IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

E-WASTE MANAGEMENT- NEED FOR BETTER HEALTH

[1]Shashikala T.G.

[1]Assistant Professor
[1]Department of Physics
[1]Government First Grade College, Vijayanagar, Bangalore, India

Abstract:

E-waste is one of the fastest growing solid waste streams around the world which is not biodegradable and get accumulates in the environment and living things. E-waste contains hazardous substances which can contaminate soil, air and water when it is not properly disposed of, reused, or recycled and hence posing a serious threat to human health and ecosystems.Thus, there is a need for proper management and disposal of electronic waste generated.This present paper highlights the amount of e-waste generation in worldwide, health and environmental impact of e-waste and also provides suggestions to deal with the challenges and problems of e waste.

Keywords: E-waste, E-waste generation and E-waste management.

1. INTRODUCTION

E-waste is an electronic waste which includes all discarded electrical and electronic products such as computers, laptops, mobile phones, televisions, refrigerators, washing machines, and many other household appliances. E-waste comprises of components having both hazardous and non-hazardous substances. Generally, there are more than 1000 toxic substances associated with e-waste and the most common substances includes Mercury, Cadmium, Lead, Sulphur, Beryllium Oxide, Americium, Brominated flame retardants (BFRs), Polycyclic aromatic hydrocarbons (PAHs), Polychlorinated biphenyls (PCBs), etc which causes an adverse effect on human health and the environment if not properly handled and also, the Non-hazardous substances includes Aluminium, Copper, Germanium, Zinc, Iron, Nickel, Tin, Silicon etc are harmless in nature.

2. OBJECTIVES

1. To Know the facts of global e-waste generation.
2. To study the impact of e-waste on health and environment during treatment processes.
3. To adopt the techniques of e-waste management.

3. GLOBAL E-WASTE GENERATION

Rapid changes in technology, changes in media, falling prices in devices have resulted in a fast-growing of electronic waste around the globe. The US-EPA has estimated that, 5 to 10% increase in the generation of e-waste each year (2012) globally. A review of European legislation on e-waste (WEEE)" highlighted that in 2005 in Europe, the increase of e-waste is between 8.3 and 9.1 million tones.

Also Environment Protection Agency has reported that US generated 1.9 to 2.2 million tones of e-waste in 2005, with only 12.5% collected for recycling. According to a report by UNEPA titled, "Recycling-from E-waste to Resources," the amount of e-waste being produced could rise by as much as 500 percent over the next decade in some countries, such as India. The United States is the world leader in producing electronic waste, tossing away about 300 million tons each year.

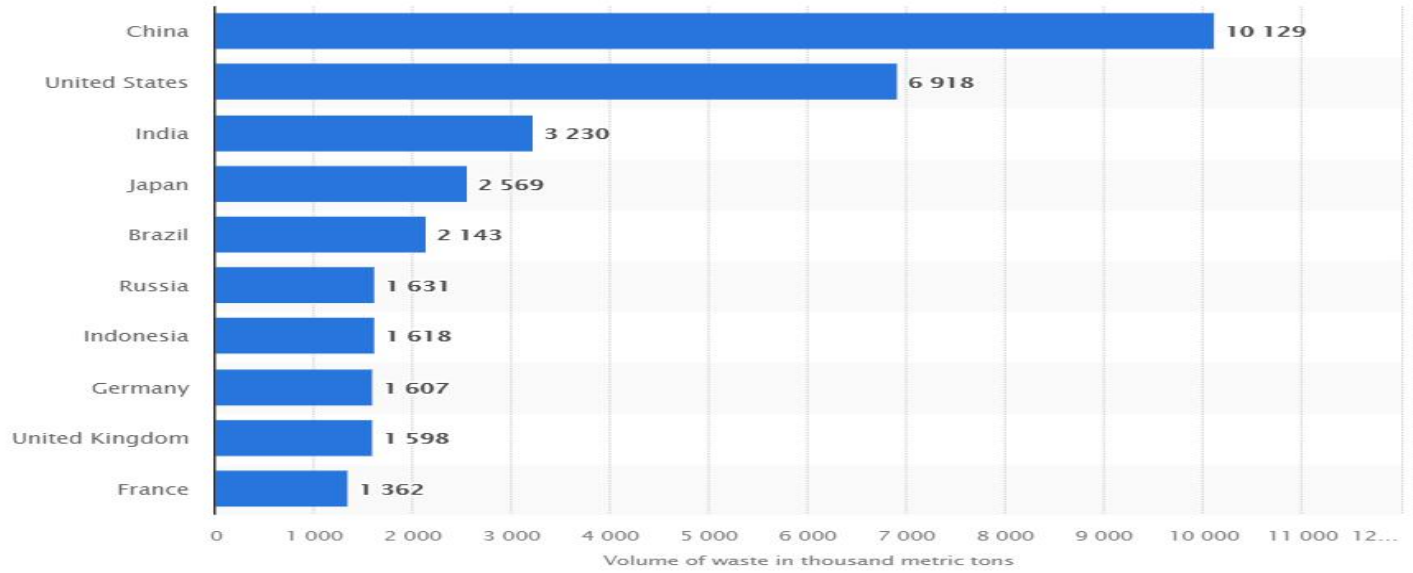
In India, the e-waste generation has been increasing faster than plastic waste, with e-junk witnessing 31% annual growth. In 2021-22, it is estimated that 16,01,155 tonnes of e-waste is generated and 5,27,131 tonnes were recycled. In India,there are 468 authorized dismantlers/recyclers in 22 states having a processing capacity of 13.85 lakh tonnes of e-waste.

In 2019 Australia generated 511,000 tonnes of e-waste. That means the average Australian produced 20kg of e-waste, compared with the global average of 7 kg. By 2030 the national total is projected to rise by nearly 30%, to 657,000 tonnes.

In Japan,it is estimated that 650,000 tons of home appliances and small electronics are discarded every year and less than 100,000 tons are actually collected for recycling.

The electronic waste generation in Brazil has experienced a continual increasing trend in recent years. In 2019, the South American country generated approximately 2.14 million metric tons of e-waste, an increase of more than 18 percent in comparison to 2015. The Brazil is the second largest generator of e-waste in Americas.The electronic waste generated by Brazil increased from 1813 kt in 2015 to 1993 kt in 2017 and reached 2143 kt in 2019.

The global E-waste monitor 2020 report found that the amount of annual domestic e-waste generation in China reaches 10.1 million tons. China remains a major e-waste dumping ground for developed countries. It is also estimated that each year (2011) over 130 million mobile phones in the United states and over 105 million mobiles phones in Europe reach their end-of-life and are thrown away. The report cites that in US more than 150 million mobiles and pagers were sold in 2008, up from 90 million, five years before, and globally more than 1 billion mobile phones were sold in 2007, up from 896 million in 2006. The UN reports estimated that the Current global waste generation levels are approximately 1.3 billion tones per year, and are expected to increase to 2.2 billion tones per year by 2025.



E-Waste Generation per Country (in 1,000 metric tons) in 2023

4. HEALTH AND ENVIRONMENTAL IMPACT OF E-WASTE

E-waste containing hazardous substances such as lead, mercury, cadmium etc contaminates soil, air and water if it is not properly disposed of, reused, or recycled. As a result, e-waste has become a serious environmental problem and an environmental threat to many countries world wide. Disposal of e-waste is a particular problem faced in many regions across the globe. E-waste disposal methods include landfill and incineration, both of which pose considerable contamination risks.

Landfill leachates can potentially transport toxic substances into groundwater while combustion in an incinerator can emit toxic gases into the atmosphere. Also, recycling of e-waste can distribute hazardous substances into the environment and may affect human health. The computer wastes that are land filled produces contaminated leachate which pollutes the groundwater. Acids and sludge obtained from melting computer chips, if disposed on the ground which causes acidification of soil.

The following table shows the adverse affects of some materials found in e-waste.

Sources of E-waste	**Constituents**	**Health effects**
Printed circuit boards, Relays and switche	Mercury	Chronic damage to brain, Respiratory and skin disorders.
Chip resistors and semiconductors	Cadmium	Causes neural damage, teratogenic, accumulates in Kidney and Liver, toxic irreversible effects on human health.
Solder in printed circuit boards, Glass panels and gaskets in computer monitors	Lead	Damage circulatory system & Kidney, central and peripheral nervous systems, also affects brain development of children.
Cabling and computer housing	Plastics including PVC	Burning of plastics produces dioxin, Damage immune system, causes reproductive and development problems, interfere with regulatory hormones.
Plastic housing of electronic equipment and circuit boards	Brominated flame retardants (BFR)	Disrupts endocrine system functions.
Mother board	Beryllium	Inhalation of fumes causes chronic berylliu disease, Skin disease and Lung cancer.
Front panel of CRTs	Barium	Short term exposure causes muscle weakness, damage to liver,spleen and heart

5. ENVIRONMENTAL IMPACTS OF E-WASTE DURING TREATMENT PROCESSES

Both in developed and developing countries, the inappropriate waste management strategies exists due to rapid increase in e-waste generation and inadequate legislation towards the effective management of e-waste. The management of e-waste by recycling and disposal to landfills causes serious environmental issues (Puckett and Smith, 2002, Robinson, 2009 and Wong et al., 2007a).

The impact of such waste from recycling and disposal processes are summarized as follows.

5.1 Recycling

The growing amount of e-waste generation around the world is being moved for recycling using manual processes through various processes leads to contamination of soil, water and air, also results in the poisoning of many local people engaged in recycling process. The most heavy metals released included Pb, Cd, Ni, Cr, Hg and As. Also, organic pollutants emitted included PAHs, PCBs, BFRs such as PBDEs, and polychlorinated dibenzo-p-dioxin/furans (PCDD/Fs) can also be formed during e-waste recycling process. Polybrominated dibenzo-p-dioxin/furans (PBDD/Fs) may occur as impurities in PBDEs, by-products of PBDE degradation during production, weathering, and recycling of flame-retardant plastics, also the entire ecosystem gets contaminated by these toxic substances.

5.2 Landfill disposal

Though the current global move towards zero wastes, the number of landfills has been increasing in both developed and developing countries. While the owners of modern landfills argue that recently constructed landfills are capable of safely isolating from the environment the pollutants found in electronics (SWANA, 2004), the presence of thousands of old landfills with no barrier and containing e-wastes is of much concern. It is found that landfills accepting electronic devices or old landfills containing e-wastes will cause groundwater contamination (Schmidt, 2002 and Yang, 1993). Pollutants have the potential to migrate through soils and groundwater within and around landfill sites (Kasassi et al., 2008). Organic and putrescible material in landfills decomposes and percolates through soil as landfill leachate which contains high concentrations of dissolved and suspended organic substances, inorganic compounds and heavy metal, thereby pollute the environment.

6. E-WASTE MANAGEMENT

It is estimated that 75% of electronic wastes are stored and normally mixed with household wastes, which finally disposed off at landfills. In industries, the e-waste management should begin at the point of generation which can be done by the following waste minimization techniques:

1)Inventory management: The Proper control over the materials used in the manufacturing process is an important way to reduce waste generation (Freeman, 1989). By reducing the hazardous materials and the excess amount of raw materials in stock, the quantity of waste can be reduced by establishing material-purchase review and control procedures and inventory tracking system.

Developing review procedures for all material purchased is the first step in establishing an inventory management program. Procedures should require that all materials be approved prior to purchase. In the approval process all production materials are evaluated to examine if they contain hazardous constituents and whether alternative non-hazardous materials are available. It also ensures that only the needed quantity of a material is ordered. This will require the establishment of a strict inventory tracking system. Purchase procedures must be implemented which ensure that materials are ordered only on an as-needed basis and that only the amount needed for a specific period of time is ordered.

2)Production-process modification: The changes can be made in the production process, which in turn reduce the generation of waste and can be achieved by changing the material product or by the more efficient use of input materials in the production process or both. The three Potential waste minimization techniques are as follows:

a) Improved operating and maintenance procedures: This procedure can be achieved by reviewing the operational procedures or lack of procedures and examination of the production process to improve its efficiency. Instituting standard operation procedures can optimize the use of raw materials in the production process and reduce the potential for materials to be lost through leaks and spills. Training should include correct operating and handling procedures, proper equipment use, recommended maintenance and inspection schedules etc.

b) Material change: Hazardous materials used in either a product formulation or a production process may be replaced with a less hazardous or non-hazardous material.

c)Process-equipment modification: Modifying existing process equipment can be a very cost-effective method of reducing waste generation. Installing such efficient process equipment or modifying existing equipment can significantly reduce waste generation.

3)Recovery and Reuse: This minimization technique eliminates the waste disposal costs, reduces raw material costs and also provides income from the waste. Waste can be recovered through inter industry exchange, on-site, or at an off-site recovery facility.

4)Volume reduction: Volume reduction technique includes the removal of the toxic portion of a waste from a non-hazardous portion which reduce the volume and cost of disposing of a waste material.

5)Sustainable product design: The minimization of hazardous wastes should be at product design stage itself keeping in mind the following factors are, a) Use of renewable materials and energy b) Use of non-renewable materials c) Rethink the product design.

7. MANAGEMENT OPTIONS

Considering the severity of the problem, it is imperative that certain management options be adopted to handle the bulk e-wastes. The following are some of the management options suggested for the government and industries.

7.1 Responsibilities of the Government

- In each district, governments should set up regulatory agencies to co-ordinate and consolidates the regulatory functions regarding toxic substances.
- It should implement the adequate laws, controls and administrative procedures for e-waste management (Third World Network. 1991). E-waste disposal laws must be reviewed and revamped.
- It must encourage research towards the development and standard of e-waste management, environmental monitoring and the regulation of waste-disposal.
- It should enforce strict regulations against dumping e-waste in the country by outsiders. Where the laws are flouted, stringent penalties must be imposed. Governments should enforce strict regulations and heavy fines levied on industries, which do not practice waste prevention and recovery in the production facilities.
- It should encourage and support NGOs and other organizations to involve actively in solving the nation's e-waste problems and it should explore opportunities to partner with manufacturers and retailers to provide recycling services.

7.2 Responsibility and Role of industries

- Generators of wastes should take responsibility to determine the output characteristics of wastes and if hazardous, should provide management options.
- Industries can adopt own policies while handling e-wastes and must adopt waste minimization techniques and all industrial personnel involved in handling e-waste should be properly qualified and trained.

- Manufacturers, distributors, and retailers should undertake the responsibility of recycling/disposal of their own products.

- Electronic manufacturers must be responsible for educating consumers and the general public regarding the potential threat to public health and the environment posed by their products materials management.

8. CONCLUSION

E-waste has emerged as one of the fastest growing waste streams world wide today.They may cause damage during inadequate storage, transportation, treatment, or disposal operations.The improper waste storage or disposal contaminates water, soil and air which leads to serious environmental and health issue at both local and global scales.Thus E-waste management is a critical issue that must be properly addressed in order to protect human health and our environment.Hence, Government should take necessary steps and has to play an important role in regulation by setting standards for the management of e-waste and enforcing these standards. By reducing, recycling, reusing the waste, designing the products using eco-friendly raw items, adopting various waste management techniques as mentioned in this paper and regulating the e-waste, we can ensure that hazardous materials are properly handled and valuable resources are recovered and reused, consequently helping us to move towards a sustainable future.

9. REFERENCES

[1] https://www.scribd.com/presentation/427267124/Solid-Waste-Management

[2] http://en.wikipedia.org/wiki/Electronic_waste

[3] https://www.step-initiative.org/e-waste-challenge.htm

[4] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2796756/

[5] https://www.hsewebsite.com/e-waste/

[6] http://ewasteguide.info/hazardoussubstances

[7] https://www.tonerbuzz.com/blog/e-waste-facts-statistics/

[8] http://greene.gov.in/wp-content/uploads/2019/08/2019082625.pdf

[9] https://www.deccanherald.com/india/generation-of-e-waste-in-india-sees-31-annual-growth-1081505.html

[10] https://www.chemistryviews.org/details/ezine/1037973/Major_Threats_From_E-Waste_Current_Generation_And_Impacts/

[11] https://wgbis.ces.iisc.ac.in/energy/paper/ewaste/static.htm

[12] https://www.dcceew.gov.au/environment/protection/waste/e-waste

[13] https://www.statista.com/statistics/727738/ewaste-generation-brazil/

[14] https://www.mdpi.com/2673-4079/1/2/12