

Impact And Management Of E-Waste For Sustainable Environment

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ABSTARCT

Generation of too much e-waste and its improper disposal and management show our carelessness towards our mother earth. About two third of global e-waste is generated by the developed countries such as USA, European countries, China and Japan. Major part of it is dumped into the developing countries of Asia and Africa as donation. Main sources of e-waste are some components of computers, laptops, LEDs, smart phones etc at the end of their life. This e-waste is sources of toxic materials like Lead, Mercury, Cadmium, Sulphur, and Chromium. Reduce, Recycling, reuse, pyrolysis are some methods of disposal of e-waste. But lack of awareness and financial constraints, during recycling and landfill disposal, leach toxic elements into soil and underground water. Through food chain toxins enter into our body and due to which deadly diseases like cancer, damage of body organs, stress related problems arises and make our life miserable and pollute our environment and hence put sustainability in danger. In developing countries most of the e-waste is handled by street vendors (kabadiwallas) and rag pickers. Lack of awareness and due to their greed they don't know the proper method of recycling to get valuable metals from the e-waste and hence unsafe handling of used electronics and e-waste in developing countries results in harming human health and our environment.

Key words: e-waste, disposal, environment, toxic, electronic gadgets, recycle.

1. INTRODUCTION

Electronic waste also known as e-waste can be defined as the waste instruments and gadgets both electrical and electronic which are undesirable, discarded, cannot be repaired and near to their end of life. It consists of discarded items of electronic appliances such as computers, laptops, mobiles, fax machines, photo-state machines, printers, refrigerators and telephones. Due to increasingly fast economic growth and urbanisation, the demand for electronic gadgets (EG) among middle class is growing at a fast pace particularly in developing countries like India. The growing use and throw culture among high income group and fast changing technology of electronic industry is root cause of generation of e-waste because demand and supply runs parallel to each other.

In India, estimated amount of e-waste is only 0.1-0.2% of the total municipal waste but this small percentage is very toxic and even put a question mark on the survival of mankind because. “e-waste” is a small word but in practical life it fast pile up and lack of awareness of methods of disposal make this toxic for our environment and hence for survival of life on our mother earth. Business sector, institutions and industries are mainly responsible for the production of this e-waste. Journey of an electrical gadgets from its cradle to grave emit lots of harmful gases and parts of discarded items are hazardous to the environment. According to Mundada (2004) “1050 tonnes per year of computer waste comes from retailers and manufacturers”

Devi and Ramesh stated that e-waste is considered harmful, as few components of electronic gadgets are hazardous and non- biodegradable and pose great threat to human health and environment. Discarded computers, televisions, VCRs, stereos, copiers, fax machines, electric lamps, cell phones, and batteries are producing a plenty of e-waste .When discarded electronics gadgets are not properly disposed off and end up in landfills, toxic chemicals are released, producing harmful impact on the earth’s atmosphere, lithosphere and hydrosphere which ultimately affects human health negatively. In the manufacturing of electronic instruments different types of metals are used, due to this mining of these metals is essential which also disturbs our ecosystem.

According to Kumar, V. (2011), in India, rules and regulations regarding proper disposal of e-waste are not so strict and most of the waste is treated as municipal waste, which is very dangerous for environment as well as for mankind. Because of development of IT industry, it not only raw materials but waste generated from them is the real cause of e-waste [Cairn 2005]. According to European Union (EU 2002), e-waste is, “Electrical or electronic equipment, which is waste, including all components, subassemblies and consumables, which are part of the product at the time of discarding.”

Some of the e-toxic components in computers are plastic computer casings; polyvinyl chloride (PVC), coated copper cables, plastic casing, circuit boards containing heavy metals like lead & cadmium, cathode ray tube(CRT), mercury switches, mercury in flat screens, capacitors, transformers etc. According to Jain, A, 500 million computers have 2.87 billion kg of plastic, 286700 kg of mercury and 716.7 kg of lead.

According to a report of world count, on an average 40 million tons of electronic waste are generated every year. Total hazardous materials in e-waste are about 70%. Only 12.5% e-waste is recycled. 85% of our e-waste is sent to landfills and incinerators which emit harmful toxins in the environment. 80% of e-waste generated in the US, European Union and other developed countries is transported to developing countries of Asia and Africa. Low level of awareness amongst people in these countries lure them to abstract precious metals by raw and rudimentary methods which lead to the habit of throwing e-waste anywhere in open spaces is also very dangerous for our environment. This not only affects the health of people directly involved in this activity but also affect our fauna and flora. According to EPA(2009) data US alone is responsible for the production of 2.37 million tonnes of e-waste which include televisions, computers, cell phones and printers, scanners and faxes.

2. Objectives

- To review e-waste generation.
- To identify toxic element emitted in the process of e-waste disposal.
- To list harmful effects of e-waste on environment and human health.
- To suggest methods for proper disposal of e-waste

3. Research Methodology

To list the electronic gadgets, which when discarded becomes e-waste, an extensive survey of the existing literature was done. After this a questionnaire was prepared and a short survey on 370 % persons (170 in urban area and 200 in rural area) was conducted to gauge the amount of e-waste produce by an Indian house-hold in rural and urban areas, whether they are aware of solid e-waste pollution or not and its harmful effects on environment and human health. A question about the methods of disposal of e-waste is also asked to know the different methods of disposal we adopt. The data is then arranged and simple statistical methods such as percentage are employed for better interpretation and analysis of data.

4. RESULTS & DISCUSSION

In this modern and technologically sound world use of electronic gadgets is our need and e-waste generation is outcome of our greed. Therefore it is a inflammable topic as life of our planet is in danger because of massive and ever-increasing production of our e-waste. It includes technology, energy, transportation, mining, communication, economy and culture. After literature review and survey a list of e-waste and the toxic element associated with it is prepared.

e-waste sources	Components	Harmful Elements
Refrigerator, T.V, LCD, LED, Computer, printers, Laptop, Smart phone, Fax ,Lamps, Battery, Inverter, Instruments, A.C, Washing Machine ,Toaster, Iron etc	Glass panels and gaskets in computer monitors, Cabling and computer housing Plastics including PVC, Cathode ray tube , Mother Board etc	Lead, Cadmium, Beryllium and Brominated flame retardants, Arsenic, Mercury, Chromium, Cadmium, Cobalt, Copper, Nickel, Barium etc

From the survey it is found that, out of the total 370 respondent 20.5% respondents are aware of e-waste pollution, 42.4% in urban areas and only 2% in rural areas. A majority of them told that they generally exchange the electronic gadgets to buy a new one. Only 5% of urban respondent change their mobile in working condition to cope up with the latest technology.

4.1 Effects of e-waste on our environment:

Air, water and soil are the three fundamental components of our environment and our survival depend on the cleanliness and purity of these three. Now a days e-waste is becoming headache for developing and developed countries. Toxic elements present in the e-waste are responsible for the pollution of environment. Mercury, heavy metals, hazardous brominated flame and retardants are mainly present in e-waste. When different parts of computers like circuit boards, copper cables and plastic computer casing, Cadmium in batteries are burnt to recollect valuable metals, furans, hydrogen chloride and highly toxic dioxins etc are released in the air which is the main cause of air pollution. Incineration is a good process to recover precious metals but during this process harmful gases are released causing environmental pollution.

When e-waste is improperly discarded and reaches to landfills then harmful substances like Mercury, Polychlorinated biphenyl, lead, chromium, arsenic and Cadmium from plastic part percolates into the soil and groundwater. Through food chain these substances enter into aquatic and non-aquatic systems. During rainy season, the surface runoff from the landfill areas take these toxic elements to our surface water bodies like lakes, ponds and rivers thus polluting our water bodies. During melting of chip of computer, mobile etc acid and sludge releases which can cause acidification of soil and hence decreases fertility of soil thus lead to soil pollution. Lead from Cathode Ray Tube is also a toxic element and affects the environment at local and global level.

4.2 Effects of e-waste on human health

Lead is the main e-waste of computer. It affects the growth of brain in the children and is also responsible for anaemia, disruption of haemoglobin synthesis, damage of kidneys and nervous system and in mild cases it leads to restlessness, insomnia, loss of appetite and gastro intestinal problems. Mercury is responsible for the irreversible damage of brain and affects reproductive system and disturbs the hormonal balance in humans. Methyl Mercury is more toxic to humans. Barium from CRT is very dangerous. Even small exposure of it damage heart, liver and spleen. It also leads to weakening of muscles. Chromium VI is responsible for the damage of DNA. Cadmium enters to humans either by air or by the consumption of contaminated water and food, leads to damage of kidneys, lungs and liver. It is also responsible for the disorder of respiratory tract and skin. Americium can induce cancer. Sulphur damages the liver, heart, kidneys, and eyes. Chromium is a known cause of cancer of respiratory track.

4.3 Methods of Disposal of e-Waste

In e-waste, solid waste constitutes its major amount. Its disposal as well as recycling process produces such elements which are very toxic to environment as well as for human health. Financial constraints, lack of awareness, lack of technical support and shortage of equipments used for and disposal of e-waste are the major barriers for safe disposal and recycling. For the socio-economic development of countries and for environmental sustainability strict rules and laws should be formulated and implemented in letter and spirit.

The best method of management of e-waste is to minimise our dependence on all the luxury electronic gadgets as Gandhi ji said that nature has plenty to fulfil the needs of everyone but not greed.

Reuse: It is not a method of disposal but is a potential way to manage our gadgets and hence economy as a result of which demand for different raw materials and hence mining will reduce. This is one of the most effective way of handling e-waste. Old but in working condition gadgets which are not very useful to techno savvy people due to its old technological version, can be very useful for economically not so well off. This is the best way to reduce e-waste. It is economically beneficial for both buyers and sellers and one get rid of ones old electronics. It is fruitful for our environment also. Sometime parts of electronic instruments can be reused and hence increases life span. Now a day's electronic shops are always ready to exchange or buy your old electronic gadgets.

Refurbishing: In order to resonate your old device with new technology, in devices certain modification and new version can be installed so that life span of an instrument increases. Due to this, demand for electronic items like computers and laptops decreases and is very helpful in reducing carbon footprints and hence it is a milestone step in management of e-waste.

Recycle: A method of processing to get low or equal rated material is known as recycling. In this method sometime good metals can be extracted during recycling. But this process is quite costly and also creates health related issues to the employees working in these plants. E-waste recycling is helpful in creating employment, to get valuable metals like gold, silver, platinum, iron and copper etc. and reduces problem of its disposal. In 2005 more than 2×10^9 kg of e-waste was generated by USA alone but only 17-18 percent of it was recycled. In USA only 10 percent of mobiles phones are recycled and on an average an American purchases a new phone every year or every one and half years which help in increasing the problem of e-waste further.

Landfills: This is the most common and easiest way to end up the e-waste, as the time passes, toxic gases pollute atmosphere, heavy metals leach into the soil and make water toxic. During rainy season surface water runoff take these toxic materials into our water bodies and agricultural farms and thus enter into our food chain. Excavation of trenches, burying e-waste in pits and covering such pits by layers of earth are the three main steps in landfills but this is not an environmental sustainable method of management of e-waste

Export: Most of the developed countries transport their second hand gadgets to the Asian and African countries as there are not very strict rules and laws in developing countries to handle this e-waste.

Construction: Now a day's some parts of e-waste are used in cement, concrete and in other components of construction. E-waste concrete is light in weight, cheap, reduces the cost of transportation and also have long life span. Hence utilization of e-waste in construction in future definitely helps our economy and a safe stair in the direction of environment sustainability.

5. Conclusion

As e-waste is source of harmful and toxic, organic and inorganic substances. Mercury, Cadmium, Nickel, Beryllium, Lead, Zinc are the hazardous elements present in the e-waste. Our environment acts as a sink for it. Majority of the people particularly in developing countries are not aware about the harmful effects of these toxic substances. Due to its toxic nature, there is exponential increase in cancer, asthma, birth related problems, stress and neurological disorders. In developed countries heavy dependency and demands for electronic gadgets leads to high demand for raw materials which consists of heavy metals as a result of which unwanted mining of natural resources increases and therefore affects our ecosystem. In spite of reduce, recycling, reuse, urban mining to regain valuable material, pyrolysis, to get energy and oil from plastic sources and to convert e-waste into building materials like cement and concrete e-waste is increasing. Proper labelling or sign should be put on each and every electronic gadget to make people aware about its harmful effects during disposal. It should not be discarded along with regular solid waste. Last but not the least we have to limit our domains of using and changing gadgets so that our mother earth do not feel heavy burden.

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