



REPORT

WEAK CONTROLS: EUROPEAN E-WASTE POISONS AFRICA'S FOOD CHAIN

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a toxics-free future

IPEN is a global network of public interest non-governmental organizations (NGOs) forging a toxics-free future. IPEN is comprised of over 550 NGOs in more than 116 countries. Together we work to ensure that toxic chemicals and metals are no longer produced, used, or disposed of in ways that harm human health and the environment. IPEN and its Participating Organizations have become a leading force in chemicals and waste regulation and are catalyzing an international movement to promote chemicals without harm and an end to the production of the world's most hazardous substances.

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Basel Action Network (BAN)

Founded in 1997, the Basel Action Network is a 501(c)3 charitable organization of the United States, based in Seattle, WA. BAN is the world's only organization focused on confronting the global environmental justice and economic inefficiency of toxic trade and its devastating impacts. Today, BAN serves as the information clearinghouse on the subject of waste trade for journalists, academics, and the general public. Through its investigations, BAN uncovered the tragedy of hazardous electronic waste dumping in developing countries.

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KEY FINDINGS

IPEN sampled eggs in Agbogbloshie, Ghana, Africa suspected to have elevated levels of persistent organic pollutants (POPs) banned under the Stockholm Convention and found:

- Alarmingly high levels of some of the most hazardous chemicals on earth, including dioxins, brominated dioxins, PCBs, PBDE, and SCCPs in the eggs of chickens that had foraged in areas where electronic waste was burned to recover metal.
- The highest-ever measured level of brominated dioxins in egg samples were discovered at Agbogbloshie.
- The analysis exposed the second highest level of dioxins ever measured in eggs, found at the Agbogbloshie scrap yard in Ghana.
- The source of the POPs at Agbogbloshie is burning plastic associated with e-wastes and auto scrap to recover metals.
- At this site, level of indicator PCB congeners exceeds the EU safe limits for egg consumption by 4-times and the safe limits for dioxins and dioxin-like PCB by 171-times.
- The samples also contained very high levels of short chained chlorinated paraffins (SCCPs), a recently listed POP for which the EU is proposing the weakest ever regulatory limits (Low POPs Content levels) in the history of the Stockholm Convention.
- Brominated flame-retardant levels were also very high in egg samples from Agbogbloshie. The analysis revealed very high levels of PBDEs and one of the highest-ever measured levels of HBCD, comparable to the highest level of HBCD ever measured in Germany.
- The totality of findings are very worrying, as they add to already published results of high levels of POPs measured in soil, sediments, water or human tissues from Agbogbloshie in previous studies. The findings demonstrate food chain contamination and human exposure to high levels of POPs as a consequence of poor controls on the international e-waste trade.



EXECUTIVE SUMMARY

Global estimates of annual e-waste production exceed 40 million tons with an annual growth rate of 4 to 5 percent [1]. There is a lack of an efficient, safe and sustainable infrastructure for its disposal in the regions of the world where the majority of the exported e-waste stream is destined to end up.

E-waste is especially dangerous because it contains heavy metals and chemicals known as persistent organic pollutants (POPs). Chemicals defined as POPs are among the world's most toxic and persistent chemicals. They are found in e-waste and can also be generated at high levels when e-waste is burned or smelted, which is often the case in developing countries.

New studies by IPEN and the Basel Action Network (BAN) reveal how weak controls in international treaties allow developed countries to export e-waste to developing countries, leading to dangerous levels of POPs exposure, and resulting in food chain contamination. The key findings of this report are:

WEAK HAZARDOUS WASTE LIMITS FAIL TO PREVENT E-WASTE EXPORT

Hazardous waste limits in the Stockholm Convention can help prevent the export of POPs waste, including e-waste, in conjunction with the Basel Convention, but are currently too weak to be effective. These limits are known as *Low POPs Content Levels* (LPCLs). Under the Stockholm Convention, POPs waste, as defined by the LPCLs, cannot be exported to any countries that do not have the advanced infrastructure to destroy it. Under the Basel Convention, computer plastics are usually not considered hazardous waste, and thus by themselves are not subject to export controls, due to the weak established LPCL. While other contents of electronic waste, such as heavy metals, usually qualify computing equipment as hazardous waste, it is certain that if the POPs content found in computer plastics and circuit boards were above the LPCL levels, then export would not be permitted.

Currently, the existing and proposed LPCL for POPs found in e-waste and 'recycled' in Africa, and other developing regions, is far too weak and exacerbates the global e-waste dumping crisis. This includes limits for chlorinated dioxins/furans, flame retardant chemicals such as PBDEs

and HBCD and short chain chlorinated paraffins (SCCPs). For example, the LPCL for many POPs is 50 ppm but the EU has proposed a limit for SCCPs of 10,000 ppm – the weakest limit in the history of the Basel and Stockholm Conventions.

E-WASTE EXPORT AND 'RECYCLING' RESULTS IN VERY HIGH LEVELS OF HAZARDOUS CHEMICALS IN EGGS

Eggs sampled by IPEN near the Agbogbloshie e-waste scrap yard in Ghana contain the highest level of brominated dioxins ever measured in eggs and one of the highest-ever measured levels of the flame-retardant chemical, hexabromocyclododecane (HBCD). These eggs also contained the second highest level of polychlorinated dibenzo-p-dioxins and furans (PCDD/F) ever measured in eggs. This highly toxic family of POPs is commonly referred to as 'dioxins.' An adult eating just one egg from a free-range chicken foraging in the Agbogbloshie area would exceed the European Food Safety Authority (EFSA) tolerable daily intake (TDI) for dioxins by 220-fold. Indicator PCBs in these eggs were four-fold higher than the EU standard. The eggs sampled exceeded the EU standard for dioxins and dioxin-like PCBs by 171-fold. These eggs also contained very high levels of SCCPs and PBDEs and relatively high levels of other POPs, such as pentachlorobenzene and hexachlorobenzene.

A LOOPHOLE IN THE INTERNATIONAL E-WASTE GUIDELINES ALLOWS EXPORT AND DUMPING

The current provisional e-waste guidelines under the Basel Convention now contain a massive new loophole promoted by the electronics industry in the name of the circular economy. It allows an exception to the fundamental rule that electronic equipment that is not functional must be considered waste. Instead, all an exporter has to do is claim that its exports are for repair, and can then completely side-step the Basel Convention waste trade controls. First, anything can be technically called repairable. Second, even legitimate repair operations have non-functional parts and other equipment that cannot be economically repaired, and will have to be disposed of in a Basel Convention Annex IV (waste defining) operation. This guideline is now a disaster for developing countries, as they lose their right to receive notification of incoming e-waste sent by traders, as well as the right to refuse its entry. Additionally, there is no substitute mechanism in the Convention to provide this transparency or control. It is regrettable that rather than putting their effort into making their products non-toxic, which would place them outside of the scope of the Basel Convention, the manufacturers have instead chosen to subvert the international treaty and its scientific definitions by removing toxic e-wastes from its scope and re-

defining anything considered repairable as exempt. For this reason, BAN has created a proper, “**Responsible Guideline**,” which allows countries to partake in legitimate repair operations but do so with consent of all countries concerned (exporting, importing, and transit) with full transparency.

GPS TRACKING REVEALS E-WASTE EXPORTS FROM THE EU TO AFRICA

GPS tracking devices can be inserted into common household electronic waste such as used televisions, printers and computers to track their export and fate. BAN followed GPS signals from Europe to the African countries of Ghana, Nigeria and Tanzania. The most e-waste exported to developing countries came from the UK, but Germany, Italy, Ireland, Poland, and Spain were all implicated in likely illegal traffic in e-waste. All of the equipment qualified as hazardous under the Basel Convention definitions due to the presence of either a cathode ray tube (CRT), mercury-bearing lamps (all of the LCDs were of this type), or circuit boards (containing high levels of lead, tin, and brominated flame retardants). All of the units also qualified as waste under EU rules as they were rendered non-functional and economically unrepairable. Extrapolating the results of the study, BAN estimates that about 352,474 metric tons of e-waste are exported from the EU to developing countries each year.



INTRODUCTION

Over 40,000,000 tons of toxic waste from discarded electronics (e-waste) is created each year with annual growth rate of 4-5%[1]. Meanwhile, there is a lack of an efficient, safe and sustainable infrastructure for its disposal in the regions of the world where the majority of the exported e-waste stream is destined to end up. A typical place in Africa where imported e-waste is received and 'recycled' in an informal setting is the large scrap yard in Agbogbloshie, near the center of Accra, Ghana.

One of the most dangerous aspects of e-waste is due to the fact that it contains chemicals known as persistent organic pollutants (POPs). Chemicals defined as POPs are the world's most toxic and persistent chemicals. They are found in e-waste and can also be generated at high levels when e-waste is burned as is often the case in developing countries.

New studies by IPEN and the Basel Action Network (BAN) have revealed how weak controls on the export of waste electronic equipment from developed countries lead to dangerous levels of human exposure and food chain contamination in African countries.

Two types of controls that need strengthening are: 1) hazardous waste limits for toxic substances in the Stockholm Convention; and 2) greater control over e-waste export in the Basel Convention even for exports for alleged recycling and repair.

HAZARDOUS WASTE LIMITS IN THE STOCKHOLM CONVENTION

A key weak link that allows the toxic trade of e-waste to continue without adequate controls are hazardous waste limits in the Stockholm Convention known as *Low POPs Content Levels* (LPCL). Chemicals defined as POPs are among the world's most toxic and persistent chemicals. They are found in many products, including e-waste, and can also be generated at high levels when e-waste is burned or smelted, as is often the case in developing countries.

LPCLs should qualify much of the computer plastic and circuit boards as being defined as 'POPs waste' and prevent the export of e-waste. But the LPCL levels are currently set too high, making them very weak and allowing large volumes of waste to escape the definition of 'POPs waste' when they should be included in this category. Further, Article 6 of the treaty mandates that POPs waste be managed by destruction or irrevers-

ible transformation of the POPs waste so that they do not exhibit POPs characteristics. POPs waste, as defined by the LPCL, cannot be exported to countries that do not have the advanced infrastructure to destroy it. Of course if the waste is not defined as hazardous waste, then Basel Convention trade controls will not apply. Currently the LPCLs for POPs found in e-waste is set far too high, allowing trade to continue with less control. The result of weak LPCL for POPs is shocking exposure levels in Africa and other locations where e-waste finally ends up.

IPEN has conducted detailed, on-the-ground, soil and egg sampling for highly toxic POPs in African countries. The newly released IPEN, ARNIKA, and CREPD study, **Persistent Organic Pollutants in Eggs: Report for Africa** [2], is based on a site investigation of a large-scale scrap yard in Ghana, which is a known destination for mostly European e-waste and also automobiles containing electronics circuitry and multiple forms of POPs-laden plastics. The results of recent egg testing at the Agbogboshie scrap yard in Ghana include the highest levels ever found of brominated dioxins (PBDD/Fs), the second highest levels ever found of chlorinated dioxins¹ (PCDD/Fs) and very high levels of dioxin like-PCBs (dl-PCBs), brominated flame retardants (PBDEs and HBCD) and short chain chlorinated paraffins (SCCPs). All of these highly toxic chemicals are listed for reduction and elimination under the Stockholm Convention, with the exception of brominated dioxins, even though that chemical group has toxicity characteristics very similar to its chlorinated analogue, chlorinated dioxins.

CONTROLS OVER WASTE EXPORT IN THE BASEL CONVENTION

The current provisional e-waste guidelines under the Basel Convention now contain a massive new loophole promoted by the electronics industry in the name of the Circular Economy. It allows an exception to the fundamental rule that electronic equipment that is not functional must be considered waste. Instead, all an exporter has to do is claim that their exports are for repair and can then completely side-step the Basel Convention waste trade controls. First, anything can be technically called repairable. Second, even legitimate repair operations have non-functional parts and other equipment that cannot be economically repaired and will have to be disposed of in a Basel Convention Annex IV (waste defining) operation. This guideline is now a disaster for developing countries as they lose their right to receive notification of incoming e-waste sent by traders, as well as the right to refuse its entry. Additionally, there is no substitute

1 “Dioxins” is a short nickname used usually for a larger group of either polychlorinated or polybrominated dibenzo-p-dioxins and dibenzofurans; we will use this shorter name accordingly in this report and will distinguish between chlorinated and/or brominated dioxins



mechanism into the Convention to provide this transparency or control. It is regrettable that rather than putting their effort into making their products non-toxic, which would place them outside of the scope of the Basel Convention, the manufacturers have instead chosen to subvert the international treaty and its scientific definitions by removing toxic e-wastes from its scope and redefining anything considered repairable as exempt. For this reason, BAN has created a proper, “Responsible Guideline,” which allows countries to partake in legitimate repair operations, but do so with consent of all countries concerned (exporting, importing, and transit) with full transparency.

The export of electronic waste from Europe to countries such as Ghana [3], has effectively become a form of hazardous waste dumping that international agreements such as the Basel Convention and Stockholm Convention were created to prevent. As a result of this Basel Convention loophole, BAN extrapolates from their study that about 352,474 metric tons of e-waste are exported from the EU to developing countries each year.

The new BAN report, **Holes in the Circular Economy: WEEE leakage from Europe** [3] reveals how the old computers, monitors and printers from consumers in Europe were able to easily be exported to African countries such as Ghana, Nigeria and Tanzania. BAN outfitted used equipment with GPS tracking devices and dropped them as consumers

would at municipal drop centers. They then followed them to their final destinations.

The end-of-life electronic goods are exported by the container load for possible re-use or recycling in Africa or Asia. Some are able to be repaired and sold, but others head to the informal scrap yards where they are broken up and often burned to remove plastic casings and access the higher value metals within. These crude processes actually create more hazardous chemical compounds than the original toxic materials inside the electronic equipment. For example, the brominated flame retardants within the plastic and cable coverings of the equipment, create highly toxic by-product chemicals, such as brominated and chlorinated dioxins, when burned.



TRACKING THE WASTES FROM EUROPE TO AFRICA

BAN has developed a tracking system using global positioning system (GPS) devices to electronically follow the destination of common household e-waste such as used televisions, printers and computers that are handed over by households and others. In the case of their latest report, the origin of this waste was from Europe. The results of the tracking project found that the most e-waste was exported from the UK, followed by Italy, Ireland, Germany, Poland and Spain. This polluting cycle of waste trade externalizes the costs of management of e-wastes, which contain significant concentrations of chemicals banned globally under the Stockholm Convention.

The BAN project was based on a sample size of 314 tracked units of equipment. Of the units deployed in the study, 19 (6%) were exported out of the countries from which they were deployed. Following extrapolation based on the amount of e-waste generated in the EU, the export rates to developing countries from the study from all of the 28 member states of the EU represents a total of 352,474 metric tons exported per annum. This amount of e-waste could fill 17,466 40-foot intermodal containers which would stretch back-to-back on 18-wheel trucks for 401 kilometers [3]. Similar amounts make their way to developing countries from Europe year after year. Each piece of equipment was estimated to have travelled over 4000 km to reach its destination.

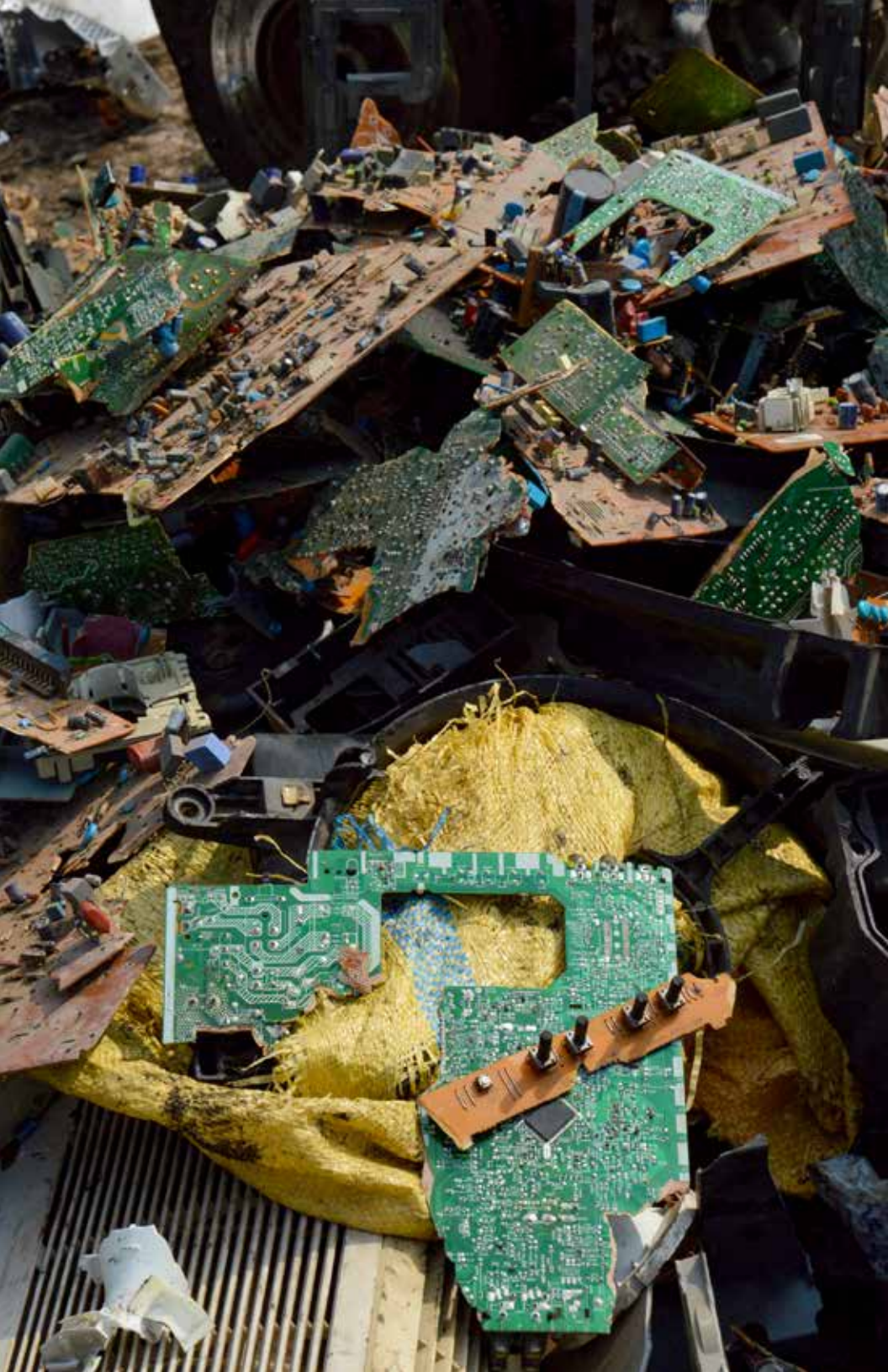
BAN notes that all of the equipment qualified as hazardous under the Basel Convention definitions due to the presence of either a cathode ray tube (CRT), mercury-bearing lamps (all of the LCDs were of this type), or circuit boards (containing high levels of lead, and tin). But also within the plastics, circuit boards and wire casings were brominated flame retardants, ready to become highly toxic dioxins when burned.



EUROPEAN E-WASTE POISONS AFRICA'S FOOD CHAIN WITH POPS



THE RESULTS OF EGG TESTING FROM THE AGBOGBLOSHIE SCRAP YARD IN GHANA INCLUDE THE HIGHEST LEVELS EVER FOUND OF BROMINATED DIOXINS (PBDD/F), THE SECOND HIGHEST LEVELS EVER FOUND OF CHLORINATED DIOXINS (PCDD/F) AND VERY HIGH LEVELS OF DIOXIN LIKE-PCB (DL-PCB), BROMINATED FLAME RETARDANTS (PBDEs AND HBCD) AND SHORT CHAIN CHLORINATED PARAFFINS (SCCP).



ELECTRONIC SCRAP 'RECYCLING' AT AGBOGBLOSHIE AND ITS TOXIC LEGACY

The IPEN and BAN reports connect some very significant dots that reveal a clear link between current global policy that allows uncontrolled movement of e-waste, resulting in highly toxic chemical levels in areas where dumping occurs, such as the Agbogbloshie scrap yard in Ghana. BAN's report tracks the e-waste from the EU as it is shipped across the world, but what happens to it when it finally ends up at the scrap yard destinations in Africa and other developing countries?

In developed countries, most local permitted e-waste 'recycling' ensures units are dismantled in enclosed, purpose-built facilities by workers wearing personal protective equipment and operating under labour laws designed to protect their health. They also operate under environmental laws to avoid environmental impacts. High-value materials extracted in the process are then sold to very high-tech smelters, fitted with sophisticated pollution control devices. Often this is conducted under extended producer responsibility (EPR) programs where manufacturers meet some or all of the costs of end of life management of the units.

The reality in Agbogbloshie and many other developing country e-waste scrap yards could not be more disparate. There, television and computer monitors and electronic units from automobiles are broken with hammers, spikes and metal bars. Components that are easily accessible are then removed. To access copper and other valuable metal among the cables and internals of the e-waste, the plastic coatings are burned on open ground, mostly by teenage boys while teenage girls stand by with water in plastic bags to quench the fires or the thirst of the boys. Most of the computer plastic and automobile plastics contain brominated flame-retardant POPs as well toxic softeners such as SCCPs. When the plastics and cable sheaths are burned, reactions occur that generate highly toxic brominated and chlorinated dioxins, as well as dioxin-like PCBs (dl-PCB) and other POPs. Brominated dioxins can also be present in e-waste plastics as contaminants accompanying the deliberately added brominated flame retardants.



Workers at the site have no protective clothing, no respirators or masks, and thus no protection against inhaling and ingesting fumes, smoke and dust that is laden with these poisonous compounds and heavy metals. The workers eat and live among the scrap yard, extending their exposure well beyond that experienced in any developed country workplace. Incredibly, the scrap yard is also adjacent to one of the largest open-air vegetable and fruit markets in Accra selling yams, onions, bananas, mangos etc. Chickens also live on the site and their eggs are consumed by the workers and residents. Cattle are raised on the scrap area for meat and milk. Most workers on the site live in rudimentary dwellings made from discarded waste materials, car bodies and other improvised construction materials. The inhabitants of the Agbogbloshie scrap yard often suffer from chronic nausea, headaches, chest and respiratory problems [4].

Agbogbloshie is part of Ghana's capital city Accra. It is the nickname of a commercial district on the Korle Lagoon of the Odaw River, near the city center. It became known as a destination for automobile and electronic scrap collected from Accra, but also from many other locations. Roughly 40,000 Ghanaians inhabited the area of Agbogbloshie, according to the estimates made between years 2009 - 2011, most of whom are migrants from rural areas [5]. Many are orphans, settling there as the only place they can attempt to scratch out a living. In 2018, the population was estimated to have grown. Oteng-Ababio *et al.* [6] claim that this settlement now serves over 80,000 people.

The Agbogbloshie market and scrap yard is situated on a former wetlands. During periods of heavy rainfall, much of the site becomes flooded and, during these times, it is likely that surface dusts and soils, along with any chemical contaminant that may contain, are carried into the adjacent, lower-lying lagoons and into the Densu river which ultimately flows into the nearby ocean. Prior studies have shown that Agbogbloshie scrap yard received approximately 171,000 tons of e-waste in 2009, which were exclusively processed through dangerous, informal practices. [7]



HIGH LEVELS OF TOXIC CHEMICALS BANNED GLOBALLY FOUND IN EGGS AT THE AGBOGBLOSHIE E-WASTE SITE

Free-range chicken eggs have been assessed in many previous studies as indicators of environmental POPs contamination for a number of reasons. Most POPs are lipophilic or attracted to and accumulate in fatty tissues of organisms. Eggs have a significant lipid content, which accumulates POPs from the hen that lays them, and this permits easier measurement of the POPs levels. Free-range chickens also pick food from among the soil and dust in the local area, ingesting some soil in the process, and therefore they act as 'active samplers,' and their eggs provide an indicator of POPs environmental contamination levels in that locality. Eggs also represent an important exposure pathway between soil, the food chain and humans. The use of commercially produced eggs by layer hens under the cover of structures and fed on relatively uncontaminated feed, as indicators of background levels for eggs, provides a basis for comparison of contaminated eggs.

In some jurisdictions, as a food source, egg consumption is governed by regulations that specify maximum threshold levels of POPs which can be compared to Tolerable Daily Intake (TDI) levels intended to protect human health. TDI can vary between young children and adults or even pregnant women, as some groups of humans are more sensitive to POPs' impacts than others. The EU limit for dioxins in eggs is 2.5 pg WHO-TEQ g⁻¹ fat and there is no current limit for brominated dioxins, despite the toxicity being very similar to chlorinated dioxins which *are* regulated.

LEVELS OF TOXIC CHEMICALS IN EGGS

Eggs sampled at the Agbogbloshie scrap yard in Ghana by Ghanian experts and the Arnika/IPEN team, contained the highest level of brominated dioxins ever measured in eggs and one of the highest-ever measured levels of the flame-retardant chemical, hexabromocyclododecane (HBCD). These eggs also contained the second highest level of chlorinated dioxins

ever measured in eggs. Levels of chlorinated dioxins in Agbogbloshie eggs were 1528 times the background levels found in supermarket eggs in Accra.

An adult eating just one egg from a free-range chicken foraging in Agbogbloshie area would exceed the European Food Safety Authority (EFSA) tolerable daily intake (TDI) for chlorinated dioxins by 220-fold. The typical daily egg consumption per person in Ghana is less than one egg a day, but even eating 2.5 grams of egg a day would exceed the EFSA TDI by more than 15-times. Indicator PCBs in these eggs were four-fold higher than the EU standard. Dioxins and dioxin like PCBs (dl-PCBs) were 171-fold higher than the standard. These eggs also contained very high levels of SCCPs and PBDEs and relatively high levels of other POPs such as pentachlorobenzene and hexachlorobenzene.

THE POP CHEMICALS FROM E-WASTE FOUND IN EGGS ARE VERY TOXIC

Dioxins are known to be extremely toxic. Numerous epidemiologic studies have revealed a variety of human health effects linked to chlorinated dioxin exposure, including cardiovascular disease, diabetes, cancer, porphyria, endometriosis, early menopause, alteration of testosterone and thyroid hormones, and altered immune system response among others [8, 9].

Brominated dioxins (PBDD/F) have been found to exhibit similar toxicity and health effects as chlorinated dioxins [10-14]. They can, for example, affect brain development, damage the immune system and fetus or induce carcinogenesis [14].

“Both groups of compounds [chlorinated and brominated dioxins] show similar effects, such as induction of aryl hydrocarbon hydroxylase (AHH)/ EROD activity, and toxicity, such as induction of wasting syndrome, thymic atrophy, and liver toxicity.” [12]

Brominated dioxins occur as a byproduct contaminant of PBDEs during their production and accompany the PBDE's into products when they are added during manufacture (e.g. when PBDEs are added to computer casing plastic as a flame retardant). They are also generated at high rates when the waste containing PBDEs is burned. The amount of brominated dioxin transported in waste and then generated when it is burned are extremely high.

The total brominated dioxin contamination in polymers arising from total historic PBDE production/use is estimated in the order of 1000 t [15]. This is an enormous amount for such dangerous chemicals as brominated

dioxins measured at levels of nano- or picograms in the real environment, and considered to be dangerous at those levels already. It means that vast amounts of these unregulated, highly toxic chemicals are reaching Africa in e-waste, along with weakly regulated e-waste containing significant levels of PBDEs.

TABLE 1: OVERVIEW OF RESULTS OF CHEMICAL ANALYSES FOR POPs IN FREE-RANGE CHICKEN EGG SAMPLES FROM GHANA, INCLUDING ONE BACKGROUND EGG SAMPLE FROM A COMMERCIAL FARM, SOLD IN A SUPERMARKET IN ACCRA, GHANA.

Locality	Accra- Agbogbloshie	Accra- super-market	EU standard / limits
Sample	AGB-E	ACC-M-E	
Fat content (%)	14.69	8.75	
PCDD/Fs (pg TEQ g ⁻¹ fat)	661	0.39	2.50
dl-PCBs (pg TEQ g ⁻¹ fat)	195	0.17	
Total PCDD/F + dl-PCBs (pg TEQ g ⁻¹ fat)	856	0.56	5.00
Total PCDD/Fs + dl-PCBs - DR CALUX (pg BEQ g ⁻¹ fat)	840	1.2	
PBDD/Fs (pg TEQ g ⁻¹ fat)	300	< 8.48	
HCB	25	< 0.2	-
PeCB	22	< 0.2	
HCBD	< 0.2	< 0.2	
7 PCB	286	< 1.4	-
6 PCB	168	< 1.2	40.00
SCCPs	2067	62	
sum HCH	< 0.6	< 0.6	
sum DDT	9.7	< 1.2	

Levels of POPs are In ng g⁻¹ fat, if not specified otherwise.

STRENGTHENING LOW POP CONTENT LEVELS TO STOP TOXIC TRADE

The Basel and Stockholm Conventions establish the Low POPs Content Levels that define 'POPs Waste,' and the Stockholm Convention mandates the destruction of POPs wastes. Such waste clearly should not be exported to developing countries with the recognition that they do not have the infrastructure and capacity to manage and destroy them.

Currently, the Low POPs Content Levels for brominated flame retardants commonly found in e-waste are very weak. These include polybrominated diphenyl ethers (PBDE), and hexabromocyclododecane (HBCD). The LPCL for plasticizer chemicals also found in e-waste such as short chained chlorinated paraffins (SCCP) are also very weak. SCCPs are now subject to a new proposal by the EU to enshrine the weakest LPCL in the history of the Basel and Stockholm Conventions at 10 000 mg/kg (PCBs and similar POPs have a LPCL of 50 mg/kg). These weak limits allow POPs waste exports, including e-waste, to lead to subsequent food chain contamination, particularly for open foraging food production involving poultry and dairy livestock.

To prevent the contamination of the food chain and stop human exposure to POPs through e-waste and other wastes contaminated by POPs trade, IPEN has proposed the following LPCLs to be adopted at the next Basel and Stockholm Convention Conferences of the Parties in April / May 2019.



Substance	IPEN proposal	Current limit
Dioxins and furans (PCDD/F) including dioxin-like PCBs	1 ppb (1 µg TEQ/kg)	15 ppb
Hexabromocyclododecane (HBCD)	100 mg/kg	1000 mg/kg Promoted and used by EU and other developed countries
Polybrominated diphenyl-ethers (PBDEs)	50 mg/kg as a sum of listed PBDEs. Includes: TetraBDE, PentaBDE, HexaBDE, HeptaBDE, DecaBDE	1000 mg/kg Promoted and used by EU and other developed countries
Short-chain chlorinated paraffins (SCCP)	100 mg/kg	10,000 mg/kg Proposed by the EU

STOPPING WASTE EXPORTS AND POPs EXPOSURE

There is a clear link between current global policy that allows uncontrolled movement of e-waste and toxic chemical contamination of the food chain where dumping occurs, such as Agbogbloshie. The scrap yard in Ghana is one example of similar sites in Africa, Asia and other developing regions where e-waste from developed nations causes environmental and food chain contamination and human exposure.

In order to halt these highly dangerous incidences of toxic exposure to those peoples in the world least able to deal with them, we recommend the following actions:

- Strict limits for POPs in products and waste must be set. Halogenated compounds, heavy metals and POPs additives must be avoided at the product design stage by industry, and waste streams still containing them must be controlled as hazardous waste, thus severely limiting the legal possibility that they can be exported to developing countries.
- Low POPs content levels must have stricter limits and assume real life scenarios. These stricter limits (defined as Low POPs Content in the Stockholm Convention) should be 50 mg/kg for PBDEs, 100 mg/kg for HBCD and SCCPs and 1 µg TEQ/kg for PCDD/Fs at a maximum.
- Materials that are defined as POPs waste must be considered as hazardous waste and sequestered and destroyed according to strict protocols and pollution controls. They should not be recycled, and should never be exported to developing countries. The setting of strict hazardous waste limits for POPs waste is a critical tool for preventing their free movement across borders to developing countries, which are lacking technologies to destroy POPs in waste in an environmentally and health protective manner.
- The transfer of cleaner, non-combustion techniques for the destruction of POPs should take place in developing countries, and these countries should receive help introducing environmentally sound management of electronic waste.
- Brominated dioxins (PBDD/Fs) must be listed under the Stockholm Convention.



- The massive “repairables loophole” now in the Basel Convention’s interim technical guideline on e-waste must be rejected. Alternatively, the Basel Action Network’s Responsible Guideline: <https://www.ban.org/the-responsible-guideline> should be endorsed.
- Illegal shipment surveillance and enforcement in European and other developed country jurisdictions should be enforced through the use of intelligence sharing, GPS tracking devices, people-in-port programs, and communication with customs agents in regions where the illegal imports are commonly targeted (Africa, Asia, Eastern Europe and Latin America).
- Harsh penalties should be imposed on illegal shippers and brokers as a long-term deterrent.
- African Countries that have not already done so, such as Ghana, should ratify the Bamako Convention, which *inter alia*, forbids all imports of hazardous waste, including electronic waste.
- All countries around the world that have not already done so should ratify the Basel Ban Amendment, which prohibits all exports of materials legally defined as hazardous wastes under the Basel Convention from countries that are members of the EU/OECD or Liechtenstein to all other countries.

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ANNEX 1. SAMPLING METHODOLOGY

Pooled samples (4-6 eggs) of eggs were collected at each of the selected sampling sites in order to obtain more representative samples. Three samples from Ghana and one pooled sample of commercial eggs (non-free-range) from Accra were assessed for polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) and dioxin-like polychlorinated biphenyls (dl-PCBs) using the DR CALUX method. These were sent to a Dutch ISO 17025 certified laboratory (BioDetection Systems B.V., Amsterdam) performing the cell-based screening analysis DR CALUX according to the European Standard EC/644/2017. The DR CALUX bioassay method is proven as cost-efficient semi-quantitative effect-based toxicity screening analyses for all kinds of stable dioxin-like compounds (PCDD/Fs, dl-PCBs, PBDD/Fs, PBBs, chlorinated and brominated polycyclic aromatic hydrocarbons, N-dioxins).

To allow congener differentiation all pooled egg samples from Ghana as well as samples of soil, ash and soot were analyzed for content of individual PCDD/Fs and an extended list of PCB congeners by HRGC-HRMS at the accredited laboratory of the State Veterinary Institute in Prague, Czech Republic. All samples were also analyzed for content of non-dioxin-like (indicator) PCBs (iPCBs), DDT and its metabolites, hexachlorocyclohexanes (HCHs), hexachlorobutadiene (HCBd), pentachlorobenzene (PeCB) and hexachlorobenzene (HCB) in a Czech certified laboratory (University of Chemistry and Technology in Prague, Department of Food Chemistry and Analysis).

The eggs from Agbogbloshie and an Accra supermarket as well as soil/ash samples from Agbogbloshie were also analyzed for PBDEs, HCBd, and for novel BFRs3 (nBFRs), tetrabromobisphenol A (TBBPA) and short chain chlorinated paraffins (SCCPs). All of these analyses were conducted in a Czech certified laboratory (Institute of Chemical Technology, Department of Food Chemistry and Analysis). The samples of free-range chicken eggs and soil in the IPEN report were sampled during second half of 2018. The analyses of eggs and soil were conducted in European laboratories in the period between October 2018 and February 2019.





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