



E-Waste Classification

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Abstract

Society today revolves around technology and by the constant need for the newest and most high-tech products we are contributing to a mass amount of e-waste. Around 44.7 million tonnes of e-waste generated in 2016 globally which was equivalent to 4500 Eiffel towers. In 2018, approx. 50 million tonnes of e-waste was reported. Thus UN called it as 'tsunami of e-waste'. Its value was at least \$62.5 billion annually. These wastes were classified into ten categories according to UN directives. All types of e-waste are mainly classified into two classes such as hazardous and non-hazardous e-waste based upon composition of used components. Many countries have adopted the Reduction of Hazardous Substances (RoHS) regulations in the manufacture of electrical and electronic equipment (EEE). The Threshold Limit for each of the hazardous substances is cause of concern. India has introduced RoHS regulations in 2014 related to producers of EEE. Green policy is the only solution for electronic industry in line with disposal of End of Life (EOL) product chain and public awareness.

Introduction

Electronic waste popularly known as e-waste can be defined as electronic equipment or products which have become obsolete due to advancement in technology, changes in life style and status and nearing to the end of their useful life. The e-waste is a vast concept according to it all the electronic products which have completed their life cycle are considered as waste. According to the Organization for Economic Cooperation and Development, any appliance using an electronic power supply on reaching its end of life would come under Waste Electrical and Electronic Equipment (WEEE). In India e-waste management assumes greater significance not only due to the generation of its own e-waste but also because of the dumping of e-waste from developed countries.

Most of this waste is handled and managed by the informal sector in the large cities and small towns where it operates in clusters. These groups collect waste in primary way, recovering its constituents like plastics, glass and metals, and trade them in local market. The scale of business is in small quantities and the processes are dangerous and hazardous. There are many organizations or networks working in India on e-waste issues such as Knowledge Bank for E-Waste Management in India, National Solid Waste Association of India, the E-waste Guide India, Toxic Links, Central Pollution Control Board, and State Pollution Control Board.

Objectives of The Study

- 1) To understand the concept of e-waste.
- 2) To study the classification of e-waste and its hazardousness.
- 3) To suggest remedial measures for proper channeling e-waste.

Methodology

The study is based upon primary source as well secondary data. The information is collected from reference books, journals, magazines and agency reports and through mode of discussion with concern authority and experts.

Concept of E-Waste

Electronic waste or e-waste describes discarded and used electrical and electronics devices which are destined for refurbishment, reuse and resale, recover, recycling through material recovery or disposal are also considered e-waste. E-waste is the material which arises from various man-machine related activities such as instrumental use, online serving and communication devices, home appliances which is normally discarded as useless or unwanted. It consists of a highly heterogeneous mass and discarded material from the urban community as well as more homogeny accumulation of techno-park, IT hubs and electronic industries.

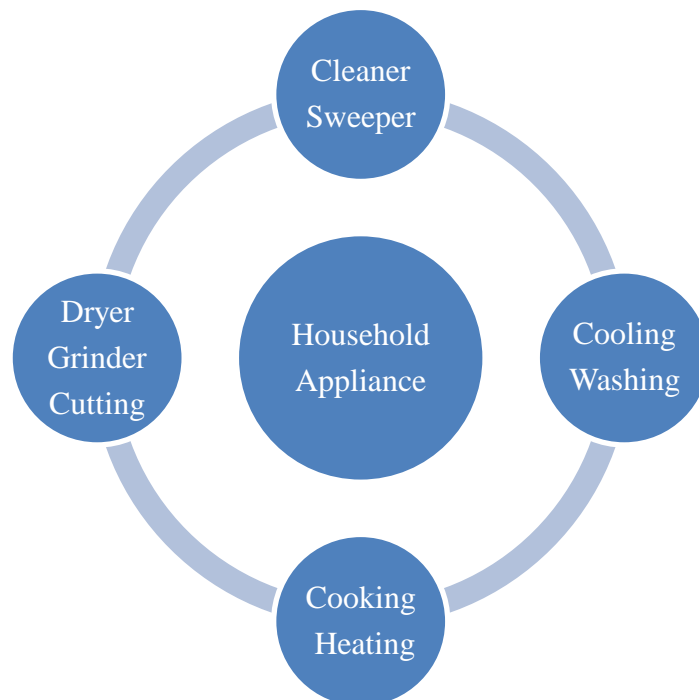
Informal and improper processing of e-waste in developing countries can lead to adverse human health effects and environmental pollution. The rapid expansion of technology and the huge consumption driven society results in the creation of a very large amount of e-waste in every minute.

Classification of E-Waste

The European WEEE Directive classifies waste in ten categories: Large household appliances (including cooling and freezing appliances), Small household appliances, IT equipment (including monitors), Consumer electronics (including TVs), Lamps and Luminaires, Toys, Tools, Medical devices, Monitoring and control instruments and Automatic dispensers.

Categories of electrical and electronic equipment

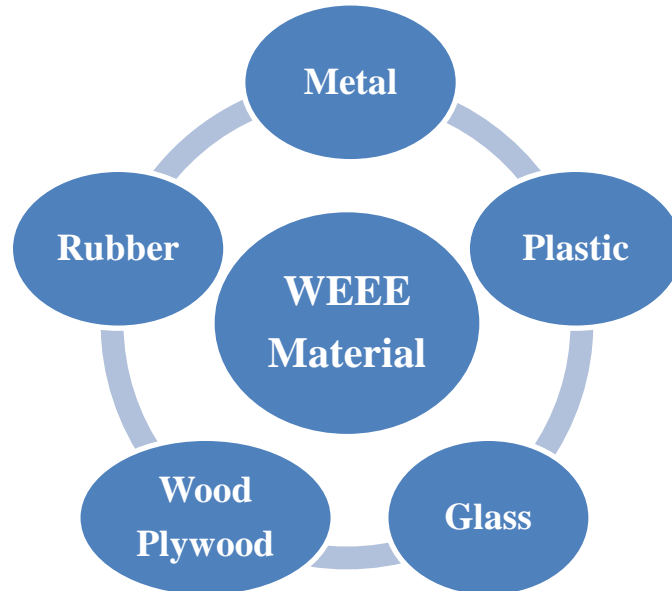
1. Large household appliances
2. Small household appliances
3. IT and telecommunication equipment
4. Consumer equipment
5. Lighting equipment
6. Electrical and electronic tools (exception of large-scale stationary industrial tools)
7. Toys, leisure and sports equipment
8. Medical devices (with the exception of all implanted and infected products)
9. Monitoring and control instruments
10. Automatic dispensers



Consumer appliances

Composition of E-Waste

Composition of e-waste is very diverse and differs in products across hazardous and non-hazardous categories. It consists of ferrous and non-ferrous metals, plastics, glass, wood and plywood, printed circuit boards, concrete and ceramics, rubber and other items. Iron and steel constitutes about 50% of the e-waste followed by plastics (21%), non-ferrous metals (13%) and other constituents. Non-ferrous metals consist of metals like copper, aluminum and precious metals ex. silver, gold, platinum, palladium etc. The presence of elements like lead, mercury, arsenic, cadmium, selenium, and hexavalent chromium and flame retardants beyond **threshold** quantities in e-waste classifies them as hazardous waste.



Composition of appliances

Classification of Components

Based on hazardousness the components in e-waste can be classified as below

Classification of Components

Hazardous Component	Hazardous Component	Non-hazardous Component
Cooling	Thermostat	Metal
Plastic	BFR – containing plastic	Motor \ Compressor
Insulation	Batteries	Glass
CRT	CFC, HCFC, HFC, HC	Concrete
LCD	External electric cables	Transformer
Rubber	Electrolyte Capacitors (over L/D 25 mm) 25mm)	Incandescent Lamp
Wiring / Electrical	--	Heating Element
Circuit Board	--	--
Fluorescent Lamp	--	--

Hazardous Substances Present In E-Waste

The possible substance of concern, which may be found in selected E-waste item, is given as follow.

Hazardous Substances in Components

Component	Possible Hazardous Content
Cooling	ODS
Plastic	Phthalate plasticize, BFR
Insulation	Insulation ODS in foam, asbestos, refractory ceramic fiber
CRT	Lead, Antimony, Mercury, Phosphors
LCD	Mercury
Rubber	Phthalate plasticizer, BFR
Wiring / Electrical	Phthalate plasticizer, Lead, BFR
Circuit Board	Lead, Beryllium, Antimony, BFR
Fluorescent Lamp	Mercury, Phosphorus, Flame Retardants
Thermostat	Mercury
BFR – containing plastic	BFRs-- brominated flame retardants

Batteries	Lead, Lithium, Cadmium, Mercury
CFC, HCFC, HFC, HC	Ozone depleting substances (ODS)
External electric cables	BFRs, plasticizers
Electrolyte Capacitors (over L/D 25 mm) 25mm)	Glycol, other unknown substances

In the above mentioned table, the substances/ components like heavy metals such as lead, mercury, cadmium and chromium (VI), halogenated substances (e.g. CFCs), polychlorinated biphenyls are hazardous, plastics and circuit boards that contain brominated flame retardants (BFRs). BFR can give rise to dioxins and furans during incineration. Other substances like arsenic, asbestos, nickel and copper may act as a catalyst to increase the formation of dioxins during incineration.

E-Waste: Health Issues:

Hazardous wastes are considered highly toxic and therefore disposal of such wastes needs proper attention so as to reduce possible environmental hazards. E-Waste creates lot of health hazards. These electronic equipment are potential threats to both human beings and the environmental, as many of their components contain toxic elements such as lead, mercury, cadmium etc. which contaminate the soil and ground water. Health experts says that exposure to these hazardous materials can cause headache, irritability, nausea, vomiting and eye-pain. The people who collect this e-waste and recycle them may suffer liver, kidney and neurological disorders. Chromium in floppy disk, lead in batteries and computer monitors and mercury in alkaline batteries and florescent lamps also pose significant health risks.

Hazardous Wastes Legislation:

In view of the ill effects of hazardous wastes to both environment and health, several rules and regulations are framed by government to address the problems and challenges posed by hazardous waste. Rules 1989 as amended to date were notified in the country under the provisions of the Environment (protection) Act 1986 for management and handling and import of hazardous waste in to the country. These rules were amended in 2003 to bring the rules in line with the requirements of the Basel Convention and also to improve the applicability and implementation aspects with regards to import of hazardous waste. Apart from Ministry of Environment and Forests, Central Pollution Board and State Pollution Control Board have been delegated certain powers for control and regulation of hazardous waste.

Reduction of The Hazardous Substances (RoHS) In The Electronic And Electrical Equipment (RoHS-2014)

There is the reduction in the use of hazardous substances such as lead, cadmium, mercury, polychlorinated biphenyls (pcbs) and other toxic and hazardous substances for which safe substitutes have been found. Many countries have adopted the RoHS regulations in the manufacture of electrical and electronic equipment. The Threshold Limit for each of the hazardous substances is cause of concern. India has introduced RoHS regulations in 2014 related to producers of EEE.

Role of Producers Towards Society

The producers of all electronic and electrical equipment may provide the following information along with the products

- (1) Enlisting of hazardous constituents present in the equipment.
- (2) A detailed information booklet on the handling of the equipment in the cases of accidental breakage or damage.
- (3) A booklet containing instructions on do's and don'ts.
- (4) Details on the disposal of the end of use of the product.
- (5) Facilitate pick-up services.

Remedial Measures

1. The government, Central Pollution Board and State Pollution Control Board need to frame strict rules and regulations regarding handling, processing and recycling of waste to safeguard the health of workers.
2. The industries should be motivated and encouraged to apply waste prevention and recovery process in production.
3. The remedies for the electronic waste lies in prevention of the manufacturing source (RoHS). Waste minimization can be achieved by adopting effective inventory control system, volume reduction, proper production design, recovery and reuse.
4. The business organizations need to conduct waste reduction audit in their units. This will help them to identify the quantity of e-waste generated in production process.
5. The business units should apply hazardous waste minimization techniques such as green initiative which will help in reduction in the quantity of hazardous e-waste components in the production process.

Conclusion

Hazardous wastes are considered highly toxic and therefore disposal of such wastes needs proper attention

so as to reduce possible environmental hazards. Electronic waste means electronic equipment or products which have become obsolete due to advancement in technology and changes in life style and status. Integrated waste management is best solution on the concept of e-waste management system should be analyzed together include all aspects of it. The business units should apply hazardous waste minimization techniques such as green initiative which will help in reduction in the quantity of hazardous e-waste components in the production process. They should also follow RoHS regulations more stringently as most responsible producers.

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