JA! Justiça Ambiental,
Av. Mao-Tse-Tung 304
Maputo, Mozambique
E-mail: ja_ngo@yahoo.com
Tel:+258 491994 , Fax: + 258 490596

Prepared by Dioxin, PCBs and Waste Working Group of the International POPs Elimination Network (IPEN) Secretariat, JA! Justiça Ambiental (Mozambique) and Arnika Association (Czech Republic)

Contamination of chicken eggs from Matola, Mozambique by dioxins, PCBs and hexachlorobenzene

JA! Justiça Ambiental

Contamination of chicken eggs from Matola, Mozambique 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, JA! Justiça Ambiental (Mozambique) and Arnika Association (Czech Republic)

Maputo - Prague (April - 28 - 2005)

Executive Summary

Free-range chicken eggs collected near Maputo/Matola showed high levels of dioxins that exceeded European Union (EU) limit by 2/3 of its value (5.07 pg/g in eggs, 3.0 pg/g is limit). Level of PCBs in eggs was almost 2.5-times of proposed EU limit. Also level of total WHO-TEQ level by 2-fold (level measured in Mozambique was 9.45 pg/g and limit is 5.0 pg/g). To our knowledge, this study represents the first data about U-POPs in any food items from Mozambique.

Dioxin profile observed in eggs from Matola is very close to profiles associated with pesticides. This conclusion is also supported by fact that there were floods which washed out the obsolete pesticides storage. Also relatively high levels of PCBs were observed in eggs and there is facility repairing and refilling transformers within 10 km radius from sampling site.

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. Mozambique signed the Convention 23rd May 2001 and intends to ratify it. 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 Mozambician 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 governmental representatives of Mozambique 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 Mozambique is needed as even basic data about U-POPs releases are missing;

2) More publicly accessible data about U-POPs releases from industry complexes in developing countries and countries with economies under transition are needed to address these sources of U-POPs properly;

3) Stringent limits for U-POPs in waste as well as air emissions should be introduced into both national legislation and under international treaties;

4) No increase of burden this region by any new U-POPs sources as can be a waste burning in cement kiln;

5) Mozambique should ratify a Stockholm Convention and to prepare National Implementation Plan of this international treaty.

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. Mozambique signed the Convention 23rd May 2001 and intends to ratify it.

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 surroundings of the cement kiln and obsolete pesticides stockpile near Matola, Mozambique were selected as a sampling site since cement kilns as well as chlorinated pesticides are known to be significant sources of U-POPs.[1, 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 U-POPs in eggs in Mozambique.

Materials and Methods

Please see Annex 1.

Results and Discussion

U-POPs in eggs sampled near Matola, Mozambique

The results of the analysis of a pooled sample of 6 eggs collected within to 0.7 - 2.5 km distance from the cement kiln Santos and close to obsolete pesticides stockpile are summarized in Tables 1 and 2. Pooled sample fat content was measured at 12.5%.

Free-range chicken eggs collected near Matola (see maps at Pictures 1 and 3) showed high levels of dioxins that exceeded European Union (EU) limit by 2/3 of its value (5.08 pg/g in eggs, 3.0 pg/g is limit). Level of PCBs in eggs was almost 2.5-times of proposed EU limit. Also level of total WHO-TEQ level by 2-fold.

Finally, high levels of DDT were found in the samples with the measured sum equal to 238.10 ng/g of fat,[3] what is level reaching half of the EU limit for sum of DDT in eggs (500 ng/g of fat).[a]

Table 1: Measured levels of POPs in eggs collected in Matola, area Santos, Mozambique per gram of fat.

	Measured level	Limits	Action level
PCDD/Fs in WHO-TEQ (pg/g)	5.08	3.0[a]	2.0[b]
PCBs in WHO-TEQ (pg/g)	4.37	2.0[b]	1.5[b]
Total WHO-TEQ (pg/g)	9.45	5.0[b]	-
PCB (7 congeners) (ng/g)	39.17	200[c]	-
HCB (ng/g)	0.92	200[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.

Table 2 shows the level of dioxins in eggs expressed as fresh weight. The US Food and Drug Administration estimates a lifetime excess cancer risk of one in 10,000 for eggs contaminated at 1 pg/g ITEQ. The eggs collected in Matola (Mozambique) fulfilled this cancer risk level from 64%.[b]

Table 2: Measured levels of POPs in eggs collected in Matola, area Santos, Mozambique per gram of egg fresh weight.

	Measured level	Limits	Action level
PCDD/Fs in WHO-TEQ (pg/g)	0.64	1[a]	-
PCBs in WHO-TEQ (pg/g)	0.55	-	-
Total WHO-TEQ (pg/g)	1.18	-	-
PCBs (7 congeners) (ng/g)	4.90		
HCB (ng/g)	0.12	-	-

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.

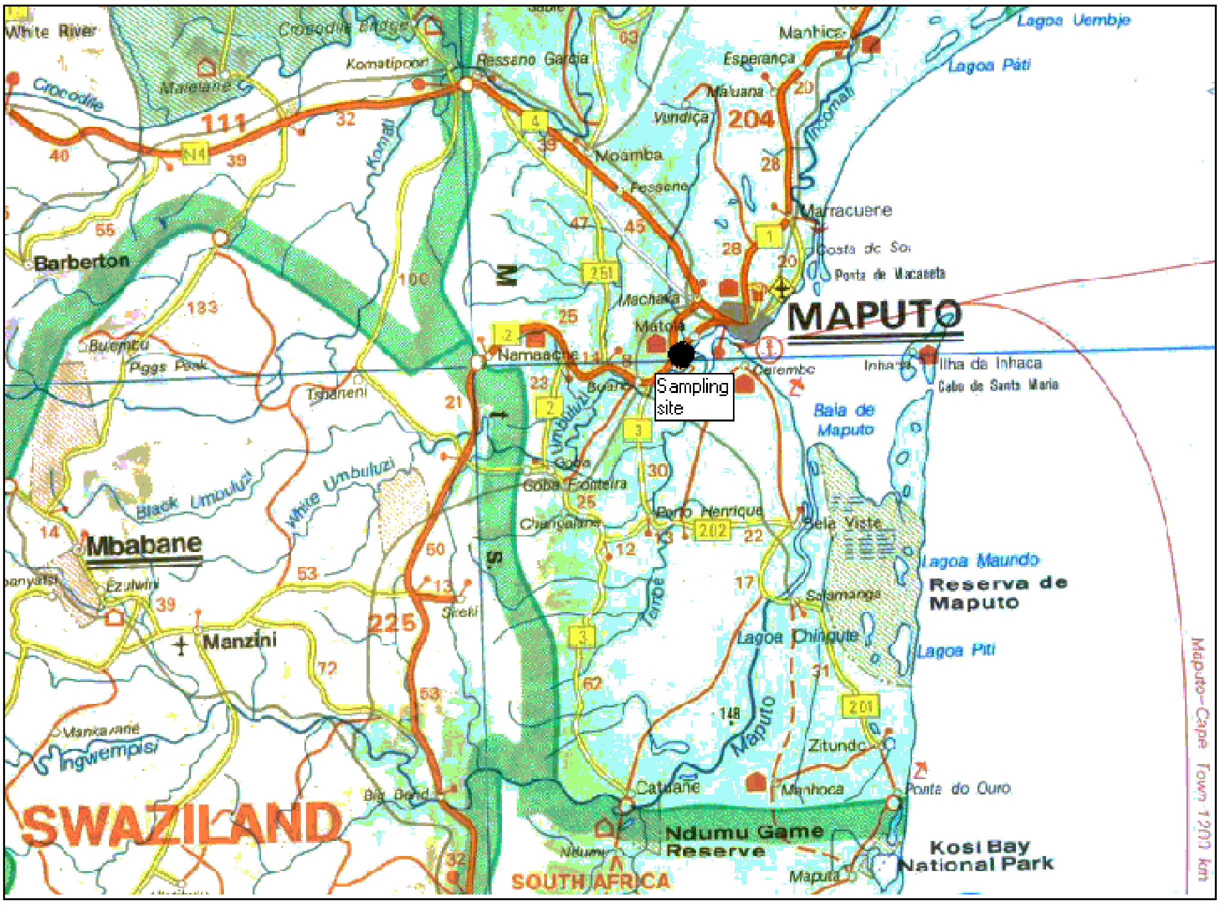
To our knowledge, the measurements of U-POPs in this study represent the first data on U-POPs in any food items ever reported in Mozambique. The levels of dioxins, and PCBs exceeding the EU limits observed in the egg samples support the need for further monitoring and source specific releases

[a] EU limit according to Council Directive 86/363/EEC.

[b] was estimated (using a cancer potency factor of 130 (mg/kg-day)-1 and rounding the risk to an order of magnitude) for consumption of 3-4 eggs per week (30 g egg/day) contaminated at 1 ppt I-TEQ.

monitoring in the Matola area. Also it suggests not to burden this region by any new U-POPs larger sources as can be a waste burning in cement kiln.

Picture 1: Map of south part of Mozambique with sampling site location near Matola.



Comparison with other studies of eggs

We compared the levels of PCDD/Fs measured in this study in eggs from Matola area Santos in Mozambique with data from other studies that also used pooled samples and/or expressed mean values of analyzed eggs (Please see Annexes 2 and 3.).

The data for eggs described in this report follow on the heels of a similar studies in Slovakia,[4] Kenya,[5] Czech Republic,[6] Belarus,[7] India (Uttar Pradesh),[8] Tanzania,[9] Senegal,[10] Mexico,[11] Turkey,[12] Bulgaria,[13] Uruguay,[14] Egypt,[15] India (Kerala),[16] Russia,[17] USA,[18] Philippines [19] and Pakistan [20] released since 21 March 2005.

Dioxins levels in the eggs sampled from Matola were comparable to those observed in Lysa nad Labem, Czech Republic (lower bound 5.00, upper bound 6.80 pg WHO-TEQ/g of fat), collected near a hazardous waste incinerator,[21] or in Mossville, USA (5.97 pg WHO-TEQ/g of fat), the site close to a PVC manufacturing plant.[22] Levels of dioxins in eggs from Matola, area Santos exceeded levels in eggs collected in a dump site neighborhood in Bolshoi Trostenec, Belarus (3.91 pg WHO-TEQ/g of fat) [23] and highly exceeded background levels in eggs measured in different studies within the range of 0.2 - 1.2 pg WHO-TEQ/g of fat. [24, 25, 26] For more comparisons with levels observed in eggs sampled during IPEN's global biomonitoring project look at graph in Annex 3. Dioxins plus dioxin-like PCBs content in this first sample of free range eggs from the Philippines was almost at the same level comparing to those that caused the recent scandal in Germany with measured total WHO-TEQ level of 9.55 pg/g of fat.[27]

The non-ortho and mono-ortho substituted PCB congeners value observed in eggs in this study is higher than levels observed in the pooled sample from Mbeubeuss, Senegal in the neighborhood of a waste dumpsite with mixed municipal and hazardous waste disposal, [28] and also higher than levels observed in the eggs from Minas, Uruguay in the surroundings of two cement kilns.[29]

Other studies showing high levels of dioxins include samples near an old waste incinerator in Maincy, France [30] and an area affected by a spread mixture of waste incineration residues in Newcastle, UK.[31] The mean dioxin values observed in these locations in pooled samples were even higher than the values observed in this study at 42.47 pg WHO-TEQ/g and 31 pg WHO-TEQ/g respectively.

It is clear that dioxins represent the major contaminant in the sampled eggs in Matola. PCDD/Fs contribute almost 55% of the whole TEQ value in eggs as visible from graph in Annex 5. Despite this substantial contribution of dioxins, the levels of PCBs including both dioxin-like PCBs as well as the 7 PCB congeners were quite high as shown in Annexes 4 and 6.

The graph in Annex 6 shows that level of 7 PCB congeners is the eighth highest observed among 22 samples analyzed during IPEN’s global biomonitoring project. It belongs to group of elevated levels observed in pooled samples from Minas in Uruguay, [32] Mbeubeuss in Senegal,[33] Coatzacoalcos in Mexico[34] and Dandora in Kenya,[35] but is lower than for example levels in free range chicken eggs from Lucknow in Uttar Pradesh, India.[36]

Possible U-POPs sources

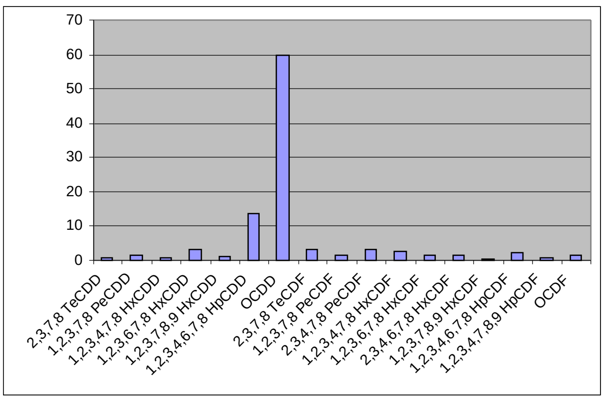
The high levels of dioxins and PCBs observed in this study provoke the question of possible sources.

All potential sources are listed in following chapter describing situation in larger surrounding of sampling site in Matola, area Santos. The six eggs were collected at three different sites, which are within a radius of 3km from a cement factory (Cimpor), and within a radius of 2.3km of Boror Warehouse, an obsolete pesticides storage, from 1998 to 2002 (sketch in the Picture 6). Other potential dioxins sources can be: aluminum production, waste incineration in pen factory, cleaning agents production, open burning of waste, and local heating using coal or wood as main energy resource.

Tracking the source of dioxins in eggs can be aided by comparing the pattern of congeners in the samples with those in the sources. Seventeen PCDD/Fs congeners patterns in eggs from Matola are shown in the graph in Pictures 2 and 3 and measured levels are shown in Table 3.

Unfortunately, dioxin air emissions measurements are not available for the comparison. However, congener patterns for these sources are available from other countries, for example Czech Republic. We used also other eggs collected during IPEN’s global biomonitoring project dioxin profiles for comparison.

Pictures 2 and 3: Seventeen PCDD/Fs congeners pattern in pooled eggs sample from Matola (in absolute measured levels at graph on left side and in WHO-TEQ levels at graph on right side).



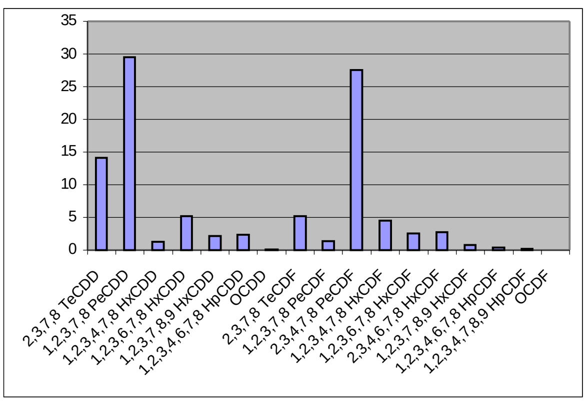
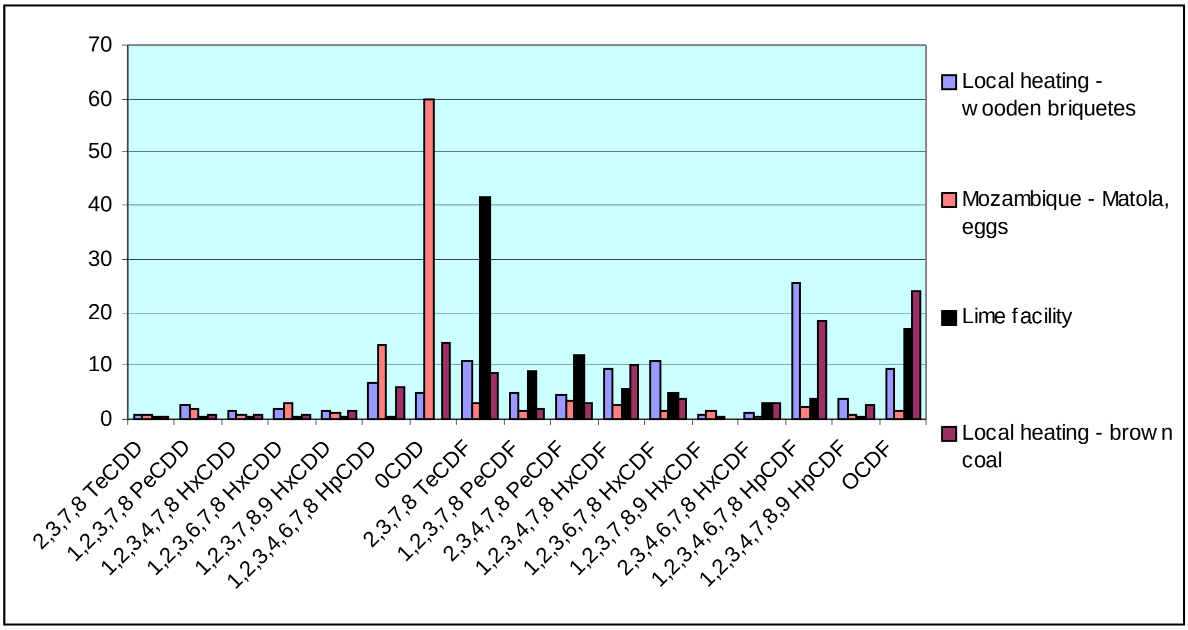


Table 3: Results of PCDD/Fs analysis in a pooled sample of 6 eggs collected in the neighborhood of the cement kiln and obsolete pesticides storage in Matola, area Santos, Mozambique.

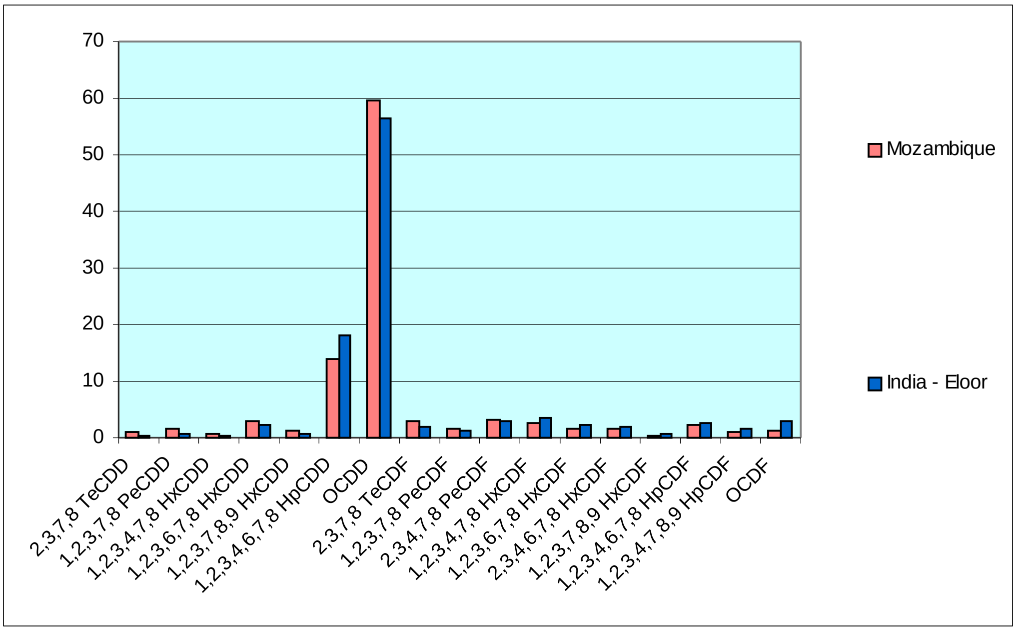
PCDD/Fs congeners	WHO-TEF	pg/g of fat	pg W-TEQ/g of fat
2,3,7,8 TeCDD	1	0.72	0.72
1,2,3,7,8 PeCDD	1	1.50	1.5
1,2,3,4,7,8 HxCDD	0.1	0.67	0.067
1,2,3,6,7,8 HxCDD	0.1	2.60	0.26
1,2,3,7,8,9 HxCDD	0.1	1.10	0.11
1,2,3,4,6,7,8 HpCDD	0.01	11.90	0.119
OCDD	0.0001	51.50	0.00515
2,3,7,8 TeCDF	0.1	2.60	0.26
1,2,3,7,8 PeCDF	0.05	1.40	0.07
2,3,4,7,8 PeCDF	0.5	2.80	1.4
1,2,3,4,7,8 HxCDF	0.1	2.30	0.23
1,2,3,6,7,8 HxCDF	0.1	1.30	0.13
2,3,4,6,7,8 HxCDF	0.1	1.40	0.14
1,2,3,7,8,9 HxCDF	0.1	0.39	0.039
1,2,3,4,6,7,8 HpCDF	0.01	2.00	0.02
1,2,3,4,7,8,9 HpCDF	0.01	0.71	0.0071
OCDF	0.0001	1.20	0.00012
Total WHO-TEQ			**5.08**

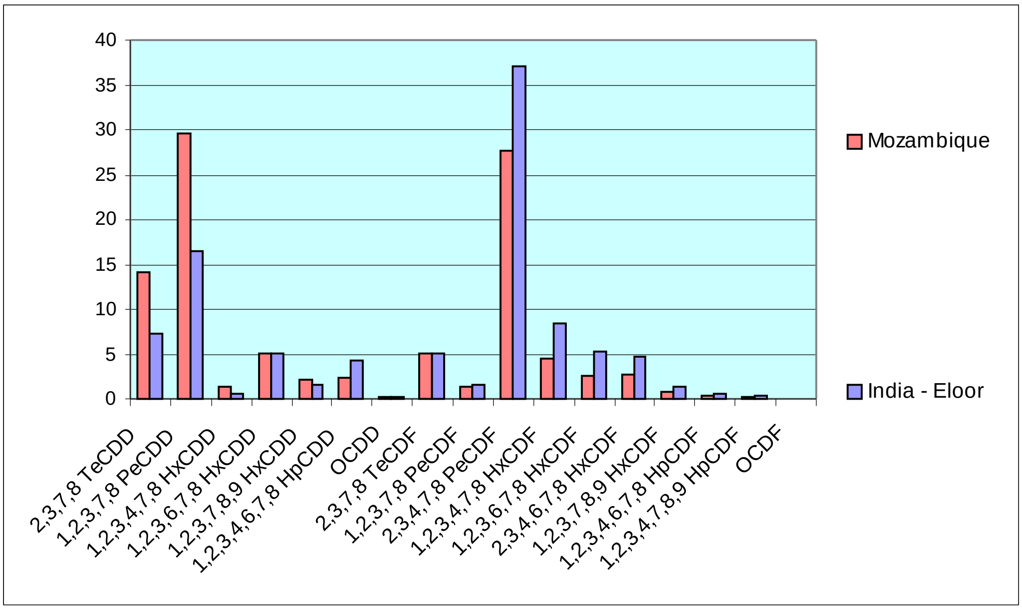
Dioxin congeners profiles (in absolute values) in eggs from Matola show high levels of OCDD and 1,2,3,4,6,7,8 HpCDDs. 2,3,7,8 TeCDD, 1,2,3,7,8 PeCDD and 2,3,4,7,8 PeCDF show highest values on total WHO-TEQ among all seventeen dioxin congeners.

Picture 4: Graph showing comparison between dioxin profiles in values of congeners on total absolute level between eggs sample from Matola and different kinds of combustion processes present in the area. We used data from research project No VaV/520/1/97 measured by Axys Varilab in 1997 used for dioxin profiles of combustion sources.



Picture 5: Graphs showing comparison between seventeen dioxin congener patterns in eggs from Matola, Mozambique and Eloor, Kerala, India. First graph compares seventeen dioxin congener value from total sum of PCDD/Fs, while second graph shows this comparison for values expressed in WHO-TEQ levels. Source: Axys Varilab 2005.[37]





Dioxin congeners pattern in pooled egg sample from Matola is dominated by PCDDs. This doesn't support hypothesis that source of dioxins in this sample is from family of combustion sources. Comparison with combustion sources patterns in graph in Picture 4 shows that this theory is almost right. Another potentially major source are dioxins as U-POPs accompanied pesticides from obsolete pesticides stockpile. Taking into account pattern for 4,5 D [38] and also comparison with free range eggs sample from surrounding of organochlorine manufacturing plant in Eloor, India [39] (Picture 5) it seems, that pesticides are most likely the source of dioxin contamination observed in free range eggs from Matola. 2,3,7,8 TeCDD and 1,2,3,7,8 PeCDD dominated dioxin profile if expressed in WHO-TEQ was observed also in eggs sampled in the area of obsolete pesticides stockpile in Klatovy-Luby, Czech Republic.[40]

We have to consider also PCBs contamination, which is actual to this locality shown in high levels of PCBs in general. PCBs are accompanied by dioxins contamination as well. PCDFs have majority in dioxine profiles, what is not case of the eggs from Matola.

Dioxin profile observed in eggs from Matola is very close to profiles associated with pesticides. This conclusion is also supported by fact that there were floods which washed out the obsolete pesticides storage. Relatively high levels of PCBs can be in relation to facility working with transformers and/or any source that potentially burns PCBs.

More information about industrial and other potential POPs sources in surrounding of the Matola and Santos

Cement kiln Cimentos de Moçambique – Cimpor, owned by a Portuguese and Mozambican joint venture company, can be one of potential sources of U-POPs in the environment of Matola surroundings. There is no prove that the cement kiln burns PCB´s and/or other wastes. There is also a plant for the maintenance, repairing and filling transformers – Tecnel – ABB, within a radius of 10 km that might be a source of PCBs contamination in the area, but we had no data about any measurements.

Within the 20km radius there are several industries, some heavy as Mozal - Aluminum smelter and Mabor – Tire factory, others in a smaller scale, such as skin leather processing industry, paint factory, Bic – pen factory which incinerates most of their rejects, Uniliver – producing cleaning products.

It should be noted that this is a highly populated area in which open burning of waste is a common practice. Another thing that must be kept in mind is the fact that 90% of the community of Mozambique, even those living within towns use coal or wood as main energy resource for their day-to-day energy needs.

Table 4: List of pesticides stored at Boror. Source: EIA document.[41]

The pesticides stored at Boror:	
FAO/WHO Class 1 pesticides, 42 tonnes of	**Internationally banned, 54 tonnes of:**
Aluminum Phosphine	Methoxyethyl mercury chloride
Azinphos Methyl	Aldrin
Brodifacoun	Camphechlor
Captafol	DDT
Carbofuran	Endrin
Cholorfenvinphos	Ethidimuron
Coumatetralyl	Lindan
Demeton-S-Methyl	Monocrotofos
Dichlorvos	Nitralin
Difenacoum	
Fenamiphos	**Also other pesticides:**
Flocoumafen	Atrazine
Furathiocarb	Endosulfan
Hydrogen Cyanide	Paraquat
Isofenphos	and some others.
Methyl Bromide	
Monocrotophos	
Patathion	

From 1998 until the beginning of 2002, during the Danida Mozambican obsoletes pesticides removal project, the pesticides were stored at the Boror warehouse. There was serious flood that submerse the whole storage place in the year 2000 (see also photos in Annex 7).

Close to sampling spot 3 is also waste dump site.

U-POPs and the Stockholm Convention

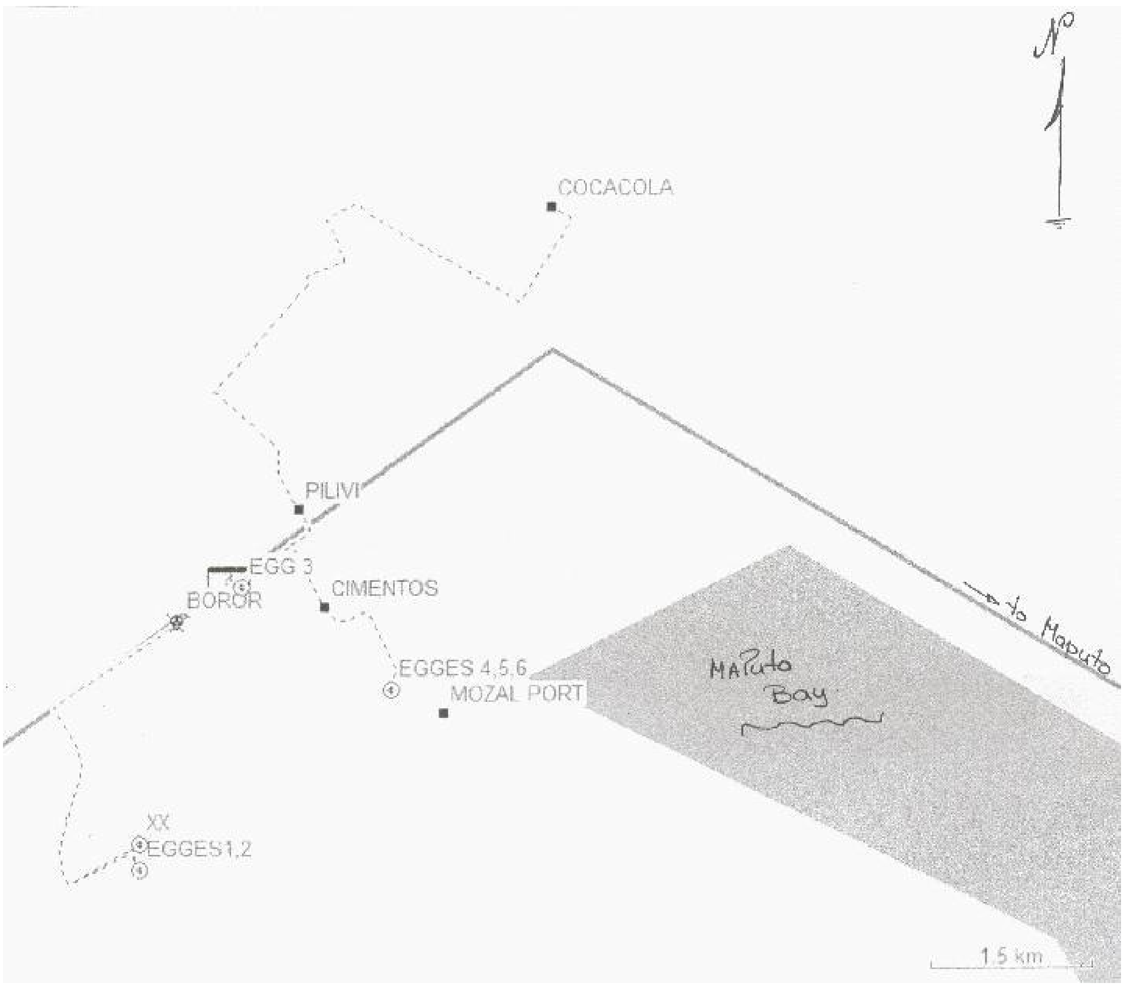
The U-POPs measured in this study are slated for reduction and elimination by the Stockholm Convention which holds its first Conference of the Parties in May 2005. Mozambique signed the Convention 23rd May 2001 and intends to ratify it.

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.[c] 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).[d] In addition, Parties are to promote both BAT and best environmental practices (BEP) for all new and existing significant source categories,[e] 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.[f] 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 Mozambician 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 governmental representatives of Mozambique and all stakeholders to honor the integrity of the Convention text and keep the promise of reduction and elimination of POPs.

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

Picture 6: Sketch of Matola surroundings with marked sampling sites (as



Annex 1. Materials and Methods

Sampling

For sampling in Mozambique we have chosen surroundings of Matola near the cement kiln and obsolete pesticides stockpile (see sketch in Picture 6).

Eggs were sampled from 3 chicken fanciers. 6 eggs total were sampled from 3 different spots in the surroundings of Matola. The hens from which the eggs were picked were all free-range although occasionally fed by different feeding stuffs. The hens can easily access soil organisms in all three breedings. Chicken's walks scale is 100 m^2, in case of one site (marked by 3 in sketch in Picture 6) it is not limited and next to waste dump site.

The village is located 2 km from the thermal power plant “Maritsa-East 2“ and 8 km from the thermal power plant “Maritsa-East 3”, and is just next to an open coal mine.

Sampling was done by two activists from NGO “JA! Justiça Ambiental” at 27 January 2005. The eggs were kept in cool conditions after sampling and then were boiled in Maputo by “JA! Justiça Ambiental” for 7 - 10 minutes in pure water and transported by express mail service to the laboratory at ambient temperature.

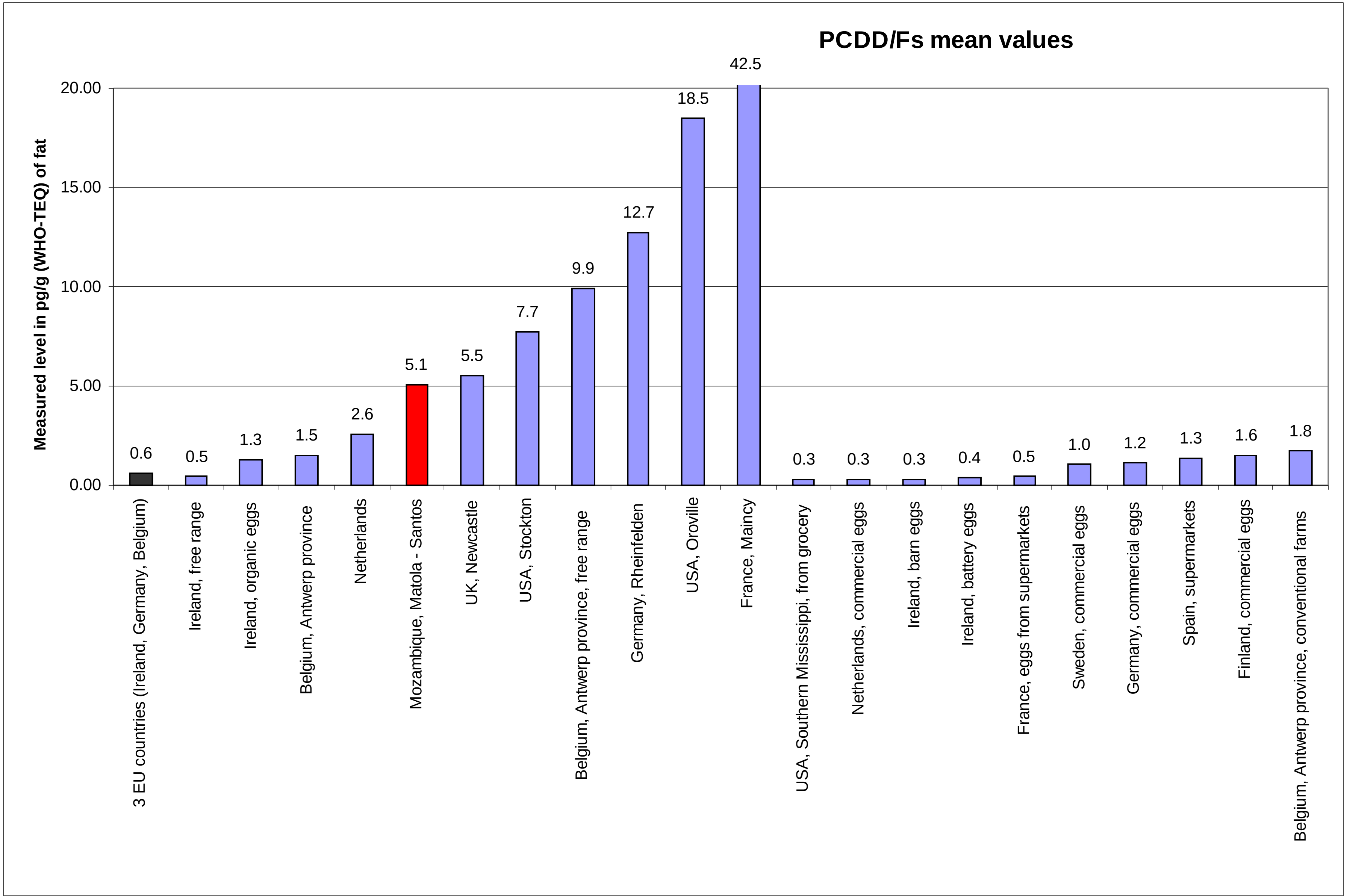
Analysis

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

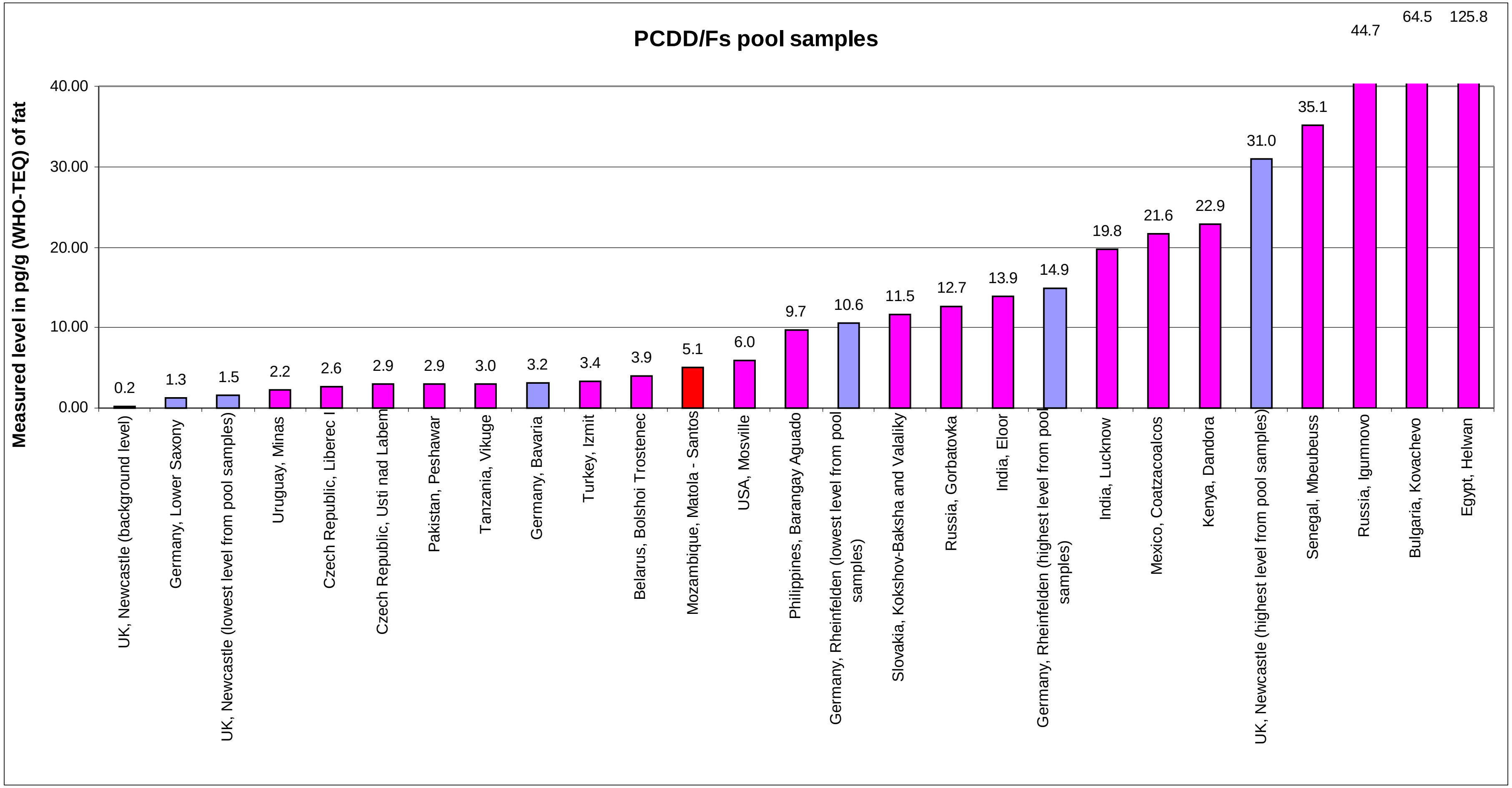
Country/locality	Year	Group	Measured level in pg/g (WHO-TEQ) of fat	Source of information
3 EU countries (Ireland, Germany, Belgium)	1997-2003	both	0.63	DG SANCO 2004
Ireland, free range	2002-2004	free range	0.47	Pratt, I. et al. 2004, FSAI 2004
Ireland, organic eggs	2002-2004	free range	1.30	Pratt, 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
Mozambique, Matola - Santos	2005	free range	5.08	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	2002-2004	not free range	0.31	Pratt, I. et al. 2004, FSAI 2004
Ireland, battery eggs	2002-2004	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
20.00
15.00
10.00
5.00
0.00
0.6
0.5
1.3
1.5
2.6
5.1
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
Mozambique, Matola - Santos
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

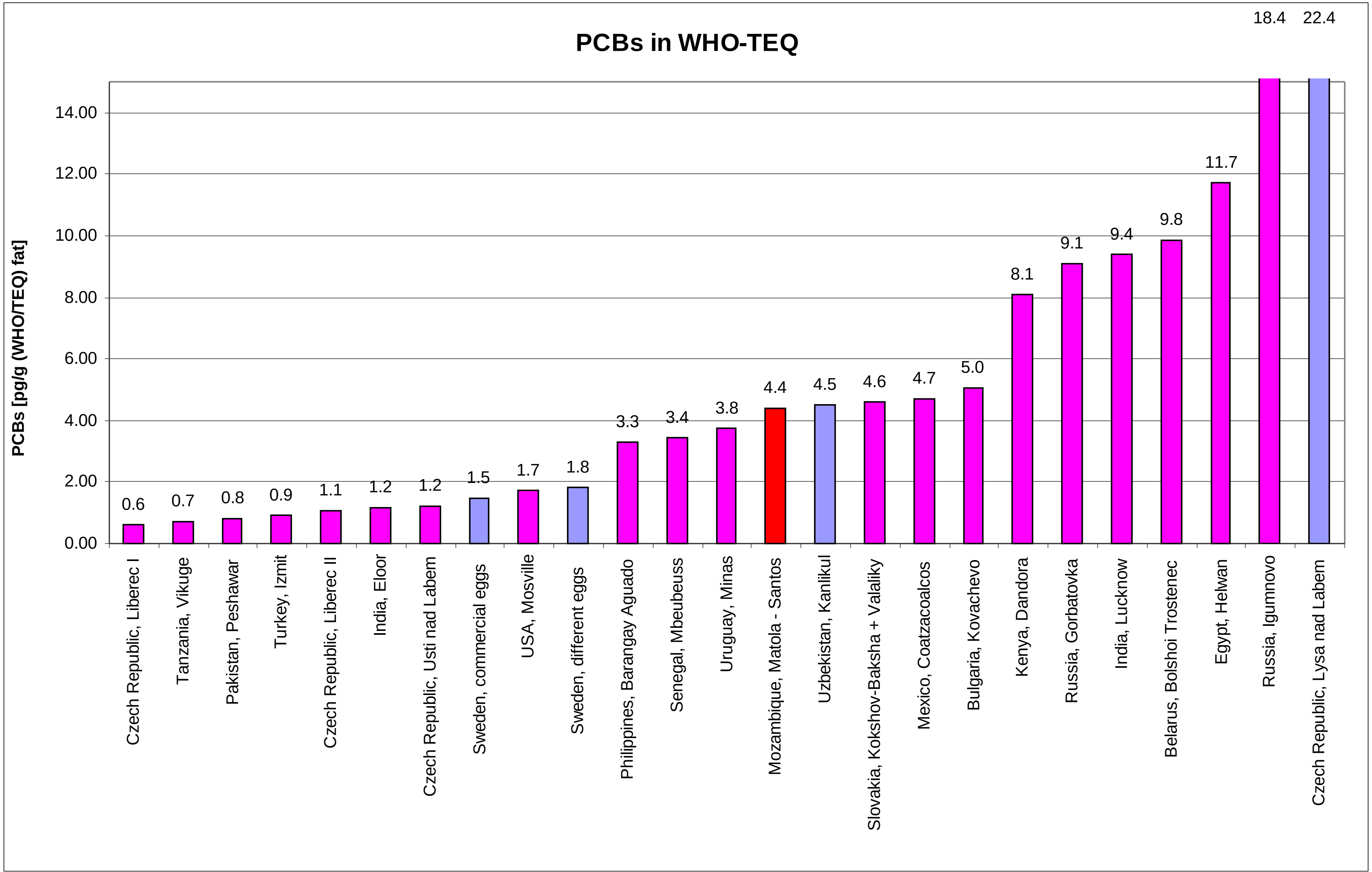
Annex 3: Levels of dioxins (PCDD/Fs) in different pool samples from different parts of world

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 pool	0.20	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 pool	1.50	Pless-Mulloli, T. et al. 2001
Uruguay, Minas	2005	free range	8/1 pool	2.18	Axys Varilab 2005
Czech Republic, Liberec I	2005	free range	3/1 pool	2.61	Axys Varilab 2005
Czech Republic, Usti nad Labem	2005	free range	6/1 pool	2.90	Axys Varilab 2005
Pakistan, Peshawar	2005	free range	3/1 pool	2.91	Axys Varilab 2005
Tanzania, Vikuge	2005	free range	6/1 pool	3.03	Axys Varilab 2005
Germany, Bavaria	1992	free range	370/37 pools	3.20	SCOOP Task 2000
Turkey, Izmit	2005	free range	6/1 pool	3.37	Axys Varilab 2005
Belarus, Bolshoi Trostenec	2005	free range	6/1 pool	3.91	Axys Varilab 2005
Mozambique, Matola - Santos	2005	free range	6/1 pool	5.08	Axys Varilab 2005
USA, Mosville	2005	free range	6/1 pool	5.97	Axys Varilab 2005
Philippines, Barangay Aguado	2005	free range	6/1 pool	9.68	Axys Varilab 2005
Germany, Rheinfelden (lowest level from pool samples)	1996	free range	-	10.60	Malisch, R. et al. 1996
Slovakia, Kokshov-Baksha and Valaliky	2005	free range	6/1 pool	11.52	Axys Varilab 2005
Russia, Gorbatovka	2005	free range	4/1 pool	12.68	Axys Varilab 2005
India, Eloor	2005	free range	6/1 pool	13.91	Axys Varilab 2005
Germany, Rheinfelden (highest level from pool samples)	1996	free range	-	14.90	Malisch, R. et al. 1996
India, Lucknow	2005	free range	4/1 pool	19.80	Axys Varilab 2005
Mexico, Coatzacoalcos	2005	free range	6/1 pool	21.63	Axys Varilab 2005
Kenya, Dandora	2004	free range	6/1 pool	22.92	Axys Varilab 2005
UK, Newcastle (highest level from pool samples)	2000	free range	3/1 pool	31.00	Pless-Mulloli, T. et al. 2001
Senegal, Mbeubeuss	2005	free range	6/1 pool	35.10	Axys Varilab 2005
Russia, Igumnovo	2005	free range	4/1 pool	44.69	Axys Varilab 2005
Bulgaria, Kovachevo	2005	free range	6/1 pool	64.54	Axys Varilab 2005
Egypt, Helwan	2005	free range	6/1 pool	125.78	Axys Varilab 2005


PCDD/Fs pool samples
Measured level in pg/g (WHO-TEQ) of fat
40.00
30.00
20.00
10.00
0.00
0.2
1.3
1.5
2.2
2.6
2.9
2.9
3.0
3.2
3.4
3.9
5.1
6.0
9.7
10.6
11.5
12.7
13.9
14.9
19.8
21.6
22.9
31.0
35.1
44.7
64.5
125.8
UK, Newcastle (background level)
Germany, Lower Saxony
UK, Newcastle (lowest level from pool samples)
Uruguay, Minas
Czech Republic, Liberec I
Czech Republic, Usti nad Labem
Pakistan, Peshawar
Tanzania, Vikuge
Germany, Bavaria
Turkey, Izmit
Belarus, Bolshoi Trostenec
Mozambique, Matola - Santos
USA, Mosville
Philippines, Barangay Aguado
Germany, Rheinfelden (lowest level from pool samples)
Slovakia, Kokshov-Baksha and Valaliky
Russia, Gorbatovka
India, Eloor
Germany, Rheinfelden (highest level from pool samples)
India, Lucknow
Mexico, Coatzacoalcos
Kenya, Dandora
UK, Newcastle (highest level from pool samples)
Senegal, Mbeubeuss
Russia, Igumnovo
Bulgaria, Kovachevo
Egypt, Helwan

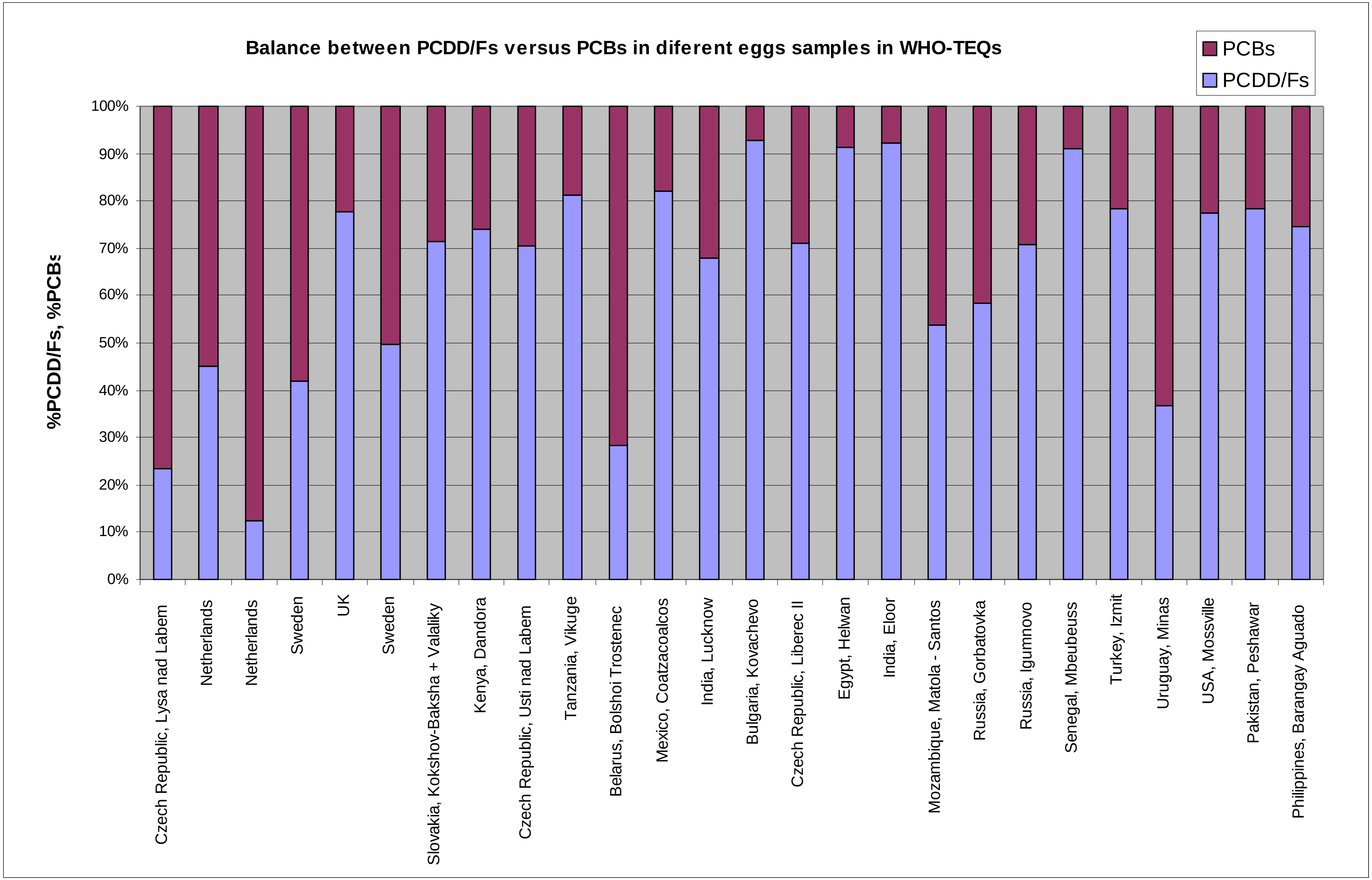
Annex 4: Levels of PCBs in WHO-TEQ in different chicken eggs samples from different parts of world

Country/locality	Year	Group	Number of measured samples	Measured level in pg/g (WHO-TEQ) of fat	Source of information
Czech Republic, Liberec I	2005	free range	3/1 pool	0.60	Axys Varilab 2005
Tanzania, Vikuge	2005	free range	6/1 pool	0.70	Axys Varilab 2005
Pakistan, Peshawar	2005	free range	3/1 pool	0.80	Axys Varilab 2005
Turkey, Izmit	2005	free range	6/1 pool	0.93	Axys Varilab 2005
Czech Republic, Liberec II	2005	free range	3/1 pool	1.07	Axys Varilab 2005
India, Eloor	2005	free range	6/1 pool	1.17	Axys Varilab 2005
Czech Republic, Usti nad Labem	2005	free range	6/1 pool	1.22	Axys Varilab 2005
Sweden, commercial eggs	1999	not free range	32/4 pools	1.45	SCOOP Task 2000
USA, Mosville	2005	free range	6/1 pool	1.74	Axys Varilab 2005
Sweden, different eggs	1993	mixed	84/7 pools	1.82	SCOOP Task 2000
Philippines, Barangay Aguado	2005	free range	6/1 pool	3.30	Axys Varilab 2005
Senegal, Mbeubeuss	2005	free range	6/1 pool	3.44	Axys Varilab 2005
Uruguay, Minas	2005	free range	8/1 pool	3.75	Axys Varilab 2005
Mozambique, Matola - Santos	2005	free range	6/1 pool	4.37	Axys Varilab 2005
Uzbekistan, Kanlikul	2001	free range	1	4.48	Muntean, N. et al. 2003
Slovakia, Kokshov-Baksha + Valaliky	2005	free range	6/1 pool	4.60	Axys Varilab 2005
Mexico, Coatzacoalcos	2005	free range	6/1 pool	4.69	Axys Varilab 2005
Bulgaria, Kovachevo	2005	free range	6/1 pool	5.03	Axys Varilab 2005
Kenya, Dandora	2004	free range	6/1 pool	8.10	Axys Varilab 2005
Russia, Gorbatovka	2005	free range	4/1 pool	9.08	Axys Varilab 2005
India, Lucknow	2005	free range	4/1 pool	9.40	Axys Varilab 2005
Belarus, Bolshoi Trostenec	2005	free range	6/1 pool	9.83	Axys Varilab 2005
Egypt, Helwan	2005	free range	6/1 pool	11.74	Axys Varilab 2005
Russia, Igumnovo	2005	free range	4/1 pool	18.37	Axys Varilab 2005
Czech Republic, Lysa nad Labem	2004	free range	4	22.40	Petrlik, J. 2005


PCBs in WHO-TEQ
PCBs [pg/g (WHO/TEQ) fat]
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
0.6
0.7
0.8
0.9
1.1
1.2
1.2
1.5
1.7
1.8
3.3
3.4
3.8
4.4
4.5
4.6
4.7
5.0
8.1
9.1
9.4
9.8
11.7
18.4
22.4
Czech Republic, Liberec I
Tanzania, Vikuge
Pakistan, Peshawar
Turkey, Izmit
Czech Republic, Liberec II
India, Eloor
Czech Republic, Usti nad Labem
Sweden, commercial eggs
USA, Mosville
Sweden, different eggs
Philippines, Barangay Aguado
Senegal, Mbeubeuss
Uruguay, Minas
Mozambique, Matola - Santos
Uzbekistan, Kanlikul
Slovakia, Kokshov-Baksha + Valaliky
Mexico, Coatzacoalcos
Bulgaria, Kovachevo
Kenya, Dandora
Russia, Gorbatovka
India, Lucknow
Belarus, Bolshoi Trostenec
Egypt, Helwan
Russia, Igumnovo
Czech Republic, Lysa nad Labem

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

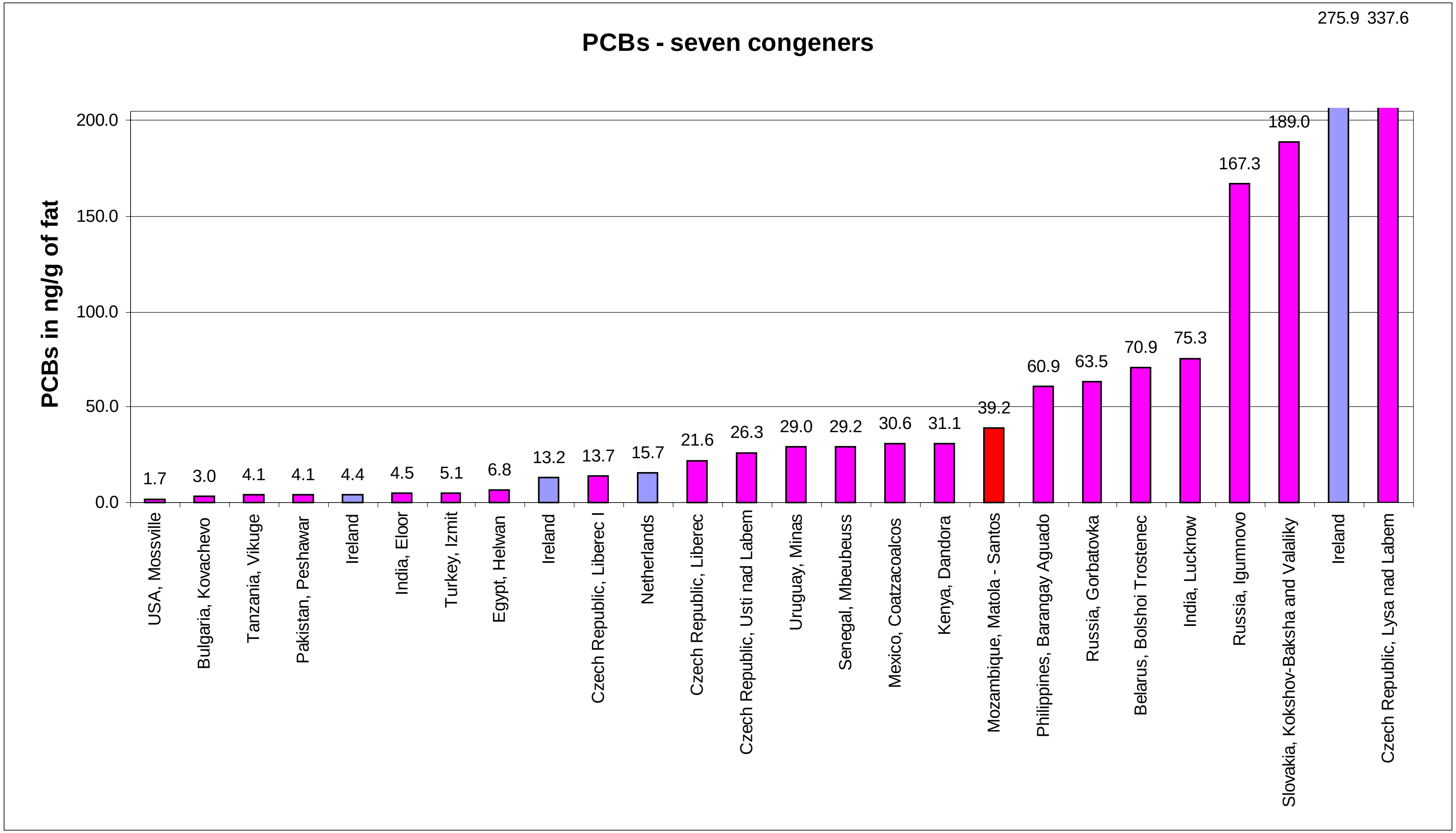
Country/locality	Year	Group	PCDD/Fs	PCBs	Total WHO-TEQ	Source of information
Czech Republic, Lysa nad Labem	2004	free range	6.80	22.40	29.20	Petrlik, J. 2005
Netherlands	2002	free range	4.74	5.76	10.50	Traag, W. et al. 2002
Netherlands	2002	free range	0.70	4.89	5.59	Traag, W. et al. 2002
Sweden	1993	mixed	1.31	1.82	3.13	SCOOP Task 2000
UK	1982	not free range	8.25	2.36	10.61	SCOOP Task 2000
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	8.1	31.02	Axys Varilab 2005
Czech Republic, Usti nad Labem	2005	free range	2.9	1.22	4.12	Axys Varilab 2005
Tanzania, Vikuge	2005	free range	3.03	0.7	3.73	Axys Varilab 2005
Belarus, Bolshoi Trostenec	2005	free range	3.91	9.83	13.74	Axys Varilab 2005
Mexico, Coatzacoalcos	2005	free range	21.63	4.69	26.32	Axys Varilab 2005
India, Lucknow	2005	free range	19.8	9.4	29.2	Axys Varilab 2005
Bulgaria, Kovachevo	2005	free range	64.54	5.03	69.57	Axys Varilab 2005
Czech Republic, Liberec II	2005	free range	2.63	1.07	3.7	Axys Varilab 2005
Egypt, Helwan	2005	free range	125.78	11.74	137.52	Axys Varilab 2005
India, Eloor	2005	free range	13.91	1.17	15.08	Axys Varilab 2005
Mozambique, Matola - Santos	2005	free range	5.08	4.37	9.45	Axys Varilab 2005
Russia, Gorbatovka	2005	free range	12.68	9.08	21.76	Axys Varilab 2005
Russia, Igumnovo	2005	free range	44.69	18.37	63.06	Axys Varilab 2005
Senegal, Mbeubeuss	2005	free range	35.1	3.44	38.54	Axys Varilab 2005
Turkey, Izmit	2005	free range	3.37	0.93	4.3	Axys Varilab 2005
Uruguay, Minas	2005	free range	2.18	3.75	5.93	Axys Varilab 2005
USA, Mossville	2005	free range	5.97	1.74	7.71	Axys Varilab 2005
Pakistan, Peshawar	2005	free range	2.91	0.80	3.71	Axys Varilab 2005
Philippines, Barangay Aguado	2005	free range	9.68	3.30	12.98	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
Netherlands
Netherlands
Sweden
UK
Sweden
Slovakia, Kokshov-Baksha + Valaliky
Kenya, Dandora
Czech Republic, Usti nad Labem
Tanzania, Vikuge
Belarus, Bolshoi Trostenec
Mexico, Coatzacoalcos
India, Lucknow
Bulgaria, Kovachevo
Czech Republic, Liberec II
Egypt, Helwan
India, Eloor
Mozambique, Matola - Santos
Russia, Gorbatovka
Russia, Igumnovo
Senegal, Mbeubeuss
Turkey, Izmit
Uruguay, Minas
USA, Mossville
Pakistan, Peshawar
Philippines, Barangay Aguado

Annex 6: Levels of seven PCBs congeners in different chicken eggs samples from different parts of world

Country	Year	Group	Measured level in ng/g fat	Source of information
USA, Mossville	2005	FR	1.7	Axys Varilab 2005
Bulgaria, Kovachevo	2005	FR	3.0	Axys Varilab 2005
Tanzania, Vikuge	2005	FR	4.1	Axys Varilab 2005
Pakistan, Peshawar	2005	FR	4.1	Axys Varilab 2005
Ireland	2002-2004	FR	4.4	Pratt, I. et al. 2004, FSAI 2004
India, Eloor	2005	FR	4.5	Axys Varilab 2005
Turkey, Izmit	2005	FR	5.1	Axys Varilab 2005
Egypt, Helwan	2005	FR	6.8	Axys Varilab 2005
Ireland	2002-2004	OE	13.2	Pratt, I. et al. 2004, FSAI 2004
Czech Republic, Liberec I	2005	FR	13.7	Axys Varilab 2005
Netherlands	1998-1999	NS	15.7	Baars, A. J. et al. 2004
Czech Republic, Liberec	2005	FR	21.6	Axys Varilab 2005
Czech Republic, Usti nad Labem	2005	FR	26.3	Axys Varilab 2005
Uruguay, Minas	2005	FR	29.0	Axys Varilab 2005
Senegal, Mbeubeuss	2005	FR	29.2	Axys Varilab 2005
Mexico, Coatzacoalcos	2005	FR	30.6	Axys Varilab 2005
Kenya, Dandora	2005	FR	31.1	Axys Varilab 2005
Mozambique, Matola - Santos	2005	FR	39.2	Axys Varilab 2005
Philippines, Barangay Aguado	2005	FR	60.9	Axys Varilab 2005
Russia, Gorbatovka	2005	FR	63.5	Axys Varilab 2005
Belarus, Bolshoi Trostenec	2005	FR	70.9	Axys Varilab 2005
India, Lucknow	2005	FR	75.3	Axys Varilab 2005
Russia, Igumnovo	2005	FR	167.3	Axys Varilab 2005
Slovakia, Kokshov-Baksha and Valaliky	2005	FR	189.0	Axys Varilab 2005
Ireland	2002-2004	OE	275.9	Pratt, I. et al. 2004, FSAI 2004
Czech Republic, Lysa nad Labem	2005	FR	337.6	VSCHT 2005

Notes: BE, barn eggs; BTE, battery eggs; FR, free range; NS, not specified; OE, organic eggs


PCBs - seven congeners
PCBs in ng/g of fat
200.0
150.0
100.0
50.0
0.0
1.7
3.0
4.1
4.1
4.4
4.5
5.1
6.8
13.2
13.7
15.7
21.6
26.3
29.0
29.2
30.6
31.1
39.2
60.9
63.5
70.9
75.3
167.3
189.0
275.9
337.6
USA, Mossville
Bulgaria, Kovachevo
Tanzania, Vikuge
Pakistan, Peshawar
Ireland
India, Eloor
Turkey, Izmit
Egypt, Helwan
Ireland
Czech Republic, Liberec I
Netherlands
Czech Republic, Liberec
Czech Republic, Usti nad Labem
Uruguay, Minas
Senegal, Mbeubeuss
Mexico, Coatzacoalcos
Kenya, Dandora
Mozambique, Matola - Santos
Philippines, Barangay Aguado
Russia, Gorbatovka
Belarus, Bolshoi Trostenec
India, Lucknow
Russia, Igumnovo
Slovakia, Kokshov-Baksha and Valaliky
Ireland
Czech Republic, Lysa nad Labem

Annex 7: Photos

Photo 1: Boror - pesticides obsolete stockpile in 1998 - 1999, before floods.

Photo 2: Boror - pesticides obsolete stockpile in 1998 - 1999, before floods.

Photo 3: Floods in 2000 in the intermediary storage of obsolete pesticides.

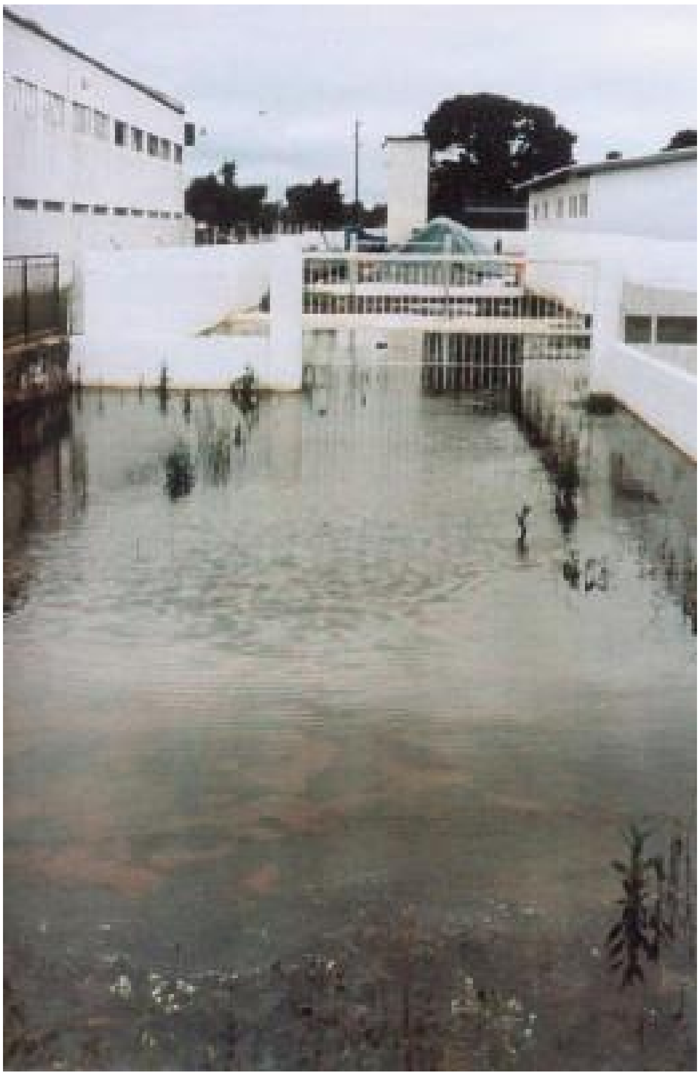


Photo 4: Another picture of the obsolete pesticides stockpile from Matola, Santos area.

References

[1] Grochowalski, A. 2002: Sprawozdanie z przeprowadzonych pomiarow i oznaczania stezenia PCDDs/PCDFs, HCB i PCBs, 30.09.2002; http://ks.ios.edu.pl/gef/doc/GF-POL-INV-R1.PDF

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

[3] 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.

[4] 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

[5] 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.

[6] 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.

[7] 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.

[8] Toxics Link, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs near 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.

[9] AGENDA, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs near the Vikuge obsolete pesticides stockpile in Tanzania by dioxins, PCBs, and hexaclorobenzene. Available at www.ipen.org 31 March 2005.

[10] PAN Africa, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs near the Mbeubeuss dumpsite in a suburb of Dakar, Senegal by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 4 April 2005.

[11] RAPAM, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs near the Pajaritos Petrochemical Complex in Coatzacoalcos, Veracruz, Mexico by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 6 April 2005.

[12] Bumerang, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs near the hazardous waste incinerator in Izmit, Turkey by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 9 April 2005.

[13] Za Zemiata, Arnika, IPEN Dioxin, PCBs and Waste WG, 2005: Contamination of chicken eggs from Kovachevo in Bulgaria by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 13 April 2005.

[14] REDES-AT, RAPAL, Arnika, IPEN Dioxin, PCBs and Waste WG, 2005: Contamination of chicken eggs near the cement kilns in Minas in Uruguay by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 14 April 2005.

[15] Day Hospital Institute, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs from Helwan in Egypt by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 11 April 2005.

[16] PMVS, THANAL, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs from Eloor in Kerala, India, by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 19 April 2005.

[17] Eco-SPES, Eco Accord, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs from the Dzerzhinsk region, Russia by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 20 April 2005.

[18] AEHR, MEAN, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs from Mossville, Louisiana, USA by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 20 April 2005.

[19] Cavite Green Coalition, Ecological Waste Coalition, GAIA, HCWH, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs from Barangay Aguado, Philippines by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 21 April 2005.

[20] SDPI, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs near the dump site on the edge of Peshawar, Pakistan by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 25 April 2005.

[21] 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.

[22] Advocates for Environmental Human Rights, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs from Mossville, Louisiana, USA by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 20 April 2005.

[23] 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.

[24] 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.

[25] 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.

[26] Pless-Mulloli, T., Schilling, B., Paepke, O., Griffiths, N., Edwards, R. 2001: Transfer of PCDD/F and Heavy Metals from Incinerator Ash on Footpaths in Allotments into Soil and Eggs.

[27] 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.

[28] PAN Africa, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs near the Mbeubeuss dumpsite in a suburb of Dakar, Senegal by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 4 April 2005.

[29] REDES-AT, RAPAL, Arnika, IPEN Dioxin, PCBs and Waste WG, 2005: Contamination of chicken eggs near the cement kilns in Minas in Uruguay by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 14 April 2005.

[30] 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.

[31] 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.

[32] REDES-AT, RAPAL, Arnika, IPEN Dioxin, PCBs and Waste WG, 2005: Contamination of chicken eggs near the cement kilns in Minas in Uruguay by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 14 April 2005.

[33] PAN Africa, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs near the Mbeubeuss dumpsite in a suburb of Dakar, Senegal by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 4 April 2005.

[34] RAPAM, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs near the Pajaritos Petrochemical Complex in Coatzacoalcos, Veracruz, Mexico by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 6 April 2005.

[35] 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.

[36] Toxics Link, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs near 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.

[37] 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.

[38] 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.

[39] PMVS, THANAL, Arnika, IPEN Dioxin, PCBs and Waste WG 2005: Contamination of chicken eggs from Eloor in Kerala, India, by dioxins, PCBs and hexachlorobenzene. Available at www.ipen.org 19 April 2005.

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

[41] Environmental Impact Assessment report for the project of Disposal of obsolete pesticides in Matola.

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.

CLUA Freiburg 1995: Chemische Landesuntersuchungsanstalt Frieburg, Germany, Jahreberícht 1997 (?).: in POPs Waste and Potential for Foodchain Contamination. Universtity of Bayreuth, Sept. 30, 2000.

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.

FSAI (Food Safety Authority of Ireland) 2004: Investigation into Levels of Dioxins, Furans, PCBs and some elements in Battery, Free-Range, Barn and Organic Eggs. March 2004.

Fuerst, P., Fuerst, C., Wilmers, K. 1993: PCDD/PCDF in Commercial Chicken Eggs - Depending on the Type of Housing. Organohalogen Compounds 13 (1993), pp 31-34.: in POPs Waste and Potential for Foodchain Contamination. Universtity of Bayreuth, Sept. 30, 2000.

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

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.

Larebeke, N. van, Hens, L., Schepens, P., Covaci, A., Baeyens, J., Everaert, K., Bernheim, J. L., Vlietinck, R., Poorter, G. De 2001: The Belgian PCB and Dioxin Incident of January–June 1999: Exposure Data and Potential Impact on Health. Environmental Health Perspectives, Volume 109, Number 3, March 2001, pp 265 - 273.

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.

MDCH (Michigan Department of Community Health) 2003a: Final report - Phase II. - Tittabawassee/Saginaw River Dioxin Flood Plain Sampling Study/Appendix II. Michigan Department of Community Health Division of Environmental and Occupational Epidemiology.

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.

Niedersachsischen Ministerium fuer Ernaehrung, Landwirtschaft und Forsten 1999: Verordnung zum Schutz der Verbraucher durch Dioxine in bestimmten Lebensmitteln tierischer Herkunft vom 09.06.1999, Bundesanzeiger Nr. 104 vom 10.06.1999, S. 8993. Verbraucherschutz. Jahresbericht 1999, Niedersachsischen Ministerium fuer Ernaehrung, Landwirtschaft und Forsten.

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.

Sotskov, U., P., Revich, B., A. et al. 2000: Ekologiya Chapaevska – okruzhayushchaya sreda i zdoroviye naselenia (Ecology of the Chapaevsk – environment and health). Chapaevsk – Moscow, 2000, 105 pp.

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.

VŠCHT 2005: Protocol of analysis No. LN 3622 - 3637. Vysoká škola chemicko-technologická v Praze (VŠCHT) Institute of Chemical Technology, Prague, Department of Food Chemistry and Analysis, March 2005.