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Contamination of chicken eggs from Mossville, Louisiana, USA by dioxins, PCBs and hexachlorobenzene

Photograph of homes next to a vinyl manufacturing facility in a section of Mossville, Louisiana, USA. These homes were torn down and the residents moved away as a result of vinyl feedstock contamination.

Contamination of chicken eggs from Mossville, Louisiana, USA by dioxins, PCBs and hexachlorobenzene

"Keep the Promise, Eliminate POPs!" Campaign Report

Prepared by Dioxin, PCBs and Waste Working Group of the International POPs Elimination Network (IPEN) Secretariat, Mossville Environmental Action Now (Louisiana, USA), Advocates for Environmental Human Rights (Louisiana, USA) and Arnika Association (Czech Republic)

Mossville - Prague - 20 April 2005

Executive Summary

Free-range chicken eggs collected near the chlorine chemical industry plants in Mossville, Louisiana showed levels of dioxins that were 16 times higher than background levels reported by US EPA in 2003. The Mossville eggs also exceeded the European Union (EU) limit for dioxins in eggs by almost 2-fold. In addition, PCB levels detected in the Mossville eggs exceeded the proposed action level set by the EU. The combined total of dioxins and PCBs expressed in measures established by the World Health Organization also exceeded the newly proposed EU limit. Dioxin congener profiles indicate that EDC/VCM production is one of the very likely sources of dioxins found in the eggs. Both dioxins and PCBs are two of the twelve persistent organic pollutants (POPs) that have been identified as global threats, requiring governments around the world to take action in accordance with an international treaty known as the Stockholm Convention on Persistent Organic Pollutants.

This study updates a previous sampling of eggs by the Agency for Toxic Substances and Disease Registry (ATSDR) and shows dioxin levels about three times higher than those measured by ATSDR in 1999. The ATSDR study also examined dioxin levels in blood. ATSDR concluded that local sources appeared to be responsible for average dioxin concentrations in blood that were three times higher than the US background level. At least 14 industrial facilities manufacture, process, store, and discharge toxic substances near Mossville including several chlor alkali and VCM plants that begin the production chain for PVC plastic. Recent US EPA Toxic Release Inventory reports show that the vinyl manufacturers, Georgia Gulf and PPG Industries, the Lyondell petrochemical facility, the Conoco Phillips oil refinery, and the Entergy power plant are all sources of dioxins in the Mossville community.

The high toxic exposure and deteriorating health situation in Mossville led to the filing of the first ever human rights petition with the Organization of American States (OAS). The brief asserts that 60 years of hazardous industrial development has interfered with fundamental human rights to health and a clean ecologically secure environment among others. The petition requests medical services, relocation, regulatory reforms in facility permits and pollution release limits.

The toxic substances measured in this study are slated for reduction and elimination by the Stockholm Convention which holds its first Conference of the Parties beginning 2 May 2005. The US signed the Convention in 2001, which obligates the government to not take any action that would undermine the provisions of this important public health and environmental treaty. 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 communities like Mossiville and others in the US and around the world by removing toxic threates to the global public's health and environment. We call upon US 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) Identify and eliminate the local sources of the dioxins and dioxin-like contaminants that are found in the blood and breast milk of Mossville residents, the soils of their homes and their food sources.

2) As the sources of dioxins and dioxin-like chemicals are identified and eliminated, take all appropriate actions to reduce exposures from any remaining reservoir sources such as soils and sediments.

3) Appropriate actions include remediation of such reservoir sources to protect and preserve the rights of Mossville residents to maintain their chosen levels of food self-sufficiency through gardening, animal husbandry, hunting and fishing without the threat of dioxins, dioxin-like chemicals and related toxic contaminants.

4) Relocate all residents who so desire to an area where significant threats of contamination by dioxins, dioxin-like chemicals and other toxic contaminants do not exist.

5) Issue a moratorium on any new permits for activities or enterprises that release dioxins, dioxin-like chemicals and other toxic contaminants into the environment in or near Mossville.

6) The US should ratify the Stockholm Convention in a manner that guarantees prompt action on new additions to the Treaty; supports state regulatory efforts; and gives clear legal authority for EPA to respond quickly and effectively to new POPs additions to the treaty such as utilizing international scientific evaluations, the precautionary approach, and the health-based regulatory standard in the Convention.

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. The US signed the Convention on 23rd May 2001.

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 Mossville community in Louisiana, USA was selected as a sampling site since the chlorine chemical industries, oil refineries, power plants, and on-site waste incineration are known to be a sources of unintentionally produced POPs.[1] Chicken eggs were chosen for several reasons: they are a common food item; their fat content makes them appropriate for monitoring chemicals such as POPs that dissolve in fat; and eggs are a powerful symbol of new life. Free range hens can easily access and eat soil animals and therefore their eggs are a good tool for biomonitoring of environmental contamination by U-POPs. This study is part of a global monitoring of egg samples for U-POPs conducted by IPEN and reflects the second round of data about U-POPs in eggs from Mossville, Louisiana after a study by ATSDR in 1999.

Materials and Methods

Please see Annex 1.

Results and Discussion

POPs in eggs sampled in Mossville, Louisiana, USA

The results of the analysis of a pooled sample of 6 eggs collected in Mossville near chlorine chemical plants, an oil refinery, coal-fired power plant, and on-site waste incinerators in are summarized in Tables 1 and 2. The fat content of the pooled sample was measured in eggs at 12.4%.

Dioxin levels in the sampled eggs from Mossville exceeded the EU limit for dioxins by almost 2-fold. The level of PCBs exceeded the newly proposed action level for eggs in the EU. In addition, the eggs in this study exceeded the newly proposed EU limit for total WHO-TEQ level in eggs.

Table 1: Measured levels of POPs in eggs collected in Mossville, Louisiana, USA per gram of fat.

	Measured level	Limits	Action level
PCDD/Fs in WHO-TEQ (pg/g)	5.67 - 5.97	3.0[a]	2.0 [b]
PCBs in WHO-TEQ (pg/g)	1.74	2.0 [b]	1.5 [b]
Total WHO-TEQ (pg/g)	7.41 - 7.71	5.0 [b]	-
PCB (7 congeners) (ng/g)	6.94	200 [c]	-
HCB (ng/g)	1.20	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 that the level of dioxins in eggs expressed as fresh weight contained 70% - 74% of the limit for commercial eggs in the USA. Despite being lower than the US limit, the eggs still appear to contain dioxin levels of concern. The samples collected in Mossville contained 0.70 – 0.74 pg WHO-TEQ/g fat compared to the US limit of 1 pg WHO –TEQ/g fat. The US Food and Drug Administration estimates a lifetime excess cancer risk of one per 10,000 for eggs contaminated at 1 pg/g ITEQ. This is 100 times higher risk of cancer than the US government's usual "acceptable" risk of one in a million .[a] This indicates that the Mossville eggs pose a higher excess cancer risk than the US government's "acceptable" level of one in a million. In addition, the US Food and Drug Administration considers

[a] 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[a, a]

eggs containing more than 1 pg WHO-TEQ/g fat dioxin to be "adulterated."[2] As seen in Table 3, the Mossville eggs were more than fives times higher than this level.

Table 2: Measured levels of POPs in eggs collected in Mossville, Louisiana, USA per gram of egg fresh weight.

	Measured level	Limits	Action level
PCDD/Fs in WHO-TEQ (pg/g)	0.70 - 0.74	1[a]	-
PCBs in WHO-TEQ (pg/g)	0.22	-	-
Total WHO-TEQ (pg/g)	0.92 - 0.96	-	-
PCBs (7 congeners) (ng/g)	0.86		
HCB (ng/g)	0.15	-	-

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 second study of dioxins in chicken eggs reported for Mossville. The levels of dioxins exceeding the EU action level observed in the egg samples support the need for further monitoring and longer-term changes to eliminate chlorinated chemicals that serve as donors for PCBs, dioxins and furans releases in all environment compartments.

It is clear that among the U-POPs listed under the Stockholm Convention, dioxins are the main contaminants found in the eggs from Mossville. However, PCBs and HCB levels observed in eggs from Mossville are not negligible as well, especially in the context of USA data for U-POPs in eggs as we discuss further. This finding supports the need for more complex study on releases of these chemicals as U-POPs from industrial facilities within the region and their levels in Mossville environment.

Comparison with other studies of dioxins in eggs from the US

Unlike other countries in IPEN's global monitoring project, there are several pre-existing studies of U-POPs in chicken eggs. These studies were focused on finding out general pollution levels or[3, 4, 5] and/or contaminant levels at heavily polluted sites:

a) Midland, Michigan - near Dow Chemical's plant and world headquarters;[6, 7]

b) Oroville, California - long track-record of pentachlorophenol use and fires in wood treatment facility using pentachlorophenol;[8, 9]

c) Mojave, California - site of metal refineries.[10]

Although dioxin concentrations reported from these sites were higher compared to Mossville eggs, the Mossville samples are still higher than eggs from some sites in Europe. For example, Mossville eggs had higher dioxin levels than eggs collected near a hazardous waste incinerator in Lysa and Labem in the Czech Republic and/or Newcastle, UK where waste incineration ash was spread on the land.

As shown in the findings below, the PCDD/F concentration in pooled sample of chicken eggs from Mossville, expressed as wet weight is 0.739 pg W-TEQ/g (wet weight), This level of dioxin is:

1) more than 16 times greater than the concentration reported most recently by US EPA[11] as the background level of dioxin in U.S eggs;

2) approximately 1.4 times higher than the concentration reported by Hayward et al.[12] (assuming, for these purposes, that differences between total TEQs based on WHO-TEFs and those based on I-TEFs are insignificant); and

3) some 2.4 times higher than the concentration reported by Schecter et al. [13] (assuming, for these purposes, that differences between total TEQs based on W-TEFs and those based on I-TEFs are insignificant).

Similarly, the concentration of dioxin-like PCBs, 1.34 pg WHO-TEQ/g fat, extrapolates to a concentration in whole egg of 0.166 pg WHO-TEQ/g (wet weight). This value is more than 4 times greater than the concentration reported by Schecter et al. (0.054 pg I-TEQ/g fresh weight). [14] In this regard, not only PCDD/F but also PCBs were observed to be a U-POPs produced in EDC/VCM production.[15]

Picture 1: Graph shows comparison of dioxin levels observed in chicken eggs in pg/g fresh weight (in I-TEQ and/or WHO-TEQ) in USA (background and average concentrations levels) and Mossville. Exact levels are in Table 3 as well as sources of information.

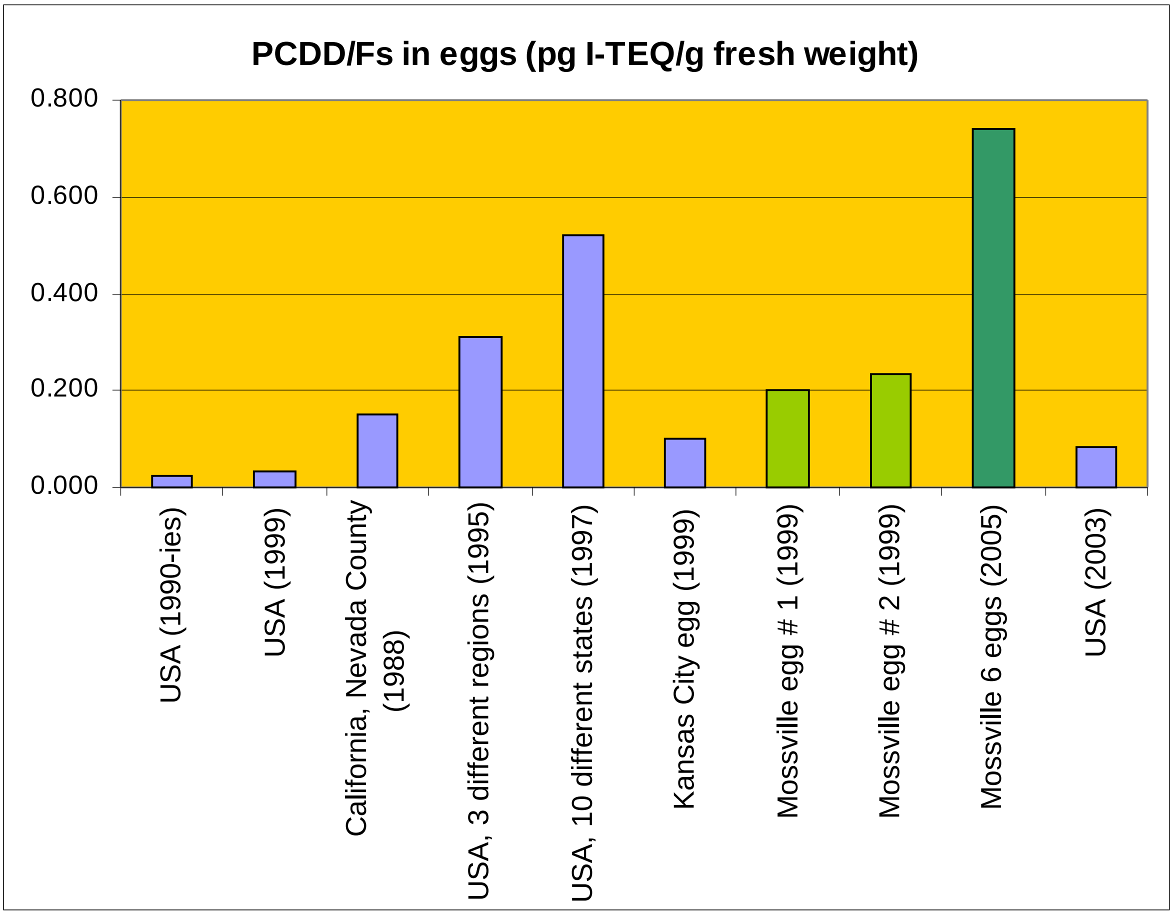


Table 3: Comparison of dioxin levels in pg/g fresh weight (in I-TEQ and/or WHO-TEQ) in chicken eggs in USA (background and average concentration levels) with chicken eggs samples from Mossville.

Site(s), year	Group	Number of samples	Measured level	Source of information
USA (1990-ies)	not specified	3	0.023	Fiedler et al. 1997,[16] Cooper et al. 1995 [17]
USA (1999)	not specified	NS	0.032	Winters, D. L. et al. 1999 [18]
California, Nevada County (1988)	free range	6	0.150	Goldman, L. R. et al. 2000 [19]
USA, 3 different regions (1995)	mixed	1 pool	0.310	Schecter et al. 1997 [20]
USA, 10 different states (1997)	free range	20	0.520	Hayward, D. G. et al. 2001 [21]
Kansas City egg (1999)	not free range	1	0.101	ATSDR 1999
Mossville egg # 1 (1999)	free range	1	0.200	ATSDR 1999
Mossville egg # 2 (1999)	free range	1	0.235	ATSDR 1999 [22]
Mossville 6 eggs (2005)	free range	6/1 pool	0.739	Axys Varilab 2005 [23]
USA (2003)	not specified	NS	0.081	US EPA 2003 [24]

Note: level for Mossville, Kansas City and US EPA reported eggs is in WHO-TEQ

Comparison with studies of eggs in other countries

We compared the levels of PCDD/Fs measured in this study in eggs from Mossville with data from other studies that also used pooled samples and/or expressed mean values of analyzed eggs (Please see Annexes 2 and 3). Note that most of the previous studies for the USA calculate levels of dioxins and PCBs on a fresh weight basis, instead of levels per g of fat as is used in Europe and other regions.

The data for eggs described in this report follow on the heels of a similar studies in Slovakia,[25] Kenya,[26] Czech Republic,[27] Belarus,[28] India (Uttar Pradesh),[29] Tanzania,[30] Senegal,[31] Mexico,[32] Turkey,[33] Bulgaria,[34] Uruguay,[35] Egypt,[36] India, Kerala,[37] and Russia [38] released since 21 March 2005.

The dioxin levels in eggs in this study exceeded the mean level observed in poultry eggs from Newcastle (site contaminated previously by incineration fly ash) in a follow up study from 2002.[39] The dioxin levels in the Mossville eggs also exceeded levels observed in both free range and non-free range chicken eggs in several European countries observed in recent studies (Netherlands,[40] Ireland,[41] EU 3 countries longer period observation[42] etc.).

Other studies showing even higher levels of dioxins in eggs than those here include samples near an old waste incinerator in Maincy, France[43] and an area affected by a waste from chlorinated compounds production in Rheinfelden, Germany.[44] 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 12.70 pg WHO-TEQ/g respectively. More data on these comparisons in Annex 2.

In comparison with chicken eggs pooled samples from other sites studied within the IPEN global monitoring project the Mossville sample level exceeded levels found for eggs sampled near a mixed waste dumpsite in Bolshoi Trostenec, Belarus [45] and/or near a hazardous waste incinerator in Izmit, Turkey [46] and several other sites. Higher levels of dioxins than the Mossville samples were observed in the Dzerzhinsk region, Russia,[47] Helwan, Egypt, [48] and near a DDT production plant in Eloor, Kerala, India [49] and some other sites. (See also Annex 3).

The levels of PCBs (in WHO-TEQ) in Mossville eggs exceeded the average US level reported by Schecter et al.[50] In addition, the observed levels were higher than those observed in free range eggs from Usti nad Labem [51] and Liberec, Czech Republic and Izmit, Turkey [52]. The Mossville eggs had lower levels of PCBs than those collected in Mbeubeuss, Senegal (an area next to mixed hazardous and municipal waste dumpsite)[53] and/or the Dzerzhinsk region, Russia (area, where also PCBs were produced in the past) [54] for example. (See also Annex 4).

PCBs contribute less than 25% of the whole WHO-TEQ value in these eggs as visible in the graph in Annex 5. However, PCBs contribute more to the WHO-TEQ value than HCB. If we use the proposed TEF value for HCB (0.0001),[55] its TEQ value in chicken eggs from Mossville would be 0.12 pg/g of fat. PCBs contribute 15 times more to the TEQ value than HCB using this value.

Picture 2: Map of Mossville and its surroundings.

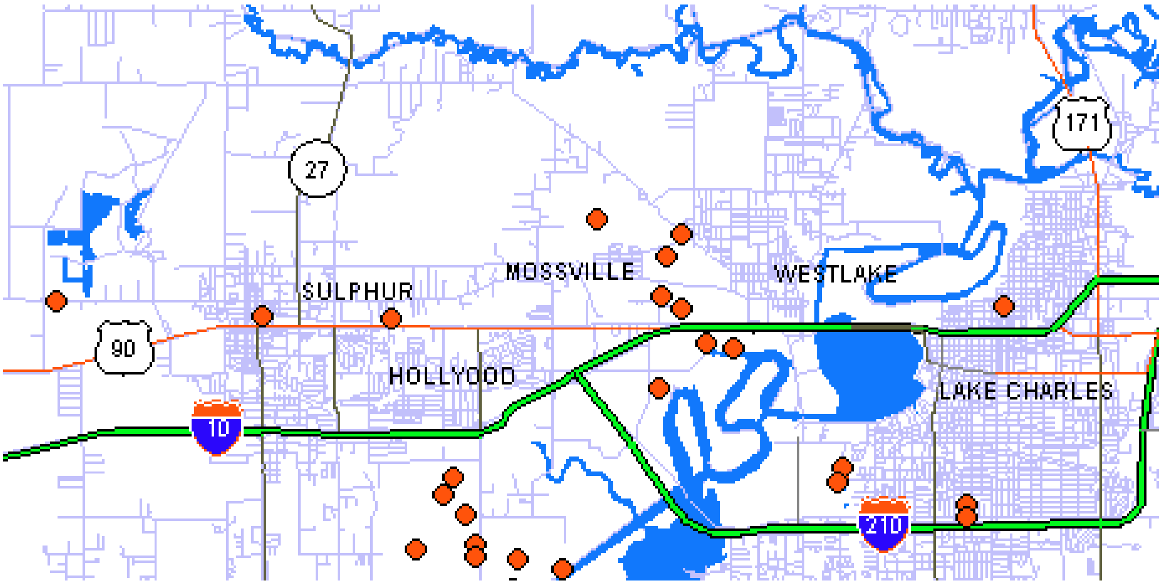


Table 4: Results of PCDD/Fs analysis in a pooled sample of 6 eggs collected in Mossville, Louisiana, USA. Note: LQL= lower than limit of determination, for lower bound and upper bound calculations counted as 0 and level of detection (= 0.3 pg/g of fat for certain congeners here) respectively.

PCDD/Fs congeners	WHO-TEF	pg/g of fat	pg W-TEQ/g of fat
2,3,7,8 TeCDD	1	LQL	0 - 0.3
1,2,3,7,8 PeCDD	1	2.10	2.1
1,2,3,4,7,8 HxCDD	0.1	1.80	0.18
1,2,3,6,7,8 HxCDD	0.1	9.50	0.95
1,2,3,7,8,9 HxCDD	0.1	2.70	0.27
1,2,3,4,6,7,8 HpCDD	0.01	40.40	0.404
OCDD	0.0001	140.00	0.014
2,3,7,8 TeCDF	0.1	0.67	0.067
1,2,3,7,8 PeCDF	0.05	0.84	0.042
2,3,4,7,8 PeCDF	0.5	1.50	0.75
1,2,3,4,7,8 HxCDF	0.1	3.00	0.3
1,2,3,6,7,8 HxCDF	0.1	2.00	0.2
2,3,4,6,7,8 HxCDF	0.1	2.50	0.25
1,2,3,7,8,9 HxCDF	0.1	0.39	0.039
1,2,3,4,6,7,8 HpCDF	0.01	9.80	0.098
1,2,3,4,7,8,9 HpCDF	0.01	0.91	0.0091
OCDF	0.0001	7.00	0.0007
Total WHO-TEQ			**5.67 - 5.97**

Possible U-POPs sources

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

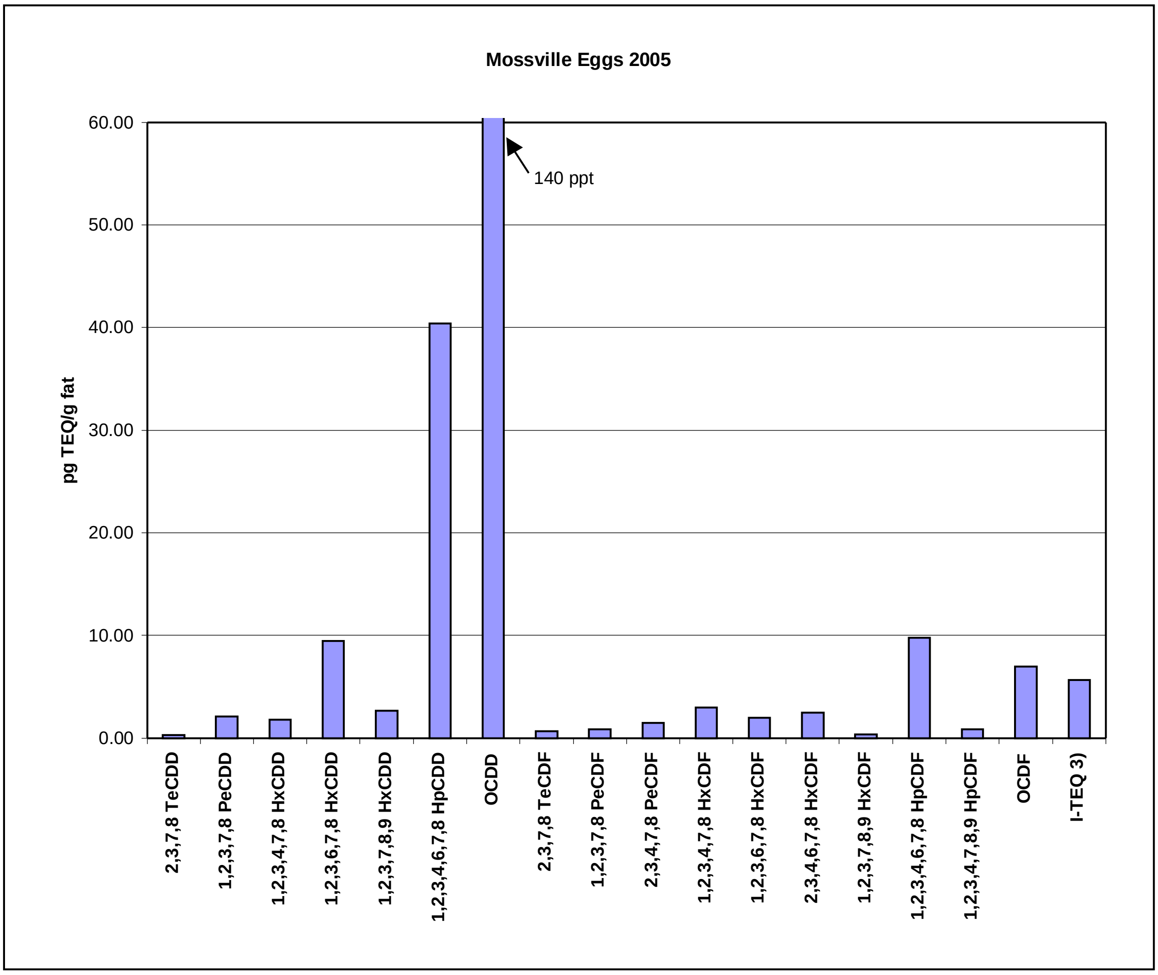
At least 14 industrial facilities manufacture, process, store, and discharge toxic substances near Mossville including several chlor alkali and VCM plants that begin the production chain for PVC plastic. Recent US EPA Toxic Release Inventory reports show that the vinyl manufacturers, Georgia Gulf and PPG Industries, the Lyndell petrochemical facility, the Conoco Phillips oil refinery, and the Entergy power plant are all sources of dioxins in the Mossville community. [65]

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 Mossville are shown in the graph in Picture 3 and measured levels are shown in Table 3.

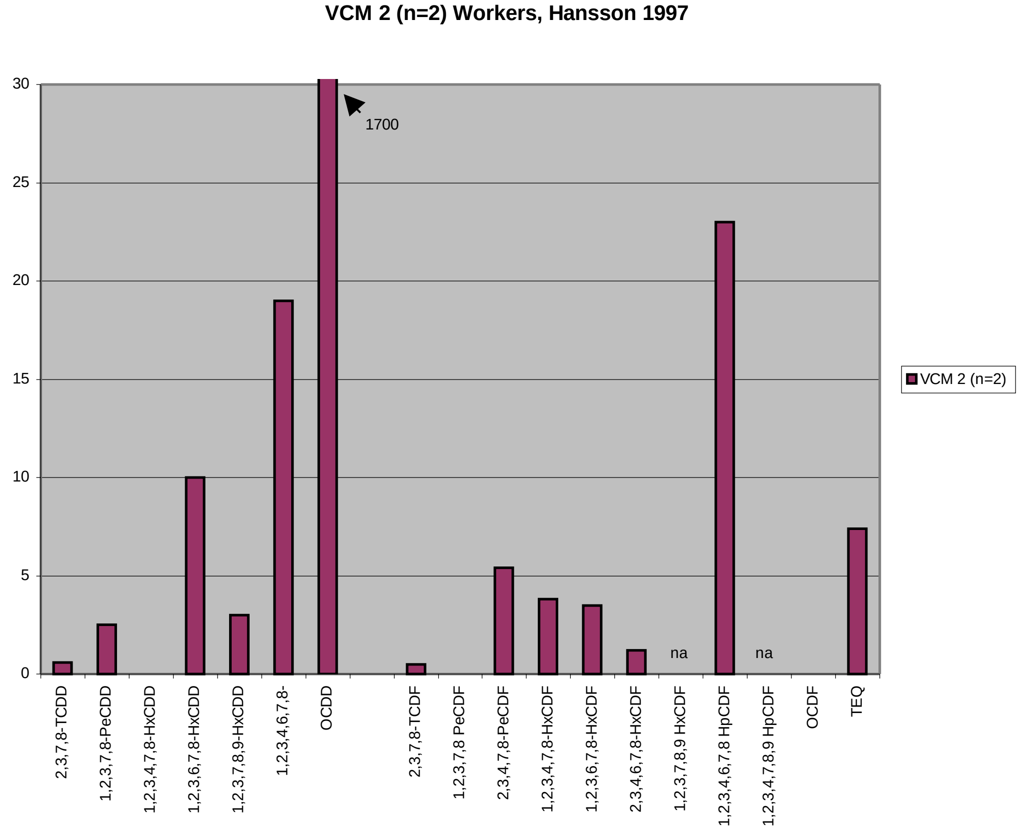
Dioxin congeners profiles (in absolute values) in all three graphs show high levels of OCDD and HpCDDs. High level of 1,2,3,4,7,8,9 HpCDF was also observed in these profiles. Comparing the congener pattern observed here with data measured for blood sample of VCM production facilities workers and for the sediment sample near the outfall pipe of the EDC/VCM production facility in Louisiana indicates EDC/VCM production is one of the very likely source of dioxins found in the eggs.

The graph in Picture 4 shows dioxin congeners profile in blood of VCM workers reported by Hansson et al.,[67] and the last graph at Picture 5 shows the results of dioxin congeners levels analysis in a sample of the sediment taken near the outfall pipe of the BF Goodrich – Geon facility in Louisiana producing VCM.[68]

Picture 3: Seventeen PCDD/Fs congeners pattern in pooled eggs sample from Mossville.



Picture 4: dioxin congeners profile in blood of VCM workers reported by Hansson et al.,[69]



Picture 5: Seventeen dioxin congeners pattern in a sample of the sediment taken near the outfall pipe of the BF Goodrich – Geon facility in Louisiana. [70]
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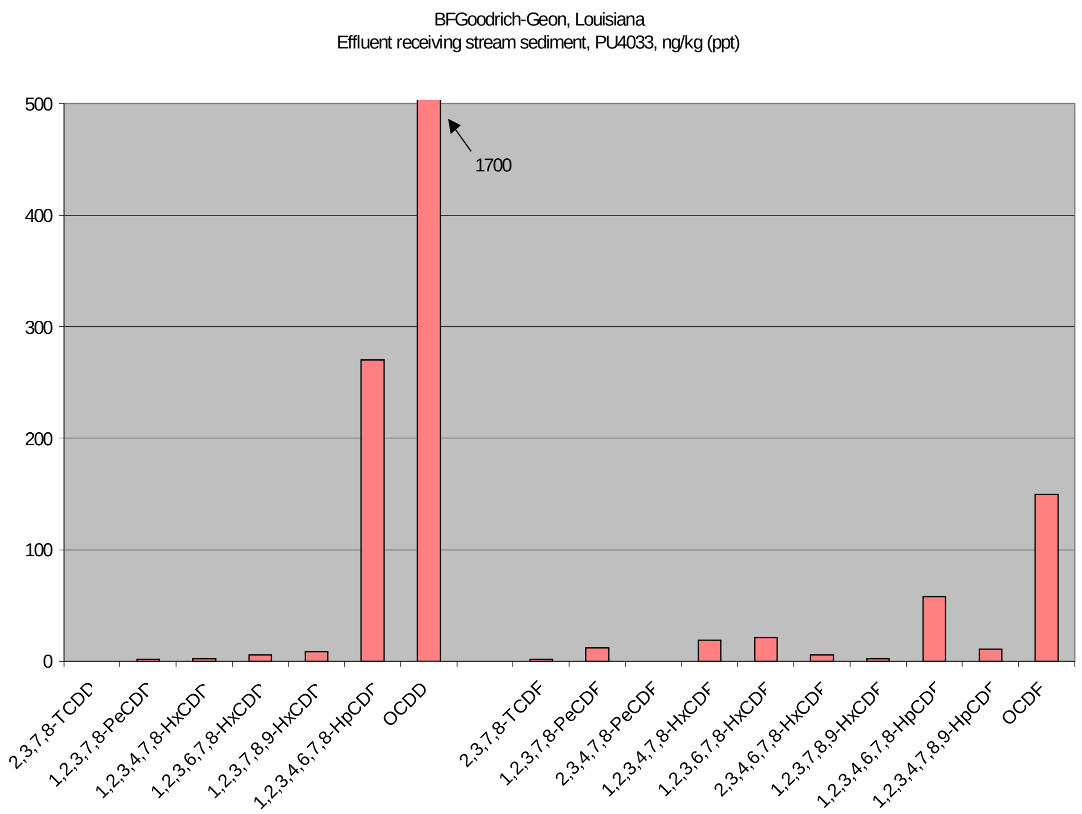

Mossville

Mossville was founded by African American families in the 1800s, and is located between the two municipalities of Sulphur and Westlake in Calcasieu Parish, Louisiana (see map at Picture 2). By living near the Calcasieu Estuary, where over 65 kilometers (40 miles) of waterways produce a rich, biologically diverse environment, African American residents of Mossville were able to sustain themselves by fishing, farming, and hunting, and developed cultural and religious traditions that were based on preserving their environment.

Currently, the Mossville community is composed of 375 households. People living in Mossville suffer from severe health problems, elevated levels of cancer-causing and hormone-disrupting chemicals in their blood, a devastated environment, and a deteriorated quality of life, all of which are associated with the massive amounts of toxic pollution released by nearby industrial facilities.

Polluting industry in Mossville

The United States government agencies have authorized 14 industrial facilities to manufacture, process, store, and discharge toxic and hazardous substances in close geographic proximity to Mossville residents. These facilities include also EDC/VCM production and hazardous waste incineration. Some of them have flares that burn chlorine containing materials.[72] Each of the facilities in the Mossville area has received from governmental agencies the requisite permits to pollute the air, water, and land. Both the U.S. Environmental Protection Agency ("EPA") and the Louisiana Department of Environmental Quality ("LDEQ") assume that industrial pollution can be adequately controlled entirely by technologically based standards. However, the reality is quite the contrary. Pollutants released by Mossville area facilities have been detected in the air at levels that exceed health-based standards.[73] Furthermore, it is well-documented that in the area of Mossville, industrial pollution has poisoned fish in local waters, and extensively contaminated groundwater and waterways.[74].

In recent years, industries have acknowledged that their facilities surrounding Mossville have annually polluted the local environment with a combined total of more than two million pounds (one million kilograms) of toxic chemicals that are scientifically known to cause cancer and damage the immune, respiratory, cardiovascular, nervous, and reproductive systems. Further, several local industries have conceded that the accidental release of just one toxic or flammable substance processed and stored at their facilities would kill or seriously injure Mossville residents.[75]

POPs measurements in the Mossville area

In 1999, the U.S. Agency for Toxic Substances and Disease Registry ("ATSDR") did an exposure study in which took samples of blood from 28 Mossville residents. The study conclusions were:

1. Blood dioxin levels were elevated in residents of Mossville who participated in the EI. The median and mean concentrations of dioxin TEQs in the EI participants were greater than the 95^{th} percentile concentration of a comparison population.
2. The blood levels of many, but not all, of the individual dioxin-like compounds were elevated in the EI participants. The levels of 1,2,3,7,8 pentachlorodibenzo-***p***-dioxin were particularly elevated and were the most significant contributor to the dioxin TEQ total.
3. Blood dioxin levels were primarily elevated in older residents of Mossville ($\geq$ 47 years old). [76]

As shown in Table 4, this study reported that Mossville residents have an average concentration of dioxin and dioxin-like PCBs in their blood that is 3 times higher than the background level represented by ATSDR's comparison group of people in different parts of the United States.

ATSDR health consultants determined that local sources are likely responsible for the significant levels of dioxin exposure among Mossville residents,[77, 78] but ATSDR did not suggest their conclusion in final report. [79] Additionally, Dr. William Toscano, a noted health researcher, warned that Louisiana's "heavy concentration of such industries such as plastics, paper mills, and chemicals manufacturing increase the potential for higher than normal exposure to dioxin."[80]

Also levels of dioxins in chicken eggs (see Table 3), soil samples and breast milk sample were part of ATSDR exposure inventory. A human breast milk sample contained 13.5 ppt of dioxin TEQs on a lipid-adjusted basis.

Surface soil samples were collected from three residential yards located across the street from a VCM plant. The concentrations of dioxin I-TEQs in the three samples were 4, 19, and 28 pg/g dry matter (d. m.). At one house, a surface soil sample from the front yard contained 19 pg I-TEQ/g d. m., and a surface soil sample from the owner's chicken coop contained 0.6 pg I-TEQ/g d.m. For comparison with these levels: near chlorine chemical plant Spolana Neratovice effluent canal measured level of dioxin in surface soil sample was 26 pg/g d.m. and in 200 meters distance from medical waste incinerator in Ostrava, Czech Republic was observed level of 19.7 pg/g d.m. in 2001.[81] Levels of dioxin observed in Mossville soils are higher than average soil level observed in U.S.[82]

Table 4: Concentrations of dioxin-like compounds (pg/g lipid or ppt) in blood serum samples from Mossville exposure study participants. Source ATSDR 1999. [83]

Analyte	Residents-median	Comparison Population - median	Residents - mean	Comparison Population - mean	Residents - 95th percentile	Comparison Population - 95th percentile
2378D	7.3	2.0	7.6	2.3	18.2	4.8
12378D	19.2	4.8	28.8	5.1	77.1	9.1
1234/678D	99.1	61.0	131.8	58.2	306	106
123789D	13.6	6.3	17.8	6.4	37.1	11.9
1234678D	102.7	65.2	126.9	71.3	351.3	143.8
1234679D	4.25	3.0	4.2	3.2	13.1	9.2
OCDD	906	556	1126	626	2429	1288
2378F	0.0	0.9	0.2	0.7	1.2	1.8
12378F	0.0	0.8	0.2	0.7	1.6	1.8
23478F	8.1	5.6	11.9	5.9	38.0	11.5
1234/678F	16.8	10.5	22.3	10.7	76.7	19.9
123789F	0.0	0.8	1.2	0.6	4.9	2.0
234678F	1.7	2.3	3.1	2.0	15.4	4.1
1234678F	19.6	11.3	25.2	12.2	67.2	24.5
1234789F	0.0	1.4	0.4	1.1	2.3	3.0
OCDF	NR	11.0	NR	7.7	NR	70.2
3344-PCB	ND	38.9	ND	34.7	ND	100.7
3445-PCB	0.0	3.2	1.2	3.2	8.2	7.4
33445-PCB	31.7	16.9	59.7	20.5	172	55.7
334455-PCB	27.0	20.2	39.9	20.5	105.7	39.4
Total WHO-TEQ	**54.8**	**19.9**	**68.3**	**21.0**	**162.3**	**37.5**

NR - not reported due to analytical interference
ND - not detected

The Human Right to a Healthy Environment

On behalf of Mossville residents and Mossville Environmental Action Now, a volunteer community organization, Advocates for Environmental Human Rights ("AEHR") has filed the first ever human rights petition seeking remedies for Mossville residents suffering from toxic chemical exposures. The petition demands reform of the U.S. environmental regulatory system that permits toxic, hazardous industrial facilities to severally damage the environment and threaten human health in Mossville and many other U.S. communities populated mostly by people of color and the poor. AEHR filed the human rights petition with the Organization of American States Inter-American Commission on Human Rights in March 2005. The petition applies international human rights laws, which recognize that environmental damage and governmental failure to provide appropriate environmental and public health protection can violate the human rights to life, health, and privacy. AEHR is a nonprofit, public interest law firm whose mission is to defend the human right to a healthy environment.

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 in Uruguay. USA signed the Convention in May 2001. This signature obligates the US government to not take any action that would undermine the provisions of this important public health and environmental treaty.

The Stockholm 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.[b] 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).[c] In addition, Parties are to promote both BAT and best environmental practices (BEP) for all new and existing significant source categories,[d] 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.[e] 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 American 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 U.S. government and all stakeholders to honor the integrity of the Convention text and keep the promise of reduction and elimination of POPs.

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[b] Article 5, paragraph (c)

[c] Article 5, paragraph (d)

[d] Article 5, paragraphs (d) & (e)

[e] Article 5, paragraph (a), subparagraph (i)

Annex 1. Materials and Methods

Sampling

For sampling in USA we have chosen the Mossville area which contains a large number of long-operating chlorine chemical industries.

The eggs were collected from the Mossville one mile from a PVC factory and oil industry area. The site is located northwest chemical industry area.

The hens from which the eggs were picked were all free-range. We collected 12 eggs from two chicken fanciers. The eggs were sampled from hens of approximately 3 years of age. Although they were regularly provided with corn and commercial chicken feed, the rest of their feeding is what they get from the soil. The range covered by the chickens was 23 square meters.

The sampling was done by a member of the environmental group, Mossville Environmental Action Now on 28 January 2005. The eggs were kept in cool conditions after sampling and then boiled in Mossville for 7 - 10 minutes in pure water and transported by express services to the laboratory at ambient temperature.

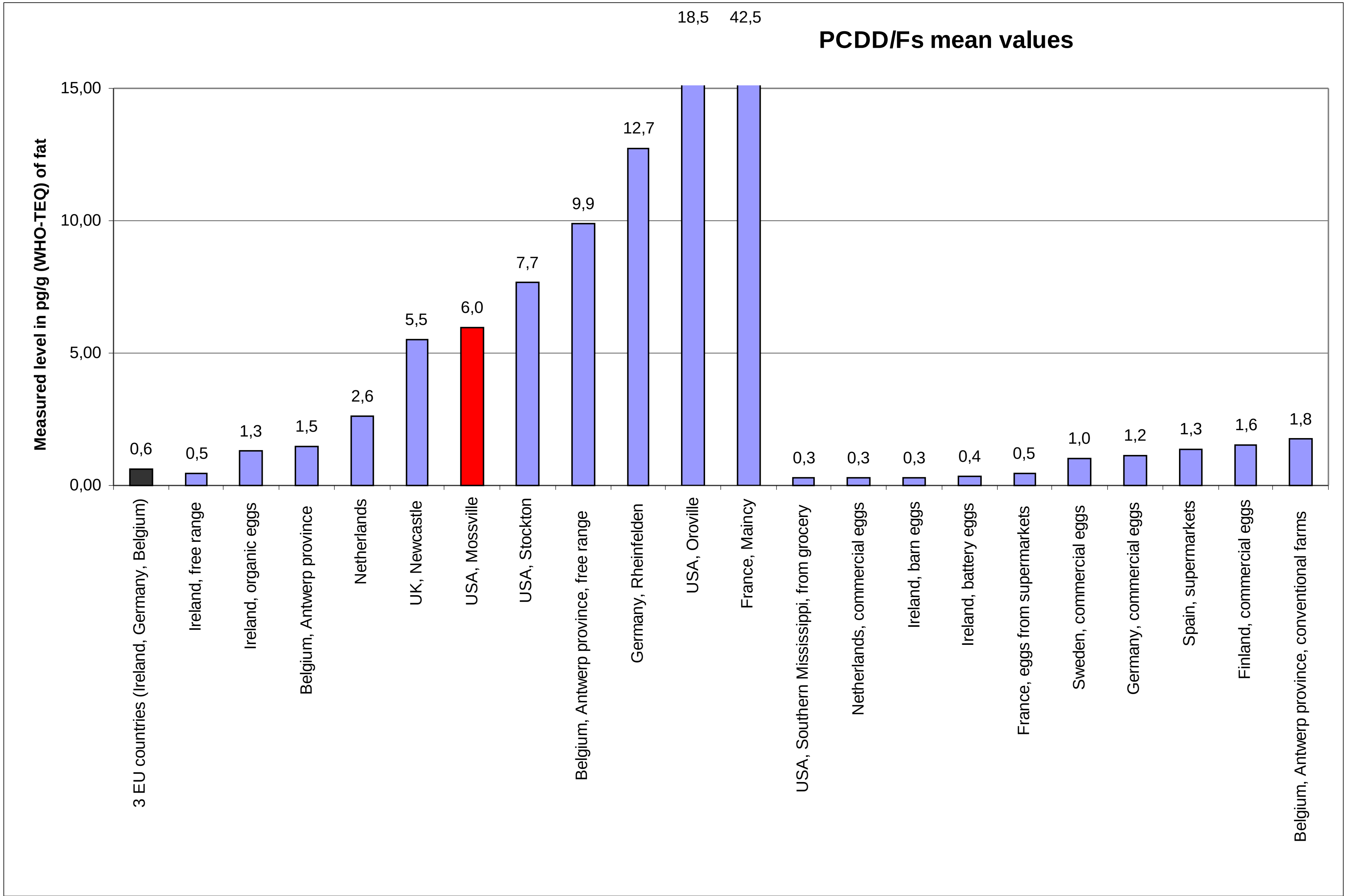
Analysis

After being received by the laboratory, the eggs were kept frozen until analysis. The egg shells were removed and the edible content of 6 eggs was 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.

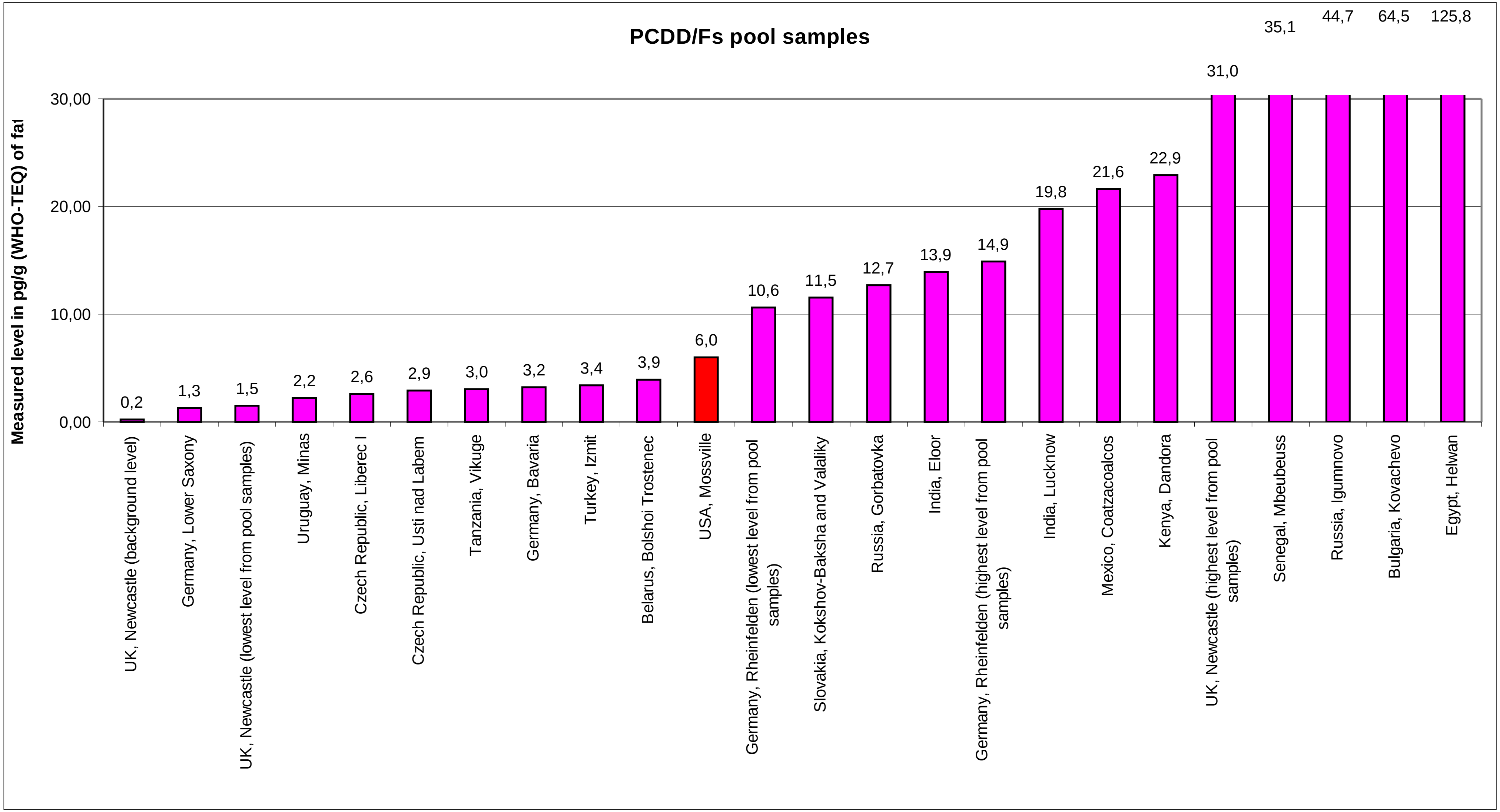
Annex 2: Mean values found within different groups of eggs from different parts of world

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
UK, Newcastle	2002	free range	5,50	Pless-Mulloli, T. et al. 2003b
USA, Mossville	2005	free range	5,97	Axys Varilab 2005
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
15,00
10,00
5,00
0,00
18,5
42,5
0,6
0,5
1,3
1,5
2,6
5,5
6,0
7,7
9,9
12,7
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
UK, Newcastle
USA, Mossville
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
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
USA, Mossville	2005	free range	6/1 pool	5,97	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

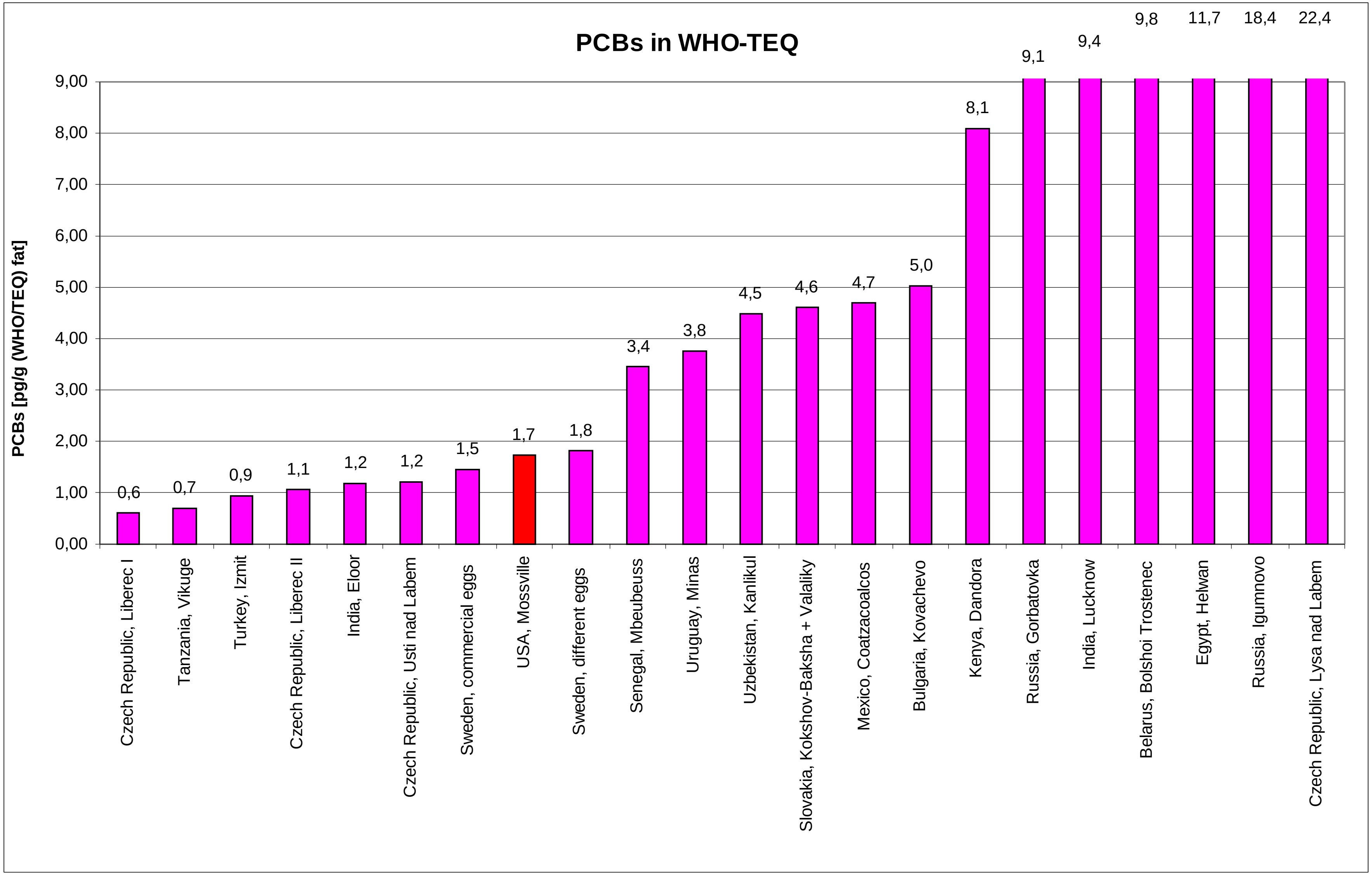


PCDD/Fs pool samples
Measured level in pg/g (WHO-TEQ) of fat
30,00
20,00
10,00
0,00
0,2
1,3
1,5
2,2
2,6
2,9
3,0
3,2
3,4
3,9
6,0
10,6
11,5
12,7
13,9
14,9
19,8
21,6
22,9
31,0
35,1
44,7
64,5
125,8
UK, Newcastle (background level)
Germany, Lower Saxony
UK, Newcastle (lowest level from pool samples)
Uruguay, Minas
Czech Republic, Liberec I
Czech Republic, Usti nad Labem
Tanzania, Vikuge
Germany, Bavaria
Turkey, Izmit
Belarus, Bolshoi Trostenec
USA, Mossville
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

.

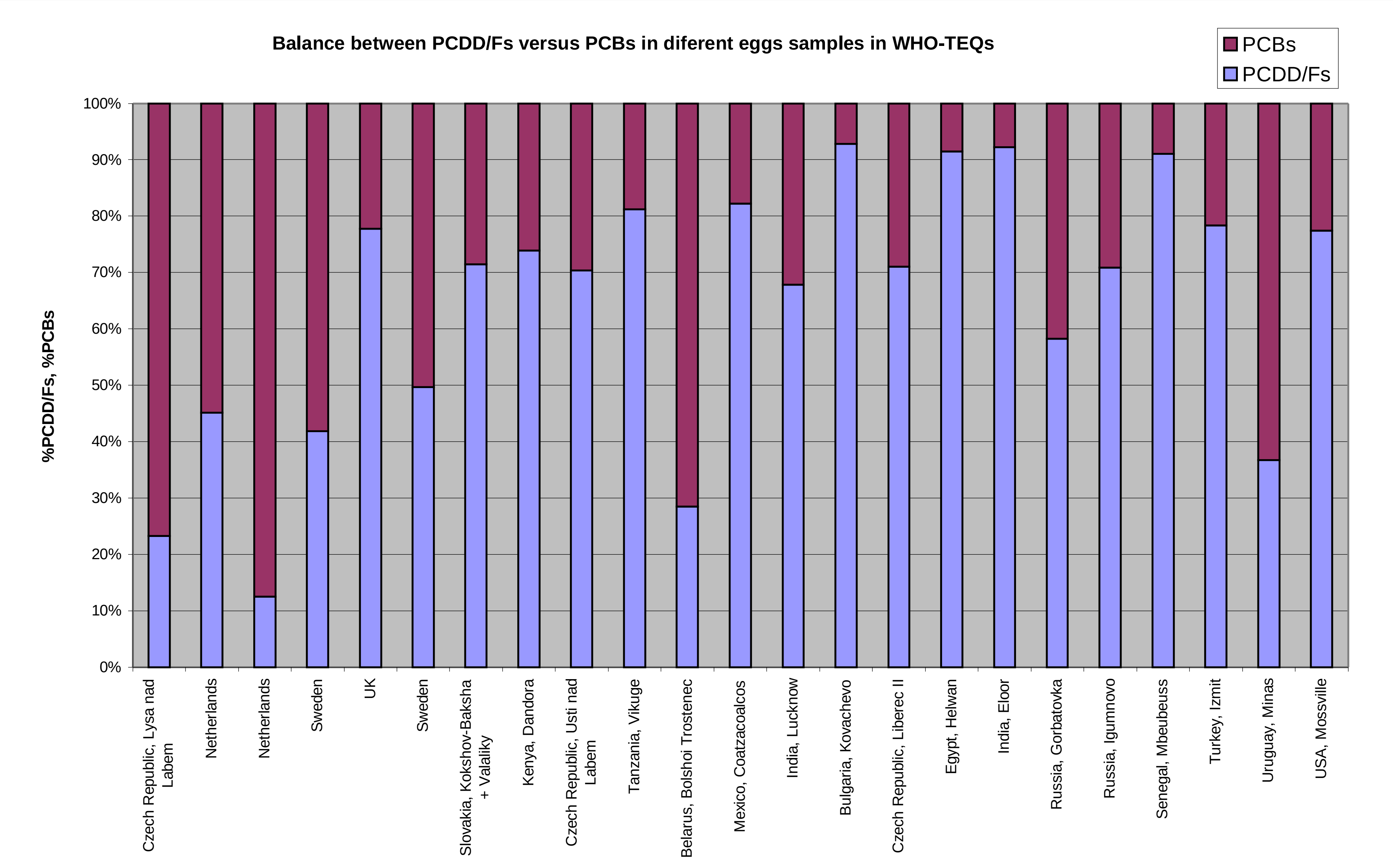
Annex 4: Levels of PCBs in WHO-TEQ in different chicken eggs samples from different parts of world

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
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, Mossville	2005	free range	6/1 pool	1,74	Axys Varilab 2005
Sweden, different eggs	1993	mixed	84/7 pools	1,82	SCOOP Task 2000
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
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]
9,00
8,00
7,00
6,00
5,00
4,00
3,00
2,00
1,00
0,00
0,6
0,7
0,9
1,1
1,2
1,2
1,5
1,7
1,8
3,4
3,8
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
Turkey, Izmit
Czech Republic, Liberec II
India, Eloor
Czech Republic, Usti nad Labem
Sweden, commercial eggs
USA, Mossville
Sweden, different eggs
Senegal, Mbeubeuss
Uruguay, Minas
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
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



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
Russia, Gorbatovka
Russia, Igumnovo
Senegal, Mbeubeuss
Turkey, Izmit
Uruguay, Minas
USA, Mossville

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