The Egg Report

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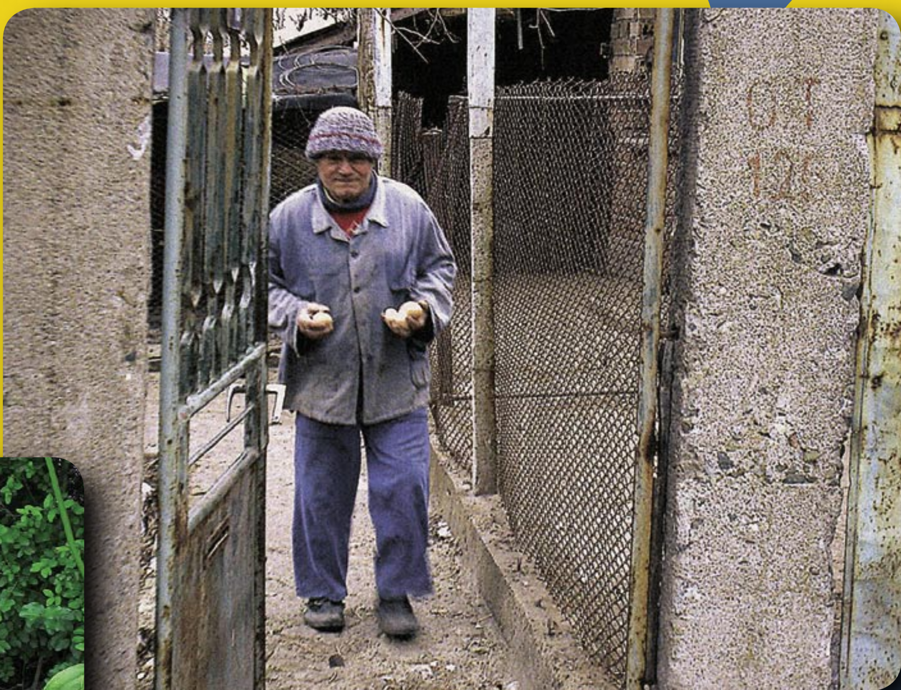

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KEEP THE PROMISE ELIMINATE POPs

Keep the Promise Eliminate POPs Report

The Egg Report

Contamination of chicken eggs from 17 countries by dioxins, PCBs and hexachlorobenzene

“Keep the Promise, Eliminate POPs!” Campaign and Dioxin, PCBs and Waste Working Group of the International POPs Elimination Network (IPEN) Report

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Note that Annexes 7 – 10 are in a separate document due to their size.

Executive Summary

A study of free-range chicken eggs from 20 locations in 17 countries found high levels of contamination with dioxins and PCBs. Because these are highly toxic substances that can seriously harm human health and the environment, they earmarked for minimization and elimination where feasible by the Stockholm Convention on Persistent Organic Pollutants (POPs). These pollutants along with hexachlorobenzene (HCB) are known as unintentional persistent organic pollutants (U-POPs) because they are created as unintentional by-products of certain combustion and industrial processes.

The International POPs Elimination Network (IPEN), a global network of 350 public interest organizations working to eliminate POPs, asked whether free-range chicken eggs might contain U-POPs if collected near waste incinerators, cement kilns, the metallurgical industry, waste dumps, and chemical production facilities involving chlorine because these facilities are known to be potential sources of U-POPs. These types of sites were investigated in five continents in the following countries: Belarus, Bulgaria, Czech Republic, Egypt, India, Kenya, Mexico, Mozambique, Pakistan, Philippines, Russia, Senegal, Slovakia, Tanzania, Turkey, Uruguay and USA. The study focused mainly on locations in developing countries and countries with economies in transition since POPs data in these countries are often lacking.

Chicken eggs were chosen for the study because they are a common food item and their fat content makes them appropriate for monitoring fat-soluble chemical pollutants such as U-POPs. Eggs are also a powerful symbol of new life. The study focused on backyard and free-range hens because they eat worms, insects, and other small organisms making their eggs a useful bio-indicator of food and environmental contamination.

The data shows that composite eggs samples at all 20 sites and in all 17 countries contained high levels of U-POPs. The lowest levels of dioxins in these egg samples were more than two times higher than the background levels of dioxins in eggs from foraging chickens that have been reported in several studies in Europe and North America. Seventy percent of the samples exceeded the European Union (EU) limit for dioxins in eggs. Sixty percent of them also exceeded proposed EU limits for PCBs in eggs. In addition, one sample even surpassed the EU limit for hexachlorobenzene (HCB). Three egg samples reported in this study contain some of the highest dioxin levels ever measured in chicken eggs. Samples collected near the metallurgical facility in Egypt, the thermal power plant in Bulgaria, and the chlor-alkali facilities in Russia yielded dioxin levels that range from 44 – 126 pg/g (WHO-TEQ) of fat. To our knowledge, this study represents the first data about U-POPs in chicken eggs for Belarus, Bulgaria, Egypt, India, Mexico, Kenya, Mozambique, Pakistan, Philippines Senegal, Tanzania, Turkey, and Uruguay. Table 1 shows a summary of the results.

These data have implications for national and international policies on U-POPs since the Stockholm Convention goal is to reduce and eliminate these substances.

1. The study illustrates the need for publicly available information on U-POPs in food, the environment, and humans. This information is largely unavailable in most of the countries examined in this study.

2. The likely U-POPs sources investigated in this study should be prioritized for action in national plans for minimizing and eliminating these substances. To help countries establish such priorities, the United Nations Environment Programme (UNEP) developed a Dioxin Toolkit that proposes factors governments can use to estimate U-POPs emissions from various sources. Unfortunately, the most recently revised edition of the Toolkit still has no source identification strategy to assist countries in identifying those sources that are not listed in the Toolkit and still has inadequacies that might lead countries to underestimate the importance of the likely sources of U-POPs that contaminated the eggs investigated in this study. For example, the Toolkit does not include PCBs or HCB and its emission factors may

Picture 1: Eggs sampling near the Koshice municipal waste incinerator in Slovakia.

substantially misrepresent actual conditions in developing countries and countries with economies in transition.

3. This study illustrates the importance of completely destroying POPs in wastes before allowing them to be released to the environment. Several dump sites in this study (e.g. Belarus, Russia, and Senegal) contain POPs wastes that probably contributed to the resulting dioxin and PCB contamination observed in the eggs. Unfortunately, the guidelines on POPs wastes which were recently adopted by the Basel Convention and now proposed for adoption by the Stockholm Convention do not establish the necessary levels of destruction that must be achieved with POPs wastes but instead allow relatively high releases of POPs to all media from the technologies used for their supposed destruction.

4. The highly contaminated eggs demonstrate the need for international guidelines to help countries design facilities that avoid or minimize formation and environmental release of U-POPs. The Stockholm Convention is developing guidelines on Best Available Techniques and Best Environmental Practices (BAT/BEP) to help governments do this. However, the present draft document still needs more work before it is ready for adoption by the Parties of the Stockholm Convention. For example, a reader of the *Guidelines* could easily conclude that it is acceptable for *any* cement kiln, of *any* design, in *any* region of the world, to accept and burn POPs waste and other halogenated wastes. In contrast, the Stockholm Convention correctly states that using a cement kiln to burn hazardous wastes has the potential to generate and release large quantities of U-POPs to the environment. This is an especially important concern if a kiln is used to burn POPs wastes or other halogenated wastes.

5. Several contaminated egg samples in this study are linked to PVC plastic production or burning and this indicates a role for material substitution as a strategy to reduce and eliminate U-POPs. The Stockholm Convention calls for guidelines on substitute materials as a means of reducing and eliminating U-POPs, but they have not yet been developed.

Picture 2: Dzerzhinsk, effluent waste from chlorine chemical industry ends in the area called “White sea”.

The Stockholm Convention mandates its Parties to take specific actions aimed at eliminating the toxic substances measured in this study from the global environment. IPEN views the Convention text as a promise by the world community to take the actions needed to protect the global public’s health and the environment from the injuries that are caused by POPs. This promise was agreed upon by representatives of all major stakeholders, governments, representatives of relevant industrial sectors, and representatives of civil society. We call upon all governments and all other stakeholders to honor the integrity of the Convention text and to keep the promise to reduce and eliminate POPs.

Picture 3: Large mixed waste dumpsite in Mbeubeuss, Senagal.

Recommendations

1. More publicly available data about POPs releases to air, water, soil, and sediment is needed to properly address sources.

2. The Dioxin Toolkit should be substantially revised; references should be provided for its proposed emission factors; factors should be reported as a range (likely high, likely median, likely low); more data from developing countries and countries with economies in transition should be used. Further investigations are needed to shed light on the relative importance of U-POPs releases from industrial sources (which we suspect the Toolkit often substantially underestimates), and U-POPs releases from bio-mass combustion (which we suspect the Toolkit substantially overestimates). Finally, the Toolkit must be made subject to independent and disinterested review.

3. The proposed Basel Convention guidelines for POPs wastes should be modified to define "low POPs content" at an appropriate and health-protective level and establish levels of destruction and irreversible transformation that are sufficient to ensure POPs characteristics are no longer exhibited. The current proposed Basel Convention guidelines on POPs wastes are inadequate in both regards and should not be adopted since they permit significant releases of POPs to the environment.

4. The Guidelines for Best Available Techniques and Best Environmental Practices should be further revised to improve: accuracy; consistency with the Stockholm Convention; consideration of POPs sources of highest concern to least developed countries, information on alternatives to POPs sources; information relevant to economic and social considerations; and user-friendliness. The Expert Group should take up guidelines on substitute or modified materials and products as a means of reducing and eliminating unintentionally-produced POPs, as is called for in the report to the first Conference of the Parties of the outgoing Expert Group Co-Chairs.

Picture 4: Chicken in Malika, the sampling site near Mbeubeuss dumpsite, Senegal.

Table 1. Persistent organic pollutants in free-range chicken eggs from 17 countries

Sampling proximity to:	Country	About the site	Levels of contamination
Cement kilns	Uruguay	Near Minas; 2 kilns; no monitoring; nearby stream for drinking water	2X background levels of dioxins[a] 1.1X EU action level for dioxins [b] 1.9X EU proposed PCB limit [c]
	Mozambique	Matola cement kiln factory; also obsolete pesticides stockpile; in semi-urban zone close to the city of Maputo	5X background levels of dioxins 1.7X EU limit for dioxins 2X EU proposed PCB limit
Chemical manufacturing	Czech Republic	Spolchemie Usti nad Labem; chlorinated solvents manufacturing and incinerator near confluence of two rivers	2X background levels of dioxins 1.5X EU action level for dioxins 0.2X EU HCB limit
	India – Eloor	Hindustan Insecticides Ltd.; manufacturing of DDT, lindane and other pesticides; POPs waste stockpile; hazardous waste incinerator; wetland area with direct discharges to creek and tidal inflow and outflow of Periyar River	14X background levels of dioxins 4.6X EU limit for dioxins
	Mexico	Pajaritos PEMEX petrochemical complex; Veracruz; VCM production for PVC plastic & incinerators	19X background levels of dioxins 6X EU limit for dioxins 1.5X EU proposed PCB limit
	Russia - Gorbatovka	Near “Orgsteklo” Dzerzhinsk; former PCBs production and hazardous waste incinerator, chlorinated hazardous wastes dumpsites	12X background levels of dioxins 4X EU limit for dioxins 4.5X EU proposed PCB limit
	Russia - Igumnovo	Near “Kaprolaktam” and “Korund” Dzerzhinsk; pesticides production, chlor alkali plant, PVC plastic and incinerator; near Oka River	44X background levels of dioxins 15X EU limit for dioxins 9X EU proposed PCB limit
	USA	Mossville, Lousiana; chlor alkali plants for PVC plastic, coal power plant, oil refinery, and petrochemical plant	6X background levels of dioxins 2X EU limit for dioxins 1.2X EU proposed action level for PCBs
Hazardous waste incinerator	Turkey	Izaydas incinerator; operated illegally for years; burns chlorinated waste	3X background levels of dioxins 1.7X EU action level for dioxins
Medical waste incinerator	India – Lucknow	Queen Mary’s Hospital; fly ash dumped into municipal drains; dense residential; more medical waste incinerators in city	20X background levels of dioxins 6.6X EU limit for dioxins 4.7X EU proposed PCB limit

Table 1. Continued

Medical waste incinerator	Philippines	Integrated Waste Management Inc. (IWMI) medical waste incinerator in Barangay Aguado; bottom ash containing dioxins is mixed in hollow concrete blocks; close to two rivers and a creek	9.7X background levels of dioxins 3X EU limit for dioxins 1.7X EU proposed PCB limit
Municipal waste incinerator	Slovakia	Koshice incinerator; 91,000 tons/year burned; serious fire in 2004	11X background levels of dioxins 3.8X EU limit for dioxins 2.3X EU proposed PCB limit
	Czech Republic – Liberec	Incinerator in large city; also medical waste incinerator, and metallurgy present in the city	2.5X background levels of dioxins 1.3X EU action level for dioxins 1.3X EU HCB limit
Metallurgical facility	Egypt	Metallurgical industry including many facilities in the city of Helwan; coal based chemical and cement industry; densely populated industrial area south of Cairo on the Nile	125X background levels of dioxins 42X EU limit for dioxins 6X EU proposed PCB limit
Obsolete pesticide dump	Tanzania	Vikuge DDT site; from Greece in 1980s; 282,000 ppm DDT in soil; no fence	3.5X background levels of dioxins 1.5X EU action level for dioxins
Thermal power plant	Bulgaria	Maritza East 2 plant in Kovachevo; largest dioxin source in NIP	64X background levels of dioxins 21X EU limit for dioxins 2.5X EU proposed PCB limit
Waste dump	Belarus	Bolshoi Trostenec site; close to water reservoir; drains to river; no waterproofing protection	3.8X background levels of dioxins 1.3X EU limit for dioxins 5X EU proposed PCB limit
	Kenya	Dandora dump; dense residencial; Nairobi River passes below	23X background levels of dioxins 7.6X EU limit for dioxins 4X EU proposed PCB limit
	Pakistan	Municipal dumpsite near Charsadda road; also medical waste and incinerator ash; no waterproofing protection; close to water channel	2.9X background levels of dioxins 1.5X EU action level for dioxins
	Senegal	Mbeubeuss dump; both municipoal and hazardous waste; on lake bottom; one part lies in groundwater	35X background levels of dioxins 11X EU limit for dioxins 1.7X EU proposed PCB limit

[a] Please see page 13 for an explanation of background levels of dioxins in eggs
[b] European Union (EU) Council Regulation 2375/2001 established this threshold limit value for eggs and egg products. There is a stricter limit of 2.0 pg WHO-TEQ/g of fat for feedstuff according to S.I. No. 363 of 2002 European Communities (Feeding stuffs) (Tolerances of Undesirable Substances and Products) (Amendment) Regulations, 2002.
[c] These proposed new limits are discussed in the document Presence of dioxins, furans and dioxin-like PCBs in food. SANCO/0072/2004.

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 in Punta del Este, Uruguay. The Convention was signed by 151 countries and ratified by 97 countries at the time of this writing.

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"; all of which are chlorine-containing chemicals. Among this list of POPs there are four substances/groups of 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. (Please see Annex 2 for a more detailed description.)

The International POPs Elimination Network (IPEN) asked whether free-range chicken eggs might contain U-POPs if collected near potential sources named by the Stockholm Convention. These sources include waste incinerators, cement kilns, the metallurgical industry, open burning at waste dumps, and chemical production processes involving chlorine. These hot spots were investigated in four continents in the following countries: Belarus, Bulgaria, Czech Republic, Egypt, India, Kenya, Mexico, Mozambique, Pakistan, Philippines, Russia, Senegal, Slovakia, Tanzania, Turkey, Uruguay and USA.

Two main approaches have been used to investigate relationships between levels of PCBs or dioxins in environmental compartments and those in poultry meat or eggs. One method has been controlled exposure studies where bioaccumulation is monitored during the ingestion of specially formulated diets containing specific concentrations of PCBs or dioxins.[1, 2, 3, 4, 5] The second technique has been to focus on levels of PCBs and dioxins in chickens reared in locations known to be contaminated with these chemicals. .[6, 7, 8, 9, 10, 11] Results from both types of research clearly indicate that even relatively low levels of environmental contamination can result in the accumulation of PCBs and dioxins in poultry tissues and eggs. Measurable quantities of PCBs and dioxins have been found in commercial feed, herbage, bedding and drinking water, but soils (or possibly soil organisms) appear to be the principal source of exposure for foraging poultry. [12, 13] It should be noted, however, that virtually all the available data concerns chickens. [14] Other terrestrial domestic birds such as bantams (type of chicken) are likely to share a similar diet, but the affinity of ducks for water bodies such as ponds or streams could result in exposure to a slightly different spectrum of potential sources of PCBs and dioxins.

Chicken eggs were chosen for the study because 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. The study focused on free-range hens because they can easily access and eat soil animals and therefore their eggs are good tools for biomonitoring of environmental contamination. As described by Pirard et al. [15] "*In the past, eggs from free ranging chickens have already been followed-up and showed relatively high level of dioxins compared to those from commercial battery-farming.*[16, 17, 18] *Soils, and their incorporated organisms appeared to be the main source of dioxin contamination*[19, 20, 21] *for such foraging poultries since soils are known to act as a* *conservative matrix for long term dioxin deposition.*[22, 23] *Foraging animals, and especially chickens and cows, can therefore been used as efficient bioindicators of potential environmental dioxin contamination.*[24] *Monitoring of levels in milk or eggs from such animals raised in the vicinity of known emission sources such as chemical waste incinerator*[25]*, pentachlorophenol wood treatment facilities*[26, 27] *or municipal solid waste incinerator (MSWI)*[28] *is thus often carried out.“*

This study focused on sites in developing countries and countries with economies in transition since POPs data in these countries is often lacking. For some countries, the data in this study represents the first time that occurence of U-POPs has been documented in any segment of their environment. For many countries this is the first documentation of U-POPs in chicken eggs ever recorded. Separate national reports can be viewed at http://www.oztoxics.org/ipepweb/.

Picture 5: Eloor, Kerala, India the burnt down endosulfan plant (Hindustan Insecticides Limited).

Results and Discussion

Potential U-POPs sources in 17 countries

IPEN selected egg sampling sites near potential sources of U-POPs. Annex C of the Stockholm Convention lists source categories for these substances including waste incinerators, cement kilns, pulp production, metallurgical industries, open burning of waste, utility boilers, and chemical production. Table 2 shows that a variety of sites were used in the study and that many are located near residential living areas and rivers. For more information about sampling and analysis, please see Annex 1.

Table 2. Egg sampling sites near potential sources of U-POPs

Sampling proximity to:	Country - locality	About the site	Distance from putative source
Cement kilns	Uruguay - Minas	Near Minas; 2 kilns, ANCAP and CUCSA; no monitoring; nearby stream for drinking water	0.5 - 2 km
	Mozambique - Santos	Matola cement kiln factory; also obsolete pesticides stockpile; in semi urban zone close the city of Maputo	0.7 - 2.5 km
Chemical manufacturing	Czech Republic – Usti nad Labem	Usti nad Labem; Spolchemie chlor-alkali and chlorinated solvents manufacturing; former DDT production; near two rivers; HCB found in fish and river sediments	2.5 km
	India – Eloor	Hindustan Insecticides Ltd.; manufacturing of DDT, lindane and other pesticides; POPs waste stockpile; hazardous waste incinerator; wetland area with direct discharges to creek and tidal inflow and outflow of Periyar River	0.1 - 0.5 km
	Mexico - Coatzacoalcos	Pajaritos PEMEX petrochemical complex; Coatzacoalcos, Veracruz; VCM production for PVC plastic; incinerators burining chlorinated wastes; nearby stream POPs and metal contamination; community nearby	1.5 - 2 km
	Russia - Gorbatovka	Near “Orgsteklo”Dzerzhinsk; former PCBs production and hazardous waste incinerator, chlorinated hazardous wastes dumpsites;	2.5 km
	Russia - Igumnovo	Near “Kaprolaktam” and “Korund” Dzerzhinsk; pesticides production, chlor alkali plant, PVC plastic and incinerator; near Oka river;	2.5 km
	USA - Mossville	Mossville, Lousiana; chlor alkali plants for PVC plastic, coal power plant, oil refinery, and petrochemical plant	1 km
Hazardous waste incinerator	Turkey - Izmit	Izaydas incinerator contructed by Lurgi (Germany); operated illegally for years; burns chlorinated waste including PCBs; 2 km from a village and 10 km from Izmit	2 km

Table 2. continued

Sampling proximity to:	Country - locality	About the site	Distance from putative source
Medical waste incinerator	India – Lucknow	Queen Mary's Hospital; leachate and fly ash dumped into municipal drains; waste transported in open cycle rickshaws, no protective clothing, dense residential area, doctors and nurses live adjacent to incinerator chimney	0.5 km
	Philippines - Barangay Aguado	Integrated Waste Management Inc. (IWMI) medical waste incinerator in Barangay Aguado; bottom ash containing dioxins is mixed in hollow concrete blocks; close to two rivers and a creek	0.5 km
Municipal waste incinerator	Slovakia – Kokshov-Baksha & Valaliky	Koshice incinerator; 91,000 tons/year burned; only minimal emission prevention until recently; serious fire in 2004; dioxins found in breast milk in 2001	1 - 2 km
	Czech Republic – Liberec	Incinerator in large city; also medical waste incinerator, and metallurgy present in the city; elevated levels of U-POPs in city environment observed	0.2 km
Metallurgical facility	Egypt - Helwan	Metallurgical industry including many facilities in city of Helwan; also coal based chemical and cement industry; densely populated industrial area south of Cairo on the Nile	1.5 km
Obsolete pesticide dump	Tanzania - Vikuge	Vikuge DDT site; from Greece in 1980s; open air storage 6 years; 282,000 ppm DDT in soil; strong DDT odor; no fence; persistent skin diseases & respiratory infections	0.5 - 2 km
Thermal power plant	Bulgaria - Kovachevo	Maritza East 2 plant in Kovachevo; largest dioxin source in NIP; 5 km from village; near river; town includes briquette factory, coal mine burning tires, obsolete pesticide dump	4.5 km
Waste dump	Belarus - Bolshoi Trostenec	Bolshoi Trostenec site; close to water reservoir; drains to river; no waterproofing protection; both household and industrial waste; 1km from village	0.5 - 1 km
	Kenya - Dandora	Dandora dump; dense residential; Nairobi River passes below and drains into Indian Ocean	0.03 km
	Pakistan - Peshawar	Municipal dumpsite near Charsadda road; also medical waste and incinerator ash; no waterproofing protection;	0.25 km
	Senegal - Mbeubeuss	Mbeubeuss dump; on lake bottom; one part lies in groundwater; household and waste from 30 industries dumped including petrochemical and hospital waste	0.7 km

Picture 6: Minas, Uruguay, sampling site near the cement kiln.

Background levels of dioxins in eggs

U-POPs by definition travel long distances from their sources and bioaccumulate in the food chain. This creates an existing background level of POPs in the environment, foods, and humans with no uncontaminated place to serve as a true control. To understand whether particular sites contain elevated levels of U-POPs it would be desirable to compare them with background levels. However, levels of U-POPs may vary greatly within developing countries and countries with economies in transition making it difficult to identify a single background level.

Extensive sampling to fully characterize and define control levels of U-POPs in all seventeen countries was beyond the scope of this study. However, for some countries such as the Czech Republic, Slovakia, and the US, pre-existing data on POPs in eggs provided information about background levels. In other countries such as Bulgaria, Egypt, Pakistan and Russia, pre-existing data indicated POPs contamination at the particular site or gave information about general contamination in the country.

Clues about background levels of dioxins in eggs are revealed in several scientific studies performed in industrialized countries. [29] [30] [31] Pirard, C. et al. used bioproduct eggs as a marker for background that contained 1.07 pg WHO-TEQ/g fat.[32] Malisch, R. et al. used market eggs for a background level with measured levels that ranged from 1.13 to 1.35 WHO-TEQ/g fat.[33] In a study focused on chicken eggs from allotments in Newcastle, UK affected by incineration fly ash, Pless-Mulloli, T. et al. measured eggs from Hawthorn Farm as a control sample with an observed level of 0.2 WHO-TEQ/g fat.[34] We used the results of these studies as the general background level of dioxin content in eggs that ranged between 0.2 - 1.2 pg WHO-TEQ/g of fat. This range is also in agreement with the study of Goldman, L. R. et al., for eggs from foraging chickens.[35]

To define background levels for non-ortho- and mono-ortho PCBs is more difficult since dioxins are more commonly measured chemicals in eggs comparing to PCBs. A UK

Picture 7: Dzerzhinsk, Russia. Site called "Black Hole" with toxic chemical waste including phenols.

study of the impact of pyres burning animals with foot and mouth disease on dioxins and PCBs in locally produced food provides some data for background levels of PCBs but does not specify how the places for samples were selected. Observed levels of PCBs in these control samples ranged between 1.4 - 2.4 pg WHO-TEQ/g of fat.[36] Much lover levels were observed in non free range eggs on the market in Netherlands, which is usually the type of sample used as a control. Levels of PCBs in these eggs ranged from 0.1 - 1.0 pg WHO-TEQ/g of fat.[37] Winters et al. reported PCB levels of 0.1 pg WHO-TEQ/g of fresh weight for eggs in USA.[38] For HCB we considered as background level the concentration observed in commercial eggs in the Czech Republic, which is 1.0 ng/g fat.[39]

The EU limit for dioxins in eggs

In November 2001, the European Union (EU) established a regulation creating a threshold limit value for dioxins in eggs and egg products sold on the market of 3.0 pg WHO-TEQ/g of fat.[40] The regulation covered free-range eggs beginning 10 January 2004. The EU established the regulation, *"…to ensure consumer protection…"* and said that, *"…continuing efforts should be made to limit environmental releases of dioxins and related compounds to the lowest levels feasible."* In addition, the EU stated that, *"Maximum levels for dioxins and dioxin like PCBs are an appropriate tool to prevent unacceptably high exposure of the human population and to prevent the distribution of unacceptably highly contaminated foodstuffs e.g. from accidental pollution and exposure. Furthermore, the setting of maximum levels is indispensable for the implementation of a regulatory control system and to ensure uniform application."* In 2002, the EU established a regulation on feed stuffs that limited dioxins in animal products including eggs and egg products to 0.75 pg WHO-TEQ/g of fat. [41] The same regulation limits dioxins in animal fat (including egg fat) to 2.0 pg WHO-TEQ/g of fat. In cases of non-compliance, the European Commission recommends an investigation to identify the source of the contamination, an analysis to check for the presence of dioxin-like PCBs, and the implementation of measures to reduce or eliminate the source of contamination. [42]

U-POPs in eggs from 20 locations in 17 countries

The data in Tables 3 and 4 shows that composite egg samples at all 20 sites and in all 17 countries contained high levels of U-POPs. To our knowledge, this study represents the first data about U-POPs in chicken eggs from Belarus, Bulgaria, Egypt, India, Mexico, Kenya, Mozambique, Pakistan, Philippines Senegal, Tanzania, Turkey, and Uruguay. The fat content of the eggs is shown in Table 5.[a] For more information about sampling, analysis, and detection limits please see Annex 1. The range of observed concentrations in Table 3 are lower and upper bound levels. For lower bound levels, zero was used for values below the limit of detection (LOD). To calculate upper bound levels, the detection limit was used.

In most of the samples, dioxins are the main contributor to total WHO-TEQ values. Three exceptions are the eggs collected near a dumpsite in Belarus in which dioxins contributed less than 30% of total WHO-TEQ and the eggs collected near cement kilns in Uruguay and Mozambique in which dioxins contributed 35 - 50%. The highest concentrations of dioxin-like PCBs were found in eggs collected near a facility producing chlorine-based chemicals in Russia, 18 pg WHO-TEQ/g fat; eggs collected near metallurgy facilities in Egypt, 12 pg WHO-TEQ/g fat; and eggs collected in Belarus, almost 10 pg WHO-TEQ/g fat

The lowest dioxin concentrations in the composite eggs samples in this study were more than two times higher than background levels observed in eggs collected from areas with no obvious dioxin sources (0.2 - 1.2 pg WHO-TEQ/g of fat). [43] [44] [45] Seventy percent of the samples in Table 3 were sufficiently contaminated to exceed the European Union (EU) limit for dioxins in eggs of 3pgWHO-TEQ/g of fat.. In fact, all of the U-POPs sources in Table 2 contained at least one sampling location with eggs contaminated enough to surpass the EU dioxin limit. Sixty percent of the samples in Table 3 also exceeded the proposed EU limit for dioxin-like PCBs in eggs. These include eggs sampled near waste dumps, a thermal power plant, cement kilns, medical waste incinerator, municipal waste incinerator, metallurgical factories, and chlor-alkali manufacturing.

Three egg samples in this study contain some of the highest dioxin levels ever reported in chicken eggs. Samples collected near the chlor-alkali facilities in Russia, a thermal power plant in Bulgaria, and metallurgical facilities in Egypt contained dioxin levels of 44, 65, and 126 pg WHO-TEQ /g fat respectively.

As shown in Table 3 many egg samples were contaminated with HCB, although only one exceeded the EU regulatory limit. Eggs collected near a municipal waste incinerator in the city of Liberec (Czech Republic) (which also contains a metallurgical facility) contained 250 ng/g fat HCB as compared to the EU limit of 200 ng/g fat. Other samples taken from chlorine chemistry manufacturing areas in Russia, Czech Republic and Mexico also showed high levels of HCB.

High levels of seven PCBs congeners were found in egg samples from the area near a hazardous waste incinerator and obsolete wastes stockpile in the Czech Republic, a municipal waste incinerator in Slovakia, and a chlorine chemistry manufacturing area in Russia.

Table 4 shows the levels of U-POPs in egg samples expressed as fresh weight. The values for dioxins in this table can be compared to the estimate by the US Food and Drug Administration declaration that in one case, eggs containing dioxin concentrations of 1 pg I-TEQ/g fresh weight or above are to be regarded as "adulterated."[46] In fact, the US detained imports of eggs and egg products from Belgium, France, and the Netherlands unless importers, "…could provide laboratory test results showing PCBs are not detectable and/or that dioxins do not exceed 1 part-per-trillion (ppt)." [47] Table 4 shows that composite egg samples from all 20 locations contained detectable levels of PCBs. The data also shows that composite egg samples from many sites carried dioxin levels that exceeded the 1 ppt level. These sampling sites include Bulgaria - Kovachevo (near a thermal power plant)[48] , Egypt - Helwan (metallurgical industries were

[a] Arnika asked the laboratory at Institute of Chemical Technology in Prague to also measure HCB and seven PCB congeners content in eggs from Lysa nad Labem (close to hazardous waste incinerator). The results of this measurement (HCB 46.4 ng/g of fat and PCBs 377.6 ng/g of fat, by 16.4 % of fat content) are not included in the tables, but are incorporated into graphs in annexes that also show measured levels.

found as the most likely source) [49], India - Lucknow (several medical waste incinerators)[50], Philippines - Barangay Aguado (neighborhood of medical waste incinerator)[51], India - Eloor (DDT manufacturing facility was found as the most likely source) [52], Kenya - Dandora (open burning at waste dump was pointed as the most likely source) [53], Senegal - Mbeubeuss (chlorinated chemical waste including waste dumpsite found as the most likely source) [54], Slovakia - Kokshov-Baksha (municipal waste incinerator was found as the most likely source) [55], Mexico - Coatzacoalcos[56] and Russia - Dzerzhinsk region[57] (chlorine chemical manufacturing facilities were pointed as the most likely sources).

Dioxin congener patterns and putative sources

Dioxin contamination can be linked to potential dioxin sources by comparing the patterns of congeners, the so-called dioxin profiles. This was performed in this study, though for most sources in developing countries and countries with economies under transition there were no available data to provide congener patterns for comparison. To add to the complication, previous studies indicate different transfer efficiencies for different congeners from soil to eggs. [58, 59] To provide additional clues as to sources, pollution dispersion maps were also used along with older studies and observations of local NGOs. All these details are more fully discussed in previously published national reports available at http://www.oztoxics.org/ipepweb but there are a few examples below. Dioxin profiles expressed both in absolute concentrations and WHO-TEQ concentrations for each pooled sample are presented in Annex 7.

The dioxin profile of the egg sample from Kokshov-Baksha, Slovakia had a pattern very similar to that of emissions from a municipal waste incinerator operated without a dioxin filter, which is consistent with the sampling location.. In contrast, the expected pattern for eggs from the dumpsite at Mbeubeuss, Senegal was combustion from open burning. Surprisingly, the congeners showed the pattern of chlorinated chemicals such as pentachlorophenol rather than open burning as potential source. Consequently, the national report for Senegal highlighted chemical waste in the dumpsite as the most likely source of dioxins in the eggs from this site. Similarly, the congener pattern of dioxins in the composite egg sample from Egypt suggests metallurgic sources as the most likely potential source of contamination. In some cases based on the congener patterns, it was only possible to state that combustion sources were a major source of the dioxins in the eggs. This was the case for the high levels of dioxins observed in eggs from Kovachevo, Bulgaria.

HCB and its putative source

Industrial sources of HCB include production of the following: vinyl chloride monomer (VCM), electrolytic chlorine, chlorinated solvents, and pesticides. [60] High levels of HCB were recently found in air emissions from municipal waste incinerators and metallurgy.[61] However, the source of the high levels of HCB in eggs from Liberec, Czech Republic could not be directly compared to previous studies since there are not many measurements of this pollutant from Czech sources. In some cases, elevated levels of HCB are observed in sites close to chlorine chemicals manufacturing industries, where this chemical occurs as a by-product in the production of certain chemicals. This is consistent with the putative chlorine chemicals manufacturing source in the Czech Republic where the eggs were collected as well as a best estimate of the potential pollution pathway via air.

Comparison with other studies of U-POPs in eggs

The highest dioxin concentration measured in chicken eggs is apparently 713.1 pg WHO-TEQ, which occurred at one of the Belgian farms affected by contaminated feed stuffs in 1999.[62] The second highest reported levels of dioxins and PCBs were found in eggs from other contaminated sites (see also graph in Annex 10). For more information on previous studies of POPs in chicken eggs, please see Annex 3 which describes samples from the Pontypool, UK hazardous waste incinerator; Rheinfelden, Germany chlor-alkali and pentachlorophenol manufacturing; Newcastle, UK incinerator fly ask contamination; Maincy, France municipal solid waste incinerator; Oroville, USA pentachlorophenol facility; Chapaevsk, Russia chlorine chemical industry manufacturing; Libis and Lysa nad Labem, Czech Republic chlorine chemical industry manufacturing, and hazardous waste incinerator; and Midland, USA chlorine chemical industry manufacturing at the world headquarters of Dow Chemical.

Health and exposure

All four U-POPs found in eggs in this study are highly toxic. Possible effects associated with dioxins and furans include immunotoxicity, carcinogenicity, endocrine disruption, diabetes, and reproductive and developmental damage. HCB is considered a possible carcinogen and is known to cause liver disease in humans. PCBs are associated with neurological damage and are probably carcinogenic to humans. For more information on the properties and toxicity of U-POPs, please see Annex 2.

As previously mentioned, free-range chickens were used in this study to bio-monitor the presence of U-POPs in areas near potential sources such as waste incinerators, cement kilns, the metallurgical industry, waste dumps, and chemical production facilities involving chlorine. These sources can release U-POPs to air, water, soil, and sediment where they are available for ingestion and bioaccumulation. Several studies have noted pathways that trace the movement of U-POPs from soil, soil organisms, and dust ingestion to contamination of free range chickens and their eggs. Three types of pathways have been cited: air pollution, waterways, and direct waste disposal. Air pollution from industrial facilities or landfill dust can settle on soil where U-POPs are taken up by soil organisms and eaten by chickens. Accessible river banks or sediments, flooding rivers or the use of sediments to enrich soil might also provide chickens access to U-POPs. In addition, direct waste disposal can contaminate soil with U-POPs as observed previously in Newcastle (fly ash from incinerator) [63], Rheinfelden (waste from chlorine chemistry)[64], and in this study in Mbeubeuss, Senegal, where chlorine chemicals wastes are a probable major source of contamination.[65]

Forecasting potential pollution pathways and finding the most affected areas is different from place to place and is also source dependent. In the case of combustion sources, air releases and/or residues from processes might be main sources of U-POPs. In these sources pollution dispersion maps for air releases and/or at prevailing wind charts and maps provide clues as to likely areas of U-POPs contamination. The fate of residues from combustion sources is also very important and often underestimated as a source of contamination. Dust from the ashes can be carried either by wind or by waterways far from the place of its open dumping. In case of chemical factories an important pollution carrier is water due to effluents directly discharged into rivers, streams and/or water beds. Accidental leaks or deliberate dumping into underground waterways is another source. In India, Hindustan Insecticides Limited (HIL) in the Eloor area is located in a wetlands area and in the Czech Republic Spolana Neratovice is located on the shore of the Labe River (see Annex 3, case study on Libis).

Pollution pathways are only part of the environmental fate of pollutants. Dioxin congener patterns for specific U-POPs pollution sources were taken into consideration when looking for sources of contamination in specific cases. More detailed discussion about this topic is included in the separate national/location reports at http://www.oztoxics.org/ipepweb/.

Limitations of the study

This study of U-POPs in free range chicken eggs provides a snap shot of U-POPs levels from many localities around the world. Pooled samples provide a broader view of U-POPs content than a single egg sample, but the view is still limited by a single pooled sample per locality. Financial constraints prohibited more sampling to ascertain U-POPs levels in other parts of each country but this study resembles the WHO breast milk study in this respect. Both studies examined U-POPs levels in many countries to get a picture of contamination in various localities.

The IPEN sampling was conducted during a single short time period. In some countries the winter season may have affected the range that chickens covered and/or egg laying behavior and fat content. Since this study provides some of the first information about U-POPs in developing countries and countries with economies under transition, there was little data available for comparison. This hindered comparisons of congener profiles between samples and putative sources.

Picture 8 and 9: Dumpsite near Bolshoi Trostenec, Belarus. One of hot spots chosen for chicken eggs sampling project.

Table 3: Measured levels of POPs in eggs collected in 17 countries and 20 locations per gram of fat.

	Belarus - Bolshoi Trostenec	Bulgaria - Kovachevo	Czech Republic – Liberec I	Czech Republic - Liberec II	Czech Republic - Usti nad Labem	Egypt – Helwan	India – Eloor	Limits	Action level
Dioxins in WHO-TEQ (pg/g)	3.63 - 3.91	64.54	2.56 -2.61	2.23 -2.63	2.13 - 2.90	125.78	13.91	3.0[a]	2.0[b]
PCBs in WHO-TEQ (pg/g)	9.83	5.03	0.60	1.07	1.22	11.74	1.17	2.0[b]	1.5[b]
Total WHO-TEQ (pg/g)	13.46 - 13.74	69.57	3.21	3.70	3.35 - 4.12	137.52	15.08	5.0[b]	-
PCB (7 congeners) (ng/g)	70.87	3.04	13.69	21.61	26.32	6.80	4.46	200[c]	-
HCB (ng/g)	4.70	25.50	65.00	250.00	35.80	15.10	7.70	200[d]	-

	India - Lucknow	Kenya - Dandora	Mexico - Coatzacoalcos	Mozambique - Santos	Pakistan - Peshawar	Philippines - Barangua Aguado	Russia – Gorbatovkaka	Limits	Action level
Dioxins in WHO-TEQ (pg/g)	19.80	22.92	21.63	5.08	2.85 - 2.91	9.68	12.68	3.0[a]	2.0[b]
PCBs in WHO-TEQ (pg/g)	9.40	8.10	4.69	4.37	0.80	3.30	9.08	2.0[b]	1.5[b]
Total WHO-TEQ (pg/g)	29.20	31.02	26.32	9.45	3.65 - 3.71	12.98	21.76	5.0[b]	-
PCB (7 congeners) (ng/g)	75.34	31.10	30.62	39.17	4.14	60.90	63.50	200[c]	-
HCB (ng/g)	3.80	4.40	34.50	0.92	1.10	1.70	68.90	200[d]	-

	Russia – Igumnovo	Senegal – Mbeubeuss	Slovakia - Kokshov-Baksha	Tanzania - Vikuge	Turkey – Izmit	Uruguay – Minas	USA – Mossville	Limits	Action level
Dioxins in WHO-TEQ (pg/g)	44.69	35.10	11.52	3.03	3.37	2.18	5.67 - 5.97	3.0[a]	2.0[b]
PCBs in WHO-TEQ (pg/g)	18.37	3.44	4.60	0.6 - 0.7	0.93	3.75	1.74	2.0[b]	1.5[b]
Total WHO-TEQ (pg/g)	63.06	38.53	16.12	3.63 -3.73	4.30	5.93	7.41 – 7.71	5.0[b]	-
PCB (7 congeners) (ng/g)	167.31	29.17	189.00	4.10	5.13	29.00	7.90	200[c]	-
HCB (ng/g)	11.80	1.70	10.70	19.10	5.30	1.40	1.20	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 feeding stuff according to S.I. No. 363 of 2002 European Communities (Feeding stuffs) (Tolerances of Undesirable Substances and Products) (Amendment) Regulations, 2002.
[b] These proposed new limits are discussed in the document Presence of dioxins, furans and dioxin-like PCBs in food. SANCO/0072/2004.
[c] Limit used for example in the Czech Republic according to the law No. 53/2002 as well as in Poland and/or Turkey.
[d] EU limit according to Council Directive 86/363/EEC, level in brackets is proposed new general limit for pesticides residues (under which HCB is listed) according to the Proposal for a Regulation of the European Parliament and of the Council on maximum residue levels of pesticides in products of plant and animal origin,0 COM/2003/0117 final - COD 2003/0052.

Table 4: Measured levels of POPs in eggs collected in 17 countries and 20 locations per gram of egg fresh weight.

	Belarus - Bolshoi Trostenec	Bulgaria - Kovachevo	Czech Republic – Liberec I	Czech Republic - Liberec II	Czech Republic - Usti nad Labem	Egypt – Helwan	India – Eloor	Limits	Action level
Dioxins in WHO-TEQ (pg/g)	0.43 - 0.47	7.81	0.26	0.25 -0.30	0.24 - 0.33	17.61	1.82	1[a]	-
PCBs in WHO-TEQ (pg/g)	1.18	0.61	0.06	0.12	0.14	1.64	0.15	0 [a]	-
Total WHO-TEQ (pg/g)	1.62 - 1.65	8.42	0.32	0.42	0.38 - 0.47	18.97	1.98	-	-
PCBs (7 congeners) (ng/g)	8.50	0.37	1.38	2.46	2.97	0.95	0.58		
HCB (ng/g)	0.56	3.09	6.57	28.50	4.05	2.11	1.01	-	-

	India - Lucknow	Kenya - Dandora	Mexico - Coatzacoalcos	Mozambique - Santos	Pakistan - Peshawar	Philippines - Barangay Aguado	Russia – Gorbatovkaka	Limits	Action level
Dioxins in WHO-TEQ (pg/g)	2.48	2.64	2.55	0.64	0.38 - 0.39	1.21	1.64	1[a]	-
PCBs in WHO-TEQ (pg/g)	1.18	0.93	0.55	0.55	0.11	0.41	1.17	0 [a]	-
Total WHO-TEQ (pg/g)	3.65	3.57	3.10	1.18	0.49 - 0.50	1.62	2.81	-	-
PCBs (7 congeners) (ng/g)	9.42	3.58	3.61	4.90	0.55	7.61	8.19		
HCB (ng/g)	0.48	0.51	4.07	0.12	0.15	0.21	8.89	-	-

	Russia – Igumnovo	Senegal – Mbeubeuss	Slovakia - Kokshov-Baksha	Tanzania - Vikuge	Turkey – Izmit	Uruguay – Minas	USA – Mossville	Limits	Action level
Dioxins in WHO-TEQ (pg/g)	4.87	3.65	1.41	0.42	0.47	0.23	0.70 – 0.74	1[a]	-
PCBs in WHO-TEQ (pg/g)	2.00	0.36	0.56	0.08 - 0.10	0.13	0.40	0.22	0 [a]	-
Total WHO-TEQ (pg/g)	6.87	4.01	1.97	0.50 - 0.51	0.59	0.64	0.92 - 0.96	-	-
PCBs (7 congeners) (ng/g)	18.24	3.03	23.06	0.57	0.71	3.10	0.98		
HCB (ng/g)	1.29	0.18	1.31	2.64	0.73	0.15	0.15	-	-

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

[a] The FDA limited eggs and egg-containing products from entering the US from Belgium, France, and the Netherlands unless importers could provide, "…test results showing PCBs are not detectable and/or that dioxins do not exceed 1 part-per-trillion (ppt); FDA talk paper, June 11, 1999. 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 (Feeding stuffs) (Tolerances of Undesirable Substances and Products) (Amendment) Regulations, 2002.

Table 5: Number of measured eggs and fat content in pooled samples (%).

Sampling site	Number of eggs in pooled sample	Fat content in pooled sample (%)
Belarus - Bolshoi Trostenec	6	12.0
Bulgaria - Kovachevo	6	12.1
Czech Republic – Liberec I	3	10.1
Czech Republic - Liberec II	3	11.4
Czech Republic - Usti nad Labem	6	11.3
Egypt - Helwan	6	14.0
India – Eloor	6	13.1
India - Lucknow	4	12.5
Kenya - Dandora	6	11.5
Mexico - Coatzacoalcos	6	11.8
Mozambique - Santos	6	12.5
Pakistan - Peshawar	3	13.3
Philippines - Barangua Aguado	6	12.5
Russia – Gorbatovka	4	12.9
Russia – Igumnovo	4	10.9
Senegal – Mbeubeuss	6	10.4
Slovakia - Kokshov-Baksha & Valaliky	6	10.9
Tanzania - Vikuge	6	13.8
Turkey – Izmit	6	13.8
Uruguay – Minas	8	10.7
USA – Mossville	6	12.4

U-POPs and the Stockholm Convention

The Stockholm Convention mandates Parties to take specific actions aimed at eliminating the pollutants found to contaminate eggs in this study from the global environment.

The data presented in this study illustrates the need for publicly available information on U-POPs in food, the environment, and humans which is largely unavailable in most of the countries in this study. In 12 of the 17 countries examined here (70%), the data in Tables 3 and 4 represents the first information about U-POPs contamination of this common food source ever reported.

The likely U-POPs sources investigated in this study should be prioritized for action in national plans for minimizing and eliminating these substances. To help countries establish such priorities, the United Nations Environment Programme (UNEP) developed a Dioxin Toolkit that proposes factors governments can use to estimate U-POPs emissions from various sources. Unfortunately, this Toolkit has inadequacies that might lead countries to underestimate the importance of the likely sources of U-POPs that contaminated the eggs investigated in this study. This is because the Toolkit does not include PCBs or HCB and because the Toolkit's emission factors may substantially misrepresent actual conditions in developing countries and countries with economies in transition. 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.[b] 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. Please see Annex 4 for a more complete discussion of the Toolkit.

The highly contaminated eggs demonstrate the need for international guidelines to help

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

countries develop policies and strategies and to require or promote techniques, especially those related to the contents and management of domestic, municipal, medical, and industrial wastes, that will lead to the avoidance and/or minimization of activities and processes that form and release U-POPs. The Stockholm Convention is developing guidelines on Best Available Techniques and Best Environmental Practices (BAT/BEP) to help governments do this. However, the present draft document still needs more work before it is ready for adoption by the Parties of the Stockholm Convention. For example, a reader of the ***Guidelines*** could easily conclude that it is acceptable for ***any*** cement kiln, of ***any*** design, in ***any*** region of the world, to accept and burn POPs waste and other halogenated wastes. In contrast, the Stockholm Convention correctly states that using a cement kiln to burn hazardous wastes has the potential to generate and release large quantities of U-POPs to the environment. This is an especially important concern if a kiln is used to burn POPs wastes or other halogenated wastes. Parties of the Stockholm Convention are 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.

Several contaminated egg samples in this study are linked to PVC plastic production or burning (medical waste incineration, chlor-alkali and VCM production, open burning at waste dumps). This indicates a role for material substitution as a strategy to reduce and eliminate U-POPs. The Stockholm Convention calls for guidelines on substitute or modified materials, products, and processes as a means of reducing and eliminating U-POPs, but they have not yet been developed.[e]

This study also illustrates the importance of completely destroying POPs in wastes before allowing them to be released to the environment. Several dump sites in this study (e.g. Belarus and Senegal) contain POPs wastes that probably contributed to the resulting dioxin and PCB contamination observed in the eggs. Unfortunately, the guidelines on POPs wastes that have been recently adopted by the Basel Convention and are now put forward for consideration by the Stockholm Convention do not establish levels of destruction and such that POPs characteristics are no longer exhibited. Instead the Basel guidelines establish release limit values that can allow the release of relatively large amounts of undestroyed POPs in the stack gases, liquid effluents and solid residues of the processes used for supposed destruction. As an example, the Basel guidelines allow the release of solid residues, such as ashes, that contain dioxin concentrations as high as 15 µg TEQ /kg. [66] Incinerator ash with dioxin content less than one-third this level were used in Newcastle (UK) for the reconstruction of footpaths. This resulted in contamination of poultry eggs which, on the average, exceeded the EU dioxin limit in eggs by 5.5 – 7-fold. In the Basel guidelines, this same high dioxin concentration, 15 µg TEQ /kg, is established as the "low POPs content" level, below which destruction or irreversible transformation is not necessary. The proposed Basel Convention guidelines on POPs wastes should not be adopted because they permit significant releases of POPs to the environment. Please see Annex 6 for a more complete discussion of disposal of POPs wastes.

The Stockholm Convention on POPs is historic. It is the first global, legally binding instrument that has the aim 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 global public's health and environment from the injuries that are caused by POPs, a promise that was agreed by representatives of the global community: governments, interested stakeholders, and representatives of civil society. We call upon all governmental representatives and all stakeholders to honor the integrity of the Convention text and keep the promise of reduction and elimination of POPs.

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

Annex 1. Materials and Methods

Sampling

For sampling in every country IPEN participating organizations (IPEN PO) have chosen an area close to potential or known U-POPs sources. Ten – sixteen eggs were sampled from the chosen area and sampling details recorded including: location; chicken feed type; details about the range covered by the chickens; age, longitude and latitude; and many other data. The hens from which the eggs were picked were all free-range though occasionally provided with home made and/or bought food. All hens could easily access soil organisms.Sampling was done in a period between 18 December 2004 - 15 March 2005. The eggs were kept in cool conditions after sampling and then were boiled in the country of origin for 7 - 10 minutes in pure water and transported by express services and personally by IPEN POs 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 3 - 8 [f] eggs were homogenized. The numbers of eggs analyzed in the pooled samples are in Table 5. 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 dioxins, PCBs and HCB was analyzed by HR GC-MS on Autospec Ultima NT.

Analysis for dioxins, PCBs and HCB was done in the Czech Republic in laboratory Axys Varilab. Laboratory Axys Varilab jointly owned by a Czech - Canadian company, 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.

Limits of detection for HCB varied between 0.1 – 0.4 ng/g fat. Limits of detection for dioxins and furans are shown in the table below for all the congeners for each sample. For PCBs, limits of detection for PCBs 77, 81, 126, and 169 varied from 0.0002 – 0.0003 ng/g fat. For PCBs 105, 114, 118, 123, 156, 157, 167, and 189 the limit of detection varied from 0.02 – 0.5 ng/g fat

[f] The numbers of eggs per pooled sample differ from place to place according to several factors: Czech veterinary restrictions on sending them to the laboratory; the need for extra eggs in case of laboratory problems; or for use in analyzing other POPs as described in separate reports.

Limits of Detection for Dioxins

	Belarus - Bolshoi Trostenec	Bulgaria - Kovachevo	Czech Republic-Liberec	Czech Republic - Usti nad Labem	Egypt – Helwan	India – Eloor
Congeners	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)
2,3,7,8 TeCDD	0.5	0.4	0.6	0.3	0.3	0.3
1,2,3,7,8 PeCDD	0.6	0.4	0.9	0.4	0.3	0.3
1,2,3,4,7,8 HxCDD	0.5	0.3	0.4	0.3	0.3	0.3
1,2,3,6,7,8 HxCDD	0.6	0.4	0.6	0.4	0.3	0.3
1,2,3,7,8,9 HxCDD	0.5	0.3	0.4	0.3	0.3	0.3
1,2,3,4,6,7,8 HpCDD	0.6	0.4	0.7	0.4	0.4	0.4
OCDD	1.3	0.7	1.0	0.7	0.8	0.7
2,3,7,8 TeCDF	0.5	0.4	0.6	0.3	0.3	0.3
1,2,3,7,8 PeCDF	0.5	0.4	0.7	0.4	0.3	0.3
2,3,4,7,8 PeCDF	0.5	0.4	0.7	0.4	0.3	0.3
1,2,3,4,7,8 HxCDF	0.5	0.3	0.4	0.3	0.3	0.3
1,2,3,6,7,8 HxCDF	0.5	0.4	0.5	0.3	0.3	0.2
2,3,4,6,7,8 HxCDF	0.6	0.4	0.5	0.4	0.3	0.3
1,2,3,7,8,9 HxCDF	0.6	0.4	0.5	0.4	0.3	0.3
1,2,3,4,6,7,8 HpCDF	0.6	0.4	0.6	0.4	0.3	0.3
1,2,3,4,7,8,9 HpCDF	0.6	0.4	0.6	0.4	0.3	0.3
OCDF	1.0	0.7	1.2	0.7	0.7	0.6

	India - Lucknow	Kenya - Dandora	Mexico – Coatza-coalcos	Mozambique - Santos	Pakistan - Peshawar	Philippines - Barangua Aguado
Congeners	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)
2,3,7,8 TeCDD	0.3	0.4	0.3	0.3	0.3	0.3
1,2,3,7,8 PeCDD	0.3	0.3	0.3	0.3	0.5	0.3
1,2,3,4,7,8 HxCDD	0.3	0.3	0.3	0.3	0.2	0.3
1,2,3,6,7,8 HxCDD	0.3	0.3	0.3	0.3	0.4	0.3
1,2,3,7,8,9 HxCDD	0.3	0.3	0.3	0.3	0.2	0.3
1,2,3,4,6,7,8 HpCDD	0.4	0.4	0.4	0.4	0.3	0.4
OCDD	0.7	0.8	0.8	0.8	0.6	0.7
2,3,7,8 TeCDF	0.3	0.3	0.3	0.3	0.3	0.3
1,2,3,7,8 PeCDF	0.3	0.3	0.3	0.3	0.4	0.3
2,3,4,7,8 PeCDF	0.3	0.3	0.3	0.3	0.4	0.3
1,2,3,4,7,8 HxCDF	0.3	0.4	0.4	0.3	0.3	0.3
1,2,3,6,7,8 HxCDF	0.3	0.3	0.3	0.3	0.4	0.3
2,3,4,6,7,8 HxCDF	0.3	0.4	0.4	0.3	0.3	0.3
1,2,3,7,8,9 HxCDF	0.3	0.4	0.4	0.3	0.3	0.3
1,2,3,4,6,7,8 HpCDF	0.3	0.3	0.3	0.3	0.4	0.3
1,2,3,4,7,8,9 HpCDF	0.3	0.3	0.3	0.3	0.4	0.3
OCDF	0.6	0.7	0.7	0.6	0.6	0.6

Limits of Detection for Dioxins continued

	Russia – Gorbatovka	Russia – Igumnovo	Senegal – Mbeubeuss	Slovakia - Kokshov-Baksha	Tanzania - Vikuge	Turkey – Izmit
Congeners	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)
2,3,7,8 TeCDD	0.3	0.4	0.5	0.4	0.3	0.3
1,2,3,7,8 PeCDD	0.3	0.3	0.4	0.3	0.3	0.3
1,2,3,4,7,8 HxCDD	0.3	0.3	0.4	0.3	0.3	0.3
1,2,3,6,7,8 HxCDD	0.3	0.4	0.4	0.3	0.3	0.3
1,2,3,7,8,9 HxCDD	0.3	0.3	0.4	0.3	0.3	0.3
1,2,3,4,6,7,8 HpCDD	0.4	0.4	0.5	0.4	0.3	0.4
OCDD	0.8	0.9	0.8	0.9	0.7	0.7
2,3,7,8 TeCDF	0.3	0.4	0.4	0.3	0.3	0.3
1,2,3,7,8 PeCDF	0.3	0.3	0.3	0.3	0.3	0.3
2,3,4,7,8 PeCDF	0.3	0.3	0.3	0.3	0.3	0.3
1,2,3,4,7,8 HxCDF	0.3	0.4	0.4	0.3	0.3	0.3
1,2,3,6,7,8 HxCDF	0.3	0.3	0.3	0.3	0.3	0.3
2,3,4,6,7,8 HxCDF	0.3	0.4	0.4	0.3	0.3	0.3
1,2,3,7,8,9 HxCDF	0.3	0.4	0.4	0.3	0.3	0.3
1,2,3,4,6,7,8 HpCDF	0.3	0.4	0.4	0.3	0.3	0.3
1,2,3,4,7,8,9 HpCDF	0.3	0.4	0.4	0.3	0.3	0.3
OCDF	0.6	0.7	0.8	0.7	0.6	0.6

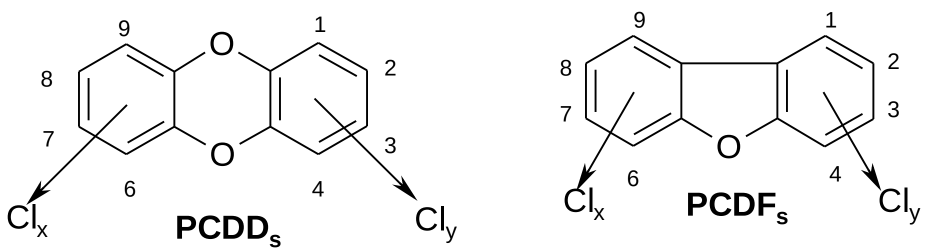
	Uruguay – Minas	USA – Mossville
Congeners	Limit of detection (pg/g fat)	Limit of detection (pg/g fat)
2,3,7,8 TeCDD	0.4	0.3
1,2,3,7,8 PeCDD	0.4	0.3
1,2,3,4,7,8 HxCDD	0.3	0.3
1,2,3,6,7,8 HxCDD	0.4	0.3
1,2,3,7,8,9 HxCDD	0.3	0.3
1,2,3,4,6,7,8 HpCDD	0.4	0.3
OCDD	0.9	0.7
2,3,7,8 TeCDF	0.4	0.3
1,2,3,7,8 PeCDF	0.4	0.3
2,3,4,7,8 PeCDF	0.4	0.3
1,2,3,4,7,8 HxCDF	0.4	0.3
1,2,3,6,7,8 HxCDF	0.4	0.3
2,3,4,6,7,8 HxCDF	0.4	0.3
1,2,3,7,8,9 HxCDF	0.4	0.3
1,2,3,4,6,7,8 HpCDF	0.4	0.3
1,2,3,4,7,8,9 HpCDF	0.4	0.3
OCDF	0.8	0.5

Annex 2. Chemical profiles of U-POPs

Dioxins and Furans

Structure and properties

Dioxins (polychlorinated dibenzo-p-dioxins, or PCDDs) and furans (polychlorinated dibenzofurans, or PCDFs) are two groups of chemicals with similar chemical structures **(Picture 2.1)** each varying according to the number and position of chlorine atoms attached to the dioxin or furan moiety. There are 75 different dioxins and 135 different furans. The number and placement of their chlorine atoms also determines their physical, chemical, and toxicological properties.



Picture 2.1 Structure of polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDDs/Fs)

Dioxins show very low solubility in water (especially the ones that are highly chlorinated), and low volatility, they are readily absorbed on the surface of solid particles, and decompose very slowly. As a result of these characteristics, Dioxins are found primarily in soil, sludge and sediments, and in very limited amounts in the dissolved form in surface or other waters. Due to a high distribution coefficient, (known as Kow), they are able to bioaccumulate in the adipose tissues of animals and people.

Sources

Among the most significant dioxin sources are waste incinerators (including municipal waste incinerators), iron ore sintering plants, production and use of the wood preservative pentachlorophenol, and pulp and paper mills using chlorine for the bleaching process. PCBs are the most significant potential source of furans, a fact that underlies the concern about accidental burning of PCBs.

Toxicity

A number of types of cancers, as well as total cancer incidence, have been related to accidental and occupational exposure to one particular dioxin, 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), the most toxic of the dioxins. (See references at the end of the Annex) In their recently published book, Schecter and Gasiewicz note that recent data ". . . provide evidence for reproductive, developmental, and immunotoxic effects in humans." In addition, an increased prevalence of diabetes and increased mortality due to diabetes and cardiovascular diseases has been reported. In children exposed to dioxins, effects on neurodevelopment, neurobehavioral and effects on thyroid hormone status have been reported at exposures at or near background levels. At higher exposures, due to accidental exposure (Yusho and Yu Cheng populations), children exposed transplacentally to dioxins show skin defects (such as chloracne), tooth mineralization defects, developmental delays, behavior disorders, decrease in penile length at puberty, reduced height among girls at puberty and hearing loss.

Dioxins and furans persist for long periods and everyone is exposed to them. They enter the human body by ingestion, inhalation, and skin penetration. The most important route for human exposure to dioxins is food consumption, contributing more than 90% of total exposure, of which products of fish and other animal origins account for approximately 80%.

Forty specialists from 15 countries met at the headquarters of the World Health Organization (WHO) in Geneva from 25 to 29 May 1998 to evaluate the risks which dioxins might cause to health. After ample debate, the specialists agreed on a new tolerable daily intake range of 1 to 4 picogrammes/kilogram body weight. The experts, however, recognized that subtle effects may already occur in the general population in developed countries at current background levels of 2 to 6 picogrammes/kilogram body weight. They therefore recommended that every effort should be made to reduce exposure "…to the lowest possible level."

Polychlorinated biphenyls (PCBs)

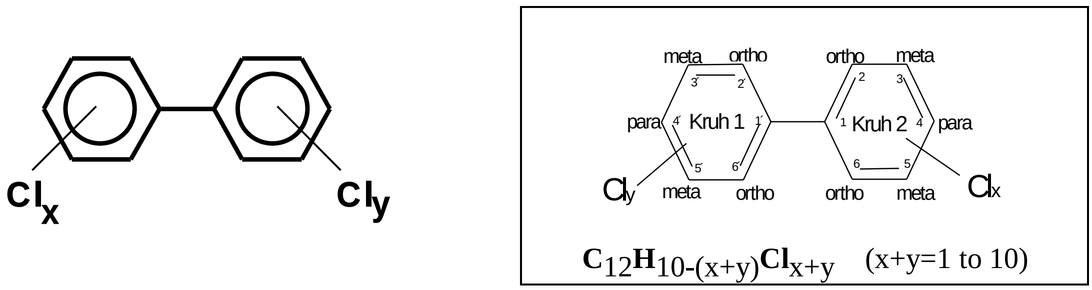
Structure

PCBs are organic compounds which have hydrogen atoms on the biphenyl skeleton replaced, to various extents, by chlorine atoms. The number of chlorine atoms in the molecule can range from 1 to 10, and theoretically 209 isomers (congeners) of PCBs can exist (Picture 2.2). However, only about 100 congeners prevail in industrially produced mixtures of PCBs. The proposed Toxic Equivalency Factors from the World Health Organization for dioxin-like PCBs range over four orders of magnitude.

Sources

The chemical stability and heat resistance of PCBs led to their extensive intentional use in two types of applications:

1) closed uses – dielectric fluids in electrical equipment such as transformers, capacitors, heat transfer and hydraulic systems; and



Picture 2.2 Structure of polychlorinated biphenyls

2) open uses – as pesticide extenders, sealants, in carbonless copy paper, industrial oils, paints, adhesives, plastics, flame retardants and to control dust on roads. This use was widely banned in the 1970s.

In the 1970s, countries of the Organization for Economic Co-operation and Development (OECD) restricted the use of PCBs to closed systems. Manufacture for export to non-OECD countries continued in Europe until 1983. Currently, 16 countries prohibit the import of PCBs, whereas six others allow the import of PCBs only under special circumstances. However, PCBs are in use in numerous countries worldwide.

Monsanto, Bayer, DSW-VEB, Caffaro, S.A. Cros, Prodelec and others produced PCBs intentionally under various trade names including "Arochlor", "Pyrochlor", "Asbestol", "Askarel", "Bakola", "Chlorinol", "Chlorphen", "Fenochlor", "Dykanol", "Orophene", "Clophen", "Pyranol", "Saft-T-Kuhl" and "Sovol".

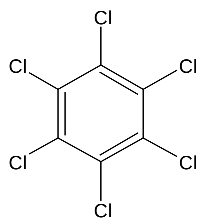
PCBs are created as unintentional by-products from many of the sources that generate dioxins. They are produced during the combustion of organic materials containing chlorine as well as during the manufacture of various chlorine-containing chemicals, such as ethylene dichloride. A study of PCB release from unintentional sources found that industrial coal combustion produced significant levels of PCBs expressed as TEQ, though they represented only a small fraction of the total PCBs. [67] Other unintentional sources include municipal waste incineration, electric arc furnaces, shredders, sinter plants, cement plants, crematoria, and coal-based power stations. [68 69 70]

Releases
A major source of PCBs expressed either as mass or TEQ is leakage from capacitors and transformers. Ongoing releases of PCBs to the environment occur from fires, spills, and leaks from closed systems; evaporation or leakage from landfills or PCB storage sites; incineration of waste containing PCBs (which were once used in a wide array of consumer products); and incomplete incineration of waste PCBs. PCBs released to the environment can be accompanied by the presence of dioxins.

Toxicity
PCBs are classified as probable human carcinogens (group 2A) by IARC and produce a wide spectrum of adverse effects in animals, including reproductive toxicity and immunotoxicity. Prenatal exposure to PCBs is associated with reduced concentration and poorer verbal, pictorial, and auditory working memory in humans. The most common route of PCB entry into humans is ingestion of contaminated food, including fish; however, PCBs may also be inhaled and absorbed through the skin. PCBs are extremely persistent and accumulate, especially in adipose tissues. They are bioaccumulated from water and river sediments by algae and plankton and thereby enter food chains. The distribution coefficients between water and fat for the individual congeners of PCBs are so high that experimental fish kept for a longer time in water contaminated by trace concentrations of PCB concentrated these substances in their bodies up to a thousand-times. The distribution of PCBs in the bodies of fish is not uniform. For example, in carp, they accumulate especially in adipose tissues, head, central nervous system, gallbladder, and other internal organs. In contrast, concentrations in blood and smooth muscles are significantly lower.

Hexachlorobenzene - HCB

Structure and properties
HCB (Picture 2.3) is a white crystalline solid or crystal and is used as a fungicide.
HCB is a very stable, low volatile compound of lipophilic nature showing low solubility in water, and considerable ability to accumulate in adipose tissues of organisms and to absorb on surfaces of solid particles. It decomposes only very slowly in the environment. In the scientific literature, chlorinated phenols are mentioned as its decomposition products. These properties of HCB result in long persistence in the environment and its entry into food chains.



Picture 2.3: Stucture of HCB

Sources
HCB was originally introduced in 1940's as a seed-dressing for cereal crops to prevent fungal disease. HCB is used as fungicide, disinfectant, and as a starting or intermediate raw material during production of certain chemicals (pentachlorophenol, some chlorinated aromatic compounds). As an industrial chemical, it is used, for example, in production of pyrotechnic products, synthetic rubber and aluminum. For its fungicide properties it was used for treatment of wheat and onion, and for seed treatment. HCB has also been used in various industrial processes, for example, as a fluxing agent in the manufacture of aluminum and as a dispersing agent in the production of rubber for tires. HCB was voluntarily cancelled for use as a pesticide in 1984 in the U.S. and is no longer

commercially manufactured as an end product in that country. It is also banned in India and Japan and its use is restricted in several other countries. However, it may still be in use in several countries.

HCB also produced as an unintentional by-product of combustion processes involving chlorinated compounds (for example, during waste incineration or in metallurgy) and as a by-product in the manufacture of certain chlorinated pesticides (such as lindane) and industrial chemicals (for example, in chlorine chemistry or during chlorine bleaching of pulp). In this latter group are chlorinated solvents, such as carbon tetrachloride, perchloroethylene, trichloroethylene and chlorinated benzenes.

Toxicity

HCB is toxic to both humans and animals when long-term exposure occurs. Its main health effect is liver disease. HCB is also known as an endocrine disruptor and probable human carcinogen (2B category according to IARC ranking). Human exposure to HCB may occur through several pathways including consumption of dairy products or meat from cattle grazing on contaminated pastures; consuming low levels in food, eating or touching contaminated soil; drinking small amounts in contaminated water; inhaling low levels in contaminated air; drinking contaminated breast milk from exposed mothers; occupational exposure from the use or production of HCB; and exposure to HCB as a by-product from other industrial processes, such as waste incineration.

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Annex 3. Previous studies of POPs in chicken eggs

Contamination of chicken eggs by U-POPs has been reported historically in several studies in various locations. The available data focuses on dioxin or PCB contamination and no studies have examined the relationship between HCB release as a U-POP and its level in eggs. In fact measurements of HCB levels from more recent years are rather rare. The following studies describe U-POPs contamination in chicken eggs:

Pontypool (UK)

A. Lovett and co-workers repeatedly studied the area surrounding the Pontypool hazardous waste incinerator in southern England. Sampling was carried out around a number of industrial facilities in the Panteg district and involved a variety of environmental compartments e.g. soil, grass, air, milk, eggs, poultry and vegetables. The results provided evidence of some unusual environmental contamination in a strip of land 200 m wide around the eastern boundary of the incineration plant. Fugitive emissions from the site appeared to be substantially responsible for this situation and exposure calculations indicated that eggs were potentially the major source of higher PCB and dioxin intakes.[71, 72] The measured median levels of dioxins were for duck and bantam eggs in the most polluted area of Pontyfelin House were 28.6 and 92.3 pg WHO-TEQ/g of fat respectively. For the same groups median levels of 46 congeners of PCBs were 1436 and 2623 ng/g of fat respectively.[g]

Rheinfelden (Germany)

Rheinfelden is an industrial area located in the southwestern part of Germany, which is partly contaminated with dioxins. Two local sources of dioxins were identified for soil contamination: residues of pentachlorophenol production and chlor-alkali processes. On the site of a former disposal site ("Zielgasse") chicken were kept. The soil contamination in the area, where chickens were kept ranged between 377 and 2168 pg I-TEQ/g. In this area two typical patterns of congeners was detected in soil: one typical for pentachlorophenol contamination with elevated octa-dioxin and low penta- and hexachlorodibenzofurans levels, and the other with low octa-dioxin and elevated penta- and hexachlorodibenzofurans (residues of chlorine production as possible source).[73]

Two different chicken egg samplings were done in the area of former disposal site "Zielgasse" at the beginning of the 1990s. Frommberger measured levels between 173 and 514 pg I-TEQ/g of fat[74] and Shmid measured levels between 25.5 and 39.7 pg I-TEQ/g of fat in three eggs sampled from chickens raised in another part of the disposal site.[75] Malisch sampled two eggs from chickens kept in another part of the town and found 11.5 and 47.1 pg I-TEQ/g of fat. These different results provoked a quality control study to evaluate the results of four laboratories for determination of dioxins in eggs samples from Rheinfelden. Laboratories measured levels of dioxins 10.6 - 14.9[h] pg I-TEQ/g of fat. Also eggs from market to show background levels were measured with results ranged between 1.13 - 1.35 pg I-TEQ/g of fat.[76]

The level of 514 pg I-TEQ/g[i] of fat measured by Frommberger in chicken eggs from Rheinfelden is to our knowledge the second highest level of dioxins ever found in chicken eggs following the level of 713.1 pg WHO-TEQ/g of fat measured in chicken eggs during the Belgian dioxin scandal in 1999.[77]

Newcastle (UK)

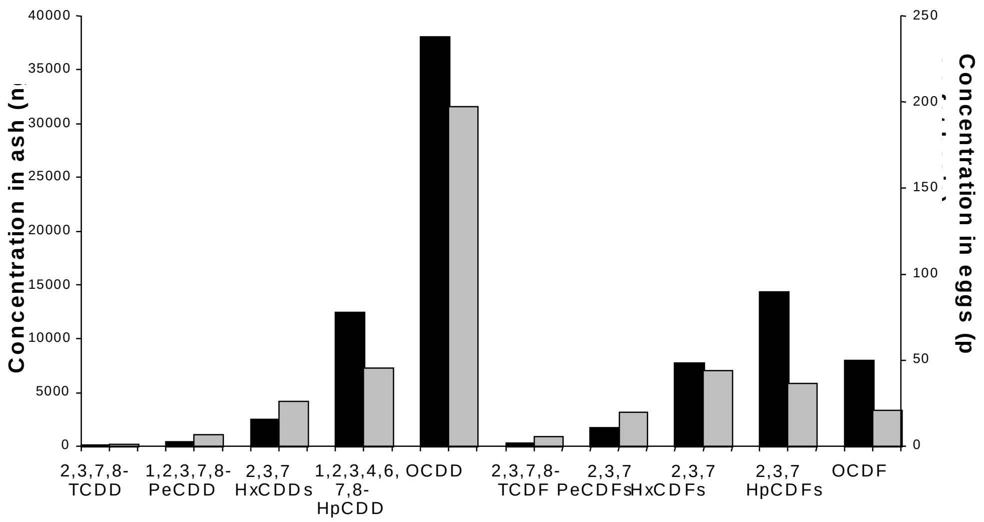
Between 1994 - 1999, 2000 tons[78] of fly ash from the nearby Byker waste incinerator was used on footpaths in Newcastle. Tanja Pless-Mulloli et al.[79] studied the influence of its use on contamination of soil and poultry. They examined a number of factors that could influence the level of dioxins contamination. The concentrations of dioxins found in the fly ash ranged from 0.02 to 4.224 ng/g (in I-TEQ).

[g] levels for grams of fat were calculated from data published in A. A. Lovett's team report published in Chemosphere Vol. 37 (see quotations).

[h] range of different results of laboratories.

[i] although this level is in I-TEQ, we think that it would remain second highest level even after recalculation in units of WHO-TEQs.

Seventeen out of 19 egg samples from allotments which had received ash showed levels of contamination well in excess of barn held supermarket eggs (6). Seventeen out of 19 egg samples from allotments, which had received incinerator ash showed the influence of ash in the pattern of contamination (see Figure 1). The weighted average of all the egg samples was 16.4 pg/g I-TEQ. The weighted average for those samples, which showed the incinerator pattern in the egg samples was 22.2pg/g I-TEQ.



Picture 3.1 Comparison of the toxic congener pattern in ash and eggs.
Westmacott Street: ash 2123 ng/kg I-TEQ, incinerator pattern, eggs 18 pg/g I-TEQ lipid basis, incinerator pattern, chicken have access to ash.

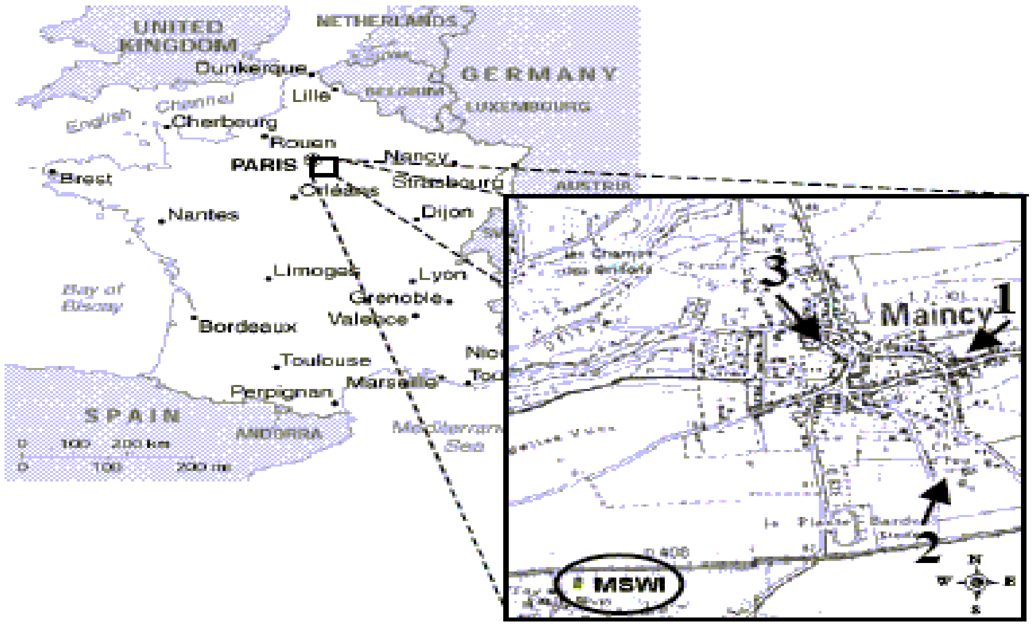
Wastes with dioxin content less than one-third the “low POPs level” for dioxins[80] set out by the Basel Convention were used in Newcastle for reconstruction of footpaths. This resulted in contamination of poultry eggs which, on the average, exceeded the EU dioxin limit in eggs by 5.5 – 7 fold.

Maincy (France)

Maincy, a small French village located at about 60km south of Paris, is located to an old waste incinerator that operated for over 20 years. This municipal solid waste incinerator had recently been closed due to very high dioxin emission rates that were more than 2000 fold higher than the actual European norm of 0.1ngTEQ/Nm³.

Studies carried out by team of scientists led by Belgian scientist Catherine Pirard found levels of dioxins in soil ranging between 3.26 - 59.04 pg I-TEQ/g dry matter compared to levels of dioxins in eggs ranging between 5.1 - 121.55 pg WHO-TEQ/g fat. .[81] The sum of mono- and non-ortho PCBs ranged from 0.78 to 2.80 pg I-TEQ/g d.m. in soils and from 0.85 to 52.48 pg WHO-TEQ/g fat in eggs. [82] In the first study abdominal fat levels were also measured and the levels ranged between 34.3 and 121.1 pg WHO-TEQ/g of fat. Also these levels exeed the EU norm set at 2 pg WHO-TEQ/g fat. [83] In a second study, measured concentrations were higher than the 0.1 to 6 pg TEQ/g of dry weight range usually reported for soil surfaces sampled close to operating European incinerator,[84, 85,86] with the exception of one study reporting levels for soils collected near another very old incinerator.[87]

Concentrations of dioxins in eggs and free-ranging chicken samples in Maincy were found to be more than 15 times higher than the European norm set at 3 pg WHO-TEQ/g fat and would potentially be harmful for exposed population. These represent the fourth highest level of dioxins measured in chicken eggs to our knowledge just after level found recently in eggs from Helwan in Egypt.[88]



Picture 3.2: Map showing location of Maincy within France and more detailed view of Maincy vicinity with 3 sites marked where team led by Catherine Pirard sampled soils, chickens and chicken eggs. Also the location of an old incinerator. is marked. Sites selected for soil sampling were located between 1250 and 1500m from the incerator, under the prevailing wind stream (NE). Source: Pirard, C. et al. 2003.[a]

Oroville (California, USA)

In Oroville, California several biomonitoring studies were performed after accidental fires in a pentachlorophenol wood treatment facility in 1962 and 1987. After the second fire, Oroville became a destination for scientists who wanted to study the relationships between soil contamination by dioxins and its movement into free range chickens and humans.

Chang et al. found high levels of dioxins in chicken meat and eggs sampled in Oroville after the second serious fire. *"The concentrations measured in eggs, poultry, and bovine tissues are of public health concern. Modest assumptions as to human consumption (i.e., 1 egg/day) results in exposure in the range of 10-30 pg/kg day, which is in excess of most currently accepted ADIs. This suggests that unacceptable food animal contamination can result from exposure to soils with TCDD toxic equivalent concentration (CATEF)*[j] *in the 10-50 ppt range, which is 20-100X lower that the commonly used 1 ppb action level for contaminated soils,"* they concluded.[89] Another conclusion of the study was that the source of the soil and animal contamination in the areas studied around Oroville was most likely related to pentachlorophenol and its associated dioxins.

Some results from a more recent study from the area of Oroville are shown in Table 3.1. Based on these results we have calculated the highest level of dioxins measured in eggs from Oroville, which is 69.23 pg WHO-TEQ/g lipid. This is one of the highest dioxin levels ever measured and even exceeds the recently found dioxin level in eggs from Bulgaria.[90]

Soil from where the chickens grazed contained 34-40 pg ITEQ/g and the dioxin contamination profile (of higher chlorinated dioxins dominating over all other dioxins) matched that in the eggs. This pattern is generally seen in pentachlorophenol production[91, 92] and incineration.[93, 94]

Blood levels among Oroville contaminated egg and meat consumers were elevated compared

[j] CATEF = 2,3,7,8 TCDD, TCDF, PeCDD's PeCDF's = 1.0 rel. potency; 2,3,7,8 HxCDD's, HxCDF's, HpCDD's, HpCDF's = 0.03 rel. potency, all other isomers - 0 re]. potency

to US urban populations and a comparison group from rural areas. The elevated levels did not cause expectations of acute disease. However, the observed elevations were comparable to those reported among an occupationally exposed group among whom the overall cancer rate was elevated.[95]

Midland (Michigan, USA)

In 2000, soil samples collected more than 20 miles downriver from Dow Chemical's global headquarters in Midland, Michigan found very elevated levels of dioxin, nearly 25 times higher than the residential cleanup level in

Area sampled	Number of sites/samples	ITEQ concentration (pg ITEQ/g egg or ppt)[a] Average	Geometric mean	Minimum	Maximum	Number > 1 ppt
Home-produced eggs						
Oroville: index homes	2/4[b]	10.03	9.01	5.6	18.26	4 (100%)
Greater Oroville area (11-km radius)	23/24[c,d]	3.40	1.72	0.08	13.16	15 (65%)
Nevada County	5/6[d]	0.15	0.04	0.01	0.63	0
Commercial eggs						
Oroville	5/6[d]	0.03	0.03	0.01	0.48	0

[a]Where PCDD and PCDF values were below detection limits, zero was entered into the ITEQ calculation. [b]Samples were collected at two different times at each home. [c]Corresponding statistics do not include index homes. [d]Corresponding statistics are based on one sample from each collection site.

Table 3.1: Dioxin concentrations in chicken eggs from Oroville and comparison areas (Nevada County) (pg I-TEQs/g fresh weight) Source: Goldman et al. 2000.[a]

In Oroville, the question of residential emissions surfaced. Goldman et al. discussed that question in their study: *"That the contamination may not be solely attributable to the 1987 fire was suggested by two samples of liver from cows raised at the same index house and slaughtered in 1985 and in 1988; the samples had nearly identical levels and patterns.[96] However, in 1963 there was a larger PCP fire at the wood treatment facility; that fire burned for 1 week. Recent estimates indicate a 25-100-year half-life for PCDDs/PCDFs [dioxins] in soil.[97] Other potential industrial sources were located near the wood treatment facility; most notably, four teepee burners were within 2 km. Teepee burners were used as incinerators prior to 1980 to burn waste wood, including the remains in PCP wood-treatment cylinders.[98] Burning PCP-treated wood in homes is also a possible source of contamination, but larger burners are present at industrial facilities and residential emissions are unlikely to be as great as emissions from industrial sources."*[99]

Michigan of 90 ppt, and well over the average background in Michigan of 6 ppt. Subsequent testing has found dioxin concentrations as high as 16,000 ppt and a contamination fingerprint that stretches more than 50 miles from the source. The contamination is extensive throughout the 100-year floodplain of the Tittabawassee River, the Saginaw River, and into the Saginaw Bay. The Saginaw Bay watershed is the largest watershed in the Great Lakes, and empties into Lake Huron.

For more than three decades, studies of wildlife and fish in the area have suggested impacts on the reproduction and function of wildlife. In the last two decades, elevated levels of dioxin have been found in fish and wildlife.

Recently, much more extensive testing has been conducted on wildlife and on chicken eggs in the area given the new information on the extent and magnitude of the contamination.

Chickens were raised on the contaminated floodplain by a family interested in raising safe and healthy food. The meat and eggs were both consumed by the residents. They chickens were allowed to free range over the property, and were often observed eating insects and other things from the yard. They were also fed commercial feed. Four egg samples were provided to the Michigan Department of Environmental Quality. Dioxin concentrations ranged from 16 to 49 ppt TEQ. Based on the results, the regulatory agency charged with protection of public health, the Michigan Department of Community Health, recommended the residents no longer consume the chicken or eggs. See the chart below for individual egg sample results.

Eggs from Riverside Boulevard, Saginaw County, Michigan

Sample	**Dioxin** (pg WHO-TEQ/g of fat)
Egg 1	49
Egg 2	42
Egg 3	42
Egg 4	16

This data is reported in: Final Report: Phase II Tittabawassee/Saginaw River Dioxin Flood Plain Sampling Study, June, 2003. Michigan Department of Environmental Quality

An analysis of the congeners in the eggs closely matches the congener profile found in soils from the site, suggesting that the dioxin is readily bioavailable to chickens, and the contaminated soils are the source of the dioxin contamination in the chicken eggs. Residents were advised to no longer eat chicken or egg products from eggs raised on the contaminated floodplain.

This data is reported in: Final Report: Phase II Tittabawassee/Saginaw River Dioxin Flood Plain Sampling Study, June, 2003. Michigan Department of Environmental Quality

Wild game were also collected and tested by a contractor for Dow Chemical. State reanalysis of that data found the levels were high enough to merit the second wild game advisory in the State's history. Levels of dioxins in the wild game harvested in the floodplain downstream of Dow's facility were up to 7 times higher than samples taken upstream of the facility in deer muscle meat, 118 times higher in deer liver, 66 times higher in turkey, and 40 times higher in squirrel.

The Michigan Department of Community Health (MDCH) is advising hunters and their families to not eat liver from deer in the area; to limit consumption of muscle meat from deer; to not eat turkey from the floodplain; and to limit consumption of squirrel from the floodplain.

These advisories joined the much older dioxin fish consumption advisories for several species of fish in the Tittabawassee and Saginaw Rivers, Saginaw Bay, and Lake Huron.

Chapaevsk (Russia)

The town of Chapaevsk has a population of 80 thousand and is located in the Middle Volga region. The large concentration of chlorine chemical industries has created a serious dioxin contamination problem within the city. During 1967-1987 a chemical plant there produced hexachlorocyclohexane (lindane) and its derivatives. Later it produced other pesticides and chlorinated chemicals (liquid chlorine, acids, methyl chloroform, vinyl chloride, and some other chemicals). It was considered that the HCH production was responsible for dioxin contamination in the city's environment. Tests seemed to confirm it. But after the production was stopped in 1987, a continued output of dioxin was still observed. At present, the plant stands practically idle; the main contamination source is represented by the technological equipment, the plant's territory and industrial wastes.[100]

Dioxins were measured in eggs as well as human blood. Measured levels ranged from a very low level 0.0001 to very high one of 18.1 pg WHO-TEQ/g of fat.[101] To our knowledge, these are the only available data concerning dioxins levels Russian eggs aside from IPEN's present study.

Dioxins were found also in all samples of cow's milk from Chapaevsk. The 2,3,7,8-TCDD level was 17.32 pg WHO-TEQ/g fat compared to the accepted regulatory standard in Russia of 5.2 pg WHO-TEQ/g fat. Levels of dioxins in blood samples of residents living within 5 km of the plant were found to be 75.7 pg WHO-TEQ/g of fat. Residents living further than 5km from the plant had dioxin levels of 44.1 pg WHO-TEQ/g of fat.[102]

Libis and Lysa nad Labem (Czech Republic)

As in the previous case of Chapaevsk, eggs were used as additional monitoring samples in two cases in the Czech Republic during last years.

Libis is a village located near the large chlorine chemical plant, Spolana Neratovice. This site also contains dioxin contamination due to past production of pesticides and an obsolete chlor-alkali plant. Dioxins in chicken egg were also measured and found to contain 23.39 pg WHO-TEQ/g. The Czech State Veterinary Administration measured 7 PCB congeners and HCB in eggs from Libis and found high levels of these chemicals at 553 ng/g of fat and 1,156 ng/g of fat respectively. These levels exceeded EU limits. It is likely that the 7PCB congeners and HCB are not U-POPs releases since PCBs are still in use in the Czech Republic in transformer oils and HCB was one of compounds used in pesticides produced by Spolana Neratovice in the past.

High levels of dioxins and PCBs were found in sediments surrounding Spolana Neratovice as well as in poultry meat from chickens in the area (up to 109 pg WHO-TEQ/g of fat dioxins + PCBs, from which 29 pg WHO-TEQ/g was the value for dioxins).[103] Also levels in human blood were measured and median values of dioxins and PCBs ranged between 51.2 - 57.4 pg WHO-TEQ/g of fat and 42.0 - 54.0 pg WHO-TEQ/g of fat respectively. Dioxin values were approximately one third from total WHO-TEQs. HCB was observed in median values range between 209 - 248 ng/g of fat by inhabitants in the area surrounding Spolana Neratovice.[104]

Eggs and other food sources as well as game animals were sampled for dioxins, furans, and HCB near a hazardous waste incinerator located in Lysa nad Labem during years 2003 and 2004. Levels of dioxins and PCBs measured in a pooled sample of 4 eggs ranged between 5.0 - 6.8 pg/g of fat (in WHO-TEQ) and 21.7 - 22.4 pg/g of fat (in WHO-TEQ) respectively. The HCB level measured in eggs was 46.2 ng/g of fat. This sample was in addition to monitoring in which chickens, hares, pheasants and fish meat were measured. Almost all poultry and game samples exceeded the EU limit for poultry and game meat (2.0 pg/g of fat in WHO-TEQ).[105] Also human blood was analyzed for dioxins and PCBs with levels ranging from 4.2 – 18.6 pg/g of fat (in WHO-TEQ) and 7.1 – 40.2 pg/g of fat (in WHO-TEQ) respectively.[106]

Annex 4. Dioxin toolkit

Each country must prepare an inventory of its dioxin sources and estimates of their releases. A country will not be eligible to receive funds for addressing dioxin sources that are not listed in its inventory, since sources prioritized for action are based on the inventory. To help countries assemble their inventories, UNEP developed a draft Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases. As indicated by its title, the Toolkit addresses only two of the U- POPs – the polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans, referred to collectively as dioxins. The other two targeted U-POPs, HCB and PCBs have yet to be addressed.

Source Identification Strategy

No dioxin source identification strategy is presented in the newly revised Toolkit, despite agreement durng the plenary at INC7 that such a strategy would be presented in the 2005 edition. The Toolkit's list of dioxin sources is not a definitive list, e.g., new sources are still being discovered. As a consequence, a source identification strategy gives countries the means necessary to identify all of their important dioxin sources so these sources can be included in their inventories and so be eligible for funding assistance. Such a strategy is particularly important for developing countries and countries with economies in transition, which may have sources that have not yet been recognized because they involve processes and practices not present in developed countries.

Emission Factors

Most emission factors in the Toolkit are derived from processes and practices in developed countries. There is no scientific basis for the assumption that these emission factors are applicable to activities in developing countries and countries with economies in transition. Indeed, recalculating dioxin releases for several countries, using the Toolkit methodology but substituting certain emission factors from published studies has been shown to change dramatically the ranking of sources. In fact, experts whom IPEN-participating NGOs have consulted suggest that some listed emission factors may be overstated by as much as one or two orders of magnitude, while some others may be similarly understated. An example of a source category with a potentially greatly overstated emission factor is biomass combustion; examples of understated emission factors are those for EDC/VCM/PVC manufacture and cement kilns.

If governments rely solely on theToolkit list of sources and emission factors to assemble their dioxin source inventories, some may end up with highly distorted priorities in their National Implementation Plans (NIPs). Priorities expressed in NIPs can strongly influence national policy priorities, and they can also influence how money is spent and how international assistance is provided.

Even for the most advanced technologies in the wealthiest of countries, emission factors derived for one facility may differ significantly from those derived for another facility even though the processes and inputs are similar. In other words, there is uncertainty in emission factors. Some countries that have developed their own emission factors allow for this uncertainty by using a range of values, e.g., a likely high value; a likely low value; and a likely median value.[k] This gives a more balanced perspective to the estimation of releases from source categories and their subsequent prioritization.

Among the Toolkit emission factors of particular concern are those for biomass combustion and open burning of household waste. For example, the Toolkit emission factor for forest fires, grassland and moor fires is about 40 times higher than found in a recent study;[107] its emission factor for burning wood in household heating stoves is 200 times greater than values reported by the Canadian government;[108] and its emission factor for burning household waste is far higher than any of the values published in the scientific literature. [109]

[k] Indeed one or more countries requested in their comments that the Toolkit follow this approach but they received no response.

For some sources, the Toolkit does not provide emission factors that will enable Parties to comply with their obligations. For example, the Toolkit provides emission factors for cement kilns rather than cement kilns burning hazardous waste, as required by the Convention. The Toolkit contains the assertion, apparently based on the partial assessment of a cement kiln in Thailand, that burning hazardous waste has no impact on emission factors for cement kilns. The Toolkit alluded to another study that reported much larger emission factors for cement kilns burning hazardous waste but gave no details. The study in question, a large national study of many cement kilns, found emission factors for air releases from cement kilns burning hazardous waste were 77 times higher and releases in cement kiln dust 100 times higher than in cement kilns not burning hazardous waste. [110]

Updating and Revision of the Toolkit

The process for updating and revising the Toolkit is also a matter of concern. Comments on the Toolkit have been submitted by countries, pubic health and environmental NGOs, and industry NGOs experts at every stage of the Toolkit's development. Needless to say, these comments have generally been professionally prepared and well-documented. However, to our knowledge, there were no direct responses to these comments and, at least for our comments and those submitted by some countries, little evidence that they influenced subsequent Toolkit revisions. For example, we are aware of multiple requests, both from countries and environmental NGOs, for source citations for the Toolkit's emission factors and the use of ranges for such factors rather than single values that are not reflected in the final product.As mentioned earlier, there is failure to honor the agreement in the INC7 plenary to include a source identification strategy.

Contrary to other UNEP-managed processes that we have participated in, the procedures for developing and revising the Toolkit are notable for their lack of responsiveness and transparency. Parties and stakeholders need better opportunities for review and for input. Finally, the process should not only be more responsive and transparent, but it should also be subject to independent review and verification by experts in the field who have no personal stake in the present product.

Annex 5. BAT/BEP guidelines

The Stockholm Convention aims to continuously minimize and, where feasible, eliminate the release of U-POPs. Under certain circumstances, Parties are required to give priority consideration to alternative techniques that do not generate U-POPs and to promote or require alternative materials, products and processes to prevent the formation and release of U-POPs. To achieve this goal and carry out these measures, Parties to the Convention will need information to support the development of appropriate policies and strategies and to select appropriate techniques. Toward this end, an Expert Group was established and has prepared draft guidelines on Best Available Techniques and Best Environmental Practices (BAT/BEP). While the present draft document is a significant step forward, more work is necessary before it is ready for adoption by the Parties of the Stockholm Convention.

To illustrate this, we will use as a case example, the portion of Section V addressing *Cement kilns firing hazardous waste.*

Cement kilns firing hazardous waste

The summary to this section states, *"If properly operated, releases of chemicals listed in Annex C (unintentional POPs) from cement kilns firing hazardous waste are of minor importance."* It would be false and misleading to generalize this statement to all cement kilns burning all kinds of hazardous wastes in countries at all stages of development. In addition, the related full section states that there exists "*considerable uncertainty*[l]" about dioxin releases from cement kilns. Moreover, taking into consideration the admitted lack of information on dioxin releases in cement kiln dust, it is clear that the information available cannot support such a sweeping conclusion. [m]

In fact, *Cement kilns firing hazardous waste* are identified in Annex C, Part II of the Stockholm Convention as a source category with the potential for comparatively high formation and release of unintentional POPs to the environment. [n] When a decision is made to use a cement kiln to burn POPs wastes or other halogenated wastes, both the operator and national regulatory authorities should be aware that this practice has the potential to generate and release large quantities of U-POPs to the environment,as the Stockholm Convention correctly states. In some industrialized countries, regulatory authorities are comfortable with allowing this practice for certain wastes in certain state-of-the-art facilities. The current draft of the *Guidelines* generalizes from this experience in a way that can lead to serious harm. A reader of the draft *Guidelines* could easily conclude that it is acceptable for ***any*** cement kiln, of ***any*** design, in ***any*** region of the world, to accept and burn POPs waste and other halogenated wastes; and if the kiln is *"properly operated,"* doing so will result in U-POPs releases of at most, *"minor importance."*

The purpose of this example is to demonstrate that the *Guidelines* document remains a work-in-progress. COP1should not adopt these guidelines as considerable additional work is still needed.

Alternatives and Substitute or Modified Materials

[l] Guidelines, Section V, Subsection B, Paragraph 3.3.1

[m] This section provides a table of dioxin concentrations in stack gases of cement kilns and associated air emission factors. [m] According to the column headings in the table, these dioxin measurements were taken at an unknown number of cement kilns under unknown conditions except for the *"use of alternative fuel and raw materials"*. In other words, this table of data has no demonstrable relevance to cement kilns firing hazardous waste. To be relevant and useful, data should be collected during the co-firing of hazardous waste, especially waste that contains POPs and/or POPs precursors, such as halogenated wastes.

[n] Cement kilns, per se, are not listed in the Stockholm Convention Annex C as either a Part II or a Part III source category. Parties are not mandated to require BAT for an ordinary cement kiln firing conventional fuels, or even for that matter, a cement kiln firing non-hazardous wastes. A Party, of course, may chose to do so if it determines or suspects that such a kiln is a significant source of unintentional POPs. However, Section V of the Guidance document covers guidance for Part II source categories, and therefore, is to be read as BAT guidelines for kilns firing hazardous waste.

The Expert Group that developed the draft BAT/BEP Guidelines limited its work to *facilities, processes, techniques and practices* and, for the most part, only created placeholders for the important topic of alternative processes, techniques and practices to prevent the formation and release of U-POPs. In addition, they did not address matters relating to ***substitute or modified materials and products*** on the understanding that this topic was beyond their scope. However, these vital topics should be addressed in future intersessional work following COP1.

Ilustrative photo: Egg sampling in Kokshov-Baksha, Slovakia.

Annex 6. Disposal of POPs wastes

Establishing guidelines for POPs wastes involves an interaction between two Conventions: the Stockholm Convention and the Basel Convention. Article 6 of the Stockholm Convention addresses POPs stockpiles and wastes. It instructs the Stockholm Convention Conference of the Parties to cooperate closely with the appropriate bodies of the Basel Convention to do three things:

- "*establish levels of destruction and irreversible transformation necessary to ensure that the characteristics of persistent organic pollutants … are not exhibited";*
- *"determine what they consider to be the methods that constitute environmentally sound disposal"; and*
- *"work to establish, as appropriate the concentration levels of the chemicals listed in Annexes A, B and C in order to define the low persistent organic pollutant content"* below which POPs wastes need not undergo destruction or irreversible transformation but are to be disposed of in an environmentally sound manner. [o]

The Basel Convention Open Ended Working Group (OEWG) prepared a series of guidelines on wastes consisting of or containing POPs. The first two guidelines in the series – "General Technical Guidelines for Environmentally Sound Management of Wastes Consisting of, Containing or Contaminated with Persistent Organic Pollutants," and "Technical Guidelines for Environmentally Sound Management of Wastes Consisting of, Containing or Contaminated with Polychlorinated Biphenyls, Polychlorinated Terphenyls or Polybrominated Biphenyls" -- were approved and adopted at the seventh Conference of Parties (COP7) of the Basel Convention, 25–29 October 2004. [p, q]

At Basel COP7, Greenpeace pointed out that it was premature and inappropriate to present the guidelines for adoption and use by Basel Parties before the Stockholm COP had the opportunity to consider the determinations made in the guidelines. Since the Stockholm COP had not yet convened, there had been no opportunity for the required cooperative determinations of these issues. Nonetheless, specific determinations are made with respect to each of the issues in the guidelines that were adopted by Basel COP7 and presented to the Basel Parties for their use.

Two problematic areas of the Basel guidelines are "low POPs content" and "levels of destruction and irreversible transformation."

Low POPs content

Guidelines for low POPs content should take public health and environmental impacts into account to prevent further harm.
The current guidelines are:

"the following provisional definitions for low POP content should be applied:

(a) PCBs: 50 mg/kg[r];

(b) PCDDs and PCDFs [dioxins]: 15 mg TEQ/kg[s]; and

(c) *Aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, HCB, mirex and toxaphene: 50 mg/kg for each of these POPs.[t]"*

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[o] Article 6, paragraph 2 (a)

[p] General technical guidelines for the environmentally sound management of wastes consisting of, containing or contaminated with persistent organic pollutants. Basel Convention Report on the implementation of the decisions adopted by the Conference of the Parties at its seventh meeting UNEP/CHW.7/8/Add.1/Rev.1, 26 October 2004

[q] Technical guidelines for environmentally sound management of wastes consisting of, containing or contaminated with polychlorinated biphenyls (PCBs), polychlorinated terphenyls (PCTs) or polybrominated biphenyls (PBBs). , Basel Convention Report on the implementation of the decisions adopted by the Conference of the Parties at its seventh meeting UNEP/CHW.7/8/Add.2/Rev.1, 26 October 2004.

[r] Determined according to national or international methods and standards.

[s] TEQ as referred to in Annex C, Part IV, paragraph 2 of the Stockholm Convention, excluding co-planar PCB.

[t] Determined according to national or international methods and standards) for each of these POPs

Unfortunately, the current POPs waste guidelines do not explain the basis, scientific or otherwise, for the selection of the "low POPs content" concentrations established in the guidelines: [u] These values are not based on considerations of potential impacts on public health and the environment nor are they based on the capabilities of available technologies for the destruction / irreversible transformation of POPs in wastes. In fact, the "low POPs" values are higher, by orders of magnitude, than some existing health-based and technology-based values.[v] One result of settling high values for „low POPs content" will be to minimize the quantities of POPs wastes that are prioritized for destruction. The other result will be to maximize the quantities of POPs wastes that are left to be dealt with through landfilling or other unsatisfactory methods of disposal.

Wastes with dioxin content less than one-third the "low POPs level" for dioxins[111] set out by the Basel Guidelines for POPs wastes were used in Newcastle for reconstruction of footpaths. This resulted in contamination of poultry eggs with average levels that exceeded the EU dioxin limit by 5.5 – 7 fold.

Another important consequence of the values for "low POPs content" concerns financial considerations. Financial and technical assistance may be available for destroying POPs in wastes where concentrations are higher than the "low POPs content" values. It is less likely that such assistance will be available for dealing with wastes that contain POPs at levels below the "low POPs content" thresholds. The net result of the high values for "low POPs content" is diminished availability of assistance for destroying POPs and increased potential for negative impacts on public health and the environment from POPs that are not destroyed.

Levels of Destruction and Irreversible Transformation

To comply with the Stockholm Convention, the POPs waste guidelines must establish levels of destruction and irreversible transformation that are necessary to ensure that the characteristics of POPs are not exhibited. These characteristics, which are listed in Annex D of the Stockholm Convention, are persistence, bioaccumulation, potential for long-range environmental transport, and adverse effects. Since every molecule of a POP exhibits these characteristics, the Stockholm Convention requires that technologies used to destroy or irreversibly transform POPs in wastes must do so with effectively 100 percent efficiency.

Some of the technologies that have demonstrated destruction efficiencies of effectively 100 percent are described in considerable detail in the Basel POPs waste guidelines. In addition, the Basel guidelines also acknowledge the importance of destruction efficiency as a performance criterion for such technologies. In fact, in its last session before COP7, the Basel OEWG recommended that the requirement of a destruction efficiency of 99.9999 percent be considered for inclusion in the POPs guidelines.[w] However, this recommendation was set aside in intersessional work and the guidelines adopted by Basel COP7 do not establish levels of destruction and irreversible transformation. Instead, they establish extraordinarily high limit values for the concentrations of POPs that can be released, *undestroyed*, in the solid residues of the processes that are supposed to achieve destruction/irreversible transformation. For dioxins, the guidelines establish a limit value for releases to air of 0.14 ng TEQ/m^3, that is considerably less stringent than the internationally accepted standard of 0.1 ng TEQ/m^3. For all other POPs releases to air and to water, the guidelines simply defer to "*pertinent national legislation and international rules, standards and guidelines.*"

These "*provisional levels of destruction and irreversible transformation, based upon absolute levels (i.e., waste output streams of treatment*

[u] General technical guidelines for the environmentally sound management of wastes consisting of, containing or contaminated with persistent organic pollutants, Basel Convention Report on the implementation of the decisions adopted by the Conference of the Parties at its seventh meeting UNEP/CHW.7/8/Add.1/Rev.1, 26 October 2004

[v] U.S. Environmental Protection Agency. Treatment Standards for Hazardous Wastes: 51 FR 40572-01, 40578; proposed rule; 55 FR 22520-01, 22524, final rule. Universal Treatment Standards: 59 FR 49782, 47986; final rule.

[w] Basel Open Ended Working Group. Report of the Third Session, Geneva, 26-30 April 2004, UNEP/CHW/OEWG/3/34.

processes)" will allow releases of high concentrations of undestroyed POPs in the stack gases, aqueous effluents and solid residues of the technological processes that are supposed to be destroying the POPs. This is contrary to the Stockholm Convention's goal of reducing and eventually eliminating POPs releases.

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