).



Also studies of consortium RECETOX - TOCOEN & Associates, and reports of the company Axys Varilab, concern monitoring of soils.

RECETOX - TOCOEN, in co-operation with ČHMÚ, has been carrying out regional background monitoring of POPs on the observatory Košetice since 1988. Each year, samples of agricultural, meadow and forest soils are taken. In 1994, 1996 to 1999, and again in 2001, TOCOEN also carried out analyses of soils and needles in spruce ecosystems in border mountains. The purpose of this was to obtain further information on POPs transport.

Other studies include monitoring carried out in the vicinity of big industrial sources, namely in the vicinity of the company DEZA Valašské Meziříčí, company Sokolovská uhelná, joint-stock company, and in the vicinity of cement works in Mokrá and in Beroun. However, the findings of these studies are not publicly available.

In 1997 - 2001, Axys Varilab conducted a study of POPs deposition for the Ministry of the Environment of the Czech Republic, designated VaV 520/6/99. Its results also provided a overview of dioxins, PCBs, and PAHs burden of soils in various localities. The most important findings of this study are summed in the following paragraphs and in Tables Nos. 8, 9, and 10.[45]

The first table (Table No. 8) comprises results of analyses of soil samples from various sites and various layers from one locality. Prague - Libuš was selected for this experiment.

Table No. 8: POPs contents in various soils in the locality Prague - Libuš.

Type of site	**Layer** (cm)	**PCDD/Fs** (pg I-TEQ/g)	**PCBs** (ng/g)	**PAHs** (µg/g)
Meadow	0 – 5	1.2	119.0	2.0
	5 – 10	1.4	142.0	2.7
	10 - 15	1.4	147.0	3.8
Forest	0 – 5	3.3	42.0	0.6
	5 - 10	15.9	311.0	2.5
	10 - 15	0.4	3.5	0.3
Field	0 - 15	0.5	5.9	0.44

The results showed that the type of plant cover and agricultural use of soil have a decisive impact on POPs content. The lowest values were found in field soil. The highest ones were found in the middle layer of forest top soil. However, there are significant differences in the POPs content in individual layers found in the case of forest soil. In meadow soil, POPs content did not depend on the depth of sampling.[i]

Measurements in Prague - Libuš were followed by analyses of 43 samples of soils from various regions of the Czech Republic. The majority was taken from grass-covered areas in the vicinity of AIM (automated emission monitoring) stations where POPs in the air were measured within the framework of this project, or of project VaV/520/1/97. A lower number of samples were taken from forest soils and within the framework of a targeted study of the environment in Ústí nad Labem.

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[i] According to the report, soil from one of the places of the meadow was probably polluted by Delor 103 or Arochlor 1242. Authors of the study conclude this from significant proportion of trichlorinated PCBs.

Table No. 9: Content of PCDD/Fs in soils from various kinds of localities in the Czech Republic.

	Content of PCDD/Fs in soils from different places in the Czech Republic (pg I-TEQ/g)									
	Min.	Max.	Mean	Percentile					STD	n
				10%	25%	50%	75%	90%		
Background	0.07	7.5	2.86	0.34	1.15	2.27	4.47	5.8	2.31	10
Village	1.33	7.0	2.78	1.38	1.56	2.13	3.03	4.8	1.78	8
City	0.50	19.7	4.49	0.75	1.53	3.92	5.53	9.5	4.36	21
Forest	13.8	29.4	20.7	14.4	15.3	19.9	25.3	27.7	6.27	4

Table No. 10: Content of PCBs in soils from various kinds of localities in the Czech Republic.

	Content of PCBs in soils on various types of places in the Czech Republic (ng/g, sum of congeners)								
	Min.	Max.	Mean	Percentile					STD
				10%	25%	50%	75%	90%	
Background	1.4	15.8	6.7	2.4	4.0	4.8	8.7	11.5	4.6
Village	2.0	651.1	206.4	3.1	4.2	18.1	454.6	560.4	260.5
City	3.6	279.6	72.6	8.6	20.1	41.8	83.6	200.2	76.6
Forrest	37.6	307.0	118.2	43.2	51.5	64.2	130.9	236.6	109.7

Non-governmental organisations Greenpeace and Arnika also took several point samples of soils in the vicinity of potential sources of pollution.[46, 47, 48]

4.3 Waters

In the Czech Republic, state monitoring of water quality is carried out by the Czech Hydro-meteorological Institute (ČHMÚ). Within its framework they began monitoring PCBs in 1990), PAHs (since 1992), HCB and HCHs (since 1993), and of DDT and aldrin (since 1995). Monitoring of these substances in sediments and suspended sediments began in 2000. In addition to this a number of measurements are carried out within the framework of activity of international commissions for the protection of Elbe, the Oder, and the Danube. T. G. Masaryk Water Research Institute (VÚV TGM) in Prague was in charge of research monitoring of rivers (Project Elbe, Project Morava, Project the Oder).

Currently, an important stimulus for monitoring of POPs in water environment (surface and underground water, sediments and suspended sediments, water organisms, and other biological matrices) is represented by Council Directive 76/464/EEC on pollution caused by certain dangerous substances. There is also Council Directive 86/280/EEC on limit values and quality objectives for discharges of certain dangerous substances.

On the basis of these directives, programmes were prepared for the elimination of pollution for aldrin, dieldrin, DDT, endrin, HCB, HCHs (including Lindane), PAHs, PCBs and chlorinated alkanes (SCCPs). Basic data for these programmes was provided by research task VaV/650/3/00, monitoring presence and movement of hazardous substances in hydrosphere is carried out by ČHMÚ and VÚV TGM in Prague.[49] In addition to the above-mentioned substances, concentrations of PBDEs were also monitored.

Water quality is also monitored by River Basin companies and by Agricultural Water Management Administration. Further, a network for monitoring of underground water quality exists in the Czech Republic but only PAHs and HCHs are monitored within the framework of this network.

Further projects, especially in Moravia, were carried out by the consortium RECETOX - TOCOEN & Associates (project IDRIS, project BETWEEN etc.).

The majority of the following data was taken from the Initial National POPs Inventory.[50] Other sources used in the case of the individual substances are mentioned therein.

4.3.1 DDT

DDT concentrations in surface waters are usually in the range of tenths to units ng/l. However, significantly higher concentrations are being found in contaminated places. Probably, the most important locality with old DDT burden are premises of the company Spolek pro chemickou a hutní výrobu in Ústí nad Labem, which causes really serious contamination by DDT on a large scale. DDT was produced in Spolchemie in 1950s and 1960s. Studies confirm substantial contamination of soil on the premises of the company causing the contamination of Klíšský stream, and of Bílina river. It is estimated that ca 6 grams of DDT flow into Bílina in waste water daily. At present, decontamination of the premises of the company is being carried out but neither the stream nor the river is being decontaminated.

A further potential source of pollution is Spolana Neratovice, where DDT was also produced. This is confirmed by high DDT concentrations in sediment from Obříství, amounting to 4.222 ng/g, found by measurements carried out in 2000 - 2001. Further high concentrations were found in southern Moravia in basins of the rivers Morava and Dyje.

DDT concentrations in sediments and suspended sediments are in the range of units to tens ng/g. Exceptions are the above-mentioned places in the vicinity of certain chemical companies, where concentrations are in the order of thousands ng/g. These places also influence areas downstream of the Elbe river. This is confirmed by high DDT concentrations found in Děčín and Hřensko. A high value amounting to 1,500 ng/g, was found in 2000 in Znojmo.

DDT and its metabolites accumulate very well. Results show that DDT's ability to accumulate in fish is by an order of magnitude higher than the ability of HCB or HCHs. The maximum sum of DDT, 1,709 ng/g was found in liver of barbel.

DDT does not reach underground water because of its readiness to bind to solid materials and by its low solubility in water.

4.3.2 Aldrin, dieldrin, endrin (drins)

Concentrations of these substances in surface water are in the range of, at most, units ng/l, in suspended sediments and sediments in units ng/g. These correspond to natural background values. These substances were not detected in underground water.

4.3.3 HCHs

Concentrations in surface water of these substances are in the range of, at most, from 1 to 178 ng/l, in suspended sediments at most in units ng/g and in sediments in the range up to 50 ng/g. A higher value was found in Ústí nad Labem, namely 320 ng/g with increased concentrations being found in the Morava basin downstream of industrial sources. The concentrations found there were in the range of tens to hundreds ng/g.

These substances were not detected in underground water by the network for monitoring of underground water quality. [51, 52]

4.3.4 HCB

Important sources of the contamination of hydrosphere are waste waters from industrial plants (especially chemical). A similar source can be also any sewage sludge originating in these plants. The HCB content in waste waters from Spolchemie Ústí nad Labem exceeds usual background values by several orders of magnitude.

In a report of the International Commission for Protection of Elbe (MKOL), the following industrial sectors are listed as sources of contamination of hydrosphere: production of plastics and rubber, aluminium production, and production of halogenated organic substances.[53] Emissions from Spolchemie were 40 kg/year in 1999, and 10 kg/year in 2000. Considerably lower HCB concentrations were found in Moravia.

Within the framework of Project Morava, HCB measurements were carried out in waste waters from 20 industrial plants. The majority of values were under the detection limit (2 ng/l). The highest value (17 ng/l), was found in waste water from the plant Tylex Letovice.

HCB concentrations in surface water are usually in the range of tenths to tens ng/l. Exceptions are the results of analyses from the vicinity of Spolchemie. Releases from this plant influenced the water quality in the river Elbe. As shown by Figure 16, the situation there is improving.

Figure No. 16: Trend of HCB concentrations in the water of Labe river at the Czech - German border locality Hřensko/Schmilka in the period 1993 - 2002 (single samples, medium = M and maximum = Max. levels).

The MKOL Report states data on the annual runoff of HCB from the Czech Republic in Elbe. The runoff was 180 kg in 1999, 110 kg in 2000, 46 kg in 2001, and 76 kg in 2002.

The concentrations in sediments and suspended sediments are in the range of units to tens ng/g. Again, an exception is found in the vicinity of the Spolchemie Company where concentrations exceeding 10,000 ng/g were found in sediments of Bílina River under the discharge from the company. According to the MKOL Report, values 1,700, 860, and 2,000 ng/g were found in Elbe sediments in Hřensko in 2000, 2001, and 2002, respectively.[54]

HCB concentrations in fish tissues are in the range of units to tens ng/g, depending on the species. High concentrations were found by the Arnika Association in the vicinity of the mine Jan Šverma in Žacléř area. Concentrations 462, and 619 ng/g of fat, respectively were found in two trout. Hazardous wastes have been deposited for many years Into this mine.[55] We found that sewage sludge from waste water treatment by the Spolchemie company has been deposited there. This sludge can be regarded as a possible source of the contamination.

4.3.5 PCBs

PCBs concentrations in surface water are usually in the range of units to tens ng/l. However, in the vicinity of certain industrial sources concentrations in the range of tens and hundreds ng/l can be found. Significantly higher values are connected with accidents.

One such accident took place in Rožmitál in 1985 when PCBs were released from a plant for the production of asphalt, and concentration 250,000 ng/l was measured in the Skalice River. Orlická dam, into which the river flows, was contaminated. In 1988 a ban on the consumption of fish from the Skalice river was issued.

In 1977, there was a fire in coating plant Modřec u Poličky. A decontamination column was installed on the site but the performance of the column is not permanently stable and increased levels of indicator congeners of PCBs can be found in discharge into surface watercourses and in underground water. For example, in 1999 - 2001, PCBs concentrations at the discharge from the drainage were in the range from 170 ng/l to 33,090 ng/l (the maximum value measured on September 12, 2001).[56]

Concentrations of PCBs in suspended sediments are in the range of tens ng/g. The highest concentration in the river Elbe was found in 2001 in Valy, (namely 240 ng/g) with higher values were found in sediments.

In the Bílina River in Ústí nad Labem the value was 2,300 ng/g. Due to aerial transport, concentrations in the order of tens ng/g are measured in places having no industry. In 1986, concentrations in the range from 15 to 40 ng/g were

Photo No. 4: Abandoned industrial area in Pardubice near Labe (Elbe) river. Downstream from Pardubice is Labe more burdened by PCBs. Lagoons with waste water in surrounding of chemical plants at this locality contain cocktail of different chemicals including PCBs.

found in Šumava. The more burdened watercourses include the Labe (Elbe), from Pardubice (see Photo No. 4) to its confluence with Vltava, which is significantly cleaner. However, the concentrations increase again downstream of the paper mill in Štětí and of Spolchemie in Ústí nad Labem.

Concentrations of PCBs in fish vary greatly from tens to thousands ng/g of fish tissue. Higher concentrations are connected with higher fat content in the given sample. Hygienic limit 500 ng/g is exceeded only exceptionally. However, some measured concentrations were higher by an order of magnitude. In measurements in 1999 - 2001, concentrations in tens ng/g were found.

In 1980s, fish from parts of rivers affected by accident in the coating plant in Rožmitál contained PCBs in concentrations 0.08 - 9.2 mg/kg of muscle.[57]

Concentrations of PCBs in underground water are under the detection limit, with the exception of contaminated places, such as, (for example), premises of the coating plant Modřec, where concentrations of indicator congeners of PCBs found in decontamination drill holes were from 0 to 23 μg/l (in 2000 - 2002).[58]

4.3.6 PCDD/Fs

Results of analyses of dioxin contents in surface water are relatively scarce in the Czech Republic. PCDD/Fs show very low solubility in water and they bind to sludge particles. A higher number of measurements were carried out in the vicinity of Spolana Neratovice where concentrations in the range from 0.1 to 12.3 pg WHO-TEQ/g were found. In samples of water from the premises of Spolana concentrations 166.3 and 1159.2 pg WHO-TEQ/g were found.[59]

In the case of sediments a higher number of results are available. There were results published of long-term monitoring within the framework of TOCOEN projects from three localities - from Košetice, Zlín, and Beroun. Further, data comes from measurement in the vicinity of Spolana Neratovice. Data from the TOCOEN projects are stated in the following Table No. 11.

Table No. 11: Dioxins and dioxin like-PCBs in sediments. Data from the TOCOEN projects. Data are in pg TEQ/g dry weight. [60]

Locality	Period	Number of samples	PCDD/Fs	DLPCBs
Košetice – 7 places	1996-2001	n=11	1.4	0.19
Zlín – 5 places	1993, 1996-98, 2001	n=5	1.64 (0.56-5.6)	0.4 (0.11-1.6)
Beroun – 16 places	2001	n=16	1.83 (0.21-11.2)	0.69 (0.11-8.37)

Concentrations in the range of approximately 10 to 100 pg WHO-TEQ/g were found in sediments in the river Elbe. The highest concentration was in samples of sediments from the premises of Spolana reached 15142.1 pg WHO-TEQ/g.[61]

In other localities of the Elbe basin, concentrations 0.9 - 12.3 pg WHO-TEQ/g were found.[62] A high value after floods was found in Litoměřice area (75.3 pg WHO-TEQ/g).[63]

The number of analyses of fish is low. Relatively low concentrations were found in the vicinity of Spolana before floods and after them, in the range from 0.5 to 1.1 pg WHO-TEQ/g.[64] Several further data are from the vicinity of Lysá nad Labem where increased contamination by PCDD/Fs and PCBs was found in various animal matrices. In four fish samples from this locality, the Czech Environmental Inspection Agency (ČIŽP) found PCDD/Fs concentrations in the range from 3.6 to 25 pg WHO-TEQ/g of fat.[65] The fish were bred in small ponds. High concentrations of PCBs were found in two samples of these fish and are probably connected with the illegal landfill of wastes with PCBs content in Milovice.

In Lužická Nisa in Liberec, concentration of dioxins in the amount of 0.9 pg WHO-TEQ/g of live weight (35.2 pg WHO-TEQ/g of fat) was found by analysis of trout commissioned by the Arnika Association.[66] Concentration of PCDD/Fs in a trout from Lampertický stream under the Jan Šverma mine was 13.1 - 16.2 pg WHO-TEQ/g of fat.[67]

Photo No. 5: Waste water treatment plant for Prague during the floods in August 2002. Waste water from Czech capitol city is considered as major contributor to PBDEs contamination in Vltava river.

4.3.7 PBDEs

In 2001 - 2003 a team from the Institute of Chemical Technology (VŠCHT) in Prague carried out extensive research on the content of BFRs in fish. Five species of fish were tested: chub, barbel, common perch, bream, and brown trout (Hajšlová, J. et al. 2003, 2004).[68, 69] Presentation of J. Hajšlová (2003) states that 50 analyses of composite samples of 270 fish were conducted.

The VŠCHT team analysed the content of 10 congeners of PBDEs (47, 49, 66, 85, 99, 100, 153, 154, and 183). The highest concentrations of PBDEs were found in fish caught in localities influenced by industrial companies (in the river Elbe in the locality of Valy - downstream of Pardubice) or by plants treating waste water from big cities (in Vltava in the locality of Klecany, downstream of the Prague waste water treatment plant).

Lower concentrations were found in fish in Štěchovice or also in Prague - Podolí. The highest concentrations, in relation to live weight, were found in milt of bream from the locality Klecany (57.97 ng/g of live weight). However, this is also caused by high fat content in milt. The highest concentration expressed in ng/g of fat was found in the muscle of bream (729.42 ng/g of fat).

During three years of research into the PBDEs content in fish and river sediment they also tested for the presence of congener 209, decabrominated diphenylether. This prevails in outlines of use of the individual groups of PBDEs in industry in the later years. Within the framework of the research, presence of this congener could not be found in sediments from Czech rivers.

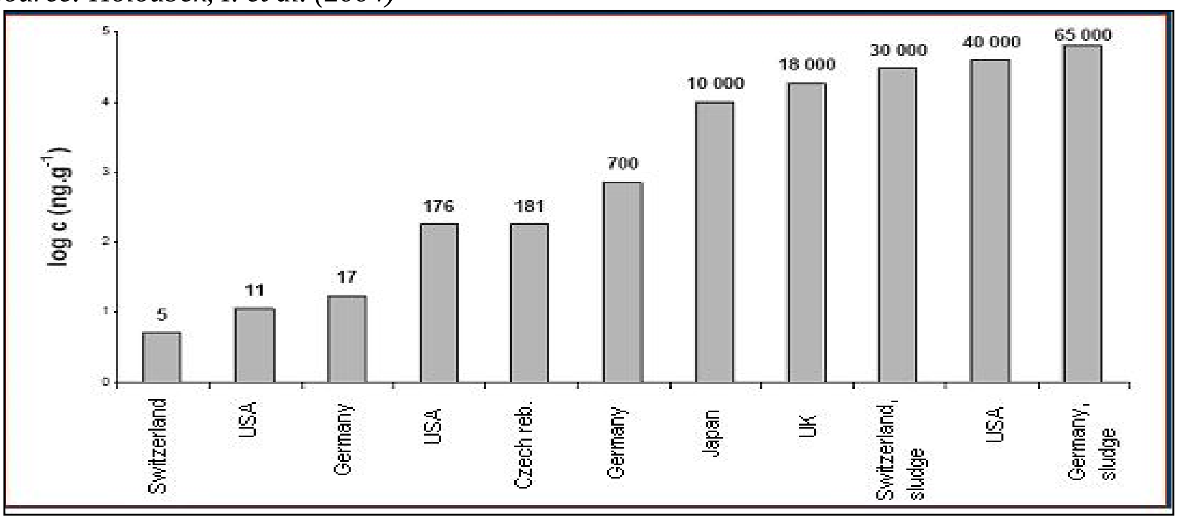
4.3.8 SCCPs (chlorinated alkanes C 10 - 13)

In 2001 and 2002, concentrations of chlorinated paraffin's with a short chain (C 10 - 13) were also monitored in fresh water sediments in the Czech Republic. The following concentrations were found: Košetice: ∑ C11-C13: 24 – 45.78 ng.g-1 of dry weight
Zlín: ∑ C10-C13: 16,30 – 180.75 ng.g-1 of dry weight, (6 samples > 100 ng.g-1 of dry weight)
Beroun: ∑ C10-C13: 4.58 – 34 ng.g-1 of dry weight (in 5 samples only). [70]

Comparison of values found in the Czech Republic with other states is given in the graph in Figure No. 17.

Figure No. 17: Concentrations of SCCPs in fresh water sediments from various countries.

Source: Holoubek, I. et al. (2004)[13]



III. SOURCES OF POLLUTION AND POPs RELEASES INTO THE ENVIRONMENT

5. Old environmental burdens

The term 'old environmental burden' designates the remains of human activity with negative environmental impacts, such as pollution of underground water, contamination of soils and buildings. A risk analysis is to be worked out for assessment of risks connected with pollution of rock environment (soils, underground water, soil atmosphere), building constructions, and waste landfills, generally designated as environmental burdens. Decisions on decontamination of the burden is then based on this analysis. In 1996, the Ministry of the Environment issued a methodical instruction setting limits of hazardous substances in surface and underground water and in soils.[71] If limit C is exceeded, decontamination intervention is necessary.[j]

Because numerous companies in the Czech Republic used PCBs in their production or in their equipment, cleaning of these substances also forms a part of costs for cleaning of old environmental burdens. Two such examples are given in Chapter 4.3, in its part concerning water pollution by PCBs. In addition to PCBs, many preparation plants and stores of pesticides were on the territory of the Czech Republic. There were also two plants where pesticides were produced (Spolana Neratovice and Spolchemie in Ústí nad Labem). Wastes with POPs content may be found in certain old, unsecured waste landfills. Table No. 12 shows a list of certain burdens where pesticides have a share in the pollution. In Spolana Neratovice, in addition to high concentrations of POPs pesticides (DDT, HCB, HCHs), high dioxin concentrations were found in buildings where sodium salt of 2,4,5-T[k] was produced in the past. Through resellers, this substance was supplied from here, among others, for the production of Agent Orange. One of three buildings of the old production of pesticides was run in concrete sarcophagus. The remaining two buildings will be decontaminated by the company SITA Bohemia, using BCD technology (see below).

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[j] Explanation of limits A - C of the Methodical Instruction of the Ministry of the Environment of the Czech Republic: According to the Methodical Instruction of the Ministry of the Environment of July 3, 1996, exceeding of limits of category A in soils (and underground water) is regarded as pollution of the given environmental component, with the exception of areas with naturally increased content of the substances in question. Exceeding of limits B is regarded as pollution which can have negative impact on human health and the individual environmental components and which requires further measures. Exceeding of limits C represents pollution which can pose a substantial risk of endangering of human health and environmental components and requires a preventive intervention.

[k] 2,4,5-trichlorophenoxyacetic acid

Table No. 12: List of other sites contaminated by POPs and other pesticides according to districts (some were cleaned up, but it is not specified how). Source: I. Holoubek et al. 2004. [72]

Locality (district)	Character of contamination
Bedrč (Benešov) *]	DDT thrown in old well, new case
Václavice č.p. 9 (Benešov)	Contamination by HCHs, DDE, DDT, DDD, HCB found – demolition and remediation started (this building owner is State Estate Jeneč)
Šebánovice u Vrchotových Janovic (Benešov) *]	Former pesticide storage of Agricultural Cooperative (JZD) Vrchotovy Janovice. There is a decision of the Czech Inspection for Environment to remediate that is not yet finished.
Hodonín u Nasavrk – hazardous waste landfill (Chrudim) *]	Hazardous waste landfill contains used packaging for pesticides (contaminated by petroleum compounds, organochlorine pesticides, DDT and PCBs. In CHKO (Landscape and Nature Protected Area) Železné hory - in Mniška larger underground water contamination at deep levels was found.
Zájezdec (Chrudim)	Obsolete pesticides (including DDT) from this village were brought to Aliachem a. s. OZ Synthesia Pardubice
Horšovský Týn (Domažlice) *]	Serious contamination by pesticides and petroleum compounds.
Dešná (Jindřichův Hradec) *]	Petroleum hydrocarbons in six sub-localities and pesticides in two sub-localities; remediation of non-saturated zone finished, underground water remediation focused on petroleum compounds continues.
Hájek u Ostrova nad Ohří (Karlovy Vary)	Dump of the Hájek mine near Ostrov nad Ohří was contaminated by residues from pesticides production in Spolana Neratovice. HCH and chlorobenzenes were measured in surrounding of dump. Source: Hešnaur, L., Jech, J. 2001.
Luby u Klatov (Klatovy) *]	See Annex 4.
Neratovice - chemical plant Spolana (Mělník) *]	High levels of 2,3,7,8 tetrachlorodibenzo-p-dioxin, by-product of pesticides production, mercury contamination approximately 265 tons; and organochlorine pesticide contamination. Pilot decontamination of former pesticides production unit by using BCD technology was accomplished. Full project is going to start in January 2006. See text bellow and tables 13.

Table 12 Continued

Myšlín u Mnichovic (Praha-West) *]	Storage - petroleum compounds, pesticides and chlorophenols exceed limit C according to Ministry of Environment Methodological Instructions.
Dubno (Příbram) *]	Pesticides
Vranová Lhota - underground storage of hazardous waste (Svitavy)	Vranová Lhota was well known hazardous waste landfills in the district Svitavy in a former underground mine. There were also obsolete pesticides based on DDT and mercury compounds dumped. Remediation finished by Spring 2002.
Chabařovice – former hazardous waste landfill for Spolchemie (Ústí nad Labem)	HCB produced in Spolchemie chemical plant as by-product during the production of epichlorohydrin was stored on Chabařovice haz. waste landfill until the end of year 1992. Real amount of stored HCB is not known. Landfill is going to be covered and monitored.
Všebořice - current storage of hazardous waste for Spolchemie (Ústí nad Labem)	HCB from Spolchemie Ústí nad Labem was stored in its new hazardous waste landfill in Všebořice in the period 1992 -1999. Full amount of HCB produced as a by-product stored in Všebořice during this period was 300 tons. It was stored in plastic containers and covered by a sand layer between them and by a fly ash and cement mixture on the top.
Ústí nad Labem - Spolchemie - chemical plant (Ústí nad Labem)	Chemical plant area itself is probably contaminated by organochlorine pesticides and HCB. Mercury contamination remediation is planed to start soon and will continue for 12 years, beginning in 2004. HCB was burned in hazardous waste incinerator MEGAWASTE – EKOTERM, spol. s r. o. Prostějov since the year 2000.

*] Localities taken from priority list of contaminated sites prepared by Department for Contaminated Sites of the Czech Ministry of Environment (version updated to 2002). All data to middle of year 2003.

5.1 Economic costs for decontamination of old environmental burdens

Decontamination of old environmental burdens is financed from funds gained during the privatisation of industry after 1990. Till the end of 2005, these funds were administrated by the National Property Fund, which also co-ordinated commissioning of decontamination works. An article of M. Martinovičová (2005) analysed its activity. Substantial part of the article is copied below:[73]

"According to the concluded contracts, the National Property Fund should pay 150 billion CZK for

cleaning up of old environmental burdens. Up to March 2005, it had provided only a fraction of this sum and, in the same year, it ceased to exist as an institution. Its environmental obligations were taken over by the Ministry of Finance. For the cleaning up of environmental burdens the National Property Fund (FNM) should have used returns from private companies that had caused the burdens by their former activities. However, the situation in practice is different. The returns amounting to hundreds of billions vanished, and in more than 10 years, FNM hardly covered a seventh of the guaranteed amount. Specifically, less than 22 billion from the guaranteed 156 billion CZK.

In spite of this state officials are optimistic. According to a statement of the Public Relations Department of FNM, the given environmental guarantees will not burden the state budget, because money from further privatisation of state companies will be transferred to a special account of the Ministry of Finance. From this account the possible meeting of guarantees will be financed in future years.

Since 1991 to this January, the Fund concludes in total 275 environmental contracts and obligations amounting to 156 billion. In addition to obligations ensuing from Government decisions this sum includes also debts of the Fund, ensuing directly from sale contracts.

Approximately 200 cases are under way.

The National Property Fund already finished 67 environmental contracts, with the total amount of guarantees almost seven billion CZK.

Table No. 13: Allocation of FNM funds on cleaning up environmental burdens. Source: FNM[74]

		January 2005	**In total from 1991 till January 30, 2005**
Contractual guarantees approved by the Government	Number	0	270
	Amount of guarantees (in million CZK)	0	143,694.23
Concluded environmental contracts (FNM of the Czech Republic/assignee), and obligations from sale contracts	Number	0	275
	Amount of guarantees (in million CZK)	0	156,072.18
Environmental contracts which were cancelled	Number	0	8
	Not provided guarantee = saving (in million CZK)	0	2,196.78

Table 13 Continued

Finished environmental contracts	Number	1	67
	Not provided guarantee = saving (in million CZK)	0	5,277.31
	Amount of guarantees (in million CZK)	1.26	6,777.28
Current state of guarantees and contractual obligations	Number	-	200
	Amount of guarantees (in million CZK)	-	147,098.12
Settlements made from the funds of FNM of the Czech Republic (in million CZK)	For supervision	2.48	534.11
	Decontamination and other works	595.33	21,410.49
	In total	597.81	21,944.60

…Currently, 200 guarantees amounting to 147 billion CZK are "running". According to the statement of the Public Relation Department of the Fund, they will be transferred to newly established special department of the Ministry of Finance. This department is now being under construction and its exact name has not been set yet. Apparently, in this year (Note: year 2005), *a minimum of new contracts on guarantees for environmental burdens will be concluded, however, also a minimum number of the current contracts will be finished. It means that the Ministry of Finance must take into account that it will take over ca 200 contracts on guarantees for environmental burdens, which it will have to further work at, and settle.*

Allegedly, the procedure will not be changed.

According to Act No. 171/1991 Coll., the Fund uses its property for covering costs connected with cleaning up of environmental burdens caused by the activities of companies. It means that this is not a provision of means from state budget, but the use of a part of returns from privatisation of state property. It is also subject to the Act on Public Procurement.

In this connection, there exists an obligatory procedure, according to which the Fund concludes an environmental contract with the assignee of the privatised property, on the basis of a decision on privatisation, and after approval of the guarantee by the Government. According to a statement of the Fund, the cleaning up of old environmental burdens is based on approved environmental audits including research, risk analysis, and administrative decision issued by independent Czech Environmental Inspection Agency and subsequent decontamination works themselves." So much for the article on ensuring of finances for decontamination of old environmental burdens.

Photo No. 6: BCD CZ (a daughter company of SITA) facility in Spolana Neratovice.

5.2 Decontamination of dioxin burden in Spolana Neratovice

BCD technology was chosen for decontamination of buildings A1030 and A1420, contaminated by dioxins and POPs pesticides, in Spolana Neratovice. Although the possibility to use GPCR technology was also available, the company operating this technology in the time of decision-making was not invited to participate in the tender at all.[75] Pilot project of decontamination was implemented by SITA and BCD CZ between August 15 and October 2, 2003. The technology (see Photo No. 6) is composed of two basic units:

- Unit of indirect thermal desorption - ITD, separating contaminants from soil, construction debris, and other solid materials, and

- BCD reactor, where destruction of contaminants obtained by the ITD process, as well as of chemicals which remained in the buildings from pesticides production, takes place.

Results of the pilot project are described in a report dated November 2003.[76] Two summary tables from the report are presented below. The first of them (Table No. 14) demonstrates efficiency of cleaning of the burden from dioxins, the second one (Table No. 15) describes efficiency of destruction of HCB and Lindane.

Within the framework of the pilot project, dioxin measurements in output gas from the ITD technology and in output gas from the BCD technology were carried out. The measured values were 0.0312, and 0.0201 ng I-TEQ/m^3, respectively.

Table No. 14: Efficiency of dioxin destruction in the BCD pilot project in Spolana Neratovice.

Input material	**Input ng/g TEQ**	**Treated mixture of oil and sludge ng/g TEQ**
Chemicals (ref. BCD 2)	209	0[1]
Chemicals (ref. BCD 3)	200	0.0043
Chemicals (ref. BCD 4)	11	0.00023
Chemicals (ref. BCD 5)	84	0.23
Chemicals (ref. BCD 6)	47	0[1]
Chemicals (ref. BCD 7)	35	0[1]
Dust (ref. BCD 8)	1.620	0.00052
Condensate from ITDU (ref. BCD 9)		
Water fraction	96 ng/ml	
Organic fraction	876 ng/g	
Treated product from the mixture		0[1]
Chemicals (ref. BCD 10)	78	0[1]

Table No. 15: Efficiency of HCB and Lindane destruction in the BCD pilot project in Spolana Neratovice.

Input material	**Input mg/kg**		**Treated mixture of oil and sludge mg/kg**	
	HCB	Lindane	HCB	Lindane
Chemicals (BCD 2)	29,000	1,500	<1.0[1]	<1.0[1]
Chemicals (BCD 3)	200,000	900	<2.0[1]	<2.0[1]
Chemicals (BCD 4)	550,000	1,000	<2.0[1]	<2.0[1]
Chemicals (BCD 5)	25,000	1,100	<2.0[1]	<2.0[1]
Chemicals (BCD 6)	270,000	1,000	<2.0[1]	<2.0[1]
Chemicals (BCD 7)	160,000	1,000	<2.0[1]	<2.0[1]
Dust (BCD 8)	7,600	7	<2.0[1]	<2.0[1]
Condensate from ITDU (BCD 9)				
Water fraction	630		<2.0	
Organic fraction	11,000		<2.0	
Treated product from the mixture			<2.0[1]	<2.0[1]
Chemicals (BCD 10)	1,598	19,532	<2.0[1]	<2.0[1]

The output data cannot be used for overall evaluation of efficiency of POPs destruction in view of the fact that a part of materials and wastes will be destroyed in hazardous waste incinerator SPOVO Ostrava, partially owned by the SITA company. Efficiency of POPs destruction in the incinerator was not assessed in the time of the pilot project. The Arnika Association estimated at least 52 tons of materials, which were planned to be incinerated in untreated form, will first be subjected to decontamination by the BCD technology, and that the limit for dioxins (PCDD/Fs) in water discharged from a special waste water treatment plant into sewerage system of Spolana was tightened to 2.5 ng I-TEQ/l from the initial 5 ng I-TEQ/l. Based on a request of the Arnika Association, DDT concentrations will be measured in emissions into air.[77]

6. Newly created environmental burdens

In order to prevent the creation of new hotspots, it is necessary to complete a inventory of emissions to wastes and to water. It is simply not known where a portion of wastes containing POPs 'vanishes' to in the Czech Republic. They could possibly become part of new construction products, certified by a competent authorised entity. Unfortunately, we did not find to-date any case in which POPs content in the waste in question had been taken into consideration within the framework of certification, even in cases when the presence of these substances was certain. This concerns, for example, wastes from end technologies of flue gases treatment. Only in some of the plants was it possible to discover where these wastes actually ended up. Some details are published in studies by the Toxics and Waste Programme of the Arnika Association in August 2004.[78, 79]

In selected cases of the management of these residues we have shown that movement of these wastes is not sufficiently controlled and there does not exist sufficient measures to prevent POPs dispersal into the environment. Another example is management of sewage sludge from Spolchemie Ústí nad Labem which can contain high HCB concentrations. Thanks to a certificate of an authorised entity even this sludge could become part of a product and, in this way, escape control applying to movement of wastes. More details are given below in case studies.

6.1 Wastes as a source of POPs contamination of the environment

Sources of contamination of the environment by substances to which the Stockholm Convention applies are emissions from the individual processes, the importance of which is specified by the Stockholm Convention - and old stocks of these substances deposited in stores and landfills. Equipment and buildings that came into contact with these substances are another source of contamination as are materials and products from countries where these substances are still in use (for example for treatment of cotton).

Photo No. 7: In this building in Tachov (in Plzeň Region) is stored waste with PCBs. Such places can be source of contamination by PCBs.

The following tables (Nos. 16 - 18) are an overview of wastes that can contain POPs. Chapter 8.5 deals with POPs quantities that can be present in some categories of wastes.

Concerning organochlorine pesticides: Their production was banned in the Czech Republic. However, old stocks of these substances are often discovered. The following tables contain lists of wastes where these substances could be present..

Hexachlorobenzene was used as a fungicide but it is also formed as a by-product in production of certain chemicals. As an industrial product it was used in production of pyrotechnics, synthetic rubber, and aluminium.[80] The area of Spolchemie Ústí nad Labem is highly contaminated. HCB contamination was found also in Spolana Neratovice. A list of wastes which can contain HCB is given in the Table No. 17.

Table No. 16: Overview of waste categories which can contain aldrin, chlordane, DDT, dieldrin, endrin, HCB, HCHs, heptachlor, mirex, toxaphene. Source: Programme of reduction of surface water pollution by dangerous substances and particularly dangerous harmful substances.[81]

Catalogue number	Description
07 04 16 05 08*	Wastes from the manufacture, formulation, supply and use of organic pesticides (except wastes listed under Nos. 02 01 08 and 02 01 09), wood preserving agents (except wastes listed in subgroup 03 02) and other biocides Discarded organic chemicals consisting of or containing dangerous substances
16 07 09*	Wastes containing other dangerous substances (Wastes from transport and storage tanks and barrels cleaning, except wastes listed in groups 05 and 12)
20 01 19*	Pesticides (Separately collected fractions, except wastes listed in subgroup 15 01)

Table No. 17: Overview of waste categories which can contain HCB. Source: Programme of reduction of surface water pollution by dangerous substances and particularly dangerous harmful substances. [82]

Catalogue number	Description
06 07	Wastes from the manufacture, formulation, supply and use of halogens and halogen chemical processes
07 01 03*	Organic halogenated solvents, washing liquids and mother liquors
07 01 07*	Halogenated still bottoms and reaction residues
07 01 09*	Halogenated filter cakes and spent absorbents
15 01 10*	Packaging containing residues of or contaminated by dangerous substances
16 05 08*	Discarded organic chemicals consisting of or containing dangerous substances
16 07 09*	Wastes containing other dangerous substances (Wastes from transport and storage tanks and barrels cleaning, except wastes listed in groups 05 and 12)

Photo No. 8: In the former Soviet Army military base Milovice was at he beginning of 1990-ies placed never working hazardous waste incinerator. Only result was unsafe POPs waste stockpile including PCBs waste. This photo was taken at the beginning of 2004.

In the Czech Republic PCBs were used on a broad scale until their production was stopped in 1983. They were used as plasticisers, in manufacture of carbon-free copy paper, lubricators, Indian ink, impregnation materials, paints, glues, waxes, additives for cements and plasters, materials for lubricating casting moulds, materials for dust separators, sealing liquids, flame retardants, immersion oils, and pesticides. From these applications they could be freely released into the environment.

Table No. 18: Overview of waste categories which can contain PCBs. Source: Programme of reduction of surface water pollution by dangerous substances and particularly dangerous harmful substances. [83]

Catalogue number	Description
13 01 01*	Hydraulic oils containing PCBs
13 03 01*	Waste insulating or heat transmission oils containing PCBs
13 03 06*	Mineral-based chlorinated insulating and heat transmission oils other than those mentioned under number 13 03 01
13 05	Wastes from oil/water separators
15 01 10*	Packaging containing residues of or contaminated by dangerous substances
16 01 09*	Components containing PCBs (End-of-life vehicles – car wrecks)
16 02 09*	Transformers and capacitors containing PCBs
16 02 10*	Discarded equipment containing or contaminated by PCBs other than those mentioned under number 16 02 09
16 02 13*	Discarded equipment containing hazardous components other than those mentioned under numbers 16 02 09 to 16 02 12
16 02 15*	Hazardous components removed from discarded equipment
16 05 08*	Discarded organic chemicals consisting of or containing dangerous substances
16 07 09*	Wastes containing other dangerous substances (Wastes from transport and storage tanks and barrels cleaning, except wastes listed in groups 05 and 12)
17 09 02*	Construction and demolition wastes containing PCBs (for example PCB-containing sealants, PCB-containing resin-based floorings, PCB-containing sealed glazing units, PCB-containing capacitors)

Table No. 19: Overview of up-to-now results of inventory taking of equipment which contain or can contain PCBs. In many cases the inventory was not finished yet. [84]

Region	Total amount of PCBs in tons	Number of entities operating or owning equipment with PCBs
Capital City of Prague	14.46	10
Region of Central Bohemia	47.52	13
Region of South Bohemia	23.90	12
Plzeň Region	34.51	8
Karlovy Vary Region	3.73	4
Ústí Region	55.65	17
Liberec Region	1.87	9
Hradec Králové Region	14.71	33
Pardubice Region	9.60	28

Region	Total amount of PCBs in tons	Number of entities operating or owning equipment with PCBs
Region Vysočina	2.95	19
Region of South Moravia	30.77	25
Olomouc Region	30.24	15
Zlín Region	12.28	10
Region of Moravia-Silesia	188.72	19

Table No. 20: Overview of waste categories which can contain PAHs. Source: Programme of reduction of surface water pollution by dangerous substances and particularly dangerous harmful substances. [85]

Catalogue number	Description
01 04 07*	Wastes containing dangerous substances from physical and chemical processing of non-metalliferous minerals
01 05 05*	Oil-containing drilling mud's and wastes
03 02 01*	Non-halogenated organic wood preservatives
05 01	Wastes from petroleum refining
05 06	Wastes from the pyrolytic treatment of coal
06 13 05*	Waste soot from combustion
07 01 01*	Aqueous washing liquids and other liquors (Wastes from the manufacture, formulation, supply and use of basic organic chemicals)
07 01 08*	Other still bottoms and reaction residues
07 02	Wastes from the manufacture, formulation, supply and use of plastics, synthetic rubber and man-made fibres
10 08	Wastes from other non-ferrous thermal metallurgy
13 02	Waste engine, gear and lubricating oils
13 07	Wastes of liquid fuels
13 08	Oil wastes not otherwise specified
15 01 10*	Packaging containing residues of or contaminated by dangerous substances
16 01 07*	Oil filters (End-of-life vehicles - car wrecks)
16 05 08*	Discarded organic chemicals consisting of or containing dangerous substances
16 07 08*	Wastes containing oil
17 03	Bituminous mixtures, coal tar and tarred products
19 01	Wastes from incineration or pyrolysis of waste
19 03	Stabilised/solidified wastes
19 11	Wastes from oil regeneration

However, PCBs were also used in closed systems, as cooling liquids in transformers, dielectric liquids in small and large capacitors, fireproof and heat-carrying anticorrosion hydraulic liquids in mine equipment and vacuum pumps, heat-carrying media. They are still used in this manner.

In recent years and inventory of such equipment was taken. These hazardous wastes, which must be disposed of safely, have catalogue numbers listed in the following Table No. 18 and gradually their disposal is taking place.

The Ministry of the Environment of the Czech Republic also took an inventory of equipment containing PCBs contacting 899 companies for information.

In 227 facilities (owning entities) was confirmed 492.9 t of PCBs in different equipment. Table No. 19 states amounts of PCBs (fillings) in the individual regions of the Czech Republic updated to 31st January 2005.

The specification of wastes which can contain PCDD/Fs for the Czech Republic does not exist. However one was prepared for the EU countries.[86] Generally, it can be said that high concentrations of PCDD/Fs can be found in wastes at industrial facilities which are regarded as a significant source of these substances. There is scant data on content of PCDD/Fs in wastes in the Czech Republic. High concentra-tions have been found for example, in fly ashes from waste incinerators, and in sewage sludge. There were four samples of sewage sludge in the Czech Republic with measured results in a range from 21.2 – 280.2 pg TEQ/g of dry matter (2001).[87] Sewage sludge can be indirectly contaminated by PCDD/Fs releases from fly ash that are put on landfills which use municipalities waste water treatment plants to clean up waste water ??[88]

Ash and soot from households can be contaminated by dioxins, especially when chemically treated wood or wastes have been burned. Also the remains after a fire can be highly contaminated, especially if PVC (electrical wiring, etc.) was burned. Enormously high concentrations were found in the old departments of Spolana Neratovice and in neighbouring soil.

The Table No. 20 lists wastes that can contain PAHs. The Stockholm Convention does not apply to them but they are monitored within the framework of the Convention on Long-Range Transboundary Air Pollution (LRTAP).

6.2 Case studies of management of wastes containing POPs in the Czech Republic

6.2.1 Case of municipal waste incinerator Termizo Liberec – the problem of certification of products made of waste from incinerators

The Termizo incinerator has a projected capacity of 96,000 tons per year. Flue gases treatment has been carried out in three stages since 2003. The first stage is an electrostatic filter, in the second stage the flue gases are treated in two-stage gas washer, and the third stage is a fabric filter for capture of dioxins (GORE-TEX).

Photo No. 9: Fly ash and bottom ash mixture sampling at bicycle path in the Protected Landscape Area Jizerské hory.

At present, the incinerator meets the emission limit for dioxins, 0.1 ng TEQ/m^3. Maximum value of dioxin emissions from this incinerator amounting to 7.3 ng TEQ/m^3, was measured in 2000.

The incinerator produces 370 to 385 kg of ash matter per a ton of incinerated waste (2002, 2003). This represents ca 35,700 tons of hazardous waste per year (without separated iron). The Regional Authority of the Liberec Region allowed the incinerator to mix bottom ash and washed fly ash.

In 2002, Termizo received a certificate for the mixture of bottom ash and fly ash and for its use in the building industry according to Act No. 22/1997 Coll., on technical requirements on products. This certificate enabled the incinerator operators to use 33,818 tons of a heavily contamination product in construction in 2003. In 2004 and 2005, the incinerator was selling this product without a valid certificate. When Arnika called attention to this fact, the certificate was quickly re-issued to the company.
During the certification the possible release of dioxins and other POPs into the environment was not assessed. Ca 5 g TEQ PCDD/Fs ends in the mixture of bottom ash and fly ash from the Liberec municipal waste incinerator per year.

The mixture from the Liberec incinerator has even been used for the construction of a bicycle path in the Protected Landscape Area Jizerské hory. Another example is its use in the construction of a road to a waste landfill in Frýdlant area. Here the ash can be found quite loose in a heap.

In 2005, Arnika took 2 samples of this "product" and the results of their analyses for POPs content are presented in Table No. 21.

Table No. 21: Content of POPs in the mixture of bottom and fly ash from the incinerator in Liberec used as a construction material. Samples were taken in Frýdlant area.

Place of sampling	PCDD/Fs in pg WHO-TEQ/g	PCDD/Fs inv pg I-TEQ/g	PCBs in pg WHO-TEQ/g	Total TEQ in pg WHO-TEQ/g	HCB in ng/g	PBDEs in ng/g
Oldřichov v Hájích	66	57.6	1.6	67.6	0.53	0.714 (2.715)
Větrov	134.2	122	8.6	142.8	2.1	5.849 (6.849)

Table No. 22 shows the levels of dioxins discovered in wastes produced by the municipal waste incinerator in Liberec in year 2000.

Table No. 22: Results of measurements of dioxin contents in bottom ash and fly ash in Liberec[89, 90].

Type of waste	Measurement No. 1 ug I-TEQ/kg	Measurement No. 2 ug I-TEQ/kg
bottom ash (2911)	0.00437	0.0197
treated fly ash (2912)	0.362	0.363
mixed bottom ash with treated fly ash (2913)	0.062	0.066

Type of waste	Measurement No. 1 ug I-TEQ/kg	Measurement No. 2 ug I-TEQ/kg
boiler ash (11249)*	0.0113	-

According to the provisional guidelines for POPs waste adopted by the Basel Convention, it is not necessary to treat the waste in any special way if it does not contain dioxins in concentrations higher than 15 ug I-TEQ/kg dry weight.[91] In the case of adoption of low POP levels according to Basel Convention, the Stockholm Convention will fail to protect the environment from releases of dioxins in fly ashes produced by the waste incinerator in Liberec.

6.2.2 Case of mine Jan Šverma near Žacléř

Fly ash from the municipal waste incinerator in Liberec was not managed in accordance with the best available practice in 2000 - 2001. According to a report of district authorities, in 2000 the Termizo company handed its wastes over to INGEO, a limited liability company who subsequently transported them to GEMEC Union, a joint-stock company, which had secured the use of the underground space of former bituminous coal mine Jan Šverma near Žacléř. In addition to fly ash from the Liberec waste incinerator, wastes from other incinerators (for example, Lysá nad Labem) was dumped in the mine. Also in the case of the Jan Šverma mine the possibility of dioxin releases was not assessed.

Sewage sludge from Spolchemie Ústí nad Labem, which can also contain high concentrations of HCB, was dumped in the mine. Analyses of trout near the mine was commissioned by the Arnika Association in 2004 and this detected presence of PCDD/Fs, PCBs and HCB (see Table No. 23).[92,93]

Table No. 23: Results of analyses of trout caught in Lampertice stream in 2004 for POPs content.

Sample designation	Dioxins (PCDD/Fs) in pg WHO-TEQ/g of fat		PCBs (indicator congeners) in ng/g of fat	PCBs in pg WHO-TEQ/g of fat	Laboratory
trout - I	13.1 – 16.2		3,660	106	Axys-Varilab
trout - II - kidney	-		-	-	Ecochem
trout - III	-		1,828	-	VŠCHT
	Hexachloro-benzene in ng/g of fat	**Mercury in mg/kg**	**Sum of PBDE in ng/g of fat**	**Sum of PBDE in ng/g of live weight**	
trout - I	462	-	-	-	Axys-Varilab
trout - II - kidney	-	0.03	-	-	Ecochem
trout - III	619	-	55	0.76	VŠCHT

6.2.3 Case of SAKO Brno and case Mydlovary

Photo No. 10: A waste mixing plant of the QUAIL company in Hůrka near Temelín Nuclear Power Plant, where also fly ashes from waste incinerators is used to prepare product used in Mydlovary then.

The municipal waste incinerator in Brno is the first solid municipal waste incinerator in the Czech Republic to meet the emission limit for dioxins 0.1 ng TEQ/ m^3.

According to the annual report of the SAKO company, efficiency of flue gases treatment in this incinerator is in the range from 97.3 to 99.7 %. Approximate amount of dioxins in fly ashes can be determined on the basis of data published in the EIA documentation, prepared as a base document for application for financial support from the ISPA fund.[94] Dioxins concentration in flue gases during failure of flue gases treatment was 4.634 ng TEQ/ m^3, which means dioxins concentration at the time when flue gases treatment was functional was 0.075 ng TEQ/ m^3. It can be estimated from these data that the incinerator emits on average, ca 45 ng TEQ of dioxins per a ton of incinerated waste into solid wastes, and 0.7 ng TEQ of dioxins per a ton of incinerated waste into air.

These values correspond to dioxins concentrations found in solid wastes from the incinerator in Liberec. There follows from these data that municipal waste incinerators in the Czech Republic produce approximately 5 g I-TEQ of dioxins per 100,000 tons of incinerated waste, and majority of which ends up in solid wastes.

The amount of waste incinerated in the Brno incinerator, the production of hazardous wastes and the way of disposal thereof in 1998 to 2002 are given in Table No. 24. Information for the years 2002 and 2003 is available from a Report on Waste Production and Management of the QUAIL company.

Table No. 24: Flows of selected wastes in the SAKO incinerator in 1998 to 2002.

Year	**Incinerated waste** (t/year)	**Hazardous waste production** (amount, source) 190103+190107 (t/year)	**Transfer of hazardous waste** (amount, district) 190103+190107 (t/year)
1998	119,123	4,040.33 (ISOH, Brno-city)	re-categorised as other waste
1999	106,401	3,520.46 (ISOH, Brno-city)	3,520.46 (ISOH, České Budějovice)
2000	105,050	3,533.47 (ISOH, Brno-city)	3,533.47 (ISOH, České Budějovice)

Year	Incinerated waste (t/year)	Hazardous waste production (amount, source) 190103+190107 (t/year)	Transfer of hazardous waste (amount, district) 190103+190107 (t/year)
2001	99,303	3,589 (probably into Hodonín district)	3,589 (probably into Hodonín district)
2002	112,051	3,911.23 (except END product)	3,911.23 (2,083.84 to Týn nad Vltavou)

It is also not known where the contaminated fly ashes from the incinerator SAKO Brno are disposed of. The incinerator operators hand them over to the company QUAIL INGENIERING which probably uses them again in its products. Apparently, it uses them in a liquid settling basin in Mydlovary. This happens despite the decision of the authorities that these wastes must not be put there. Unfortunately, according to the available information, fly ashes from the Malešice incinerator in Prague also end up there. After Arnika stopped them being deposited in the Žacléř area, they simply disappear to another place.

7. Integrated pollution register as a source of information on POPs releases

Integrated Pollution Register (IPR) is a database which provides detailed information on the use and releases of chemical substances hazardous for the environment or human health. Anybody can thus find in one location the collected data showing the amount of these substances each specific industrial or agricultural company releases into the environment yearly. In the Czech Republic, the Register was introduced by the Act No. 76/2002 Coll. on integrated prevention, and Government Order No. 368/2003 Coll. specified its content.

7.1 Results of analysis of data from the IPR

For the first time, data reported by the individual companies into the Czech IPR were published on the internet page http://www.irz.cz on September 30, 2005. In total, reports on releases and transfers of chemical substances were provided by 871 plants from the whole Czech Republic. This Chapter is based on analysis of data from the IPR.[95]

In our analysis, only chemical substances and groups thereof, to which the Stockholm Convention applies, were included into the list of POPs from the IPR. It is a relatively conservative list of these substances. The Czech IPR concerns only the following substances: hexachlorobenzene, dioxins (PCDD/Fs), polychlorinated biphenyls (PCBs), aldrin, endrin, DDT, dieldrin, and heptachlor. From the twelve substances present on the list of the Stockholm Convention, the Czech IPR does not include toxaphene, mirex, and chlordane.

Photo 11: Prague Municipal Waste Incinerator in Malešice reported 8 g I-TEQ of dixins in wastes for year 2004.

Table No. 25 should comprise of a sequence of the biggest polluters of the environment by dioxins (more exactly, by polychlorinated dibenzo-p-dioxins and dibenzofurans, i.e., PCDDs and PCDFs). The conditional mood in the previous sentence is used because it is obvious that not all the plants which should reported amounts of dioxins in wastes and waste water into the IPR had not done so. These substances are not monitored in these components, although it is required by the Regulation of the European Parliament and Council No. 850/2004/EC on POPs brought in force in the Czech Republic in 2004. Unfortunately the state administration does not insist on the measurement of dioxins and other POPs in wastes in many cases. Consequently (for example) the Liberec municipal waste incinerator Termizo, joint-stock company, did not report dioxins in wastes into the IPR.

However, according to an estimate of a study of the Arnika Association[96], dioxins are contained in wastes in the order of hundreds grams I-TEQ.[l] With the exception of the incinerator in Malešice (it reported 8 g I-TEQ in wastes in 2004), the plants included in the first ten were listed there due to dioxin emissions into air.

A simple sum of dioxin emissions into air from the first eight plants amounts to 579 g I-TEQ. However, according to the calculations of the team of authors of the NIP of the Stockholm Convention in the Czech Republic, the total emissions of these substances to air in 2001 were 179 g I-TEQ.[97] But data of the three biggest polluters by dioxins in the IPR are calculated on the basis of measurements. Therefore, it is obvious that a mistake has been made somewhere.

One notable flaw in the IPR is the setting of too high limits for reporting of dioxins (1 g I-TEQ per year). In the United Kingdom, the limit for reporting of dioxins is one hundred-times lower. If the same limit for reporting were introduced in the Czech Republic, data of the IPR would provide better information on polluters by these substances.

The number of plants that reported dioxins in releases and transfers corresponds to the present level of limits for reporting, and also to the level of checking of the obligation to measure dioxins in wastes from the state administration authorities. This number is only 20. The absurd figure of 6.7 kg I-TEQ of dioxins in emissions into air, reported by Válcovny plechu, a.s. Frýdek-Místek, was deleted from the IPR after Arnika criticised it on the internet[m].

Table No. 25: Sequence of plants according to the amount of dioxins (PCDD/Fs) in total releases (emissions into air, water, and soil), and transfers (wastes and waste waters handed over out of the plant) according to data published in the Integrated Pollution Register for the year 2004 (http://www.irz.cz).

Sequence	**Organisation/Company**	**Plant (locality)**	**Amount of substances in g I-TEQ**
1.	TŘINECKÉ ŽELEZÁRNY, a.s.	Třinec	240.0
2	ŽDB, a.s.	ŽDB, a.s., Bohumín	190.0
3.	VYSOKÉ PECE Ostrava, a.s.	VYSOKÉ PECE Ostrava, a.s.	52.0

[l] I-TEQ = International Toxic Equivalent, to which the measured total values of concentrations of 17 toxic dioxin congeners in the environment are converted.
[m] News item of September 30, 2005

Sequence	Organisation/Company	Plant (locality)	Amount of substances in g I-TEQ
4.	Elektrárny Opatovice, a.s.	Power plant Opatovice	27.1
5.	KOVOHUTĚ MNÍŠEK, a.s.	KOVOHUTĚ MNÍŠEK, a.s., Mníšek pod Brdy	27.0
6.	Slezský kámen, a.s.	Slévárna Písečná	23.0
7.	Teplárny Brno, a.s.	Plant Brno-north, Brno, Obřanská	10.4
8.	Mittal Steel Ostrava a.s.	Mittal Steel Ostrava a.s.	10.0
9.	Pražské služby, a.s.	Malešice incinerator	8.0
10.	TOS-MET, spol. s r.o.	TOS-MET, spol. s r.o., Čelákovice	4.2

In total, 53 plants reported POPs according to the list of the Stockholm Convention into the Register. Data on this group of substances in the Integrated Pollution Register for the year 2004 reflect the overall high limits for reporting, and also insufficient pressure from the state administration authorities on the companies to monitor these substances. This conclusion is also valid for the evaluation of substances evaluation that have has not been incorporated into our tables, but which are, according to their properties, classified as POPs: PAHs, hexachlorobutadiene (HCBD), polybrominated diphenylethers, organic tin compounds, and pentachlorophenol (PCP). Data in the IPR for the year 2004 are present only for hexachlorobutadiene, from two plants.

7.2 Recommendations ensuing from analysis of the IPR concerning POPs

Undoubtedly, the Integrated Pollution Register (IPR), as presented on the internet pages http://www.irz.cz, is a breakthrough in informing the public on the releases and transfer of chemical substances hazardous to the environment and human health. While the simple fact that the register exists is definitely progress in the right direction, especially when compared to the situation before September 30, 2005. It is not possible to neglect the defects within it due to pressure from the industrial lobby, the Ministry of Industry and Trade and the Ministry of Agriculture at the time of its creation.

In an analysis published in 2005, we have tried to bring attention to several defects which the present IPR contains. From the point of view of POPs monitoring in releases and transfers, it is an important necessity to amend the IPR in order to:

1) Include transfers inside the facilities/plants (in foreign registers called "on site transfers");
2) Contain data on inputs of substances which would help the public to understand certain high amounts of hazardous substances on outputs from the plants, and, simultaneously, it would enable the calculation for example, of the efficiency of POPs destruction in certain equipment;
3) Limits for reporting better reflect the situation in releases and transfers of the individual substances in the Czech Republic (for example in the way that at least 2/3rds of the monitored

chemicals in emissions, wastes, and waste water were reported into the IPR)[n];

4) Cover a larger scope of substances hazardous for human health and the environment, including the ones which are candidates for the list of substances to which the Stockholm Convention applies.

In addition to that, our analysis document has examples when there is a failure in monitoring the duty of reporting, or of obligations to monitor certain hazardous substances, from the state administration authorities. Specifically, this is documented by the following facts:

a) Complete absence of data on accidental releases, caused by misinterpretation of the Government Order No. 368/2003 Coll. by the Ministry of the Environment of the Czech Republic[98];
b) Necessity to enforce the obligation to measure persistent organic pollutants in wastes, ensuing from the Regulation of the European Parliament and Council No. 850/2004/EC on POPs, and, because of that, a low number of reports containing data on POPs in wastes and waste water;
c) Gaps in comparison of data from the IPR with emission inventories of certain substances (in our analysis, this is documented on the example of dioxin emissions).

According to the NIP, the Ministry of the Environment of the Czech Republic has the following duty: "After first reporting of emissions and transfers into the Integrated Pollution Register (IPR) by the individual users of the substances, to assess benefit of this tool to POPs inventory, and to adjust limits for reporting POPs emissions to the situation in the Czech Republic, and to the need to obtain, by means of the IPR, more information on POPs releases into the environment." This task should be fulfilled by the end of 2007.

8. Assessment of sources of POPs emissions in the Czech Republic - is it feasible?

8.1 Basic information on inventory of POPs emissions

In recent years, high attention has been paid to the taking of inventory of emissions (releases) of POPs formed as unintentional by-products, i.e., dioxins, PCBs, HCB, and PAHs. The present emission inventory for the Czech Republic, presented in one of the annexes to the National POPs Inventory[99, 100], assesses only inputs into air. It is necessary to acknowledge the fact that the team of the authors of the Inventory tried to assess PCBs and HCB emissions into air, in spite of that UNEP neither prepared methodology, nor proposed emission factors for such an assessment. Thus, the Czech Inventory includes estimate of releases into air for all substances included in Annex C to the Stockholm Convention. Also the assessment of POPs releases into air for the Czech Republic is

[n] In the case of hexachlorobenzene, the limits for reporting of releases are set as follows: into air 10 kg, into water 1 kg, into soil 1 kg, and in wastes or waste water also 1 kg. If this is compared with the total estimated amount of emissions of this substance into air ca 4.7 kg per year, it is clear that the limit for reporting is too high. In 2004, the limit amount of transfers in waste water was exceeded by only one company. Releases of hexachlorobenzene were not reported by a single company.

incomplete to date. We pay more attention to this below.

Photo No. 12: Hazardous waste incinerator Ekotermex Vyškov was was not able to meet EU standards for dioxin emissions for long time. It burns mainly medical waste. Medical waste incineration was considered as one of major uninenentionally produced POPs sources in Annex C of the Stockholm Convention.

According to Holoubek et al. (2003)[101], the inventory of POPs emissions into air is based on a list of important emission sources presented in the Stockholm Convention. These sources are:

(a) Waste incinerators, including co-incinerators of municipal, hazardous or medical waste or of sewage sludge;
(b) Cement kilns firing hazardous waste;
(c) Production of pulp and paper using elemental chlorine or chemicals generating elemental chlorine for bleaching;
(d) The following thermal processes in the metallurgical industry:
• Secondary copper production;
• Sinter plants in the iron and steel industry;
• Secondary aluminium production;

• Secondary zinc production.

In addition to these sources, the Stockholm Convention lists the following source categories as potentially important:
(a) Open burning of waste, including burning of landfill sites;
(b) Thermal processes in the metallurgical industry not mentioned above;
(c) Residential combustion sources;
(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) Operation of 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 calculation of emissions is carried out by means of emission factors and is based, especially, on consumption of fuels and energy, and, further, on outputs of the individual sectors. These data are adopted mainly from the System of Registration of Air Pollution Sources REZZO, a database administrated by the Czech Hydro-meteorological Institute (ČHMÚ).

REZZO 1 includes stationary installations for combustion of fuels having thermal output higher than 5 MW and installations of particularly significant technological processes.

REZZO 2 includes stationary installations for combustion of fuels having thermal output from 0.2 to 5 MW, installations of significant technological processes, open coal mines and areas with the possibility of burning, spontaneous firing or flying away of pollutants.

REZZO 3 includes especially small boiler houses having output below 0.2 MW. A separate category of the Register is formed by mobile sources.

REZZO 4 subject to monitoring along line constructions (road transport on road segments included into transport census), and subject to area monitoring on the level of districts (other mobile sources).

8.2 Current state of emission inventory

Table No. 26 shows estimates of PCDD/Fs, PCBs and PAHs emissions in 2001 to 2003 according to the NIP proposal of January 2004.[102] These estimates are calculated on the basis of more precise emission factors. Former estimates were much higher.

Table No. 26: POPs emission into atmosphere in 2001 to 2003. Source: ČHMÚ, TOCOEN Report. No. 252, Brno, January 2004.[103]

Year	PAHs (kg/year)	PCBs (kg/year)	PCDD/Fs (g TEQ/year)
2001	36,700	96.1	190.6
2002	24,400	82.5	177.3
2003	25,700	86.6	178.3

The National POPs Inventory came to the conclusion that PCDD/Fs emissions in the Czech Republic are decreasing. This was partially because of the introduction of emission limit 0.1 ng I-TEQ/m^3 for waste incinerators,[o] which are discussed in more detail in Chapter 9.

The subsequent Table No. 27 shows shares of the individual sources on the total POPs emissions into atmosphere, according to the updated version of the National POPs Inventory.

Table No. 27: Shares of the individual sources on total emissions into atmosphere in kg. Values for HCB are stated in the National POPs Inventory as orientation ones. Source: TOCOEN Report. No. 249, Brno, version 2005.[104]

Type of source	PAHs	PCBs	HCB	PCDD/Fs (in I-TEQ)
REZZO 1 (combustion of fossil fuels having thermal output higher than 5 MW)	10,278.2	4.818	2.740	0.005
REZZO 2 (thermal output from 0.2 to 5 MW)	2,355.2	0.288	0.037	0.001
REZZO 3 (thermal output below 0.2 MW including local heating)	155,850.7	14.933	0.481	0.026
Transport	32,020.2	39.517	0.024	0.000
Technology	141,380.1	3.934	1.386	0.152
Waste incinerators	43.0	0.205	0.062	0.005
In total	**341,927.3**	**63.694**	**4.729**	**0.190**

8.3 Development and changes of emission inventories of POPs releases into air

Inventory of POPs emissions into air was subject to certain development. We will try to demonstrate it on estimates of dioxin emissions which have, most probably, the longest history.

In the middle of 1990s the total estimated dioxin emissions into air were at the level of 2,121 g

[o] Also a petition action organised by NGOs in 1998 - 1999, supported by 13,209 citizens of the Czech Republic, contributed to the introduction of this limit.

I-TEQ for 1990, and 1,777 g I-TEQ for 1994.[105] According to the emission inventory published in 2000 the total dioxin emissions into air were 650 g I-TEQ (data for the year 1999). Emission factors for PCDD/Fs as stated in tables 2 - 4 (Annex 2) were used for this calculation.

The NIP proposal in the version of December 2003 stated 1,251.7 g I-TEQ of dioxins for 1990, 643.2 g I-TEQ of dioxins for 1999 (see Table No. 28) and by approximately 20 g I-TEQ lower estimate for 2001.[106] This value was assessed as too high in the European context. In that time, the authors assessed dioxin emissions from local heating as being exaggerated and estimated that dioxin emissions were 179 g I-TEQ in 2001.[107] Subsequently, emission factors were re-assessed (see Table 2-1 in Annex 2) and the estimated total annual dioxin emissions into air were re-calculated in accordance with them. The latest emission inventory states that 190.6 g I-TEQ of dioxins was released into air in the Czech Republic in 2001.[108]

Tables 2 - 4 to 2 - 6 in Annex 2 state the original emission factors for PCDD/Fs, PCBs, and HCB from 2000. The latest version of emission inventory of POPS released into air states new emission factors for PCDD/Fs, PCBs, HCB (see Tables 2 - 1 to 2 - 3 in Annex 2), and PAHs. It also contains comparison of results obtained according to the original emission factors and according to the newly calculated ones (see Table 29). From this it is obvious that instead of an estimated 406,561 g PCBs, a new estimate was calculated at the level of 63,694 g PCBs being released into air in 2001. Also the estimate of PAHs releases was decreased by 100 000 kg.

Table No. 28: Original estimates of POPs emissions in 1990 – 2001. Taken from Holoubek, I. et al. (2003) [109]

Year	PAHs		PCBs		PCDD/Fs	
	(kg/year)	(% of year 1990)	(kg/year)	(% of year 1990)	(g/year)	(% of year 1990)
1990	751.6	100	772.9	100	1,251.7	100
1991	747.0	99.4	772.0	99.9	1,219.9	97.5
1992	1,131.1	150.5	741.3	95.9	1,219.8	97.5
1993	1,114.7	148.3	643.6	83.3	1,140.4	91.1
1994	951.4	126.6	629.8	81.5	1,135.3	90.7
1995	1,357.2	180.6	622.9	80.6	1,135.0	90.7
1996	971.4	129.2	554.5	71.7	921.5	73.6
1997	657.4	87.5	447.8	57.9	830.2	66.3
1998	656.7	87.4	457.7	59.2	766.7	61.3
1999	556.6	74.1	485.4	62.8	643.2	51.4
2000	487.6	64.9	474.1	61.3	743.8	59.4
2001	460.0	61.2	406.6	52.6	620.4	49.6
2001[p]	286.2		55.4		179.0	

[p] Note to this line in the original report: newly re-calculated emissions on the basis of more precise data - back re-calculation will be carried out.

Table No. 29: Comparison of emission inventories prepared on the basis of the original emission factors, and of the new ones.

	Emission inventory prepared on the basis of the new emission factors (kg)			Emission inventory prepared on the basis of the original emission factors (kg)		
	ΣPAHs	**PCBs**	**PCDD/Fs**	**ΣPAHs**	**PCBs**	**PCDD/Fs**
REZZO 1	10,278.20	4.818	0.005	9,314.2	12,480	0.115
REZZO 2	2,355.2	0.288	0.001	8,708.6	4,268	0.024
REZZO 3	155,850.7	14.933	0.026	387,894.5	325,359	0.353
Transport	32,020.2	39.517	0.000	20,875.3	28,834	0.039
Technology	141,380.1	3.934	0.152	32,948.10	35,620	0.090
Incinerators	43.0	0.205	0.005	246.1	27,867	0.009
Total	**341,927.3**	**63.694**	**0.190**	**459,740.80**	**406,561**	**0.620**

A new light was shed on the inventory of POPs releases by the first publication of data from the Integrated Pollution Register. (These data were discussed in Chapter 7.) A simple sum of dioxin emissions into air in 2004 stated in the Register is 588.573 g I-TEQ[110] the sum of emissions from eighteen point sources of air pollution only. Moreover, data of the individual metallurgical plants exceed the annual balance of the total dioxin emissions into air in a year. Details are given in Chapter 7.1 and Table No. 25. Assessment whether data listed in the IPR are correct can be made on the basis of input data only. In the time of preparation of this study, these data were not available to us.

For the purpose of comparison, we state here data on PCDD/Fs emissions from the latest inventory in the EU concerning the year 2000. Emissions from transport were 1.5 - 1.8 %, emissions from processing of iron ore 12.0 - 18.1 %, emissions from waste incinerators 23.1 - 25.9 %. This inventory also includes sources that have not been covered by the Czech inventory as of the time of publication of this report. For example, the estimated release of PCDD/Fs during fires at landfill sites is 2.4 - 8.1 %.[111]

8.4 Comments to the inventory of POPs releases

Generally, it can be said that in the field of industrial sources, emissions into air have decreased significantly in the past years. Nevertheless, because this happened on the basis of completing the equipment by end technologies of flue gases treatment, the real decrease of the total POPs releases into the environment need not be as significant as often stated. However, even the inventory of

Photo No. 13: Open fire at Tušimice (Ústí nad Labem Region in North Bohemia) landfill in July 2005 emissions into air is not complete and remains to be completed. For example, it does not include emissions from fires. According to the data of the Fire Rescue Service in Prague, 237 fires at landfills and 788 fires of wastes took place in 2002. According to foreign data, ca thousand times more PCDD/Fs is released during such fires than in the case of incineration of the same amount of waste in an incinerator. In the time of fire, high concentrations of PCDD/Fs in the air can be measured. For the purpose of information, we mention data from Croatia where PCDD/Fs concentration in the air at the level of 13,200 g I-TEQ/m^3 was measured in the time of fire of a landfill. Usual PCDD/Fs concentrations in the time of the fire were in the range from 9 to 306 g I-TEQ/m^3. At Photo No. 13 is large fire at Tušimice sanitary landfill in July 2005.

In addition to POPs releases during fires, the inventory does not include all the sources listed in the Stockholm Convention. For example, it disregards the chemical industry and chemical processes. In the case of cement kilns does not acknowledge a difference between plants incinerating wastes and plants which do not. It also failed to give any calculation on potential releases from old burdens - for example, from Spolana Neratovice despite specific information to this plant being is available from the risk analysis prepared by the National Property Fund.

Essential shortcoming of the POPs inventories prepared to date is they do not include releases into components of the environment other than the air. As yet measurements are not consistently carried out in the Czech Republic from which such releases could be calculated.

Big changes in the estimates of total POPs releases into air show that estimates of emissions from local heating is highly relative.[q] Even more so now given the estimate of HCB emissions from local heating is based on a single measurement in 1997.

From the text of the update of the inventory[112] carried out in 2005, it is not clear from what number of measurements or from what specific measurements the updated emission factors were derived. Because of that, it would be useful to include in future versions, references to original sources from which the data was taken. It should be noted that the newer version of the inventory is more clearly organised, and because of that, easier to understand.

Any new inventory of POPs emissions should also react on data published in IPR to avoid possible contradiction.

8.5 POPs releases in wastes and waste water

A specific list of wastes which can contain POPs does not exist for the Czech Republic. However, the list published in BiPRO study prepared for the European Commission in 2005 could serve as certain guidelines.[113]

This problem is best understood in the case of incinerators. Flue gases treatment in these facilities shows high efficiency, so that more than 95 % POPs are caught in solid wastes.[114] If they are not

[q] Difference between the individual estimates according to the old emission factors, and according to the new ones, is 327 g I-TEQ of dioxins released from local heating in 2001.

managed safely, these substances can be released again.[115, 116] Unfortunately, our experience confirms that little attention is paid to the issue of POPs presence in these wastes. The majority of fly ashes from incinerators are used in various construction products in our country. Similarly, we have encountered a case of bad management of sludge from a waste water treatment plant, which can also contain high POPs concentrations. This was sludge from Spolchemie Ústí nad Labem. This company reported into the IPR the production of 423,385.2 kg HCB in wastes in 2004. HCB is a by-product which has been, and is, formed in Spolchemie during the production of industrial chemicals such as tetrachloromethane, perchlorethylene, and trichloroethylene.

Another example is the management of waste waters from flue gases treatment. These are not monitored in the Czech Republic. These waste waters are not discharged directly into receiving water but usually pass through one or two waste water treatment plants where they go through a process of diluting and subsequently, the uncontrolled release of the POPs they contain into the environment. The cause of this situation is the unclear implementation of the EU Directive No. 2000/76/EC on waste incineration.

Spolchemie Ústí nad Labem reported into the IPR, 7.5 kg HCB in waste waters transferred out of the plant in 2004.

8.5.1 Case study: Calculation of releases of PCDD/Fs contained in wastes produced by the incinerator into the environment on example of the Liberec MWI

In contrast to other similar plants in the Czech Republic, measurements of dioxin contents were carried out in wastes produced by the incinerator in Liberec. Basic results of these measurements are shown in Table No. 22. In addition to them, the level of 0.2136 ug I-TEQ/kg was also discovered in the mixture of fly ash with bottom ash[117]. The operator of the incinerator let the mixture of fly ash and bottom ash be reclassified as waste which does not have hazardous characteristics. Since 2001 it has possessed a certificate enabling this mixture to be sold as a construction material.

Despite this certificate of non-hazardous characteristics the mixture of fly ash and bottom ash contains relatively high concentrations of dioxins, which, in the case of a similar mix of ashes used in Newcastle upon Tyne, England, resulted in contamination of eggs and poultry in the vicinity of roads where it was used[118]. Therefore, it should be included into the calculation of total releases of PCDD/Fs into the environment.

UNEP prepared a proposal of “Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases”, and it contained a tool for the calculation of total releases of dioxins into the environment with emission factors. We have tried to use this Toolkit for the calculation of the amounts of PCDD/Fs contained in the wastes produced by the incinerator in Liberec. The result is shown in Table No. 30. After that, we made the same calculation using known information concerning the amounts of wastes produced by the above mentioned incinerator and the levels of dioxins found in these wastes. Similar data for waste waters, as well as for filter cake, are not available[r].

For calculations concerning the year 2003 only estimate of releases of PCDD/Fs in product/material for which the mixture of bottom ash with fly ash was certified could be made. Our calculations were based on data on wastes production given by the incinerator in an application for the issuance of a IPPC certificate. Information on the calculations is contained in Table No. 31.

Photo No. 14: Liberec Municipal Waste Incinerator.

In each of the cases, a calculation according to real values has been carried out in two variants designated "a" and "b" in view of the fact that the levels of dioxins found in the mixture of fly ash with bottom ash differ significantly. The real amount of dioxins contained in this waste is likely somewhere between both variants.

In the case of a calculation according to the Toolkit[119], in comparison with a calculation based on measured values very different numbers were obtained. This was caused by several facts:

1) The Toolkit supposes much lower amounts of residual wastes after combustion of one ton of solid municipal waste.

2) The Toolkit does not suppose that mixing of bottom ash with fly ash would occur. Therefore, much lower level of dioxins in bottom ash is set.

3) Emission factors for releases of PCDD/Fs into the environment are given as simple numbers without ranges.

r For our calculation, we have used the concentration of dioxins found in treated fly ash also for the filter cake. In reality it can be expected that the filter cake contains much higher level of dioxins than in our calculation.

Table No. 30: Calculation of PCDD/Fs releases per year for MWI in Liberec based on UNEP's Toolkit and on real-life measurements.

	Annual release						**Total annual release in g TEQ/a**
	g TEQ/a Air	**g TEQ/a Water**[s]	**g TEQ/a Land**[t]	**g TEQ/a Products**	**g TEQ/a Fly ash**	**g TEQ/a Bottom Ash**	
Toolkit	0.048	0	0	0	1.44	0.144	**1.584**
Reality 2002a	0.0898	?	?	0	0.3828	8.2780	**8.7506**
Reality 2002b	0.0898	?	?	0	0.3828	2.4030	**2.8756**
Reality 2003a	0.037	?	?	8	0.4203	0.1440	**8.6013**
Reality 2003b	0.037	?	?	2.25	0.4203	0.1440	**2.8513**

Table No. 31: Amounts of residues produced by MWI in Liberec per year[120].

Type of waste	**Amounts of produced waste per year in tons**		
	2001	**2002**	**2003**
Filter cake (19 01 05)	1,085.22	1,051.44	1,154.8
Waste water from flue gases treatment etc. (19 01 06)	106.12	121.54	21.5 *
Bottom ash (19 01 12) **	33,703.92	38,754.17	2,316.09 ***
Other ashes (mainly boiler ash; 19 01 13)	128	113	92

* only amount transferred out of the plant included - waste water treated at plant's waste water treatment facility is not included in this figure
** there is also treated fly ash included in this figure
*** biggest part of this waste is used as product (construction material) since the beginning of 2003, so the amount of this "product" is not included in the waste total here anymore.

The difference between the calculation according to Toolkit and the reality will still increase after concentrations of dioxins in waste waters from Liberec are known. They are not taken into account at all in the case of municipal waste incinerators in the Toolkit.

In spite of the fact that this calculation concerns only one municipal waste incinerator in the Czech Republic, it can play an important role from the point of view of the calculation of total releases of dioxins into the environment - considering that this incinerator forms 1/4 of the total capacity of municipal waste incinerators in the Czech Republic.

Comparison of the real values for this incinerator with the theoretical calculation according to the

s There were 20 - 120 tons of waste water from fly ash bath process produced by MWI in Liberec, but PCDD/Fs levels were not measured in it.
t A unanswered question is: "how to evaluate releases of PCDD/Fs from mixed bottom ash and fly ash when it is applied during land recovery" (for example).

Toolkit documents significant shortcomings of this tool. In this case, its use would result in underestimation of the importance of wastes produced by the incinerator from the point of view of the content of dioxins. On the other hand, it is, as a matter of course, questionable whether classification of the incinerator in Liberec into the best, 4., class according to the Toolkit is correct. However, we based our calculation on classification which would be, in our opinion, chosen by Czech authors of POPs inventory.

8.5.2 Estimate of total amount of dioxins in wastes produced by incinerators in the Czech Republic

In the incinerator in Lysá nad Labem, dioxin concentration was measured in front of the filter. The measured value was 9,515 ng TEQ/m^3. Emission factor 145,000 ng TEQ/t of wastes corresponds to this value. In worse incinerators this emission factor can be significantly higher (ca 20x). From this, there follows estimate of total production of dioxins by hazardous waste incinerators at the level 7.5 to 150 g TEQ/year. Calculation based on UNEP Dioxin Toolkit[121] would result in the value 2.5 - 41 g TEQ/year. However, this manual does not take into account high dioxin concentrations in fly ashes, found in specific cases from the Czech Republic. Its authors based the manual rather on experience with technologically more perfect incinerators from Germany.

Table No. 32: Overview of approximate production of bottom ash, fly ash, and other wastes from flue gases treatment in incinerators of solid municipal waste in the Czech Republic, related to one ton of incinerated wastes according to data of years.[u]

Place	Bottom ash production per 1 ton of incinerated waste in %	Fly ash production per 1 ton of incinerated waste in %
Termizo Liberec	24.8 to 37	4.1 to 6.2
Incinerator of solid municipal waste Prague – Malešice	23.2	3.8
SAKO Brno	23.8	4.3

Overview of the amount of municipal waste incinerated in 2002 by the individual incinerators is in Table No. 33 (in total, they incinerated 410,700 tons of waste). If calculations were based on dioxin concentration in fly ash from municipal waste incinerators at the level ca 360 pg I-TEQ/g,[v] then fly ashes from them would contain 6 g I-TEQ of dioxins as a minimum estimate.

On this assumption, we based our calculation of the lower limit of the estimate of dioxin amounts in these wastes in 2002. For calculation of the upper limit, we used data of the municipal waste incinerator Prague - Malešice, stated in the report into the IPR in 2004, i.e., 8 g I-TEQ of dioxins in

[u] Percentage calculated from figures given in different official reports by waste incinerators operating companies (EIA and IPPC reports for example).

[v] This concentration corresponds approximately to the one found in washed fly ash from the Liberec incinerator in 2000.

wastes and we assumed that ca 1 g I-TEQ of dioxins was contained in bottom ash from this incinerator.[w] The amount of fly ash was calculated according to data from Table No. 32. Thus, the total amount of dioxins in fly ashes from municipal waste incinerators in 2002 would be in the range 6 - 19.5 g I-TEQ.

In the study of 2004, we based a similar calculation on assumption that 5 g I-TEQ of dioxins is produced in the Czech incinerators per 100 000 tons of incinerated waste. Estimate of their total amount in 2002 was then close to the upper limit of the estimate calculated here.[122]

Table No. 33: Estimate of dioxin amounts in fly ash from municipal waste incinerators in 2002.

	Prague	Brno	Liberec	Total
Amount of incinerated waste in thousands of tons	202.0	112.1	96.6	410.7
Estimate of amount of fly ash in kg/year	7,676	4,820	3,960 – 5,989	
Lower limit of the estimate	2.763	1.735	1.425 - 2.156	5.923 - 6.654
Upper limit of the estimate	7	4.5	8	19.5

According to the above-mentioned estimates, fly ashes from waste incinerators in the Czech Republic contained 13.5 to 170 g I-TEQ of dioxins in 2002. Content of dioxins in bottom ash produced by incinerators in the Czech Republic is in the order of tenth to units grams I-TEQ.

Due to absence of higher amount of measurements, it is impossible to carry out a similar estimation for polychlorinated biphenyls and hexachlorobenzene.

8.5.3 Brief conclusion

POPs releases into wastes represent a serious problem in the Czech Republic as the approved NIP noted. The NIP orders the Ministry of the Environment of the Czech Republic "to solve speedily the problem of production and management of waste HCB, and risks connected with transporting of HCB wastes" by June 2007. A further measure, which, according to the NIP, the Ministry of the Environment of the Czech Republic should implement continuously, is "control of management of fly ashes from thermal and combustion or pyrolytic processes". This is a correct first step, but one that alone will not solve the problem of POPs releases in wastes. The solution is to prevent formation of fly ashes or to use subsequently some of the available technologies for chemical decomposition of dioxins and other POPs contained therein. This requirement is based also on the petition Toxics Free Future - II, which was supported by over 14 thousands citizens of the Czech Republic to date.

[w] This would correspond to dioxin concentration in bottom ash ca 20 pg I-TEQ/g of dry matter.

8.6 Concluding recommendations concerning the inventory of releases of POPs from Annex C of the Stockholm Convention

If the POPs inventory is to be used as a basis for strategic political decisions concerning, among others, investments resulting in POPs elimination. Then it should have stronger basis than just one (or a few measurements) in the case of sources which are subsequently evaluated as the biggest ones. For the same reason the UNEP Dioxin Toolkit cannot be used for this purpose as shown by analysis of certain inventories of dioxin releases of Latin American countries.

Therefore, it is necessary to ask the question whether it is actually feasible to estimate total POPs releases into the environment. This is possible but it will always be an estimate only in view of the fact that releases of dioxins and other POPs are not measured continuously.

In order to enable evaluation what importance to attach to numbers derived in this way, it is necessary that the original data, on which the inventory of releases is based, be published. Specifically, there should be published numbers, conditions, and years of measurements from which the emission factors are derived. There should also be the original data on outputs of activities for which the releases are calculated. Information on outputs of activities is easily available in a tool which the UNEP Dioxin Toolkit provides in the form of an Excel file. In the cases when a single emission factor for the given activity cannot be unambiguously determined, we rather recommend to carry out an estimate in a range from the minimum possible to the maximum possible value.

The uncertainty of emission inventories emphasises the necessity to concentrate on substitution of materials, the production, use, or disposal of which results in POPs releases into the environment, (as recommended in Article 5 of the Stockholm Convention). Such material is, for example, PVC, which has a widely acknowledged share on the increase of POPs releases into the environment, especially during its disposal, either in the form of incineration, in local heating, or in the case of spontaneous fires in buildings or in landfills.

In our opinion, little attention is paid to the substitution of materials resulting in POPs releases, both in Czech Republic and at international level including the implementation of the Stockholm Convention.

Photo 15: Discussion in front of the Ekotermex Vyškov Hazardous Waste Incinerator in May 2003.

9. Development in the field of waste incineration

In the end of 1980s and in the beginning of 1990s, a number of hazardous waste incinerators were built in the Czech Republic. These included medical waste incinerators with a theoretical projected capacity of 23 thousand tons of wastes being produced by hospitals. Two hundred and twenty such incinerators were in operation in 1992 the majority equipped with only basic air pollution control device catching dust particles. Some did not even have that.

A high proportion of these incinerators were closed with the introduction of stricter requirements on air protection introduced by the first Clean Air Act adopted in 1991.[x] Despite this, ca 90 - 100 incinerators of hazardous and medical wastes still remained in operation in the second half of the 1990s.[y]

Thanks to the introduction of an emission limit for dioxins, the total number of waste incinerators in the Czech Republic has decreased to approximately one third within the last 6 years. Simultaneously, the amount of incinerated waste increased by 80 % from 1999 to 2003. However, this happened in particular due to putting into operation two big municipal waste incinerators - in Prague - Malešice, and in Liberec. Development of the amounts of incinerated hazardous and medical wastes in incinerators is demonstrated in Table No. 34. The amount of municipal waste incinerated in each of the three Czech incinerators of solid municipal waste is given in Table No. 35. Development of the methods of waste management is stated in Table No. 36.

Table No. 34: Amount of waste incinerated in incinerators of hazardous and medical waste in 1999 to 2003 (in thousand tons). Source: Czech Statistical Office.

Year	1999	2000	2001	2002	2003
Amount	42	43		61	76

Table No. 35: Amount of waste incinerated in municipal waste incinerators in 1998 to 2002 (in thousand tons).

Year	Prague	Brno	Liberec
1998	129.1	119.1	0
1999	193.6	106.4	0
2000	166.9	105.1	?
2001	196.3	99.3	83.0
2002	202.0	112.1	96.6

Table No. 36: Waste management in the Czech Republic in 2001 to 2003 (t). Source: VÚV T.G.M. - CeHo.

Method of waste management	2001	2002	2003
Use similarly as a fuel, incineration with use of heat	704,411	401,209	545,113
Incineration on land	125,157	401,669	325,078
Physical and chemical methods	4,439,750	909,391	800,593
Biological methods	4,439,750	909,391	800,593

x These requirement did not consider POPs at all.

y According to the Statistical Yearbook of the Ministry of the Environment (1996), 90 waste incinerators were registered in the Czech Republic in 1996. 40 of them did not meet emission limits. The total capacity of these incinerators was 222,500 tons/year. The Czech Environmental Inspection Agency registered over a hundred facilities for waste incineration in 1997.

Method of waste management	2001	2002	2003
Landfilling	10,484,774	7,731,062	7,231,137
Use as secondary raw material	13,059,980	14,850,206	14,621,551
Storage	1,786,275	30,651	8,230
Another way of use/disposal	16,553	1,754,602	2,061,164
Total	30,839,645	32,037,902	30,936,108

In 2002, 53 incinerators were still in operation as a result of transitional exemption from compliance with the dioxin emission limit. Today this number is only 25. According to measurements carried out in the end of 2004 and in the beginning of 2005, all incinerators comply with the emission limit for PCDD/Fs into air.

IV. STOCKHOLM CONVENTION IMPLEMENTATION

10. State of implementation of the Stockholm Convention, participation of NGOs in preparation of the NIP, and development of their activities relating to POPs

The Czech Republic signed the Stockholm Convention at the time of its creation, on May 23, 2001, and has deposited the instruments of ratification on August 6, 2002.

Non-governmental organisations were engaged in the issue of persistent organic pollutants long before that. Therefore, it was logical that their representatives participated in meetings of the expert group preparing the NIP. Specifically, these representatives were Jindřich Petrlík (Arnika Association), Miroslav Šuta (Greenpeace Czech Republic), and Ondřej Velek (Partnership, o.p.s.). The NIP proposal was based on UNIDO Project No.: GF/CEH/01/003, carried out by the consortium RECETOX - TOCOEN & Associates. This proposal was subject to several comment procedures and had to be revised, especially in view of the reservations of the Ministry of Industry and Trade and the Ministry of Finance of the Czech Republic. Finally, the proposal was adopted by the Government of the Czech Republic on December 7, 2005 in the form of an acceptable compromise[123] which was however, less ambitious than the version at the end of 2004. The introduction of the NIP proposal and a chapter on the activities the Arnika Association oriented on persistent organic pollutants was included.[124] We attach this to this Report (see Annex 4).

Czech environmental non-governmental organisations were engaged in issues connected with persistent organic pollutants before 1989, when the so-called ‘velvet revolution’ took place. In reports of dissidents contamination of milk by PCBs was described, for example. In the second half of 1980s, the Environmental Section of the Czechoslovak Biological Association at the Czechoslovak Academy of Sciences prepared the first summary evaluation of the state of the environment in the then Czechoslovakia. Due to its political charge, the document was disseminated by the underground press and only in September 1989 was it published in the form of a book.[125] The report also contained a chapter devoted to PCBs and in part concentrating on heterogeneous substances. There was also data on burden of the citizens by DDT, HCB, HCH, and

3,4-benzo(a)pyrene.

The magazine of the Czech Union for Nature Conservation "Nika", and dissident magazine "Environmental bulletin" issued by Ivan Dejmal[z] in underground press paid attention to the issue of toxic substances. In 1992, there began the story of more intense activities of environmental organisations with critical attitude to waste incineration, connected also with efforts to reduce dioxin emissions.

Petition action was organised in 1998 - 1999 by the organisation Children of the Earth and supported by 13,209 citizens of the Czech Republic, contributed significantly to introduction of the limit for dioxin emissions from incinerators at the level 0.1 ng I-TEQ/m^3. Also at that time the Czech branch of Greenpeace worked at persistent organic pollutants. In 1997, for example, it organised an extensive action concentrating on pollution of the river Elbe. Since 2001, the Toxics and Waste Programme of the Arnika Association (activities of which are described in more detail, in Annex 4), has continued the activity of the section "For clean land, air, and water" of the organisation Children of the Earth. Its petition "Toxics Free Future" helped to push through ratification of the Stockholm Convention by the Czech Republic.

In previous years Greenpeace Czech Republic was engaged in four cases connected with POPs pollution: a store of toxic wastes in Milovice (it contained also PCBs and DDT), dioxin burden of Spolana Neratovice,[126, 127], pollution of the Elbe by POPs from other chemical plants,[128] and municipal waste incinerator in Malešice.

In December 2003 an informal "Stockholm network" was created in order to co-ordinate steps of Czech NGOs and representatives of certain self-government authorities in their participation in preparation of the NIP of the Stockholm Convention. The network was established by participants of a seminar organised by the Arnika Association in December 2003, where a common position paper was created.[129] This served as a basis on which representatives of NGOs were formulating comments to the proposal of the NIP of the Stockholm Convention (see Annex 4). Later (in July 2004) a petition "Toxics Free Future - II" was created to support this position.

By the date of publication this report the petition has been signed by more than 14 thousand people. This petition action is still continuing and it has helped in the adoption of the NIP. Reservations of the "Stockholm network" to the NIP and to the National POPs Inventory are essentially contained in this Report. However, in spite of these non-governmental organisations declared adoption of the plan a progress in the field of reduction of environmental contamination by POPs.[130]

11. Proposals of measures

Major NGOs and local authorities' proposals regarding the NIP and the Stockholm Convention implementation in general remaining the same as they have been stated in the "Common position paper" (see Annex 3).

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[z] Ivan Dejmal later became Minister of the Environment of the Czech Republic.

We can repeat them:

- prevention of creating new sources of POPs (for instance construction of new waste incinerators)

- substitution of materials, which cause (or may cause) appearance of POPs during their production, usage or liquidation (for instance PVC, halogenated retarders and paraffin's etc.)

- prevention of emergence of POPs by appliance of BAT – best available technologies and of processes that are the best for the environmental point of view – BEP.

- preferring technologies with the ability of complete POPs´ destruction to those which only remove POPs to other waste, environmental compounds or other products (ash, waste water, products)

- proper registration of old and newly created burdens, i.e. of places contaminated by POPs (for instance the wrong way of treating ash from incinerators etc.)

- complete register of POPs´ emissions, including releases to water and to waste, eventually to soil and geological subsoil (in accordance with the Stockholm Convention).

- concrete and more radical adjustments of legislation concerning proper registers of all kinds of POPs´ emissions, prevention of their emergence and environmentally friendly clean-up of localities already polluted by POPs.

- improve of law enforcement in the field of environmental pollution by POPs (e.g. to use POPs limits within IPPC when possible, not to allow enter the environment for wastes polluted by POPs etc.)

- introduction of economic tools leading to prevention of POPs´ emergence and appliance of principle „polluters pay"(internalization of external costs) in case of the established sources.

- mechanisms of free access to information

- informing and educating public about the effects that the POPs have on environment and health and about behaviour that is responsible in terms of preventing releases of POPs and about usage of materials which cause creation of these chemicals

- taking into consideration emergence of POPs during creation of municipal, regional and state policies (for instance of State energy Policy and other plans and conceptions such as Plan of Waste Management etc.).

This report also shows importance for:

- enlargement of list of chemicals showing POPs properties needed to be monitored in all environment compartments, humans, food and animals, even PCDD/Fs are not monitored well because of economic constrains for their analysis;

- analysis of POPs in a home grown food, what is missing within monitoring systems though it shows much better on potential risks;

- filling the gap of completely missing data about some emerging substances such as PFOS, SCCPs and/or PBDD/Fs and others;

- completing the list of environmental burdens really contaminated by POPs;

- building a capacity for safe destruction of POPs wastes including contaminated soils and solid wastes from contaminated buildings (existing hazardous waste incinerators create new POPs and their releases are not enough controlled regarding POPs content);

- improvement for handling with waste incineration residues that contain high levels of POPs;

- enhancement of the Integrated Pollution Register - Czech version of PRTR regarding the information needed on POPs releases and transfers (for detailed suggestions see chapter 7.5);

- filling the gaps in the Czech Rep unintentionally produced POPs inventory as there is missing data bout releases to water, soil, and in residues.

Some more suggestions related to specific chemical substance/-s are included under their profiles in Annex 1.

Also the uncertainty of emission inventories emphasises the necessity to concentrate on substitution of materials which the production, use, or disposal of which results in POPs releases into the environment, as recommended in Article 5 of the Stockholm Convention. Such material is, for example, PVC, which has a provable share on increase of POPs releases into the environment, especially during its disposal, either in the form of incineration, in local heating, and in the case of spontaneous fires in buildings or in landfills. In our opinion, little attention is paid to substitution of materials resulting in POPs releases, both at the level of the Czech Republic and at the international level, including the implementation of the Stockholm Convention.

Annex 1. Profiles of the individual substances and groups thereof

Aldrin

CAS: 309-00-2

Basic characteristics, occurrence and use in the Czech Republic:
Aldrin is an insecticide which was used against ticks, moths, termites, and other insects. On a small scale it was used also for seed treatment. In the Czech Republic it was used in a minimum amount only and was banned in 1980.

Impact on human health:
It harms immune and reproductive systems. It is not classified as a carcinogen (group 3 according to IARC).

Burden of inhabitants of the Czech Republic:
Burden of inhabitants is monitored since 1994. Exposure is not significant. In 2002, the National Institute of Public Health (SZÚ) detected aldrin in 6 samples of 108, namely in forced vegetables, sea fish, vegetable fats, frankfurters, smoked and marinated fish.

Monitoring:
It is monitored in waters and in foodstuffs. Its concentrations in surface waters are in the range of units ng/l, in suspended sediments and sediments in units ng/g. These values correspond to the background levels. In underground waters, aldrin was not detected.

Results of measurements:
Soil: not available
Water (surface): below the detection limit up to 161.2 ng/l (C90 in profile Svitava, Obřany) [131]
Breast milk: not available
Fish: below the detection limit up to 0.001 mg/kg
Eggs: below the detection limit up to 0.020 mg/kg of fat[132]

Limits:
Decree No. 68/2005 Coll., amending Decree No. 158/2004 Coll., lays down contents of residues in foodstuffs and foodstuff raw materials as a sum of aldrin and dieldrin, expressed as dieldrin. Limits are laid down for tea, hop, oil seeds, parsnip, gourd family - edible skin, gourd family - inedible skin, and other foodstuffs of plant origin. In the case of animal foodstuffs limits are laid down for meat, milk and eggs.

Decree No. 252/2004 Coll., as amended by Decree No. 187/2005 Coll., laying down hygienic requirements on drinking water. The highest limit level is 0.03 μg/l. It is determined only if it is expected in the given source.

Decree No. 275/2004 Coll. lays down hygienic requirements on bottled water. The limit of

0.025 μg/l is set for pesticide substances, valid for each of the substances separately.

Government Order No. 61/2003 Coll. on indicators and values of acceptable pollution of surface waters and waste waters, on requirements on a permit for discharge of waste waters into surface waters and into sewerage systems, and on sensitive areas, ranks aldrin among especially hazardous substances, and lays down emission limits for this substance, valid during production and its processing. Further, this Order lays down an acceptable value of pollution of surface waters by aldrin at the level of 0.005 μg/l. It also lays down requirements on monitoring of old burdens etc. According to the Government Order No.25/1999 Coll., aldrin is classified as a toxic substance (T), hazardous for the environment (N). R-phrases R 24/25-40-48/24/25-50/53. S-phrases S (1/2)22-36/37-45-60-61.

Not binding (orientation) limits are laid down for:
Methodical Instruction of the Environmental Damage Department of the Ministry of the Environment of the Czech Republic published in 1996, lays down criterions for pollution of soils and underground water.

The substance is: banned since 1980.

Importance of the substance for implementation of the Stockholm Convention in the Czech Republic: low.

Main sources of releases: The substance is neither produced nor used in the Czech Republic.

State of inventory of sources: None.

Main measures proposed by NGOs: To map places where pesticides were stored and prepared in the past.

Main hot spots in connection with this substance: None.

Chlordane

CAS: 57-74-9

Basic characteristics, occurrence and use in the Czech Republic:
Chlordane is a contact insecticide with a broad spectrum of use. It was never registered, produced or used in the Czech Republic.

Impact on human health:
It harms immune and reproductive systems. It is ranked among potentially carcinogenic substances (group 2B according to IARC).

Burden of inhabitants of the Czech Republic:
Burden of inhabitants is monitored since 2002. Exposure is not significant. Significant exposure sources include various animal products, especially fish and butter. However, the values found are

very low.

Monitoring:
Monitoring of chlordane in environmental components is not carried out. Burden of inhabitants by means of dietary exposure is monitored.

Results of measurements:
Soil: not available
Water (surface): not available
Breast milk: not available
Fish: not available
Eggs: not available

Limits:
Decree No. 68/2005 Coll., amending Decree No. 158/2004 Coll., lays down contents of residues in foodstuffs and foodstuff raw materials. Limits are laid down for tea, hop, oil seeds, and other foodstuffs of plant origin. In the case of animal foodstuffs limits are laid down for meat, milk and eggs.

Decree No. 252/2004 Coll., as amended by Decree No. 187/2005 Coll., laying down hygienic requirements on drinking water. The standard lays down the highest limit levels for pesticide substances and for sum thereof.

Decree No. 275/2004 Coll. lays down hygienic requirements on bottled water. The limit of 0.025 μg/l is set for pesticide substances, valid for each of the substances separately.
According to the Government Order No.25/1999 Coll., chlordane is classified as a substance harmful to health (Xn), hazardous for the environment (N). R-phrases R 21-22-40-50/53. S-phrases S (2-)-36/37-60-61.

Not binding (orientation) limits are laid down for:
Methodical Instruction of the Environmental Damage Department of the Ministry of the Environment of the Czech Republic published in 1996, lays down criterions for pollution of soils and underground water.

The substance is not and was not: registered in the Czech Republic.

Importance of the substance for implementation of the Stockholm Convention: low.

Main sources of releases: The substance is neither produced nor used in the Czech Republic.

State of inventory of sources: None.

Main measures proposed by NGOs: None.

Main hot spots in connection with this substance: None.

DDT

CAS: 50-29-3

Basic characteristics, occurrence and use in the Czech Republic:
From 1950s to 1970s DDT was used extensively in agriculture in our country. The highest consumption of this substance was in plant production for control of various pests. DDT was banned in 1974 and its use stopped in 1983. Substances formed during its decomposition, particularly DDE, are also hazardous. This pesticide, together with PCBs, ranks among the most important contaminants on the territory of the Czech Republic.

Impact on human health:
It harms immune, hormonal and reproductive systems. It is ranked among potentially carcinogenic substances (group 2B according to IARC).

Burden of inhabitants of the Czech Republic:
Burden of inhabitants is monitored since 1994. Exposure is no significant, although persisting. It can be significant in places contaminated by DDT, where, simultaneously, people consume foodstuffs from animals kept in household farms. SZÚ (National Institute of Public Health) found the highest DDT levels in sausages, light brawn, short sausages, freshwater fish, tinned fish and butter.

Monitoring:
In the Czech Republic, DDT is monitored in all important matrices. It is monitored in foodstuffs as well as in breast milk. Concerning the environmental components, it is monitored in soil and in water or sediments. The highest DDT concentrations in Czech rivers were found in Bílina at its mouth into the Elbe downstream of the Spolchemie Company. High concentrations in fish from the Elbe were found in Děčín and in Obříství (downstream of the Spolana Company). In the past, high DDT concentrations were found also in 10 samples of carps from Nové Mlýny reservoirs, where the maximum value reached 12,750 ng/g.

Results of measurements:
Soil (arable): p,p´-DDT (at most 649 ng/g of dry weight), o,p´-DDT (at most 369 ng/g of dry weight), p,p´-DDE (at most 589 ng/g of dry weight), o,p´-DDE (at most 11.2 ng/g of dry weight), p,p´-DDD (at most 48.5 ng/g of dry weight), o,p´-DDD (at most 19.80 ng/g of dry weight) - basal monitoring of soils, analyses of 2000 to 2004[133]
Another soil: vicinity of Spolana: DDT sum[aa] 2,588.0 ng/g (Libiš, V Chaloupkách 10, August 2002)[134]

Water (surface): p,p´-DDT (at most 872.68 ng/l, 1995), p,p´-DDD (at most 204.7 ng/l, 1995), p,p´-DDE (at most 128.18 ng/l, 1995) [135, 136, 137]

[aa] DDT sum designates here, as well as in all other cases, sum of all metabolites DDT, DDE, and DDD.

Spolana - DDT sum 462.5 ng/l (Spolana Neratovice, amelioration drain, gatehouse, at discharge from the industrial premises, September 2002) [138]

Breast milk: at most 2,311 ng/g of fat (C90, MZSO - National Monitoring of Health of Inhabitants, 1994), [139] older data: DDT sum 6,011 ng/g of fat (data of 1978)[140]

Fish: p,p´-DDT (at most 173 ng/g, bream, 1999), p,p´-DDD (at most 728 ng/g, bream, 1999), p,p´-DDE (at most 894 ng/g, chub, 1999), [141, 142, 143] data are related to g of fish muscle; DDT sum (at most 12,750 ng/g of fat, carp, 1996),[144]
Vicinity of Spolana Neratovice: 1,256.8 ng/g of muscle (carp, Libiš, pool in floodplain forest, in the vicinity of Spolana Neratovice, October 2002) [145]

Eggs: 1,977 ng/g of whole eggs (Libiš, 2003)[146]

Further results of measurements:
Sediments: 11,210.0 ng/g (Spolana Neratovice, near building A1420, sediment after floods, inside the industrial premises, August 30, 2002) [147]

Limits:
Decree No. 68/2005 Coll., amending Decree No. 158/2004 Coll., lays down contents of residues in foodstuffs and foodstuff raw materials. Limits are laid down for the sum of p,p´-DDT, o,p´-DDT, p,p´-DDE and p,p´-DDD. Limits are laid down for tea and other foodstuffs of plant origin. In the case of animal foodstuffs, limits are laid down for meat, milk, eggs, and fish.

Decree No. 252/2004 Coll., as amended by Decree No. 187/2005 Coll., laying down hygienic requirements on drinking water. The standard lays down the highest limit levels for pesticide substances and for sum thereof.

Decree No. 275/2004 Coll. lays down hygienic requirements on bottled water. The limit of 0.025 μg/l is set for pesticide substances, valid for each of the substances separately.

Government Order No. 61/2003 Coll. on indicators and values of acceptable pollution of surface waters and waste waters, and on requirements on a permit for discharge of waste waters into surface waters and into sewerage systems and on sensitive areas, ranks DDT among especially hazardous substances and lays down emission limits for this substance, valid during production and its processing. Further, this Order lays down an acceptable value of pollution of surface waters by the DDT sum at the level of 0.025 μg/l. It also lays down requirements on monitoring of old burdens etc.

In the case of pesticide substances limits for soil are laid down by the Decree No. 13/1994 Coll. The limit is laid down, on the one hand, for the individual substances at the level of 0.01 mg/kg of dry weight, and for the sum of pesticides at the level of 0.1 mg/kg of dry weight.

According to the Government Order No.25/1999 Coll., DDT is classified as a toxic substance (T), hazardous for the environment (N). R-phrases R 25-40-48/25-50/53. S-phrases S (1/2-)22-36/37-45-

60-61.

Not binding (orientation) limits are laid down for:
Methodical Instruction of the Environmental Damage Department of the Ministry of the Environment of the Czech Republic published in 1996, lays down criterions for pollution of soils and underground water.

The substance is: banned since 1974, its use stopped in 1983.

Importance of the substance for implementation of the Stockholm Convention: medium.

Main sources of releases: The substance is neither produced nor used in the Czech Republic, however, it can be released from contaminated places (see the main hot spots) or from old stocks of this pesticide still present (for example, in a backfilled well in Bedrč in Benešov area).

State of inventory of sources: The inventory is not complete, there exists a basic list in the National POPs Inventory.

Main measures proposed by NGOs: Mapping of places where pesticides were stored and prepared in the past. Decontamination of the affected localities. Monitoring of levels of DDT and its metabolites during decontamination of old burdens in chemical companies (Spolana Neratovice, Spolchemie Ústí nad Labem) and consistent measures for prevention of further releases of this substance from contamination focuses. Arnika also tries to push through decontamination of former pesticide storage in Klatovy-Luby. The storage was returned in restitution back to the original owner. It is necessary to clean similar localities in the Czech Republic.

Main hot spots in connection with this substance:
High DDT concentrations were found, for example, in the former pesticide storage in Klatovy-Luby and in chemical substances Spolana Neratovice and Spolchemie Ústí nad Labem and in their vicinity. Further places highly contaminated by DDT: Bedrč near Benešov, Václavice, Šebánovice near Vrchotovy Janovice, Hodonín near Nasavrky, and others (see table in Chapter 5).

Dieldrin

CAS: 60-57-1

Basic characteristics, occurrence and use in the Czech Republic:
Dieldrin was used as insecticide against ticks, moths, termites and other insects. On a small scale it was used for seed treatment. Dieldrin is toxic for mammals and in the past it was used as a rodenticide. It was banned in 1980. For further information please see section "Monitoring".

Impact on human health:
It harms immune and reproductive systems. It is not classified as a carcinogen (group 3 according to IARC).

Burden of inhabitants of the Czech Republic:
Burden of inhabitants is monitored since 1994. Exposure is not significant. Fish and fish products show the highest contamination. Dieldrin residues were found in certain meat products and even in certain kinds of fruits and vegetables.

Monitoring:
It is monitored especially in water environment and in foodstuffs. Its concentrations in surface waters are in the range of units ng/l, in suspended sediments and sediments in units ng/g. It means that they are at the level of background levels. In underground waters dieldrin was not detected.

Results of measurements:
Soil: not available
Water (surface): below the detection limit up to 34.5 ng/l (C90 in profile Olšava, Uherský Brod)[148]
Breast milk: not available
Fish (breeding): below the detection limit up to 0.003 mg/kg
Eggs: average value 0.001 mg/kg of fat
Note: Source of data for fish and eggs: SVS ČR 2005[149]

Limits:
Decree No. 68/2005 Coll., amending Decree No. 158/2004 Coll., lays down contents of residues in foodstuffs and foodstuff raw materials as a sum of aldrin and dieldrin, expressed as dieldrin. Limits are laid down for tea, hop, oil seeds, parsnip, gourd family - edible skin, gourd family - inedible skin and other foodstuffs of plant origin. In the case of animal foodstuffs, limits are laid down for meat, milk and eggs.

Decree No. 252/2004 Coll., as amended by Decree No. 187/2005 Coll., laying down hygienic requirements on drinking water. The highest limit level is 0.03 μg/l. It is determined only if it is expected in the given source.

Decree No. 275/2004 Coll. lays down hygienic requirements on bottled water. The limit of 0.025 μg/l is set for pesticide substances, valid for each of the substances separately.
Government Order No. 61/2003 Coll. on indicators and values of acceptable pollution of surface waters and waste waters, on requirements on a permit for discharge of waste waters into surface waters and into sewerage systems and on sensitive areas, ranks dieldrin among especially hazardous substances, and lays down emission limits for this substance, valid during production and its processing. Further, this Order lays down an acceptable value of pollution of surface waters by dieldrin at the level of 0.005 μg/l. It also lays down requirements on monitoring of old burdens etc.

According to the Government Order No.25/1999 Coll., dieldrin is classified as a highly toxic substance (T+), hazardous for the environment (N). R-phrases R 25-27-40-48/25-50/53. S-phrases S (1/2-)22-36/37-45-60-61.

Not binding (orientation) limits are laid down for:
Methodical Instruction of the Environmental Damage Department of the Ministry of the Environment of the Czech Republic, published in 1996, lays down criterions for pollution of soils

and underground water.

The substance is: banned since 1980.

Importance of the substance for implementation of the Stockholm Convention: low.

Main sources of releases: The substance is neither produced nor used in the Czech Republic.

State of inventory of sources: None.

Main measures proposed by NGOs: To map places where pesticides were stored and prepared in the past.

Main hot spots in connection with this substance: None.

Endosulfan

CAS: 115-29-7

Basic characteristics, occurrence and use in the Czech Republic:
Endosulphane is an organochlorine pesticide used as insecticide (for insect control) or acaricide (for acarid control). In the Czech Republic, this pesticide is still applied on a small scale under designation Thiodan 35 EC (currant, strawberry, lettuce for seed production, caraway, and decorative plants). Its use is permitted till the existing stocks are consumed. Its consumption was 176 kg in 2000, and only 8 kg in 2001.

Impact on human health:
Endosulphane ranks among endocrine disruptors. It can cause psychical problems, such as motor and memory disorders. It is more toxic than DDT. Symptoms of poisoning are intense convulsions, timidity, increased sensitivity, salivation, loss of movement co-ordination.

Burden of inhabitants of the Czech Republic:
Burden of inhabitants is monitored since 1994. Exposure of inhabitants is very low and it is at about the level of 0.1 % of the acceptable dose (ADI, RdF), set at 0.006 mg/kg of body weight/day.

Monitoring
In 2002, in total 1,346 samples (59 % of them being from the Czech Republic) were analysed within the framework of pesticide residues monitoring in foodstuffs. Endosulphane was detected in 16 cases (Holoubek, I., et al., 2002). Different data obtained in 2002 were reported by the Research Institute of Agricultural Economics: 2,621 samples of foodstuffs were taken with the aim to determine contamination of foodstuffs by pesticide residues. In the case of 44 samples (pepper, lettuce, tomatoes, tangerines, and apricots), pesticides were found in amounts exceeding the limits. Endosulphane, chlorothalomil, malathione, and dicofol were the pesticides most frequently present in the unsatisfactory samples.[150]

ČHMÚ (Czech Hydro-meteorological Institute) carries out monitoring of α-endosulphane especially in underground waters, further also in surface waters, sediments, and suspended sediments. In 1995 - 2002, analyses of α-endosulphane were carried out in 461 samples of underground water. The limit of detection at the level of 2 ng/l was not exceeded.[151]

Results of measurements:
Soil: not available.

Water (surface): α-endosulfan was analysed in 20 profiles (8 in Bohemia, 12 in Moravia). In Bohemia, its concentrations exceeded the limit of detection in 4 profiles, in Moravia in 11 profiles. The highest value was found in Moravia in Olomouc, namely 17.9 ng/l (year 2001, ČHMÚ).[152]

Breast milk: not available.

Fish: not available.

Eggs: not available.

Further results of measurements:
Underground water: Limit of detection at the level of 2 ng/l was not exceeded.

Suspended sediments: The highest annual arithmetic mean 4,4 µg/kg on Elbe in Děčín (year 2001, ČHMU)

Sediments: The highest annual arithmetic mean 2,5 µg/kg in locality Raškov on Morava River (year 2001, ČHMU). [153]

Limits:
Decree of the Ministry of Agriculture No. 68/2005 Coll. lays down the maximum acceptable residual amount of endosulphane in various agricultural commodities.

Government Order No. 61/2003 Coll. lays down emission standards: indicators and values of acceptable pollution of surface waters 0.01 µg/l. The emission standards express the acceptable pollution of surface waters at flow Q355, or, optionally, at the minimum guaranteed flow of water in the watercourse, or value, which will be met, if the annual number of samples not-complying with this standard is not higher than 5 %.

Decree of the Ministry of Health No. 376/2000 Coll. laying down requirements on drinking water and scope and frequency of its control, lays down a limit of 0.1 µg/l.
Decree No. 275/2004 Coll. lays down hygienic requirements on bottled water. The limit of 0.025 µg/l is set for pesticide substances, valid for each of the substances separately.

In the case of pesticide substances, also limits for soil are laid down, by the Decree No. 13/1994 Coll. The limit is laid down, on the one hand, for the individual substances at the level of 0.01 mg/kg of dry weight, and, on the other hand, for the sum of pesticides at the level of 0.1 mg/kg of dry weight.

Not binding (orientation) limits are laid down for: No such limits exist.

Use of the substance is: permitted till the existing stocks are consumed.

Importance of the substance for implementation of the Stockholm Convention: NGOs aim at its inclusion in the list of the Stockholm Convention.

Main sources of releases: Runoff from soil after treatment of plants (currant, strawberry, lettuce for seed production, caraway, and decorative plants) by the preparation Thiodan 35 EC - at present, its registration is no longer valid, but it is permitted to consume the existing stocks. Potential sources of releases are also pesticide stores and preparation rooms - older, as well as new ones.

State of inventory of sources: The inventory does not exist.

Main measures proposed by NGOs: Inclusion of this substance in the list of pesticides, production and use of which is banned according to the Stockholm Convention. Safe liquidation of olds stocks of endosulphane, rather than its further application to the soil in future. Mapping of places where pesticides were stored and prepared in the past. Decontamination of the affected localities. Arnika also tries to push through decontamination of former pesticide storage in Klatovy-Luby. The storage was returned in restitution back to the original owner. It is necessary to clean similar localities in other places in the Czech Republic, too. Old stocks of endosulphane should be safely liquidated using a method which does not produce new POPs.

Main hot spots in connection with this substance: High endosulphane concentrations were found, for example, in the former pesticide storage in Klatovy-Luby. It can be expected that similarly high concentrations can be present in other localities of former or existing stores and preparation rooms of pesticides.

Endrin

CAS: 72-20-8

Basic characteristics, occurrence and use in the Czech Republic:
Endrin was used as insecticide, against field mice. It was used at ca 100,000 ha. On a small scale, it was used also for seed treatment. It was banned in 1984.

Impact on human health:
It harms immune and reproductive systems. It is not classified as a carcinogen (group 3 according to IARC).

Burden of inhabitants of the Czech Republic:
Burden of inhabitants is monitored since 1994. Exposure of inhabitants is negligible. Accidental exposure cannot be excluded. Its source are, predominantly, foodstuffs of animal origin.

Monitoring:
It is monitored in waters and in foodstuffs. Its concentrations in surface waters are in the range of units ng/l, in suspended sediments and sediments in units ng/g. These values correspond to the background levels. In underground waters, endrin was not detected.

Results of measurements:
Soil: not available
Water (surface): below the detection limit up to 151.1 ng/l (Jihlava, year 2000)
Breast milk: not available
Fish: not available
Eggs: not available

Limits:
Decree No. 68/2005 Coll., amending Decree No. 158/2004 Coll., lays down contents of residues in foodstuffs and foodstuff raw materials. Limits are laid down for hop and other foodstuffs of plant origin. In the case of animal foodstuffs, limits are laid down for meat, milk, and eggs.

Decree No. 252/2004 Coll., as amended by Decree No. 187/2005 Coll., laying down hygienic requirements on drinking water. The standard lays down the highest limit levels for pesticide substances and for sum thereof.

Decree No. 275/2004 Coll. lays down hygienic requirements on bottled water. The limit of 0.025 μg/l is set for pesticide substances, valid for each of the substances separately.

Government Order No. 61/2003 Coll. on indicators and values of acceptable pollution of surface waters and waste waters, on requirements on a permit for discharge of waste waters into surface waters and into sewerage systems, and on sensitive areas, ranks endrin among especially hazardous substances, and lays down emission limits for this substance, valid during production and its processing. Further, this Order lays down an acceptable value of pollution of surface waters by endrin at the level of 0.005 μg/l. It also lays down requirements on monitoring of old burdens etc.

According to the Government Order No.25/1999 Coll., endrin is classified as a highly toxic substance (T+), hazardous for the environment (N). R-phrases R 24-28-50/53. S-phrases S (1/2-)22-36/37-45-60-61.

Not binding (orientation) limits are laid down for:
Methodical Instruction of the Environmental Damage Department of the Ministry of the Environment of the Czech Republic, published in 1996, lays down criterions for pollution of soils and underground water.

The substance is: banned since 1984.

Importance of the substance for implementation of the Stockholm Convention: low.

Main sources of releases: The substance is neither produced nor used in the Czech Republic.

State of inventory of sources: None.

Main measures proposed by NGOs: To map places where pesticides were stored and prepared in the past.

Main hot spots in connection with this substance: None.

Heptachlor

CAS: 76-44-8

Basic characteristics, occurrence and use in the Czech Republic:
Heptachlor is an organochlorine insecticide used, in particular, for control of soil insects and ants. Partially, it was used also for control of insects in households, in farm buildings, and for seed treatment. It was not produced in the Czech Republic and its use for agricultural purposes was banned in 1989.

Impact on human health:
It harms immune and hormonal systems. It is ranked among substances potentially carcinogenic for humans (group 2B according to IARC).

Burden of inhabitants of the Czech Republic:
Burden of inhabitants is monitored since 1994. Children in the age of 4 to 6 years are subject to more significant exposure. Foodstuffs of animal origin can be its source in particular. Significant sources are milk fat and fish oil.

Monitoring:
Heptachlor was monitored in surface waters and sediments within the framework of the Project Morava. In biological matrix, it was monitored within the framework of the Project Elbe. However, it is not monitored permanently.

Results of measurements:
Soil: not available
Water (surface): below the detection limit up to 326.2 ng/l (Morava, Kroměříž, year 2000)[154]
Breast milk: not available
Fish: not available
Eggs: not available

Limits:
Decree No. 68/2005 Coll., amending Decree No. 158/2004 Coll., lays down contents of residues in foodstuffs and foodstuff raw materials. The limit is laid down for a sum of heptachlor and heptachlor-epoxide. Limits are laid down for tea and for other foodstuffs of plant origin. In the case

of animal foodstuffs limits are laid down for meat, milk and eggs.

Decree No. 252/2004 Coll., as amended by Decree No. 187/2005 Coll., laying down hygienic requirements on drinking water. The highest limit value is 0.03 μg/l. It is determined only if it is expected in the given source.

Decree No. 275/2004 Coll. lays down hygienic requirements on bottled water. The limit of 0.025 μg/l is set for pesticide substances, valid for each of the substances separately.

According to the Government Order No.25/1999 Coll., heptachlor is classified as a toxic substance (T), hazardous for the environment (N). R-phrases R 24/25-33-40-50/53. S-phrases S (1/2-)-36/37-45-60-61.

Not binding (orientation) limits are laid down for:
Methodical Instruction of the Environmental Damage Department of the Ministry of the Environment of the Czech Republic, published in 1996, lays down criterions for pollution of soils and underground water.

The substance is: banned since 1989.

Importance of the substance for implementation of the Stockholm Convention: low.

Main sources of releases: The substance is neither produced nor used in the Czech Republic, but old pesticide stores and preparation rooms can be sources of releases.

State of inventory of sources: None.

Main measures proposed by NGOs: To map places where pesticides were stored and prepared in the past.

Main hot spots in connection with this substance: To map places where pesticides were stored and prepared in the past.

Hexachlorobenzene (HCB)

CAS: 118-74-1

Basic characteristics, occurrence and use in the Czech Republic:
HCB was used as a fungicide for treatment of wheat and onion, and as a seed treatment agent. In addition to that, it is formed as an intermediate product during production of certain chemicals (in the Spolchemie company in Ústí nad Labem). As an industrial chemical, it was used, for example, for production of pyrotechnics, synthetic rubber, and aluminium. HCB is formed also as an unintentional by-product during incineration of chlorinated substances.

Impact on human health:
It harms immune, hormonal, and reproductive systems. It is ranked among potentially carcinogenic substances (group 2B according to IARC).

Burden of inhabitants of the Czech Republic:
Burden of inhabitants is monitored since 1994. Average exposure of the inhabitants is not significant. In particular, foodstuffs of animal origin can be its source. In some localities, high HCB concentrations were measured in fish. In the case of monitored foodstuffs available on the market, milk fat is on the first places.

Monitoring:
In the Czech Republic, HCB is monitored in all important matrices. It is monitored in foodstuffs, as well as in breast milk, and in majority of the environmental components. Its concentrations in the air are determined within the framework of specific projects.

Results of measurements:
Soil (arable): at most 34 ng/g of dry matter, basal monitoring of soils, analyses of 2000 to 2004[155]
Water (surface): 852.92 ng/l (C90, Bílina - Ústí nad Labem, 1999)[156]
Breast milk: at most 1,717.0 ng/g of fat (VaV 520/6/99, Ústí nad Labem, 2000), median for this group of measurements is 357 ng/g of fat (VaV 520/6/99, Ústí nad Labem, 2000),[157] older data - 9,645 ng/g of fat (data of 1978)[158]
Fish: at most 91 ng/g of muscle (chub, Labe - Děčín, 2000) [159]
Eggs: at most 1,156 ng/g of fat (Libiš, May 2003, in the vicinity of the Spolana Neratovice company) [160]

Limits:
According to Annex No. 1 to Decree No. 356/2002 Coll., hexachlorobenzene is ranked among other chlorinated persistent organic pollutants (group of substances No. 3.4, which further includes hexychlorocyclohexane, tetrachlorophenol, and trichlorobenzene), for which a general emission limit is laid down in the following way: "The total weight concentration of these pollutants 0.2 mg/m^3, after conversion to the conditions of standard state, must not be exceeded. In the shortest possible time, these substances must be eliminated from emissions into the outer air."

Decree No. 252/2004 Coll., as amended by Decree No. 187/2005 Coll., laying down hygienic requirements on drinking water. The standard lays down the highest limit levels for pesticide substances and for sum thereof.

Decree No. 275/2004 Coll. lays down hygienic requirements on bottled water. The limit of 0.025 μg/l is set for pesticide substances, valid for each of the substances separately.

Government Order No. 61/2003 Coll. on indicators and values of acceptable pollution of surface waters and waste waters, on requirements on a permit for discharge of waste waters into surface waters and into sewerage systems, and on sensitive areas, ranks HCB among especially hazardous substances, and lays down emission limits for this substance, valid during production and its processing. Further, this Order lays down an acceptable value of pollution of surface waters by HCB at the level of 0.005 μg/l. It also lays down requirements on monitoring of old burdens etc.

Decree No. 68/2005 Coll., amending Decree No. 158/2004 Coll., lays down contents of residues in foodstuffs and foodstuff raw materials. Limits are laid down for tea, hop, oil seeds and other foodstuffs of plant origin. In the case of animal foodstuffs, limits are laid down for meat, milk, eggs and fish.

Decree No. 451/2000 Coll. defines limits valid for feeds.

In the case of pesticide substances limits for soil are laid down by the Decree No. 13/1994 Coll. The limit is laid down for the individual substances at the level of 0.01 mg/kg of dry weight and for the sum of pesticides at the level of 0.1 mg/kg of dry weight.

According to the Government Order No.25/1999 Coll., HCB is classified as a toxic substance (T), hazardous for the environment (N). R-phrases R 45-48/25-50/53. S-phrases S 53-45-60-61.

Not binding (orientation) limits are laid down for:
Methodical Instruction of the Environmental Damage Department of the Ministry of the Environment of the Czech Republic published in 1996, lays down criterions for pollution of soils and underground water.

The substance is: banned for use as a pesticide since 1977.

Importance of the substance for implementation of the Stockholm Convention: high.

Main sources of releases: HCB is a by-product of production of industrial chemicals, such as tetrachloromethane, perchloroethylene, trichloroethylene, or pentachlorobenzene (produced in Spolek pro chemickou a hutní výrobu in Ústí n/L). HCB is also formed during electrolytic production of chlorine, together with octachlorostyrene. Combustion processes (secondary production of metals, incineration of wastes, and combustion of coal) are a significant source.

State of inventory of sources: Emission inventory was carried out.

Main measures proposed by NGOs: To change production in the Spolchemie company in Ústí nad Labem in order that hexachlorobenzene is not formed, or to construct a non-combustion technology unit safely destroying this waste substance without forming new POPs. To prepare inventory of releases of HCB to all compartments of the environment. To introduce stricter emission limits for HCB for combustion processes. To map places where pesticides were stored and prepared in the past and to draw up a plan of cleaning thereof.

Main hot spots in connection with this substance:
Spolek pro chemickou a hutní výrobu (Spolchemie) in Ústí n/L and localities where wastes from this company were handled - for example landfills Chabařovice and Všebořice. Sewage sludge from the Spolchemie company was deposited also into the former underground mine near Žacléř.

Chemical company Spolana Neratovice.

Lindane (γ-HCH)

CAS: 58-89-9

Basic characteristics, occurrence and use in the Czech Republic:

Lindane is an organochlorine pesticide (OCPs). It is a persistent, bioaccumulative substance and a endocrine disruptor. Chemically it is a gamma-isomer of hexachlorocyclohexane. It was used for protection of roots, leaves and seeds of all usual cultural crops. It was also used for treatment of wood, wool, cotton and sheds against parasites. Today its use is limited. However, it is used for example, in preparations for control of lice. It was produced in Chemické závody Jurije Dimitrova in Bratislava, and in Spolana Neratovice. 61 680 tons of pesticides based on Lindane was used in the Czech Republic since 1996. During assessment of its presence in the environment, it is more objective to assess both the presence of γ-HCH, and its metabolite β-HCH which persists in the environment for much longer time. Because of that, we include measurements of all HCH metabolites in the results of measurements.

Impact on human health:
According to IARC, Lindane is included into group 2B as a possible carcinogen for people. Similarly as the other isomers of hexachlorocyclohexane, it is ranked among persistent organic pollutants, and, therefore, it can accumulate also in human fat tissues, and, subsequently, cause damage to both immune and endocrine systems of people.

Burden of inhabitants of the Czech Republic:
Burden of inhabitants is monitored since 1994. Exposure of inhabitants is very low at the level of 0.1 % of the acceptable dose (ADI), set at the level of 0.008 mg/kg of body weight/day (1989).

Monitoring:
Higher Lindane concentrations in Czech rivers were found in central and south Moravia, but also in the river Bílina downstream of the Spolchemie company in Ústí nad Labem. In the case of river sediments, higher values were also found in Moravia. The Initial National POPs Inventory provided also the summary of results of measurements of Lindane in subsurface waters. According to authors of the report, monitoring did not find values above the detection limit, i.e., 2 ng/l. J. Hajšlová et al. (1999) found higher values of the total sum of organochlorine pesticides in water of Moravian rivers after floods in 1997. Concentrations were in the range from 12.9 to 33.1 ng/l.[161]

Results of measurements:

Soil: the highest HCH sum 115.5 ng/g (Libiš, Mělnická 114, August 30, 2002) [162], the amount of γ-HCH in this sample was 12.0 ng/g, the amount of β-HCH 68.0 ng/g,
0.0002 – 0.356 pg/g of dry weight (data from the years 1993 – 2001, measurements in the vicinity

of motorways)[163]

Water (surface): the highest C90 value (value which will not be exceeded with the probability of 90 %) 137.1 ng/l (analyses 1995 - 2002, Czech Hydro-meteorological Institute)[164]
Spolana - HCH sum 9,083.0 ng/l (Spolana Neratovice, building A1420, water after floods, inside the industrial premises, August 30, 2002) [165]
Spolana - HCH sum 681.8 ng/l (Spolana Neratovice, amelioration drain, gatehouse, at discharge from the industrial premises, September 2002) [166]

Breast milk: γ-HCH - at most 28.8 ng/g of fat (C90, MZSO - Monitoring of State of Health of Inhabitants, 1998)
β-HCH - at most 428 ng/g of fat (VaV 520/6/99, Ústí nad Labem, 2000), median for this group of measurements is 173 ng/g of fat (VaV 520/6/99, Ústí nad Labem, 2000)

Fish: HCH sum 101.5 ng/g of muscle (carp, Libiš, pool in floodplain forest, in the vicinity of Spolana Neratovice, October 2002) [167]

Eggs: HCH sum 2.074 ng/g of whole eggs (household farm, composite sample of 12 eggs, Klatovy - Luby, 2003)[168], 20 ng/g of fat (year 2004, place was not stated).[169]

Further results of measurements:
Sediments: the highest annual arithmetic mean 161.25 ng/g (year 1999, Czech Hydro-meteorological Institute) [170]
Spolana and its vicinity - HCH sum 28,400.0 ng/g (Spolana Neratovice, building A1420, sediment after floods, inside the industrial premises, August 30, 2002) [171]

Underground water: the highest annual arithmetic mean 0.15 μg/l (analyses 1995 – 2002, Czech Hydro-meteorological Institute)

Suspended sediments: the highest annual arithmetic mean 19.5 ng/g (year 2001, Czech Hydro-meteorological Institute) [172]

Mushrooms: 0.1 – 2.0 ng/g of mushroom dry weight[173]

Butter: at most 0.003 ng/g of fat

Cow milk: at most 0.1 pg/g of fat
Note: Source of data for both butter and milk: Holoubek, I. et al. 2003[174]

Limits:
Decree of the Ministry of Agriculture No. 68/2005 Coll. lays down the maximum residual amount of Lindane in tea and hop 0.05 mg/kg, and in other foodstuffs of plant origin 0.01 mg/kg.

Government Order No. 61/2003 Coll. lays down emission standards: indicators and values of acceptable pollution of surface waters 0.01 μg/l. The emission standards express the acceptable pollution of surface waters at flow Q355, or, optionally, at the minimum guaranteed flow of water in the watercourse, or value, which will be met, if the annual number of samples not-complying with this standard is not higher than 5 %.

Decree of the Ministry of Health of the Czech Republic No. 376/2000 Coll. lays down the highest limit value for pesticide substances in drinking water 0.1 μg/l.

In the case of pesticide substances, also limits for soil are laid down by the Decree No. 13/1994 Coll. The limit is laid down for the individual substances at the level of 0.01 mg/kg of dry weight, and for the sum of pesticides at the level of 0.1 mg/kg of dry weight.

Government Order No. 368/2003 Coll. on integrated pollution register lays down limits for reporting in kg/year: 1 kg/year for emission into water, 1 kg/year for emission into soil, and 1 kg/year for transfers out of the plant. In the case of emission into air, limit for reporting was not set.

According to the Government Order No.258/2001 Coll., Lindane is classified as a toxic substance (T), hazardous for the environment (N). R-phrases R 23/24/25, R 36/38, R 50/53. S-phrases S(1/2-)13-45-60-61.

Not binding (orientation) limits are laid down for:
Methodical Instruction of the Environmental Damage Department of the Ministry of the Environment of the Czech Republic published in 1996, lays down criterions for pollution of soils and underground water.

The substance is: banned for use in agriculture. The last permitted preparation containing Lindane, intended for treatment of forest stands on a larger scale, was Endelit, permitted in 1995. It can be used in health care. In lower concentrations, it is recommended as active substance for treatment of scabies: imported preparations Jacutin and Skabicid. Jakutin is recommended also against lice. References to use of Jacutin and Skabicid can be found in descriptions of treatment of dogs and other applications (for example, among preparations for use in aquariums).

Importance of the substance for implementation of the Stockholm Convention: The substance is one of the candidates for the Stockholm Convention list of substances.

Main sources of releases: The substance is neither produced nor used in the Czech Republic on a larger scale. However, it can be released from contaminated places or old stocks of this pesticide.

State of inventory of sources: The inventory is not complete. There exists a basic list in the National POPs Inventory.

Main measures proposed by NGOs: Mapping of places where pesticides were stored and prepared in the past. Decontamination of the affected localities. Monitoring of levels of Lindane and its metabolites during decontamination of old burdens in Spolana Neratovice, and consistent measures for prevention of further releases of this and other substances from contamination focuses.

Arnika also tries to push through decontamination of former pesticide storage in Klatovy-Luby. The storage was returned in restitution back to the original owner. It is necessary to clean similar localities in the Czech Republic.

Main hot spots in connection with this substance:
High Lindane concentrations were found for example, in the former pesticide storage in Klatovy-Luby, and in Spolana Neratovice and its vicinity. Further places highly contaminated by Lindane are tied to former pesticide storehouses and preparation rooms (see table in Chapter 5).

Mirex

CAS: 2385-85-5

Basic characteristics, occurrence and use in the Czech Republic:
Insecticide used for control of ants and insects feeding on green parts of agricultural plants. Used also as an additive for certain materials. It was never produced or used in the Czech Republic.

Impact on human health:
It harms immune and reproductive systems. It is ranked among potentially carcinogenic substances (group 2B according to IARC).

Burden of inhabitants of the Czech Republic:
Burden of inhabitants is monitored since 2002. In the case of mirex, similarly as in the case of other POPs, the main source of exposure is fat of animal origin. However, the level of exposure is very low.

Monitoring:
Mirex is monitored in foodstuffs since 2002. Because it was never used in the Czech Republic, monitoring of imported foodstuffs is of significance. The highest concentration of 0.281 μg/kg was found in butter.[175]

Results of measurements:
Soil: not available
Water (surface): not available
Breast milk: not available
Fish: not available
Eggs: not available

Limits:
Decree No. 252/2004 Coll., as amended by Decree No. 187/2005 Coll., laying down hygienic requirements on drinking water. The standard lays down the highest limit levels for pesticide substances and for sum thereof.

Decree No. 275/2004 Coll. lays down hygienic requirements on bottled water. The limit of 0.025 μg/l is set for pesticide substances, valid for each of the substances separately.
According to the Government Order No.25/1999 Coll., mirex is classified as a substance harmful to health (Xn), hazardous for the environment (N). R-phrases R 21/22-50/53-62-63-64. S-phrases S

(2-)13-36/37-46-60-61.

Not binding (orientation) limits are laid down for:
Methodical Instruction of the Environmental Damage Department of the Ministry of the Environment of the Czech Republic published in 1996, lays down criterions for pollution of soils and underground water.

The substance is not and was not: registered in the Czech Republic.

Importance of the substance for implementation of the Stockholm Convention: low.

Main sources of releases: The substance is neither produced nor used in the Czech Republic.

State of inventory of sources: None.

Main measures proposed by NGOs: None.

Main hot spots in connection with this substance: None.

Perfluoroctane sulphonate (PFOS)

CAS: 1763-23-1

Basic characteristics, occurrence and use in the Czech Republic:
PFOS is a persistent, bioaccumulative substance, an endocrine disruptor. In European countries, PFOS and related chemical substances are used in fillings of foam extinguishers, as additives into carpets, in cleaning preparations for households as well as for industry, in paper industry and in packaging, in pesticides, for protective films (coatings) and as additives into them in upholstery, textile and in leather industry.

In the Czech Republic, PFOS is not produced. However, products containing this substance are imported into our country, and it is likely that some producers import it as a raw material for their production.

Impact on human health:
It is expected that PFOS will show similar effects on people as on mammals. These findings are based on research carried out on monkeys and rats. PFOS is toxic for mammals in sub-chronic repeated doses in low concentrations (several mg/kg/day), it induces cancer of liver, breasts, adrenal glands and thyroid gland, toxicity to reproduction - mortality of new-born young, connected probably with insufficient development of lungs, growth defects.

Burden of inhabitants of the Czech Republic:
Till 2005, no data were available. VŠCHT (Institute of Chemical Technology) is being developed a method of measurement of these substances.[176] The only result available to us originates from

monitoring of blood of ministers from European countries within the framework of the REACH project (5.27 ng/g of whole blood).[177]

Monitoring
The substance is not monitored. In the Czech Republic, a method of PFOS measurement has been under development in 2005.

Results of measurements:
Soil: not available
Water (surface): not available
Breast milk: not available
Fish: not available
Eggs: not available

Limits: No limits are laid down.

Not binding (orientation) limits are laid down for: No such limits exist. Sweden proposed inclusion of PFOS in the list of substances banned by the Stockholm Convention and by POPs Protocol of CLRTAP.

The substance is: used in products in the Czech Republic, it is not banned.

Importance of the substance for implementation of the Stockholm Convention: It is not on the list yet.

Main sources of releases: The substance is not produced in the Czech Republic. Sources of its releases are products containing it and productions using it. There exists neither their list nor data on amount of the used substance, let alone on releases thereof.

State of inventory of sources: The inventory was not made.

Main measures proposed by NGOs: It is necessary to incorporate the substance in the integrated pollution register, and to make a basic inventory of sources. It is also necessary to introduce monitoring of the substance in suitable matrices, on the basis of assessment of properties of the substance, and the first survey in the Czech Republic. Use of the substance should be banned, similarly as in Sweden and in the UK. The substance should be included in the list of POPs subject to the regime of the Stockholm Convention.

Main hot spots in connection with this substance: Not known.

Polybrominated diphenyl ethers (PBDEs)

Basic characteristics, occurrence and use in the Czech Republic:
PBDEs are one of sub-groups of brominated flame retardants (BFRs). Characteristics of PBDEs are similar to PCBs, which they substituted. In the Czech Republic, they are not produced, but are used. Unfortunately, the existing legislation does not enable monitoring of movement of these substances. In November 2004, the Czech Parliament adopted transposition of the Directive 2002/95/EC on reduction of use of certain hazardous substances in electric and electronic equipment. According to this new legal regulation, with certain limitation, PBDEs are ranked among substances banned in electronics and electrotechnics. When incinerated, PBDEs have a share in formation of polybrominated dibenzo-p-dioxins and dibenzofurans (PBDD/Fs), having similar effects as PCDD/Fs.

Impact on human health:
The similarity of the PBDEs to dioxins and PCBs has been a concern because their negative effects on health may prove to be similar.[178] In particular, scientists have found indications that the PBDEs may affect hormone function and may be toxic to the developing brain (93).[179] The PBDEs have been associated with non-Hodgkin lymphoma in humans, a variety of cancers in rodents and disruptions of thyroid hormone balance. [180]

They show also genotoxic effects .High PBDEs concentrations may be found in dust. For this reason attention is paid to effects of these substances on small children.

The body absorbs penta-, octa-, and deca-BDE on various levels, wherein especially penta-BDE is bioaccumulative. Obviously, the ability of PBDEs to be absorbed increases with increasing number of bromine atoms in the molecule. However, it turned out that also deca-BDE may be absorbed by people and animals, and it can decompose in the environment, as well as in living organisms, to other chemical substances which represent still higher potential risk.[181]

Till now it was not sufficiently examined whether PBDEs can cause cancer or not.

Burden of inhabitants of the Czech Republic:
In the Czech Republic, PBDEs are monitored since approximately 2001. In 2003, PBDEs concentrations were measured in fish and in breast milk. The found average concentration in breast milk, 1.46 ng/g of fat, was lower than in Sweden (3.15 ng/g of fat, year 1998), but higher than in Japan (1.1 ng/g of fat, year 2000). Concerning the individual congeners, BDE47 was detected in all samples, and congeners BDE99, BDE100, and BDE157 were detected in majority of samples.

Monitoring:
In 2003, 103 samples of breast milk were taken in order to determine PBDEs concentrations in them (see above).

Research Task VaV/650/3/00, monitoring presence and movement of hazardous substances in hydrosphere, carried out by ČHMÚ (Czech Hydro-meteorological Institute) and VÚV TGM (T. G. Masaryk Water Research Institute) in Prague, monitored, among others concentrations of PBDEs.

Results of measurements:
Soil: not available

Water (surface): not available

Breast milk: at most 17.55 ng/g of fat (sum of congeners 28, 47, 49, 66, 99, 100, 153, 154, and 183). Average: 1.46 ng/g of fat.

Fish: In total, the highest concentration in relation to live weight was found in milt of bream from locality Klecany (57.97 ng/g of live weight) on river Vltava, caught in 2001. However, this is caused also by high fat content in milt. The highest concentration expressed in ng/g of fat was found in muscle of bream caught in 2003 in Vltava, also in Klecany (729.42 ng/g of fat). The VŠCHT (Institute of Chemical Technology) team analysed content of 10 PBDE congeners (47, 49, 66, 85, 99, 100, 153, 154 a 183).[182]

Eggs: at most 10.5 ng/g of fat (Lysá nad Labem, March 2004), the following congeners were measured: 28, 47, 49, 66, 85, 99, 100, 153, 154, 183, and 209.

Further results of measurements:
Fish: The Arnika Association carried out analyses of samples of 3 trout from the vicinity of the underground mine Jan Šverma, where wastes from Liberec incinerator Termizo and sewage sludge from Spolchemie Ústí nad Labem were deposited. In one of the samples there was found PBDE sum of 55 ng/g of fat and sum of 0.76 ng/g of live weight.

Blood: In blood of the Minister of the Environment of the Czech Republic, Libor Ambrozek, there was found the highest PBDE level (49.7 pg/g of blood serum) of the 14 tested European politicians. The highest share on this value had the decabrominated congener 209.[183]

Limits: Ban of use of PBDEs in electronic and electric equipment on the basis of transposition of the European Directive 2002/95/EC in the Decree No. 232/2004 Coll.
Limits for PBDEs in air, water, soil, and wastes, are not laid down.

Not binding (orientation) limits are laid down for:
Limit for reporting of PBDEs into the Integrated Pollution Register is 1 kg/year for emissions into water and soil, and 5 kg/year for transfers.
The following R- and S-phrases apply to pentabromodiphenylether: R48/21/22, R50/53, R64, and S1/2, S36/37, S45, S60, S61.

The group of substances is: restricted by the Decree No. 232/2004 Coll., but it is not completely banned.

Importance of the substance for implementation of the Stockholm Convention: The substances are not on the list of the Stockholm Convention. The POPs Review Committee considers inclusion of penta-BDE in the list.

Main sources of releases: The sources of PBDEs are especially plants where these substances are added into products from plastics (especially from polyurethane foam). PBDEs are further released from the products during their whole lifetime and during their deposition to a landfill or incineration. The main form of release into the environment is dust formed from foam products. Very likely, industrial plants using PBDEs into their products (electronic and electrical industry, automobile industry, textile industry, etc.) will be also sources of releases.

State of inventory of sources: The inventory does not exist.

Main measures proposed by NGOs: It is necessary to ban PBDEs, or at least restrict them much more than at present. At least penta-, octa-, and deca-BDEs should be included in the list of the Stockholm Convention. The limit for reporting into the Integrated Pollution Register should be lowered, and it should be monitored much more thoroughly whether the companies comply with their duty to report content of PBDEs in releases and transfers. It is necessary to make inventory of places where PBDEs are used and subsequently, on its bases, inventory of releases. Waste with PBDEs content should be designated as hazardous one, and it should be disposed of in a way preventing formation of PBDD/Fs.

Main hot spots in connection with this substance: Places where wastes from incinerators are deposited may contain PBDEs, similarly as sewage sludge.[bb] However, the most important hot spots will be, with a high likeliness, industrial plants which use PBDEs into their products (electronic and electrical industry, automobile industry, textile industry).

Polychlorinated biphenyls (PCB)

CAS: 1336-36-3

Basic characteristics, occurrence and use in the Czech Republic:
PCBs were used in the Czech Republic on a broad scale. It is a group of substances comprising 209 congeners. Their production was stopped in the former Czechoslovakia in 1983, but they are still contained in a number of equipment, in wastes, and in contaminated buildings and soils. PCBs are also formed as unintentionally produced by-products. They are ranked among the most important toxic pollutants in the Czech Republic.

Impact on human health:
It harms immune and reproductive systems and is an endocrine disruptor. It is ranked among likely carcinogenic substances (group 2A according to IARC). They are linked especially to liver cancer.

[bb] According to analyses commissioned by the Arnika Association, mixture of fly ash and bottom ash from municipal waste incinerator Termizo contains PBDEs. Since 2003 this mixture is sold as a construction material. The mixture of fly ash and bottom ash from the Liberec incinerator was used, for example, for construction of a bicycle path in Oldřichov v Hájích using financial grant from the European Union.

They cause retarded development of children and they show a negative effect on the function of the thyroid gland.

Burden of inhabitants of the Czech Republic:
Burden of inhabitants has been monitored since 1994. Exposure of inhabitants shows a slightly downward trend, but it is still significant. Children of the age of 4 to 6 years show the highest burden. Foodstuffs of animal origin are its particular source. During monitoring carried out in 2002, the highest values were found in meat products (sausages and salamis), tinned fish and pork lard.

Monitoring:
In the Czech Republic, PCBs are monitored in all important matrices. They are monitored in foodstuffs, as well as in breast milk, and in all environmental components. In the air their concentrations are measured intermittently within the framework of research projects financed by various entities.

Systematic monitoring of soils is carried out by ÚKZÚZ (Central Institute for Supervising and Testing in Agriculture) in Brno. Since 1994 it monitors congeners 138, 153, and 180, since 1998 congeners 28, 52, and 101. Since 2000 congener 118 has also been monitored.
Systematic monitoring of water, sediments and fish is carried out by ČHMÚ (Czech Hydro-meteorological Institute). Congeners 28+31, 52, 101, 118, 138, 153, and 180 are monitored in surface water.

Monitoring of breast milk is carried out by SZÚ (National Institute of Public Health) within the framework of MZSO (Monitoring of State of Health of Inhabitants). Indicator congeners 28, 52, 101, 118, 138, 153, and 180 are monitored. Within the framework of single research actions dioxin-like PCBs are monitored.

Monitoring of eggs is carried out by SVS ČR (State Veterinary Administration of the Czech Republic. Indicator congeners 28, 52, 101, 118, 138, 153, and 180 are monitored.

Results of measurements:
Indicator congeners (or PCB sum):
Soil (agricultural land): maximum values measured in agricultural soils were 84.3 ng/g of dry weight (7 congeners - 28, 52, 101, 118, 138, 153, and 180, a sample taken in 2000 within the framework of basal monitoring of soils)[184]. The most distinctive locally measured maximums within the framework of survey of soils carried out by VÚMOP (Research Institute of Ameliorations and Soil Conservation) were in districts Děčín (530 ng/g), Prague - city (450 ng/g), Kladno (218 ng/g), and Karlovy Vary (140 ng/g).[185]
Soils other than arable ones: Spolana and its vicinity: at most 323.8 ng/g (7 congeners, Libiš, Za Rybníkem 235, near Spolana Neratovice, August 30, 2002, after floods)[186]
Water (surface): at most 250000 ng/l (PCB sum, Skalice - Rožmitál, after accident in 1986) [187]
Breast milk: at most 5,814 ng/g of fat (6 PCB indicator congeners, VaV 520/6/99, Uherské Hradiště, 1999)[188]
Fish: at most 10093 ng/g (bream - milt, VÚRH - Research Institute of Fish Culture and Hydrobiology, Lomnice - confluence with Otava, 1989)

Eggs: 22935 ng/g of fat (sum of 7 congeners, household farm, Libiš, 2003),[189]

Dioxin-like PCBs:
Soil: maximum - Spolana - 14.3 pg WHO-TEQ/g (sample 3319, year 2002) [190], 12.01 (the highest concentration found in border mountains, period 1994 - 2001) [191]
Water (surface): not available
Breast milk: at most 64.6 pg WHO-TEQ/g of fat (Uherské Hradiště I, women that had been employed in a plant producing paints with PCBs, 1999) [192]
Fish: maximum - roach 209.8 pg WHO-TEQ/g of fat or 5.48 pg WHO-TEQ/g of muscle (Milovice - pond Josef, July 2003, sampling carried out by ČIŽP - Czech Environmental Inspection Agency),[193] Spolana: pike 4.4 pg WHO-TEQ/g of muscle (Libiš, left bank of Elbe, October 8, 2002, after floods)
Eggs: 42.9 pg WHO-TEQ/g of fat (household farm, Libiš, in the vicinity of Spolana Neratovice, November 1, 2002, after floods, sampling carried out by Greenpeace), 21.7 to 22.4 pg WHO-TEQ/g of fat (household farm, Lysá nad Labem, 2004), [194]

Total PCB sum (all measured congeners):
Soil: Project VaV 520/6/99 was determining concentrations of a sum of all detected PCB congeners in various types of soils. The found maximums: for remote distance localities 15.8 ng/g, for villages 651.1 ng/g, for cities 279.6, and in forest soils 307.0 ng/g. [195]

Breast milk: at most 13,754 ng/g of fat (PCB sum, VaV 520/6/99, Uherské Hradiště, 1999)[196]

Further results of measurements:
Indicator congeners (or PCB sum):
Sediments: at most 2,289.3 (7 congeners, Libiš, amelioration drain - culvert under a housing estate, vicinity of Spolana Neratovice, September 11, 2002, after floods) [197]

Dioxin-like PCBs:
Sediments: at most 144.5 (Obříství, Labe near Štěpánský bridge, vicinity of Spolana Neratovice, August 22, 2002, after floods) [198]

Limits:
A general emission limit for PCB is laid down in Annex No. 1 to Decree No. 356/2002 Coll., in the following way: "In the case of a possible occurrence of emissions, the total weight concentration of these pollutants 0.2 mg TEQ/m^3, after conversion to the conditions of standard state must not be exceeded. In the shortest possible time these substances must be eliminated from emissions into the outer air."

Decree No. 252/2004 Coll., as amended by Decree No. 187/2005 Coll., laying down hygienic requirements on drinking water. The standard lays down the highest limit levels for pesticide substances and for sum thereof.

Decree No. 275/2004 Coll. lays down hygienic requirements on bottled water. The limit of 0.001 µg/l is set for PCBs (7 congeners).

Government Order No. 61/2003 Coll. on indicators and values of acceptable pollution of surface waters and waste waters, on requirements on a permit for discharge of waste waters into surface waters and into sewerage systems, and on sensitive areas, lays down an emission limit for acceptable pollution of surface waters at the level of 0.012 µg/l. This limit is valid for a sum of six PCB congeners: PCB , 52, 101, 138, 153, and 180. The Order also lays down requirements on monitoring of old burdens etc.

Decree No. 68/2005 Coll., amending Decree No. 158/2004 Coll., lays down contents of residues in foodstuffs and foodstuff raw materials. Limits are laid down for tea, hop, oil seeds, and other foodstuffs of plant origin. In the case of animal foodstuffs, limits are laid down for meat, milk, eggs and fish.

Decree No. 451/2000 Coll. defines limits valid for feeds.

In the case of PCBs a limit for soil is laid down by the Decree No. 13/1994 Coll. The limit is laid down at the level of 0.01 mg/kg of dry weight.

Management of wastes containing PCBs is regulated by Decrees Nos. 294/2005 Coll., and 383/2001 Coll.

According to the Government Order No.25/1999 Coll., PCBs are classified as a substance harmful to health (Xn), hazardous for the environment (N). R-phrases R 33-50/53. S-phrases S (2-)35-60-61.

Not binding (orientation) limits are laid down for:
Methodical Instruction of the Environmental Damage Department of the Ministry of the Environment of the Czech Republic published in 1996, lays down criterions for pollution of soils and underground water.
Use of the substances is: banned since 1983, in the individual equipment they could be present until 2001. They are also formed as unintentionally produced by-products of a number of processes.

Importance of the substance for implementation of the Stockholm Convention: high.

Main sources of releases: Old equipment containing oils with PCBs, landfills and stores of wastes containing PCBs (probably in Ostrava, Tachov, and in other places), places highly contaminated by PCBs in the past (for example, Milovice), old plants for coating of bituminous mixtures (Modřec, Rožmitál, etc.), metallurgical plants (releases into air, old transformers, wastes containing PCBs), chemical plants (old burdens), hazardous waste incinerators, burning of wastes in household heating systems etc.

State of inventory of sources: Emission inventory for releases into air was carried out. Some old burdens are known but a complete list does not exist. Inventory of sources of releases into wastes and waste waters is missing.

Main measures proposed by NGOs: A more complete summary of measures proposed by NGOs is given in Annex 3 to this study. From the point of view of PCB releases from new sources, it is important to prevent their putting into operation (this concerns, especially, metallurgical plants), further, to introduce emission limits and to lie down, or make stricter, limits for releases into waters and in wastes. It is also necessary to prevent use of wastes containing PCBs as construction or reclamation materials without any treatment. During cleaning of old or newly formed burdens, it is necessary to prefer technologies which will not result in formation of new POPs and, simultaneously, will attain sufficient efficiency. No such technology is in operation in the Czech Republic. From the point of view of monitoring of releases it is important to introduce limits for reporting into the Integrated Pollution Register for dioxin-like PCBs (with the limit being at least at the level of 0.1 per year). It is also necessary to complete the inventory of PCB releases into waters and wastes and to make the inventory or releases into air more precise. It is necessary to complete monitoring of biotic samples by monitoring of animals kept by households in the vicinity of potential sources of pollution by dioxin-like PCBs. It is necessary to utilise introduction of limits for PCBs in the process of issuance of permits according to Integrated Pollution Prevention Control legislation.

Main hot spots in connection with this substance: Milovice (the greater part was already decontaminated), old coating plants (for example, Modřec, Klecany, Rožmitál), landfills and stores of wastes containing PCBs (for example, Hodonín near Nasavrky, Tachov), Ostrava. Further places contaminated by PCBs are the ones where PCBs were used in the production in the past (Uherské Hradiště, Králíky, Žamberk, some plants in Prague, and others).

Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs)

Basic characteristics, occurrence and use in the Czech Republic:
PCDD/Fs are 2 groups of substances, 75 congeners of PCDDs, and 135 congeners of PCDFs. They are not manufactured, but are formed as unintentionally produced by-products. The 17 most toxic congeners from this group have been assigned values of toxic equivalent, (TEQ) by means of which the total toxicity of their concentration is expressed in the case of concentrations found in the environment. The highest dioxin concentrations in the Czech Republic are linked to the former production in chemical industry. The highest concentration found in the air (10 746 $fgTEQ/m^3$), in the centre of Prague in 1996 is linked to a hazardous waste incinerator located nearby.
Impact on human health:
They harm immune and reproductive systems and are endocrine disruptors. They show a negative effect on function of the thyroid gland. They cause retarded development of children and show a negative impact on development of the nervous system. 2,3,7,8-Tetrachlorodibenzo-/para/-dioxin (CAS number 1746-01-6) is ranked among substances carcinogenic for humans (group 1 according to IARC).

Burden of inhabitants of the Czech Republic:
Burden of inhabitants is monitored since 1994. In 2000, the estimated daily intake of a person

weighing 70 kg was 30 - 190 pg WHO-TEQ, in 2001 this number was 28 - 305 pg WHO-TEQ, and in 2002 it was 80 pg WHO-TEQ. If this figure were confirmed we would comply with the weekly limit at the level of 14 pg WHO-TEQ per 1 kg of body weight.

In 2002, the methodology of assessment of the exposure was changed. Because of this it is not possible to assess the development trend. In 2002, the share of PCDD/Fs on the total intake was 36 - 50 %, and the share of PCBs was 50 - 64 %. Again, the main source is foodstuffs of animal origin. Persons consuming higher amounts of animal fats can be exposed to several times higher doses.[cc]

Monitoring:
Monitoring of soils was carried out by ÚKZÚZ (Central Institute for Supervising and Testing in Agriculture) in Brno in 2001. Regular monitoring is not carried out. Regular monitoring of water is not carried out. Concerning fish, SVS ČR (State Veterinary Administration of the Czech Republic) monitors PCDD/Fs content in carps since 2000. Monitoring of breast milk within the framework of MZSO (Monitoring of State of Health of Inhabitants) is not carried out each year. Monitoring is also within the framework of the WHO project. Since 2004, SVS ČR carries out monitoring of eggs. However, the monitoring concerns only eggs from large-capacity breeding farms (which are put on the market most often). Each year dioxins are monitored in some of specifically focused projects financed from various sources (projects financed by state, foundations, or industry). Data obtained by these projects are not always made available to the public. This concerns especially projects financed by the industry.

Results of measurements - the highest found values:
Soil (arable): at most 14.3 pg WHO-TEQ/g of dry weight (ÚKZÚZ,. Lhota u Příbrami, 2001) [199]
Soil (other than arable one, out of industrial premises) - at most 141.58 pg WHO-TEQ/g (maximum measured in border mountains in the period 1994 - 2001, place was not described more precisely)[200]

Soil (industrial premises): at most 1,099 pg WHO-TEQ/g (composite sample from the inner premises of Spolana Neratovice, September 9, 2002, after floods)[201]

Water (surface): at most 14.7 pg WHO-TEQ/l (ČIŽP - Czech Environmental Inspection Agency, Labe - Libiš - above the waste water treatment plant, 2002), Spolana - at most 1,159.2 pg WHO-TEQ/l (inside the industrial premises during floods - building A1030, August 16, 2002) [202]

Breast milk: 22.7 pg WHO-TEQ/g of fat (median, Prague, 1999, VaV 520/6/99), 23.91 (mean, Uherské Hradiště I, 1999) range for PCDDs 2.89 - 10.1 pg WHO-TEQ/g of fat, and for PCDFs 7.12 - 72.3 pg WHO-TEQ/g of fat, found in the case of a group of 14 women from Uherské Hradiště, who worked with PCBs during paint production in the past (VaV 520/6/99, Prague)[203]

Fish: at most (per g of live weight) barbel 4.13 pg WHO-TEQ/g of live weight (Ostrava, river Odra, October 2003, expressed per g of fat: 61.4), source: measurement commissioned by Arnika
at most (per g of fat) bream 117.78 pg WHO-TEQ/g of fat (Klecany, river Vltava, 2001, expressed

[cc] The intake includes also dioxin-like PCBs, i.e., PCB congeners acting similarly as PCDD/Fs.

per g of fresh weight: 2.61 pg WHO-TEQ).[204]

Eggs: at most 23.39 pg WHO-TEQ/g of fat (household farm, Libiš, municipality near Spolana Neratovice, 2002, after floods).[205]

Further results of measurements:
Sediment - out of industrial premises, at most 518.8 pg WHO-TEQ/g (pool Černínovsko in the vicinity of Spolana Neratovice, June 24, 2002 - before floods)
- industrial premises, at most 15,142.1 pg WHO-TEQ/g (inside industrial premises of Spolana Neratovice, yard of building A1400, August 22, 2002, after floods)[206]

Limits:
Limit for emissions into air from waste incinerators and plants for co-combustion of wastes is laid down by the Government Order No. 354/2002 Coll. at the level of 0.1 ng I-TEQ/m^3. Annex No. 1 to Decree No. 356/2002 Coll. lays down the same general emission limit for dioxins (PCDD/Fs)

Annex No. 4 to the Government Order No. 354/2002 Coll. lays down a limit for dioxins in waste waters from treatment of flue gases from waste incineration plants at the level of 0.3 ng/l.

Decree No. 451/2000 Coll. defines limits valid for feeds.

2,3,7,8-Tetrachlorodibenzo-para-dioxin is on the list of substances which must not form part of composition of cosmetic preparations, according to Act No. 174/1998 Coll.

Not binding (orientation) limits are laid down for:
Recommended (not binding) emission limit for outer air is 20 fg I-TEQ/m^3.

Methodical Instruction of the Environmental Damage Department of the Ministry of the Environment of the Czech Republic published in 1996, lays down criterions for pollution of soils and underground water.

WHO set a recommended limit for daily intake of PCDD/Fs + PCBs at the level of 1 - 4 pg WHO-TEQ/kg of body weight/day.

In the EU, the recommended limit for weekly intake of PCDD/Fs + PCBs is 14 pg WHO-TEQ/kg of body weight/week.

The substance: is formed as unintentionally produced by-product of a number of processes.

Importance of the substance for implementation of the Stockholm Convention: high.

Main sources of releases: metallurgical plants, chemical plants (old burdens), waste incinerators (in fly ashes), burning of wastes in household heating systems, etc.

State of inventory of sources: Emission inventory for releases into air was carried out. Some old burdens are known. Inventory of sources of releases into wastes and waste waters is missing.

Main measures proposed by NGOs: A more complete summary of measures proposed by NGOs is given in Annex 3 to this study. From the point of view of dioxin releases, it is important to prevent putting into operation of new sources of releases of these substances, further, to introduce emission limits for a higher amount of sources and to lie down or make stricter limits for releases into waters and in wastes. From the point of view of prevention, substitution of PVC and chlorinated pesticides is important. It is also necessary to prevent use of fly ashes containing high dioxin concentrations as construction or reclamation materials without any treatment. During cleaning of old or newly formed burdens it is necessary to prefer technologies which will not result in formation of new POPs, and, simultaneously, will attain sufficient efficiency. From the point of view of monitoring of releases, it is important to lower limits for reporting into the Integrated Pollution Register (from 1 g to at least 0.1 per year), and it is also necessary to complete the inventory of dioxin releases into waters and wastes. It is necessary to complete monitoring of biotic samples by monitoring of animals kept by households in the vicinity of potential sources of dioxin pollution.

Main hot spots in connection with this substance: Spolana Neratovice a.s. (especially buildings of the former pesticide production and buildings of old amalgam electrolysis that are polluted by dioxins), Spolchemie Ústí nad Labem (old production buildings are polluted by dioxins), according to the Integrated Pollution Register, the plants Třinecké železárny, ŽDB Bohumín, and Vysoké pece Ostrava show high dioxin releases into air. Other places contaminated by dioxins include places where fly ashes from waste incinerators were deposited.

Polychlorinated naphthalenes (PCNs)

Basic characteristics, occurrence and use in the Czech Republic:
Polychlorinated naphthalenes (PCNs) form a group of 75 compounds having structure and properties similar to PCBs. Because of that the European Commission proposed to include them in the list of substances subject to POPs Protocol of the Convention on Long-Range Transboundary Air Pollution (LRTAP). They were used especially in the period from 1910 to 1970 (and possibly also earlier) into oils for capacitors, during production of insulation of cables, into rubber products, for wood protection, as an additive into motor oils or during manufacture of paints. They show good insulation properties and low flammability, similarly as PCBs. They are formed also as an unintentionally produced by-product. They were detected, for example, in fly ashes from waste incinerators. We do not have sufficient information on their use and releases in the Czech Republic.

Globally, it is estimated that 150,000 tons of PCNs were produced for use in technical mixtures, 200 t as an impurity in PCB mixtures, and 1 - 10 t by thermal processes. [207]

Impact on human health:
PCNs show a similar impact as PCDD/Fs and PCBs. Some of PCNs act via Ah receptor, affect immune system, are endocrine disruptors, in higher concentrations they can cause chloracne. In the case of people exposed to PCNs at work, skin diseases and liver diseases developed.

Burden of inhabitants of the Czech Republic:
These substances are not monitored yet. The POPs National Reference Laboratory in Frýdek Místek offers carrying out of analyses.

Monitoring:
The substances are not monitored. Polychlorinated naphthalenes were analysed within the framework of a SPMDs[dd] test for sampling of organic pollutants from waters, outer air, air at workplaces and soils in the Czech Republic. Their presence in the analysed samples was not proved.[208]

Results of measurements:
Soil: not available. In soils in the neighbouring Germany, values under LOD - 15,000 pg/g of dry matter were found. The highest concentrations were found in gardens.[209]
Water (surface): not available
Breast milk: not available. In the subcutaneous fatty tissue of people, values under LOD - 250,000 pg/g of fat were found in the world.[210]
Fish: not available
Eggs: not available

Limits: No limits are laid down.

Not binding (orientation) limits are laid down for: No such limits are laid down.

The substance: is not on the list of banned substances, but it is, practically, neither used nor produced.

Importance of the substance for implementation of the Stockholm Convention: The substances are neither subject to the regime of the Convention, nor on the list of substances which are being evaluated by the POPs Review Committee.

Main sources of releases: incineration of solid municipal waste, sintering of ores, aluminium melting, secondary magnesium production, pyrolysis of chlorinated solvents such as vinylchloride and tetrachloroethylene, pyrolysis of PAHs (the last two sources are derived from laboratory experiments).[211]

State of inventory of sources: The inventory does not exist.

Main measures proposed by NGOs: It is necessary to start at least basic monitoring of sources where these substances may be formed as unintentionally produced by-products. Characteristics of PCNs fully correspond to substances which should be subject to the Stockholm Convention, and, because of that, they should be included in the list.

[dd] passive integrative samplers using selective penetration of the sampled substances through a semi-permeable synthetic membrane

Main hot spots in connection with this substance: Not known.

Polycyclic aromatic hydrocarbons (PAHs)

Basic characteristics, occurrence and use in the Czech Republic:
Polycyclic aromatic hydrocarbons (PAHs) are a group of substances which includes several hundreds of compounds. They are typical representatives of POPs. They are formed by carbon and hydrogen, by two or more benzene rings. An important feature of PAHs is their ability to form further compounds which can be much more hazardous than the original substance.

The most important PAHs include 16 PAHs according to USEPA. The list comprises name of the substance, its abbreviation, and CAS-number: naphthalene, NAP (NA), 91-20-3, acenaphthylene, ACL, 208-96-8, acenaphthene, ACE (AC), 83-32-9, fluorene, FLE (FL), 86-73-7, phenanthrene, PHE, 85-01-8, anthracene, ANT (AN), 120-12-7, fluoranthene, FLU (FA), 206-44-0, pyrene, PYR (PY), 129-00-0, benz(a)anthracene, BaA, 56-55-3, chrysene, CHR, 218-01-9, benzo(b)fluoranthene, BpF (BbFA), 205-99-2, benzo(k)fluoranthene, BkF (BkFA), 207-08-9, benzo(a)pyrene, BaP, 50-32-8, indeno(123cd)pyrene, IP, 193-39-5, dibenz(ah)anthracene, DBA (DBahA), 53-70-3 a benzo(ghi)perylene, BPE (BghiP), 191-24-2.

Most of these substances are not manufactured, but are formed as unintentionally produced by-products, especially in combustion processes.

Impact on human health:
Some PAHs show toxic, carcinogenic and mutagenic properties. Their vapours irritate eyes and skin, cause photosensibilisation (sensitivity to light). The most known carcinogenic PAH is benzo(a)pyrene, in the case of which even the mechanism was explained, by which it directly damages the genetic information of cells. Benzo(a)pyrene, together with other PAHs, is present in flue gases from combustion of coal, wood, from other combustion processes, in exhaust gases, and in cigarette smoke. PAHs are present there in the form of very fine particles which penetrate after inhalation up to air sacs where they are caught. PAHs presence is the main cause of development of lung cancer. PAHs consumed with food cause cancer of digestive tract, and, in the case of skin contact, skin cancer.

Burden of inhabitants of the Czech Republic:
Burden by PAHs from foodstuffs was monitored last in 2003. This monitoring concerned 15 different PAHs. Exposure dose of benzo(a)pyrene was 2 ng/kg of body weight/day, and summary exposure was under 1 µg/kg of body weight/day. However, also burden from the air should be added to this. Immission limit of benzo(a)pyrene - 1 ng/m^3 was exceeded in the majority of the monitored towns. The most significant exceeding of the limit was found on stations in Ostrava (6.5 ng/m^3) and in Karviná (4.5 ng/m^3). In winter season, values of average 24-hour concentrations over 20 ng/m^3 were found on these stations in certain days. In 2004, a monitoring was carried out in soils in playgrounds of nursery schools. In the majority of cases, the recommended maximum content of benzo(a)pyrene (0.1 mg/kg) was exceeded.

Monitoring:
PAHs are monitored in selected meat products and smoked foods, and also in sea fish. Further, also in vegetable oils, wine, flour, bread, and rice.

Since 2002, from adoption of the new Clean Air Act No. 86/2002 Coll., ČHMÚ (Czech Hydrometeorological Institute) monitors pollution of air on 13 monitoring stations located around the whole Czech Republic. However, within the framework of this monitoring it monitors only PAHs for which emission limits were laid down in the Act. Results of the monitoring are mentioned below.

According to its foundation charter, ČHMÚ is responsible for operation of state networks of water quality monitoring. The measurements are carried out nation-wide. Within the framework of this monitoring, 14 PAHs are monitored, in surface and underground waters, sediments and suspended sediments.

Results of measurements:
Soil (arable): sum of the group of 15 PAHs (range of minimum and maximum: 60-9489 ng/g). The comparison is based on samples taken in 1997 - 2004.
Soil (subsoil layer): sum of the group of 15 PAHs (range of minimum and maximum: 54 - 7081 ng/g). The comparison is based on samples taken in 1997 - 2004. [212]
Water (surface, underground): ČHMÚ publishes results of measurements of 14 different PAHs. Because the amount of data is high, we do not state them here. [213]
Breast milk: not available.
Fish: not available.
Eggs: not available.

Further results of measurements:
Air: In 2003, limit for benzo(a) pyrene was exceeded on 8 stations. The highest average year values were measured in Ostravá and Karviná areas, at the level of 7.8 and 6.4 ng/m^3, respectively. The lowest value from all 13 stations, amounting to 0.4 ng/m^3, was found in Košetice. The limit is 1 ng/m^3, it will be valid since 2010. For 2003, the limit was increased by a tolerance limit, to 8 ng/m^3. Substantially higher PAHs concentrations may be found in winter season.

Sediments and suspended sediments: ČHMÚ publishes results of measurements of 14 different PAHs. Because the amount of data is high we do not state them here.

Foodstuffs: The valid limits for PAHs are often exceeded especially in the case of smoked products. The highest values are usually found in vegetable oils, in several cases of which also limit values laid down by the Decree No. 53/2002 Coll. were exceeded. Complete results of measurements are given in the Initial National POPs Inventory of the Czech Republic. [214]

Limits:
According to Annex No. 1 of the Decree No. 356/2002 Coll., PAHs are included in group 3, among persistent organic pollutants (POPs). The Decree states a sum of PAHs, and ten substances, namely

fluoranthene, pyrene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, benzo(ghi)pyrelene, indeno(1,2,3-c,d)pyrene, benz(a)anthracene, and dibenz(a)anthracene. A general emission limit of 0.2 mg/m^3 is valid for the total weight concentration of these substances. According to Annex No. 1 to the Government Order No. 350/2002 Coll., limit for PAHs, expressed as benzo(a)pyrene, is laid down at the level of 1 ng/m^3.

Emission limits for PAHs are laid down in Annex No. 1 to the Government Order No. 61/2003 Coll. For industrial waters, there is laid down a limit for plants - coal mining and briquetting plants, thermal coal treatment, wood-working industry, petroleum treatment and petrochemistry, distribution stores of petroleum substances, production of pharmaceuticals, at the level of 0.01 mg/l. PAHs are expressed as a sum of concentrations of six compounds: fluoranthene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, benzo[g,h,i]perylene, and indeno[1,2,3-c,d]pyrene.

According to Annex No. 3 to the Government Order No. 61/2003 Coll., the acceptable emission standard for surface water for the sum of PAHs is 0.2 μg/l (substance No. 108). PAHs are expressed as a sum of concentrations of six compounds: fluoranthene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, benzo[g,h,i]perylene, and indeno[1,2,3-c,d]pyrene.

PAHs limits for underground water and soil are given in Methodical Instruction of the Ministry of the Environment (Official Gazette of the Ministry of the Environment No. 3/1996).
Annex No. 2 of the Decree No.13/1994 Coll. lays down a limit for soils which are part of the agricultural land resources.

Decree of the Ministry of the Environment No. 294/2005 Coll. lays down, in Annex No. 4, a limit for sum of PAHs in wastes which can be deposited to a landfill of inert waste, at the level of 80 mg/kg of dry weight, and, in Annex No. 10, requirement on PAHs content concerning content of pollutants in wastes used on surface of land, at the level of 6 mg/kg of dry weight. Polycyclic aromatic hydrocarbons are defined as a sum of anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)pyrelene, benzo(k)fluoranthene, fluoranthene, fenanthrene, chrysene, indeno(1,2,3-c,d)pyrene, naphthalene, and pyrene.

Limits for PAHs in foodstuffs are given in Annex No. 2 to the Decree of the Ministry of Health No. 53/2002 Coll.

Integrated Pollution Register (Government Order No. 368/2003 Coll.): limits for reporting in kg/year: emissions into air = 50, emissions into water = 5, emissions into soil = 5, and transfers out of the plant = 50.

PAHs are measured as benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-c,d)pyrene.

Importance of the substance for implementation of the Stockholm Convention: The substance is not on the list of the Stockholm Convention.

Main sources of releases:
Source of releases of PAHs is, in particular, the combustion of fossil fuels. Typically these substances are released in the case of imperfect combustion processes. It means that they get into the environment, for example, during power production, waste incineration, from road transport, during cracking of petroleum, during aluminium production, from metallurgical processes, during coke and asphalt production, during cement production, from refineries, crematoriums, fires, and, last but not least, from smoking. In all cases when formation of soot and dark smoke is observed, high amounts of PAHs are formed.

In addition to big industrial sources and transport, substantial amount of PAHs is released from non-industrial sources, especially from local heating systems which have the highest share on PAHs emissions according to the present emission inventories. The non-industrial sources include also open burning of agricultural wastes and forest fires.

Also the whole number of old environmental burdens is a source of pollution by PAHs.

State of inventory of sources:
Until now the total PAHs sum was subject to reporting in the Czech Republic. For the next year, emission factors of four required PAHs are under preparation: benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, and indeno[1,2,3-c,d]pyrene.

Using the more precise emission factors, and relevant capacity data, a new PAHs emission inventory for the Czech Republic concerning year 2001 was drawn up. Subsequently, also back re-calculation of emission inventories back to the year 1990 will be carried out (the data will be available in 2006). See Chapter 8 of this study.

Inventory of sources of releases into water and in wastes was not made. Data reported in the Integrated Pollution Register, concerning year 2004, are available. Only two plants reported releases or transfers into water, PAHs content in wastes was reported by 15 plants from the whole Czech Republic. Too high limits for reporting are to blame. Consequently, inventory of PAHs releases should be completed by records of releases in waste waters and in wastes.

Main measures proposed by NGOs:
PAHs emissions into air are closely linked with energy consumption. Therefore, the main measures should be directed at programmes the aim of which will be reduction of energy requirements of the industry in the Czech Republic. Programmes of energy savings must include also households, the main source of PAHs in the Czech Republic, according to the published emission inventories. It follows from the methodology of PAHs calculation that emission data are based on specific energy consumption in family, residential, and other houses, at the level of 130 to 150 kWH/m^2/year. In the neighbouring Austria, requirement on specific heat consumption for construction of new houses at the level of 25-45 kWH/m^2/year will be valid since 2010. It is also necessary to adopt stricter emission limits for PAHs emissions from certain technological plants, for example, in metallurgy. It is necessary to include releases into water and wastes into the inventory of releases.

Main hot spots in connection with this substance:
The highest share of PAHs comes from local heating systems. In spite of this it is possible to find ca 8 industrial companies which handle PAHs in amounts higher than 1000 t/year. According to the Integrated Pollution Register, the highest emissions into air are produced by Třinecké železárny a.s. (1575.1 kg in 2004). The highest value of PAHs transfer in wastes was reported by Prunéřov power station (4275 kg in 2004). The highest PAHs transfer in waste water was reported by coking plant Jan Šverma (986.6 kg in 2004). [215]

Short chained chlorinated paraffins (SCCPs, chlorinated alkanes C 10-13)

CAS: 85535-84-8

Basic characteristics, occurrence and use in the Czech Republic:
short chained chlorinated paraffins, or chlorinated alkanes C 10-13, have the general formula $C_xH_{(2x-y+2)}Cl_y$, where x = 10 to 13 and y = 1 to x. They have been manufactured since 1930 by chlorination of n-alkanes at high temperatures and in the presence of UV radiation. In the Czech Republic, they are not manufactured. It is assumed that they are imported from the neighbouring Slovakia, where they are manufactured by the company Novácke chemické závody, joint-stock company, Nováky. They form one of the groups of polychlorinated paraffins, world-wide production of which is 300 000 tons/year with annual growth by 1 %. Since the 1980s they have been used as a substitute of PCBs, because they show comparable physico-chemical properties. Polychlorinated paraffins are consumed especially in machine industry (71 %) and in rubber industry (10 %). They are used as plasticizers, lubricants, flame retardants, as additives for production of colours, cements, adhesives, etc. In view of the amount of compounds in technical mixtures only basic information on their presence in the environment exists.

According to state records, based on Section 22 of the Act No. 157/1998 Coll. on chemical substances and chemical preparations, one company importing chlorinated alkanes C 10-13 is registered in the Czech Republic. The following amounts of these substances were put on the market in the Czech Republic in the individual years: 107 t in 2000, 105 t in 2001, no amount was reported in 2002, and 24 t in 2003. According to the records of the Register of Industrial Sources of Water Pollution (VÚV T.G.M. - : T. G. Masaryk Water Research Institute), these substances are used exclusively as auxiliary compounds on a limited scale (3 companies).

Impact on human health:
They show high bioaccumulative potential. Impacts on human health observed in the case of workers in machine industry were dermatitis and respiratory diseases. Impact on human health in the case of long-term exposure to low concentrations is not sufficiently analysed.

They are highly toxic for water organisms, they can cause long-term adverse effects in water environment. Toxicity for water organisms was proved in concentration range from 0.12 to 1.45 µg/l. [216]

Burden of inhabitants of the Czech Republic:
These substances are not monitored yet. The POPs National Reference Laboratory in Frýdek Místek offers carrying out of analyses.

Monitoring:
Presence of 1-chlorododecane and 1-chlorodecane is monitored in surface waters in 15 and 36 profiles, respectively. In 2002, sub-surface waters were monitored in 11 places. Not repeatedly, there were monitored also suspended sediments in 2001, and sediments in 2001 and 2002.

Results of measurements:
Soil: not available
Water (surface): 1-chlorododecane (measured in 36 profiles): 0.37 ng/l (Elbe, Lysá nad Labem, December 15, 2001, and Elbe, Valy, January 9, 2002), however, in the case of certain measurements in other profiles and in other dates, the concentrations were up to 1.5 ng/l. 1-chlorododecane was measured in 15 profiles in the end of 2002 and in the first third of 2002. In none of the measurement its concentration exceeded the limit of detection, the limit being 2.0 ng/l.[217]
Breast milk: not available
Fish: not available
Eggs: not available

Further results of measurements:
Sub-surface water: was analysed in 11 places in 2002. 1-chlorodecane and 1-chlorododecane did not exceed the limit of detection in any of the places.[218]

Sediments: Monitoring was carried out in 2001 in 4 profiles (Elbe-Valy, Elbe-Děčín, Odra-Bohumín, Jizera-Tuřice). All values were under the limit of detection 4 ng/g.[219]
In 2001 and 2002, concentrations of chlorinated short chain paraffins (C 10-13) were monitored also in freshwater sediments in the Czech Republic. 42 samples of sediments were taken: Košetice (14), Zlín (10), Beroun (18). The following concentrations were found:
Košetice: ∑ C11-C13: 24 – 45.78 ng/g of dry matter
Zlín: ∑ C10-C13: 16,30 – 180.75 ng/g of dry matter, (6 samples > 100 ng/g of dry matter)
Beroun: ∑ C10-C13: 4.58 – 34 ng/g of dry matter (only in 5 samples taken in 2001).[220, 221]

Limits:
In Annex No. 1 of the Act No. 254/2001 Coll. on water, chlorinated alkanes C10 - C13 are listed as a hazardous harmful substance (group of substances: organohalogen compounds and substances).

Government Order No. 61/2003 Coll. on indicators and values of acceptable pollution of surface waters and waste waters, on requirements on a permit for discharge of waste waters into surface waters and into sewerage systems, and on sensitive areas, lays down an emission limit for SCCPs in surface waters: 0.5 μg/l.

Not binding (orientation) limits are laid down for: No such limits are laid down.

The substances: are regulated by the legislation concerning water protection only. Otherwise, their consumption and production is not limited.

Importance of the substance for implementation of the Stockholm Convention: The substances are neither subject to the regime of the Convention, nor on the list of substances which are being evaluated by the POPs Review Committee.

Main sources of releases: Shoe production: chlorinated alkanes C10 - C13 are used in the Czech Republic for treatment of soles (1 company). Industry of paints: chlorinated alkanes C10 - C13 are used as chemically resistant plasticizers for paints which are dried out physically, with increased resistance to water, acids, and bases. Residues of paints formed during manufacture are liquidated through incineration in incinerators. The plasticizers may leach from the paints into water (paints of pools, tanks, fire reservoirs, etc.)

State of inventory of sources: The inventory was not carried out.

Main measures proposed by NGOs: It is necessary to prepare at least a basic list of sources where these substances are used, further, to carry out monitoring of their presence in the environment and to set better monitoring of their releases. Liquidation of their residues in incinerators is regarded as unsatisfactory by NGOs, because further POPs may be formed during it. These substances should be included in the list of substances subject to the Stockholm Convention.

Main hot spots in connection with this substance: They are not published, in spite of that a report of the Ministry of the Environment mentions them.[222] According to measurement of presence of SCCPs in surface waters, the hot spots could be certain chemical plants (in Neratovice, in Pardubice).

Toxaphene (Camphechlor)

CAS: 8001-35-2

Basic characteristics, occurrence and use in the Czech Republic:
Toxaphene is a mixture of hundreds of individual compounds. This makes its identification and quantification much more difficult. This mixture is called also polychlorinated camphenes. It is a pesticide which was used particularly for treatment of cotton. In the Czech Republic it was not produced and its use was banned in 1986. However, according to certain information, a high amount of preparations comprising toxaphene (Melipax) was imported into the former Czechoslovakia in 1963 - 1987, for treatment of clover, rape and alfalfa. It was used also in Poland or in the former East Germany. [223]

Impact on human health:
It harms immune, hormonal, and reproductive systems. It is ranked among potentially carcinogenic substances (into group 2B according to IARC).

Burden of inhabitants of the Czech Republic: Not known.

Monitoring:
Toxaphene is not monitored, however, on the basis of discovery of its use during preparation of the National Implementation Plan of the Stockholm Convention, preparations for measurement of its presence in the environment have been started.

Results of measurements:
Soil: not available
Water (surface): not available
Breast milk: not available
Fish: not available
Eggs: not available

Limits:
Decree No. 68/2005 Coll., amending Decree No. 158/2004 Coll., lays down contents of residues in foodstuffs and foodstuff raw materials. Limits are laid down for cereals, meat of slaughter animals, milk, and fish.

Decree No. 252/2004 Coll., as amended by Decree No. 187/2005 Coll., laying down hygienic requirements on drinking water. The standard lays down the highest limit levels for pesticide substances and for sum thereof.

Decree No. 275/2004 Coll. lays down hygienic requirements on bottled water. The limit of 0.025 μg/l is set for pesticide substances, valid for each of the substances separately.
According to the Government Order No.25/1999 Coll., toxaphene is classified as a toxic substance (T), hazardous for the environment (N). R-phrases R 21-25-37/38-40-50/53. S-phrases
S (1/2)36/37-45-60-61.

Not binding (orientation) limits are laid down for:
Methodical Instruction of the Environmental Damage Department of the Ministry of the Environment of the Czech Republic published in 1996, lays down criterions for pollution of soils and underground water.

The substance is: banned since 1986.

Importance of the substance for implementation of the Stockholm Convention in the Czech Republic: low.

Main sources of releases: At present the substance is neither produced nor used in the Czech Republic. However, places where it was stored or prepared for use can be sources of its releases.

State of inventory of sources: The inventory was not made. However, there exists an estimate of amount applied on the soil in the past (9852 tons in the former Czechoslovakia).

Main measures proposed by NGOs: To carry out monitoring of residues in the environment and to map places where pesticides were stored and prepared in the past.

Main hot spots in connection with this substance: Not known.

Annex 2. Available emission factors for PCDD/Fs, PCBs, and HCB

Table No. 2-1: Emission factors for PCDD/Fs

Name of the category	SNAP	NFR	Units	Czech Republic	Poland [6]	Guidebook [4]	UNEP Toolkit [5]	Notes
Combustion processes	010000		μ g (TEQ)/t				0.004-0.35	
In energy production			μ g (TEQ)/TJ				10 (01.09-230)	Combustion of coal
Power plants - boilers over 300MWt	010101		μ g (TEQ)/TJ	31.49				Combustion of bituminous coal, granulation furnace, electric separator, desulphurisation
				3.47				Combustion of brown coal, granulation furnace, electric separator, desulphurisation
Power plants, heating plants (50-300MWt)	010102, 010202, 030102		μ g (TEQ)/TJ	4.91				Combustion of brown coal, granulation furnace, electric separator or fabric filter
				1.48				Combustion of brown coal, fluidised bed furnace, electric separator or fabric filter
				0.67				Combustion of bituminous coal, electric separator
				3.69			2.5	Combustion of heavy fuel oils
	010203		μ g (TEQ)/TJ					Combustion of brown coal, grate furnace with separating

Name of the category	SNAP	NFR	Units	Czech Republic	Poland [6]	Guidebook [4]	UNEP Toolkit [5]	Notes
								equipment
Local heating	020205	1A4b	μg (TEQ)/t	6.39	18	2.5	2 (1.6-50)	Combustion of bituminous coal
				4.45	10			Combustion of brown coal
				4.45	0.61			Combustion of coke
				5 */	5	5	1.5-25	Combustion of wood, toolkit-clean wood, contaminated wood
Sintering of ores	030301	1A2a	μg (TEQ)/t	3.84-20.54	1.45	15 (0.3-17)	5 (0.3-20)	T - good separating equipment
Preheating furnaces of iron and steel works	030302	1A2a	μg (TEQ)/t			0.2	0.1	G-μg (TEQ)/ t of cement
Foundries of grey cast iron	030303	1A2a	μg (TEQ)/t	0.68			1 (0.03-10)	
Secondary lead production	030307	1A2b	μg (TEQ)/t	8.00 */	8	5-35	8 (0.5-80)	
Secondary zinc production	030308	1A2b	μg (TEQ)/t	100 */	100	62.3-379	100 (5-1000)	With separating equipment
Secondary copper	030309	1A2b	μg	50 */	50		50 (5-800)	

Name of the category	SNAP	NFR	Units	Czech Republic	Poland [6]	Guidebook [4]	UNEP Toolkit [5]	Notes
production			(TEQ)/t					
Secondary aluminium production	030310	2C3	µg (TEQ)/t	39.88	150		35 (0.5-150)	
Cement production	030311	1A2f	µg (TEQ)/t	0.001	0.07	0.05	0.05 (0.05-5)	T - dry technology with separating equipment
Lime production	030312	1A2f	µg (TEQ)/t	2.387	0.07-10		0.07 (0.07-10)	
Production of asphalt concrete	030313	1A2f	µg (TEQ)/t	0.07	0.07-0.007		0.07-0.007	
Production of bricks and tiles	030319	1A2f	µg (TEQ)/t	0.2	0.2		0.2	without separating equipment
				0.02	0.02		0.02	good separating equipment
Production of ceramic material	030320	1A2f	µg (TEQ)/t	0.07	0.07		0.07	without separating equipment
				0.007	0.007		0.007	good separating equipment
Coke ovens	040201	1B1b	µg	0.3 */	0.3		0.3-3	

Name of the category	SNAP	NFR	Units	Czech Republic	Poland [6]	Guidebook [4]	UNEP Toolkit [5]	Notes
			(TEQ)/t					
Tapping of pig iron	040203	2C1	μ g (TEQ)/t	10 */	2		10	
Open hearth furnaces in steel works	040205	2C2	μ g (TEQ)/t	3 */	2		3	
Oxygen converter - steel production	040206	2C2	μ g (TEQ)/t	3 */	2		3	
Electric arc furnace in steel works	040207	2C2	μ g (TEQ)/t	3 */	2	0.15-1.8 2-20	3	good separating equipment partial separating equipment
Incineration of household and municipal waste	090201	6C	μ g (TEQ)/t	0.93	0.5	0.5 25-1,000	0.5	up-to-date separating equipment
Incineration of industrial wastes	090202	6C	μ g		350		350	minimal separating equipment
				90	30	5-150	10	good separating equipment

Name of the category	SNAP	NFR	Units	Czech Republic	Poland [6]	Guidebook [4]	UNEP Toolkit [5]	Notes
			(TEQ)/t					
					0.05	0.5	0.75	very good separating equipment
Incineration of sludge from waste water treatment plants	090205	6C	μg (TEQ)/t	4 */	4	5-120	4	with separating equipment
Incineration of hospital wastes	090207	6C	μg (TEQ)/t		453.3	800-2,500	3,000	minimal separating equipment
				14	68	80-250	525	good separating equipment
					1.4	1	1	very good separating equipment
Incineration of contaminated wastes	090208	6C	μg (TEQ)/t	4.57				
Open burning of agricultural wastes except (100300)	090700	6C	μg (TEQ)/t	30 */	30	10	30	
Crematoria	090900	6C				80	90	without separating equipment
				10 */	10	4	10	good separating equipment
							4	very good separating equipment

Table No. 2 - 2: Available emission factors for PCBs

Name of the category	SNAP	NFR	Units	Czech Republic	Poland [6]	Guidebook [4]	Notes
Power plants - boilers over 300 MWt	010101		µ g/TJ	569.4			Combustion of bituminous coal, granulation furnace, electric separator, desulphurisation
				255.1			Combustion of brown coal, granulation furnace, electric separator, desulphurisation
Power plants, heating plants (50 - 300 MWt)	010102, 010202, 030102		µ g/TJ	3,437			Combustion of brown coal, granulation furnace, electric separator or fabric filter
				1,860.00			Combustion of brown coal, fluidised bed furnace, electric separator or fabric filter
				33,650.00			Combustion of bituminous coal, electric separator
				15,105.00			Combustion of heavy fuel oils
	010203		µ g/TJ	1,517			Combustion of brown coal, grate furnace with separating equipment
Local heating	020205	1A4b	µ g/t	603.20	31,600		Combustion of bituminous coal
				10,478	183,200		Combustion of brown coal
				10,487	9,700		Combustion of coke
					9,000		Combustion of wood
Sintering of ores	030301	1A2a	µ g/t	27, 1182, 8	65	200	
Preheating furnaces of iron and steel	030302	1A2a	µ g/t			11	G-µ g (TEQ)/t of cement

Name of the category	SNAP	NFR	Units	Czech Republic	Poland [6]	Guidebook [4]	Notes
works							
Foundries of grey cast iron	030303	1A2a	μ g/t	382.7			
Secondary copper production	030309	1A2b	μ g/t		2,600		
Secondary aluminium production	030310	2C3	μ g/t	16,652	2,600		
Cement production	030311	1A2f	μ g/t	1.25	7		
Lime production	030312	1A2f	μ g/t	24.5			
Tapping of pig iron	040203	2C1	μ g/t		3,600		
Electric arc furnace in steel works	040207	2C2	μ g/t		2,600		
Incineration of household and municipal waste	090201	6C	μ g/t	0.016	2,000		up-to-date separating equipment
Incineration of industrial wastes	090202	6C	μ g/t		30,400		without separating equipment
				4,151	19,300	5,300	good separating equipment
					380		very good separating equipment

Name of the category	SNAP	NFR	Units	Czech Republic	Poland [6]	Guidebook [4]	Notes
Incineration of hospital wastes	090207	6C	µ g/t		20,000	20,000	without separating equipment
				1,726			good separating equipment
					390		very good separating equipment

Table No. 2 - 3: Available emission factors for HCB

Name of the category	SNAP	NFR	Units	Czech Republic	Poland [6]	Guidebook [4]	Notes
Power plants - boilers over 300 MWt	010101		µg/t		13.00		Combustion of bituminous coal
Power plants, heating plants (50 - 300 MWt)	010102, 010202, 030102		µg/t		13.00		Combustion of bituminous coal
				63.80			Combustion of brown coal
				38.85			Combustion of heavy fuel oils
Local heating	020205	1A4b	µg/t		125.00		Combustion of bituminous coal
				125.00			Combustion of brown coal
					60.00		Combustion of wood
Sintering of ores	030301	1A2a	µg/t	31.79	140.00	32.00	
Preheating furnaces of iron and steel works	030302		µg/t			11.00	G-µ g (TEQ)/t of cement

Secondary copper production	030309	1A2b	µg/t		39,000.00		
Cement production	030311	1A2f	µg/t	10.93	21.00		
Lime production	030312	1A2f	µg/t	9.726			
Incineration of household and municipal waste	090201	6C	µg/t		150.00		very good separating equipment
Incineration of industrial wastes	090202	6C	µg/t		19,000.00		without separating equipment
					139.00		very good separating equipment
Incineration of hospital wastes	090207	6C	µg/t		29,000.00		without separating equipment
				45.59	295.00		very good separating equipment

Annex 2 - continuation

Table No. 2 - 4: Emission factors and annual emissions of PCDDs/Fs from the main sources in the Czech Republic. Source: Holoubek, I. et al. (2000)[224]

Category of source (based on UN/ECE POPs Protocol, Anex VIII)	**Emission factors [ng TEQ.t^{-1}]**	**Annual emissions [g TEQ.y^{-1}]**
Municipal waste incinerators	490 (Brno) 8,625 (Prague)	1.14
Medical waste incinerators	4,013.3 (480 – 2,065,000)	0.022
Hazardous waste incinerators	0 – 11,930	
Sinter plants	3,839 – 20,535	73.12
Steel production	1,240	8.50
Secondary aluminium production	39,883	4.80
Power plants	1,463.1 ^{F} / 1,249.3 ^{P}	6.01
Local heating	3,600 – 205,680 ^{BC} 640 – 75,276 ^{BR}	389.70
Coke production		
Cement production	1.19 (1.9 – 1,040)	0.30
Lime production	2,387	2.86
Mobile sources - gasoline	50	0.146
- oil	20	
These sources - total		486.70
Estimation of total emissions		650

^{F} = fluidised bed; ^{P} = pulverised; ^{BC} = brown coal; ^{BR} = briquettes

Table No. 2 - 5: Emission factors and annual emissions of PCBs from the main sources in the Czech Republic. Source: Holoubek, I. et al. (2000)[225]

Category of source (based on UN/ECE POPs Protocol, Anex VIII)	**Emission factors $[ng.t^{-1}]$**	**Annual emissions $[mg.y^{-1}]$**
Municipal waste incinerators	16	3.9
Medical waste incinerators	2,000	11
Sinter plants	27,000 – 1,183,000	3,630,000
Steel production		
Secondary aluminium production	16,652,000	2,000
Power plants	12,000 ^{F} / 11,000 ^{P}	452,500
Local heating	9,500 ^{BC} – 28,000 ^{BR}	353,900
Coke production		
Cement production	1,250	6,250
Lime production	24,500	29,480
Mobile sources - gasoline	100	223,150,000
- oil	10	
These sources - total		227,724,144.9
Estimation of total emissions		-
^{F} = fluidised bed; ^{P} = pulverised; ^{BC} = brown coal; ^{BR} = briquettes		

Table No. 2 - 6: Emission factors and annual emissions of HCB from the main sources in the Czech Republic. Source: Holoubek, I. et al. (2000).[226]

Category of source (based on UN/ECE POPs Protocol, Anex VIII)	**Emission factors $[ng.t^{-1}]$**	**Annual emissions $[g.y^{-1}]$**
Municipal waste incinerators		
Medical waste incinerators	45,592	0.25
Sinter plants	31,788	190.73
Steel production		
Power plants	3,000 ^{F} / 55,000 ^{P}	2,260.00
Local heating	125,000	465.60
Coke production		
Cement production	10,925	54.60
Lime production	9,726	11.67
Mobile sources - gasoline		
- oil		
These sources - total		2,982.85
Estimation of total emissions		-

Annex 3: Common position paper of local authorities and NGOs on the National Implementation Plan of the Stockholm Convention and its further implementation

Representatives of municipal authorities and of nongovernmental non-profit organisations (NGOs), signed bellow this standpoint, consider the Stockholm Convention as an important instrument for solving matters such as highly toxic chemicals (DDT, dioxins, PCBs and others, called persistent organic pollutants – POPs). Some of the problems connected with the POPs had been unsolved for many years. Czech legislation, which is supposed to prevent pollution by such chemicals, allows many exceptions and in some cases it is being even weakened. There are numerous places in the Czech Republic waiting for cleansing from toxic contamination. Removal of toxic materials with a content of POPs to other places means creating new environmental burdens. Reduction of risks of POPs, mainly dioxins and PCBs, has not been considered sufficiently in processes of licensing new industrial plants and in other decision-making procedures (for instance in issuing IPPC).

That is why we think that the National Implementation Plan (NIP) of the Stockholm Convention should focus on:

- prevention of creating new sources of POPs (for instance construction of new waste incinerators)

- substitution of materials, which cause (or may cause) appearance of POPs during their production, usage or liquidation (for instance PVC, halogenated retardants and paraffins etc.)

- prevention of emergence of POPs by appliance of BAT – best available technologies and of processes that are the best from the environmental point of view – BEP.

- preferring technologies with the ability of complete POPs´ destruction to those which only remove POPs to other waste, environmental compounds or other products (ash, waste water, products)

- proper registration of old and newly created burdens, i.e. of places contaminated by POPs (for instance wrong way of treating ash from incinerators etc.)

- complete register of POPs´ emissions, including releases to water and to waste, eventually to soil and geological subsoil (in accordance with the Stockholm Convention).

- concrete and more radical adjustments of legislation concerning proper registers of all kinds of POPs´ emissions, prevention of their emergence and environmentally friendly cleansing of localities already polluted by POPs.

- improvement of law enforcement in the field of environmental pollution by POPs

- introduction of economic tools leading to prevention of POPs´ emergence and appliance of principle „polluters pay“ (internalization of external costs) in case of the established sources.

- mechanisms of free access to information

- informing and educating public about the effects that the POPs have on environment and health and about behaviour that is responsible in terms of preventing releases of POPs and about usage of materials which cause creation of these chemicals

- taking into consideration emergence of POPs during creation of municipal, regional and state policies (for instance of State Energy Policy and other plans and conceptions such as Plan of Waste Management etc.)

We welcome the fact that the Plan of Waste Management of the Czech Republic does not enable support for new landfills and incinerators paid from public funds. We ask government and state authorities not to support requirement for using E.U. funds for projects of waste incinerators.

We recommend completion of the NIP by a chapter "The Best Practices I Terms of best environmental practices = BEP"

Such chapter shall include requirements for:

- substitution of halogenated precursors of POPs (PVC, brominated flame retardants, chlorinated paraffin's etc.)

- restrictive measures directed against products made of PVC, placing waste with PVC content on the list of hazardous waste, because they mean a serious complication for treatment of mixed or separated municipal waste.

- introduction of duty of reverse withdrawal of PVC products and settlement of the minimum quota for its recycling under condition that it cannot be so called toxic recycling, introduction of environmental tax on the PVC products.

- using "zero waste" strategy (prevention of creating waste, systematic separation and recycling) when working out plans of waste management on municipal, regional and state levels.

- making changes in IPPC in a way that includes announcements of all POPs listed in the Stockholm Convention and to have settled announcement limits which ensure at least 90% POPs emissions and transfers for industrial sources.

- working out programs of reduction of POP releases into environment for particular producers or individual technological units, which are including integrated licensing and announcing in IPPC.

- substituting usage of chlorinated and brominated pesticides by more environmentally friendly ways or substances, production, usage an liquidation of which would not lead to emergence of POPs.

- creation of criteria of preventing the emergence of POPs in ecolabelling (labels "Environmentally saving product“) and in placing orders paid from public budgets

Our further requirements are connected with particular problems in the NIP of the Stockholm Convention.

Unwanted by-products (polychlorinated biphenyls, hexachlorobenzene and “dioxins“ which include two groups of chemicals: polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans)

In the Stockholm Convention**,** the ultimate goal for these chemicals must an elimination of unwanted by-products in all releases (into atmosphere, water, soil and waste), not only their minimization.

An action plan of reduction of presence and emission of dioxins and other undesired by-products (PCBs and hexachlorobenzene) should be worked out. The plan would settle final goal concentrations as well as concrete steps for reduction of these emissions into all compounds of environment (similar plan is being worked out for instance in states of NAFTA, i.e. USA, Canada and Mexico).

Material substitution of POPs precursors is an important way of prevention of emergence of POPs as undesired by-products of industrial processes.

Emissions of POPs can be reduced not only by technology but also organisation measures – so called Best Environmental Practices (BEP). For instance non-toxic waste recycling instead of land filling and incineration. In some cases material substitution which gets rid of chemicals that cause creation of POPs during its production, use and liquidation.

Waste, mainly the one containing POPs, should not be further liquidated by ways leading to creation new POPs (see article 6.1.(d)(II.) of the Stockholm Convention).

It is important to introduce emission limits for dioxins, PCBs and hexachlorebenzene for the highest possible number of sources of the air pollution (for instance foundries, power stations and heating plants). Limits, already introduced in other European countries, can serve as patterns.

Treatment of ash, chimney ash and slag

Ash, chimney ash and slag from incineration processes are significant sources of POPs. This fact is evident mainly in case of waste incinerators). These kinds of waste are not treated in the correct manner that would prevent from toxic releases to the environment.

The first step in improvement of this situation must be a ban on the certification of the ash, chimney ash and slag as construction materials. There must also be a strict requirement of monitoring of surrounding locations where these are placed.

It is also necessary to make a document of MAT for ash processing which would prefer processing in the place of ash production in cases where it would be suitable. Another necessity is to recourse current practices, often illegal, when the ash is treated in way enabling POPs releases.

Another requirement is to ban the mixing and solution of waste with high concentration of POPs, with the exception of situations when its solution is demanded for the purposes of its effective disintegration to substances without the qualities of POPs.

Pesticides

The Czech Ministry of Agriculture must work out a list of former stockpiles of organochlorine pesticides. These places are potentially highly contaminated by the named chemicals.

We ask for the inclusion of former stockpile of pesticides in Klatovy-Luby and of waste dump Hájek, i.e. of location contaminated by organochlorine pesticides, among so called hotspots – prior places which wait for re-cultivation.

When giving authorisation, according to the law on chemical substances, there should be a compulsory measurement of content of POPs, mainly dioxins, in material streams in environment.

Technical substances (polychlorinated biphenyls, hexachlorobenzene)

Current register of stocks of technical substances does not include all wastes containing PCBs. Waste with the content of hexachlorobenzene is not included at all. NIP should correct this fact. With the respect of prevention of creation of POPs, we propose using methods of liquidation of these wastes and materials which do not lad to emergence of new POPs.

We prefer liquidation of PCBs, dioxins, DDT and other POPs by non-combustion technologies with high destruction efficiency as better way than proposed liquidation in incinerators or combustion in cement plants.

When choosing among destruction technologies, it is absolutely necessary to apply concern of destruction efficiency – DE, instead of criteria of destruction and removal efficiency – DRE.

Precautionary principle - proposal for completion of the list in the Stockholm Convention by other chemicals

Application of preliminary precaution principle should be made in introduction of new chemicals on a market in order to prevent emergence of another potential source of POPs. That is why we support introduction of system of verification and licensing of chemicals – so called REACH system.

NIP shall include also strategy for future, including definition of potential chemicals to be put on the list of the Stockholm Convention. We ask the Czech government to push on completing the list of following chemicals:

- polyaromatic hydrocarbons (PAHs)
- polybrominated diphenylethers
- chlorinated paraffins
- Lindane
- endosulfan

These chemicals must undergo the regime of the Stockholm Convention in the Czech Republic before they will be accepted by convention parties as new chemicals listed by the Convention.

Inventarisation and monitoring

There are insufficiencies which must be corrected in inventories of PCBs and hexachlorobenzene as undesired by-products. There is no evaluation of emissions to waste and water, and there is no estimation of emissions from fires among emissions into the air, although (for example) fires of landfills can be large sources of emissions. We also point on a possibility of under-evaluation given by a methodology of measurement – real emissions for incinerators can be higher, according to the Belgian experience and comparison of taking more long term samples than single (one-time) samples. (R. De Fré, M. Wevers, *Organohalogen Compounds* 1998).

In the Czech Republic, clear goals in reducing contamination of food chains by dioxins and PCBs must be settled in accordance with E.U. strategy, i.e. the one week limit of dioxin intake of 14 pg TEQ dioxins and PCBs/kg of body weight may not be exceeded.

Monitoring of contamination of inhabitants and ecosystems by POPs must be more transparent. Systems of identification and elimination of sources of food chain contamination must be introduced. We ask for publishing results of measurements of contamination of consumables in case concentrations of POPs have exceeded limit, and warning of consumers.

We demand more frequent monitoring of POPs in animals grown by individuals, wild animals and animal products sold out of a market network.

Public participation in preparation of NIP and connected strategic plans and free access to information about POPs

As the NIP and other plans decide among others also about construction of new plants for liquidation of POPs or about ways of waste treatment etc., participation of citizens and of local authorities in their preparation must be guaranteed. We demand the NIP of the Stockholm Convention, as a conception material, passed a process of Strategic environmental Assessment (SEA). We further asked for establishment of controlling and monitoring committee for the implementation of the Stockholm Convention with a necessary representation of local authorities and NGOs.

We demand the introduction of publicly accessible database of (if possible) targeted results of POPs measurements (of all types of emissions, as well as of results gained by monitoring of particular compounds of environment).

(This standpoint was created in Prague on 13th December 2003 during a seminar "Stockholm Convention And Reduction of Toxic Releases To Environment")

Those who agree with this standpoint:

Name	**Organisation/municipality**
Beránek Miroslav	Czech Ecological Society (Česká ekologická společnost) and head of municipality Čepí
Beranová Kristina	Arnika - program Toxics And Waste
Cíglbauer Petr	head of municipality Mydlovary
Daňhelová Lenka	Arnika Ostrava
Dejmal Ivan Ing.	Ecological Society (Ekologická společnost)
Diadovská Vasilka Bc.	ecologist - hospital Na Homolce, Prague 5
Drhová Zuzana Ing.	Green Circle (Zelený kruh)
Habrman René	A21 (Agend 21) Polička
Havel Milan Ing.	Arnika - program Toxics And Waste
Horská Věra MUDr.	Arnika České Budějovice
Jarolím Oldřich	Arnika České Budějovice
Kárský Rostislav	A21 Polička
Krejčová Marcela	association Platan
Kuncová Hana Mgr.	Arnika – program Toxics And Waste
Marcaníková Hana	Lyská iniciativa - občanské sdružení Lysin
Nahodil Jiří RNDr.	Arnika Prague
Petrlík Jindřich RNDr.	Arnika - program Toxics And Waste
Rosa Jaroslav	Lampertice
Růžičková Karolína Mgr.	Health Care Without Harm Europe
Rychtařík Václav	Klatovy - Luby, owner of real estate contaminated by pesticides
Sikorová Miroslava	Arnika Ostrava
Slejška Antonín Ing.	Arnika - program Toxics And Waste, CZ BIOM
Spěváčková Anna	association Neratovice
Šanda Ondřej	Hnutí DUHA České Budějovice
Šremer Pavel RNDr.	Society for Sustainable Living Společnost pro trvale udržitelný život
Štěpánek Petr RNDr.	local representative in Prague 4
Šuta Miroslav MUDr.	Greenpeace Czech Republic
Tylová Eva Ing.	Green Circle (Zelený kruh)
Velek Ondřej Ing.	Partnership Foundation, program „Right to Know"
Veselý Jaromír Ing. arch.	Civic League (Občanská liga) Ústí nad Labem
Záklasník Vladan Ing.	Hnutí DUHA
Záruba Adam Ing.	local organisation of Czech Association for Nature Protection (ZO ČSOP) in Orlice Hradec Králové

Annex 4: Text devoted to activities of the Arnika Association from the NIP proposal

2.3.9.1 Arnika Association

2.3.9.1.1 Activities of the Toxics and Waste Programme

Toxics Free Future

An objective of this project (campaign) was to achieve ratification of the Stockholm Convention, and introduction of the Integrated Pollution Register. A secondary objective of the project is to achieve consistent prevention of releases of toxic substances in specific places (see “hot spots“ below), and to solve the problem of cleaning up of old environmental burdens. We succeeded in accomplishing the main objective and because of that, we have set a new objective, which is implementation of the Stockholm Convention. The project includes a number of activities, including random POPs monitoring. Due to limited financial possibilities this monitoring cannot be more extensive than 1 - 4 samples in relation to one of the hot spots.

An important part of the project is also obtaining of information on results of POPs measurements from state administration bodies, as well as from the pollution producers. The obtained data are available in archives of the Programme. A part of the project is also preparation and publication of reports (Lindane - a pesticide for the blacklist, and a report on wastes produced by incinerators which is under preparation), which were provided also as one of the sources for preparation of the NIP. A substantial part of the activity is educational publications (leaflets on the Stockholm Convention called “Toxic 12”, “Toxic substances”, “Spolana and poisons near Elbe”, and others).

The project has separate internet pages http://bezjedu.arnika.org.

Cases (hot spots) in the individual regions, in which the campaign is engaged

Spolana Neratovice - old environmental burdens, environmental impact of the present operation

The issue of Spolana Neratovice is described in more detail in other places of the NIP. Arnika aims to achieve, if possible, a complete elimination of releases of toxic substances from Spolana Neratovice. Because of that we aim to achieve initially, consistent determination of sources of releases of organochlorine substances and heavy metals both from the old environmental burdens and from the present operation of the chemical plant. We also aim to stop use of mercury for chlorine production in Spolana as soon as possible. This is important in view of considerations of incorporation of mercury on the list of the Stockholm Convention, and in view of the Heavy Metals

Protocol of the LRTAP Convention. Internet pages http://spolana.arnika.org are devoted to the case.

PCBs in Ostrava

For many reasons, Ostrava is one of areas of the Czech Republic ranking among the ones with the highest burden by polychlorinated biphenyls and PCDD/Fs. Among others, this is caused by a high concentration of companies which in the past were, or still are, engaged in collecting and "liquidation" of wastes with POPs content, and also by the high concentration of industry as such. Arnika aims to achieve consistent mapping of potential sources of POPs releases into the environment in this area. Internet pages http://bezjedu.arnika.org/horka-mista/ostrava are devoted to the case.

Former pesticide storage in Klatovy - Luby

Since 1970s, pesticides, including DDT, Lindane, had been stored in one of the buildings and in the yard of the farmstead in Klatovy - Luby, which has been returned in restitution back to the Rychtařík family. Also preparation of sprays from these pesticides had taken place there. Measurement commissioned by the Arnika Association showed high concentration of DDT and its metabolites in samples obtained by sweeping of and scrapings from, the floor of the farm building, and also in eggs of hens bred in the yard. In the eggs increased level of PCDD/Fs were found. Arnika aims to achieve environmentally safe decontamination of this environmental burden. Internet pages http://klatovyluby.arnika.org are devoted to the case.

Former dump of wastes with PCBs and DDT content in Milovice, and present illegal storage of wastes with PCBs content in Mratín

The construction of a hazardous waste incinerator (Alysa company) located into the former military area in Milovice. After the company had become bankrupt, only a dump of wastes with a content of a wide spectrum of POPS (in particular, PCBs and DDT) remained. Greenpeace was engaged in the case. Arnika started to be engaged in connection with the transport of the wastes from that location by the EKOBO company, which was very closely interconnected with the owners of the hazardous waste incinerator in Lysá nad Labem (the REAN company). A part of the wastes from Milovice was incinerated at the facility although it does not show parameters for POPs liquidation. Finally, the EKOBO company stored the wastes in two buildings in the municipality of Mratín, although they did not show parameters applicable to storing of substances of the type of PCBs. Into one of the stores it also brought transformers with oils with PCBs contents. Arnika aims to achieve safer storage of these wastes till the time when an environmentally safe non-combustion technology will be available.

Hazardous waste landfill Pozďátky

Due to a lack of discipline of the operator, the insulation of the landfill has been damaged for 6 years. The case is not directly connected with POPs, although their presence on the landfill cannot be excluded due to bad registration of the deposited wastes. Internet pages http://ickm.arnika.org are devoted to the case.

Waste incinerators

A part of the project "Toxics Free Future" are several local, regional, and national activities directed at the reduction of negative environmental impact of waste incinerators. A report on management of wastes produced by the incinerators ranks among the newest activities of this kind. This report is being prepared by the Arnika Association not only for the Czech Republic, but also at the international level as a part of activities of the Dioxin, PCBs and Waste Working Group of the IPEN network. Internet pages http://spalovny.arnika.org are devoted to waste incineration.

Database of incinerators and power blocks

This is a regularly updated database of measurement of pollutants released into air or contained in wastes from waste incinerators and power blocks in the Czech Republic. The association is obtaining data for the database from source materials collected by state administration bodies, and data provided by the operators of incinerators and power blocks themselves. The database outputs have been made available on internet.[ee]

Hazardous waste incinerator in Lysá nad Labem

Photo No. 16: Lysá nad Labem - protest action in March 2002.

In the place of the older closed waste incinerator, a new one was constructed in Lysá nad Labem. The incinerator was put into trial operation in 2000. Some wastes from Milovice ended up in the incinerator. The EKOBO company which was ensuring re-packaging and deposition of wastes with PCBs content from the premises of the incinerator in Milovice, is interconnected with companies operating the incinerator in Lysá nad Labem. In March - July 2003, Arnika took a sample of soil, and two samples of poultry from the neighbourhood of the incinerator, and commissioned their analysis for content of PCDD/Fs and PCBs. The results showed increased levels of these substances in poultry. On the basis thereof, the city of Lysá nad Labem, and Regional Authority of the Region of Central Bohemia, commissioned further measurements. In addition to dioxin emissions and incineration of wastes with PCBs content, a problem of the incinerator is insufficient protection against releases of toxic substances into underground water and soil, and insufficient records of management of the

[ee] This internet presentation of the database is being completely reconstructed at present.

incinerated wastes. Internet pages http://bezjedu.arnika.org/lysa are devoted to the case.

Municipal waste incinerator in Liberec

The municipal waste incinerator in Liberec is operated by Termizo, joint-stock company owned by PPF and the city of Liberec. It was approved in 2000 after a trial operation. The capacity of the plant is 96.000 tons of wastes per year. The costs of its construction were more than 1.7 billion CZK. The incinerator had high dioxin concentrations in emission to air. In August 2000, the value 7.3 ng I-TEQ/m^3 was measured. The incinerator mixes bottom and fly ash depositing them in a municipal waste landfill despite the high dioxin concentrations present in the fly ash. Since 2002, the Termizo company has possessed a certificate on the mixture of ash and fly ash authorising the company to manage it as construction material. Arnika aims to achieve that the fly ash from the incinerator be managed in a more environmentally-friendly way. The environmental association Children of the Earth is also engaged in this case. Case study of the Liberec incinerator will form part of a study prepared by Arnika. Information concerning this case is available at internet pages http://bezjedu.arnika.org/horka-mista/liberec.

Hazardous waste incinerator in Vyškov

The hazardous waste incinerator has existed in Vyškov since 1991. At present, it has 3 incineration units and represents one of the biggest sources of environmental pollution in Vyškov. The Arnika Association started to be engaged in this issue in 2002. It prepared a summary report on the incinerator, published on the internet.

Internet pages http://vyskov.arnika.org/spalovna.shtml are devoted to the case.

2.3.9.1.2 Activities concentrating on prevention of POPs formation

An important measure mentioned in Annex C of the Stockholm Convention is the prevention of POPs formation which means best environmental practice (BEP).

Specifically, the Annex mentions the following measures:

(c) The promotion of the recovery and recycling of waste and of substances generated and used in a process;
(d) Replacement of feed materials which are persistent organic pollutants or where there is a direct link between the materials and releases of persistent organic pollutants from the source.

On these two areas, there concentrate two projects/campaigns of the Toxics and Waste Programme of the Arnika Association:

Health Care without PVC

PVC is one of the important components of wastes through incineration of which POPs are formed. POPs are also released during PVC production. Arnika aims to achieve substitution of PVC by less problematic alternatives, not only in the case of medical aids and devices. The project has its internet pages http://pvc.arnika.org.

Waste is Raw Material

Prevention of waste formation, re-use of products, waste separation, and recycling thereof, form the basis of the “zero waste“ conception promoted by Arnika in the field of waste management. It is an important tool in the prevention of POPs formation within the framework of management of municipal wastes. The project has its separate internet pages http://odpady.arnika.org. Its part is participation in work commissions of the Ministry of the Environment of the Czech Republic, relating to the Waste Management Plan of the Czech Republic.

2.3.9.1.3 International activities

European working group of IPEN

In April 2000, the Centre for Citizens' Support (at that time, a section of the organisation Children of the Earth) organised an international conference, on which an informal working group of the world-wide network IPEN (= International POPs Elimination Network) was established. Today, this working group associates over 30 non-governmental organisations from the whole Europe. In 2001, its chairmanship was taken over by the Toxics and Waste Programme of the Arnika Association. So far, the working group has organised, in total, 4 conferences, it issued three reports, and participated in the publication of proceedings of lectures from conferences organised in the Czech Republic in January 2003. Its member organisations issued a number of materials concerning POPs for education of the public.

Secretariat of the Dioxin, PCBs and Waste Working Group of the IPEN

Since January 2002, Arnika has hosted the Secretariat of the Dioxin, PCBs and Waste Working Group of the IPEN. In 2003, this Working Group organised in co-operation with UNIDO and with its financial support an international conference “Non-combustion Technologies for Destruction of POPs“, issuing proceedings of the conference. It also participates in work of an expert group established in order to interpret the terms of BAT/BEP within the framework of the Stockholm Convention.

Working Group “Incinerators” of Health Care Without Harm

Arnika is a member organisation of the international network ‘Health Care Without Harm’ (HCWH), concentrating on the issue of management of wastes, PVC, and other substances in health care from the point of view of their environmental impact. From this co-operation there followed a placing of the Secretariat of the Working Group “Incinerators” at Arnika.

In November 2003, Arnika issued a study of HCWH, “Non-combustion Technologies for

Management of Medical Wastes”.

2.3.9.1.4 Centre for Citizens' Support

In addition to the Toxics and Waste Programme, the Centre for Citizens' Support is another entity of the Arnika Association, whose activities relate to the Stockholm Convention. Its role is to provide assistance to active citizens and citizens associations in the field of environmental protection, including cases concerning pollution by pesticides or, for example, waste incinerators. This entity also originally published (still as a part of the organisation Children of the Earth) the first summary reports on POPs in central and eastern Europe (POPs - Poison in the Heart of Europe I and II).

2.3.9.1.5 Publications and internet pages

Publications concentrating on the issue of POPs

Toxics and Waste Programme

2002:

- Evaluation of Health Risks of Dioxin Substances (Czech translation of a WHO report of 1998);
- A number of materials for education of the public: Toxic 12, Toxic Substances, Spolana and Poisons near Elbe, Waste Incinerators, etc.

2003:

- International Workshop on Non-Combustion Technologies for Destruction of POPs (Prague, January 16, 2003) - proceedings (English version);
- Lindane - a Pesticide for the Blacklist;
- Non-combustion Technologies for Management of Medical Wastes (a HCWH study);
- Materials for education of the public: Dioxins, Spolana Neratovice, Incinerator Lysá nad Labem, Incinerator Mydlovary, Incinerator Liberec, etc.

Centre for Citizens' Support

2000:

- POPs - Poison in the Heart of Europe I

2001:

- POPs - Poison in the Heart of Europe II (English and completed Czech versions)

2002:

- Pesticides in Central Europe - National Reports

Internet pages concerning the issue of POPs

English pages:

IPEN - http://www.ipen.org/
IPEN - Europe - http://pops.ecn.cz/
Health Care Without Harm - http://www.noharm.org/
English pages of the Arnika Association - http://english.arnika.org/
International Workshop on Non-Combustion Technologies for Destruction of POPs (Prague, January 16, 2003) - http://pops2003.arnika.org/

In Czech language:

Toxics Free Future - http://bezjedu.arnika.org/

Hot spots of the Toxics Free Future campaign:

Klatovy - Luby - http://klatovyluby.arnika.org/
Spolana Neratovice - http://spolana.arnika.org/
Lysá nad Labem - hazardous waste incinerator - http://bezjedu.arnika.org/lysa
PCBs in Ostrava - http://bezjedu.arnika.org/ostrava
Landfill Pozďátky - http://bezjedu.arnika.org/pozdatky
Waste incinerator Vyškov - http://vyskov.arnika.org/spalovna.shtml
Liberec - municipal waste incinerator (older pages) - http://www.ecn.cz/dioxin/libspal/

Other pages:

PVC - http://pvc.arnika.org/
Waste incineration - http://spalovny.arnika.org/
Waste is Raw Material - http://odpady.arnika.org/
Centre for Citizens' Support - http://cepo.arnika.org/
Toxics and Waste Programme of the Arnika Association - http://toxic.arnika.org/
Dioxins - http://www.dioxin.cz/

Annex 5. Case study of old environmental burdens:

Klatovy - Luby - former pesticide storage

Photo No. 17: Farm buildings in Klatovy - Luby were returned to original owners after 1989, but contaminated by DDT and other dirty pesticides. They live in next house.

Production of Lindane and other organochlorine pesticides caused serious contamination of certain localities in the Czech Republic for many years. However, places where pesticides were stored and prepared for use are numerous. Such places include the farm building in Klatovy - Luby, house number 167, located in the middle of residential area of the municipality. The closest residential house is only a few meters across a yard from this building.

The contaminated building is located several tens of metres from a stream. The municipality was not directly struck by floods, but a part of it was flooded by mud from the fields. A similar torrential water can wash poisons from the former farm building in Klatovy - Luby. Under the building itself underground water is relatively shallowly under surface. As proved by analyses mentioned below, the underground water is contaminated by residues of pesticides.

The farm building in Klatovy - Luby had been used for storage and preparation of pesticides since 1960s until the beginning of 1990s (originally as STS, later as Agrochemical company). As shown by analyses of plasters of the building, soil, as well as subsurface water, this activity left catastrophic consequences (see Table No. 5 - 2). Buildings and their vicinity are highly contaminated by toxic substances - pesticides such as DDT, Lindane, fenson or atrazine, and petroleum substances. Not only soil, but also water in wells is poisoned. Eggs of hen bred in the yard are contaminated by pesticides (see Table No. 5 - 1).

Table No. 5 - 1: Results of analyses of eggs sampled in June - July 2003 in the vicinity of the former storage of pesticides in Klatovy - Luby for contents of residues of pesticides, polychlorinated biphenyls (PCBs), and polychlorinated dibenzodioxins and dibenzofurans (PCDD/Fs).

Compound	Sample of 1 egg (sampled on June 7, 2003) ng/g	Mixed sample of 12 eggs (sampled in July 2003) ng/g	Limit according to Decree No. 465/2002
Alpha - BHC	0.097	ND	
Beta - BHC	0.102	0.984	
Sum of HCH	0.199	0.984	30
Lindane	0.46	1.09	100
Hexachlorobenzene	1.0	2.4	20
Octachlorostyrene	0.007	ND	no limit
Oxychlordane	0.010	ND	no limit
trans-Nonachlor	0.010	ND	no limit
o,p'-DDD	NA	NA	
p,p'-DDD	91.3	137.7	
o,p'-DDE	0.09	0.28	
p,p'-DDE	1.6	4.7	
o,p'-DDT	2.00	4.24	
p,p'-DDT	74.3	108.4	
Sum of DDT	169	255.32	5
OCPs - total	171.211	259.79	
Sum of di- to octachlorobiphenyls (PCBs)	11	NA	
Sum of 7 congeners of PCBs	4.777	NA	
Sum of PCDD/Fs (in pg/g of fat I-TEQ)	NA	3.2 – 3.4 pg/g of fat	3*

Explanatory notes:
- Data are related to fresh weight of eggs, unless otherwise stated.
- * Limit for dioxin content according to the Directive of the European Commission

Table No. 5 - 2: Results of analyses of samples obtained by sweeping of, and scraping from, the floor, commissioned in June 2003 by the Arnika Association.

Compound	Main storage + pesticide preparation room (ng/g)	Storage of oils (ng/g)	limit C residential	limit B	limit A
Alpha – BHC	344	NA	2,500	2,000	50
Beta – BHC	10	NA	2,500	2,000	50
Lindane	3,904	NA	2,500	2,000	50
Hexachlorobenzene	16.0	NA	no limit	2,000	50
Octachlorostyrene	3.1	NA	2,500	2,000	50
Oxychlordane	ND	NA	2,500	2,000	50
trans-Nonachlor	0.3	NA	2,500	2,000	50
o,p'-DDD	NA	NA	no limit	2,000	50
p,p'-DDD	4,431	NA	no limit	2,000	50
o,p'-DDE	669	NA	no limit	2,000	50
p,p'-DDE	950	NA	no limit	2,000	50
o,p'-DDT	11,298	NA	no limit	2,000	50
p,p'-DDT	18,265	NA	no limit	2,000	50
Sum of DDT	35,612	NA	2,500*	no limit	no limit
OCPs – total	39,890	NA	no limit	no limit	no limit
Simazine	<200	1,800	4,000	3,000	50
Atrazine	870	9,700	6,000*	3,000	50
MCPA	1,500	1,300,000	4,000	3,000	50
As	6,500	45,000	70,000	65,000	30,000
Cd	2,400	3,900	20,000	10,000	500
Hg	70	400	10,000	2,500	400
Sum of 7 congeners of PCBs	NA	<250	5,000 (1,000*)	2,500	20

Explanatory notes:
* Limit C is set for diverse use of the territory.
NA - The substance was not analysed
- Values marked by printing in italics and bold type do not exceed limit C.

The analyses were carried out by the laboratories Axys Varilab (analyses of OCPs) and Ecochem (analyses of the other analysed substances). For comparison, there are also given limits set by a Methodical Instruction of the Ministry of the Environment of the Czech Republic[227] for soils. The analyses included also analyses of the content of heavy metals, in view of the fact that pesticides containing them (rodenticides) were stored in the storage.

List of abbreviations

AIM	Automatic Imissions Monitoring
AMAP	The Arctic Monitoring and Assessment Programme
As	arsen
BAT	Best Available Technique
BEP	Best Environmental Practice
BDE	brominated diphenyl ether
BHC	beta-hexachlorocyclohexane
Cd	cadmium
ČHMÚ	Český hydrometeorologický ústav
DDT	dichlorodiphenyltrichloroethane
DE	destruction efficiency
DLPCBs	dioxin like - PCBs
DRE	destruction and removal efficiency
UN ECE	United Nations Economic Commission for Europe
EÚ	European Union
FNM	National Property Fund
g	gram
HCB	hexachlorobenzene
HCWH	Health Care Without Harm
Hg	mercury
HCH	hexachlorocyclohexane
CHKO	Landscape Protected Area
IPEP	International POPs Elimination Project
IPPC	Integrated Pollution Prevention Control
IPR	Integrated Pollution Register
I-TEQ	international toxic equivalent (NATO values used)
KRNAP	Krkonoše National Park
LOD	level of detection
LRTAP	Long Range Transboundary Air Pollution
MCPA	pesticide called (4-chloro-2-methylphenoxy)acetic acid
mg	miligram
MKOL	International Commission for Protection of Elbe
ml	mililiter
monoPCBs	mono-ortho substituted PCBs
MWI	municipal waste incinerator
MZSO	National Monitoring of Health of Inhabitants
MŽP	Ministry of the Environment of the Czech Republic
ng	nanogram
NIP	National Implementation Plan
NGOs	non-government organizations

OCPs	organochlorine pesticides
PAHs	polycyclic aromatic hydrocarbons
PBBs	polybrominated biphenyls
PBDEs	polybrominated diphenyl ethers
PCBs	polychlorinated biphenyls
PCDD/Fs	polychlorinated dibenzo-para-dioxins / polychlorinated dibenzofurans
PCDDs	polychlorinated dibenzo-para-dioxins
PCDFs	polychlorinated dibenzofurans
PCNs	polychlorinated naphthalens
pg	picogram
POPs	Persistent Organic Pollutants
PRTR	Pollutant Release and Transfer Register
PVC	polyvinyl chloride
RASFF	system quick warning
REACH	Registration, Evaluation and Authorisation of Chemicals
REZZO	the System of Registration of Air Pollution Sources
SCCPs	short-chained chlorinated parafins
SZPI ČR	State Agricultural and Food Inspection of the Czech Republic
SZÚ	State Health Institute
TCB	tetrachlorobenzene
TEQ	toxic equivalent
UNEP	United Nations Environment Program
UNIDO	United Nations Industrial Development Organization
VaV	Research and Science Program
VŠCHT	Institute of Chemical Technology
VÚV TGM	T. G. Masaryk Water Management Research Institute
WHO	World Helath Organization
WHO-TEQ	Toxic Equivalent calculated according to WHO reassessment of TEFs for
γ-HCH	Lindane, gama isomer of hexachlorocyclohexane
µg	microgram
TEF	Toxic Equivalency Factor

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