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Electronic Waste: Time to Wake Up

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Abstract:-The volume of electrical and electronic waste (e-waste) being generated in the world due to exponential growth in electrical and electronic appliances and equipment, production and consumption worldwide, is reaching to unmanageable limits. The latest estimates indicate that in 2020 almost 90 – 100 million tons of e-waste will be generated globally. E-waste is today the fastest growing waste stream (about 8% a year). However, increasing quantities of e-waste and its mismanagement represents a major concern across the world due to the presence of hazardous substances such as lead, mercury, PCB, asbestos and CFC's. Uncontrolled dumping in the third world countries and inappropriate recycling processes generate negative impacts on the environment and pose risks to human health. On the other hand, e-waste contains valuable materials such as gold, silver, copper, platinum, palladium, iron, aluminium, indium, gallium and rare earth metals that may be recovered thus contributing to sustainable resource management.

Keywords: *Waste, Electronic, India, Recycle Toxic.*

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1. Introduction

With current technological innovations, there is a fast growing turnover of technologically advanced computers, laptops and other electronic devices. . Each day the sun rises with the news of a new mobile, laptop or television set being launched with latest technology. However, with each lot being manufactured there are hundreds of devices becoming obsolete and being categorized as waste. Mankind loves to flaunt the latest models of their mobiles, tabs and laptops, without any thought of their discarded units.All the discarded products are either sold as second hand items to the less fortunate or just discarded to a forgotten corner of a cupboard or later thrown away. Among the various categories of waste like municipal waste, industrial waste construction waste, the new millennium has given birth to the electrical and electronic waste, categorized as WEEE (Waste Electrical and Electronic Equipment). This is because of the following reasons:

- Rapid growth and change in this product sector leading to a growing number of products needing appropriate end-of-life management;
- The intensive energy and diverse material inputs that go into manufacturing electronics represent a high degree of embodied energy and scarce resources;
- The presence of substances of concern in some electronics that merits greater consideration for safe end-of-life management; and
- The opportunities for resource recovery through improved collection and recycling.

To better track the sales, use, storage, collection, and disposal of electronics, EPA conducted an analysis of select electronic products from residential and commercial/institutional users:

Computer	Televisions	Hard Copy Devices	Mobile Devices
laptops desktop CPUs monitors keyboards mice	cathode ray tubes (CRTs) flat-panel projection monochrome	printers fax machines scanners copiers multi-function devices	cell phones smartphones PDAs pagers

Table 1.1 Types of Electronic Devices being discarded

Based on this analysis, an estimated 50 million tons of E-waste are produced each year [6]. The USA discards 30 million computers each year and 100 million phones are disposed of in Europe each year. The Environmental Protection Agency estimates that only 15-20% of e-waste is recycled, the rest of these electronics go directly into landfills and incinerators[6,7]. About 13 percent of that weight is recycled mostly in developing countries. About 9 million tons of this waste—discarded televisions, computers, cell-phones, and other electronics—are produced by the European Union, according to the United Nations Environment Programme (UNEP). And UNEP notes that this estimate of waste is likely too low [1].

Of the total e-waste generated in the Indian subcontinent, western India accounts for the largest population at 35%, while the southern, northern and eastern regions account for 30, 21 and 14%, respectively. The top states in order of

highest contribution to waste electrical and electronic equipment (WEEE) include Maharashtra, Andhra Pradesh, Tamil Nadu, Uttar Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh and Punjab. The city-wise ranking of the largest WEEE generators is Mumbai, Delhi, Bangalore, Chennai, Kolkata, Ahmedabad, Hyderabad, Pune, Surat and Nagpur.[8]

At a glance, a computer or cell phone, doesn't seem to be dangerous. That is because they are encased in beautiful casings, visible to us, but what's inside is what poses a threat to the environment, people and animals. Electronic products are jam-packed with heavy metals, semi-metals, polymers, composites such as wear resistant aluminium composites [9] and various chemical compounds that can leak into soil and become hazardous.

2. Components of WEEE

The categorization of WEEE is done based on many factors:

a) Type of Product

This categorization is based on the type of the electronic products. As can be seen a major part of the WEEE is from household items, like smart washing machines, smart air-conditioners, refrigerators, tv sets, etc.

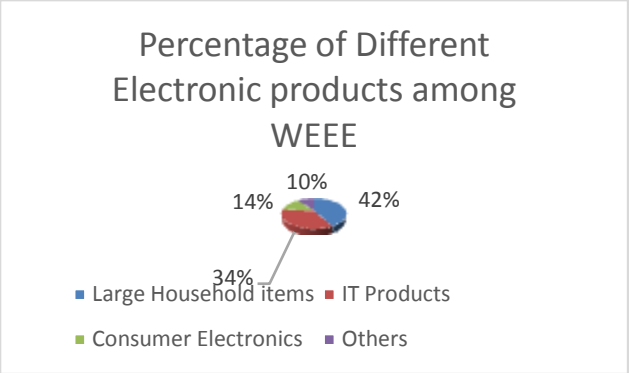

Figure 2.1 Percentage of Different Electronic **products among WEEE**

b) Hazardous & Non Hazardous

Toxic elements like, lead, mercury, copper, **barium**, nickel and even arsenic are all present within a variety of electronic products. As they're being thrown away or placed in the landfills, the products often break which can expose the inner workings and those dangerous chemicals and metals. The health hazards due to these materials are described in Table 2.1 [5].

Source of e-wastes	Constituent	Health effects
Solder in printed circuit boards, glass panels and gaskets in computer monitors	Lead (PB)	• Damage to central and peripheral nervous systems, blood systems and kidney damage. • Affects brain development of children.
Chip resistors and semiconductors	Cadmium (CD)	• Toxic irreversible effects on human health. • Accumulates in kidney and liver. • Causes neural damage. • Teratogenic.
Relays and switches, printed circuit boards	Mercury (Hg)	• Chronic damage to the brain. • Respiratory and skin disorders due to bioaccumulation in fishes.
Corrosion protection of untreated and galvanized steel plates, decorator or hardner for steel housings	Hexavalent chromium (Cr) VI	• Asthmatic bronchitis. • DNA damage.
Cabling and computer housing	Plastics including PVC	Burning produces dioxin. It causes • Reproductive and developmental problems; • Immune system damage; • Interfere with regulatory hormones
Plastic housing of electronic	Brominated flame	• Disrupts endocrine system functions

equipment and circuit boards.	retardants (BFR)	
Front panel of CRTs	Barium (Ba)	Short term exposure causes: • Muscle weakness; • Damage to heart, liver and spleen.
Motherboard	Beryllium (Be)	• Carcinogenic (lung cancer) • Inhalation of fumes and dust. Causes chronic beryllium disease or beryllicosis. • Skin diseases such as warts.

Table 2.1 Effect of E Waste Constituents on health (5)

c) Metals & Non Metals

Electronic products often contain several persistent, bio-accumulative and toxic substances, the categorization of various materials is given in Figure 2.2.

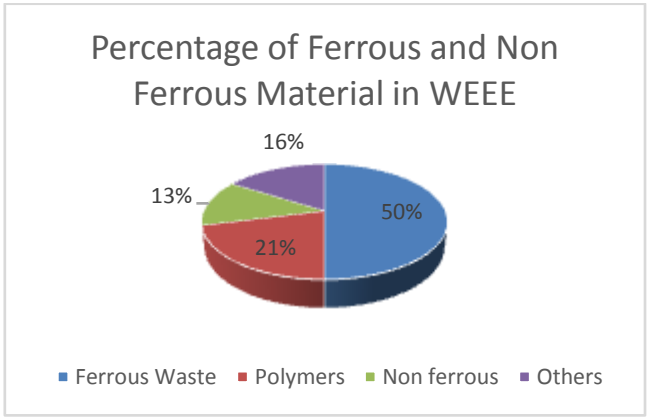

Figure 2.2 Constituents of WEEE

d) Precious and non-precious materials

The electrical and electronic waste compromises of ample amount of highly valuable materials such as gold, silver, copper, **platinum**, palladium, iron, aluminium, indium, gallium and rare earth metals that may be recovered by recycling. For example, in recycling only one ton of electronic scrap from computers, more gold can be recovered than from 17 tons of gold ore, and up to 40 times more concentrated copper than that is found in copper ore. Also, one ton of mobile phones (approximately 6,000 handsets) contain about 3.5 kg of silver, 340 g of gold, 140 g of palladium and 130 kg of copper.

These are some of the factors categorizing WEEE, and the method employed totally depends on the perspective of the analysing authority.

3. Electronic Waste Disposal Techniques

The major dump-yard of most of the electronic waste are the Asian countries like India, Pakistan,China etc. Exporting e-waste to nations such as China not only poses environmental and health threats, it also drives a thriving industry in counterfeit electronics components, which are often sold right back to Americans – and that many of these components contain digital data stored by the original users. Also, the counterfeit devices made from the original devices can often make their way to poorly managed factories, where they are sanded or put through an acid wash to remove part numbers and then re-coated in a process known as 'blacktopping' to hide identifying product information.The south Asian recycling dump yards like China, India, Pakistan, Singapore, Vietnam, and the Philippines are loaded with about more than 50 to 80 percent of e-waste from the Western world, often shredding, burning, and dismantling the products in "backyards". Emissions from thee recycling techniques adopted by these dump-yard countries are hazardous to the human health and the environment. However, the informal sector's recycling practices magnify health risks. For example, primary and secondary exposure to toxic metals, such as lead, results mainly from open-air burning used to retrieve valuable components such as gold. Combustion from burning e-waste creates fine particulate matter, which is linked to pulmonary and cardiovascular disease. Apart from the health implications of e-waste the other factors which contribute to environmental problems are the informal working conditions, poverty, and poor sanitation faced by these countries.

4. Conclusion

Developing countries with rapidly growing economies handle e-waste from developed countries, and from their own internal consumers. Currently, an estimated 70 percent of e-waste handled in India is from the Western nations, but the UNEP estimates that between 2007 and 2020, domestic television e-waste will double, computer e-waste will increase five times, and cell phones 18 times [11]. E-waste is an important global environmental and health issue. Promising policy responses have arisen from the European Union, which is defining the source as responsible for e-waste. However, why do the Third World Countries, have to depend on the policies and regulations formulated by the West? Why, We, should not take the responsibility of protecting our environment and people from the adverse effects of E-Waste? We should formulate our own regulations for protection of our people. Everybody should contribute, the manufacturers are required to eliminate dangerous toxins from production, the end user, should

dispose off, the discarded waste according to the required regulations. . However the third world countries like India and China have to take strong steps and formulate relevant policies to safeguard themselves from the Toxic effects of being the dump yard of the electronic waste from the West.

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