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E-Waste:A Challenge to Environment and Public Health

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ABSTRACT
The WEEE (waste electrical and electronic equipment) problem is becoming a global issue. The entire biota is being negatively impacted by its toxic emissions, which are combining with uncontaminated soil and air. A few examples of the direct consequences include acids, toxic substances, including heavy metals, and carcinogenic chemicals. However, same heavy metals can also have indirect effects, such as bioaccumulation. Since many of these products may be recycled, repaired, or used once more without harming the environment, they are less harmful to the ecosystem. The current study emphasises the risks that these e-waste materials pose to the public's health and the need for proper management of them.
Keywords : E-waste , toxicants ,Landfill , heavy metals ,waste electrical and electronic equipment

I. INTRODUCTION

Any electrical or electronic device that has been thrown out is considered e-waste. This covers both functional and damaged things that are discarded in the trash or given to a charity retailer like Goodwill. If an item isn't purchased in the store, it's frequently thrown away. The hazardous compounds that naturally leak from the metals in e-waste when it is buried make it extremely risky.

The electronic industry, which has significantly altered people's lifestyles over the past century, is the largest, most inventive, and fastest-growing industry in the world today. EEE has been growing dramatically over the world in recent decades, but their lifespans have been getting shorter and shorter .Although this advancement has benefited humanity, poor management has resulted in additional contamination and environmental issues. Lead, cadmium, and beryllium are only a few of the dangerous elements found in electronic equipment, along with tetrabromobisphenol-A (TBBA), polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE). Tons of electronic equipment are sent over the oceans each year, but after use they degrade into complicated waste materials that contain heavy metals such as copper, iron, aluminium, gold, and others that make up over sixty percent of e-waste, non-biodegradable polymers that make up around thirty percent of it, and dangerous pollutants that make up only 2.70 percent.

E-waste is mainly disposed of in landfills, burned, or exported to recyclers. The smoke and dust particles are removed during the deconstruction process, which includes burning, tearing, and shredding.These smoke and dust particles include carcinogens and other dangerous substances that induce severe inflammations and lesions, including various respiratory and skin illnesses. Burning circuits can emit sexy smoke and carcinogenic carbon particles from toners can cause lung and skin cancer. Circuits are burned to search for rich metals like gold, platinum, and cadmium.

E-waste is different from other waste types in that it contains both valuable and harmful components, necessitating a unique sort of treatment.E-waste disposal is a rising environmental and public health concern on a global scale since it is the part of the official urban trash cycle that is growing the fastest worldwide . The issue that increases the amount of e-waste generated is the quick expansion and rapid change in computer, cell phone, and consumer electronics components. E-wasteis mainly classified in the following 10 main categories :-

1 Large household appliances
2 Small household appliances
3 Information technology and telecommunications equipment
4 Consumer equipment
5 Lighting equipment
6 Electric and electronic tools, but excluding large scale stationary industrial tools
7 Toys, leisure and sports equipment
8 Medical devices
9 Monitoring and control instruments
10 Automatic dispenses

Pollutants in E waste

Circuit boards, batteries, plastics, and LCDs tend to contain the highest concentrations of pollutants or toxins in e-waste (liquid crystal displays). The presence of pollutants in used electrical and electronic equipment waste is

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Pollutant	Occurrence
Arsenic	Semiconductors, diodes, microwaves, LEDs (Light-emitting diodes), solar cells
Barium	Electron tubes, filler for plastic and rubber, lubricant additives
Brominated flame- proofing agent	Casing, circuit boards (plastic), cables and PVC cables
Cadmium	Batteries, pigments, solder, alloys, circuit boards, computer batteries, monitor cathode ray tubes (CRTs)
Chrome	Dyes/pigments, switches, solar
Cobalt	Insulators
Copper	Conducted in cables, copper ribbons, coils, circuitry, pigments
Lead	Lead rechargeable batteries, solar, transistors, lithium batteries, PVC (polyvinyl chloride) stabilizers, lasers, LEDs, thermoelectric elements, circuit boards
Mercury	Components in copper machines and steam irons; batteries in clocks and pocket calculators, switches, LCDs
Nickel	Alloys, batteries, relays, semiconductors, pigments
PCBs (polychlorinated biphenyls)	Transformers, capacitors, softening agents for paint, glue, plastic
Zinc	Steel, brass, alloys, disposable and rechargeable batteries, luminous substances
Selenium	Photoelectric cells, pigments, photocopiers, fax machines
Lithium	Mobile telephones, photographic equipment, video equipment (batteries)
CFC (Chlorofluorocarbon)	Cooling unit, insulation foam
Toner dust	Toner cartridges for laser printers / Copiers
Gallium arsenide	Light-emitting diode (LED)

The Indian Scenario

Countries like India are in immediate danger while the rest of the world marvels at the technological progress. Developed nations, including the US, send their e-waste to India and other Asian nations for disposal. A recent investigation discovered that a significant portion of the electronics sent to be recycled in the United States end up in Asia, where they are either disposed of or recycled with little to no consideration for the environment or the health and safety of the workers involved. Cheap labour and a lack of occupational and environmental norms in Asia are the main drivers of exports, which causes the toxic waste of wealthy nations to flow toward the world's poorest countries. It is not yet known how serious these issues are. But organizations like Toxic Links India are already striving to compile information that might be a step toward regulating this dangerous trade.

In order to reduce risks and accidents brought on by improper management of e-waste, developing countries, especially India, must become aware of the monopoly of the industrialized countries and implement the necessary management practices.

Effects of e-waste on Environment

E-waste disposal is a problem that is prevalent in many parts of the world. When computer garbage is dumped, it creates contaminated residues, which eventually contaminate the groundwater. Acidification of soil is brought on by acids and sludge produced when computer chips melt and are dumped on the ground.Some of the areas inworld are facing water shortage due to the contamination of water source which is a result of recycling wastes like acids and sludge being dumped in rivers. To meet the needs of the population, water is now being carried from remote towns. E-waste incinerators have the potential to release hazardous gases and pollutants into the air, contaminating it. Landfills that are not properly monitored can harm the environment. When some electronic devices, such circuit breakers, are broken, mercury will leak. Similar conditions apply to polychlorinated biphenyls (PCBs) from condensers. Polybrominated diphenyl ethers (PBDE) and cadmium may both leak into the groundwater and soil when plastics that contain brominated flame retardants or those contain cadmium are landfilled**.**

The environmental bioaccumulation of some toxins, such as persistent organic pollutants,

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which are not biodegradable, poses a long-term health concern. Long-term exposure of soil and water to pollution factors encourages chemical loadings, which eventually leads to high levels of harmful substance uptake in crops**.**

A large quantity of lead ion has been found to dissolve from cracked lead-containing glass, such as the cone glass used in cathode ray tubes, when it comes into contact with acidic waters, which is a common occurrence in landfills. The vaporization of metallic mercury and dimethylene mercury, both components of waste electrical and electronic equipment (WEEE), also causes special difficulties and is a reason for concern.

Additionally, landfills may have uncontrolled fires, which may happen often in many nations. Metals, as well as other chemical substances like the incredibly poisonous dioxins and furans (TCDD- tetrachloro-dibenzo-dioxin), can catch fire when exposed to them.Continuously burning PVC cables and e-waste has an immediate negative impact on the environment, filling the air with thick, black smoke that takes a long time to disperse.

If these electronic waste items are discarded with household waste the toxicants produced pose a serious threat to environment and public health.

Effects of e-waste pollutants on Publichealth

Due of the extremely serious health and environmental risks connected with it, e-waste has grown to be a bigger issue than all other wastes.

If not properly disposed of in an environmentally responsible manner, the hazardous components included in e-waste have the potential to severely harm both the environment and both human as well as animal health.

Brominated Flame Retardants

For many years, brominated flame retardants (BFRs) have been regularly added to consumer goods in an effective effort to lower fire-related injury and property damage. Because multiple types of BFRs are present in the environment and in the biota of humans, there is growing worry about this new class of chemicals.

The relevance of finding new problems related to the usage of BFRs is increased by their extensive production and use, the strong evidence of rising pollution of the environment, wildlife, and people, and the lack of awareness of potential consequences.

Long-term exposure to them can impair learning and memory since they do not breakdown easily in the environment. Brominated flame retardants have been linked to behavioural issues in newborns because they interfere with the functions of the thyroid and oestrogen in pregnant women.

Cadmium

For both the general public and populations exposed to work environments, the kidney is a crucial target organ. Between 20 and 30 years, cadmium is known to build up in the human kidney. At high concentrations, it is also known to have negative effects on the respiratory system and has been linked to bone disease. Damage to the kidneys and bones can result from the chemical included in rechargeable batteries for laptops and other electrical gadgets. Cadmium is highly harmful to humans and can bio-accumulate in the environment. It particularly harms the bones and kidneys.

Mercury

The central and peripheral nerve systems are poisoned by elemental and methyl mercury.Mercury vapour inhalation may be lethal and have detrimental effects on the lungs, kidneys, neurological, digestive, and immune systems. The inorganic salts of mercury are harmful to the kidneys if consumed and are corrosive to the skin, eyes, and gastrointestinal tract.

Different mercury compounds can cause neurological and behavioural issues when ingested, inhaled, or exposed topically. Tremors, sleeplessness, memory loss, neuromuscular side effects, migraines, and cognitive and motor dysfunction are among the symptoms. There have been reports of kidney complications, ranging from kidney failure to increased protein in the urine. The use of mercury (Hg) in lighting components for flat-screen monitors and televisions can harm breast milk.

Lead

When consumed or inhaled, lead, a naturally occurring element, can be dangerous to people, especially young children under the age of six. Lead, which is a common component of computer and television screens, can seriously harm the nervous system, blood, and reproductive systems of people as well as affect their intellectual development. Lead poisoning can have a lot of harmful impacts on human health, but it is especially harmful to children's neurological growth.

Hexavalent Chromium compounds

The poisonous form of the metal chromium is called hexavalent chromium. Compounds containing hexavalent chromium are synthetic and utilised extensively across numerous sectors. These substances, which are known to cause cancer, are utilised to make the metal casing

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that is a common feature of many electronic equipment. It can irritate or harm the eyes, skin, nose, throat, and lung (respiratory tract) in addition to causing lung cancer.

Plastic compounds

Printed circuit boards, connectors, plastic covers, and cables are all made of poly vinyl chloride (PVC) cabling. These PVCs release dioxins when burned or dumped in the ground, which affect the immunological and reproductive systems of people.

Common Disposal methods of e-waste

In developing nations, where each has distinct environmental, social, technological, economic, and cultural circumstances, there is no one particular or optimal solution for managing e-waste.The three Rs, or reduce, reuse, and recycle, are recognized as key components of environmentally sound management of Waste Electrical and Electronic Equipment (WEEE).The objective would be to decrease the production of electronic waste through making, maintaining, and using electronic equipment until it works for someone and those components that cannot be repaired somewhere else and be recycled

Presently following methods are used to dispose the e-waste

Landfills

E-waste is referred to as a poisonous time bomb when it ends up in landfills. After a couple of years, they might be released into the environment naturally, and there's a chance that wastes like batteries, which release acids and heavy metals like mercury, nickel, and cadmium, or electronic circuits, which contain lead, zinc, nickel, copper, mercury, and cadmium, might also leach. These may mingle with other fresh water sources, like rivers and streams, and reach land, including animals andpeople .The majority of the electronic garbage in the US and Australia is recycled, while the remaining is exported to Asia and Africa.

Acid Bath

The circuit board is immersed in sulfuric acid for approximately 12 hours to dissolve the copper, after which the solution is boiled, precipitated copper sulphate is removed, and the residual solution is added with scraped particles. Finally, copper smudges are removed. Acid baths are additionally used to dissolve lead and to extract gold and silver.

Incineration

Pyrolysis is another term for incineration; substances produced during incineration are likely to be more toxic than their natural state. Pyrolysis is the process of heating a substance without oxygen; no burning takes place here; instead, the heated substance is transformed into fumes, oils, and charcoal. However, only a small amount of air is used in the gasification process to turn the materials into fume, ash, and tar. In China, Africa, India, and Pakistan, incinerating electronic garbage is a common practice. When the plastic or PVC circuit board is heated, toxic fume is released that contains recognized carcinogens such carbon monoxide, sulphur dioxide, and nitrogen oxides as well as polycyclic aromatics (PCA), polychlorinated dibenzo-para-dioxins (PCDDs), and polychlorinated dibenzofurans (PCDFs).Additionally, smoke contains trace amounts of the following heavy metal residues: antimony, lead, thallium, arsenic, copper, manganese, mercury, and nickel. These residues eventually ended up in the ashes.

II. CONCLUSION

A serious global problem is emerging from waste electrical and electronic equipment (WEEE). E-waste is known to be a major source of heavy metals, toxic compounds, and carcinogens.The entire biota is negatively impacted by its toxic emissions, which are combined with uncontaminated soil and air. Acids, toxic substances, including heavy metals, and chemicals that cause cancer are examples of direct effects. Indirect consequences include biomagnification of heavy metals. In turn, resources are squandered when commercially valuable items are abandoned or unhealthy conditions emerge during informal recycling, and toxic compounds enter the waste stream without any extra steps to avoid the recognized bad effects on the environment and human health.E-waste management and disposal must be done properly in order to prevent disorders of the skin, respiratory, digestive, immunological, endocrine, and mental systems, including cancer.

E-waste recovery and disposal standards need to be developed. Development of e-waste regulations, control of e-waste import and export, and facilitation of infrastructure development should all be considered policy level initiatives. Reducing wastes might be made possible by an efficient take-back scheme that offers companies incentives to create products that are less wasteful, have less harmful components, and are simpler to disassemble, reuse, and recycle. Setting targets for collection, reuse, and recycling, requiring reporting, adding enforcement measures, and implementing deposit/refund programmes are all necessary steps to encourage customers to return electronic equipment for collection, reuse, or recycling. Designing new electronic products with

end-of-life management in mind should be a top priority.

REFERENCES

[1]. Hedman, B., Naslund, M. Nilsson, C., Marklund, S. (2005) (cited in Kevin et al., 2008), Emissions of polychlorinated dibenzodioxins and dibenzofurans and polychlorinated biphenyls from uncontrolled burning of garden and domestic waste (backyard burning). Environmental Science & Technology 39(22): 8790-8796

[2]. Kevin Brigden, Iryna Labunska, David Santillo & Paul Johnston (2008). Chemical contamination at e-waste recycling and disposal sitesin Accra and Korforidua, Ghana, Greenpeace Toxic Tech 10, August 2008.

[3]. Ramachandra T.V., Saira Varghese K. (2004), environmentally sound option for e-waste management. Envis Journal of Human Settlements retrieved on Dec-2013 from http://www.ces.iisc.ernet.in/energy/paper/ewa ste/ewaste.html#5

[4]. Sivaramanan, Sivakumaran. (2013). E-Waste Management, Disposal and Its Impacts on the Environment. UJERT. 2. 531-537. 10.13140/2.1.2978.0489.

[5]. Widmer R, Heidi Oswald-Krapf, Deepali Sinha-Khetriwal, Max Schunellmann, Heinz Bo"ni. Global perspectives on e-waste. Environmental Impact Assessment Review. 2005; 25:436-458

[6]. Sivakumaran, Sivaramanan. E-waste Management, Disposal and its impacts on the Environment. Universal Journal of Environmental Research and Technology. 2013; 3(5):531-537

[7]. Kevin B, Iryna L, David S, Paul J. Chemical contamination at e-waste recycling and disposal sites in Accra and Korforidua, Ghana, Greenpeace Toxic Tech, 2008.

[8]. Dahl R. Who pays for e-junk? Environ Health Perspect. 2002; 110: A 196-199.

[9]. C. A. Basha, "Electrical and electronic waste : a global environmental problem," no. Table 1,pp307-318,2007

[10]. M. K. S. Bhutta, A. Omar, and X. Yang, "Electronic Waste : A Growing Concern in Today ' s Environment" Vol.2011,2011

[11]. M. S. Sankhla, M. Nandan, S. Mohril, G. P. Singh, B. Chaturvedi, and R. Kumar, "Effect of Electronic waste on Environmental & Human health- A Review," vol. 10, no. 9, pp. 98–104, 201

[12]. C. Frazzoli, Electronic Waste and Human Health, 2nd ed.no.October 2018,Elsevier Inc.,2019.

[13]. T.S.Fujimori T, Itai T , Goto A, Asante KA , Otsuka M, Takahashi A, "Interplay of metals and bromine with dioxin-related compoundsconcentrated in e-waste open burning soil from Agbogbloshie in Accra, Ghana," Env. Pollut, vol. 209, pp. 155–163, 2016.

[14]. G. Gaidajis, K. Angelakoglou, and D. Aktsoglou, "E-waste: Environmental Problems and Current Management," Journal of Engineering Science and Technology Review, vol. 3, pp. 193-199, 2010.