***AGENDA, P.O. Box 77266, Dar es Salaam, Tanzania***

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

# Contamination of chicken eggs near the Vikuge obsolete pesticides stockpile in Tanzania by dioxins, PCBs and hexachlorobenzene

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## "Keep the Promise, Eliminate POPs!" Campaign Report

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*Dar es Salaam - Prague (March - 29 - 2005)*

# Executive Summary

Free-range chicken eggs collected in Vikuge village and its surroundings 56 km northeast of Dar es Salaam City showed elevated levels of dioxins and high levels of hexachlorobenzene (HCB). HCB levels were 2-fold higher than the newly proposed limit for HCB as a pesticide residue and were very close to the existing limit for this chemical in eggs. Dioxin levels exceeded background levels by almost 2.5-fold and were slightly higher than the European Union (EU) dioxin limit for eggs. To our knowledge, this study represents the first data about U-POPs in chicken eggs from Tanzania.

The most obvious potential source of POPs releases at the site is obsolete pesticides storage though it could also be open burning. The measured levels of U-POPs were accompanied by high levels of POPs pesticides residues and both together represent a concern for wider contamination. Drinking water contamination by POPs pesticides was found previously,[1] but U-POPs levels were not measured in food until this eggs sample study from the area.

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. Tanzania is a Party to Convention since it ratified the Treaty in April 2004. 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 Tanzanian 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 Tanzanian 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) More POPs monitoring in Tanzania is needed;

2) More publicly accessible data about U-POPs releases from all potential sources in the region are needed to address them properly;

3) Clear U-POPs releases inventory would help to address properly all sources of their releases

4) Stringent levels of U-POPs in waste 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. Tanzania ratified the Convention in April 2004.

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 Vikuge obsolete pesticides stockpile was selected as a sampling site since pesticides are known to be a significant source of dioxins and furans as by-products.[2] 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 ever reported in Tanzania.

# Materials and Methods

Please see Annex 1.

# Results and Discussion

### U-POPs in eggs sampled in the surrounding of the Vikuge obsolete pesticides stockpile in Tanzania

The results of the analysis of a pooled sample of 6 eggs collected in the surrounding of the Vikuge village are summarized in Tables 1 and 2. Pooled sample fat content was measured at 13.8%.

Levels of dioxins found in sampled eggs from the Vikuge in Table 1 were slightly higher than the EU dioxin limit for eggs. In addition, the samples exceeded the proposed limit for HCB by almost two-fold.

**Table 1: Measured levels of POPs in eggs collected in the surroundings of the Vikuge obsolete pesticides stockpile in Tanzania per gram of fat.**

| | Measured level | Limits | Action level |
|---|---|---|---|
| PCDD/Fs in WHO-TEQ (pg/g) | 3.03 | 3.0[a] | 2.0[b] |
| PCBs in WHO-TEQ (pg/g) | 0.6 - 0.7 | 2.0[b] | 1.5[b] |
| Total WHO-TEQ (pg/g) | 3.63 -3.73 | 5.0[b] | - |
| PCB (7 congeners) (ng/g) | 4.10 | 200[c] | - |
| HCB (ng/g) | 19.10 | 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 level of U-POPs in eggs expressed as fresh weight.

**Table 2: Measured levels of POPs in eggs collected in the surroundings of the Vikuge obsolete pesticides stockpile in Tanzania per gram of egg fresh weight.**

| | Measured level | Limits | Action level |
|---|---|---|---|
| PCDD/Fs in WHO-TEQ (pg/g) | 0.42 | 1[a] | - |
| PCBs in WHO-TEQ (pg/g) | 0.08 - 0.10 | - | - |
| Total WHO-TEQ (pg/g) | 0.50 - 0.51 | - | - |
| PCBs (7 congeners) (ng/g) | 0.57 | | |
| HCB (ng/g) | 2.64 | - | - |

Abbreviations: WHO, World Health Organization; TEQ, toxic equivalents; pg, picogram; 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 Tanzania. 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 pesticides that serve as donors for dioxin releases in both the pesticides stockpiles and application to land, which was found as the highest source of dioxins land releases in one of latest EU dioxins inventories.[3] Pesticides accompanied by dioxins as by-products are listed in "The Inventory of Sources of Dioxin in the United States" from April 1998[4] and in Bretthauer, E. et al. 1991[5] for example.

## Comparison with other studies of eggs

The dioxin levels in eggs in this study exceed background levels by 2.5-fold (0.2 - 1.2 pg WHO-TEQ/g of fat).

We compared the levels of PCDD/Fs measured in this study in eggs from the Vikuge village surrounding with data from other studies that also used pooled samples and/or expressed mean levels from more eggs samples measurements (Please see Annexes 2 and 3.) The data for eggs described in this report follow on the heels of a similar studies in Slovakia, Kenya, Czech Republic, Belarus and India (Uttar Pradesh) released since 21 March 2005.[6, 7, 8, 9, 10] Dioxin levels in the eggs sampled from the Vikuge site in Tanzania were almost at the same as levels in eggs from Usti nad Labem in the Czech Republic collected near a chlorine chemical plant and a bit lower than in eggs collected at the dumpsite in Bolshoy Trostenec in Belarus.

Other studies showing elevated levels of dioxins include samples near obsolete pesticides stockpile in Klatovy - Luby in the Czech Republic,[11] where comparable levels of dioxins (3.4 pg WHO-TEQ/g of fat) were found. Much higher levels were found in surrounding of an old waste incinerator in Maincy, France [12] and an area affected by a spread mixture of waste incineration residues in Newcastle, UK,[13] 42.47 pg WHO-TEQ/g and 31 pg WHO-TEQ/g respectively.

It is clear that dioxins represent more serious contaminant in the sampled eggs from the Vikuge comparing to PCBs. PCDD/Fs contribute over 80% of the whole TEQ value in eggs as visible from graph in Annex 5.

Much higher levels of HCB were found in the eggs collected in the surroundings of Vikuge village comparing to other sites studied by IPEN project (see Annex 6). HCB levels found in eggs from Vikuge reached more than half the level found in eggs from Usti nad Labem in the Czech Republic, which were collected near a factory producing hexachlorobenzene as a by-product.[14] However, in Vikuge HCB is probably not a U-POP but most likely present as a pesticide, although there was no evidence that HCB was stored among the other pesticides and/or included as an aging chemical in some of the stored pesticides in Vikuge.

## Possible U-POPs sources

The elevated levels of U-POPs in free range chicken eggs in these samples provoke the question of possible sources. The most obvious potential source of POPs releases at the site is the obsolete pesticides stockpile. Dioxin formation is suspected under certain conditions of DDT synthesis and therefore would become part of the organochlorine mixture present at the site. [15] As mentioned above, there is some question about whether HCB might have also been part of the initial stockpile. This would help explain finding HCB in the eggs and also dioxins which contaminate HCB preparations. Open burning of waste in the village could be an additional source of U-POPs in eggs.

## The Vikuge pesticides obsolete stockpile

The Vikuge contaminated site is located about 35 miles (56 km) northeast of Dar es Salaam City, between latitudes 6° 45’ and 6° 50’ south of the Equator and longitudes 38° 50’ and 38° 55’ east.

Between 1974 – 1976, the Sisal State Farm under the Ministry of Agriculture, developed the land into a Research Center for growing seeds for food crops, then later it became a hay farm. In 1986, the Government of Tanzania received a quantity of pesticides in different forms as a donation from the Government of Greece. It was noticed that the government of Tanzania did not expect such a large of amount of pesticides, and so, no preparation was made to receive the consignment. About 600 Mt stock received at the Vikuge site was stored under a shed measuring about 50 x 50 meters in open air. An estimated 200 Mt remained at the site.

In 1993 the shed collapsed, pesticides exposed to direct sunlight, rain and other climatic variations. The bags started leaking contaminating soils and ground water. In 1996 with assistance of the Government of Sweden (Sida), a new store was built 20m from the original site. Under the supervision of the NEMC, the Government of Tanzania repackaged the pesticides in bags. The old site still has a strong odor of DDT along with the remains of dead insects and pieces of pesticide containers in a largely barren area with no vegetation.

A study done by the National Environment Management Council in 1998 at a depth of 1m and groundwater showed concentrations of 100 mg DDT per kg soil. Another study showed that Vikuge is one of the most contaminated sites in the world with 282,000mg/kg dry weight for total DDT. The site has no fence and is only separated by firebreak route.

Villagers complained of pungent smell of DDT especially in the dry season accompanied with wind. Health effects include eye infections, persistent skin diseases and respiratory tract infections. Five elders and a young girl died after body swelling and the situation has been recurring. Loss of soil fertility resulted in a decline of crop production. Fish declined and disappeared in Lugongwe, a nearby stream (5km), in 1989 after using pesticides for fishing and slow regeneration is reported.

## U-POPs and the Stockholm Convention

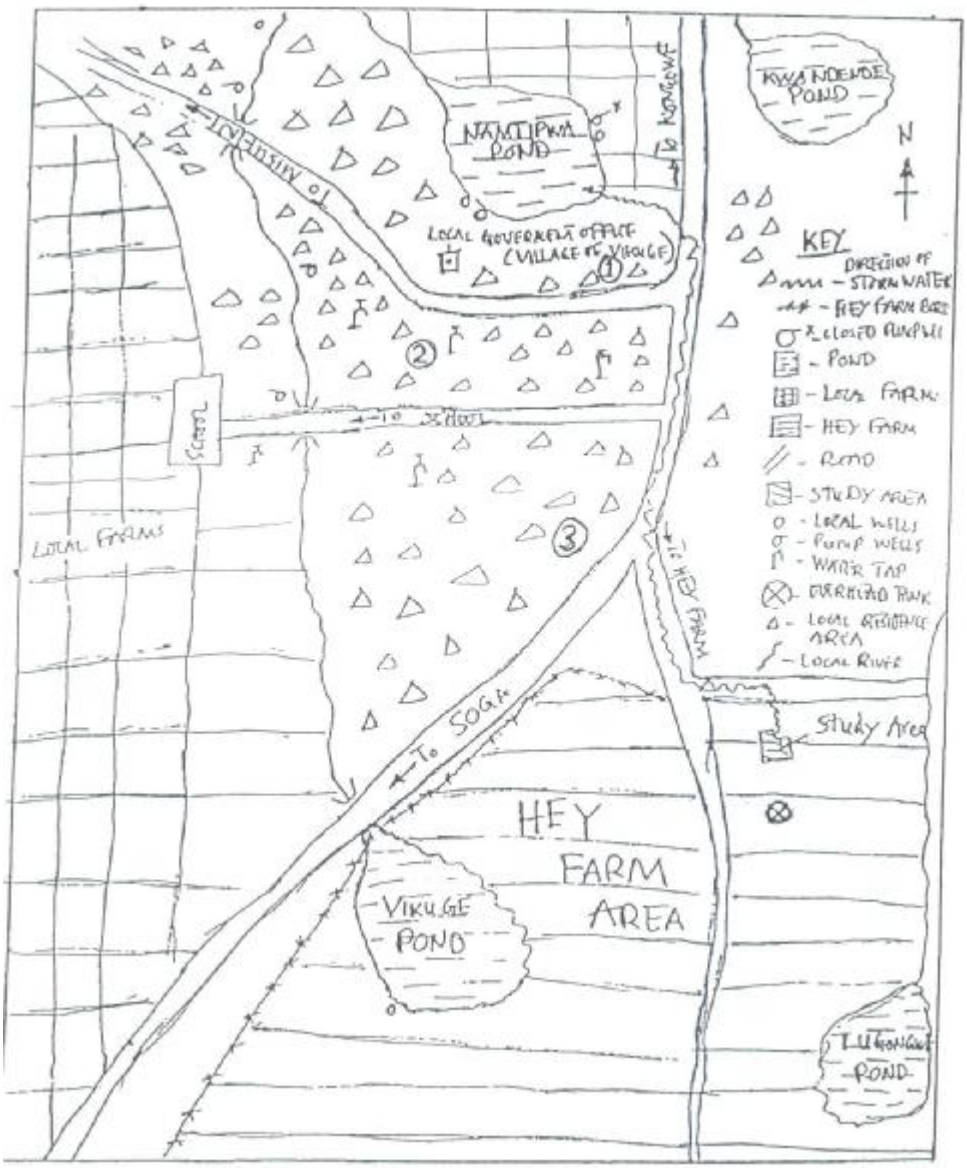
The U-POPs measured in this study are slated for reduction and elimination by the Stockholm Convention which holds its first Conference of the Parties in May 2005. Tanzania is a Party to Convention since it ratified the Treaty in 2004.

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 Tanzanian 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 Tanzanian governmental representatives and all stakeholders to honor the integrity of the Convention text and keep the promise of reduction and elimination of POPs.

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

# Annex 1. Materials and Methods




Fanciers
1 – Fancier 1
2 – Fancier 2
3 – Fancier 3

**Free hand sketch showing the egg sampling areas at the Vikuge contaminated site**

## Sampling

For sampling in Tanzania we have chosen the surroundings of the Vikuge obsolete pesticides stockpile located in the coastal zone 56 km northeast from Dar es Salaam, the business capital city of Tanzania.

The eggs were collected from three sites (see free hand sketch above). The hens from which the eggs were picked were all free-range although occasionally provided with home food supplements.

Sampling was done by members of AGENDA at marked places on 22 – 24 January 2005. Three chicken fanciers supplied 9 eggs from their free range chickens. The eggs were kept in cool conditions after sampling and then were boiled in Tanzania by AGENDA for 7 - 10 minutes in pure water and transported by express service to the laboratory at ambient temperature.

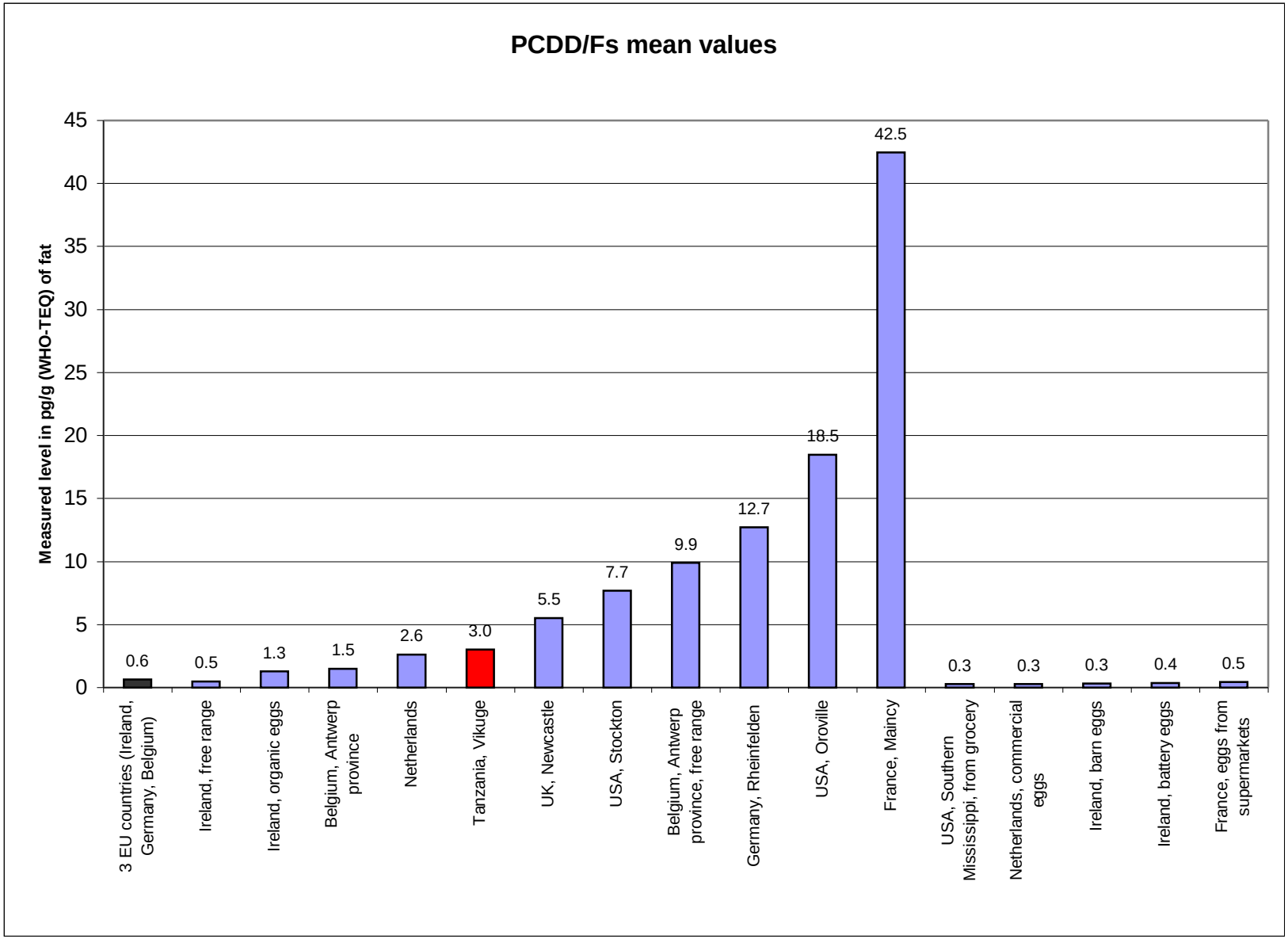
## Analysis

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.

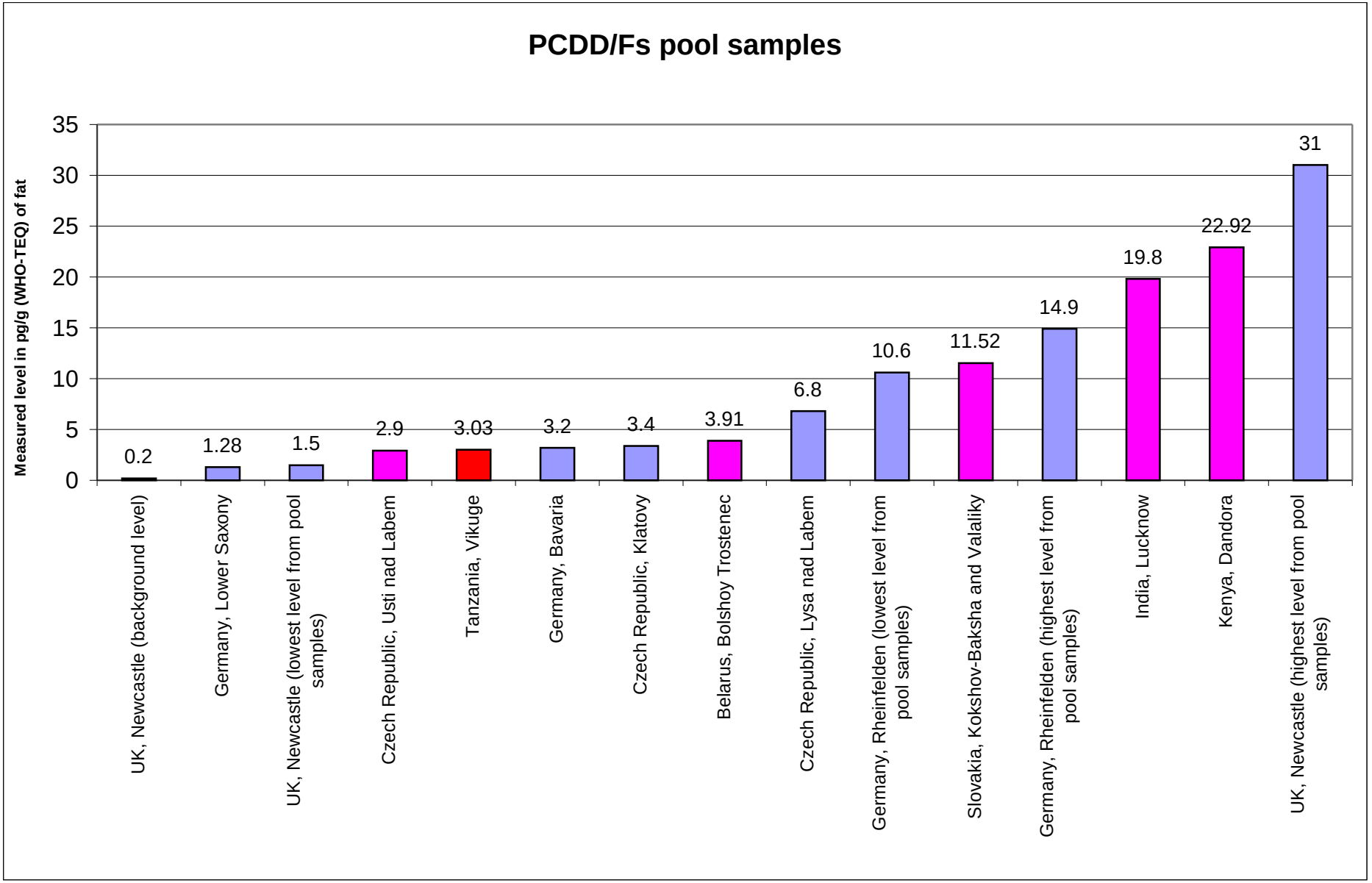
# Annex 2: Mean values found within different groups of eggs from different parts of world

| 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 | 1,30 | Pratt, I. et al. 2004, FSAI 2004 |
| Belgium, Antwerp province | 2004 | free range | 1,50 | Pussemeier, L. et al. 2004 |
| Netherlands | 2004 | free range | 2,60 | SAFO 2004 |
| Tanzania, Vikuge | 2005 | free range | 3,03 | Axys Varilab 2005 |
| UK, Newcastle | 2002 | free range | 5,50 | 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 | 9,90 | Pussemeier, L. et al. 2004 |
| Germany, Rheinfelden | 1996 | free range | 12,70 | 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 | 0,30 | 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
45
40
35
30
25
20
15
10
5
0
0.6
0.5
1.3
1.5
2.6
3.0
5.5
7.7
9.9
12.7
18.5
42.5
0.3
0.3
0.3
0.4
0.5
3 EU countries (Ireland, Germany, Belgium)
Ireland, free range
Ireland, organic eggs
Belgium, Antwerp province
Netherlands
Tanzania, Vikuge
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

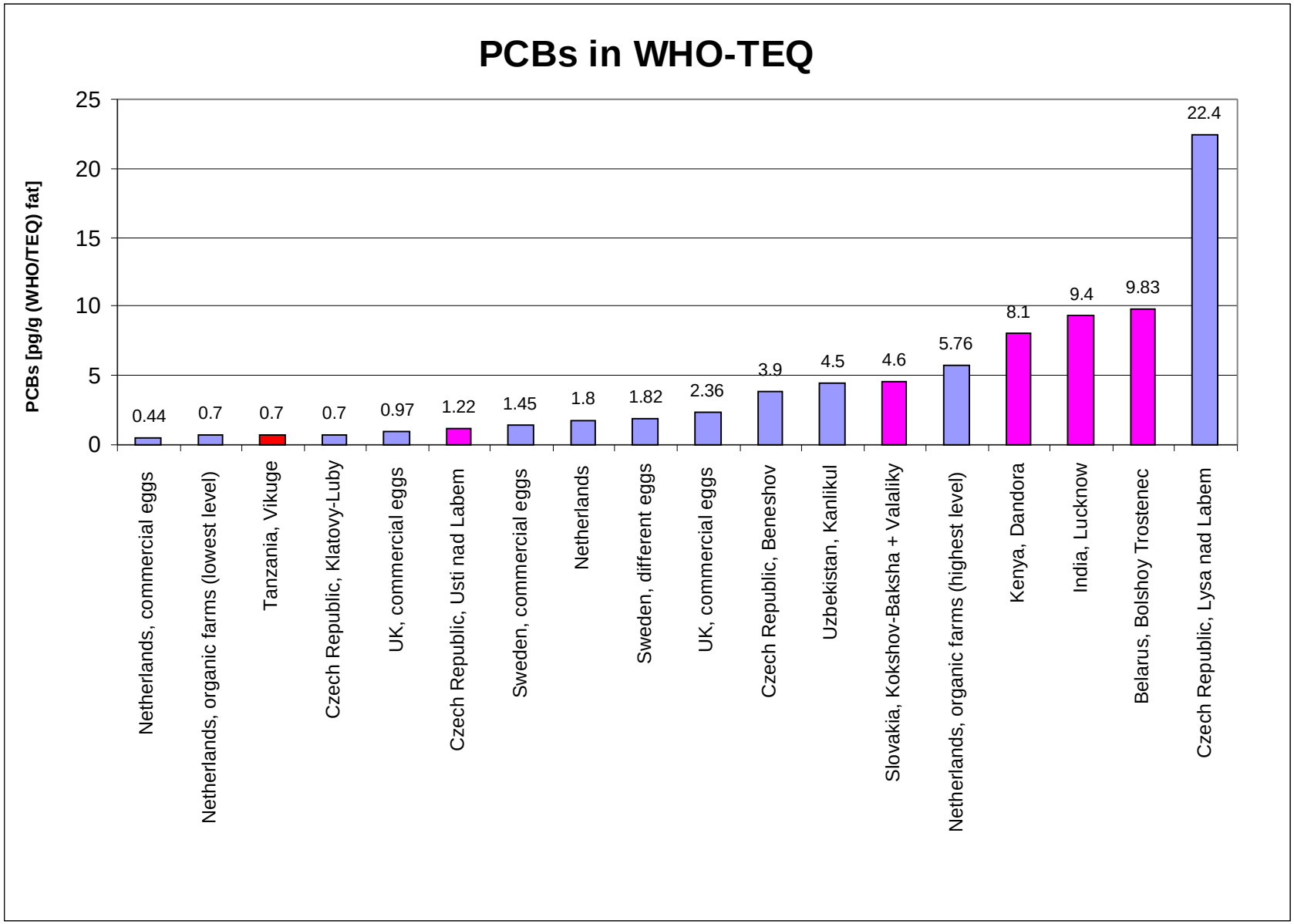
# Annex 3: Levels of dioxins (PCDD/Fs) in different pool samples from different parts of world

| 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 | Axys Varilab 2005 |
| Tanzania, Vikuge | 2005 | free range | 6/1 pooled | 3,03 | Axys Varilab 2005 |
| 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 |
| Belarus, Bolshoy Trostenec | 2005 | free range | 6/1 pooled | 3,91 | Axys Varilab 2005 |
| 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 | Axys Varilab 2005 |
| Germany, Rheinfelden (highest level from pool samples) | 1996 | free range | - | 14,9 | Malisch, R. et al. 1996 |
| India, Lucknow | 2005 | free range | 4/1 pooled | 19,8 | Axys Varilab 2005 |
| Kenya, Dandora | 2004 | free range | 6/1 pooled | 22,92 | Axys Varilab 2005 |
| 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
35
30
25
20
15
10
5
0
0.2
1.28
1.5
2.9
3.03
3.2
3.4
3.91
6.8
10.6
11.52
14.9
19.8
22.92
31
UK, Newcastle (background level)
Germany, Lower Saxony
UK, Newcastle (lowest level from pool samples)
Czech Republic, Usti nad Labem
Tanzania, Vikuge
Germany, Bavaria
Czech Republic, Klatovy
Belarus, Bolshoy Trostenec
Czech Republic, Lysa nad Labem
Germany, Rheinfelden (lowest level from pool samples)
Slovakia, Kokshov-Baksha and Valaliky
Germany, Rheinfelden (highest level from pool samples)
India, Lucknow
Kenya, Dandora
UK, Newcastle (highest level from pool samples)

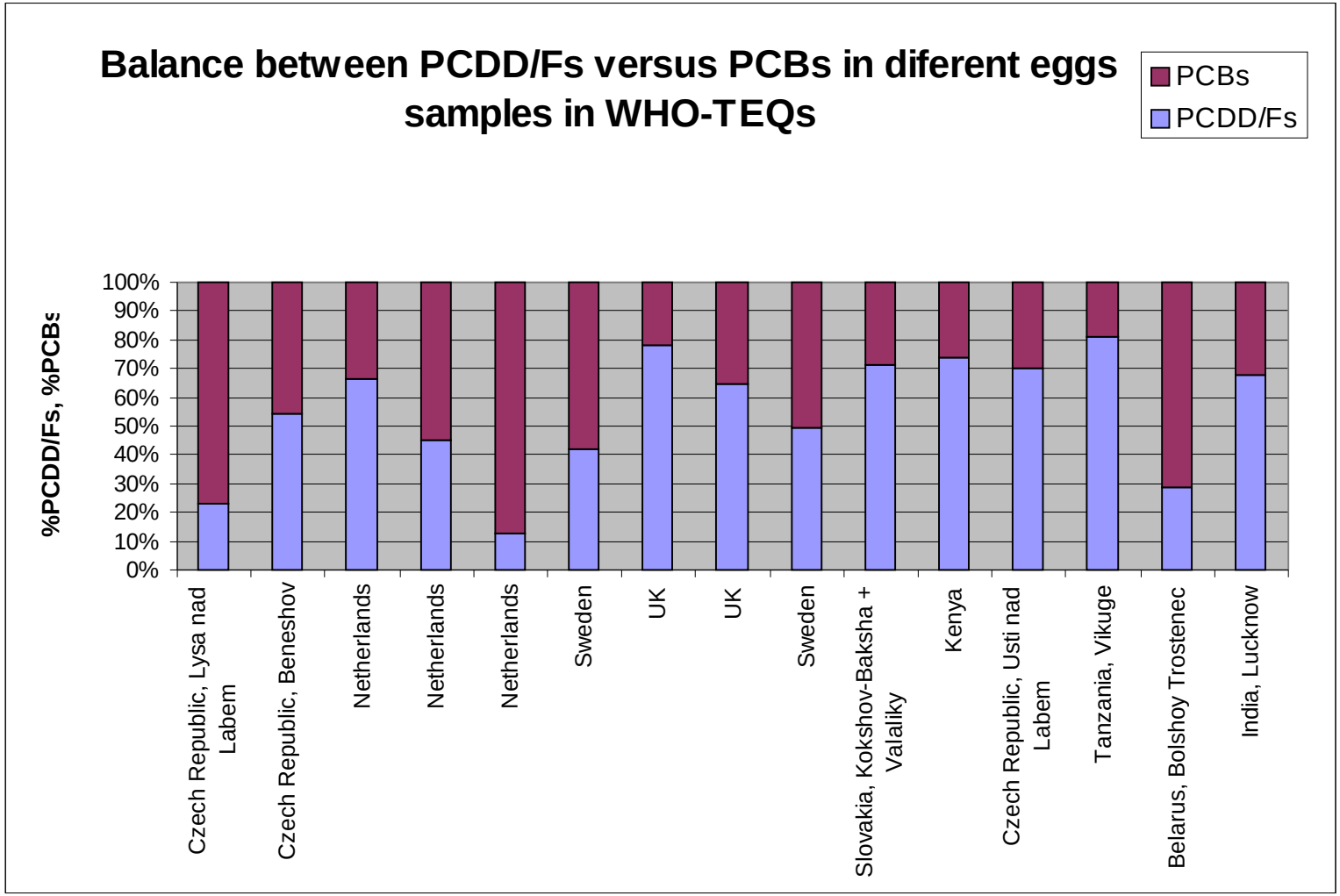
# Annex 4: Levels of PCBs in WHO-TEQ in different chicken eggs samples from different parts of world

| 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 |
| Netherlands, organic farms (lowest level) | 2002 | free range | 6 | pool | 0,70 | Traag, W. et al. 2002 |
| Tanzania, Vikuge | 2005 | free range | 6/1 pool | pool | 0,70 | |
| Czech Republic, Klatovy-Luby | 2003 | free range | free range | individual | 0,70 | 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 | 1,22 | |
| Sweden, commercial eggs | 1999 | not free range | 32/4 pools | pool | 1,45 | SCOOP Task 2000 |
| Netherlands | 1990 | mixed | 8/2 pools | pool, nonortho-PCBs | 1,80 | SCOOP Task 2000 |
| Sweden, different eggs | 1993 | mixed | 84/7 pools | pool | 1,82 | SCOOP Task 2000 |
| UK, commercial eggs | 1982 | not free range | 24/1 pool | pool | 2,36 | SCOOP Task 2000 |
| Czech Republic, Beneshov | 2004 | free range | 4 | pool | 3,90 | Axys Varilab 2004 |
| Uzbekistan, Kanlikul | 2001 | free range | - | individual | 4,50 | Muntean, N. et al. 2003 |
| Slovakia, Kokshov-Baksha + Valaliky | 2005 | free range | 6/1 pool | pool | 4,60 | |
| 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 | 8,10 | Axys Varilab 2005 |
| India, Lucknow | 2005 | free range | 4/1 pooled | pool | 9,40 | Axys Varilab 2005 |
| Belarus, Bolshoy Trostenec | 2005 | free range | 6/1 pool | pool | 9,83 | |
| Czech Republic, Lysa nad Labem | 2004 | free range | 4 | pool | 22,40 | Petrlik, J. 2005 |


PCBs in WHO-TEQ
PCBs [pg/g (WHO/TEQ) fat]
25
20
15
10
5
0
0.44
0.7
0.7
0.7
0.97
1.22
1.45
1.8
1.82
2.36
3.9
4.5
4.6
5.76
8.1
9.4
9.83
22.4
Netherlands, commercial eggs
Netherlands, organic farms (lowest level)
Tanzania, Vikuge
Czech Republic, Klatovy-Luby
UK, commercial eggs
Czech Republic, Usti nad Labem
Sweden, commercial eggs
Netherlands
Sweden, different eggs
UK, commercial eggs
Czech Republic, Beneshov
Uzbekistan, Kanlikul
Slovakia, Kokshov-Baksha + Valaliky
Netherlands, organic farms (highest level)
Kenya, Dandora
India, Lucknow
Belarus, Bolshoy Trostenec
Czech Republic, Lysa nad Labem

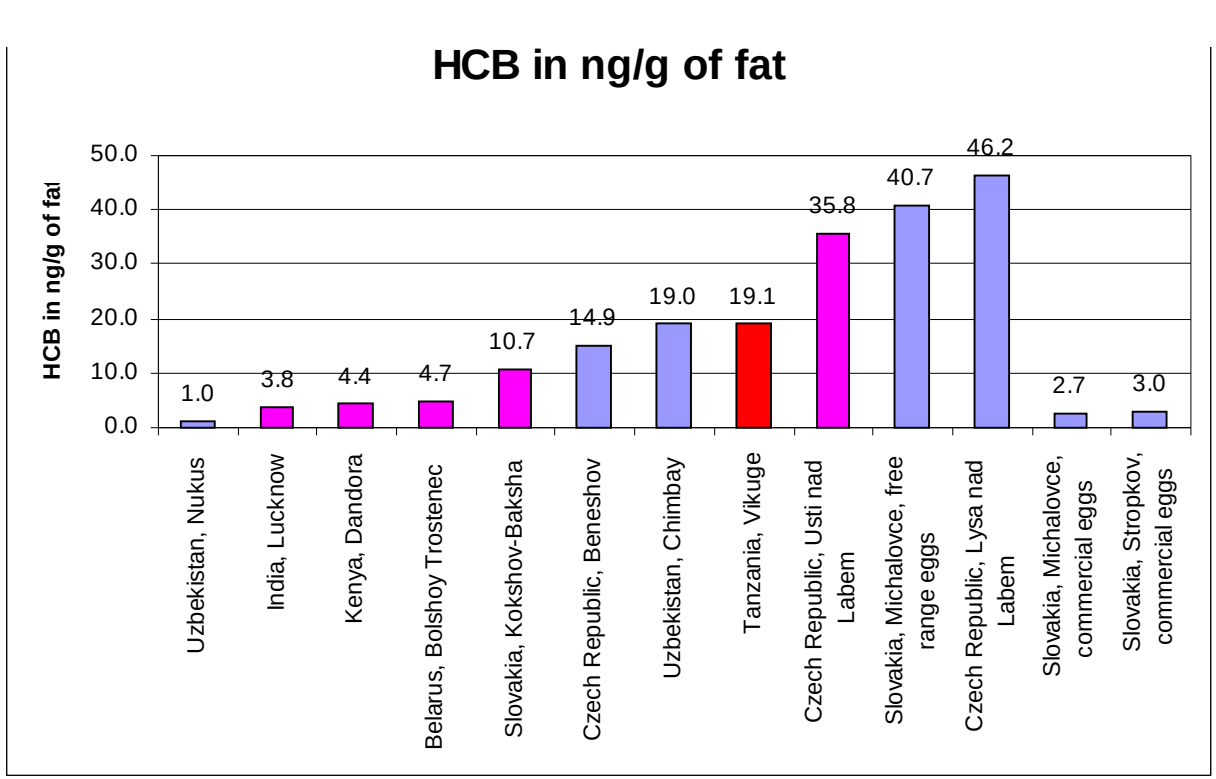
## Annex 5: Balance between PCDD/Fs versus PCBs in diferent eggs samples in WHO-TEQs

| 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 | Axys Varilab 2005 |
| Kenya, Dandora | 2004 | free range | 22,92 | 8,10 | 31,02 | Axys Varilab 2005 |
| Czech Republic, Usti nad Labem | 2005 | free range | 2,90 | 1,22 | 4,12 | Axys Varilab 2005 |
| Tanzania, Vikuge | 2005 | free range | 3,03 | 0,70 | 3,73 | Axys Varilab 2005 |
| Belarus, Bolshoy Trostenec | 2005 | free range | 3,91 | 9,83 | 13,74 | Axys Varilab 2005 |
| India, Lucknow | 2005 | free range | 19,8 | 9,40 | 29,20 | Axys Varilab 2005 |


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
Czech Republic, Usti nad Labem
Tanzania, Vikuge
Belarus, Bolshoy Trostenec
India, Lucknow

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

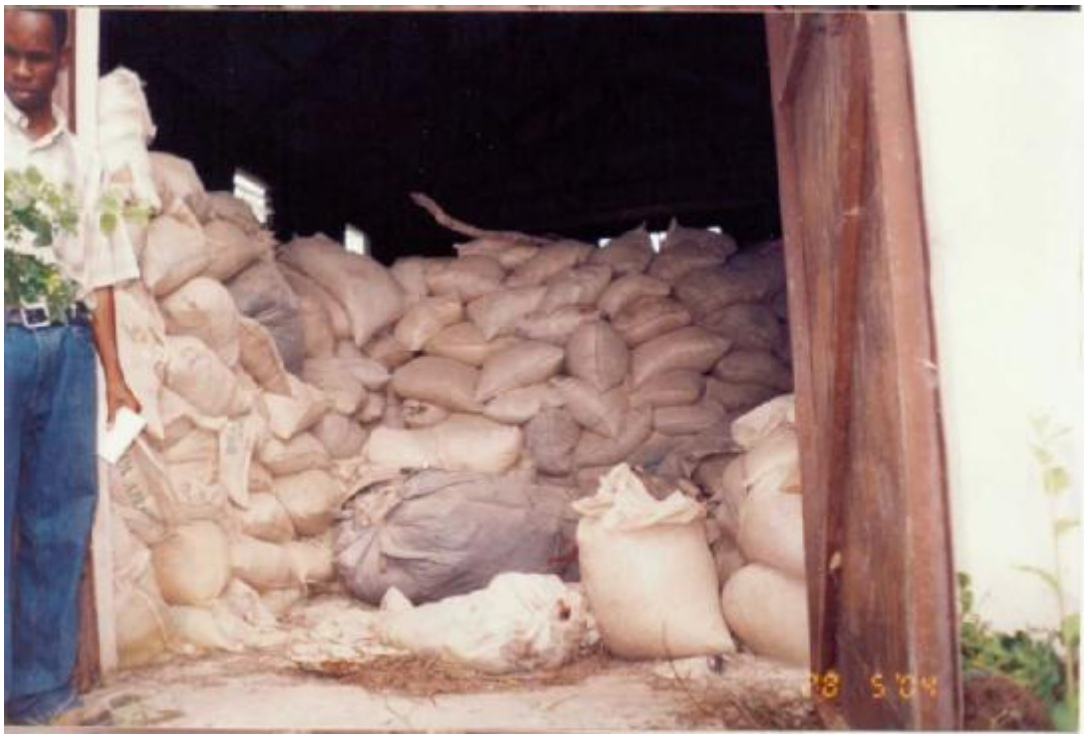
| Country | Date/year | Specification | Number of measured samples | Measured level in ng/g of fat | Source of information |
|---|---|---|---|---|---|
| Uzbekistan, Nukus | 2001 | free range | - | 1,0 | Muntean, N. et al. 2003 |
| India, Lucknow | 2005 | free range | 4/1 pooled | 3,8 | Axys Varilab 2005 |
| Kenya, Dandora | 2004 | free range | 6/1 pool | 4,4 | Axys Varilab 2005 |
| Belarus, Bolshoy Trostenec | 2005 | free range | 6/1 pool | 4,7 | Axys Varilab 2005 |
| Slovakia, Kokshov-Baksha | 2005 | free range | 6/1 pool | 10,7 | Axys Varilab 2005 |
| Czech Republic, Beneshov | 2004 | free range | 4/1 pool | 14,9 | Axys Varilab 2004 |
| Uzbekistan, Chimbay | 2001 | free range | - | 19,0 | Muntean, N. et al. 2003 |
| Tanzania, Vikuge | 2005 | free range | 6/1 pool | 19,1 | Axys Varilab 2005 |
| Czech Republic, Usti nad Labem | 2005 | free range | 6/1 pool | 35,8 | Axys Varilab 2005 |
| 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
50.0
40.0
30.0
20.0
10.0
0.0
1.0
3.8
4.4
4.7
10.7
14.9
19.0
19.1
35.8
40.7
46.2
2.7
3.0
Uzbekistan, Nukus
India, Lucknow
Kenya, Dandora
Belarus, Bolshoy Trostenec
Slovakia, Kokshov-Baksha
Czech Republic, Beneshov
Uzbekistan, Chimbay
Tanzania, Vikuge
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

**Picture 1:** Old storage site in Vikuge.

**Picture 2:** Stock of pesticides in new storage.



**Picture 3:** Closed well.

**Picture 4:** Closed well along side local well

# References

[1] AGENDA, IPEN 2004: Vikuge preliminary site report, Coast region, Tanzania. Final Report of the International POPs Elimination Project of AGENDA, August 2004.

[2] Hansen, E., Hansen, C. L. 2003: Substance Flow Analysis for Dioxin 2002. Environmental Project No. 811/2003, Miljoeprojekt. Danish Environmental Protection Agency.

[3] Costner, P. 2005: Inventorios Nacionales de Liberación de Dioxinas y Furanos. Implementación de la Convenio de Estocolmo sobre Compuestos Orgánicos Persistentes. Vienna, Austria, 8 February 2004.

[4] U.S. Environmental Protection Agency. 1998. The Inventory of Sources of Dioxin in the United States. EPA/600/P-98/002Aa, Washington, D.C., April 1998.

[5] Bretthauer, E., Kraus, H., di Domenico, A. 1991. Dioxin Perspectives: A Pilot Study on International Exchange on Dioxins and Related Compounds. New York: Plenum Press.

[6] Friends of the Earth, Arnika, IPEN Dioxin, PCBs and Waste WG 2005. Contamination of chicken eggs near the Koshice municipal waste incinerator in Slovakia by dioxins, PCBs, and hexaclorobenzene. Available at www.ipen.org 21 March 2005

[7] ENVILEAD, Arnika, IPEN Dioxin, PCBs and Waste WG 2005. Contamination of chicken eggs near the Dandora dumpsite in Kenya by dioxins, PCBs, and hexaclorobenzene. Available at www.ipen.org 24 March 2005.

[8] Arnika, IPEN Dioxin, PCBs and Waste WG 2005. Contamination of chicken eggs near the Spolchemie factory in Usti nad Labem in the Czech Republic by dioxins, PCBs, and hexaclorobenzene. Available at www.ipen.org 25 March 2005.

[9] Foundation for Realization of Ideas, Arnika, IPEN Dioxin, PCBs and Waste WG 2005. Contamination of chicken eggs near the Bolshoy Trostenec dumpsite in Belarus by dioxins, PCBs, and hexaclorobenzene. Available at www.ipen.org 29 March 2005.

[10] Toxics Link, Arnika, IPEN Dioxin, PCBs and Waste WG 2005. Contamination of chicken eggs near the the Queen Mary's Hospital, Lucknow medical waste incinerator in Uttar Pradesh (India) by dioxins, PCBs, and hexaclorobenzene. Available at www.ipen.org 30 March 2005.

[11] Beranek, M., Havel, M., Petrlik, J. 2003: Lindane - pesticide for the black list. Czech Ecological Society Report, Prague, Nov 2003.

[12] Pirard, C., Focant, J.-F., Massart, A.-C., De Pauw, E., 2004: Assessment of the impact of an old MSWI. Part 1: Level of PCDD/Fs and PCBs in surrounding soils and eggs. Organohalogen Compounds 66: 2085-2090.

[13] Pless-Mulloli, T., Edwards, R., Schilling, B., Paepke, O. 2001: Executive Summary. PCCD/PCDF and Heavy Metals in Soil and Egg Samples from Newcastle Allotments: Assessment of the role of ash from the Byker incinerator. (Includes comments from Food Standards Agency, Environment Agency). 12 February 2001. University of Newcastle.

[14] Arnika, IPEN Dioxin, PCBs and Waste WG 2005. Contamination of chicken eggs near the Spolchemie factory in Usti nad Labem in the Czech Republic by dioxins, PCBs, and hexaclorobenzene. Available at www.ipen.org 25 March 2005.

[15] US EPA 1998. The Inventory of Sources of Dioxin in the United States (Review Draft), US EPA Office of Research and Development (EPA/600/P-98-002a), 1998

## References for Tables in Annexes


Anonymus 2004: Analytical results eggs from both free range chickens and not free range chickens from Netherlands. Information provided by Netherlands to other EU member states. November 2004.

Axys Varilab CZ 2004: Protokoly č. 537/1-4 o stanovení PCDD/F, PCB vyjádřených ve WHO-TEQ, kongenerových PCB a HCB vydané zkušební laboratoří firmy Axys Vailab. Protocols No. 537/1-4. Vrane nad Vltavou, 2004.

Axys Varilab CZ 2005: Reports No. 618/1-10 on PCDD/Fs, PCBs and OCPs determinations of samples No. 4443-4450, 5769-5779, 5781-5787, 5783B, 5802 and 5808 issued in March 2005 in Vrané nad Vltavou.

Beranek, M., Havel, M., Petrlik, J. 2003: Lindane - pesticide for the black list. Czech Ecological Society Report, Prague, Nov 2003.

DG SANCO 2004: Analysis of the data contained in the report "Dioxins and PCBs in Food and Feed : Data available to DG SANCO - Joint Report DG SANCO/DG-JRC-IRMM in the ight of the proposed maximum levels in document SANCO/0072/2004.

Domingo, J.L., Schuhmacher, M., Granero, S., Llobet, J.M. 1999: PCDDs and PCDFs in food samples from Catalonia, Spain. An assessment of dietary intake. Chemosphere. 38(15):3517-3528. In US EPA 2000.

Fiedler, H.; Cooper, K.R.; Bergek, S.; Hjelt, M.; Rappe, C. (1997) Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/PCDF) in food samples collected in southern Mississippi, USA. Chemosphere. 34:1411-1419. In US EPA 2000.

Harnly, M. E., Petreas, M. X., Flattery, J., Goldman, L. R. 2000: Polychlorinated Dibenzo-p-dioxin and Polychlorinated Dibenzofuran Contamination in Soil and Home-Produced Chicken Eggs Near Pentachlorophenol Sources. Environ. Sci. Technol.2000, 34,1143-1149

Kočan, A., Jursa, S., Petrík, J., Drobná, B., Chovancová, J., Suchánek, P. 1999: Stav kontaminácie poživatín polychlórovanými bifenylmi v zaťaženej oblasti okresu Michalovce a porovnávacej oblasti okresu Stropkov. In: Cudzorodé látky v poživatinách, 10. - 12. máj 1999, Tatranská Štrba, pp. 31 - 32.

Malisch, R. 1998: Update of PCDD/PCDF-intake from food in Germany. Chemosphere. 37 (9 -12):1687-1698. In US EPA 2000.

Malisch, R., Schmid, P., Frommberger, R., Fuerst, P. 1996: Results of a Quality Control Study of Different Analytical Methods for Determination of PCDD/PCDF in Eggs Samples. Chemosphere Vol. 32, No. 1, pp. 31-44.

Muntean, N., Jermini, M., Small, I., Falzon, D., Peter Fuerst, P., Migliorati, G., Scortichini,G., Forti, A. F., Anklam, E., von Holst, C., Niyazmatov, B., Bahkridinov, S., Aertgeerts, R., Bertollini, R., Tirado, C., Kolb, A. 2003: Assessment of Dietary Exposure to Some Persistent Organic Pollutants in the Republic of Karakalpakstan of Uzbekistan. Vol. 111, No 10, August 2003, Environmental Health Perspectives, 1306-1311.

Petrlik, J. 2005: Hazardous waste incinerator in Lysa nad Labem and POPs waste stockpile in Milovice. International POPs Elimination Project (IPEP) Hot Spot Report. Arnika, Prague 2005.

Pirard, C., Focant, J.-F., Massart, A.-C., De Pauw, E., 2004: Assessment of the impact of an old MSWI. Part 1: Level of PCDD/Fs and PCBs in surrounding soils and eggs. Organohalogen Compounds 66: 2085-2090.

Pless-Mulloli, T., Edwards, R., Schilling, B., Paepke, O. 2001b: Executive Summary. PCCD/PCDF and Heavy Metals in Soil and Egg Samples from Newcastle Allotments: Assessment of the role of ash from the Byker incinerator. (Includes comments from Food Standards Agency, Environment Agency). 12 February 2001. University of Newcastle.

Pless-Mulloli, T., Air, V., Schilling, B., Paepke, O., Foster, K. 2003b: Follow-up Assessment of PCDD/F in Eggs from Newcastle Allotments. University of Newcastle, Ergo, Newcastle City Council, July 2003.

Pratt, I., Tlustos, Ch., Moylan, R., Neilan, R., White, S., Fernandes, A., Rose, M. 2004: Investigation into levels of dioxins, furans and PCBs in battery, free range, barn and organic eggs. Organohalogen Compounds – Volume 66 (2004) 1925-31.

Pussemier, L., Mohimont, L., Huyghebaert, A., Goeyens, L., 2004. Enhanced levels of dioxins in eggs from free range hens: a fast evaluation approach. Talenta 63: 1273-1276.

SAFO (Sustaining Animal Health and Food Safety in Organic Farming) 2004: Onderzoek naar dioxine in eieren van leghennen met vrije uitloop. SAFO, September 2004. Published at: http://www.agriholland.nl/nieuws/home.html. 12/10/2004.

SCOOP Task 2000: Assessment of dietary intake of dioxins and related PCBs by the population of EU Member States. Reports on tasks for scientific cooperation Report of experts participating in Task 3.2.5 (7 June 2000) and Annexes to Report SCOOP Task 3.2.5 (Dioxins). Final Report, 7 June, 2000. European Commission, Health & Consumer Protection Directorate-General, Brussels 2000.

SVA CR (State Veterinary Administration of the Czech Republic) 2004: Chart with results of regular monitoring in Middle Bohemian region. Document reached by Arnika upon request for information.

Traag, W., Portier, L., Bovee, T., van der Weg, G., Onstenk, C., Elghouch, N., Coors, R., v.d. Kraats, C., Hoogenboom, R. 2002: Residues of Dioxins and Coplanar PCBs in Eggs of Free Range Chickens. Organohalogen Compounds Vol. 57 (2002). 245-248.