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Contamination of chicken eggs from Kovachevo, Bulgaria by dioxins, PCBs and hexachlorobenzene

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"Keep the Promise, Eliminate POPs!" Campaign Report

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Executive Summary

Free-range chicken eggs collected in Kovachevo, Bulgaria showed some of the highest levels of dioxins ever measured in chicken eggs. Dioxins in eggs from Kovachevo exceeded European Union (EU) limits by more than 20-fold. Levels of PCBs in eggs exceeded the proposed EU limit by more than 2-fold. Finally, the eggs exceeded the proposed EU limit for WHO-TEQ values. To our knowledge, this study represents the first data about U-POPs in chicken eggs from Bulgaria.

Considering the dioxin congener pattern in the eggs dominated by PCDF, the most obvious dioxin source is combustion of chlorine-containing materials. Additional sources are also possible. Based on prevailing winds, the thermal power plant, Maritza East 2, could be a major source. Another smaller source could be the burning of used tires in a coal mine boiler and an obsolete pesticides stockpile since relatively high levels of DDT were also observed.

High levels of dioxins in eggs are consistent with the results of the national POPs inventories (based on theoretical calculations) for year 2001[1] and 2002 [2] in which thermal power plants are accounted for 51% and 49% respectively of the total dioxins releases in the country.[a] On the other hand, taking into account comparison with patterns from brown coal burning sources, the data also supports development of better monitoring of unintentionally produced persistent organic pollutants (U-POPs) sources in general. Calculations of dioxin releases based on emissions factors cannot substitute for rigorous monitoring and data collection.

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. Bulgaria is a Party to Convention since it ratified the Treaty in December 2004. The Convention mandates Parties to take specific actions aimed at eliminating these pollutants from the global environment. We view the Convention text as a promise to take the actions needed to protect Bulgarian 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 Bulgarian 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) Levels of dioxins and PCBs in this pooled sample of eggs supports calls for a larger monitoring study which would be focused on all U-POPs levels in the environment of the Stara Zagora region and possibly from some other parts of the country;

2) The heavy burden of U-POPs that already exists in the region argues against constructing any new sources of U-POPs; calls for measurements of existing ones; and should trigger clean up of any historically contaminated sites by POPs in the region using a non-combustion technology;

3) More publicly accessible data about U-POPs and other toxic chemical releases from industry complexes in Bulgaria are needed.

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[a] using the data from EIA document on National Hazardous Waste Treatment Center, Maritza East 2 is accounted for 20% of the total dioxins air emissions in the country

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. Bulgaria ratified the Convention in December 2004.

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

The International POPs Elimination Network (IPEN) asked whether free-range chicken eggs might contain U-POPs if collected near potential sources of U-POPs named by the Stockholm Convention. The industrialized area near the city of Radnevo in the Stara Zagora region was selected as a sampling site since the Executive Environmental Agency (Bulgarian EPA) noted several dioxins releasing hot spots in the area near the village of Kovachevo.[3] 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 to our knowledge reflects the first data about U-POPs in chicken eggs from Bulgaria.

Materials and Methods

Please see Annex 1.

Results and Discussion

U-POPs in eggs sampled in Kovachevo, Bulgaria

The results of the analysis of a pool sample of 6 eggs collected within a distance of 4.5 km from the Maritsa East 2 thermal power plant in the Stara Zagora region are summarized in Tables 1 and 2. Note that this area is close to the potential location of a New Hazardous Waste Center. Pooled sample fat content was measured at 12.1%.

Free-range chicken eggs collected in Kovachevo showed one of the highest levels of dioxins ever measured in chicken eggs. Dioxins in eggs from Kovachevo were more than 20 times higher than the European Union (EU) limit. Level of PCBs in eggs exceeded the proposed EU limit by 2.5-fold. In addition, the levels of HCB were among the higher levels measured in IPEN's global sampling project. Finally, high levels of DDT were found in the samples with the measured sum equal to 547.11 ng/g of fat,[4] what is level exceeding the EU limit for sum of DDT in eggs (500 ng/g of fat).[b] To our knowledge, this study represents the first data about U-POPs in chicken eggs from Bulgaria.

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

Table 1: Measured levels of POPs in eggs collected in Kovachevo near Stara Zagora (Bulgaria) per gram of fat.

	Measured level	Limits	Action level
PCDD/Fs in WHO-TEQ (pg/g)	64.54	3.0[a]	2.0[b]
PCBs in WHO-TEQ (pg/g)	5.03	2.0[b]	1.5[b]
Total WHO-TEQ (pg/g)	69.57	5.0[b]	-
PCB (7 congeners) (ng/g)	3.04	200[c]	-
HCB (ng/g)	25.50	200[d]	-

Abbreviations: WHO, World Health Organization; TEQ, toxic equivalents; pg, picogram; 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 exceeded the limit for commercial eggs in the USA by almost 8-fold. 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 samples collected in Kovachevo (Bulgaria) exceeded this cancer risk level.[c]

Table 2: Measured levels of POPs in eggs collected in Kovachevo near Stara Zagora (Bulgaria) per gram of egg fresh weight.

	Measured level	Limits	Action level
PCDD/Fs in WHO-TEQ (pg/g)	7.81	1[a]	-
PCBs in WHO-TEQ (pg/g)	0.61	-	-
Total WHO-TEQ (pg/g)	8.42	-	-
PCBs (7 congeners) (ng/g)	0.37		
HCB (ng/g)	3.09	-	-

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

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

To our knowledge, the measurements of U-POPs in this study represent the first data on U-POPs in chicken eggs ever reported in Bulgaria. 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 monitoring in the region Stara Zagora. The data also argue against further burdening this region with any new U-POPs sources such as a proposed large hazardous waste incinerator for the National Hazardous Waste Center.

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[c] 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 ITEQ[c, c]

Comparison with other studies of eggs

We compared the levels of PCDD/Fs measured in this study in eggs from Kovachevo, Bulgaria 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,[5] Kenya,[6] Czech Republic,[7] Belarus,[8] India (Uttar Pradesh),[9] Tanzania,[10] Senegal,[11] Mexico[12] and Turkey[13] released since 21 March 2005. Dioxins levels in the eggs sampled from Kovachevo are much higher than all of those presented in previous reports prepared as a part of an IPEN project focused on eggs sampling. To compare these data please see the Annex 3, which shows that eggs from Kovachevo were two times higher than levels of dioxins in eggs from Mbeubeuss in Senegal (near mixed wastes landfill) and by three times higher than levels found in eggs sampled near the Dandora dumpsite (Kenya), near the Pajaritos petrochemical complex in Mexico, and/or in the city of Lucknow in Uttar Pradesh (India). We also compared the measured levels of dioxins in eggs from Kovachevo with the maximum levels reported to date in chicken eggs around the world (see Annex 4).

Eggs from Kovachevo appear to contain the sixth highest levels of dioxins ever measured in eggs. The highest levels were found in Belgium at the time of the dioxin scandal in 1999 where levels reached 713.1 pg WHO-TEQ/g of fat.[14] The second highest levels were found in Rheinfelden in 1992 within the area contaminated by chemical production (514 pg WHO-TEQ/g of fat).[15] Other highly contaminated samples include Pontypool (92.31 pg WHO-TEQ/g of fat)[16] and dioxins found in the among eggs sampled in the neighborhood of an old waste incinerator in Maincy (France) shut down in 2002 (121.55 pg WHO-TEQ/g of fat).[17] Eggs from Kovachevo contain dioxin levels similar to those sampled in Oroville, California (USA) (69.2 and 53.9 pg WHO-TEQ/g of fat) at a place contaminated due to a pentachlorophenol application facility.[18]

It is clear that dioxins represent the most serious contaminant in the sampled eggs from Kovachevo. PCDD/Fs contribute more than 90% of the whole TEQ value in eggs as visible from graph in Annex 6. Despite this substantial contribution of dioxins, levels of PCBs and HCB are not negligible as shown in Annexes 5 and 7. Levels of PCBs in WHO-TEQs are much lower than those found in eggs from Lysa nad Labem in the Czech Republic.[19] They are also lower than in eggs from Bolshoi Trostenec in Belarus (dumpsite area)[20] and/or in Lucknow in India (city with several medical waste incinerators),[21] but are higher than in eggs from Usti nad Labem in the Czech Republic.[22] Comparable levels of PCBs in WHO-TEQs were found in Kokshov-Baksha (Slovakia)[23] and/or Coatzacoalcos (Mexico),[24] but also in organic farms in Netherlands.[25] HCB in eggs from Kovachevo exceed background levels (1 ng/g of fat) by more than 25-fold (see Annex 7). The sum of seven PCBs congeners sum was very low in comparison to other countries.[26]

Possible U-POPs sources

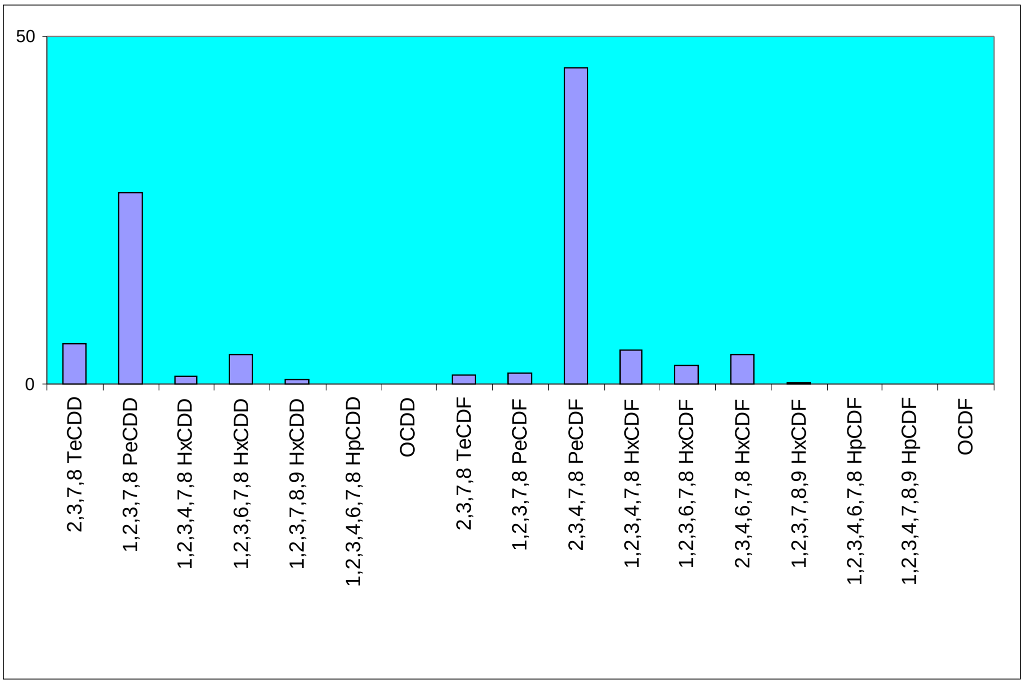
The high levels of U-POPs in free range chicken eggs in these samples provoke the question of possible sources. There are several potential sources of dioxins, PCBs and HCB as by-products within the surrounding of the village Kovachevo.

The nearest potential U-POPs sources to sampling place are thermal power plants, a briquettes production facility Brikel (15 km south west from Kovachevo next to town Galabovo), a heating boiler occasionally used to burn tires, as well as local heating sources and an obsolete pesticides stockpile. See also the map at Picture There are more potential U-POPs sources located in the Stara Zagora region including burning household waste at Radnevo's landfill (located on the east edge of the town) and Agrobiochim, an abandoned chemical plant.

Table 3: Results of PCDD/Fs analysis in a pool sample of 6 eggs collected in Kovachevo village in Bulgaria.[27]

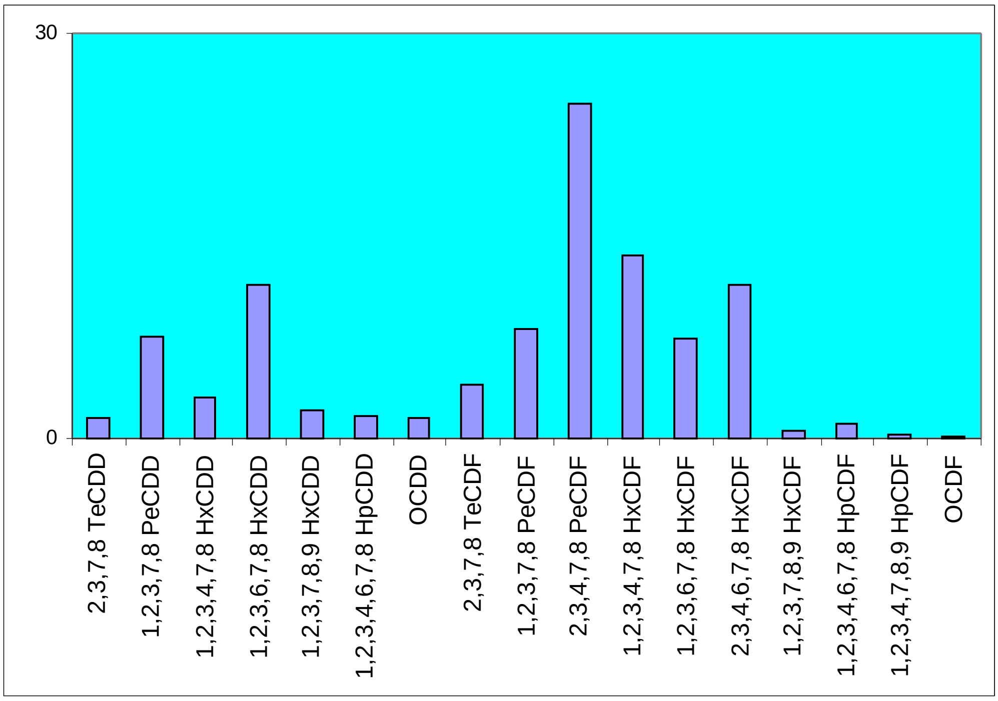
PCDD/Fs congeners	WHO-TEF	Values in pg/g of fat in WHO-TEQ	Values in pg/g of fat
2,3,7,8 TeCDD	1	3.70	3.70
1,2,3,7,8 PeCDD	1	17.80	17.80
1,2,3,4,7,8 HxCDD	0.1	0.71	7.10
1,2,3,6,7,8 HxCDD	0.1	2.71	27.10
1,2,3,7,8,9 HxCDD	0.1	0.49	4.90
1,2,3,4,6,7,8 HpCDD	0.01	0.04	4.00
OCDD	0.0001	0.00035	3.50
2,3,7,8 TeCDF	0.1	0.94	9.40
1,2,3,7,8 PeCDF	0.05	0.95	19.00
2,3,4,7,8 PeCDF	0.5	29.35	58.70
1,2,3,4,7,8 HxCDF	0.1	3.22	32.20
1,2,3,6,7,8 HxCDF	0.1	1.75	17.50
2,3,4,6,7,8 HxCDF	0.1	2.71	27.10
1,2,3,7,8,9 HxCDF	0.1	0.14	1.40
1,2,3,4,6,7,8 HpCDF	0.01	0.027	2.70
1,2,3,4,7,8,9 HpCDF	0.01	0.0068	0.68
OCDF	0.0001	0.000031	0.31

Picture 1: Graph showing a PCDD/Fs pattern in eggs from Kovachevo expressed in WHO-TEQs (% of congeners from whole PCDD/Fs WHO-TEQ).

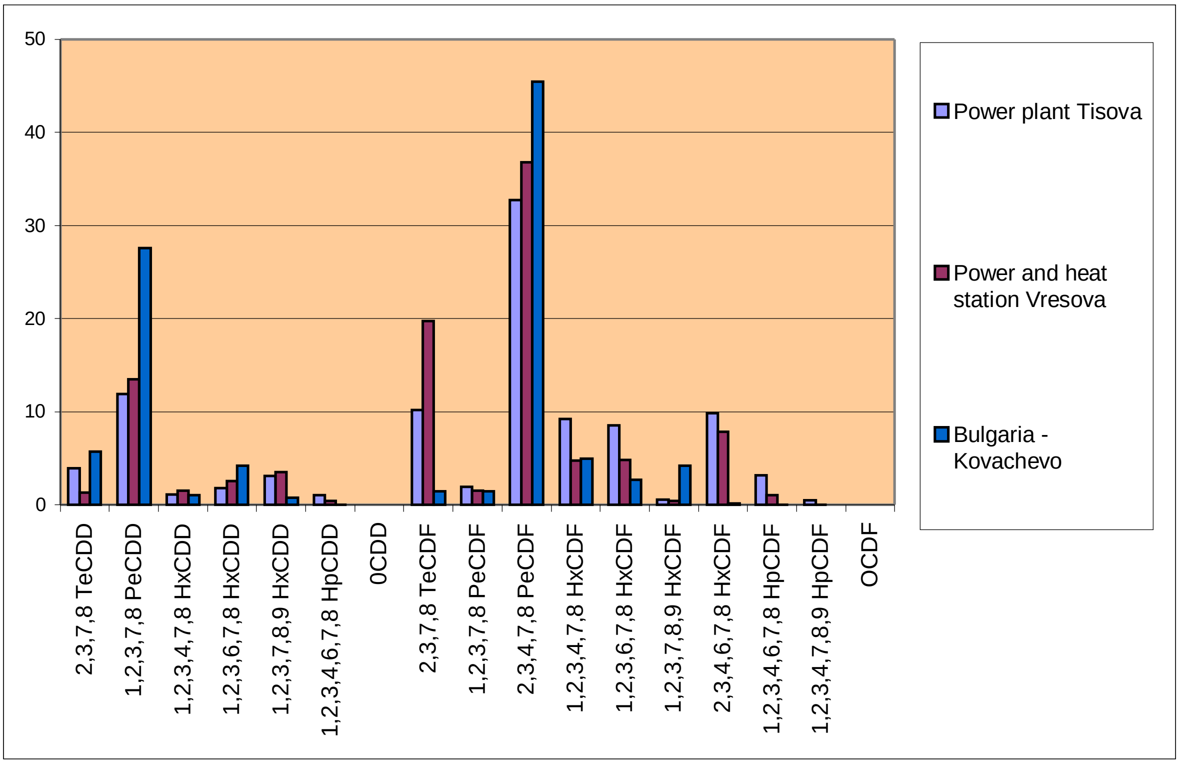


Tracking the source of dioxins in eggs can be aided by comparing the pattern of congeners in the samples with those in the sources. Unfortunately, dioxin air emissions from all potential sources measurements in the region are not available for the comparison. However, congener patterns for brown coal burning sources are available from the Czech Republic. A comparison of eggs and these sources patterns in TEQ levels is shown in the graph in Picture 3.

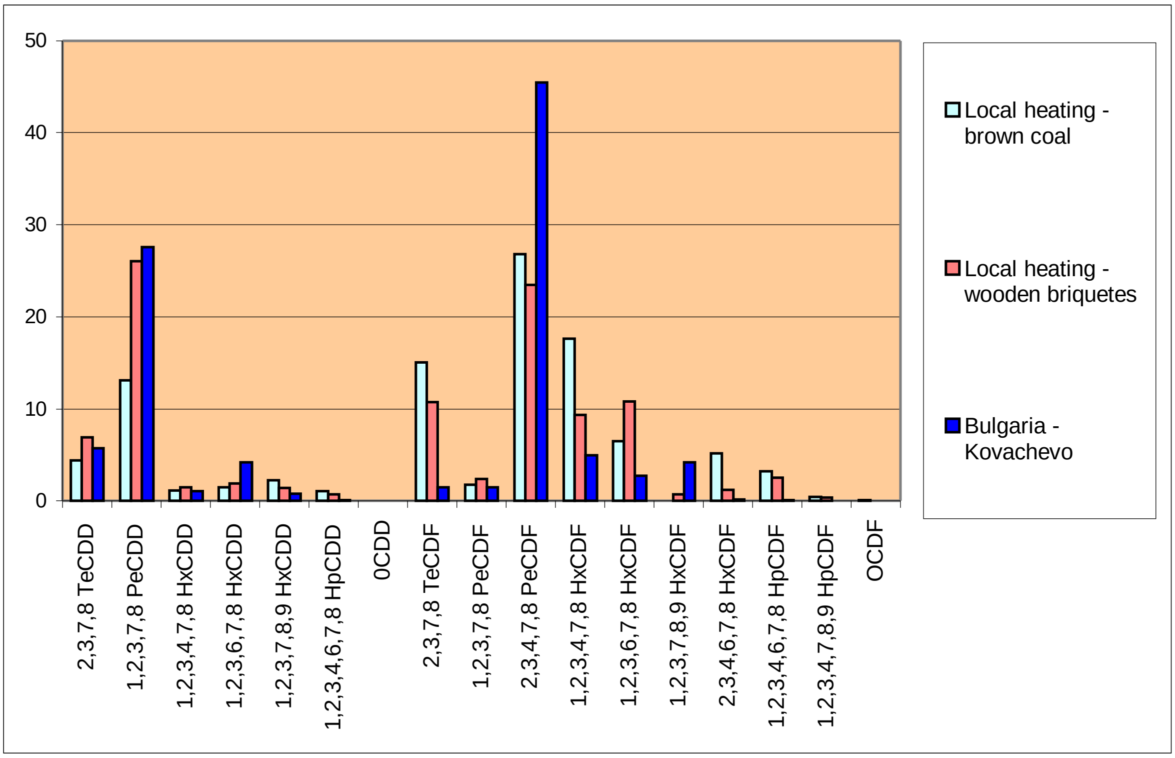
Picture 2: Graph showing a PCDD/Fs pattern in eggs from Kovachevo expressed in absolute levels of 17 PCDD/Fs congeners.



Picture 3: Comparison of PCDD/Fs pattern in eggs from Kovachevo expressed WHO-TEQs with patterns of Czech brown coal burning power plants.



Picture 4: Comparison of PCDD/Fs pattern in eggs from Kovachevo expressed WHO-TEQs with patterns of the local heating sources measured in the Czech Republic.



followed by 1,2,3,7,8 PeCDD and 1,2,3,6,7,8 HxCDD if expressed in total levels not including the WHO-TEQ values (see Picture 2). The PCDD/Fs pattern expressed in WHO-TEQs is shown on graph in Picture 1 and all 17 measured PCDD/Fs congeners levels are shown in Table 3. Comparing the pattern with the data measured for Czech brown coal burning power plants is shown in Picture 3. We can not state that these patterns are same, but they are not completely different. In addition, the patterns of local heating from the Czech Republic are not the same or completely different (see Picture 4). Most likely there will be more sources contributing to the dioxins contamination found in eggs. Based on prevailing winds (see Picture 5), the Maritza East 2 thermal power plant could be a major dioxin source. [d] The obsolete pesticides storage near one of sampling places could also play a role (see relatively high level of DDT found in eggs) since pesticides are known to be a significant source of dioxins and furans as by-products.[28] The burning of used tires in a coal mine boiler can be locally a significant source of dioxins as well.

It is also important to consider the spread of pollutants from Maritza East 2. Because of the large volume of exhausted gases, their high speed when leaving the stacks, and the high stack heights at over 300m, air emissions do not fall only in the region of Maritza East, but cover other areas and regions.[29]

Level of dioxins and PCBs in this pooled eggs sample support calls for a larger monitoring study which would be focused on all U-POPs levels in the environment of the Stara Zagora region and possibly also from some other parts of the country. High levels of dioxins in eggs are consistent with the results of the national POPs inventories (based on theoretical calculations) for year 2001[30] and 2002 [31] in which thermal power plants are accounted for 51% and 49% respectively of the total dioxins

[d] using the data from EIA document on National Hazardous Waste Treatment Center, Maritza East 2 is accounted for 20% of the total dioxins air emissions in the country

releases in the country. On the other hand, taking into account comparison with patterns from brown coal burning sources, the data also supports development of better monitoring of unintentionally produced persistent organic pollutants (U-POPs) sources in general. Calculations of dioxin releases based on emissions factors cannot substitute for rigorous monitoring and data collection and data published here raise some doubts about real sources of dioxins in the region. (See also the following chapter.)

A lot of information about potential toxic chemicals releases are not either accessible to the public or are not known. For example, U-POPs releases are not mostly measured in Bulgaria.

The data presented in this study strongly argues against building the National Hazardous Waste Center in this region that would included a waste incinerator. The Center would add even more dioxins and possibly other UPOPs to an already overburdened region. In contrast, the Bulgarian national POPs pesticides inventory suggested that obsolete pesticides should be destroyed by incineration in the proposed Center. This would only add to the high levels of UPOPs in Kovachevo. Pesticides should be preferably destroyed by non-combustion technologies that do not create POPs.[32]

More information about the surrounding of the village Kovachevo and potential POPs sources in its area

The village of Kovachevo is located in a valley of a hilly plain. The Maritza East 2 thermal power plant is 4.5 km away in the northeast direction occupying an area of 164 ha and surrounded by settlements in all directions: Radezki at 3.5 km, Maca, the town of Radnevo at 20km, etc. In the area are also: an artificial lake “Ovtcharitza” (an internationally protected ornithological site and wetland of national importance), brown coal mines “Troyanovo1”, “Troyanovo North” and “Troyanovo 3” (providing 80% of the country's coal), the thermal power plant “Maritza-East 3” and “Brikel” (producing electricity and briquettes).[33] For detailed situation see also map at Picture 6.

The main water source for the industrial needs of Maritza East 2 is the Ovtcharitza River, flowing southwest. However, the village of Kovatchevo water supply for industrial and household purposes comes from three drilling points. A possible pollution pathway is waste water, contaminated with used industrial oils, containing PCBs. A major source of dust emissions is the temporary deposition site, to which fly and bottom ash from the power plant are transported by water. After drying, the ashes are transported to a permanent deposition site.

In addition, the coalmine has a small boiler for heating that sometimes burns used tires (according to information from the local inhabitants), but that is not a regular practice, and apparently the local citizens are planning to take action to stop this soon.

There is also an obsolete pesticides stockpile at the northeast edge of the village Kovachevo.[e]. The storage is abandoned. There are about 20 pierced rusty 20 litre tanks outside the building. The place has not been managed for many years.

A waste landfill with frequent open burning is located on the eastern edge of the town of Radnevo relatively close to Kovachevo (15 - 20 km). This could be additional source of U-POPs in the region. Another potential source would be an Agrobiochim chemical plant located 7 km east from Stara Zagora, which was shut down few years ago and produced caprolactam, nylon 6, MMA and PMMA, ammonia, nitric acid, ammonium nitrate, ammonium sulphate, urea and plant protection agents.[34] Caprolactam production was considered to be also a dioxins releases source. [35]

[e] 50 m northwest from the third chicken fancier (see Annex 1)

Data about POPs in the surroundings of Kovachevo

According to the Executive Environmental Agency, thermal power plants are among the greatest emitters of PCDD/Fs in the country. The estimated types and quantities of some POPs emitted by the three thermal power plants in the area are shown in Table 4.

Table 4. Types and quantities of some POPs in the region of Stara Zagora, Bulgaria. Source: EIA document for NHWC.[36]

Pollutant	Thermal Power Plant (TPP) 1	TPP 2	TPP 3
PAH t/y	0,0547	0,3512	0,1641
PCB's kg/y	3,0753	19,4329	9,0436
DIOX g/y	7,4661	47,3279	21,9545

Note: The numbers cited are for 2002, derived by calculation, not actual measurements.
The statistics provided here are only provisional and not yet formally confirmed, as the National POPs Inventory and the National Chemicals Management Profile, both of which are part of the UNEP/GEF project, have not been officially finalized yet, and further adjustments to the data might be expected. The numbers cited for HCBs, PCBs and dioxins and furans are based on the CORINAIR-94, SNAP-94 calculation method, specified by the Bulgarian legislation.[37]

According to the Executive Environmental Agency the highest level of dioxin/furan emissions for 2002 originates from the thermal power plant “Maritza East” 2, producing over 47 g I-TEQ/year [38] (more than 20% of the country’s total releases - see also Table 5). The second biggest PCDD/Fs polluter is thermal power plant “Maritza East” 3, situated in the same area, emitting almost 22 g I-TEQ/year (over 10% of the total estimated amount for Bulgaria). The fifth biggest emitter, “Brikel”, an industrial plant for briquette production, is also located in the region of Stara Zagora, near the town of Gulubovo. Collectively, the three thermal power plants emitted almost 40% of all dioxins/furans released in 2002 according to National POPs Inventory and the National Chemicals Management Profile and EIA document for NHWC.[39,40]In addition, there are three open coal mines in the vicinity.

Table 5: Air polluting emissions of specific organic pollutants in the ambient air in 2001, listed by source categories. Source: EEA 2002.[41]

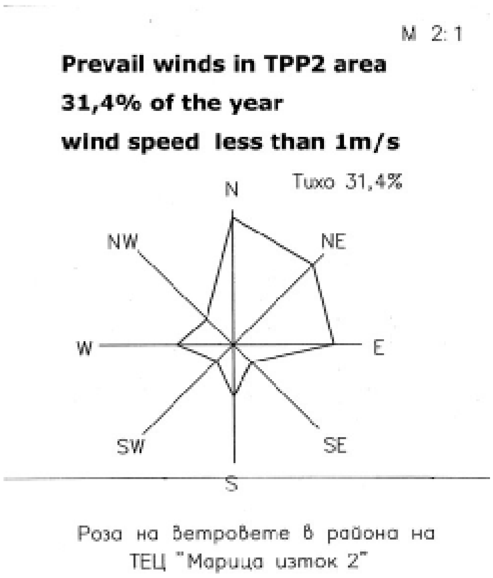
Groups of emission sources	Polyaromatic hydrocarbons t/y	Dioxins and furans g/y
N1.TPP (thermal power plants)	7.877	102.049
N2.Domestic burning	39.811	44.920
N3.Combustion processes in industry (incl. energy generation)	1.227	8.325
N4.Non-combustion production processes	16.984	20.464
N5. Extraction and processing of fossil fuels	-	-
N6. Use of solvents	-	-
N7. Road transport	28.908	6.241
N8.Another kind of transport	2.526	11.494
N9. Waste treatment and depositing	0.005	7.362
N10. Agriculture	-	-
N11. Natural sources	-	-
Total	**97.338**	**200.855**

Za Zemiata didn't find any publicly accessible health study for the Kovachevo larger area.[42] However, according to unofficial information, some internal health checks have been performed among the workers in the coal mines and the TPPs. The general information available states that there is a rather high rate of disease among adult population.

There is a plan to construct a National Hazarodous Waste Treatment Centre (NHWC) in the same area (3 km from Kovatchevo village) will create yet another source of POPs in an already heavily polluted area. In that case, over 21,000 people living within 10 km from the proposed site for the NHWTC would be affected.

A diagram of pollution dispersion is only available for SO_2 emissions from TPP Maritza East 2. [43] A scheme of the prevailed winds can be seen in Picture 5.

Picture 5: Prevail winds for the surrounding of Kovachevo and the area of Maritza East 2. Source: Energprojekt 2004. [44]



U-POPs and the Stockholm Convention

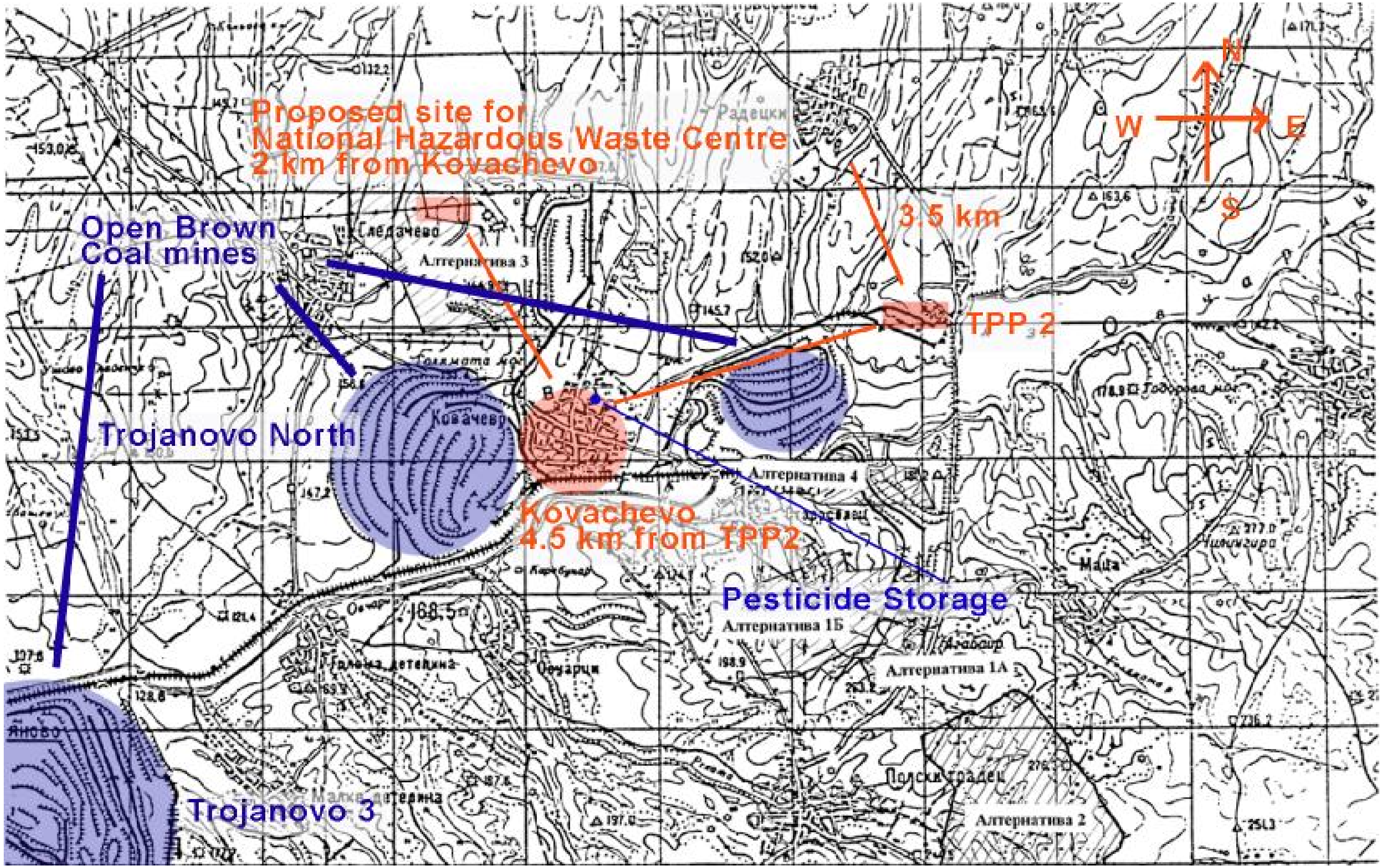
The U-POPs measured in this study are slated for reduction and elimination by the Stockholm Convention which holds its first Conference of the Parties in May 2005. Bulgaria ratified the Convention in December 2004.

The Convention mandates Parties to take specific actions aimed at eliminating these pollutants from the global environment. Parties are to require the use of substitute or modified materials, products and processes to prevent the formation and release of U-POPs.[f] 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).[g] In addition, Parties are to promote both BAT and best environmental practices (BEP) for all new and existing significant source categories,[h] 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.[i] 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 Bulgarian 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 Bulgarian governmental representatives and all stakeholders to honor the integrity of the Convention text and keep the promise of reduction and elimination of POPs.

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

Picture 6: Map showing the village Kovachevo larger surrounding. There is a plan to build a new U-POPs source - large hazardous waste incinerator marked as NHWC (National Hazardous Waste Center).



Annex 1. Materials and Methods

Sampling

For sampling in Bulgaria we have chosen the village of Kovachevo. Kovachevo is located in a very industrialized region of Stara Zagora. This village is surrounded by coal mines and thermal power plants and the area was pointed out by state institutions as a POPs hot spot.

Eggs were sampled from 3 chicken fanciers. 14 eggs in total were sampled from 3 different spots in the village: 6 from the middle of the village, 6 from the back end, close to the coal mine, and only 2 (no more available) from the entrance of the village, close to a storage for obsolete pesticides and to an intensively used road (40 passanger busses several times a day). For U-POPs analysis were chosen 2 eggs from each part of village - 6 all together. The hens from which the eggs were picked were all free-range although occasionally by different feeding stuffs. In case of the first chicken fancier: a mix of wheat, barley, chickpeas, soy, and a special component to increase laying of eggs (from the shop). The second chicken fancier uses locally grown wheat to feed chicken and third one feeds them by locally grown wheat and grains. The hens can easily access soil organisms in all three areas. The range covered by the chickens differ in all three fanciers and is as follows: 1. 30 m^2 (winter), 200 m^2 (other seasons); 2. 5000 m^2; 3. 40 m^2.

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 Za Zemiata (For the Earth) at 18 January 2005. The eggs were kept in cool conditions after sampling and then were boiled in Sofia by Za Zemiata for 7 - 10 minutes in pure water and transported by express bus to the laboratory at ambient temperature.

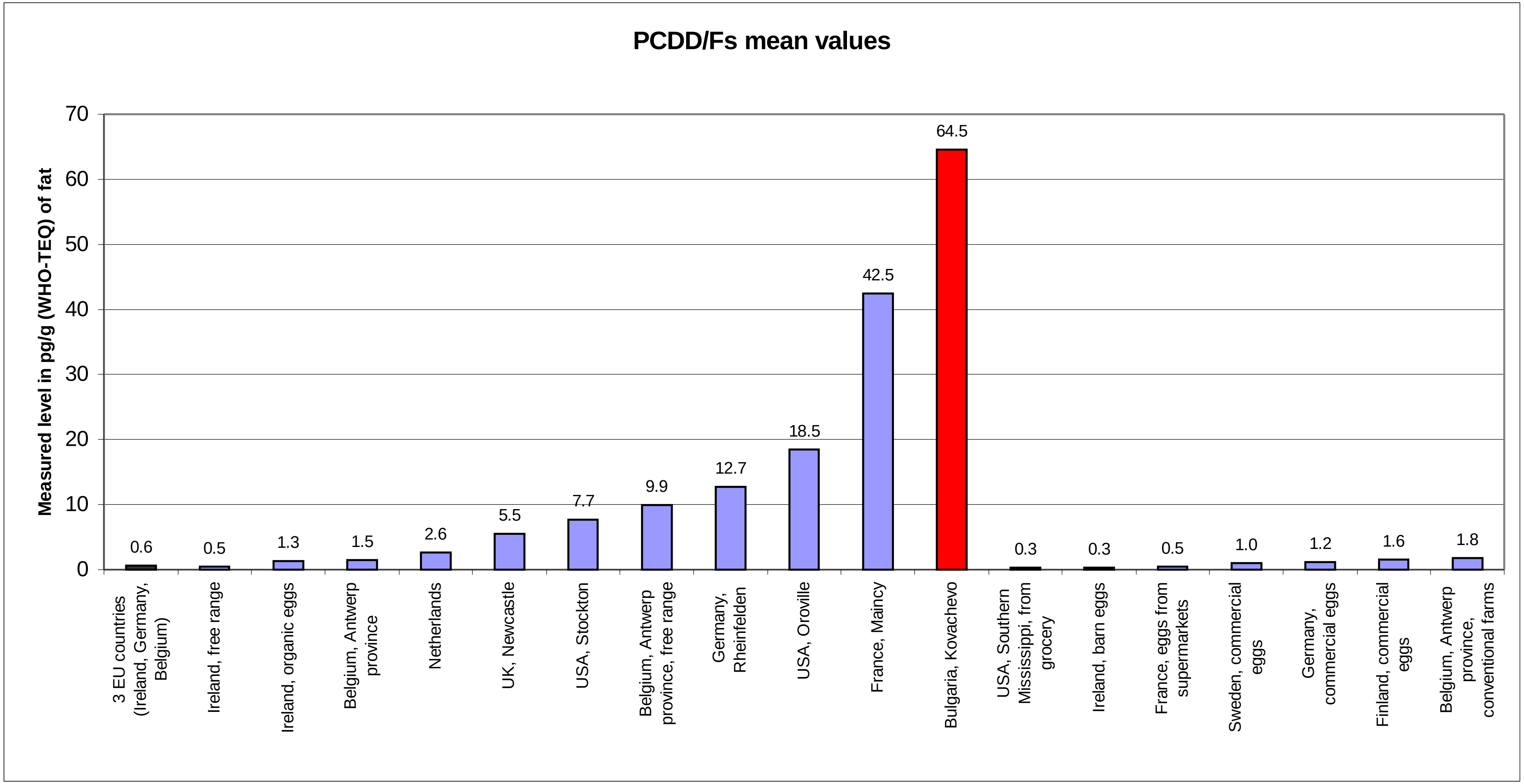
Analysis

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

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

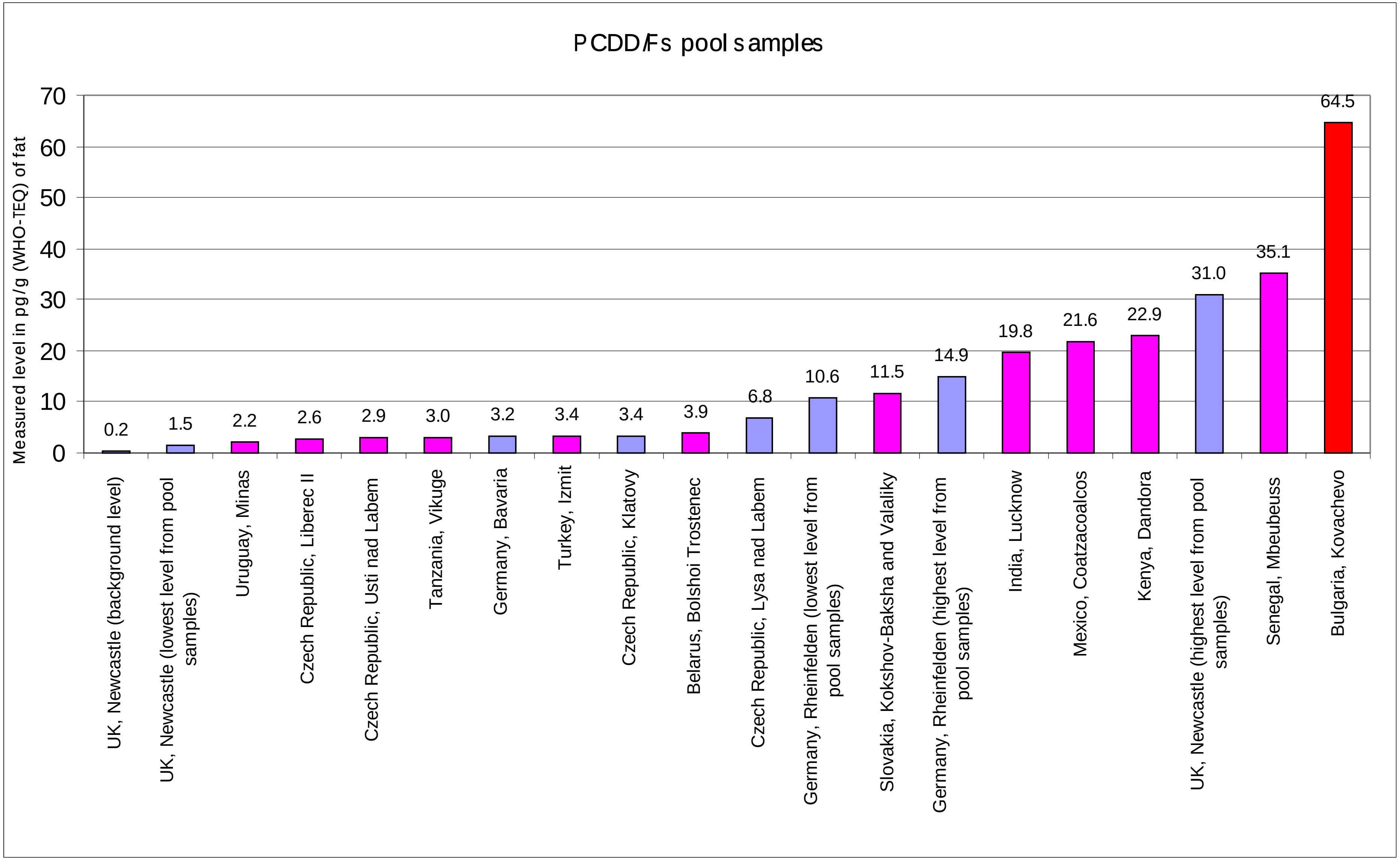
Annex 2: Mean values found within different groups of eggs from different parts of world

Country/locality	Year	Group	Measured level in pg/g (WHO-TEQ) of fat	Source of information
3 EU countries (Ireland, Germany, Belgium)	1997-2003	both	0.63	DG SANCO 2004
Ireland, free range	2002-2005	free range	0.47	Pratt, I. et al. 2004, FSAI 2004
Ireland, organic eggs	2002-2005	free range	1.30	Pratt, I. et al. 2004, FSAI 2004
Belgium, Antwerp province	2004	free range	1.50	Pussemeier, L. et al. 2004
Netherlands	2004	free range	2.60	SAFO 2004
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
Bulgaria, Kovachevo	2005	free range	64.54	Axys Varilab 2005
USA, Southern Mississippi, from grocery	1994	not free range	0.29	Fiedler, H. et al. 1997
Ireland, barn eggs	2002-2005	not free range	0.31	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
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
0
10
20
30
40
50
60
70
0.6
0.5
1.3
1.5
2.6
5.5
7.7
9.9
12.7
18.5
42.5
64.5
0.3
0.3
0.5
1.0
1.2
1.6
1.8
3 EU countries (Ireland, Germany, Belgium)
Ireland, free range
Ireland, organic eggs
Belgium, Antwerp province
Netherlands
UK, Newcastle
USA, Stockton
Belgium, Antwerp province, free range
Germany, Rheinfelden
USA, Oroville
France, Maincy
Bulgaria, Kovachevo
USA, Southern Mississippi, from grocery
Ireland, barn eggs
France, eggs from supermarkets
Sweden, commercial eggs
Germany, commercial eggs
Finland, commercial eggs
Belgium, Antwerp province, conventional farms

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

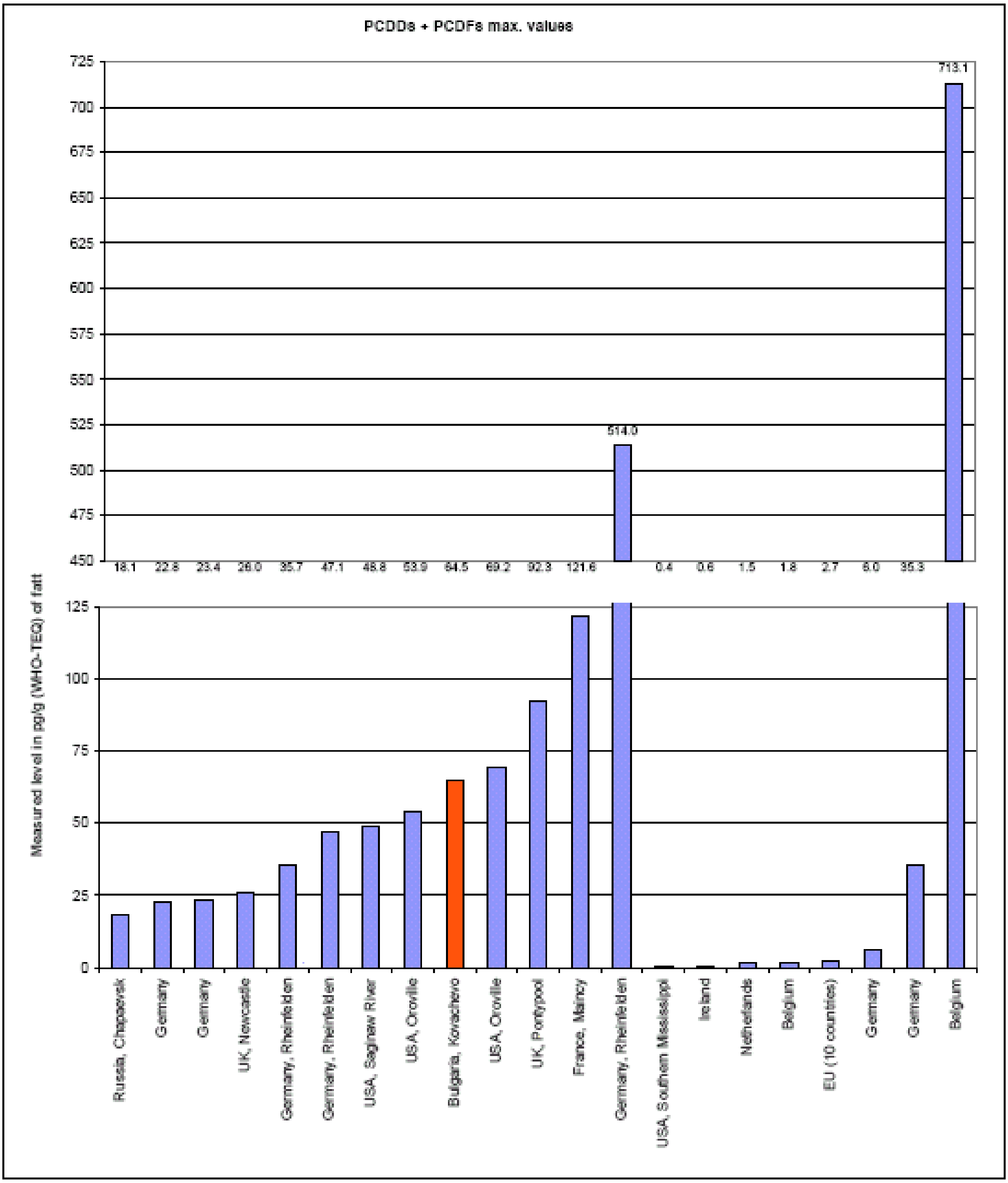
Country/locality	Year	Group	Number of eggs/measured samples	Measured level in pg/g (WHO-TEQ) of fat	Source of information
UK, Newcastle (background level)	2000	free range	3/1 pool	0.20	Pless-Mulloli, T. et al. 2001
UK, Newcastle (lowest level from pool samples)	2000	free range	3/1 pool	1.50	Pless-Mulloli, T. et al. 2001
Uruguay, Minas	2005	free range	8/1 pool	2.18	Axys Varilab 2005
Czech Republic, Liberec II	2005	free range	3/1 pool	2.63	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
Czech Republic, Klatovy	2003	free range	12	3.40	Beranek, M. et al. 2003
Belarus, Bolshoi Trostenec	2005	free range	6/1 pool	3.91	Axys Varilab 2005
Czech Republic, Lysa nad Labem	2004	free range	4	6.80	Petrlik, J. 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
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
Bulgaria, Kovachevo	2005	free range	6/1 pool	64.54	Axys Varilab 2005


PCDD/Fs pool samples
Measured level in pg/g (WHO-TEQ) of fat
0
10
20
30
40
50
60
70
0.2
1.5
2.2
2.6
2.9
3.0
3.2
3.4
3.4
3.9
6.8
10.6
11.5
14.9
19.8
21.6
22.9
31.0
35.1
64.5
UK, Newcastle (background level)
UK, Newcastle (lowest level from pool samples)
Uruguay, Minas
Czech Republic, Liberec II
Czech Republic, Usti nad Labem
Tanzania, Vikuge
Germany, Bavaria
Turkey, Izmit
Czech Republic, Klatovy
Belarus, Bolshoi Trostenec
Czech Republic, Lysa nad Labem
Germany, Rheinfelden (lowest level from pool samples)
Slovakia, Kokshov-Baksha and Valaliky
Germany, Rheinfelden (highest level from pool samples)
India, Lucknow
Mexico, Coatzacoalcos
Kenya, Dandora
UK, Newcastle (highest level from pool samples)
Senegal, Mbeubeuss
Bulgaria, Kovachevo

Annex 4: Maximum levels of dioxins (PCDD/Fs) in different groups of analyzed chicken eggs from different parts of world

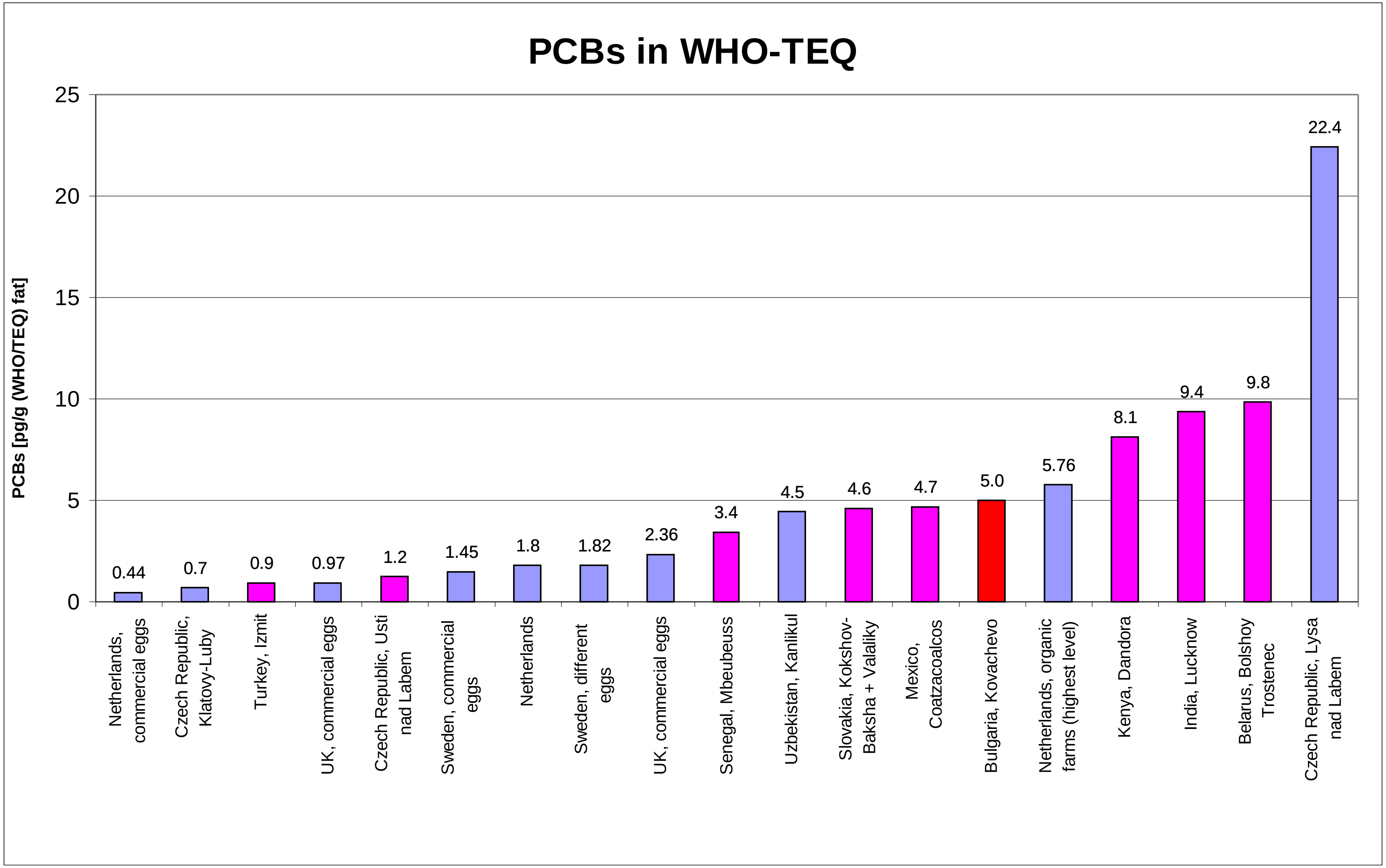
Country	Year	Group	Measured level in pg/g (WHO-TEQ) of fat	Source of information
Russia, Chapaevsk	1994	free range	18.1	Sotskov, U., P., Revich, B., A. et al. 2000
Germany	1995	free range	22.8	CLUA Freiburg 1995
Germany	1993	free range	23.4	Fuerst 1993
UK, Newcastle	2002	free range	26	Pless-Mulloli, T. et al. 2003b
Germany, Rheinfelden	1991	free range	35.7	Malisch, R. et al. 1996
Germany, Rheinfelden	1991	free range	47.1	Malisch, R. et al. 1996
USA, Saginaw River	2002	free range	48.76	MDCH 2003a
USA, Oroville	1994	free range	53.85	Harnly, M. E. et al. 2000
Bulgaria, Kovachevo	2005	free range	64.54	Axys Varilab 2005
USA, Oroville	1988	free range	69.23	Harnly, M. E. et al. 2000
UK, Pontypool	1993 - 1994	free range	92.31	Lovett, A. A. et al. 1998 *]
France, Maincy	2004	free range	121.55	Pirard, C. et al. 2004
Germany, Rheinfelden	1992	free range	514	Malisch, R. et al. 1996
USA, Southern Mississippi	1994	not free range	0.385	Fiedler, H. et al. 1997
Ireland	2002-2005	not free range	0.58	Pratt, I. et al. 2004, FSAI 2004
Netherlands	2004	not free range	1.5	Anonymus 2004
Belgium	1999	not free range	1.78	Niedersachsischen Ministerium fuer Ernaehrung, Landwirtschaft und Forsten 1999
EU (10 countries)	1990-99	not free range	2.67	Hansen, E., Hansen, C. L. 2003
Germany	1995	not free range	6.04	CLUA Freiburg 1995
Germany	1993 - 1996	not free range	35.292	Malisch, R. 1998
Belgium	1999	not free range	713.1	Larebeke, N. van et al. 2001

*] median level from 3 bantam chicken eggs samples measured close to hazardous waste incinerator


PCDDs + PCDFs max. values
Measured level in pg/g (WHO-TEQ) of fat
713.1
514.0
18.1
22.8
23.4
26.0
35.7
47.1
48.8
53.9
64.5
69.2
92.3
121.6
0.4
0.6
1.5
1.8
2.7
6.0
35.3
Russia, Chapaevsk
Germany
Germany
UK, Newcastle
Germany, Rheinfelden
Germany, Rheinfelden
USA, Saginaw River
USA, Oroville
Bulgaria, Kovachevo
USA, Oroville
UK, Pontypool
France, Maincy
Germany, Rheinfelden
USA, Southern Mississippi
Ireland
Netherlands
Belgium
EU (10 countries)
Germany
Germany
Belgium

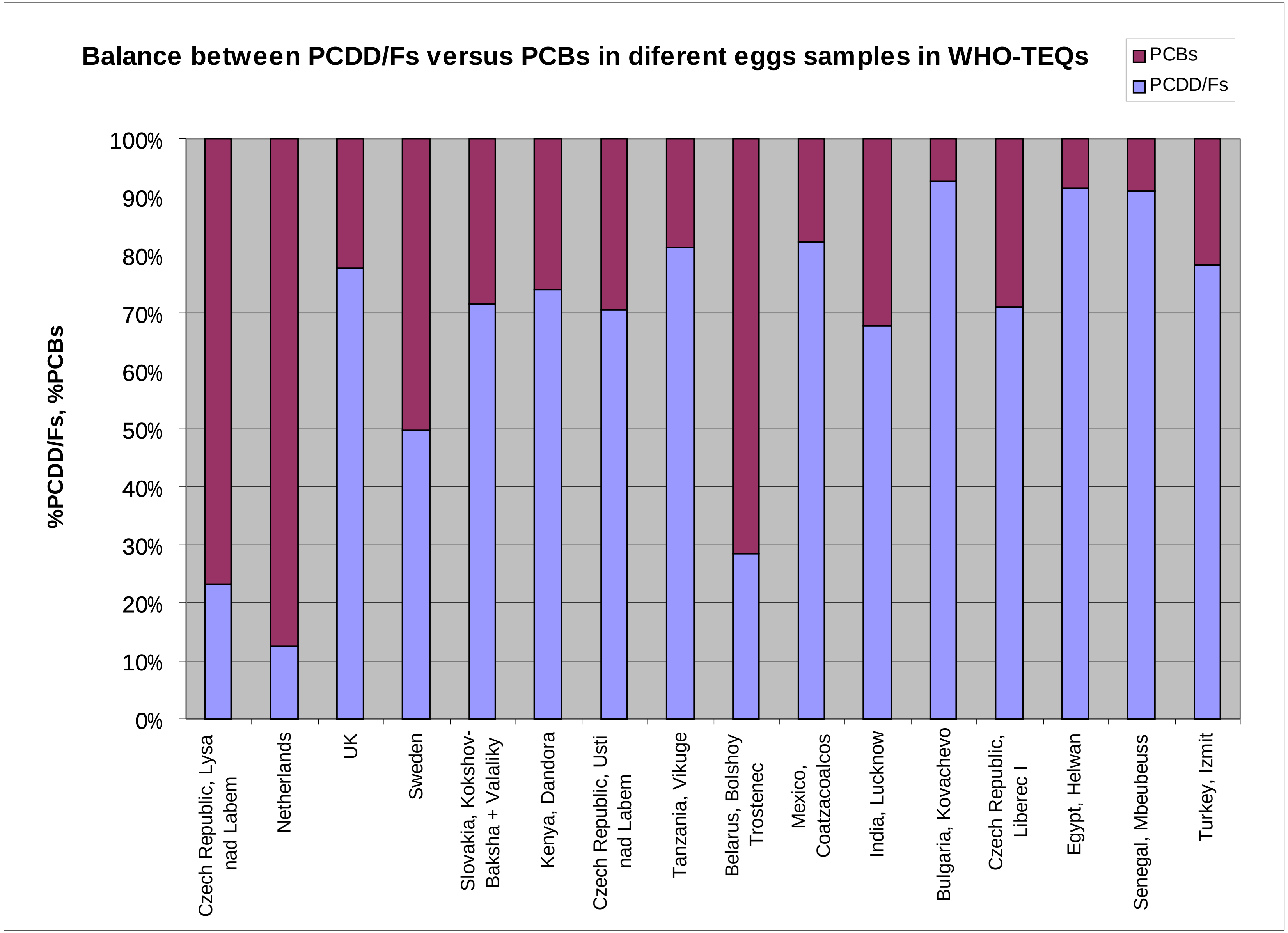
Annex 5: Levels of PCBs in WHO-TEQ in different chicken eggs samples from different parts of world

Country/locality	Year	Group	Number of measured samples	Specification	Measured level in pg/g (WHO-TEQ) of fat	Source of information
Netherlands, commercial eggs	1999	not free range	100/2 pools	pool, nonortho-PCBs	0.44	SCOOP Task 2000
Czech Republic, Klatovy-Luby	2003	free range	free range	individual	0.70	Beranek, M. et al. 2003
Turkey, Izmit	2005	free range	6/1 pooled	pool	0.90	Axys Varilab 2005
UK, commercial eggs	1992	not free range	24/1 pool	pool	0.97	SCOOP Task 2000
Czech Republic, Usti nad Labem	2005	free range	6/1 pool	pool	1.20	Axys Varilab 2005
Sweden, commercial eggs	1999	not free range	32/4 pools	pool	1.45	SCOOP Task 2000
Netherlands	1990	mixed	8/2 pools	pool, nonortho-PCBs	1.80	SCOOP Task 2000
Sweden, different eggs	1993	mixed	84/7 pools	pool	1.82	SCOOP Task 2000
UK, commercial eggs	1982	not free range	24/1 pool	pool	2.36	SCOOP Task 2000
Senegal, Mbeubeuss	2005	free range	6/1 pooled	pool	3.40	Axys Varilab 2005
Uzbekistan, Kanlikul	2001	free range	-	individual	4.50	Muntean, N. et al. 2003
Slovakia, Kokshov-Baksha + Valaliky	2005	free range	6/1 pool	pool	4.60	Axys Varilab 2005
Mexico, Coatzacoalcos	2005	free range	6/1 pooled	pool	4.70	Axys Varilab 2005
Bulgaria, Kovachevo	2005	free range	6/1 pooled	pool	5.00	Axys Varilab 2005
Netherlands, organic farms (highest level)	2002	free range	6	pool	5.76	Traag, W. et al. 2002
Kenya, Dandora	2004	free range	6/1 pool	pool	8.10	Axys Varilab 2005
India, Lucknow	2005	free range	4/1 pooled	pool	9.40	Axys Varilab 2005
Belarus, Bolshoy Trostenec	2005	free range	6/1 pool	pool	9.80	Axys Varilab 2005
Czech Republic, Lysa nad Labem	2004	free range	4	pool	22.40	Petrlik, J. 2005


PCBs in WHO-TEQ
PCBs [pg/g (WHO/TEQ) fat]
25
20
15
10
5
0
0.44
0.7
0.9
0.97
1.2
1.45
1.8
1.82
2.36
3.4
4.5
4.6
4.7
5.0
5.76
8.1
9.4
9.8
22.4
Netherlands, commercial eggs
Czech Republic, Klatovy-Luby
Turkey, Izmit
UK, commercial eggs
Czech Republic, Usti nad Labem
Sweden, commercial eggs
Netherlands
Sweden, different eggs
UK, commercial eggs
Senegal, Mbeubeuss
Uzbekistan, Kanlikul
Slovakia, Kokshov-Baksha + Valaliky
Mexico, Coatzacoalcos
Bulgaria, Kovachevo
Netherlands, organic farms (highest level)
Kenya, Dandora
India, Lucknow
Belarus, Bolshoy Trostenec
Czech Republic, Lysa nad Labem

Annex 6: Balance between PCDD/Fs versus PCBs in diferent eggs samples in WHO-TEQs

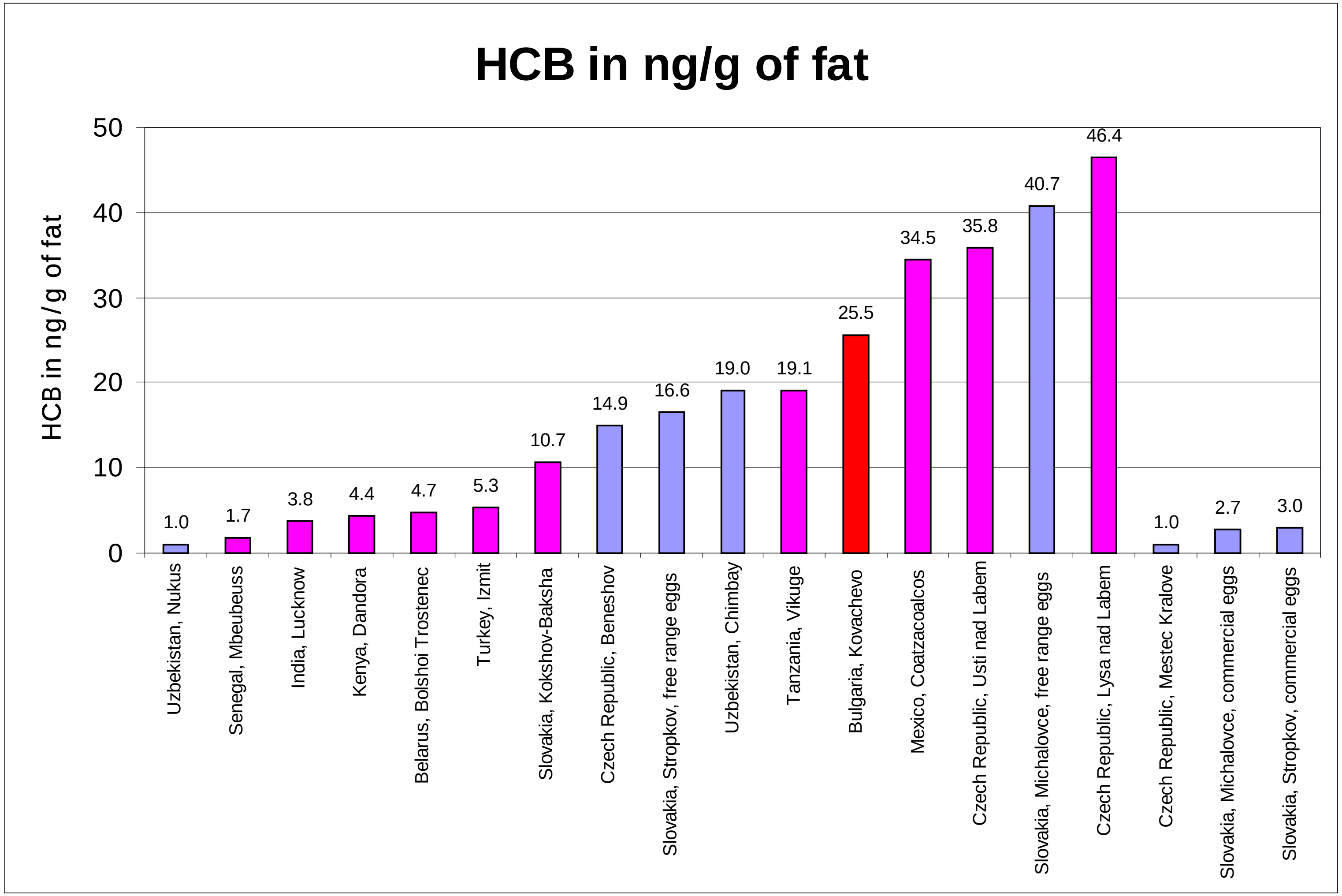
Country/locality	Year	Group	PCDD/Fs	PCBs	Total WHO-TEQ	Source of information
Czech Republic, Lysa nad Labem	2004	free range	6.80	22.40	29.20	Petrlik, J. 2005
Netherlands	2002	free range	0.70	4.89	5.59	Traag, W. et al. 2002
UK	1982	not free range	8.25	2.36	10.61	SCOOP Task 2000
Sweden	1999	not free range	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, Bolshoy 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 I	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
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



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
UK
Sweden
Slovakia, Kokshov-Baksha + Valaliky
Kenya, Dandora
Czech Republic, Usti nad Labem
Tanzania, Vikuge
Belarus, Bolshoy Trostenec
Mexico, Coatzacoalcos
India, Lucknow
Bulgaria, Kovachevo
Czech Republic, Liberec I
Egypt, Helwan
Senegal, Mbeubeuss
Turkey, Izmit

Annex 7: Levels of HCB in ng/g of fat in different chicken eggs samples from different parts of world

Country	Date/year	Group	Number of measured samples	Measured level in ng/g of fat	Source of information
Uzbekistan, Nukus	2001	free range	-	1.0	Muntean, N. et al. 2003
Senegal, Mbeubeuss	2005	free range	6/1 pooled	1.7	Axys Varilab 2005
India, Lucknow	2005	free range	4/1 pooled	3.8	Axys Varilab 2005
Kenya, Dandora	2004	free range	6/1 pool	4.4	Axys Varilab 2005
Belarus, Bolshoi Trostenec	2005	free range	6/1 pool	4.7	Axys Varilab 2005
Turkey, Izmit	2005	free range	6/1 pooled	5.3	Axys Varilab 2005
Slovakia, Kokshov-Baksha	2005	free range	6/1 pool	10.7	Axys Varilab 2005
Czech Republic, Beneshov	2004	free range	4/1 pool	14.9	Axys Varilab 2004
Slovakia, Stropkov, free range eggs	before 1999	free range	1	16.6	Kocan, A. et al. 1999
Uzbekistan, Chimbay	2001	free range	-	19.0	Muntean, N. et al. 2003
Tanzania, Vikuge	2005	free range	6/1 pool	19.1	Axys Varilab 2005
Bulgaria, Kovachevo	2005	free range	6/1 pooled	25.5	Axys Varilab 2005
Mexico, Coatzacoalcos	2005	free range	6/1 pooled	34.5	Axys Varilab 2005
Czech Republic, Usti nad Labem	2005	free range	6/1 pool	35.8	Axys Varilab 2005
Slovakia, Michalovce, free range eggs	before 1999	free range	1	40.7	Kocan, A. et al. 1999
Czech Republic, Lysa nad Labem	2004	free range	1	46.4	VSCHT 2005
Czech Republic, Mestec Kralove	2003	not free range	3	1.0	SVA CR 2004
Slovakia, Michalovce, commercial eggs	before 1999	not free range	1	2.7	Kocan, A. et al. 1999
Slovakia, Stropkov, commercial eggs	before 1999	not free range	1	3.0	Kocan, A. et al. 1999


HCB in ng/g of fat
HCB in ng/g of fat
50
40
30
20
10
0
1.0
1.7
3.8
4.4
4.7
5.3
10.7
14.9
16.6
19.0
19.1
25.5
34.5
35.8
40.7
46.4
1.0
2.7
3.0
Uzbekistan, Nukus
Senegal, Mbeubeuss
India, Lucknow
Kenya, Dandora
Belarus, Bolshoi Trostenec
Turkey, Izmit
Slovakia, Kokshov-Baksha
Czech Republic, Beneshov
Slovakia, Stropkov, free range eggs
Uzbekistan, Chimbay
Tanzania, Vikuge
Bulgaria, Kovachevo
Mexico, Coatzacoalcos
Czech Republic, Usti nad Labem
Slovakia, Michalovce, free range eggs
Czech Republic, Lysa nad Labem
Czech Republic, Mestec Kralove
Slovakia, Michalovce, commercial eggs
Slovakia, Stropkov, commercial eggs

Annex 8: Photos

Photo 1. A view of the thermal power plant Maritza East 2 from the entrance of Kovachevo village. One of the sampling sites at front of the picture (the nearest one to the obsolete pesticides stockpile).

Photo 2. Some of the walking territory of the hens.

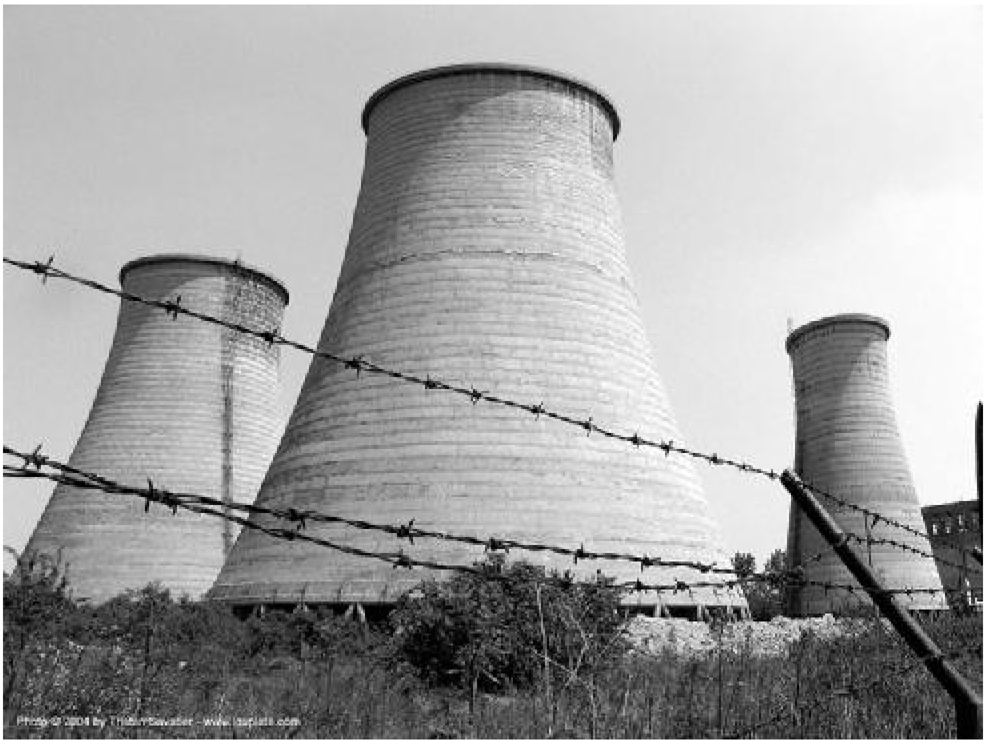
Photo 3. The handing of the eggs

Photo 4. Surface brown coal mine area.

Photo 5. The hens in their house.

Photo 6. Obsolete pesticides stockpile

Photo 7. Abandoned plant Agrobiochim, Stara Zagora. Photo by: Tristan Savatier.



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