Industrial workers improvise using sacks as protective gear, source: PROBICOU File photo

Pro-biodiversity Conservationists in Uganda (PROBICOU),
Plot 181 Bombo Road, Crown House Building (Ku-Biiri)P.O Box 34407 Kampala, Uganda
TEL: +256-414-532676, +256-782-393912, +256-712- 666340
Email: tumwesigyeus@yahoo.com, probicon@probiodiversity.org

HEAVY METALS, HUMAN HEALTH AND OUR ENVIRONMENT

Chemical discharge oozing out of an industry.

This is a publication by: Pro-biodiversity Conservationists in Uganda (PROBICOU),
Plot 181 Bombo Road, Crown House Building (Ku-Biiri)P.O Box 34407 Kampala, Uganda
TEL: +256-414-532676, +256-782-393912, +256-712- 666340
Email: tumwesigyeus@yahoo.com, probicon@probiodiversity.org

Supported by: The Swedish Society for Nature Conservation (SSNC)

Editorial team
Robert Tumwesigye Baganda
(Coordinator)

Dr. David Ogaram
Consultant Toxicoligist

Mr. Paul Twebaze
(Program officer- Waste Management)

Ms. Sharifah Nakigozi
(Program officer- Biodiversity Conservation)

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Editorial

Management of Heavy Metals –A global Agenda

We welcome you to yet another exciting magazine on heavy metals, human health and our environment. Sustainable chemicals management is one of the most critical global challenges that require the effort of all of us. Both recent and current events continue to demonstrate our vulnerability to poor management

In the aftermath of the 1992 United Nations Conference on Environment and Development (UNCED) Rio de Janerio, where new environmental issues were identified for deepened international cooperative actions, the international environmental agenda has undergone significant expansion. One of the most important of new issues has been enhanced chemicals management which still presents a major challenge to international community.

Heavy metals such as lead, mercury, arsenic and cadmium are becoming a concern for everyone because of their ability to cause harm to not only the environment but also human health. These chemicals are on spotlight for elimination internationally. The current attempts to regulate heavy metals include initiatives to eliminate the use of lead in paints and putting in place an international agreement for a stand alone binding document to reduce the use of mercury and mercury containing products.

This publication gives an overview of sustainable chemical management practices especially heavy metals. It highlights some of the chemical management gaps, challenges and attempts in place to overcome such challenges. In Uganda, issues concerning sound management of chemicals are still not considered a priority. The knowledge and awareness on chemicals is still inadequate and only institutions that deal with chemicals on a day to day basis have had on-and- off programmes for their employees with no wider effort to raise awareness in the public.

The low awareness on heavy metals in the country has contributed to gross misuse of this category of chemicals that would have otherwise been easy to manage. The limited knowledge on management of heavy metals has also culminated into increased economic costs associated with high environmental impacts, water treatment and health costs. Costs associated with response to chemical accidents and eventual health risks are increasing at a very fast rate. Highly toxic heavy metals cannot be confined within industries, academic institutions, and households where they are used. The air and water spread them so far and wide, compromising the quality of life and eroding the ecological structure and human substance basis. Their negative environmental impact is felt even in remotest areas.

Understanding of heavy metals and their potential impact to human life and the environment are an important aspect for sustainable management of chemicals. Actions on chemicals management therefore require ongoing public education and awareness programmes. Awareness on heavy metals should be intensified to cover all players such as customs workers, legislators, inspectors, importers, farmers, academicians, policy makers, rural communities, the urban poor and any other people handling or even those close to chemicals.

PROBICOU with the support from Swedish Society for Nature Conservation has decided to contribute to increased awareness on heavy metals by extending knowledge on health effects of heavy metals, sustainable policies for sustainable management of chemicals, civil society perspectives and contributions, as well as a number of interesting stories. Please enjoy!

Editorial team.

REFERENCES

1. (3) K. Jay and L. Steiglitz, “Identification and Quantification of Volatile Organic Components in Emissions of Waste Incineration Plants,” CHEMOSPHERE Vol. 30, No. 7 (1995), pgs. 1249-1260, identified the following volatile organic chemicals emitted from a solid waste incinerator stack:

2. Grateful appreciation to Greenpeace UK, Canonbury Villas London N1 2PN whose publication ‘Incineration and Human health State of knowledge of the impacts of waste incinerators on human health’ Greenpeace 2001 provided much of the information for this article.

3. Health Impacts of Waste Management policies

4. Edited by P.Nicolopoulou-Stamati, L.Hens and C.V. Howard

5. PROBIOU is committed to raise awareness on the effects of chemicals on both human health and the environment. PROBICOU will continue to advocate for a non toxic free environment. PROBICOU aspires to cause an indelible mark on this planet earth because sustainable ecology and environment are fundamental factors for continued civilized existence on earth. Please join us for this noble cause.

BAN, 2005. The digital dump: exporting re-use and abuse to Africa. Basel Action Network. October, 24, 2005. Jim Puckett (Editor). <www.ban.org>.

Finlay A. E-waste challenges in developing countries: South Africa case study. APC Issue Papers. Association for Progressive Communications. November 2005. http://www.apc.org.

Fichter, K., 2003. E-commerce: sorting out the environmental consequences. Journal of Industrial Ecology 6 (2), 25–41.

Lee, C-H., Chang, S-L., Wang, K-M., Wen, L-C., 2000. Management of scrap computer recycling in Taiwan. Journal of Hazardous Materials A73, 209–220.

Liu X, Tanaka M, Matsui Y. Electrical and electronic waste management in China: progress and the barrier to overcome. Waste Manag Res 2006;24:92–101.

Musson, S.E., Jang, Y.-C., Townsend, T.G., Chung, I.-H., 2000. Characterization of lead leachability from cathode ray tubes using the toxicity characterization leaching procedure. Environmental Science & Technology 34, 4376–4381.

Osibanjo, O; Nnorom, I.C. (2007) Electronic waste (e-waste): Material flows and management practices in Nigeria. Waste management 28 (8): 1472-1479. doi:10.1016/j.wasman.2007.06.012. available online at www.sciencedirect.com

Osibanjo, O; Nnorom, I.C. (2007), The challenge of electronic waste (e-waste) management in developing countries. Waste management & research 25:489-501. doi: 10.1177/073424x07082028. (international solid waste association, iswa). available online at www.sagepub.com/journalsprodmansub.nav

Osibanjo, o; Nnorom, I.C (2007) Material flows of mobile phones and accessories in Nigeria: Environmental implications and sound end-of-life management options. Environmental impact assessment review 28:198-213. doi: 10.1016/j.eiar.2007.06.002. available online at www.sciencedirect.com

Dangers of incineration still down played in Uganda

By Robert Tumwesigye Baganda
Coordinator
PROBICOU

The emissions from incineration include organic compounds, e.g. dioxins (which have recently been classified as a human carcinogen), polychlorinated bi-phenyls (PCBs), volatile organic compounds (VOCs), and other chemicals, heavy metals, particulates, inorganic gasses and other gasses. With regard to the emission of chemicals from incinerator stacks, it is generally regarded that setting maximum concentrations to allow 'dilution and dispersion' strategies, are adequate for substances of acute toxicity. This is only suitable in situations where the compound is water soluble, with established NOAEL (no observed adverse effect level), and where it is rapidly degraded. Dilution and dispersal will not work in the situation where dioxins and other compounds are soluble in fat, and are persistent and/or bio-accumulate. The human body is not designed to cope with the carbon/chlorine compound. The concentration of these compounds simply increases as they ascend through the food chain and the compounds accumulate in fat tissue. Every living creature on earth now has persistent carbon/chlorine based compounds in it's fat. It is conservatively estimated that the average person in the 'developed' world has between 300 and 500 discernible residues in their bodies, the so-called body burden of chemicals.

Many of the chemicals produced, by incineration are persistent, bioaccumulative (they accumulate in the body, because the body is not designed to excrete them), and toxic. Furthermore, there may be a long latency period before any adverse health effects become visible. Emissions of dioxins from incinerators may be said to be 'low', but the emissions to air only account for what is inhaled; these chemicals will also be found on vegetation and soil and intake will be increased in this way, as well as by absorption from the skin. The concentration of these compounds is increased each time a step in the food chain is traversed. The longest food chains are found in marine ecosystems, e.g. a small fish contaminated by chemical pollutants will be eaten by a larger fish. As the larger fish will eat many small fish, the concentration of the chemicals will therefore be higher in the larger fish. There are other food chains in nature. These chemicals return to us when we consume the food.

For the general population of industrialized countries, research indicates that dioxins are exerting effects on people at current background levels found in the environment. Such effects include altering the levels of certain hormones, enzymes, and immune system cells. Recent research has shown that calculations of the amounts of dioxin released from incinerators may have been seriously underestimated, by up to thirty times.

The toxicological significance of many volatile organic compounds is unknown. However, they are known to contribute to ozone formation, when they combine with nitrogen oxides in sunlight to produce ground level ozone. This is a respiratory irritant.

Apart from mercury, the heavy metals generally remain in the fly and bottom ash. Mercury is found in the emissions to air, and depending on its chemical state, may either be water soluble and remain close to the incinerator, or be carried long distances. Mercury is now being found in humans throughout the world in concentrations which are known to be toxic.

Most methods used to reduce the emissions of nitrogen oxides from incinerators may increase the levels of particulates in the emissions. It is also of concern that for every one ton of waste incinerated, one ton of carbon dioxide is produced. This will have a deleterious impact on our commitments to the Kyoto protocol on climate change. The numerous adverse health effects associated with climate change are already evident throughout the world, and these will inevitably become more severe unless greenhouse gas emissions are reduced.

For many substances, no 'safe' standards exist. For example, regulations consider chlorinated dioxins. However, there are similar dioxin-like chemicals for which there are no 'safe levels' estimated. A case in point is mixed chloro and bromo-dioxins, which are also released in appreciable quantities and appear to have equal toxicological significance. There is no obligation to monitor these chemicals, as there is no standard 'safe limit'.

Fourthly, there is no 'standard' person; people vary genetically and from an environmental exposure standpoint. The foetus and young child being, of course the most sensitive. It is disturbing to note that the blood-brain barrier is only fully developed at six months of age. Therefore, the foetus and young baby are acutely sensitive to the effects of these largely fat-soluble chemicals. This is even more worrying when we note that the brain is composed largely of fatty material, and know the devastating effects that these chemicals have on neurological development.

For every three tons of waste incinerated, on average one ton of ash is produced. The safe disposal of this also poses a problem, because it also contains dioxins and other chemicals, and heavy metals.

(1) DIOXIN has the following health effects

- Suppresses the Immune system, Suppression of cell-mediated and humeral immunity, increased susceptibility to infectious challenge, auto immune response.
- Male reproductive toxicity ; Reduced sperm count, testicular atrophy, abnormal testis structure, reduced size of genital organs, feminized hormonal responses, feminized behavioural responses
- Female reproductive toxicity ; Decreased fertility, inability to maintain pregnancy, ovarian dysfunction, endometriosis
- Developmental impacts; Birth defects, foetal death, impaired neurological development and subsequent cognitive deficits, altered sexual development.
- Modulation of hormones, receptors and growth factors

Heavy metals and our health

By Robert Tumwesigye Baganda, Paul Twebaze, and Ellady Muyambi - PROBICOU

What are heavy metals?
The term heavy metal is loosely used to refer to metals with high atomic mass. Notable among them are arsenic (As) -atomic mass units 74.9, cadmium (Cd) -atomic mass units 112, lead (Pb) -atomic mass units 207 and mercury (Hg) - atomic mass units 200. These metals are notable because of their poisonous character.

What are their benefits?
Heavy metals are used in industrial applications such as, in the manufacture of pesticides, storage batteries, alloys, electroplated metal parts, mobile phones, computers and other information technology gadgets.

Why are we concerned?
We are concerned because they are toxic (poisonous). Heavy metals can even be toxic in small amounts. Consequently, it is important for us to inform ourselves about the heavy metals and to take protective measures against excessive exposure.

How do they enter our bodies?
Heavy metals may enter the human body through food, water, air, or absorption through the skin when they come in contact. Children may acquire toxic levels from the normal hand-to-mouth activity or putting in mouth objects that are not food. Ingestion is the most common route of exposure in children. Industrial exposure is mainly for adults. As a rule, acute poisoning is more likely to result from inhalation or skin contact of dust, fumes or vapors, or materials in the workplace. However, lesser levels of contamination may occur in residential settings, particularly in older homes with lead paint or old plumbing.

How do they affect human health?
Heavy metal toxicity can result into damaged or reduced mental and central nervous function, lower energy levels, and damage to blood composition, lungs, kidneys, liver, and other vital organs. Long-term exposure may result in slowly progressing physical, muscular, and neurological degenerative processes that mimic Alzheimer's disease, Parkinson's disease, muscular dystrophy, and multiple sclerosis. Repeated long-term contact with some metals or their compounds may even cause cancer and allergies.

Some Examples of heavy metals

MERCURY

Mercury exists naturally in the environment. It exists in three forms: elemental mercury, organic and inorganic mercury. Mercury continues to be used in thermometers, thermostats, and dental amalgam. Mercury is also used in, sphygmomanometers, batteries, fluorescent lights among others.

Effects on human health

The nervous system is sensitive to all forms of mercury. Methyl mercury and metallic mercury vapours are more harmful than other forms because more mercury in these forms reaches the brain. Very young children are more sensitive than adults to mercury. Mercury in the mother's body passes to the foetus and may accumulate there. Prolonged exposures to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing foetus. Short-term exposure to high levels of metallic mercury vapours may cause effects including lung damage, nausea, vomiting, diarrhoea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

Exposure to sufficiently high levels of metallic mercury causes permanent damage to the brain. When mercury accumulates in the kidneys it damages them. All forms of mercury can cause kidney damage.

Short-term exposure (hours) to high levels of metallic mercury vapour in the air can damage the lining of the mouth and irritate the lungs and air passages, causing tightness of the breath, a burning sensation in the lungs, and coughing.

Some chemicals are used in making such Vaseline products. Source: PROBICOU file photo

Inorganic mercury can damage the stomach and intestines, producing symptoms of nausea, diarrhoea, or severe ulcers if swallowed in large amounts. If children swallow mercuric chloride their hearts can be affected thus rapid heart rate and increased blood pressure.

Death

*Inorganic Mercury***.** A lethal dose of mercuric chloride was estimated to be 10–42 mg Hg/kg for a 70-kg adult (Gleason et al. 1957). Death from oral exposure to inorganic mercury is usually caused by shock, cardiovascular collapse, acute renal failure, and severe gastrointestinal damage The most common findings in cases reported were gastrointestinal lesions (e.g., mild gastritis to severe necrotizing ulceration of the mucosa) and renal involvement (e.g., albuminuria, anuria, and uremia).

LEAD

Lead is a heavy, low melting metal that occurs naturally in the earth's crust. It is usually found combined with two or more other elements to form lead compounds. The largest use for lead is in batteries used in cars and other vehicles. Lead compounds are used as a pigment in paints, dyes, and ceramic glazes.

Tetraethyl lead and tetramethyl lead were until recently used in as petrol additives to increase octane rating. This has been phased out in Uganda. Tetraethyl lead may still be used in petrol for off-road vehicles and airplanes. Lead used in ammunition, which is the largest non-battery end-use, has remained fairly constant in recent years. However, even the use of lead in bullets as well as in fishing sinkers is being reduced because of its harm to the environment.

Exposure

People living near hazardous waste sites may be exposed to lead and chemicals that contain lead by breathing air, drinking water, eating foods, or swallowing dust or dirt that contain lead. People may be exposed to lead by eating food or drinking water that contains lead. Drinking water in houses containing lead pipes may contain lead, especially if the water is acidic or "soft"

People who live near busy highways or on old orchard land where lead arsenate pesticides were used in the past may be exposed to higher levels of lead. People may also be exposed to lead when they work in places where lead is used. Foods may contain small amounts of lead. Leafy fresh vegetables grown in lead-containing soils may have lead-containing dust on them.

Effects on Human health

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead mainly affects the nervous system, both in adults and children.

Long-term exposure of adults to lead at work has resulted in decreased performance of the nervous system. Lead exposure may also cause weakness in fingers, wrists, or ankles. It also causes increase in blood pressure, particularly in middle-aged and older people. Lead exposure may also cause anaemia. At high levels of exposure, lead can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

Children are more vulnerable to lead poisoning than adults. Children are exposed to lead all through their lives. They can be exposed to lead in the womb if their mothers have lead in their bodies. Babies can swallow lead when they breast feed, or eat other foods, and drink water that contains lead. Babies and children can swallow and breathe lead in dirt, dust, or sand while they play on the floor or ground. These activities make it easier for children to be exposed to lead than adults. The dirt or dust on their hands, toys, and other items may have lead particles in it.

Children are more sensitive to the health effects of lead than adults. A child who swallows large amounts of lead may develop anaemia, kidney damage, colic (severe "stomach ache"), muscle weakness, and brain damage, which ultimately can kill

A letter to the President, Obama about Mercury

February 9, 2009

President Barack Obama

The White House, 1600 Pennsylvania Ave NW, Washington, DC 20500

Re: Legally binding treaty to reduce mercury exposure

Dear President Obama,

We, the undersigned groups, strongly urge you to support an international agreement to control mercury pollution and reduce human exposure to mercury. Mercury is a dangerous neurotoxin that can make its way up the food chain into humans, and poses an increased exposure risk to developing fetuses and young children, causing permanent learning disabilities. Mercury is also a persistent, bioaccumulative, transboundary pollutant. Emissions to and from the United States contaminate the earth's air, soil, water and fish. Because of this global contamination, mercury pollution requires a coordinated international response. Of high concern is mercury emissions from coal-fired power plants and other sources of unintentional emissions of mercury, and indeed these are important sources of mercury pollution in the United States and throughout the world.

However, there are also intentional uses of mercury that can pollute the environment. As you know, mercury is also a *commodity metal* (like iron or copper), traded on the global market, and is used for many industrial and commercial purposes including over 1,000 tons per year in small scale gold mining. As a result, the continued trade in mercury also contributes to global mercury pollution. Because of its toxic nature and increasingly available alternatives to its use, we have a unique opportunity and responsibility to address this contaminate through international regulation or ban of its trade. Since 2001, countries around the world have been discussing options to control mercury pollution and in 2003 agreed that enough was known to warrant immediate action to reduce global mercury pollution. Most countries now favor the negotiation of a legally binding international agreement as the most viable approach to deal with this problem.

However, over the past six years, the Bush administration consistently opposed this position. In mid-February, the world will take up this question again at the 25th meeting of the United Nations Environment Program Governing Council. At this meeting, the United States must change its current position on mercury and come prepared to support a legally binding agreement to reduce mercury exposure. The UNEP Governing Council meeting will provide your administration with its first opportunity on the world stage to demonstrate a real change in approach to international environmental issues, an approach that embraces cooperation and leadership, rather than obstruction and inaction. Therefore, we urge you to seize this opportunity for leadership, and support an international agreement to control this dangerous pollutant. We welcome any questions or comments on our letter.

Please feel free to forward them to: mercurypolicy@aol.com or call: 802.223.9000. Thank you.

Sincerely,

Michael Bender, Mercury Policy Project, Montpelier, VT

John Blair, president, Valley Watch, Inc., Evansville, IN

The introduction of the global system of mobile communication (GSM) and the use of mobile phones have also revolutionized communication in both developed and developing countries. In July 2000, the Group of Eight Developed countries, G8, established the 'Okinawa Charter on Global Information Society' at the Okinawa Summit in Japan. This is an initiative to bridge the 'digital divide', aimed at improving the access to communication technologies in the world's poorer countries. This Charter and other similar initiatives have since revolutionalized information and communication technologies (ICT) in developing countries.

In 2005, there were more than 1.32 billion GSM subscribers around the world connected to 626 GSM networks operated in about 198 countries worldwide (Scharnhorst et al., 2005). It was estimated that the number of mobile phones in use worldwide in 2003 was 1.3 billion and this was predicted to double by 2006 (Seliger, 2003).Recent reports from the International Telecommunication Union (ITU) suggest that Africa is the world's fastest growing market for mobile phones. Mobile subscribers on the continent by 2005 were estimated at 51.8 million, a staggering 1000% increase since 1998. The projected growth of the number of subscribers is put at between 100 and 200 million by the year 2010 (Finlay, 2005). This prediction will be surpassed as mobile phone subscribers in Nigeria has already reached 50 million in 2006, a record 10,000 increase since 2000 Osibanjo, and Nnorom,(2007). Importation of cheaper second hand sets from developed countries contributed significantly to the widespread availability and use of phones by all segments of the society including both the affluent and the common man.

Worldwide about 500 million personal computers (PCs) reached the end of their life (EoL) in the decade between 1994 and 2003 and these contain approximately 2,870,000 ton of plastics, 718,000 ton of lead, 1,363 ton of cadmium and 287 ton of mercury . Most of these EoL will end up as waste in developing countries releasing their toxic constituents, endangering the environment and human health. E-waste is growing at a rapid and uncontrollable rate and is the fastest growing portion of the municipal solid waste stream. Currently WEEE constitutes 1% of municipal waste in the US (Li et al., 2006) and 4% in the EU (Yla-Mella et al., 2004). As these PCs become obsolete, they are replaced and the old PCs are disposed.

Personal computers (PCs) constitute the second largest component next to Cathode Ray Tubes (CRTs) in the e-waste stream and are growing most rapidly. PCs also contain the largest amount of printed wiring board (PWB) among electronic products. The cathode ray tubes (CRTs) in computer monitors and televisions contain about 8% lead by weight ; amounting to about 2–4 kg of lead each (Powel, 2002). Computer CRTs present a disposal problem because of their growing magnitude in the waste stream and their role as a major source of Pb in Municipal Solid Waste (MSW) (Musson et al., 2000; Lee et al., 2000). Consumer electronics accounts for 27% of Pb discards in MSW in 1986 in the US and is projected to comprise 30% of lead discards by 2007. By 2000, CRTs were projected to contribute 29.8% of all Pb in MSW or approximately 98.7% of all Pb from electronics (Musson et al., 2000). Lead is included in CRTs for various reasons among which is providing shield necessary for x-rays (Lee et al., 2000).

At this rate, the E-waste continues to be a serious threat especially when efficient recycling is dependent, to a large degree, on the possibility to trade recyclables internationally because no one country possesses the skills, capacity or infrastructure to reuse, recycle or recover the immense variety of recyclable materials. As a consequence, the market is driving recyclables across borders faster than the development of policies, safeguards and legislation. (Portias 2009). Perhaps the challenge of complying with stringent environmental safeguards and controls; and the economic costs in developed countries are responsible for the adoption of the easier option of exporting e-waste to developing countries and further fuel the increase in the globalization of trade in waste.

References

BAN, 2005. The digital dump: exporting re-use and abuse to Africa. Basel Action Network. October, 24, 2005. Jim Puckett (Editor). <www.ban.org>.

Finlay A. E-waste challenges in developing countries: South Africa case study. APC Issue Papers. Association for Progressive Communications. November 2005. http://www.apc.org.

Fichter, K., 2003. E-commerce: sorting out the environmental consequences. Journal of Industrial Ecology 6 (2), 25–41.

Lee, C-H., Chang, S-L., Wang, K-M., Wen, L-C., 2000. Management of scrap computer recycling in Taiwan. Journal of Hazardous Materials A73, 209–220.

Liu X, Tanaka M, Matsui Y. Electrical and electronic waste management in China: progress and the barrier to overcome. Waste Manag Res 2006;24:92–101.

Musson, S.E., Jang, Y.-C., Townsend, T.G., Chung, I.-H., 2000. Characterization of lead leachability from cathode ray tubes using the toxicity characterization leaching procedure. Environmental Science & Technology 34, 4376–4381.

Osibanjo, O; Nnorom, I.C. (2007) Electronic waste (e-waste): Material flows and management practices in Nigeria. *Waste management* 28 (8): 1472-1479. doi:10.1016/j.wasman.2007.06.012. available online at www.sciencedirect.com

Osibanjo, O; Nnorom, I.C. (2007), The challenge of electronic waste (e-waste) management in developing countries.W*aste management & research* 25:489-501. doi: 10.1177/073424x07082028. (international solid waste association, iswa). available online at www.sagepub.com/journal-sprodmansub.nav

Osibanjo, o; Nnorom, I.C (2007) Material flows of mobile phones and accessories in Nigeria: Environmental implications and sound end-of-life management options. E*nvironmental impact assessment review* 28:198-213. doi: 10.1016/j.eiar.2007.06.002. available online at www.sciencedirect.com

the child. At still lower levels of exposure, lead can affect a child's mental and physical growth. Foetuses exposed to lead in the womb, because their mothers had a lot of lead in their bodies, may be born prematurely and have lower weights at birth. Exposure in the womb, in infancy, or in early childhood also may slow mental development and cause lower intelligence later in childhood. There is evidence that these effects may persist beyond childhood.

CADMIUM

Cadmium is an element that occurs naturally in the earth's crust. It is usually present as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulphur (cadmium sulphate, cadmium sulphide). Cadmium is most often present in nature as complex oxides, sulphides, and carbonates in zinc, lead, and copper ores.

Main uses

The most significant use of cadmium is in nickel/cadmium batteries, as rechargeable or secondary power sources exhibiting high output, long life, low maintenance and high tolerance to physical and electrical stress. Cadmium coatings provide good corrosion resistance, particularly in high stress environments such as marine and aerospace applications where high safety or reliability is required; the coating is preferentially corroded if damaged. Other uses of cadmium are as pigments, stabilisers for PVC, in alloys and electronic compounds. Cadmium is also present as an impurity in several products, including phosphate fertilisers, detergents and refined petroleum products.

Exposure

Food and cigarette smoke are the biggest sources of cadmium exposure for people. Apart from tobacco smokers, people who live near hazardous waste sites or factories that release cadmium may also get exposed to it. Workers can be exposed to cadmium in air from the smelting and refining of metals, or from industries that make cadmium products such as batteries, coatings, or plastics. Cadmium can enter ones body from the food, water from particles in the air you breathe, or from breathing in cigarette smoke that contains cadmium. Higher amounts of cadmium can enter your body from air or smoke that you inhale (25 to 60% of the cadmium present) than from cadmium in foods you eat (about 5-10% enters the body). One can also be exposed when soldering or welding metal that contains cadmium.

Effects on Human health

Eating food or drinking water with very high cadmium levels severely irritates the stomach, leading to vomiting and diarrhoea, and sometimes death. Eating lower levels of cadmium over a long period of time can lead to a build-up of cadmium in the kidneys. If the levels are high, the cadmium will cause kidney damage, and also causes bones to become fragile and break easily.

At high levels, cadmium can damage the stomach and intestines. Children absorb more cadmium than adults. The young can also get decreased bone strength due to cadmium exposure than adults. Studies indicate that more cadmium is absorbed into the body from the diet if the diet is low in calcium, protein, or iron, or if the diet is high in fat (because fat slows down the passage of food in the gut and allows more time for absorption). Children who do not get enough iron, calcium, or protein may also absorb more cadmium.

Conclusion

In order to protect human health and the environment from the harmful effects of heavy metals, it is necessary to improve awareness and information exchange on exposure, risk reduction, substitutes and effective regulatory approaches to reduce reliance on heavy metals.

Civil Society Statement on Mercury and Other Heavy Metals of Concern

We, participants of the NGO Skill-share on Heavy Metals meeting in Dar es Salaam, Tanzania 12-14 November 2008, Hosted by Agenda,

Aware that mercury, cadmium, lead and other metals pose special concerns because of their permanence and potential for serious harm to the environment and human health, especially of children and future generations;

Mindful that the awareness of policy makers and the general public about the risks of mercury and other heavy metals to human health and the environment is often very low, particularly in Africa;

Acknowledging that lead, cadmium, and other substances of concern are present in many products, including children's toys and paints, and in electronic products and wastes, contributing to unacceptable exposures to children and other vulnerable groups;

Cognizant of the fact that artisanal and small scale gold miners all over the world are still using metallic mercury and that alternative technologies are often expensive or not easily accessible to this group of users;

Aware that health care devices containing mercury are still produced and used, especially in developing countries;

Concerned about the lack of data on the sources, amount, and environmental fate of mercury and other substances of concern used in products and industrial processes, including small scale mining;

Welcoming the progress that the United States and Europe have made in phasing out many mercury-containing products, instruments, and processes, and that the European Union and the United States have already enacted a mercury export ban;

Noting with concern that increasing quantities of used consumer electronics shipped from developed countries to developing countries are actually e-waste, which contain large amounts of toxic materials and heavy metals, and which contribute to serious threats to human health and the environment in these countries, including many in Africa;

Commit ourselves to:

Raise awareness about the impacts of mercury and other metals on human health and the environment and the need for, and availability of, safer alternatives, by providing information, education and training to policy makers, civil society organizations, and local communities;

Support the establishment of national, regional, and sub-regional networks for sharing knowledge, experiences, technologies and expertise in support of products and processes that are free of mercury and other heavy metals;

Promote and support research and use of mercury–free technologies and, where mercury-free technologies are not yet feasible, effective mercury recovery techniques and techniques that utilize less mercury, particularly in artisanal and small scale gold mining;

Assist in the development of systematic and comprehensive inventories on production, use, trade, and stockpiles of mercury and other metals of concern;

Advocate the adoption and implementation of effective national regulatory measures to control production, import, and use of mercury and other metals of concern in all African countries;

Advocate at the global level for an international legally binding instrument to reduce, phase out, and ultimately eliminate production, trade and use of mercury and mercury containing products; to promote the transfer of mercury-free technologies; and to reduce mercury releases and exposures from atmospheric emissions of mercury, wastes that contain mercury, and mercury-contaminated sites;

Urge governments, intergovernmental organizations, and the second meeting of the International Conference on Chemicals Management to take immediate measures to eliminate lead from paints throughout the world;

Call upon the Governing Council of the United Nations Environment Program at its twenty-fifth session in February 2009 to establish an intergovernmental negotiating committee to develop a legally binding instrument to control production, trade, use, and environmentally sound storage of mercury;

Call upon the UNEP Governing Council to adopt the Global Mercury Policy Framework recommended by the ad hoc Open-ended Working Group on Mercury;

Further call upon the UNEP Governing Council, UNEP, and individual governments to take immediate actions to develop and implement specific mercury control measures of high priority, using existing legal and voluntary frameworks.

HEAVY METALS, HUMAN HEALTH AND OUR ENVIRONMENT

E-waste and heavy metals; a global health and environmental challenge

The electrical and electronic equipment (EEE) sector is largely a globalized industry with production and assemblage occurring mainly in developed countries. EEE comprises electrical gadgets such as fridges, air conditioners, washing machines, microwave ovens; and electronic products such as computers and accessories, mobile phones, television sets and stereo equipment. The growth in global electrical and electronic equipment (EEE) production and consumption has been exponential in the last two decades, fuelled by rapid changes in equipment features and capabilities, decrease in prices, and the growth in internet use (Campbell and Hasan, 2003). This has created a large volume of waste stream of obsolete electrical and electronic devices (WEEE or e-waste) in developed countries. With the globalization of trade in e-waste, there is high level of trans-boundary movement of electrical and electronic devices as secondhand or end –of-life electronic equipment into developing countries in an attempt to bridge the 'digital divide'.

Twebaze Paul:

Computers contain plenty of lead, mercury, and cadmium.

E-wastes contain several toxic substances including heavy metals such as lead, nickel, chromium, mercury and organic pollutants such as polychlorinated biphenyls (PCBs), and the common flame retardants. Thus globalization of e-waste has environmental and health implications in the downstream end of the EEE supply chain entailing disposal of waste, as developing countries are economically challenged, lack the infrastructure for sound hazardous waste management including recycling, or effective regulatory framework for toxic chemicals and wastes management. Furthermore there is pervading low public awareness of the hazardous nature of e-waste with the use of low-end or crude waste management techniques. The fast growing volume of e-wastes imports in developing countries whether in a form of post-consumer goods or end-of-life equipment imported or generated domestically require the development of sound capacity to prevent, minimize, re-use, recycle or recover materials from such wastes and to dispose of the residues arising from these operations in an environmentally sound manner.

In recent years, significant international transboundary movement has evolved in used and end – of life personal computers and accessories, computer hardware, home appliances, old electric devices, CD players, radio, fans, fluorescent tubes, medical equipment, television, transformers, switch boards and used mobile phones that have been transported from developed to developing countries , for the removal of usable parts, for repairs, refurbishment, reuse and for processing for the recovery of raw materials. Relatively cheaper labor costs, weak environmental occupational laws and regulations have made developing countries attractive as the destinations for e-waste export from developed countries. Import and export statistics provided by Parties to the Basel Convention for the year 2000 show that there were imports of more than 17.5 million tonnes and export of 1.6 million tonnes designated as used electrical and electronic assemblies or scrap.

In the European Union the total weight of electronic appliances available on market in 2005 exceeded 9.3 million tons. Among these electronic appliances are 48 million personal computers (desktops and laptops); 32 million television displays and 776 million lamps (UNU WEE Directive Review Study, 2007). The growth of the PC industry started in the early 1980s and by 1989, an estimated 21 million PCs were sold worldwide; in 1998 this figure reached 93 million. In 2001, there were over 300 million internet users worldwide and this, was estimated to increase to more than 500 million users by 2003 (Fichter, 2003).

Most developing are currently undergoing a rapid advancement in information and communication technology (ICT) through the use of computers. A very significant proportion of ICT users including internet services rely on secondhand equipment from developed countries, primarily from Europe and North America. Some of these countries manufacture or assemble computers locally to supplement imported computers while the relative proportion varies from country to country. Nigeria has a few companies assembling computers locally but production statistics is not available. Nonetheless about 95% of computers in use in Nigeria are imported. The country imports annually at least 5 million units/year of personal computers equivalent to 60,000 metric tons/year mainly from USA (45%) and European Union (45%) (BAN 2005).

In China, about 14 million personal computers have been sold in 2005 in addition to 48 million television displays, nearly 20 million refrigerators and 7.5 million air conditioners in 2001 (He et al.,(2006). India had an installed basis of 5 million personal computers in 2006. Electric and electronic waste is also a growing concern in South America where, since 2000, the use of personal computers in the region grows around 15% a year (World Development Indicators Database). For example Peru manufactures locally about 75% of computers in use while the computer industry grew astronomically by 70% in 2007 (PERU Company 2007a).

World Bank distributes mercury-containing bulbs

Robert Tumwesigye Baganda

I am responding to the article titled "World bank did not halt distribution of free bulbs" by Steven Shalita that appeared in the New Vision of 19 January, 2007. In that article, Steven puts it clear that 800,000 energy saving bulbs were procured. About 598,000 bulbs have been distributed freely and about 240,000 remaining bulbs are in the offing for distribution. The World Bank needs to be informed that the same energy saving bulbs contain mercury, a dangerous substance currently being phased out worldwide. Moreover, there are no means of safe disposal of mercury available so far. Apart from mercury in fluorescent bulbs, mercury in Uganda is also used in thermometers, thermostats, dental amalgam, sphygmomanometers and rechargeable batteries among others.

Fluorescent bulbs being promoted by the World Bank contain small quantities of mercury and emit ultraviolet light which have a negative impact on people suffering from diseases accompanied by light sensitivity.

Mercury is both harmful to health and the environment. Mercury affects the nervous system. Very young children are more sensitive than adults to mercury. Mercury in the mother's body passes to the foetus and may accumulate there. Prolonged exposures to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing foetus. Short-term exposure to high levels of metallic mercury vapours may cause effects including lung damage, nausea, vomiting, diarrhoea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

Exposure to sufficiently high levels of metallic mercury causes permanent damage to the brain. When mercury accumulates in the kidneys it damages them. All forms of mercury can cause kidney damage.

Short-term exposure (hours) to high levels of metallic mercury vapour in the air can damage the lining of the mouth and irritate the lungs and air passages, causing tightness of the breath, a burning sensation in the lungs, and coughing.

Inorganic mercury damages the stomach and intestines, producing symptoms of nausea, diarrhoea, or severe ulcers if swallowed in large amounts. If children swallow mercuric chloride their hearts can be affected thus rapid heart rate and increased blood pressure.

Mercury may also lead to death. A lethal dose of mercuric chloride was estimated to be 10–42 mg Hg/kg for a 70-kg adult (Gleason et al. 1957). Death from oral exposure to inorganic mercury is usually caused by shock, cardiovascular collapse, acute renal failure, and severe gastrointestinal damage.

My question is: Has the World Bank put in place measures for safe disposal of the bulbs? I very well know the serious problem of power in Uganda but the World Bank as an international credible body should not use double standards to distribute obsolete products to developing countries. European Union for example has banned the trade in mercury and we are also waiting for the Obama Administration to take action on mercury. Africa's position is very clearl and this is to phase out mercury. As Uganda prepares to phase mercury use, the World Bank should revise the policy on energy saving bulbs. For example in Mauritius energy bulbs were distributed and a lot of money was spent recollecting them.

Sweden bans mercury

Press release 15 January 2009,
Ministry of the Environment, Government bans all use of mercury in Sweden

The Government today decided to introduce a blanket ban on mercury. The ban means that the use of dental amalgam in fillings will cease and that it will no longer be permitted to place products containing mercury on the Swedish market.

"Sweden is now leading the way in removing and protecting the environment from mercury, which is non-degradable. The ban is a strong signal to other countries and a Swedish contribution to EU and UN aims to reduce mercury use and emissions," says Minister for the Environment Andreas Carlgren.

The Government's decision means that products containing mercury may not be placed on the Swedish market. In practice this means that alternative techniques will have to be used in dental care, chemical analysis and the chloralkali industry. The Swedish Chemicals Agency will be authorised to issue regulations on exceptions or grant exemptions in individual cases.

In connection with the Government's decision, waste containing mercury will be disposed of in deep geological repositories in other EU countries. The Swedish market for hazardous waste is small. Last spring, a government inquiry established that there are existing repositories for waste containing mercury in, for example, Germany that more than adequately meet the safety requirements on which Swedish legislation is based. Creating a new Swedish repository would be around 15 times more expensive than depositing waste in existing facilities in the EU. The bodies consulted on this matter shared the inquirys conclusions.

"By using common solutions and almost forty years of experience of storing mercury in the EU, we are not lowering safety standards. The waste will be transported to a deep geological repository with high safety standards. In accordance with the polluter pays principle, the owners of the waste will be responsible for ensuring that disposal in a repository is arranged and paying for it," says Mr Carlgren.

The disposal possibilities in other EU countries provide better incentives for the desired development of safe, large-scale technologies to stabilise waste containing mercury.

Since the beginning of the 1990s there has been a ban in Sweden on the manufacture and sale of certain products containing mercury, including thermometers and other measuring devices and electronic components.

The new regulations enter into force on 1 June 2009.

Chemical pollution feminizing men

By Gatonye Gathura
Adopted from the daily nation Thursday January 15, 2009

The female contraceptive pill, agricultural and industrial chemicals are feminising males, reducing their fertility and generally threatening the basic reproductive organs, according to over 250 studies done worldwide and new claims by a Vatican newspaper.

According to the Vatican newspaper *L'OSServatore Romano* last week, the pill "has for some years had devastating effects on the environment by releasing tonnes of hormones into nature" through female urine.

In the newspaper Pedro Jose Maria Simon Castellvi, president of the International Federation of Catholic Medical Associations, claimed that the association has sufficient evidence to state that a significant cause of male infertility is the environmental pollution caused by the pill.

And some top scientists are in agreement that the hormone oestrogen, which is contained in the contraception pill has joined hundreds of other agricultural and industrial chemicals known as 'gender-benders' that have been found to be responsible for lower sperm counts in men, increased birth defects and a general feminization of males.

Recent studies have found that most of the chemicals used in the world, including in Kenya's agricultural and industrial sectors, disrupt the endocrine system which among others is instrumental in regulating growth and development as well as sexual function and reproductive processes the body.

According to a global survey incorporating more than 250 studies from all parts of the world, which was first published by *The Independent*, baby boys born to women exposed to widespread chemicals in pregnancy are being born with smaller penises and feminized genitals.

Giving credence to the Vatican claims, scientists at Cardiff University in the UK found that brains of male starlings that ate worms contaminated by female hormones at sewerage works had subtly changed so that they sung at greater length with increased virtuosity.

In places like Kenya where sewerage water is not treated before release into the environment such disruptive toxins are bound to find their way in the food chain.

A United Nations study carried out around Dandora dumpsite in Nairobi, concluded that chicken eggs in the area were highly contaminated with dioxins — a class of chemical contaminants that are formed during combustion processes such as waste incineration and has been known to disrupt the body's hormonal balance.

Eggs

The eggs analysis showed high levels of dioxins and other persistent organic pollutants (POPs) in Dandora. Dioxin levels were found to be more than six times higher than the European Union dioxin limit for eggs while levels of PCBs, (a highly toxic class of chemical pollutants) exceeded proposed regulatory limits by more than four-fold.

The Dandora study concluded that people in the area are highly exposed to these pollutants some of which are known to have serious heath effects including birth defects, miscarriages, low sperm counts and others.

Exposure for people in Nairobi would come through the consumption of free-range chicken eggs or other products from animals such as goats, pigs and cows that feed and drink from the surrounding area.

"Another likely pathway would be through the consumption of vegetables grown along the banks of the river that passes around the edge of the dump and the direct inhalation of fumes from the site," says the Dandora study.

Another UN study, 'Hotspots report for contaminated site: Kitengela site in Kenya,' investigated the area which hosts a store used by the Ministry of Agriculture as a temporary storage facility for obsolete pesticides and other chemicals prior to their disposal.

Rubbished

The study found out that the site is contaminated with a wide variety of toxins, including POPs pesticides and industrial chemicals."The estimated weight of contaminated soil around the store is 400 tonnes, and the site is a potential health hazard to the local community.

Lead for car batteries poison an African town

HEIDI VOGTTHIAROYE SUR MER, Senegal

Adopted from the state News paper available http://www.thestate.com/

First, it took the animals. Goats fell silent and refused to stand up. Chickens died in handfuls, then en masse. Street dogs disappeared. Then it took the children. Toddlers stopped talking and their legs gave out. Women birthed stillborns. Infants withered and died. Some said the houses were cursed. Others said the families were cursed.

The mysterious illness killed 18 children in this town on the fringes of Dakar, Senegal's capital, before anyone in the outside world noticed. When they did - when the TV news aired parents' angry pleas for an investigation, when the doctors ordered more tests, when the West sent health experts - they did not find malaria, or polio or AIDS, or any of the diseases that kill the poor of Africa.

They found lead. The dirt here is laced with lead left over from years of extracting it from old car batteries. So when the price of lead quadrupled over five years, residents started digging up the earth to get at it. The World Health Organization says the area is still severely contaminated, 10 months after a government cleanup.

The tragedy of Thiaroye Sur Mer gives a glimpse at how the globalization of a modern tool - the car battery - can wreak havoc in the developing world.

As the demand for cars has increased, especially in China and India, so has the demand for lead-acid car batteries. About 70 percent of the lead manufactured worldwide goes into car batteries, which are also used to power TVs and cell phones in some areas.

Both the manufacturing and the recycling of these batteries has moved mostly to the Third World. Between 2005 and 2006, four waves of lead poisoning involving batteries were reported in China. And in the Vietnamese village of Dong Mai, lead smelting left 500 people with chronic illnesses and 25 children with brain damage before the government shut it down three years ago, according to San Francisco-based OK International, which works on environmental standards for battery manufacturing.

Thiaroye Sur Mer is a town of 100,000 where yearly rains leave people wading through knee-deep water inside their cement-block houses. A train track bisects the town and daily trains speed through just a few steps from homes. The ocean used to supply a livelihood, but fishing hasn't been good the past few years. Young men have increasingly taken to trying to sneak into Europe aboard large canoes with outboard motors.

For years, the town's blacksmiths extracted lead from car batteries and remolded it into weights for fishing nets. It's a dangerous, messy process in which workers crack open the batteries with a hatchet and pull small pieces of lead out of skin-burning acid. The work left the dirt of Thiaroye dense with small lead particles.

Then the price of lead climbed, and traders from India came and asked about the dirt. They offered to buy bits of lead by the bag for 60 cents a kilogram, says Coumba Diaw, a middle-aged mother of two.

So Diaw dug up the dirt with a shovel and carried bags of it back to her house. There, she sat outside and separated out the lead with a sifter. It took just an hour of sifting to make what she did in a day of selling vegetables at the market. She kept her two daughters nearby as she worked.

Women all over the neighborhood did the same, creating dust clouds of lead. Then the sicknesses started. The deaths came, one after another, over the five months from October 2007 through March 2008.

At first, people thought it was malaria or tuberculosis. Doctors at the local health clinic kept seeing the same symptoms with no response to treatment and started running more tests.

That's when Demba Diaw's 4-year-old daughter died. First she got a bad fever. Then she started vomiting. Diaw, a 31-year-old teacher at an Islamic school, thought it was malaria and took her to the hospital. The next day she was dead.

"The doctors couldn't say what she died of," says Diaw. His voice rises as he talks, and he spits out the words. He shows a picture of his daughter that he carries with him, and the plastic casing of a lead battery.

Diaw started talking to other parents whose children had the same symptoms. They were spending more money each day for more lab tests but not getting any answers. So he called the local media and held a news conference to demand an investigation.

At about the same time, the hospital confirmed lead poisoning. The World Health Organization was called in. The government ran blood tests on relatives of the dead children. Their mothers and siblings were found to have lead levels of 1,000 micrograms per liter. Just 100 micrograms per liter is enough to impair brain development in children.

A block from Diaw's house, the illness struck his niece, two-year-old Raminatou, the child Coumba Diaw carried on her back.

"It started with a fever. Her skin was hot. She would tremble and her eyes would roll back. She would drool. Her legs would splay out. She cried all the time," says Coumba Diaw. She speaks without emotion, recounting the events as if it all happened to someone else.

Diaw rushed her daughter to the hospital. Now that they knew the problem, they saved Raminatou.

The cleanup started in March, but was not extensive, residents say. On a side street in Thiaroye Sur Mer, a man points out a pile of sacks full of lead pellets that have sat against a wall for months through the rainy season. He says someone ditched the sacks there when they heard the lead was dangerous, and they were missed by the cleanup operation.

About 950 people have been continuously exposed to lead dust in the neighborhood, and many children show signs of neurological damage, according to WHO. The sifting tossed lead particles into the air where people could inhale it.

In richer countries, recycling of lead batteries is regulated. Most U.S. states require anyone who sells lead-acid batteries to collect spent ones and ship them to recycling plants licensed and regulated by the Environmental Protection Agency. Europe has similar oversight.

"It's when you get to Third World countries where you don't have regulations or attempts to control the movement of this product that you see these kind of tragedies occurring," says Maurice Desmarais, executive director of Battery Council International, a U.S.-based trade group.

Although North America and Europe continue to be the world's biggest buyers of cars, fewer and fewer car batteries are made there. Manufacturing has moved where labor is cheaper and environmental protections regulations are more lenient, or at least more leniently enforced.

"There's not a developing country where this isn't happening," says Perry Gottesfeld, of OK International. Most in Thiaroye say they will never go back to sifting dirt for lead. But some still don't believe it is dangerous.

Such batteries contain plenty of lead. Source PROBICOU File Photo

Mohamadou Diagne, a scrap metal trader, says he hasn't bought any lead since the poisonings became known. But he says he grew up cracking open batteries for lead, and he hasn't been poisoned. He has not had his blood tested for lead. "My father is 75. He's never had any problems," he says. An Indian buyer about a half-mile away from the town still has a large yard full of battery casings and sacks of lead pellets. The company used to buy some of the lead dug up in Thiaroye. Workers there confirm that they ship the lead and batteries out of the country but won't give further details. The owner declined a number of requests for an interview.

The government has stripped the top layer of dirt from the roads with earthmovers and is paying the hospital bills of anyone sickened by the lead. That's at least 55 children to start, and likely more once the testing is finished.

The World Health Organization says there's still so much lead in the ground that the area is toxic. The government wants to relocate the entire neighborhood. But Demba Diaw says the government just wants to profit from the lead in their earth, and Coumba says this is her only home.

Like many other families, the Diaws are too poor and too rooted to move. So they will stay where the lead poisons the earth.