

Electronic Waste—Problems and Solutions

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Abstract— In the present scenario, entire world is dealing with a giant problem which is Electronic waste. Electronic waste can be described as discarded all electronic and electrical devices at the end stage of their life. Rapid changes in technology is producing more e-waste due to which the hazardous components like Arsenic, Cadmium, Barium, Lead, Lithium, Mercury produce harm full effects on environment and human health. So this paper presents an overview of e-waste management and suggestions to tackle with this problem.

Keywords- E-waste, Hazardous, Environment, Management.

I. INTRODUCTION

A. What is Electronic-waste?

Electronic waste can be defined as the disposal of all electrical and electronics equipments such as televisions, computers, cell phones etc. [1] Both developed and developing country like India are facing this problem e-waste. Rapid changes in technologies is the main cause of electronic waste in such a huge manner. Generally waste produces by electronics devices are called e-waste, computer consist various components such as mother board, cpu, cd generate e-waste if they can not recycled efficiently.

E-waste consists of waste which generating through electronics and electrical devices that are no longer in use and are not performing the intended functions. Composition of e-waste consist many ferrous and non ferrous metals, some ferrous metals are like plastic bags, glass, wood, plywood etc and non ferrous metals like copper, silver, gold, platinum, palladium, Arsenic, Cadmium, Barium, Lead, Lithium, Mercury and so on. So the presence of these kind of materials in the large quantity make the e-waste hazardous, all these materials are the main cause of pollution and effect the entire environment badly, e-waste also effect the human health, wild life and entire ecosystem.

B. History of E-waste-

In the 1980 there was two events that gave the whole world a rude awareness about the E-waste. The first event was the khain sea waste disposal event. A ship that was carrying about 14,000 tonnes of hazardous ash from incinerated e-waste in Philadelphia, USA. The second event was happened in koko in 1988, Nigeria. About 3,500 tonnes of toxic waste from Italy was dumped in the koko. These events led to the Basel convention to reduce the movements of these waste from developed country to under developing country and provide some rules for e-waste management.[2]

C. Major Resources of E-waste-

Almost every used electronic devices are considered as e-waste such as unwanted cell phones, cameras, CD players, TVs, radios, drillers, fax machines, photocopiers, printers, toners, ink cartridges, batteries, re-chargeable batteries, digital calculators and clocks, CRT monitors, electric solders, computer mother boards, key board, industrial and house hold electronic machinery such as oven, fridge, sewing & washing machines, fan, air-conditioner, grinder, iron heater, military and laboratory electronic equipment's, etc. [3]

II. E-WASTE MANAGEMENT

Mainly Electronics waste devices consists of devices that use electricity. In the context of e-waste management three rules are used that are recycle, reused, reduce by applying these rules production of e-waste can be reduce through smart manufacturing. Recycling a metal is more use full in generating a new metal while Reuse save the environment near about 40%. [4]

E-waste management concept contain some strategies that are-

- Inventory management
- production-process modification
- volume reduction
- recovery and reuse.
- Inventory Management

Efficient way of reducing the e-waste production is the proper planning of materials used in manufacturing process. There are two methods that can be used in inventory management i.e. inventory tracking system and establishing Material purchase review and control procedures. For the inventory tracking system only needed materials should be ordered when they required for the particular period of the time. While in the review and control purchase review that all the purchased material should be approved first and check that in which amount hazardous and non hazardous component are available in the materials.

III. PRODUCTION-PROCESS MODIFICATION

Amount of waste production can be minimize through the modification in the production process.

In the modification three concept can be used which are improved operating and maintenance procedures, material change and equipment modification. In the context of improved operations and maintenance regular checking of procedures and lack of maintenance considered for the reduction of e-waste in the efficient manner. With the help of standard procedures, minimization of raw material can be done easily and implementation of strict maintenance rules can reduce the electronic waste due to equipment failure. An other concept is material change which deal with the hazardous and non hazardous components present in the materials. Manufacturer companies should use that materials which contain less harm full component than more like in the circuit board manufacturing, manufacturers can use water based flux rather than solvent based. While in the concept of equipment modification updated equipments can be used for less waste production. Sometimes changes in equipments can be very cost effective but many times small changes in materials

within particular process can reduce the waste in large amount.

IV. VOLUME REDUCTION

Process of removal of hazardous components from the waste considered in the volume reduction technique with the help of which cost of disposal of waste minimize. Volume reduction technique splits into two categories i.e. source Segregation and waste concentration. Segregation concept contain separation of valuable metals from the waste so that they can be recovered while concentration methods include ultra filtration, reverse osmosis, freeze vaporization etc through which waste can be reused or recycled.

V. RECOVERY AND REUSE

There are a large number of techniques available like reverse osmosis, electrolysis, condensation,

electrolytic recovery, filtration, centrifugation etc through which minimization of disposal cost and raw material cost can be done easily. Recovery process provides best use of equipments till the efficient performance and also reduce the amount of e-waste because rather than producing new equipments recovery could done if possible.[5]

There are a list of e-waste management rules that government establish in 2016-

Organization have been introduced all rules related to manufacturer, dealer and all rest of stack holders.

State government have to prepare overall plan for efficient implementations and to provide a report to ministry of environment.

Damages done to environment due to improper management of e-waste to pay financial penalty for violation of provisions.

E-waste generated during manufacturing period is responsibility of the manufacturer to collect and channelize it for recycling and seek authorization from SPCB.

The transporter shall be required to carried out a document that is prepared by sender during the transportation of e-waste.

In the recycling process to ensure safety, health and skill development of workers state government should establish some rules.[6]

VI. PROBLEMS

All electronic and electrical equipments contain large amount of hazardous substances which have negative impacts on environment and human health. Due to these hazardous substances mercury, lead, cadmium diseases like cancer, liver damage, heart diseases, eye and throat irritation happen and pollution occur which effect entire ecosystem and wild life. Some hazardous substances are briefly described here-

- Mercury- mercury mostly present in the fluorescent tubes and flat screen monitors. It not only effect the human health but also animal life. It effect human health like memory loss, muscle weakness and in animal life include death, fertility.
- Sulphur- mainly sulphur present in lead acid batteries and it effect human health include liver damage, heart damage and generate sulphuric acid in the ecosystem.
- BFRs- It stands for Brominated flame retardants. Used in electronic equipments like PBBs, pentaBDE. It effects human health like thyroid problems, improper development of nervous system.
- Cadmium- it mainly found in light sensitive resistors. It effect human health include kidney damage and harms micro organism in soil.
- Lead- lead mostly present in CRT monitor glass. It effect brain development of children and made damage to blood system.
- Beryllium oxide- it is used in filling thermal interface material. It effect human health include skin problem and lung cancer etc.
- Plastic including PVC- it is commonly found in cabling. Its burning generate dioxin which effect reproductive system and damage immune system.
- Hexavalent chromium (Cr)- It is commonly present in Corrosion protection of untreated and galvanized steel plates. It effect human health include DNA damage.

- Often these hazards generate due to improper management of electronic equipments and lack of recycling process.[7]

VII. SOLUTIONS

As the problem of e-waste is growing day by day then management of this giant problem is necessary, one simple solution of it is recycling the equipments. Developed country does not pay attention on prevention and increase dumping of e-waste in developing countries. To prevent the world from this problem Basel convention become active and proposed some responsibility for management of electronic waste. In the context of solutions government, manufacturer and citizens should have some duties. Here is a list of duties-

VIII. Duties of GOVERNMENT-

- Government should enhance the research in the e-waste disposal and how to minimize the presence of hazardous substances in equipments.
- Government should provide a list of strict rules to manufacturer and consumer for dumping of e-waste.
- Government should establish offices in each state and district which have responsibility regarding harmful components and coordinate with the manufacturing factories.
- Duties of industries-
- Industries should provide the training to employees so that they use materials that have less hazardous components.
- Team involved in reducing the waste should be highly qualified and trained.
- Manufacturers should have responsibility of e-waste generation to describe the output characteristics.
- Duties of citizens-
- Before buying electronic product consumer should check that they have less hazards.
- Consumer should have that product that can be recycled.
- Consumer should buy only that product which are certified by regulatory authorities.

- Following are some recommended solutions for electronic waste-
- Governments should ban on all imports of e-waste materials.
- Government should take large investment in this field.
- Tax have to be paid on large production of waste.
- Domestic process should used for minimization of waste.
- Before decomposing the waste advice of consultant should be adopted.[8]

IX. CONCLUSIONS

It is high time to prevent entire ecosystem from this giant problem. Governing authorities have to take a step by establishing rules to handle e-waste and develop some organization in every state which make awareness in people about electronic equipments. It is well known that today's electronic equipments are tomorrow electronic waste, so

manufacturer should produce that product which can be recycled and manufacturer have to take responsibility of e-waste. There is no ideal model regarding reduction of e-waste so specific implementation of policies and management is required for pollution free environment .

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