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Poisoning the poor Electronic waste in Ghana

REPORT AUGUST 2008

GREENPEACE

Creating a toxic-free future

image
Inside cover: Young boys working in the Agbogbloshie scrap market in Ghana's capital city, Accra. Agbogbloshie is the main centre for e-waste recycling in the country.

In April 2008, following evidence that e-waste is being exported, often illegally, to Ghana from the EU and US, Greenpeace conducted the first investigation of workplace contamination from e-waste recycling and disposal in Ghana. The results indicate that there may be substantial exposure of workers and bystanders to hazardous chemicals.

Greenpeace campaigns for electronics producers to eliminate hazardous chemicals from the manufacture of their goods, and to take responsibility for their products over their entire lifecycle; from design to use to waste.

Contents

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Special thanks to Mike Anane.

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image below
Piles of obsolete computers and TV monitor casings dumped by a lagoon at the Agbogbloshie scrap market in Ghana's capital city, Accra. Agbogbloshie is the main centre for e-waste recycling in the country.

Section 1: Global e-waste trade spreads to Ghana

As the global market for electronic goods expands, and the lifespan of many of those products gets shorter, there has been a rapid growth in electronic waste (e-waste). The UN estimates that 20-50 million tonnes of e-waste is produced globally every year.[1]

Many electronic products such as laptops and mobile phones contain hazardous chemicals and materials,[2] and recycling or disposing of them can pose serious threats to human health and the environment.[3] E-waste often ends up dumped in countries with little or no regulation of its recycling or disposal. Historically this has taken place in Asia, but recently the trade has spread to other regions, particularly West Africa.

Sending old electronic equipment to developing countries is often hailed as "bridging the digital divide." But, all too often this simply means dumping useless equipment on the poor. One estimate suggests that 25-75% of "second hand goods" imported to Africa can not be reused.[4]

In April 2008, following evidence that e-waste is being exported, often illegally, to Ghana from the EU and US, Greenpeace conducted the first investigation of workplace contamination from e-waste recycling and disposal in Ghana. The study extends Greenpeace's global exposé of e-waste, which has previously documented environmental contamination from these practices in China and India.[5]

In Ghana, Greenpeace experts collected soil and sediment samples from two e-waste recycling sites: the Agbogbloshie scrap market in the capital city, Accra, the main centre for e-waste recycling in the country; and from a scrapyard in the smaller city of Korforidua, thought to be typical of the numerous small-scale e-waste recycling workshops in Ghana.

The samples were analysed at the Greenpeace Research Laboratories at the University of Exeter, UK. The full results are published in the Greenpeace Laboratories Technical Note (hereafter referred to as the "Contamination Study") released in August 2008, in conjunction with this report.[i]

Computers, monitors and TVs are the main e-wastes processed at the scrap yards. At Agbogbloshie, these are manually dismantled at numerous small workshops within the market. Some parts are burned to remove plastics from valuable metals. Materials of no value are dumped along with other waste. Much of the work is carried out by children, some as young as 5, with no protective equipment and using basic tools, or bare hands (see box 1).

The study found that many samples contained numerous hazardous substances: including very high levels of the toxic metal lead; chemicals such as the phthalates DEHP and DBP, which are known to interfere with sexual reproduction; and chlorinated dioxins known to promote cancer (see chemical breakdown summary pages 12-15).

Though the study did not attempt to quantify the damage caused to the environment or human health, the results indicate that there may be substantial exposure of workers and bystanders to hazardous chemicals.

In Ghana, the Greenpeace team documented e-waste from European, Japanese, and US brands, including: Philips, Sony, Microsoft, Nokia, Dell, Canon and Siemens. Labels revealed the equipment came from a range of organisations such as Den Kongelige Livgarde – the Danish Royal Guard, and the US Environmental Protection Agency.

The team saw containers of e-waste from Germany, Korea, Switzerland and the Netherlands being opened at Tema harbour; the biggest port in Ghana. The container numbers revealed that all the European containers had been shipped via Antwerp in Belgium.

Exporting hazardous e-waste is illegal in the EU, but the US Environment Protection Agency classifies it as legitimate recycling.

Millions of tonnes of obsolete electronics products are unaccounted for in these regions; around 80% in the US, and up to 75% in the EU (around 6.6 million tonnes in 2006). Some of this e-waste is still stored in people's homes; some ends up in landfill; some is incinerated; and some is exported to developing countries, such as Ghana.[6]

i Brigden, K., Labunska, I., Santillo, D. (2008): Chemical contamination at e-waste recycling and disposal sites in Accra and Korforidua, Ghana. Greenpeace Research Laboratories Technical Note 10/2008, www.greenpeace.org/ghanacontamination

image
Greenpeace scientist Kevin Brigden takes samples from an open burning site at an e-waste disposal and recycling scrap yard in Ghana. The samples were analysed at the Greenpeace Research Laboratories at the University of Exeter in the UK.

Global e-waste hotspots

Ghana Boy scavenging e-waste for any electrical components from which he can reclaim the copper.

Delhi A boy winces at the smoke rising from computer motherboards being melted over open fires in an e-waste recycling yard.

China A young girl displays a piece of e-waste. Children living in an e-waste recycling area in China have been found to have significantly high levels of lead in their blood.

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image Obsolete electrical equipment recorded by a Greenpeace team in Ghana in April 2008, brands include: Microsoft, Sharp, Hewlett Packard, Philips and Panasonic and from organisations including the US Environmental Protection Agency.

Greenpeace holds producers responsible for their products over their entire lifecycle; from design, to use, to waste.

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image below
A young boy uses a discarded computer monitor to carry copper wiring that has been extracted through the burning of PVC casings and wires. This process releases toxic chemicals into the environment.

Section 2: Toxic alert! Summary of Contamination Study findings[7]

Nearly all samples taken by the Greenpeace team contained numerous hazardous chemicals, and very high levels of many toxic metals. Most toxic substances found in the samples are either used in electronic goods, or are formed when some hazardous materials in the products are burned.

In some cases certain metals were present at concentrations over one hundred times higher than typical background levels for soils, including the highly toxic metal lead. Contamination with other toxic metals, such as cadmium and antimony, was also detected.

Two plastic softeners (phthalates), found in some samples (DEHP and DBP) are classified in Europe as toxic to reproduction, due to their ability to interfere with sexual development in mammals, especially in males.[8] The burning of PVC wire covers and cables is likely to release these phthalates into the environment.

There was also a widespread presence of PBDEs, chemicals used as flame retardants. Some of these chemicals are now banned in Europe because of their ability to accumulate in the environment, and their toxicity; exposure to some PBDEs can affect brain development in animals. (see chemical breakdown summary on pages 12-15).

One sample contained chlorinated dioxins, toxic chemicals known to cause cancer[9] at a level just below the threshold defined as being "indicative of serious contamination" in the Netherlands.[10]

The nature and extent of chemical contamination found at the sites in Ghana is similar to that found at e-waste open burning sites in China, India[11] and Russia.[12] In some countries, studies have found contamination of the wider environment around e-waste recycling yards, including in recycling workers homes.[13]

Children living in an e-waste recycling area in China, for example, have significantly higher levels of the toxic metal lead in their blood, than children in a neighbouring area.[14] The environmental contamination found in the Ghanaian samples, suggests children working on and living near e-waste sites in Ghana could be exposed to toxic chemicals.

The results of the study clearly show the need for electronics producers to eliminate hazardous substances from their products, and take responsibility for the entire life cycle of their goods. There is also a need for stronger legislation to prevent the import of e-waste into Ghana.

Greenpeace documented children, mostly boys working in the Agboblogshie scrap market. Most were between the ages of 11-18, but there were some as young as 5. Many have been sent by their parents to earn money in the capital city.

The boys take the electronic scrap apart, often just using their bare hands and a stone. They are looking for metal parts mostly aluminium and copper, which they remove and place in a separate pile. When they crush or burn the appliances dusts and fumes, potentially toxic, are released into the air around them – their working area - and may enter their lungs.

As copper is mostly encased in cables and wires coated in plastic, these are burned to "free" the copper. This not only releases toxic chemicals present in their make-up; but the burning itself can create even more dangerous chemicals.

Adult worker Mohammed Hassan told Greenpeace how the toxic smoke is making workers sick, and how they want it to stop.

Copper and other recovered metal, is sold to local dealers who sell them on again to industries such as an iron rod factory in neighbouring city, Tema. Some scrap workers also collect plastic casings and printed circuit boards. Though these materials are not recycled in Ghana, workers tell of Asian traders who export them. The majority of Cathode Ray Tubes (CRTs) used in TV and computer monitors, are dumped releasing highly toxic substances.

According to recycling workers, copper is sold at US$0.22 per half kilo, and plastic at US$0.01 per kilo. The boys send the money they raise back home, often to the North, one of the poorest regions of the country.

box 1: Conversations with workers at the Agboblogshie market, Accra.

image Boy breaking and old cathode ray tube TV monitor to extract its metal parts.

Greenpeace documented children, mostly boys working in the Agboblogshie scrap market. Most were between the ages of 11-18, but there were some as young as 5.

Section 3: Bridging the digital divide, or dumping on the poor? How EU e-waste is smuggled into Ghana

Despite laws in the EU prohibiting the export of hazardous e-waste (see box 2), thousands of tonnes of EU e-waste end up in developing countries, such as Ghana.

It is shipped there in containers labelled “second-hand goods;” as EU law allows reusable goods to be exported. Despite EU guidelines which say electronics can only be considered second-hand reusable goods if they are tested for use and properly packed and labelled, an EU Commission official estimates that 25-75% of such “second hand goods” imported to Africa, are broken and can not be reused.[15]

Sending old electronic equipment to developing countries is often hailed as “bridging the digital divide.” But, all too often this simply means dumping useless equipment on the poor.

Local campaigner Mike Anane told Greenpeace: “People in developed countries bring [electronic equipment] here ostensibly to bridge the digital gap; but in actual fact they are creating a digital dump.”[16]

Two e-waste traders in Ghana told the Greenpeace team that appliances coming in from the Netherlands are shipped via Antwerp in Belgium. These reports tally with the team’s findings that all the EU e-waste they saw coming into Tema port, had been shipped through Antwerp. There appears to be a serous lack of control over regulation of exports from Antwerp Harbour.

There are no guidelines in Ghana to differentiate waste from second-hand equipment. Even goods that might be usable are often missing vital components. They may not, for example, have the correct plug fitted, or the right software installed.

Moreover, most appliances that do work on arrival only have a short second life, as they were already old, and / or were damaged during the transit. In the end virtually all used electronics entering Ghana end up in scrap yards potentially exposing workers, children and local residents to a toxic cocktail of hazardous chemicals.

The Ghana Environmental Protection Agency says that long overdue national guidelines are being developed in Ghana to regulate imports of used electronic goods into the country.[17] There is also a need for other controls that ban the import of e-waste and ensure its safe recycling.

Local environmental campaigner Mike Anane holds up an obsolete computer. Sending old electronic equipment to developing countries is often hailed as “bridging the digital divide." In reality, however, all too often it is "creating a digital dump."

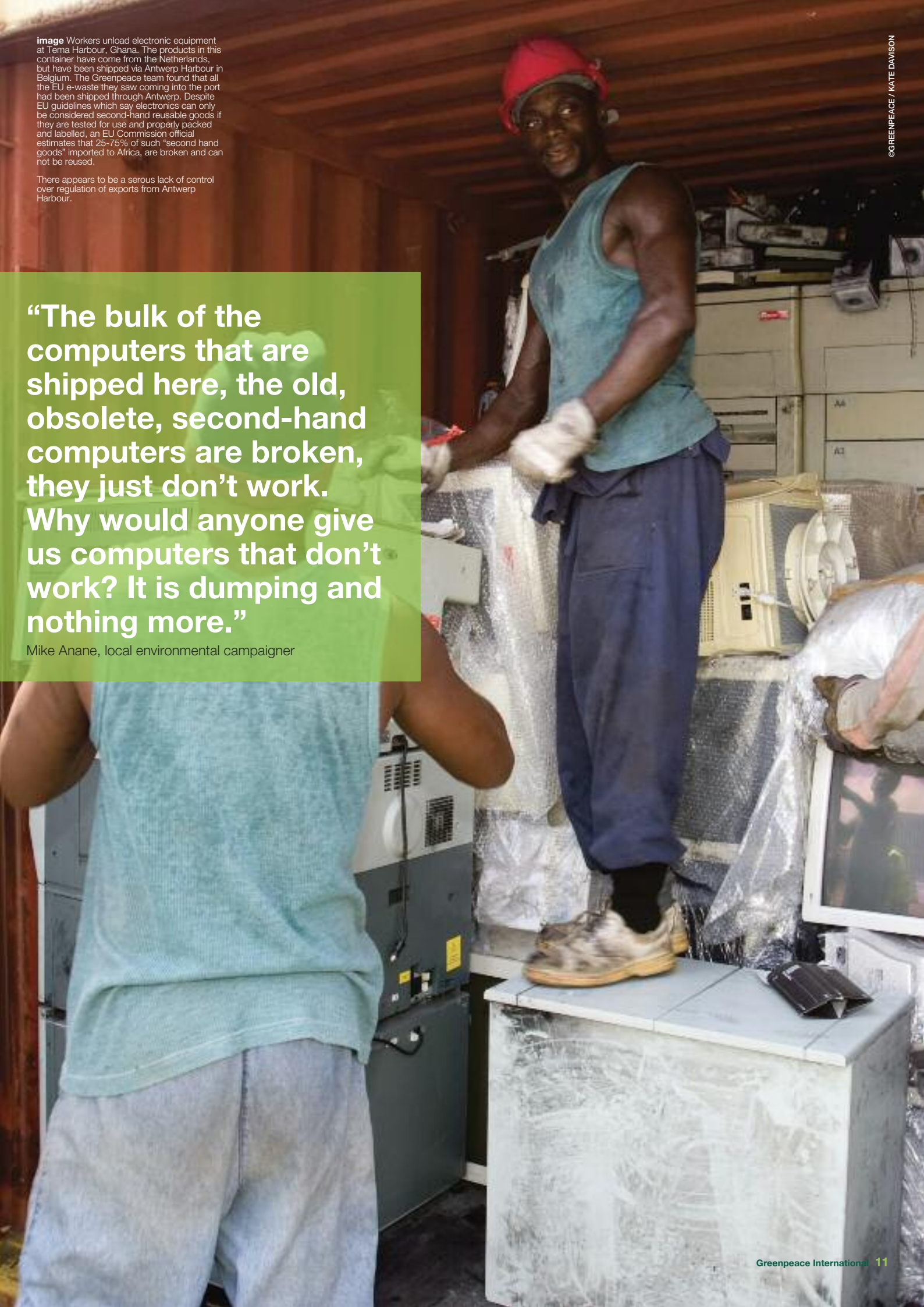

image Workers unload electronic equipment at Tema Harbour, Ghana. The products in this container have come from the Netherlands, but have been shipped via Antwerp Harbour in Belgium. The Greenpeace team found that all the EU e-waste they saw coming into the port had been shipped through Antwerp. Despite EU guidelines which say electronics can only be considered second-hand reusable goods if they are tested for use and properly packed and labelled, an EU Commission official estimates that 25-75% of such "second hand goods" imported to Africa, are broken and can not be reused.

There appears to be a serous lack of control over regulation of exports from Antwerp Harbour.

"The bulk of the computers that are shipped here, the old, obsolete, second-hand computers are broken, they just don't work. Why would anyone give us computers that don't work? It is dumping and nothing more."

Mike Anane, local environmental campaigner

image Boys burning PVC wire covers and cables to extract the copper wiring underneath. Burning these materials not only releases the toxic chemicals present in their make-up; but the burning itself can create even more dangerous chemicals. Two plastic softeners (phthalates), found in some samples (DEHP and DPB) taken by the Greenpeace team, are classified in Europe as toxic to reproduction, due to their ability to interfere with sexual development in mammals, especially in males. The burning of PVC wire covers and cables is likely to release these phthalates into the environment.

Summary of the key chemicals found at e-waste recycling sites in Ghana[ii]

Cadmium (Cd) occurs in electronics both as cadmium metal, in some switches and solder joints, and as cadmium compounds in rechargeable batteries, UV stabilisers in older PVC cables and "phosphor" coatings in older cathode ray tubes. Like lead, cadmium can accumulate in the body over time, with long-term exposure causing damage to the kidneys and bone structure. Cadmium and its compounds are known human carcinogens, primarily through inhalation of contaminated fumes and dusts.

Lead (Pb) is widely used in electronic goods, as a major component of solders (as an alloy with tin) and as lead oxide in the glass of cathode ray tubes (televisions and monitors), as well as in lead-acid batteries. Its compounds have also been used as stabilisers in some PVC cables and other products. Lead is highly toxic to humans, as well as to animals and plants. It can build up in the body through repeated exposure and have irreversible effects on the nervous system, particularly the developing nervous system in children.

[ii] for a full list refer to the Contamination Study

source Brigden, K., Labunska, I., Santillo, D. (2008): Chemical contamination at e-waste recycling and disposal sites in Accra and Korforidua, Ghana
Greenpeace Research Laboratories Technical Note 10/2008,
www.greenpeace.org/ghanacontamination

image Livestock grazing at the Agbogbloshie market in Accra, Ghana. Dumping and burning of e-waste here releases toxic chemicals into the environment. The market is on flat ground by the Densu River, and frequently floods after heavy rainfall. When this happens, the contaminated surface dusts and soils are likely to be carried from the site into surrounding lagoons and the river itself.

image Discarded computer and TV monitor casings dumped at the side of the road. Thousand of tonnes of hazardous e-waste is shipped into Ghana every year from the US and the EU, often under the guise of being "reusable second-hand goods"

Phthalates are commonly used to soften plastics, especially PVC. There are substantial concerns about their toxicity. The phthalate DEHP, for example, is capable of interfering with development of the testes in early life. Both DEHP and DBP are classified as "toxic to reproduction" within Europe. There are few controls on the marketing and use of phthalates, despite their toxicity, the volumes used and their ability to leach out of products throughout their lifetime. Of the controls which do exist, the best known is the EU-wide ban on the use of six phthalates in children's toys and childcare articles. While this addresses one important exposure route, exposures through other consumer products remain unaddressed, including electrical and electronic equipment.

Antimony (Sb) is a metal with a variety of industrial uses, including as a flame retardant (as antimony trioxide) and as a trace component of metal solders. In some forms, antimony shows many chemical similarities to arsenic, including in its toxicity. Exposure to high levels in the workplace, as dusts or fumes, can lead to severe skin problems and other health effects. Antimony trioxide is recognised as a possible human carcinogen.

source Brigden, K., Labunska, I., Santillo, D. (2008): Chemical contamination at e-waste recycling and disposal sites in Accra and Korforidua, Ghana
Greenpeace Research Laboratories Technical Note 10/2008
www.greenpeace.org/ghanacontamination

image Girls carry out their chores around the open burning sites at the Abogbloshie market. Burning the wire covers and cables (to extract the copper underneath) not only releases toxic chemicals present in their make-up, but the burning itself can create even more dangerous chemicals.

image Boys carrying bundles of electric cables and other parts. Burning the wire covers and cables (to extract the copper underneath) not only releases toxic chemicals present in their make-up, but the burning itself can create even more dangerous chemicals.

Until the late 1970s, **PCBs (polychlorinated biphenyls)** were widely used in insulating fluids for electrical transformers and capacitors, as well as flame-retardant plasticisers in PVC and other polymer applications. These chemicals can also be produced during the combustion of chlorinated organic materials, including PVC. They are highly persistent and bioaccumulative chemicals, which rapidly become widespread through the environment and build up several thousand-fold in body tissues of wildlife. PCBs exhibit a wide range of toxic effects including suppression of the immune system, liver damage, cancer promotion, damage to the nervous system, behavioural changes and damage to both male and female reproductive systems.

Chlorobenzenes have been used as solvents in PCB formulations (historically used in transformers), and can also be formed during the combustion of the chlorinated plastic PVC. These chemicals are relatively persistent and bioaccumulate. Effects of exposure depending on the type of chlorobenzene, with common impacts include those on the liver, thyroid and central nervous system (CNS). Hexachlorobenzene (HCB), the most toxic and persistent chemical of this group, is a also an endocrine disruptor and a possible human carcinogen.

source Brigden, K., Labunska, I., Santillo, D. (2008): Chemical contamination at e-waste recycling and disposal sites in Accra and Korforidua, Ghana Greenpeace Research Laboratories Technical Note 10/2008, www.greenpeace.org/ghanacontamination

image Worker dismantling electric components using his bare hands, at the Agbogbloshie scrap yard in Accra, the main centre for e-waste recycling in Ghana. Much of the dismantling is carried out by children, some as young as 5, with no protective equipment and using basic tools, or bare hands.

image Boy holding copper that has been extracted by burning electric cables and other components. Burning wire cables not only releases toxic chemicals present in their make-up, but the burning itself can create even more dangerous chemicals.

PBDEs (polybrominated diphenyl ethers) are one of several classes of brominated flame retardants used to prevent the spread of fire in a wide variety of materials, including casings and components of many electronic goods. They are environmentally persistent chemicals, some of which are highly bioaccumulative and capable of interfering with normal brain development in animals. Several PBDEs are suspected endocrine disruptors, demonstrating an ability to interfere with hormones involved in growth and sexual development. Effects on the immune system have also been reported.

Triphenyl phosphate (TPP) is one of several organophosphorus flame-retardants used in electronic equipment, for example in the casings of computer monitors. TPP is acutely toxic to aquatic life and a strong inhibitor of a key enzyme system in human blood. It is also known to cause contact dermatitis in some individuals and is a possible endocrine disruptor.

source Brigden, K., Labunska, I., Santillo, D. (2008): Chemical contamination at e-waste recycling and disposal sites in Accra and Korforidua, Ghana Greenpeace Research Laboratories Technical Note 10/2008, www.greenpeace.org/ghanacontamination

image Young adult worker carries a bundle of electric cables and other components to be burned at an open fire. The casings are burned to retrieve the copper underneath. Burning wire cables not only releases toxic chemicals present in their make-up, but the burning itself can create even more dangerous chemicals.

Stronger and more comprehensive legislation is urgently needed

Some countries and regions have introduced legislation to restrict the use of hazardous substances in new electronic goods, and regulate the collection and recycling of e-waste.

Such regulation is often limited, however, as it excludes many hazardous substances used in electronics, and many fail to fully address the management of e-waste.

In Europe, the Waste Electrical and Electronic Equipment (WEEE)[18] and the related Restrictions on Hazardous Substances (RoHS)[19] Directives, go some way towards addressing the problems of e-waste; but they are limited to the EU, and are not fully comprehensive.

The RoHS Directive excludes many hazardous substances, including those specifically identified at e-waste sites[20] and that continue to be used in new products[21], including phthalates, PVC and antimony. To offer the necessary protection to human health and the environment, RoHS and similar regulations need to be extended to cover the full range of hazardous substances used by the electronics sector.

Until such regulations are in force, electronics producers need to lead the way by voluntarily phasing out all hazardous chemicals and materials from their products. These chemicals will, of course, remain as a problem for some time to come as older equipment becomes obsolete and enters the waste stream, but ultimately only through stricter controls on manufacturing can we stop building this toxic legacy.

The WEEE Directive requires that producers set up systems and finance for the collection and treatment of electrical and electronic wastes. In other words it has established individual producer responsibility (IPR) for e-waste. This creates internalisation of the end-of-life costs of a manufacturer's own products and creates incentives for `toxic free´ design. Additionally, IPR can lead to greater scrutiny of the entire collection chain, as it makes it much easier to see how much of their e-waste producers take responsibility for.

Even with the WEEE Directive, it is estimated that only 25% of e-waste generated within the EU is currently collected and treated[22]. The Directive is up for revision, some improvements that would reduce illegal e-waste include: higher collection requirements; binding criteria on export for reuse; and reporting and traceability obligations.

Meanwhile internationally, the Ban Amendment of the UN Basel Convention[23] that prohibits the shipment of hazardous waste, including e-waste, from most industrialised to developing countries, is still awaiting its entry into force.

The EU has ratified the Basel Ban and introduced legislation to control export of e-waste to developing countries, yet thousands of tonnes of e-waste still ends up in Ghana, much disguised as "second-hand" goods. Ghana has ratified the Ban Amendment, but has yet to implement it in its national legislation.

It is in the interests of Ghana and other e-waste importing countries to implement the Basel Ban Amendment, even before it goes into force. Ghana and other places must also introduce producer responsibility legislation. This would make electronics producers responsible for the safe recycling of all their goods, be they new or second-hand, sold in Ghana and elsewhere.

box 2

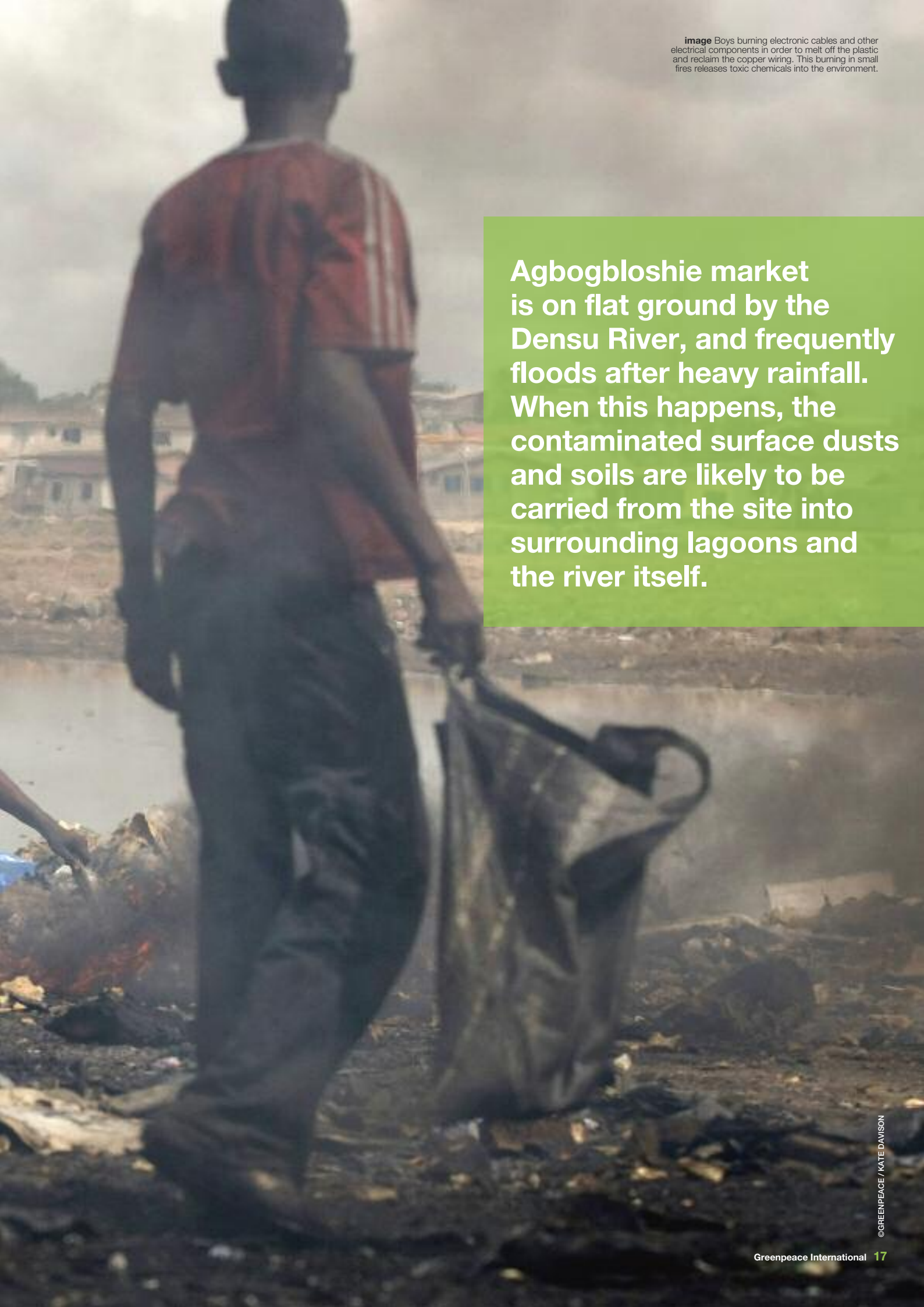

image Boys burning electronic cables and other electrical components in order to melt off the plastic and reclaim the copper wiring. This burning in small fires releases toxic chemicals into the environment.

Agbogbloshie market is on flat ground by the Densu River, and frequently floods after heavy rainfall. When this happens, the contaminated surface dusts and soils are likely to be carried from the site into surrounding lagoons and the river itself.

The Contamination Study shows the urgent need to address the problems posed by the crude recycling and disposal of hazardous e-waste in Ghana, and elsewhere.

In part, this requires tighter controls on the movement of e-waste, including where old equipment is shipped under the guise of 'used goods.'

Ultimately, however, the manufacturers of electronic products must take responsibility for the entire life cycle of their products, even before it is legally required. This includes responsibility at the products' end of life, such as through take back and recycling schemes offered free of charge, and globally wherever their products are sold.

The choices made when products are designed determine the safety of waste management. Even when e-waste is handled with the best technologies, the presence of toxic and hazardous substances in electronic products, means recycling them can be dangerous.

Impacts from recycling and disposal of e-waste can, therefore, only be fully addressed by eliminating the use of all chemicals and materials during manufacture of new products coming on to the market, and eventually entering the waste stream.

Some countries and regions have introduced legislation to restrict the use of certain hazardous substances in electronic goods. These are limited, however, and often exclude many toxic chemicals and materials used in such products. (see box 2).

All producers need to take Individual Producer Responsibility (IPR) for their products' end-of-life costs. This means they take financial responsibility for the entire lifecycle of their products. As recycling of hazardous waste is costly and dangerous, IPR provides incentives to producers to eliminate toxic substances in product design. Doing this makes it cheaper and easier to recycle their products at end-of-life.

Greenpeace campaigns for electronics producers to:

- lead the way by voluntarily phasing out all hazardous chemicals and materials from their products
- take responsibility for the entire life cycle of their products, which includes responsibility at the products' end-of-life, such as through effective take back and recycling schemes that are offered free of charge and globally (wherever their products are sold)
- take the necessary steps to individualise their financial responsibility, and internalise their own products end-of-life costs and
- encourage the introduction, in all countries, of adequately stringent regulation for both the manufacture of electronic equipment and the end-of-life waste management.

E-waste has to be minimised. Unavoidable e-waste must be recycled and disposed of as safely as possible. This can in part be achieved through design of products with greater life-spans, that are safer and easier to repair, upgrade and recycle, and which, as far as possible, avoid the use of hazardous chemicals.

image Breaking obsolete electrical components and wiring for their copper content.

The majority of second-hand electrical goods that are imported to Ghana from developed countries are beyond repair and are either dumped or "recycled" in this crude fashion.

Greenpeace is campaigning to pressurise the producers of electronic goods to remove the hazardous chemicals from their goods and to become more responsible for end-of-life products.

ultimately only through eliminating hazardous chemicals from electronics, can we stop building this toxic legacy.

GREENPEACE

Greenpeace is an independent global campaigning organisation that acts to change attitudes and behaviour, to protect and conserve the environment and to promote peace.

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