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E-Waste: A Challenge for Environment and Health

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Abstract
In terms of the long-term survival of the environment as well as the health of the general population all over the world, electronic garbage, also known as e-waste, has established itself as a major global problem. This is because of the implications that it poses for both of these factors. The reason for this is that it offers significant dangers to the health of an individual. The information that is offered in this article provides an analysis of the complexities that are related with electronic waste, including its origins, implications, and potential solutions on the environment. As the rate of technical innovation continues to quicken, there is a corresponding increase in the number of electronic devices that are being discarded and abandoned. This is a direct result of the rapid pace of technological advancement. It is of the utmost importance that an investigation and action be made as promptly as possible in order to decrease the negative repercussions that this occurrence has brought about. This is because of the fact that this occurrence has brought about.
Keywords: E-waste, electronic garbage, hazardous materials, Health risks ect.

1. Introduction

Electronic garbage (e-waste) includes a broad variety of obsolete electronic items, such as desktops, laptops, cellphones, TVs, and other home appliances. Electronic waste has grown at an exponential rate due to the fast degradation of technology caused by incessant innovation and consumer demand. [1] In 2019, the world produced almost 53.6 million metric tons of electronic garbage, and experts predict that number will climb sharply in the years to come (Global E-garbage Monitor, 2019).[2]

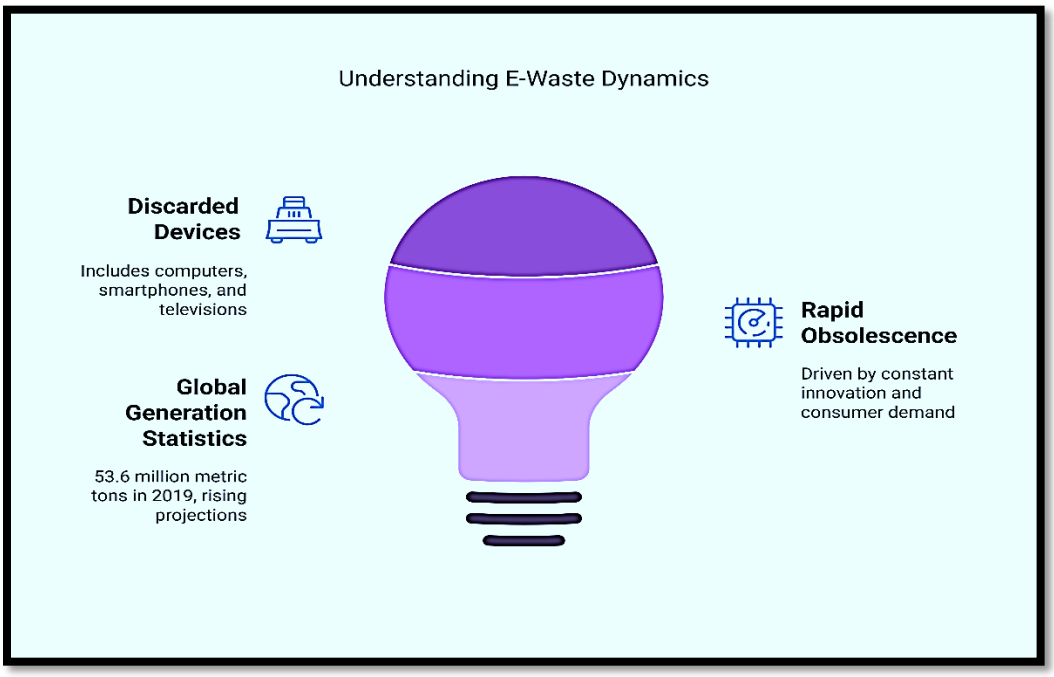

Fig.No.1 Diagram represent the understanding of E-Waste Dynamics

2. Effects on the Environment

The improper disposal of electronic trash has the potential to cause significant environmental contamination. This contamination could be in the form of harmful substances. of the third kind Additionally to lead, mercury, cadmium, and brominated flame retardants, a great number of electrical equipment may include additional substances that have the potential to be harmful to human health. It's possible that these compounds are present in the environment. [3]: When electronic waste is burned or disposed of in landfills, it frequently leaches harmful compounds into the soil and water, which can lead to pollution of both of these habitats. This can create a situation in which the environment is contaminated. An additional element that contributes to the problem of air pollution and increases in global temperature is the fact that the combustion of electronic trash sends dangerous particles into the environment. This is a factor that contributes to the problem. [4]

Table No. 1 Electronic garbage and electrical and electronic devices (EEE)

3. Risks in Health

The effects of e-waste on human health are just as worrisome. Occupational hazards in the informal e-waste recycling sector can cause respiratory illnesses, skin conditions, and neurological abnormalities in

S.No.	Categories of EEE	Examples of EEE
01	Temperature exchange equipment	Cold storage appliances, freezers, HVAC systems, and heat pumps Screens
02	Screens and monitors	Electronic devices such as tablets, computers, notebooks, and televisions
03	Lamps	Fluorescent, high-intensity discharge, straight-fluorescent, compact-fluorescent, and light-emitting diode lamps Large
04	Large equipment	Appliances for washing, drying, and dishwashing as well as electric stoves, huge printers, photocopiers, and solar panels

workers who do not wear protective gear. [6] Additionally, communities residing in close proximity to e-waste disposal sites face the danger of potential exposure to harmful substances that might impact their health and wellbeing.

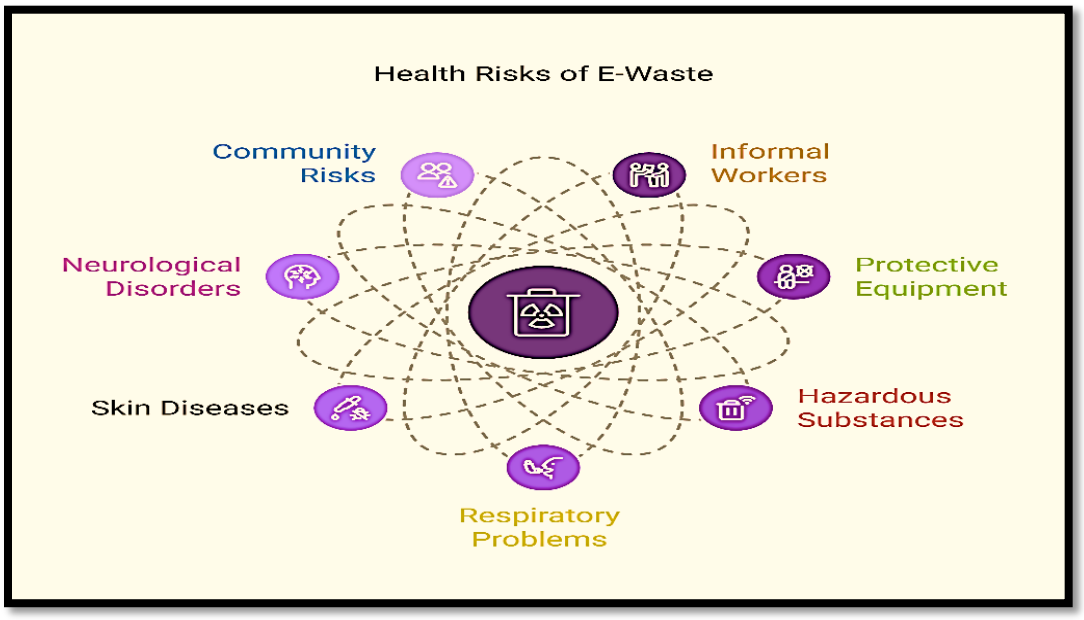

Fig.No.2 flow chart showing the health risk of E-Waste

4. Solutions and Recommendations

Addressing the e-waste challenge requires a multifaceted approach [7,8]

1. **Policy and Regulation:** In order to control the disposal of electronic trash and encourage responsible recycling, governments should impose strict rules. A policy known as extended

producer responsibility (EPR) might encourage product designers to make items with lower environmental impact and greater ease of recycling.

2. **Educating** the public can help them make better decisions when it comes to recycling and e-waste disposal. The dangers of e-waste to humans and the environment can be brought to light through awareness programs.
3. **Cutting-Edge Recycling Tools:** Putting money into cutting-edge recycling tools can make processing e-waste safer and more efficient. Reducing the demand for virgin resources is another goal of developing technologies to recover valuable materials from e-waste.
4. **Collaboration**: Stakeholders, including governments, NGOs, and the private sector, must collaborate to create comprehensive e-waste management systems. International cooperation is essential to address the transboundary movement of e-waste and ensure responsible recycling practices globally.

Table No.2 Hazardous substances from electrical and electronic equipment [9,10]

S.No.	Hazardous substances	Component of EEE
1.Elements	Lead (Pb	Devices such as cathode ray tubes, printed circuit boards, light bulbs, televisions, and batteries
	Chromium (Cr) or hexavalent chromium	Coatings that prevent corrosion, data cassettes, and floppy drives
	Mercury (Hg)	Items such as thermostats, sensors, screens, cells, PCBs, and cold cathode fluorescent lights
	Zinc (Zn)	Cathode ray tubes and metal coatings
2. Persistent Organic Pollutants(POPs)	Brominated flame retardants	Thermoplastic components and cable insulation are two examples of the many polymers used in computer construction.
	Polybrominated diphenyl ethers (PBDEs)	Condensate from heat transfer fluids used in electrical devices, especially transformers and capacitors.

Methods for Avoidance[11]

The prevention of this problem is a shared responsibility between communities, recycling service providers, and governments. Lessening toxicity, simplifying materials, and finding ways to reuse components and materials should all be part of the prevention strategy. Even though they are still present in e-waste from older generations of electronics, some compounds, such as polychlorinated biphenyls, are banned by member countries of the Organisation for Economic Co-operation and Development. To reduce e-waste exposures, increase downstream monitoring, and promote reuse and waste policies that promote e-waste and related toxicity reduction, national governments should

implement international agreements and programs.[12] An essential goal in reducing and ending exposure for children should be the elimination of child labour in e-waste. Adapted general principles for informal e-waste recycling include dust control and ventilation, safe work practice training, personal protective equipment (PPE) usage, and medical monitoring. To lessen the impact of open dumping and burning, special precautions need to be followed. In Accra, Ghana, the Pure Earth/Blacksmith Institute launched a pilot project by establishing a simple e-waste recycling centre. The centre was outfitted with multiple powered wire-stripping machines, which allowed the facility to salvage plastic-coated cables and wires of varying sizes from the dump, allowing for the extraction of copper and other valuable materials without resorting to burning. Even though the site has not been burned down yet, the proposal has a lot of community backing. Remediating polluted environments is crucial to protecting vulnerable populations from further exposure, especially in cases where informal recycling occurs near residential areas.[13,14].

Table No.3 Hazardous substances released during e-waste combustion[15]

S.No.	Chemicals released during WEEE combustion	Released as
01	Furans and dioxins Phthalates, polychlorinated dibenzodioxins, anddibenzofurans Polychlorinated biphenyls (DL-PCBs) that are similar to dioxin Furans and dioxins Phthalates, polychlorinated dibenzodioxins, and dibenzofurans, Polychlorinated biphenyls (DL-PCBs) that are similar to dioxin	Waste products from burning Waste products from combustion (also present in generator, capacitor, and transformer coolants, lubricants, and dielectric fluids)
02	Hydrocarbons with several aromatic rings The following compounds are present: naphthalene, acenaphthene, acenaphthylene, anthracene, phenanthrene, fluorene, fluoranthene, benzo(a)antracene, chrysene, pyrene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)antracene, benzo(g,h,i)perylene, indeno [1,2,3-cd] pyrene	Combustion byproducts

Effects on Health by electronic waste elements[16]

Research on the toxicological consequences of electronic waste elements (EEEs) (including heavy metals) and, more lately, compounds used in e-waste burning, has been conducted during the past 30 years. More than a thousand chemical compounds combine to form e-waste, which has toxicological implications. Working at an e-waste dismantling site is associated with an increased risk of

hypothyroidism, abnormal thyroid function, elevated serum PBDE levels, and elevated Thyroid stimulating hormone (TSH) levels, according to a systematic review. There is also an association between chromium, manganese, nickel, and lung function, according to the same review. Additionally, there are neonatal outcomes such as decreased birth weight and length at birth, and effects on reproductive health include an increase in spontaneous abortions, stillbirths, and premature deliveries. Some studies have shown that exposure to electronic trash throughout children might cause developmental delays, behavioural issues, and changes at the cellular level and function.

Toxicological Implications of E-Waste[17]

E-waste comprises over a thousand chemical compounds, many of which are toxic. The dismantling and burning of electronic devices release harmful substances into the environment, leading to serious health risks for those exposed. A systematic review has identified several health issues linked to working at e-waste dismantling sites, including:

Hypothyroidism and Abnormal Thyroid Function: Workers in these environments show increased risks of thyroid-related health issues, with elevated serum levels of polybrominated diphenyl ethers (PBDEs) and Thyroid-stimulating hormone (TSH).[18]

Respiratory Health: There is a noted association between exposure to heavy metals such as chromium, manganese, and nickel, and compromised lung function.[19].

This article explores the toxicological consequences of electronic waste (e-waste) and its components, particularly focusing on heavy metals and compounds released during e-waste burning. Over the past three decades, extensive research has highlighted the health risks associated with exposure to e-waste, particularly for workers in dismantling sites and vulnerable populations such as children and pregnant women. The findings indicate significant health implications, including hormonal disruptions, respiratory issues, and adverse reproductive outcomes.

Conclusion

E-waste presents a formidable challenge that requires immediate attention from all sectors of society. By understanding the environmental and health implications of e-waste and implementing effective solutions, we can work towards a more sustainable future. It is crucial to foster a culture of responsible consumption and disposal to mitigate the adverse effects of e-waste on our planet and public health. Despite the fact that there are international initiatives to restrict and monitor the trade of electronic trash and to improve working conditions in the countries that bear the highest burden of electronic waste, there is still a great deal of work to be done when it comes to managing electronic waste. In the realm of environmental health, electronic waste is a developing problem that has an impact on the most vulnerable workers in the informal sector, including children and pregnant women. There is a combination of substances and several mechanisms that are responsible for the harmful consequences that electronic waste has. In order to provide assessment, follow-up, and treatment, health care programs ought to incorporate people that have been exposed to the risk. When it comes to the handling of electronic trash, both industrialised and emerging nations require environmental legislation that are practical and effective.

Conflict of Interests

The authors have no conflict of interests.

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