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A Review Study of E-Waste Management in India

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ABSTRACT

E-waste or Electronic wastes are referred to the electronic goods that are dumped out or unwanted. Each year, around 50 million ton of e-wastes are produced. Depending upon their nature of reaction, there are possibilities for dangers depending upon the situation. Discarded computers, batteries and other electro chemical wastes may results in unwanted results. So it's important to be awake of e wastes in addition to the other physical wastes. The situation is alarming as India generates about 1.5 lakh tones of e-waste annually and almost all of it finds its way into the informal sector as there is no organized alternative available at present. This paper discusses the present scenario of e-waste management and possible e-waste handling strategies in India.

Keywords: Electronic waste, Danger, Physical wastes and E-waste management.

1. INTRODUCTION

Electronic industry is the world's largest and innovative industry for its kind. Tons of electronic items are shipped over oceans every year. However, after their usage time they become a complex waste matter. It consists of many hazardous heavy metals, acids, toxic chemicals and non-degradable plastics etc. About 75% of e-wastes are unsure for their purpose or finding ways to use them which include refurbishment, remanufacture and reuse their parts for repair etc. Most e-recyclers were exporting the toxic materials such as leaded glass, mercury lamps etc. to developing countries due to their cheap labor. The main reason for third world countries to consume e-wastes from Europe and USA is poverty. Dismantling process takes much labor. Dismantling not only involve in unscrewing but also shredding, tearing and burning. Circuits are burnt to hunt the valuable metals such as gold, platinum, cadmium etc. But the wire coat of those consists of PVC and PCB which may produce hazardous smoke, and carbon particles and they may lead to lung and skin cancer. A survey led by Ms. Sadhana Tiwari, Mr. Anil Khandekar, Ms. Rashmi Singh,and Dr. Dilip R. Pangavhane found the major contributions of E-waste and proposes effective strategies to tackle the E-waste[1]. The statuses of E waste in India are discussed in [2]. E-waste leads to lot of environmental and health issues which are discussed in [3]-[5]. E waste not only affects the environment but also affect the human health adversely. There are different methods for managing the problems of E waste disposal [6]-[8]. The methods for reusing and recycling of E-waste are described in [10].

2. PROBLEMS FACED

E-waste and pollution is a global problem. The UN suggests that global e-waste is expected to exceed 40 million tons per year. End of product life recycling is highly polluting, non-cost effective and unregulated in most of the countries. The trouble of e-waste not only pollutes the land-fill it is having serious health implications due to chemical leaching into the water table, eventually making its way to agricultural produce and into people. According to a recent report by the BBC, e-waste pollution is causing severe health concerns for millions of people around the world, mostly in the developing nations of Africa, Europe and Asia. Approximately 23% of deaths in these nations are linked to pollution and other environmental impacts. The report also concluded that more than 200 million people worldwide are at risk of exposure to toxic waste. The use of electrical and electronic equipment (EEE) on the rise, the amount of electrical and electronic waste (e-waste) produced each day is equally growing enormously around the globe. Recycling of valuable elements contained in e-waste such as copper and gold has become a source of income mostly in the informal sector of developing or emerging industrialized countries. However, recycling techniques such as burning cables for retaining the inherent copper expose both adult and child workers as well as their families to a range of hazardous substances.

3. E- WASTE IN INDIA

Consequence of e-wastes in India about 80,000 people working for recycling sector, some villages such as Seelampur has scrap markets where piles of e- wastes are separated for recycling. They separate copper from wires after burning them. Plastic and PVC codes produce noxious smoke which is irritable to eyes and cause respiratory problems. In count acid treatment is given to isolate metals; corrosive acids also released from used batteries of cell phones and computers, according to scientists of Greenpeace recycling of a computer in India costs just 2$ while it is 20$ in US, not only cheap labour but also for the profit from recovered metals of circuit boards such as copper gives earning of 3 to 5 $ per day workers are spending on dismantling e-wastes rather considering their own health (Figure 3.2). However, currently they are building an e-waste recycling plant in Bangalore which was estimated as having the capacity to handle 60,000 tons of e-wastes annually. In India about 24% of e-waste was produced from Mumbai, and, Delhi, Bangalore and Chennai are 21.2, 10.1 and 9.1 respectively [2].

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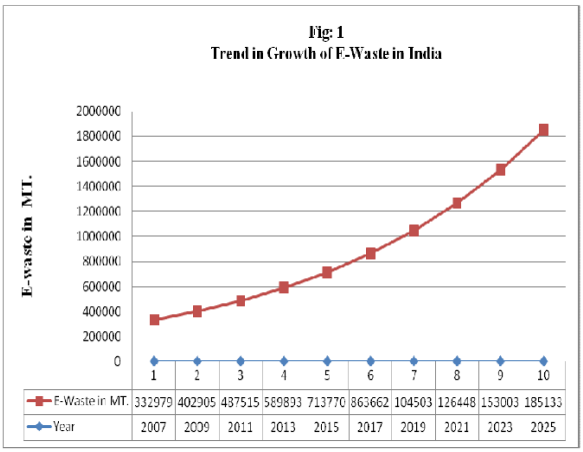

Fig.3.1 Trend in growth of e-waste in India

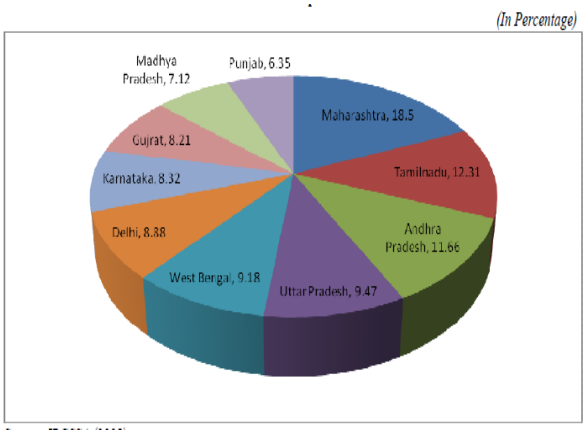

Fig 3.2 E-waste generation in top ten states of India

Fig 3.3 reveals the E-waste generation in top ten cities of India. The situation is alarming in India as it generates about 1.5 lakh tones of e-waste annually and almost all of it finds its way into the informal sector as there is no organized alternative available at present. E-waste generated in a few cities across the nation show an alarming picture. In India Mumbai is on the top with 24.02 percent in terms of E-waste generation followed by Delhi with 9730.5 (21.21%) metric tonnes e-waste. Bangalore, Chennai, Kolkata, Ahmedabad, Hyderabad, Pune, Surat and Nagpur takes third, fourth, fifth, sixth, seventh, eighth, ninth and tenth place respectively.

4. MANAGEMENT OF E-WASTE

It is estimated that 80 % of electronic items are stored due to doubt of how to manage it. These electronic junks lie unattended in houses, offices etc. and normally mixed with household wastes, which are finally disposed at landfills .In industries management of e-waste should begin at the point of generation. This can be done by waste minimization techniques and by sustainable design of product. Waste minimization in industries involves adopting the inventory management, production-process modification, volume reduction, recovery and reuse. In inventory management, there is proper control over the materials used in the manufacturing process. By reducing both the quantity of hazardous materials used in the process and the amount of excess raw materials in stock, the quantity of waste generated can be reduced to an extent. This can be done in two ways i.e. by establishing material-purchase review and control procedures and by inventory tracking system. Developing review procedures for all material purchased is the first step for establishing an inventory management program. Procedures require all materials be approved prior to purchase. In this method, all production materials are evaluated and examined if they contain hazardous constituents. Another inventory management procedure for waste reduction is to ensure that only the required quantities of materials are ordered. This requires the establishment of a strict inventory tracking system. Purchase procedures must be implemented such that it ensure that materials are ordered only on an as-needed basis and that only amount needed for a specific period of time is ordered. Production-process modification Changes are made in the production process, which will reduce the waste generated. This reduction can be accomplished by changing the materials used to make the product. Potential waste minimization techniques can be divided into three categories:

- Improved operating and maintenance procedures
- Material change
- Process-equipment modification.

Improvements in the operation and maintenance of process equipment can result in considerable waste reduction. This can be accomplished by reviewing current operational procedures or examination of the production process for the ways to improve its efficiency. Instituting standard operation procedures can optimize the use of raw materials in the production process and hence reduce the potential for materials to be lost through leaks and spills. A strict maintenance program and stresses corrective maintenance can lessen waste generation caused by equipment failure. An employee-training program is an important element of any waste reduction program. Training should include correct operating and handling procedures, proper equipment use, recommended maintenance, inspection schedules, correct process control specifications and proper management of waste materials. Hazardous materials used in either a product formulation or a production process can be replaced with a less hazardous or non-hazardous material. This is a widely used technique and is applicable to most of the manufacturing processes. Implementation of this waste reduction technique may require only some minor process adjustments. It may require extensive new process equipment for example, a circuit board manufacturer can replace solvent-based product with water-based flux and at the same time replace solvent vapour degreaser with detergent parts washer.

Modifying existing equipment to take advantage of better production techniques can appreciably reduce waste generation. New or updated equipment can use raw materials more efficiently producing less waste. In addition, it reduces the number of rejected or off-specification products and thereby reducing the amount of material which has to be disposed of. Modifying existing process equipment can also be a very cost-effective method of reducing waste generation. By decreasing the number of parts that have to be reworked, the quantity of waste can be significantly reduced. Volume reduction includes those techniques that remove the

hazardous portion of waste from non-hazardous portion. These techniques are usually used to reduce the volume, and hence the cost of disposing waste material. Two general categories of waste stream volume reduction are: source segregation and waste concentration. Segregation of wastes, in many cases is a simple and economical technique for waste reduction.

Wastes containing different types of metals can be treated separately so that the metal value can be recovered. Concentration of a waste stream may increase the possibility that the material can be recycled or reused. Methods include gravity and vacuum filtration, ultra filtration, reverse osmosis etc.

Recovery and reuse: This technique can reduce waste disposal costs, reduce raw material costs and provide income from a saleable waste. Waste can be recovered on-site, or off-site recovery facility, or through inter-industry exchange. Numbers of physical and chemical techniques are available to reclaim a waste material such as reverse osmosis, electrolysis, condensation, electrolytic recovery, filtration etc. However recycling of hazardous products has no environmental benefit if it simply moves the hazards into secondary products that eventually have to be disposed of. Unless the goal is to redesign the product to use nonhazardous materials, such recycling is not a proper solution. Sustainable product design: Minimization of hazardous wastes should be at product design stage itself keeping in mind the following factors:

- Rethink the product design: Efforts should be made to design a product with fewer amounts of hazardous materials. For example, the efforts to reduce material use are reflected in some new computer designs that are flatter, lighter and more compact
- Use of renewable materials and energy:. Bio-based toners, glues and inks are used more often. Solar computers also exist but today they are very expensive.
- Use of non-renewable materials that are safer: Since many of the materials used are non-renewable, designers could ensure the product is built for re-use, repair or upgradeability. Some computer manufacturers such as Dell and Gateway lease out their products thereby ensuring that they get them back to further upgrade and lease out again.

The management of e-waste as per Indian scenario can be divided into three main sections viz: Collection, Recycling and Recovery and Disposal. The sections are further divided to the sub sections as per their further activities involved.[4] To optimize the use of available resources and infrastructure of both informal and formal stake holders a few suggestions applicable for Indian scenario are listed so that their potential may be fully utilized for the Environmentally Sound Management of e-waste .

➢ The e-waste collection must be emphasized by creating local, urban, District level, and state level collection points so that the maximum amount of e-waste can be collected. Initially, the investment will be high as approach is new, but after some time it will be established and well known for e-waste collection point. To attract people for voluntarily disposal, the awareness about the monetary benefits have to be given to the people concerned and diseases caused due to e-waste at grass root level. By this way we can motivate people to come forward for the disposal of e-waste.

➢ The registered recycler's representative will train the local collectors about the e-waste and its harmful effects on human beings, atmosphere, water, air, soil and ambience in absolute by conducting seminars, workshops with the help of Doctors.

➢ Set the door-to-door e-waste collection. Its storage and further packaging mechanism can be done in the locality by one to one contact or by phones with the help of formal or/and informal collectors keeping the incentives to the informal as per minimum monetary expectations.

➢ The separated equipment's, components etc., are packed by pasting slip with all details needed to be done on local stations and dispatch it to the registered recyclers.

➢ Transport the e-wastes to the registered recycler's destination. After recovery, recycling and refurbishment the remaining material after decontamination are disposed of either through incineration or through secured land filling.

➢ Fix the rates item-wise which are to be given to the user after receipt of items concerned and its collection charges up to the point of collection.

5. CONCLUSION

E-waste are everywhere in our society. They are characterized by a complex chemical composition and difficulty in quantifying their flows at local and international level. The pollution caused by their irregular management has degraded the environment mostly in poorer countries, receiving them for recycling and recovery of valuable metals. Motivated by the minimization of environmental effects caused by the generated e-waste, many technological changes have been developed. They are:

- ✓ The replacement of CRT screens with LCD screens (Pb elimination).
- ✓ The introduction of optical fibres (Cu elimination from the cablings).
- ✓ The introduction of rechargeable batteries (Ni, Cd reduction, but Li increase), etc.
- ✓ The production of "halogen-free" appliances, not contributing to the production of PCBs and dioxins (but production is more expensive).
- ✓ The introduction of legislative restrictions (Pb, Hg, PBBs and PBDE up to 1000 mg/kg,).

Summarizing the above, e-waste separation from the rest of solid waste and their successful recycling for the recovery of valuable raw materials are of great importance. The management system has to be rationally designed. The environmental benefits from the collection, transportation, management and the financial benefits from the recovery should not be set-off by the required resources and energy consumptions for the system operation.

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