Human Rights Impacts of E-Waste

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Impacts of E-Waste Pollution on People

E-waste or electronic waste is a major waste stream resulting from the boom in consumer electronics in the past decades. With the rapid pace of technology innovation and obsolescence that leads to shortened product lifespans, the growing demand for electronics and its resulting waste poses a significant challenge in every stage of its life-cycle from the utilization of raw materials, production and ultimately waste management.

Electronic components are not totally benign. They often contain a cocktail of hazardous materials that pose adverse health and environmental impacts at the point of extraction to the production of the component. Some of the most common toxic chemicals associated with electronics are as follows:

- Arsenic. Arsenic is present as gallium arsenide found in light emitting diodes (LEDs). Chronic exposure to arsenic can result to various skin diseases and can decrease nerve conduction velocity.[1] Arsenic and arsenic compounds are also known human carcinogens.[2]

- Barium. Barium can be found in spark plugs, fluorescent lamps and in the coating of CRT monitors.3 Once exposed to the environment, it can easily transform to its stable forms, barium sulfate and barium carbonate. Short term exposure to barium could lead to brain swelling, muscle weakness and damage to the heart, liver and spleen.[4]

- Beryllium. A known human carcinogen, beryllium is used for x-ray machines and mirrors. Its alloys are also used in televisions, calculators, computers and other electronic devices. It can settle as dust in the air, exposure to which may lead to beryllicosis (chronic beryllium disease).[5] People exposed to beryllium can also cause a form of skin disease that is characterized by poor wound healing and wart-like bumps.[6]

- Brominated flame retardants (BFRs). Flame retardants are used in electrical and electronic appliances to lend them flame resistant qualities. The combustion of these halogenated compounds releases toxic emissions including dioxins which can lead to severe hormonal disorders, as well as cancer.[7]

- Cadmium. Cadmium can be found in some rechargeable batteries, semiconductor chips and in the phosphor coating of CRT monitors. Once released in the environment, it can accumulate in the bodies of aquatic organisms and agricultural crops. Due to its long half-life and stability, cadmium can bioaccumulate in the body.[8] Continuous, low-level exposures to cadmium causes kidney disease and bone brittleness.[9] Moreover, it is a known human carcinogen, causing lung cancer to workers exposed to cadmium present in the air.[10]

- Hexavalent chromium. Hexavalent chromium is commonly found in the metal parts of electronic equipment, particularly as an anti-corrosive coating on screws, rivets, bolts, frames, chassis, switches, plugs, among others. It is easily absorbed in the human body and can produce toxic effects to the cells, such as damage to the DNA.[11]

- Lead. Lead is the 5th mostly widely used metal. It is commonly found in electronic and electrical equipment such as batteries, cable sheating, glass of CRT monitors, among others. It is a potent neurotoxin, and short term exposure to high concentrations of lead can cause vomiting, diarrhea, convulsions and damage to the kidney and reproductive system. It can also cause anemia, increased blood pressure, and induce miscarriage for pregnant women. Children are considered to be particularly vulnerable to exposure to lead, for it can damage nervous connections and cause brain disorders.[14]

- Mercury. Mercury is used in switches, thermostats, batteries and fluorescent lamps. Like lead, it accumulates in the body and targets the central nervous system.[15] Chronic exposure to mercury can also cause kidney damage.[16]

- Polyvinyl chloride. Polyvinyl chloride (PVC) is mainly found in the plastic components of electrical and electronic equipment. When burned, PVC releases harmful dioxins, furans and phthalates, which are known carcinogens and reproductive toxicants.[17]

- Phthalate esters. Phthalates are a group of chemicals that are used as softeners to PVC. Since they are not chemically-bound to the plastic, they can easily leech into the environment, thus causing asthmatic and allergic reactions to children.[18]

In its final life-cycle stage, e-wastes remain a major challenge. According to a report by the United Nations University, the global quantity of e-waste generation for 2014 was around 41.8 Mt, comprised of 1.0 Mt of lamps, 3.0 Mt of small IT, 6.3 Mt of screens and monitors, 7.0 Mt of temperature exchange equipment, 11.8 Mt of large equipment and 12.8 Mt of small equipment.[19] This figure is expected to grow to up to 49.8 Mt in 2018, with an annual growth rate of 4 to 5 percent.[20] The issue brief tackles the end of life issues surrounding electronics.

Human Rights Implications

Right to life

Under Article 6 of the ICCPR, *"Every human being has the inherent right to life. This right shall be protected by law. No one shall be arbitrarily deprived of his life."* In addition, Article 6 of the Convention on the Rights of the Child (CRC) also recognizes that *"every child has the inherent right to life" and that the survival and development of the child is ensured to the "maximum extent possible".*

The main risks that electronic wastes pose to the right to life stem from the presence of potentially hazardous substances that may be release during recycling and material recovery. Toxic substances can be found in different process emissions or outputs, such as leachates from dumping activities, particulate matter from dismantling activities, fly and bottom ashes from burning activities, fumes from smelting and desoldering activities, wastewater from dismantling and shredding facilities and effluents from cyanide leaching and other leaching activities.[21]

Various studies have reported the soaring levels of toxic heavy metals and organic contaminants in samples of dust, soil, river sediment, surface water, and groundwater of Guiyu in China.[22] Concurrent to these results are the observed high incidence of skin damage, headaches, vertigo, nausea, chronic gastritis, and gastric and duodenal ulcers of residents within the same area.[23]

A study by Xu et al. reports that, as a consequence of informal e-waste recycling, the Guiyu had about four times higher risk of stillbirth (4.72%) compared to Xiamen, used as control site (1.03%).[24]

Right of children and adults to the highest attainable standard of health

Article 12 of the International Covenant on Economic, Social and Cultural Rights (CESR) states that *"The States Parties to the present Covenant recognize the right of everyone to the enjoyment of the highest attainable standard of physical and mental health"*. Furthermore, the covenant also recognizes the right of workers to healthy working conditions.

With respect to the rights of children, Article 24 of the CRC recognizes, *"the right of the child to the enjoyment of the highest attainable standard of health* […] *taking into consideration the dangers and risks of environmental pollution"*. Article 10 of the CESCR also calls for *"special measures of protection and assistance to be taken on behalf of all children and young persons without any discrimination"*.

Environmental contamination and health impacts of electronic wastes go beyond e-waste recycling facilities, as the pollutants' environmental transport and transformation processes allow them to affect other communities. A clear evidence of this is shown in a study conducted in Guiyu, China, considered as one of the most famous e-waste dumping sites in the world. Surface dust samples from recycling workshops, adjacent roads, a schoolyard, and an outdoor showed elevated levels of heavy metals such as cadmium, cobalt, chromium, copper, nickel, lead and zinc.[25] The levels at the schoolyard and food market also showed that public places were adversely impacted, and that risk posed by circuit board recycling warrants an urgent investigation into heavy metal-related health impacts.

A study conducted by Chang and Hong (2013) in several e-waste recycling sites in China showed that open burning of e-wastes and acid leaching activities result to increased exposure to dibenzo-p-dioxins and dibenzofurans (PCDD/D) via dietary intake, inhalation, soil/ dust ingestion and dermal contact. Dietary intake exposure, considered to be the most important exposure route for infants, children and adults living in or near the sites, ranged from 5.59 to 105.16 pg WHO-TEQ/kg bw/day, which exceeds the tolerable daily intakes.[26] Similarly, residents of e-waste recycling sites in South China are also exposed to 3,200 ng/kg bw/day of novel brominated flame retardants, 3,920 ng/kg bw/day of polybrominated diphenyl ethers and 5,280 ng/kg bw/day of organophosphate flame retardants.[27]

Also, e-waste recycling activities had contributed to the elevated blood lead levels (BLL) in children living in China. Geometric mean BLL of children in Luqiao in Zheijing province, China was 6.97 µg/dL, with 38.9 percent of the children having BLLs above 10 µg/dL.[28] When compared to a control group, the researchers also found a negative relationship between BLLs and IQ, thus cementing evidence on the potential serious threat of e-waste recycling on children's health. Infants, due to their hand-to-mouth behaviour, are also considered as one of the most vulnerable groups in areas where soils and dusts are contaminated with lead. [29] In the Philippines, lead exposure in children is estimated to cost the country 15,019,373,494 USD which corresponds to 3.82% of GDP lost to lead-attributable IQ loss.[30]

It seems evident from the several studies in China that the archaic recycling techniques employed in e-waste processing, coupled with the issues on volume, have resulted to increased levels of contaminants on soil and surface water. As such, associated health problems have been observed, including diseases and problems related to the skin, stomach, respiratory tract and other organs. Given the genotoxic and reproductive system effects of the cocktail of chemicals found in electronic wastes, workers were also reported to suffer from high incidences of birth defects, infant mortality, tuberculosis, blood diseases, anomalies in the immune system, damage to the kidneys and respiratory systems, lung cancer, underdevelopment of the brain in children and damage to the nervous and blood systems. Perhaps more alarming in this scenario is the generational effects of toxic exposure to pregnant women and the unborn fetus, thus requiring long term health studies to be conducted.

Right to Food

According to Article 25 of the Universal Declaration of Human Rights and Article 11 of CESCR *"Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food"*. The right to adequate food and water is established also in the Food and Agriculture Organization (FAO) Voluntary Guidelines to support the Progressive Realization of the Right to Adequate Food in the Context of National Food Security,[32] and the *"access to, and consumption of, adequate, safe and nutritious food"* (emphasis added) has also found protection under the Food Assistance Convention.[33]

The unregulated processing of electronic wastes leads to the release of harmful chemicals and substances that can find its way to our food sources. A study by Wang et al. (2012) determined the concentrations of polyaromatic hydrocarbons (PAH) generated from e-waste recycling activities and their potential impacts on soil, vegetation and human health. They found that the PAG concentration in plants ranged from 199 to 2,420 ng/g, and that the total daily intake of PAHs and carcinogenic PAHs through vegetables at the dismantling site were estimated to be at 279 and 108 ng/kg/d, respectively.[34] These values indicate that the consumption of vegetables that were grown near such sites is risky and should be avoided.

Alternatively, long range transport of pollutants was also observed, thus suggesting the potential for secondary exposure in areas distant from the point source of contamination. Environment-to-food chain contamination leads to the accumulation of contaminants in agricultural lands making them available for uptake by grazing livestock. Since most chemicals of concern have slow metabolic rates in animals, they can accumulate in the tissues and be excreted in edible products such as eggs and milk.[35]

Right to access information

Under Article 19 of the ICCPR, *"everyone has the freedom to seek, receive and impart information and ideas of all kinds"*. Gaining access to information is especially essential when human rights are violated due to unwarranted exposure to toxic chemicals. Several countries have recognized the people's right to know about the toxic chemicals in the environment where they live and work in. Governments are increasingly recognizing the right to access information about toxic substances in products. The ILO's Chemicals Convention (c.170) recognizes that workers have right to information about the hazards of chemicals used in the workplace, and employers have a duty to inform workers in this regard.[36] Under Article 17 of the CRC, State Parties *"shall ensure that the child has access to information and material from a diversity of national and international sources, especially those aimed at the promotion of his or her … physical and mental health."*

Speaking of domestic policy, the US enacted the Emergency Planning and Community Right to Know Act (ECPRA) to establish requirements regarding emergency planning and *"community right to know"* reporting on hazardous and toxic chemicals to further increase the public's awareness and access to information on chemicals at individual facilities, their uses and releases into the environment.[37]

Labeling products is also an important tool to inform consumers at the point of purchase that a product contains toxic chemicals, such as mercury, and may require special handling at end of life. For example, the European Union has established the Restriction on Hazardous Substances (RoHS) directive in 2003, which restricts (with exceptions) the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment.[38] WEEE products that have RoHS logo comply with the maximum levels of lead (<1,000 ppm), mercury (<100 ppm), cadmium (<100 ppm), hexavalent chromium (<1,000 ppm), PBBs (<1,000 ppm) and PBDEs (<100 ppm).[39]

In countries where concrete right to know policies are lacking or absent, end of life management of electronic wastes tend to be problematic. For instance, in the Philippines, 88 percent of households dispose of their mercury-containing lamps with domestic wastes, while 1 percent sells them to the informal waste recycling sector.[40] Improper disposal of this type of wastes due to lack of knowledge on their composition contributes to the release of mercury to the environment.

Workers Rights

In addition to the rights of workers mentioned previously, including the right to information, under Article 18 of ILO c.170 *"[w]orkers shall have the right to remove themselves from danger resulting from the use of chemicals when they have reasonable justification to believe there is an imminent and serious risk to their safety or health."* In addition, workers also have the right to *"information on the identity of chemicals used at work, the hazardous properties of such chemicals, precautionary measures, education and training."*

The e-waste recycling sector in developing countries is largely unregulated, using archaic methods to recover valuable materials from e-waste components. The main components of interests for these recyclers are materials containing copper (wires and cables, CRT yokes), steel (internal computer frames, power supply housings, printer parts), plastics (housings of computers, printers, faxes, phones, monitors), aluminum (printer parts), printer toners and printed circuit boards. Of most concern is the manual disassembly and recovery of valuable components from wires and cables, CRTs and printed circuit boards. [41] Manual disassembly of e-wastes increases the release of hazardous substances to the environment, such as when fluorescent lamps are broken resulting to the release of mercury vapor. On the other hand, acid-leaching operations in these workshops lead to the release of excessive levels of metals including dissolved arsenic, chromium, beryllium, lead, nickel, among others. Open burning of certain components to isolate copper from plastics in which they are encased, particularly from plastic-coated wires and cables release significantly higher levels of pollutants to the environment because they burn in relatively low temperatures in comparison with incinerators.

Despite these environmental and health hazards, informal e-waste recyclers often do not use any personal protective equipment that will protect them from the dangers brought by the processing of electronic wastes. In India, the informal recycling sector employs unskilled migrant laborers and people from marginalized groups.[42] These include women and children who carry out 12-14 hours' worth of work per day, sitting on the ground amongst piles of electronic parts. The ILO documents that the recycling process is carried out using bare hands, without the use of masks, cleaning, crushing or heating the parts. Many workers also site cramped in unventilated rooms with inadequate lighting and no clean drinking water or toilets. Many of the workers complain of eye irritation, breathing problems and constant headaches. Most people involved in the informal recycling are the urban poor with low literacy levels, and hence have very little awareness regarding the hazards of e-waste and recycling processes.

The occupational conditions that these workers are exposed to are harsh. A study conducted by Fujimori, et al (2012) on formal and informal e-waste recycling facilities in the Philippines confirmed the presence of pollutant metals in dust and soil matrices in the workplace. These pollutants include nickel, copper, lead, zinc, cadmium, cobalt, manganese, among others.[43] On the other hand, residents near e-waste recycling facilities were found to have elevated urinary levels of cadmium and lead, with the body burden correlated with the duration of dismantling.[44] In another study from China, human scalp hair samples were collected to find out heavy metal exposure to workers from intense e-waste recycling sites. Higher concentrations of Pb, Cu, Mn, and Ba metals were found in hair of exposed as compared to the hair in control group.[45]

ILO Convention on the Worst Forms of Child Labor

Article 3(d) of the ILO Convention on the Worst Forms of Child Labor specifies such labor as including *"work which, by its nature or the circumstances in which it is carried out, is likely to harm the health, safety or morals of children"*. Working as a waste picker is considered hazardous as child workers jeopardize their health and chance of normal development when performing such tasks.[46] ILO described working with e-waste recycling, by its nature and circumstances, likely to harm the health, safety and morals of children, and that the conditions in which the work is carried out exert an extremely negative impact on a child's health status.

For example, in Ghana, children are employed and are primarily involved in burning activities and manual dismantling.[47] According to a thematic evaluation conducted by the ILO, these children often suffer from poor labor conditions and face various risks and hazards, varying from occupational accidents to heavy metal and chemical poisoning and ergonomic and psychosocial problems. Children at e-waste recycling sites were reported to be suffering from medical problems such as breathing ailments, skin infections and stomach diseases.[48] In Guiyu, China, 80 percent of the children were estimated to suffer from respiratory diseases, and a rising surge of leukemia and BLL were observed.[49]

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