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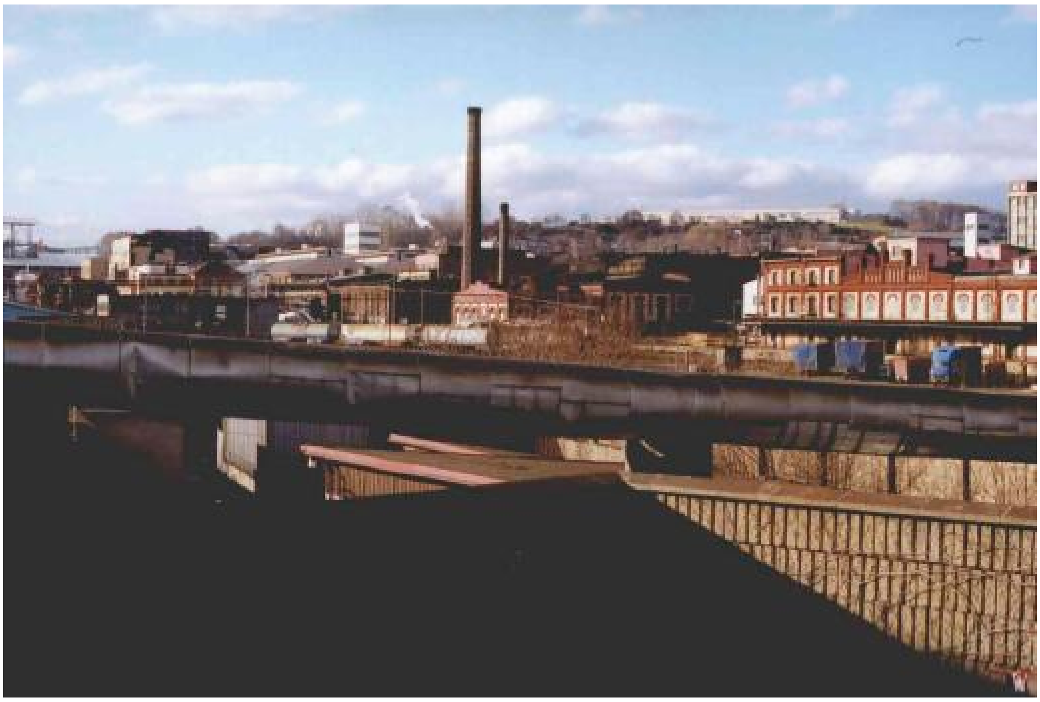
*Prepared by Dioxin, PCBs and Waste Working Group of the International POPs Elimination Network (IPEN) Secretariat and Arnika Association (Czech Republic)*

# Contamination of chicken eggs near the Spolchemie Ústí nad Labem chemical plant in the Czech Republic by dioxins, PCBs and hexachlorobenzene



# Contamination of chicken eggs near the Spolchemie Ústí nad Labem chemical plant in the Czech Republic by dioxins, PCBs and hexachlorobenzene

## “Keep the Promise, Eliminate POPs!” Campaign Report

*Prepared by Dioxin, PCBs and Waste WG of the International POPs Elimination Network (IPEN) Secretariat, and Arnika Association (Czech Republic)*

*Prague (March - 24 - 2005)*

# Executive Summary

Free-range chicken eggs collected in Usti nad Labem showed high levels of hexachlorobenzene and elevated levels of dioxins. The hexachlorobenzene (HCB) level was 2.5 times higher than newly proposed limit for HCB as a pesticide residue. Dioxin levels were two times higher than background levels. The highest observed levels of these chemicals were close to the European Union (EU) dioxin limit for eggs and nearly 1.5 times higher than the dioxin action level for eggs in the EU. This study contributes to the sparse data about U-POPs in free range chicken eggs from the Czech Republic.

The most obvious potential source of POPs releases at the site is the chlorine chemical plant Spolchemie, which still produces HCB as a by-product of chlorinated solvents manufacturing. Spolchemie products include carbon tetrachloride, perchloroethylene, trichloroethylene and chlorinated benzenes. Other sources of POPs could be contaminated sites and/or waste incineration inside the chemical plant as well as in the neighbouring town of Trmice.

The toxic substances measured in this study are slated for reduction and elimination by the Stockholm Convention which holds its first Conference of the Parties beginning 2 May 2005. The Czech Republic is a Party to Convention since it ratified the Treaty in August 2002. The Convention mandates Parties to take specific actions aimed at eliminating these pollutants from the global environment. We view the Convention text as a promise to take the actions needed to protect Czech and global public’s health and environment from the injuries that are caused by persistent organic pollutants, a promise that was agreed by representatives of the global community: governments, interested stakeholders, and representatives of civil society. We call upon Czech governmental representatives and all stakeholders to honor the integrity of the Convention text and keep the promise of reduction and elimination of POPs.

# Recommendations

1) Include HCB in the UNEP Toolkit and elevate the importance of HCB releases in the guidelines for Best Available Techniques (BAT) and Best Environmental Practices and all other documents prepared under the Stockholm Convention.

2) Government and industry stakeholders should implement the material substitution principle as a strategy to prevent HCB formation during chemical manufacturing.

3) Government and industry stakeholders should clarify dioxin pollution pathways related to chlor-alkali and other chlorine-related industries and implement strategies to prevent dioxin formation.

4) An inventory of HCB releases should be established to help to address all sources and releases.

5) Stringent limits for U-POPs, especially for HCB, in waste as well as air emissions should be introduced into both national legislation and under international treaties.

# Introduction

Persistent organic pollutants (POPs) harm human health and the environment. POPs are produced and released to the environment predominantly as a result of human activity. They are long lasting and can travel great distances on air and water currents. Some POPs are produced for use as pesticides, some for use as industrial chemicals, and others as unwanted byproducts of combustion or chemical processes that take place in the presence of chlorine compounds. Today, POPs are widely present as contaminants in the environment and food in all regions of the world. Humans everywhere carry a POPs body burden that contributes to disease and health problems.

The international community has responded to the POPs threat by adopting the Stockholm Convention in May 2001. The Convention entered into force in May 2004 and the first Conference of the Parties (COP1) will take place on 2 May 2005. Czech Republic ratified the Convention in August 2002.

The Stockholm Convention is intended to protect human health and the environment by reducing and eliminating POPs, starting with an initial list of twelve of the most notorious, the "dirty dozen." Among this list of POPs there are four substances that are produced unintentionally (U-POPs): polychlorinated biphenyls (PCBs), hexachlorobenzene (HCB), polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs) The last two groups are simply known as dioxins.

The International POPs Elimination Network (IPEN) asked whether free-range chicken eggs might contain U-POPs if collected near potential sources of U-POPs named by the Stockholm Convention. The surrounding of the chlorine chemical plant Spolchemie in Usti nad Labem was selected as a sampling site since it is known to be a significant source of hexachlorobenzene and a potential source of dioxins and furans as by-products.[1] Chicken eggs were chosen for several reasons: they are a common food item; their fat content makes them appropriate for monitoring chemicals such as POPs that dissolve in fat; and eggs are a powerful symbol of new life. Free range hens can easily access and eat soil animals and therefore their eggs are a good tool for biomonitoring of environmental contamination by U-POPs. This study is part of a global monitoring of egg samples for U-POPs conducted by IPEN and reflects the first data about POPs in eggs in the vicininty of Usti nad Labem .

# Materials and Methods

Please see Annex 1.

# Results and Discussion

## U-POPs in eggs sampled in the Usti nad Labem city in Czech Republic

The results of the analysis of a pooled sample of 6 eggs collected within a 2 km distance from the chemical plant Spolchemie in Usti nad Labem are summarized in Tables 1 and 2. Pooled sample fat content was measured at 11.3%.

The sampled eggs exceeded background levels for HCB in chicken eggs (1 ng/g of fat) by almost 35-fold. In addition, the eggs exceeded the newly proposed EU limit for HCB as pesticide residue in eggs by 2.5-fold. The upper range level of dioxins is very close to the EU limit for dioxins in eggs and exceeded the proposed EU action level for these chemicals.

**Table 1: Measured levels of POPs in eggs collected in Usti nad Labem city in Czech Republic per gram of fat.**

| | Measured level | Limits | Action level |
|---|---|---|---|
| PCDD/Fs in WHO-TEQ (pg/g) | 2.13 - 2.90 | 3.0[a] | 2.0[b] |
| PCBs in WHO-TEQ (pg/g) | 1.22 | 2.0[b] | 1.5[b] |
| Total WHO-TEQ (pg/g) | 3.35 - 4.12 | 5.0[b] | - |
| PCB (7 congeners) (ng/g) | 26.32 | 200[c] | - |
| HCB (ng/g) | 35.80 | 200 (10)[d] | - |

Abbreviations: WHO, World Health Organization; TEQ, toxic equivalents; pg, pictogram; g, gram; ng, nanogram.

[a] Limit set up in The European Union (EU) Council Regulation 2375/2001 established this threshold limit value for eggs and egg products. There is even more strict limit at level of 2.0 pg WHO-TEQ/g of fat for feedingstuff according to S.I. No. 363 of 2002 European Communities (Feedingstuffs) (Tolerances of Undesirable Substances and Products) (Amendment) Regulations, 2002.

[b] These proposed new limits are discussed in the document Presence of dioxins, furans and dioxin-like PCBs in food. SANCO/0072/2004.

[c] Limit used for example in the Czech Republic according to the law No. 53/2002 as well as in Poland and/or Turkey.

[d] EU limit according to Council Directive 86/363/EEC, level in brackets is proposed new general limit for pesticides residues (under which HCB is listed) according to the Proposal for a Regulation of the European Parliament and of the Council on maximum residue levels of pesticides in products of plant and animal origin, COM/2003/0117 final - COD 2003/0052.

Table 2 shows the levels of U-POPs in eggs expressed as fresh weight.

**Table 2: Measured levels of POPs in eggs collected in the Usti nad Labem city in Czech Republic per gram of egg fresh weight.**

| | Measured level | Limits | Action level |
|---|---|---|---|
| PCDD/Fs in WHO-TEQ (pg/g) | 0.24 - 0.33 | 1[a] | - |
| PCBs in WHO-TEQ (pg/g) | 0.14 | - | - |
| Total WHO-TEQ (pg/g) | 0.38 - 0.47 | - | - |
| PCBs (7 congeners) (ng/g) | 2.97 | | |
| HCB (ng/g) | 4.05 | - | - |

Abbreviations: WHO, World Health Organization; TEQ, toxic equivalents; pg, pictogram; g, gram; ng, nanogram.

[a] U.S. Department of Agriculture Food Safety and Inspection Service [Memo 8 July 1997] Advisory to Owners and Custodians of Poultry, Livestock and Eggs. Washington, DC:U.S. Department of Agriculture, 1997. FSIS advised in this memo meat, poultry and egg product producers that products containing dioxins at levels of 1.0 ppt in I-TEQs or greater were adulterated. There is an even more strict EU limit at level of 0.75 pg WHO-TEQ/g of eggs fresh weight for feeding stuff according to S.I. No. 363 of 2002 European Communities (Feedingstuffs) (Tolerances of Undesirable Substances and Products) (Amendment) Regulations, 2002.

To our knowledge, the measurements of U-POPs in this study represent the first data on U-POPs in chicken eggs ever reported in Usti nad Labem region. The levels of dioxins exceeding the EU limits observed in the egg samples support the need for further monitoring and longer-term changes to eliminate chlorinated chemicals that serve as donors for hexachlorobenzene, dioxins and furans releases in all environment compartments. As HCB is not fully covered as a U-POP by all relevant documents and/or their drafts prepared under Stockholm Convention, it is very important to cover this gap and introduce stricter rules for handling HCB-containing wastes as well as for HCB releases into the environment.

## Comparison with other studies of eggs

The data for eggs described in this report follow on the heels of a similar studies in Slovakia and Kenya, released since 21 March 2005.[2, 3] The level of hexachlorobenzene measured in eggs from Usti nad Labem is the third highest level recently measured in free range chicken eggs in the Czech Republic (the highest was found in eggs from surrounding of Spolana Neratovice in Libis[4] and the second highest in Lysa nad Labem in the neighborhood of a hazardous waste incinerator[5]) and the highest level measured among mentioned similar studies published this March.

The dioxin levels in eggs in this study exceed background levels by 2-fold (0.2 - 1.2 pg WHO-TEQ/g of fat).

Some other studies showing elevated levels of dioxins include samples near obsolete pesticides stockpile in Klatovy - Luby in the Czech Republic,[6] where comparable levels of dioxins (3.4 pg WHO-TEQ/g of fat) were found. Much higher levels (almost 10-times and more) were found near an old waste incinerator in Maincy, France [7] and an area affected by a spread mixture of waste incineration residues in Newcastle, UK,[8] 42.47 pg WHO-TEQ/g and 31 pg WHO-TEQ/g respectively.

It is clear that HCB represents a serious contaminant in the sampled eggs from the Usti nad Labem city.

Concerning the balance between PCBs and PCDD/Fs contribution to the whole WHO-TEQ, PCDD/Fs have majority over 70% of the whole TEQ value in eggs as visible from graph in Annex 5.

## POPs in the environment of the Usti nad Labem city and surrounded areas

As Spolchemie in Usti nad Labem produced DDT in the past and is one of two chlor-alkali plants in the Czech Republic, there are plenty of data about POPs levels in the environment in Usti nad Labem and its surrounding. Therefore we will focus only on those most relevant to the U-POPs discussed in this report.

Following the data about HCB levels it is almost clear that a major contamination pathway of this chemical are water releases. Table 3 shows data about released HCB in waste water from the plant based on its own reporting.

**Table 3: HCB Amount in Spolchemie´s waste water.[9]**

| HCB | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|---|
| (kg/year) | 51 | 39 | 14 | 2 | 2 | 0,06 |

High levels of HCB were found in river sediments. Figures from May 2003 range between 20 - 5,300 µg/kg of dry matter. Also significant levels of HCB were found in fish caught downstream from plant in the Labe river with levels ranging from 8.7 - 17.6 ng/g of fresh weight in August 2002 up to 91 ng/g measured in August 2000.

Dioxins emissions were measured only from waste incinerators in Usti nad Labem. No data exist about dioxins releases into the air from the general chemical plant. The waste incinerator located in the area of Spolchemie released PCDD/Fs into to the air from flue gases at levels of 0.011 ng I-TEQ/ $m^3$ (August 2001) up to 1.42 ng I-TEQ/ $m^3$ (January 2000) over the 2000 – 2003 time period. Another hazardous waste incinerator located in Trmice (approximately 5 km southwest from the sampling locality) released in flue gases dioxins at concentrations in the range 0.09 - 0.53 ng I-TEQ/$m^3$.

There is also area of obsolete production buildings highly contaminated by POPs in Spolchemie, that could be a significant source of POPs contamination. In the obsolete amalgam electrolysis area the following levels of dioxins were measured in soils last year: 200 - 700 pg/g of dry matter and even higher levels were found in the dust and plasters of the building 20 – 3,400 pg/g of dry matter.

Levels of POPs were also measured in the blood serum of Usti nad Labem inhabitants. Fifty samples taken in 2002 ranged between 42-1130 ng/g of serum lipids and the median level was 182 ng/g of serum lipids.[10]

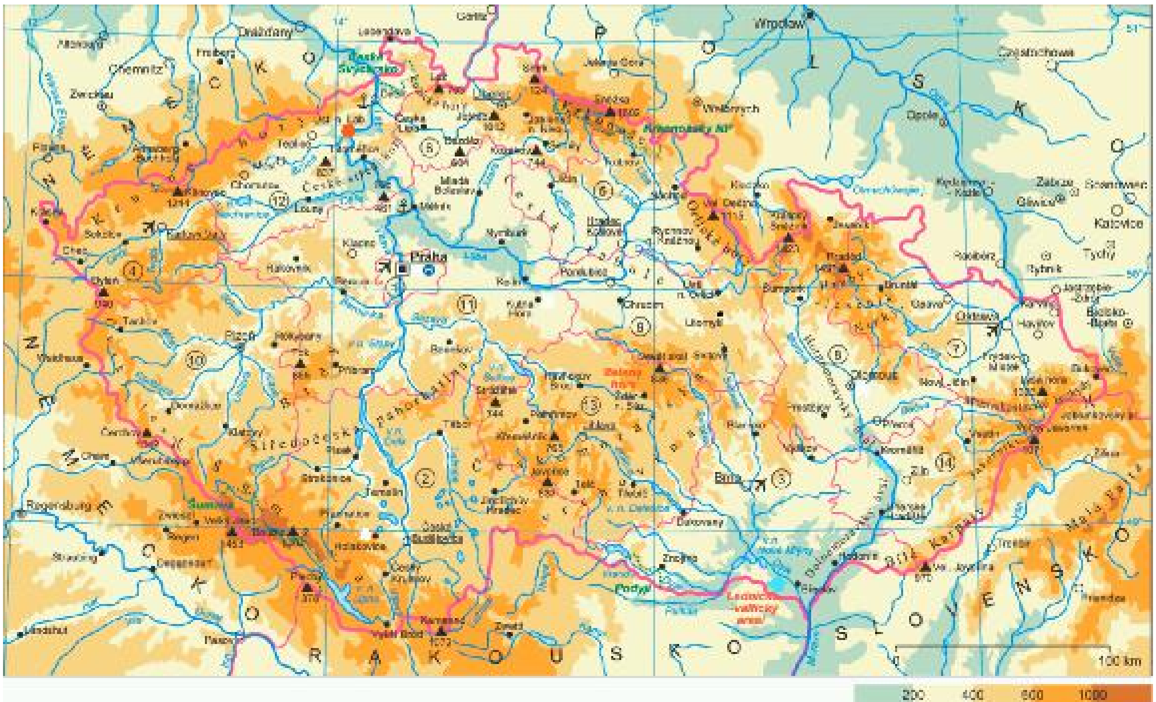
## Possible U-POPs sources

The high levels of hexachlorobenzene and elevated levels of dioxins in free range chicken eggs in these samples provoke the question of possible sources. There are three major potential sources of HCB releases: new as well as old (obsolete) production of different chlorinated chemicals in Spolchemie Usti nad Labem and hazardous waste incineration.[11] There are many different potential sources of PCDD/Fs in the Usti nad Labe, so we can hardly to point one as a major source of elevated levels of dioxins measured in free range chickens.

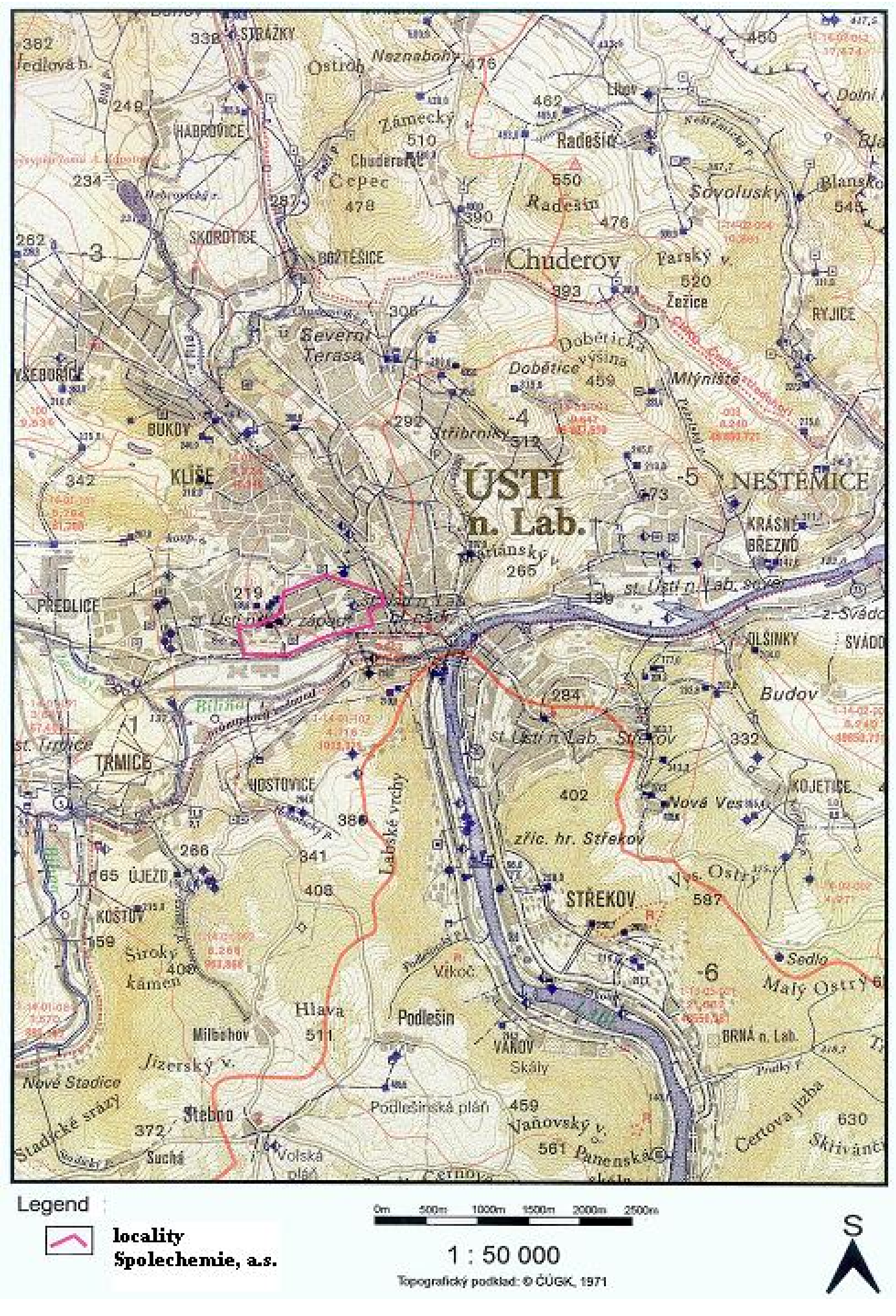
We also want to clearly state that we used free range chicken eggs just as a tool for biomonitoring since it is not very common to raise homegrown chicken and to eat either eggs or meat from them in the urban area of Usti nad Labem. The levels of U-POPs observed in this study clearly shows that these chemicals entered food chains in the area anyway.

## The Spolchemie chlor-alkali and chlorine based chemical production plant in Usti nad Labem (Czech Republic)

The city of Ústí nad Labem, the centre of the region called "Ústecký kraj", has approximately 100 000 inhabitants including the surrounding villages. The city is situated in North Bohemia on the both shores of rivers Labe and Bílina (see maps at pictures 1 and 2)




Picture 1: Ústí nad Labem location in the Czech Republic (red mark)




Picture 2: Location of Spolchemie (Spolek pro chemickou a hutní výrobu, a.s.) in Ústí nad Labem city (Source: Rýdl J., annex IV_20 Location of Spolek pro chemickou a hutní výrobu, a.s., Application for the integrated permision, 2004)

Spolek pro chemickou a hutní výrobu, a.s. Ústí nad Labem, founded in 1856, is situated approximately 500 meters from Ústí nad Labem centre closed to the Bílina river and to the largest Czech river – Labe (Elbe) (Picture 2). Spolchemie is focused on: production of inorganic compounds, inorganic specialties production, resin production, and organic dye-stuff production.

Spolchemie´s area is placed in the eastern industrial zone between the Bílina river, railway line Ústí nad Labem – Teplice v Čechách (from the south) and the Ovčí vrh ridge (from the north). This industrial area is aproximatelly 54 hectares large. It was always and is still used for production of the chemical substances and chemical products. The plot is between 145 a 160 meters above the sea level and its slope is from the north to the south.

The figures about chlorine produced per year shown in Table 4 give some idea about the scale of production in this chemical plant.

**Table 4: The Amount of chlorine produced in Spolchemie during years 1999 – 2003 (Source: Czech Ministry of Environment)**

| chlorine produced by / year | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|
| Spolchemie | 6 982 | 2 922 | 1 292 | 1 293 | 3 525 |

The nearest settlement - the individual type - can be found approximately 250 m to the northwest from the facility border. The nearest settlement - the collective type - can be found approximately 150 m to the north from the facility border in Klíšská street.

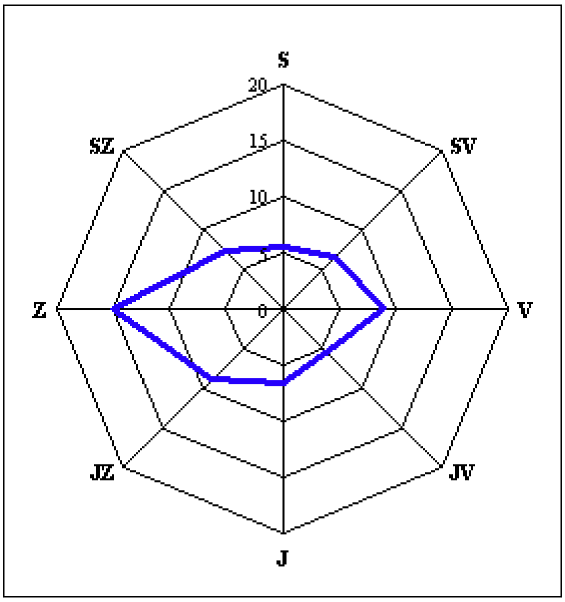
Closed to the Spolchemie approximately 500 m south throught the Bílina valley there is a borderline with a natural and landscape-protected area called České Středohoří.

The wind direction diagram in Picture 3 and the accompanying Table helps to give an image of how potential POPs air releases are dispersed from Spolchemie.

**The Wind Rose – WasP Method**
**Locality: Ústí nad Labem – Spolchemie´s area**

**Elevation: 10 m**

| Relative Frequency of the Wind directions (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| direction | N | NW | E | SE | S | SW | W | NW | No wind |
| % | 5.5 | 6.6 | 8.9 | 5.5 | 6.6 | 8.9 | 15.1 | 7.2 | 35.7 |




(Source: EIA / Dispersion Study (Rozptylová studie – Kombinovaný způsob výroby epichlorhydrinu), author: Czech Hydrometeorological Institute, department in Ústí nad Labem, 2004)

### U-POPs and the Stockholm Convention

The U-POPs measured in this study are slated for reduction and elimination by the Stockholm Convention which holds its first Conference of the Parties in May 2005. Czech Republic is a Party to Convention since it ratified the Treaty in 2002.

The Convention mandates Parties to take specific actions aimed at eliminating these pollutants from the global environment. Parties are to require the use of substitute or modified materials, products and processes to prevent the formation and release of U-POPs.[a] Parties are also required to promote the use of best available techniques (BAT) for new facilities or for substantially modified facilities in certain source categories (especially those identified in Part II of Annex C).[b] In addition, Parties are to promote both BAT and best environmental practices (BEP) for all new and existing significant source categories,[c] with special emphasis on those identified in Parts II and III. As part of its national implementation plan (NIP), each Party is required to prepare an inventory of its significant sources of U-POPs, including release estimates.[d] These NIP inventories will, in part, define activities for countries that will be eligible for international aid to implement their NIP. Therefore it is important that the inventory guidelines are accurate and not misleading.

The Stockholm Convention on POPs is historic. It is the first global, legally binding instrument whose aim is to protect human health and the environment by controlling production, use and disposal of toxic chemicals. We view the Convention text as a promise to take the actions needed to protect Czech and global public's health and environment from the injuries that are caused by persistent organic pollutants, a promise that was agreed by representatives of the global community: governments, interested stakeholders, and representatives of civil society. We call upon Czech governmental representatives and all stakeholders to honor the integrity of the Convention text and keep the promise of reduction and elimination of POPs.

# Annex 1. Materials and Methods

## Sampling

For sampling in the Ustecky kraj region of Czech Republic, we have chosen the surroundings of the chemical plant Spolchemie located in the centre of regional capitol city Usti nad Labem.

The eggs were collected from one site in part of city called Klíše (see map at Picture 2). The hens from which the eggs were picked were all free-range of age between 1 - 2 years although regularly provided with home food supplements - leftovers from the school kitchen.

Sampling was done by members of Arnika Association on 15 January 2005. One chicken fancier supplied 10 eggs from his free range chickens. The eggs were kept in cool conditions after sampling and then were boiled in Arnika office for 7 - 10 minutes in pure water and transported by train to the laboratory at ambient temperature.

[a] Article 5, paragraph (c)
[b] Article 5, paragraph (d)
[c] Article 5, paragraphs (d) & (e)
[d] Article 5, paragraph (a), subparagraph (i)

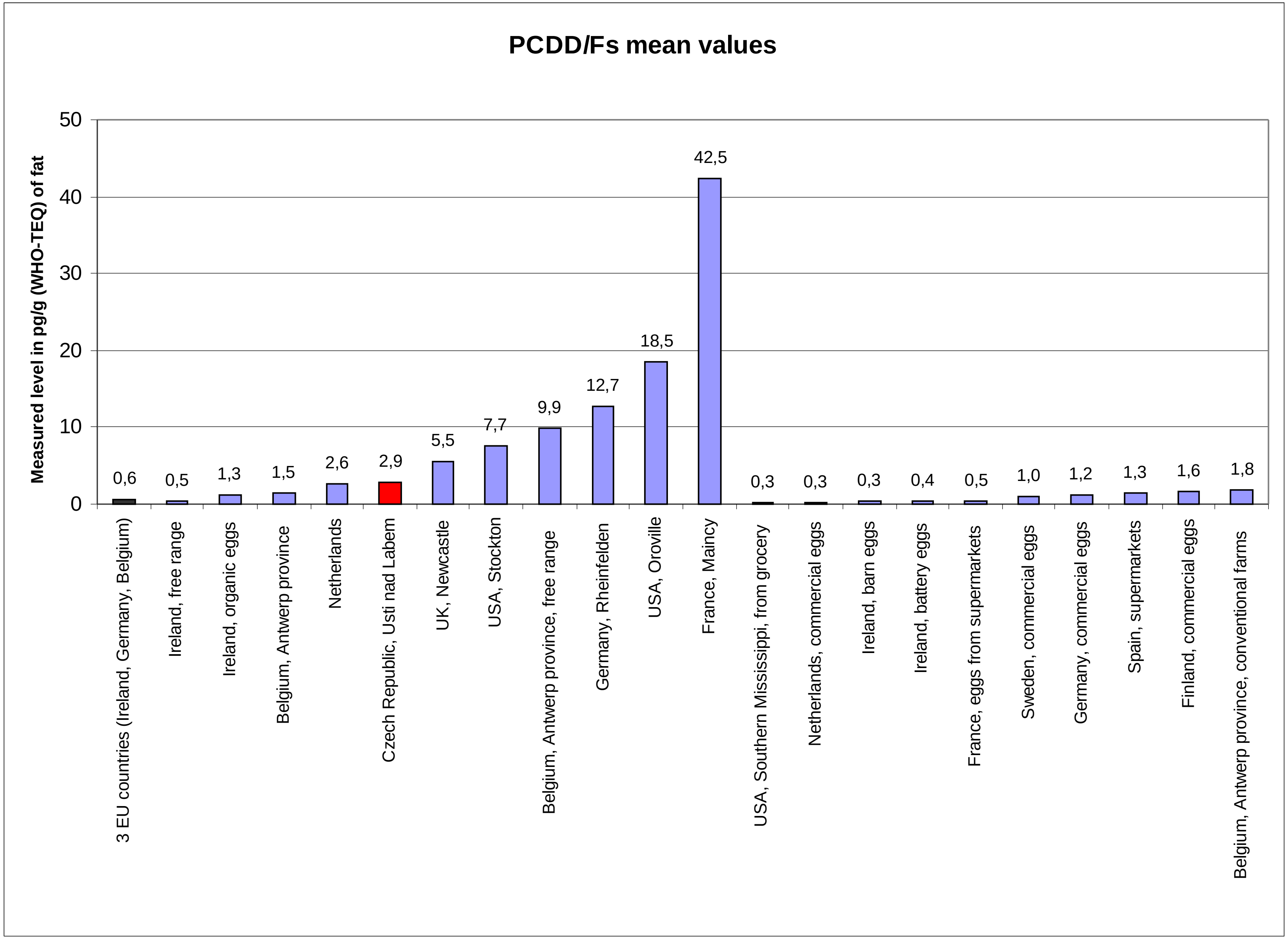
## Analysis

After being received by the laboratory, the eggs were kept frozen until analysis. The egg shells were removed and the edible contents of 6 eggs were homogenised. A 30 g sub-sample was dried with anhydrous sodium sulphate, spiked by internal standards and extracted by toluene in a Soxhlet apparatus. A small portion of the extract was used for gravimetric determination of fat. The remaining portion of the extract was cleaned on a silica gel column impregnated with $H_2SO4$, NaOH and $AgNO_3$. The extract was further purified and fractionated on an activated carbon column. The fraction containing PCDD/Fs, PCBs and HCB was analysed by HR GC-MS on Autospec Ultima NT.

Analysis for PCDD/Fs, PCBs and HCB was done in the Czech Republic in laboratory Axys Varilab. Laboratory Axys Varilab, which provided the analysis is certified laboratory by the Institute for technical normalization, metrology and probations under Ministry of Industry and Traffic of the Czech Republic for analysis of POPs in air emissions, environmental compartments, wastes, food and biological materials.[a] Its services are widely used by industry as well as by Czech governmental institutions. In 1999, this laboratory worked out the study about POPs levels in ambient air of the Czech Republic on request of the Ministry of the Environment of the Czech Republic including also soils and blood tests.

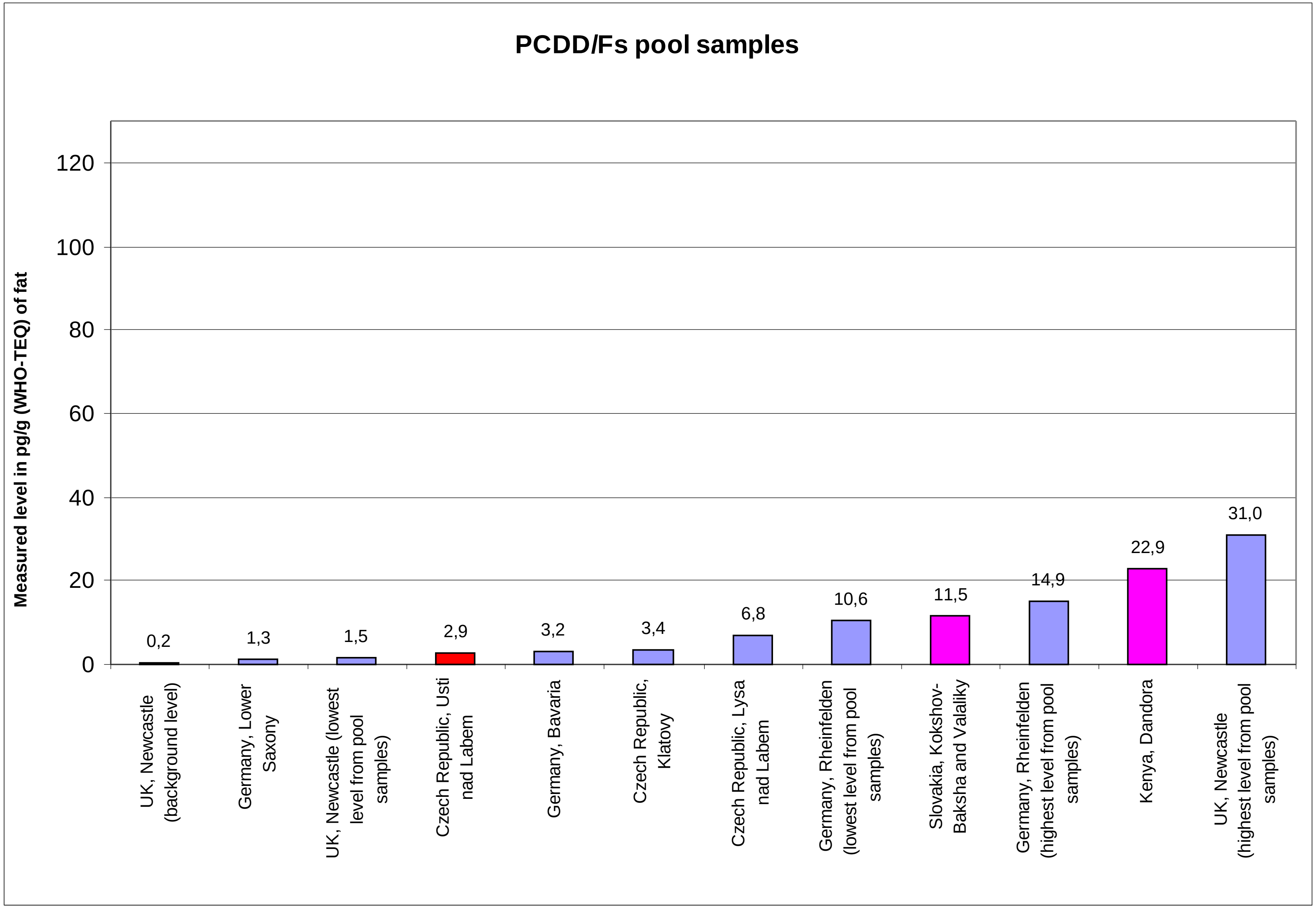
## Annex 2: Mean values found within different groups of eggs from different parts of world

| Country/locality | Year | Group | Measured level in pg/g (WHO-TEQ) of fat | Source of information |
|---|---|---|---|---|
| 3 EU countries (Ireland, Germany, Belgium) | 1997-2003 | both | 0,63 | DG SANCO 2004 |
| Ireland, free range | 2002-2005 | free range | 0,47 | Pratt, I. et al. 2004, FSAI 2004 |
| Ireland, organic eggs | 2002-2005 | free range | 1,3 | Pratt, I. et al. 2004, FSAI 2004 |
| Belgium, Antwerp province | 2004 | free range | 1,5 | Pussemeier, L. et al. 2004 |
| Netherlands | 2004 | free range | 2,6 | SAFO 2004 |
| Czech Republic, Usti nad Labem | 2005 | free range | 2,9 | |
| UK, Newcastle | 2002 | free range | 5,5 | Pless-Mulloli, T. et al. 2003b |
| USA, Stockton | 1994 | free range | 7,69 | Harnly, M. E. et al. 2000 |
| Belgium, Antwerp province, free range | 2004 | free range | 9,9 | Pussemeier, L. et al. 2004 |
| Germany, Rheinfelden | 1996 | free range | 12,7 | Malisch, R. et al. 1996 |
| USA, Oroville | 1994 | free range | 18,46 | Harnly, M. E. et al. 2000 |
| France, Maincy | 2004 | free range | 42,47 | Pirard, C. et al. 2004 |
| USA, Southern Mississippi, from grocery | 1994 | not free range | 0,29 | Fiedler, H. et al. 1997 |
| Netherlands, commercial eggs | 2004 | not free range | 0,3 | Anonymus 2004 |
| Ireland, barn eggs | 2002-2005 | not free range | 0,31 | Pratt, I. et al. 2004, FSAI 2004 |
| Ireland, battery eggs | 2002-2005 | not free range | 0,36 | Pratt, I. et al. 2004, FSAI 2004 |
| France, eggs from supermarkets | 1995-99 | not free range | 0,46 | SCOOP Task 2000 |
| Sweden, commercial eggs | 1995-99 | not free range | 1,03 | SCOOP Task 2000 |
| Germany, commercial eggs | 1995-99 | not free range | 1,16 | SCOOP Task 2000 |
| Spain, supermarkets | 1996 | not free range | 1,34 | Domingo et al. 1999 |
| Finland, commercial eggs | 1990-94 | not free range | 1,55 | SCOOP Task 2000 |
| Belgium, Antwerp province, conventional farms | 2004 | not free range | 1,75 | Pussemeier, L. et al. 2004 |


PCDD/Fs mean values
Measured level in pg/g (WHO-TEQ) of fat
50
40
30
20
10
0
0,6
0,5
1,3
1,5
2,6
2,9
5,5
7,7
9,9
12,7
18,5
42,5
0,3
0,3
0,3
0,4
0,5
1,0
1,2
1,3
1,6
1,8
3 EU countries (Ireland, Germany, Belgium)
Ireland, free range
Ireland, organic eggs
Belgium, Antwerp province
Netherlands
Czech Republic, Usti nad Labem
UK, Newcastle
USA, Stockton
Belgium, Antwerp province, free range
Germany, Rheinfelden
USA, Oroville
France, Maincy
USA, Southern Mississippi, from grocery
Netherlands, commercial eggs
Ireland, barn eggs
Ireland, battery eggs
France, eggs from supermarkets
Sweden, commercial eggs
Germany, commercial eggs
Spain, supermarkets
Finland, commercial eggs
Belgium, Antwerp province, conventional farms

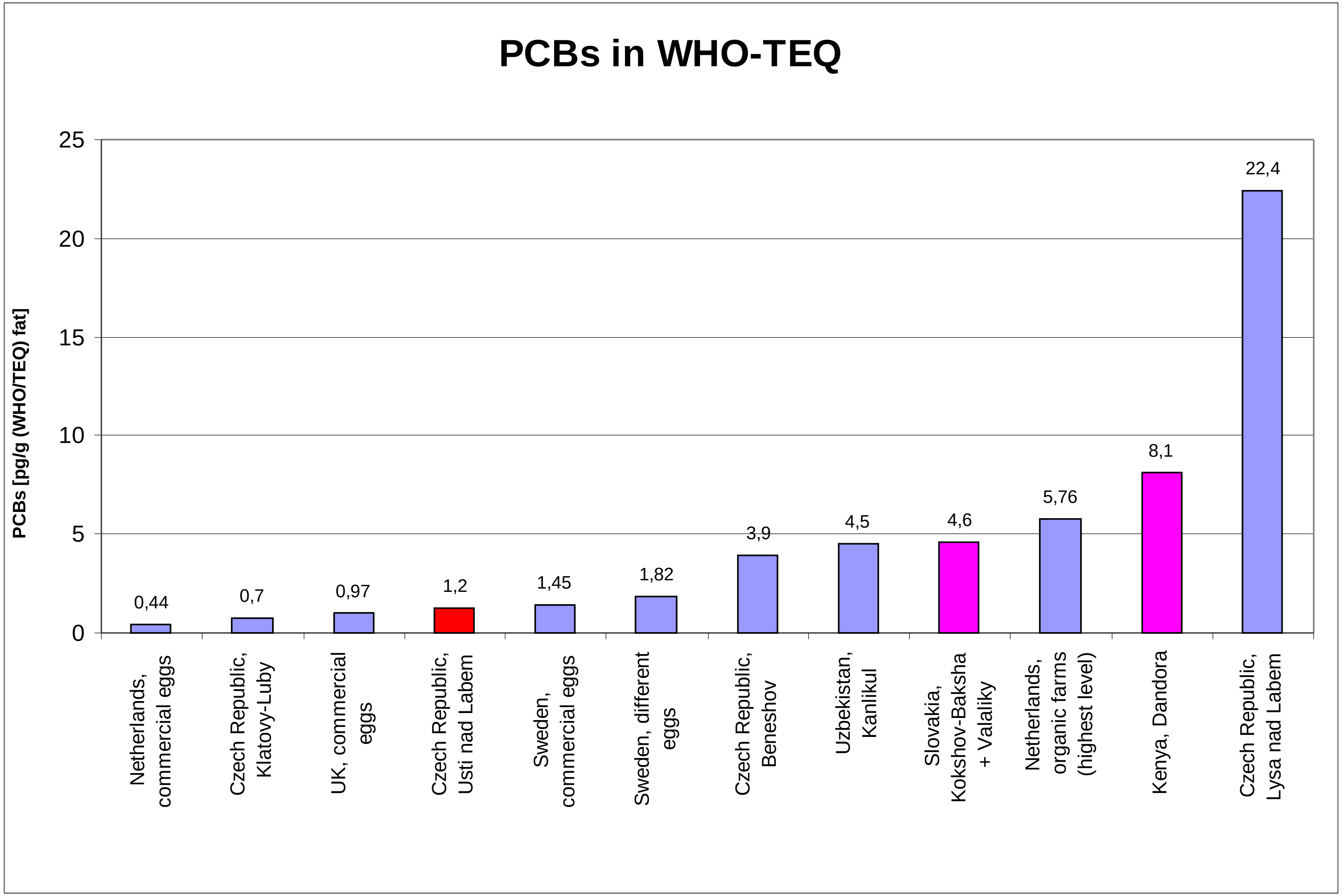
## Annex 3: Levels of dioxins (PCDD/Fs) in different pool samples from different parts of world

| Country/locality | Year | Group | Number of eggs/measured samples | Measured level in pg/g (WHO-TEQ) of fat | Source of information |
|---|---|---|---|---|---|
| UK, Newcastle (background level) | 2000 | free range | 3/1 pooled | 0,2 | Pless-Mulloli, T. et al. 2001 |
| Germany, Lower Saxony | 1998 | free range | 60/6 pools | 1,28 | SCOOP Task 2000 |
| UK, Newcastle (lowest level from pool samples) | 2000 | free range | 3/1 pooled | 1,5 | Pless-Mulloli, T. et al. 2001 |
| Czech Republic, Usti nad Labem | 2005 | free range | 6/1 pooled | 2,9 | |
| Germany, Bavaria | 1992 | free range | 370/37 pools | 3,2 | SCOOP Task 2000 |
| Czech Republic, Klatovy | 2003 | free range | 12 | 3,4 | Beranek, M. et al. 2003 |
| Czech Republic, Lysa nad Labem | 2004 | free range | 4 | 6,8 | Petrlik, J. 2005 |
| Germany, Rheinfelden (lowest level from pool samples) | 1996 | free range | - | 10,6 | Malisch, R. et al. 1996 |
| Slovakia, Kokshov-Baksha and Valaliky | 2005 | free range | 6/1 pooled | 11,52 | |
| Germany, Rheinfelden (highest level from pool samples) | 1996 | free range | - | 14,9 | Malisch, R. et al. 1996 |
| Kenya, Dandora | 2004 | free range | 6/1 pooled | 22,92 | |
| UK, Newcastle (highest level from pool samples) | 2000 | free range | 3/1 pooled | 31 | Pless-Mulloli, T. et al. 2001 |


PCDD/Fs pool samples
Measured level in pg/g (WHO-TEQ) of fat
0
20
40
60
80
100
120
0,2
1,3
1,5
2,9
3,2
3,4
6,8
10,6
11,5
14,9
22,9
31,0
UK, Newcastle (background level)
Germany, Lower Saxony
UK, Newcastle (lowest level from pool samples)
Czech Republic, Usti nad Labem
Germany, Bavaria
Czech Republic, Klatovy
Czech Republic, Lysa nad Labem
Germany, Rheinfelden (lowest level from pool samples)
Slovakia, Kokshov-Baksha and Valaliky
Germany, Rheinfelden (highest level from pool samples)
Kenya, Dandora
UK, Newcastle (highest level from pool samples)

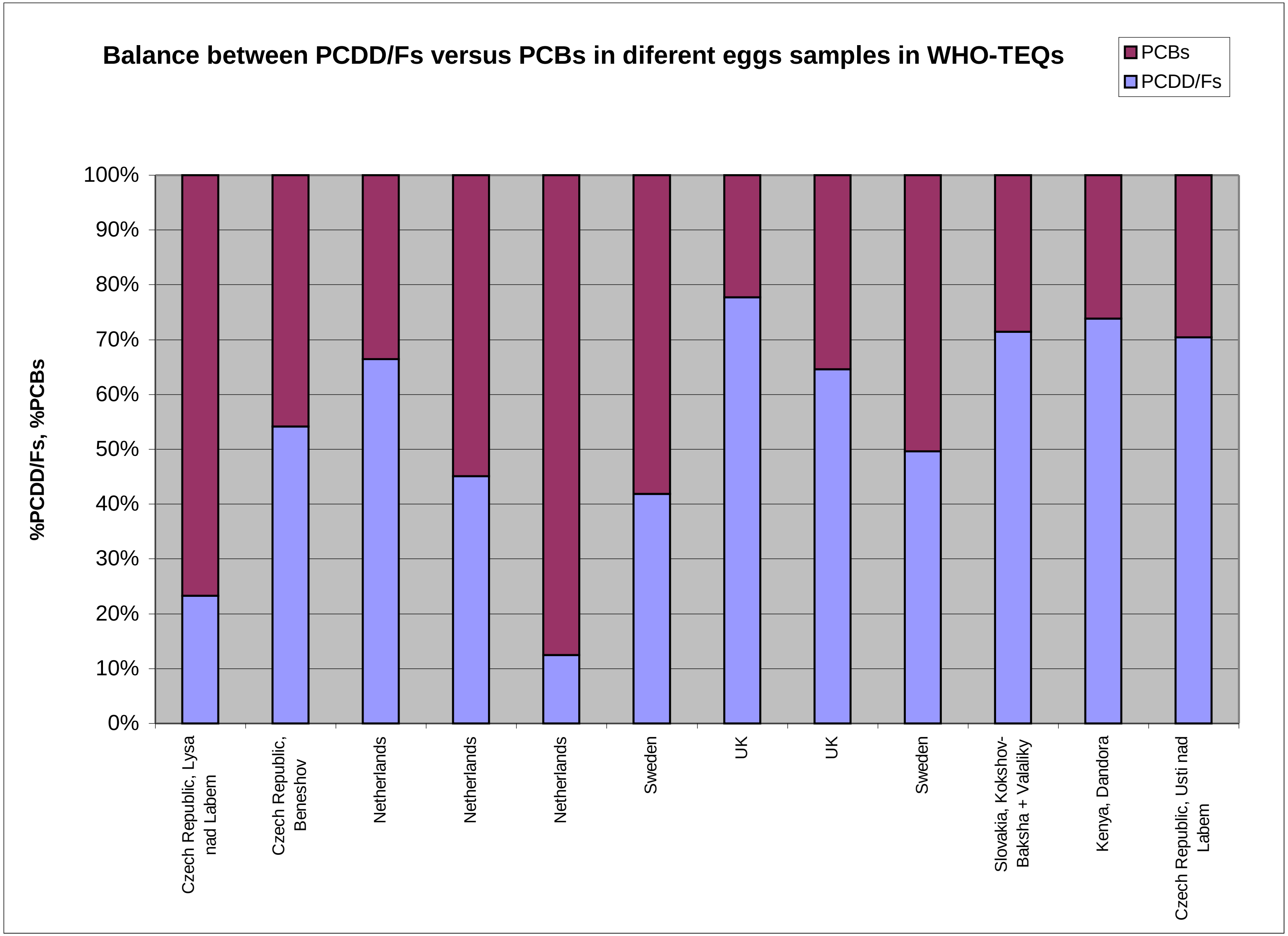
## Annex 4: Levels of PCBs in WHO-TEQ in different chicken eggs samples from different parts of world

| Country/locality | Year | Group | Number of measured samples | Specification | Measured level in pg/g (WHO-TEQ) of fat | Source of information |
|---|---|---|---|---|---|---|
| Netherlands, commercial eggs | 1999 | not free range | 100/2 pools | pool, nonortho-PCBs | 0,44 | SCOOP Task 2000 |
| Czech Republic, Klatovy-Luby | 2003 | free range | free range | individual | 0,7 | Beranek, M. et al. 2003 |
| UK, commercial eggs | 1992 | not free range | 24/1 pool | pool | 0,97 | SCOOP Task 2000 |
| Czech Republic, Usti nad Labem | 2005 | free range | 6/1 pool | pool | 1,2 | |
| Sweden, commercial eggs | 1999 | not free range | 32/4 pools | pool | 1,45 | SCOOP Task 2000 |
| Sweden, different eggs | 1993 | mixed | 84/7 pools | pool | 1,82 | SCOOP Task 2000 |
| Czech Republic, Beneshov | 2004 | free range | 4 | pool | 3,9 | Axys Varilab 2004 |
| Uzbekistan, Kanlikul | 2001 | free range | - | individual | 4,5 | Muntean, N. et al. 2003 |
| Slovakia, Kokshov-Baksha + Valaliky | 2005 | free range | 6/1 pool | pool | 4,6 | |
| Netherlands, organic farms (highest level) | 2002 | free range | 6 | pool | 5,76 | Traag, W. et al. 2002 |
| Kenya, Dandora | 2004 | free range | 6/1 pool | pool | 8,1 | |
| Czech Republic, Lysa nad Labem | 2004 | free range | 4 | pool | 22,4 | Petrlik, J. 2005 |


PCBs in WHO-TEQ
PCBs [pg/g (WHO/TEQ) fat]
25
20
15
10
5
0
0,44
0,7
0,97
1,2
1,45
1,82
3,9
4,5
4,6
5,76
8,1
22,4
Netherlands, commercial eggs
Czech Republic, Klatovy-Luby
UK, commercial eggs
Czech Republic, Usti nad Labem
Sweden, commercial eggs
Sweden, different eggs
Czech Republic, Beneshov
Uzbekistan, Kanlikul
Slovakia, Kokshov-Baksha + Valaliky
Netherlands, organic farms (highest level)
Kenya, Dandora
Czech Republic, Lysa nad Labem

## Annex 5: Balance between PCDD/Fs versus PCBs in diferent eggs samples in WHO-TEQs

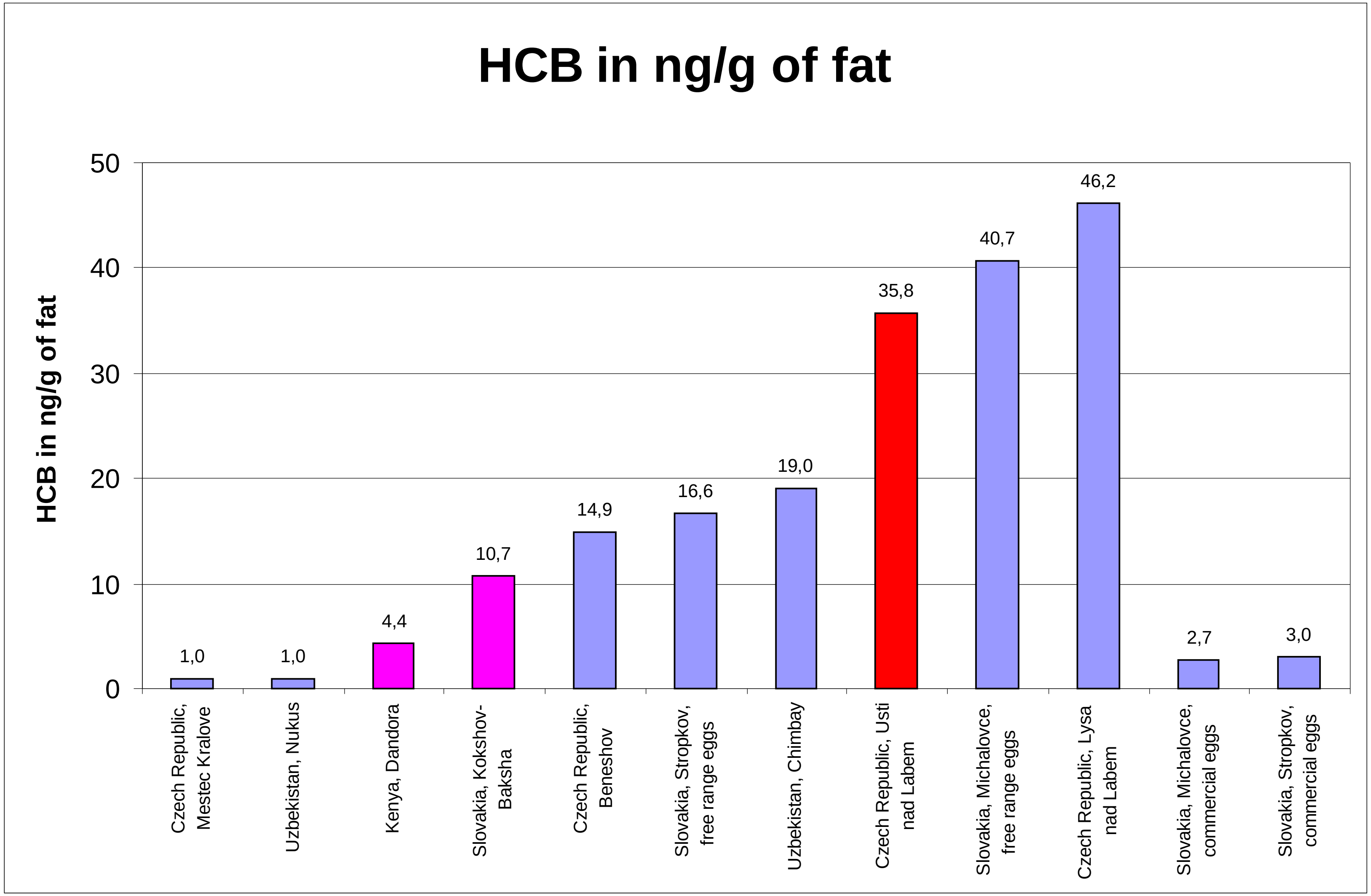
| Country/locality | Year | Group | PCDD/Fs | PCBs | Total WHO-TEQ | Source of information |
|---|---|---|---|---|---|---|
| Czech Republic, Lysa nad Labem | 2004 | free range | 6,80 | 22,40 | 29,20 | Petrlik, J. 2005 |
| Czech Republic, Beneshov | 2004 | free range | 4,60 | 3,90 | 8,50 | Axys Varilab 2004 |
| Netherlands | 2002 | free range | 3,01 | 1,52 | 4,53 | Traag, W. et al. 2002 |
| Netherlands | 2002 | free range | 4,74 | 5,76 | 10,50 | Traag, W. et al. 2002 |
| Netherlands | 2002 | free range | 0,70 | 4,89 | 5,59 | Traag, W. et al. 2002 |
| Sweden | 1993 | mixed | 1,31 | 1,82 | 3,13 | SCOOP Task 2000 |
| UK | 1982 | not free range | 8,25 | 2,36 | 10,61 | SCOOP Task 2000 |
| UK | 1992 | not free range | 1,77 | 0,97 | 2,74 | SCOOP Task 2000 |
| Sweden | 1999 | not free range | 1,43 | 1,45 | 2,48 | SCOOP Task 2000 |
| Slovakia, Kokshov-Baksha + Valaliky | 2005 | free range | 11,52 | 4,60 | 16,12 | |
| Kenya, Dandora | 2004 | free range | 22,92 | 8,1 | 31,02 | |
| Czech Republic, Usti nad Labem | 2005 | free range | 2,9 | 1,22 | 4,12 | |



Balance between PCDD/Fs versus PCBs in diferent eggs samples in WHO-TEQs
PCBs
PCDD/Fs
%PCDD/Fs, %PCBs
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Czech Republic, Lysa nad Labem
Czech Republic, Beneshov
Netherlands
Netherlands
Netherlands
Sweden
UK
UK
Sweden
Slovakia, Kokshov-Baksha + Valaliky
Kenya, Dandora
Czech Republic, Usti nad Labem

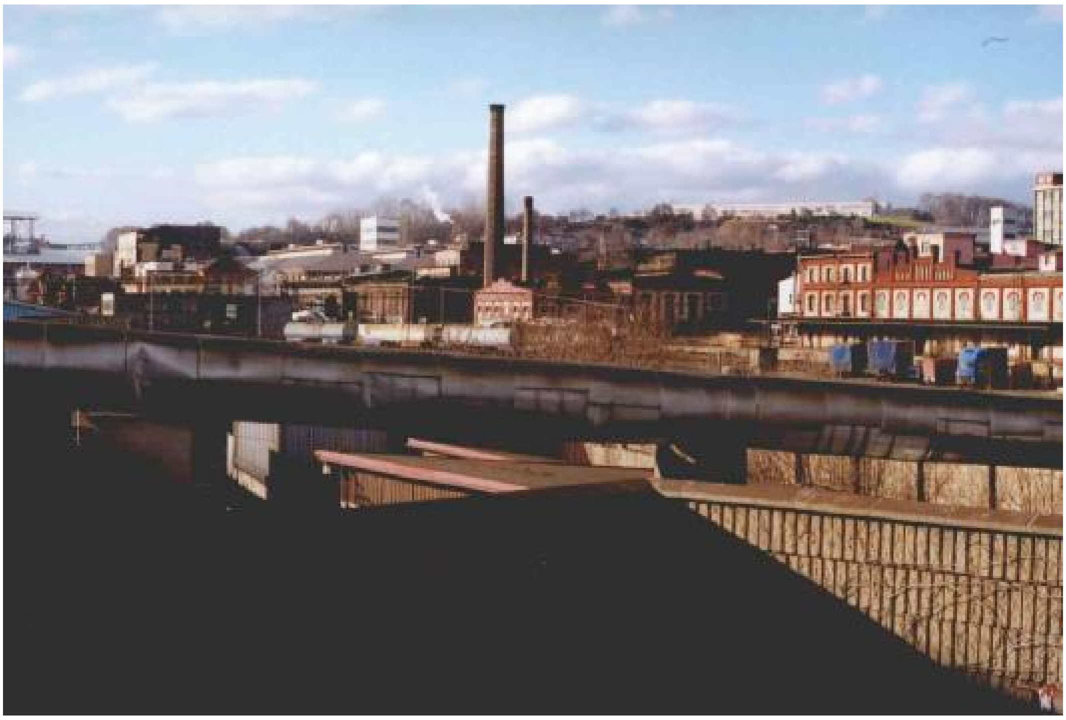
## Annex 6: Levels of HCB in ng/g of fat in different chicken eggs samples from different parts of world

| Country | Date/year | Specification | Number of measured samples | Measured level in ng/g of fat | Source of information |
|---|---|---|---|---|---|
| Czech Republic, Mestec Kralove | 2003 | free range | 3 | 1,0 | SVA CR 2004 |
| Uzbekistan, Nukus | 2001 | free range | - | 1,0 | Muntean, N. et al. 2003 |
| Kenya, Dandora | 2004 | free range | 6/1 pool | 4,4 | |
| Slovakia, Kokshov-Baksha | 2005 | free range | 6/1 pool | 10,7 | |
| Czech Republic, Beneshov | 2004 | free range | 4/1 pool | 14,9 | Axys Varilab 2004 |
| Slovakia, Stropkov, free range eggs | before 1999 | free range | 1 | 16,6 | Kocan, A. et al. 1999 |
| Uzbekistan, Chimbay | 2001 | free range | - | 19,0 | Muntean, N. et al. 2003 |
| Czech Republic, Usti nad Labem | 2005 | free range | 6/1 pool | 35,8 | |
| Slovakia, Michalovce, free range eggs | before 1999 | free range | 1 | 40,7 | Kocan, A. et al. 1999 |
| Czech Republic, Lysa nad Labem | 2004 | free range | 4/1 pool | 46,2 | Petrlik, J. 2005 |
| Slovakia, Michalovce, commercial eggs | before 1999 | not free range | 1 | 2,7 | Kocan, A. et al. 1999 |
| Slovakia, Stropkov, commercial eggs | before 1999 | not free range | 1 | 3,0 | Kocan, A. et al. 1999 |


HCB in ng/g of fat
HCB in ng/g of fat
0
10
20
30
40
50
1,0
1,0
4,4
10,7
14,9
16,6
19,0
35,8
40,7
46,2
2,7
3,0
Czech Republic, Mestec Kralove
Uzbekistan, Nukus
Kenya, Dandora
Slovakia, Kokshov-Baksha
Czech Republic, Beneshov
Slovakia, Stropkov, free range eggs
Uzbekistan, Chimbay
Czech Republic, Usti nad Labem
Slovakia, Michalovce, free range eggs
Czech Republic, Lysa nad Labem
Slovakia, Michalovce, commercial eggs
Slovakia, Stropkov, commercial eggs

# Annex 7: Photos

General view at Spolchemie chemical plant. Photo by: Hana Kuncova.



Another general view at Spolchemie chemical plant. Photo by: Hana Kuncova.

Sampling site with garden, where chickens are foraging. Photo by: Hana Kuncova.

Chicken searching for and eating soil organisms at garden. Photo by: Hana Kuncova.

View at typical quiet urban area, where eggs were sampled. Chimney of hazardous waste incinerator and heat and power plant at Trmice (approx. 5 km far) is visible at picture. Photo by: Hana Kuncova.

Chicken at sampling site. Photo by: Hana Kuncova.

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