E-Waste Generation, Consequences and Health Issues: A Review

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Abstract:

Electronic garbage can harm the environment since it is made with harmful components. CRTs, printed board assemblies, capacitors, mercury switches and relays, batteries, liquid crystal displays (LCDs), photocopier cartridges, selenium drums, and electrolytes contain lead, mercury, and hexavalent chromium. As the worldwide waste stream from discarded electronics grows, understanding how exposure to electronic waste affects human health becomes more critical. 40 million tons of e-waste are created annually. E-waste contains harmful metals and chemicals from laptops, cell phones, and TVs. E-waste recycling centers are often where children work, live, and play. Humanity has developed electronic gadgets that improve our lives, work, and leisure. Technology brings health risks from electronic waste. Researchers have known for a while that electronic garbage, or e-waste harms the environment, but most people are ignorant of its health risks. Electronic trash currently poses one of the greatest threats to human survival. This page introduces e-waste, discusses its global context, its environmental and health risks, India's production, and India's regulations to handle it. This paper analyses India's present regulations and identifies its flaws to help improve electronic waste management.

Key words: E-waste, Human Health, E-waste Disposal, Recycling, Hazards

Introduction:

E-waste, or electronic waste, e-scrap or end-of-life electronics are terms that describe any used electronic device that is at the end or is nearing the end of its purposeful life. This definition electronics which are destined for reuse, recycling, or disposal. Others define includes used resale, salvage, the re-usables (working and repairable electronics) and secondary scrap (copper, steel, plastic, etc.) to be "commodities", and reserve the term "waste" for residue or material which is dumped by the buyer rather than recycled, including residue from reuse and recycling operations.[1] The rapid uptake of information technology around the world, coupled with the advent of new designs and technologies at regular intervals is causing the early obsolescence of much electrical and electronic equipment [2]. Informal processing of electronic waste in developing countries may cause serious health and Every day, millions of tonnes of refrigerators, televisions, mobile phones and computers are discarded around the world. Together, these are called electronic waste or e-waste. These are very complex things, containing metals like copper, tin, cadmium, mercury and lead, as well as plastics and wood. Disposing of them is now a major international problem. E-wastes are not degradable by *soil bacteria*. Nor can they cannot be destroyed by burning. When they are dumped in landfills, they occupy too much space and leak out dangerous chemicals into the air or soil. If these enter sources of drinking water like rivers or wells, they can cause serious health problems in humans, animals and plants alike [3].

Various sources of E-wastes:

Any appliance that runs on electricity has the potential to cause damage to the environment if it is not disposed properly. Common things of electrical and electronic waste are: Large household appliances like refrigerators/freezers, washing machines, dishwashers, televisions.

- Small household appliances which include toasters, coffee makers, irons, hairdryers.
- Information Technology (IT) and Telecommunications equipment namely personal computers, telephones, mobile phones, laptops, printers, scanners, photocopiers etc.
- Lighting equipment such as fluorescent lamps.
- Electronic or Electrical tools i.e. handheld drills, saws, screwdrivers etc.
- Toys, leisure and sports equipment.
- Monitoring and control instruments.
- Automatic dispensers.

Fig 1.: Electronic waste generated from various sources

Categorization of E –Waste:

Electronic trash Computer trash is growing dramatically due to rising demand for information technology and its importance to national development. Government, public, and commercial sectors are rapidly disposing of obsolete electronics like laptops, phones, and more.

Two main sources of e-waste in India are:

- Domestic e-waste.
- International e-waste.

Domestic e-waste comes from several sectors:

- Small businesses and households
- Institutions, government buildings, large businesses, and foreign embassies
- Retailers and PC manufacturers
- PC resale market

E-product obsolescence is caused least by homes. The unauthorised dumping of rubbish computers from other countries creates the e-waste problem. Illegal e-waste trading is driven by low processing costs, low labour costs, and weak environmental enforcement [4].

The generation of WEEE can be broken down into three categories, with large household appliances a ccounting for 42% of the total, information and communication technology equipment making up 34 %, and consumer electronics making up the remaining 14% [5].

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Composition of E-Waste

E-waste comes from households, bulk consumers like government offices and businesses, manufacturers, and retailers. Most of the e-waste collected or recycled has reached the end of its life and was probably made a decade ago, but the rest can be reused or refurbished if properly cared for. E-waste includes washing machines, refrigerators, air conditioners, vacuum cleaners, televisions, PCs, laptops, and phones. The highest percentage of e-waste is glass at 37%, followed by metal at 33% and plastic at 30%. (see Graph 1: Components of e-waste and Graph 2: Metallic constituents of e-waste)[6]
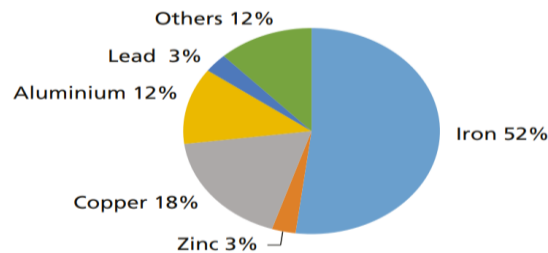

Graph 1: Components of e-waste
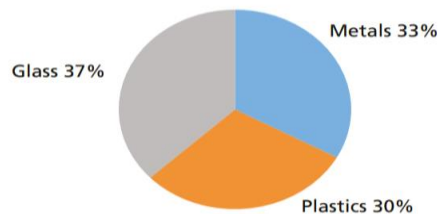
Source: Electricals and Electronics manufacturing in India, ASSOCHAM, NEC technologies, 2018

Composition of E-Waste includes materials like: Valuable metals like gold, platinum, silver and palladium. Useful metals like copper, aluminum, iron etc. Hazardous substances like radioactive isotopes and mercury. Toxic substances like PCB's and Dioxins. Plastic like High Impact Polystyrene (HIPS), Acrylonitrile Butadiene Styrene (ABS), Polycarbonate (PC), Polyphenylene oxide (PPO) etc. Glass material like Cathode Ray Tube glass made up of SiO_2, CaO, Na. For instance, a mobile phone contains more than 40 elements, base metals such as Copper (Cu) and Tin (Sn), special metals such as Lithium (Li), Cobalt (Co), Indium (In) and Antimony (Sb) and precious metals such as Silver (Ag), Gold (Au), and Palladium (Pd).

Iron, Copper and aluminum are the major component of the e-waste generated from the various sources.

Graph 2: Metallic constituents of e-waste

Source: Electricals and Electronics manufacturing in India, ASSOCHAM, NEC technologies, 2018

Every year, over 50 million metric tons of e-waste is produced throughout the world. As previously stated, much of that electronic waste ends up in developing countries where people don't have access

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to the proper equipment to handle it. Workers take whatever measures possible to get rid of that waste, including burning or recovering valuable materials that are still useful, like copper and gold.

This exposes those people to harmful substances. Many electronics contain toxic materials like nickel, zinc, lead, chromium, barium and flame retardants. These can all cause damage to the human body. Lead may get into the blood, kidneys and even the nervous system.

Impact of E waste on Environment:

The consequences of incorrect disposal of electronic waste on the environment pose very significant concerns and dangers to the environment on a global scale as a whole. These impacts are known as "e-waste" effects. The soil, air, and water components of the environment are harmed when these wastes are disposed of in an improper manner.

Impacts of Electronic Waste on the Air The most prevalent effect electronic waste has on the air is through the creation of air pollution. When electronic waste is burned, hydrocarbons can be released into the environment, which contributes to air pollution.

E-Waste May Have a Bad Effect on the Soil It is possible for e-waste to have a harmful impact on the soil. Toxic heavy metals are released during the decomposition process of electronic trash. The elements lead, arsenic, and cadmium are examples of heavy metals. When these toxins travel through the soil and into the plants and trees, they have an effect. As a consequence, these toxins can make their way into the food supply of humans, which can result in congenital abnormalities as well as a variety of other health concerns.

Heavy metals like mercury, lithium, and lead present in electronics (found in mobile phone and computer batteries), etc., when not disposed of properly, these heavy metals penetrate from soil to groundwater, which then run to the surface as streams or small ponds of water. The effects of E-Waste on Water Heavy metals like mercury, lithium, and lead present in electronics (found in mobile phone and computer batteries)[7].

Health Impacts of E-waste:

E-waste is often disposed of in unsafe conditions and contains many toxic substances that are harmful to humans and the environment. Most e-waste is illegally processed by informal workers who use unregulated, dangerous recycling methods that can harm health [8]. Unfortunately, the recycling labour force has a low literacy rate and little awareness of e-waste hazards, so many of them are unknowingly engaging in health-harming activities. [9] In Delhi, 25,000 workers, including children, dismantle 10,000–20,000 tonnes of e-waste by hand. E-waste toxins expose them without protective gear. Waste pickers dump or burn unrecyclable materials. Both methods release toxic chemicals into the air, water, and soil. E-waste exposure can harm workers in these facilities, who often lack safety gear. Skin contact, inhalation, and ingestion of contaminated dust can cause exposure. E-waste exposure can cause thyroid changes, stillbirths, premature births, and spontaneous abortions. [10] Lung function decreased and behaviour changed. Significant DNA damage is also present. E-waste is especially harmful to pregnant women, children, and the elderly. 400,000–500,000 Indian children aged 10-15 recycle e-waste. [11] Chemical absorption can harm a child's growth and cause permanent damage. E-waste recycling raised children's blood lead levels, which is especially dangerous for them. E-waste exposure can cause spontaneous abortions, stillbirths, premature births, and low birth weights in pregnant women [12].

E-waste management:

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Collect, Treat, Dispose of e- Waste :

Treatment and disposal methods:

Landfilling: Electronic waste is mostly buried. Electronic waste is usually dumped in landfills or burned, releasing toxic and carcinogenic chemicals into the air.

Incineration: Waste is burned in high-temperature incinerators (900-1000o C). It reduces waste volume and converts environmentally hazardous organic compounds.

E-Waste Recycling: Dismantling, processing, and final processing. Recycled element value may be higher than other treatments.

Re-use: Use after slight modifications to the original equipment, such as refilling an inkjet cartridge. Donate working computers to educational institutions. Manufacturers accept unrepairable computers. This can significantly reduce E-Waste converted into safer compounds [13].

Duties and Accountabilities of the Government:

It is recommended that governments establish regulatory agencies in each district. These agencies should be tasked with the responsibility of coordinating and consolidating the regulatory functions of the various government authorities regarding hazardous substances, along with the provision of severe punishments for those who violate these regulations. It is imperative that research be encouraged into the development and standard of hazardous waste management, environmental monitoring, and the regulation of the disposal of hazardous e-waste. This is more encouraging in India with the launch of Swachh Bharat Abhiyan in October 2014, wherein the revenue earned by recycling e-waste and recovering metals was included in the initiative.

The Obligations and Functions of Businesses and Industries:

The producers of wastes ought to be the ones to assume responsibility for figuring out the output characteristics of wastes and, if the wastes are dangerous, providing solutions for their management. The obligation of recycling and disposing of their own products ought to be taken on by the manufacturers, distributors, and retailers of those products, and they ought to do so by educating and financially compensating the customers.

The Duties That Along With Being a Citizen:

The prevention of waste, more than any other waste management strategy, including recycling, is likely the most desirable alternative.

The lifespan of valuable products can be extended and the amount of time they spend outside of the waste management system can be increased by donating electronics for reuse. Nonetheless, care should be taken while donating such products, and it is imperative that the items be in operational condition before being given away. The practice of reusing things is not only better for the environment, but it also has social and economic benefits. Schools, non-profit organizations, and families with lower incomes can afford to use technology that they otherwise would not be able to purchase if people donate their used devices to these groups. Never throw out electronic waste along with your regular rubbish or other types of household waste. This ought to be separated in the location, and either sold or given away to a variety of organizations.

Participatory methods should be utilized in the administration of e-waste by non-governmental organizations [5].

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Conclusion:

Electronic trash is a major source of heavy metals and organic contaminants. Without proper collection, reuse, and recycling systems, dangerous compounds in electronic devices like lead, beryllium, mercury, cadmium, chromium, brominates flame retardant, and others would continue to pollute soil, groundwater, and air, endangering wildlife and people. E-waste in India comes from indigenous production and illegal imports. India generates and imports e-waste in unknown amounts. Yet escalating quantities and unmanaged disposal are a disaster. Environmental practises are worrying. Reusing and recycling electronic equipment lowers harmful and hazardous waste in the environment. Consequently, e-waste management is a new problem for waste management in India. To improve product design, safe and ecologically friendly raw materials and the latest technology should be used. All those procedures will reduce environmental pollution from harmful elements in electronic items and assist clean the environment.

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