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A Review Study of E-Waste Management in India

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Abstract: The electronic goods that are dumped out or unwanted are referred to e-waste or Electronic waste. There is production of around 50 million tons of e-wastes each year. There are potentials for hazards depending on the situation, depending on their type of reaction. Discarded computers, batteries, and other electro-chemical waste can produce undesirable results. So in addition to other physical wastes, it's important to be aware of e-wastes. The situation is worrying as India produces approximately 1.5 lakh tones of e-waste annually and almost all of them find their way into the informal sector as there is currently no structured alternative available. This paper discusses the present scenario of e-waste management and possible e-waste handling strategies in India. Developed countries export this waste to developing countries such as China and some Asian nations, where environmental standards are low, are the most important recipients of e-waste which in most cases, is processed illicitly. The environmental burden of e-waste is born by people that live in developing countries.

Keywords: Electronic waste, E-waste management, Hazardous, Physical wastes, Recycle.

INTRODUCTION

For its kind the electronic industry is the largest and most innovative industry in the world. Each year tons of electronic goods are shipped across oceans. However, they become a complex waste matter after their time of use. It is made up of many harmful heavy metals, liquids, toxic chemicals and plastics that are not degradable. Approximately 75 percent of e-wastes are unknown for their intent or finding ways to use them, including refurbishing, re-manufacturing and fixing their components, etc. Owing to their cheap labor, most e-recyclers were exporting toxic materials such as leaded glass, mercury lamps etc. to developing countries.Poverty is the main reason for e-waste[1] consumption by third world countries from Europe and the USA. The process of dismantling requires much work. Dismantling involves not only de-screwing but also shredding, tearing and burning. Circuits are burned to hunt the precious metals like gold, platinum, cadmium, etc. But the wire coat of those consists of PVC and PCB that can contain toxic smoke, and carbon particles and can lead to cancer of the lungs and skin. E-waste contributes to a lot of environmental and health issues the main reason for e-waste use by third world countries from Europe and the USA is poverty. The method of dismantling requires much effort. Dismantling requires not only screw-out but also shredding,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.

PROBLEMS FACED

E-waste is a global problem like pollution. The UN estimates that global e-waste will soon reach 40 million tons per annum. The termination of product life recycling in most countries is highly polluting, non-cost efficient and unregulated. The e-waste problem[2] not only pollutes the land-fill it has serious health consequences due to chemical leaching into the water table but ultimately leads to agricultural production.According to a recent BBC survey, e-waste contamination is causing severe health concerns to millions of people worldwide mostly in Africa, Europe and Asia's developing nations. Approximately 23 per cent of deaths are linked to pollution and other environmental impacts in these nations. The report also concluded that more than 200 million people are at risk of exposure to toxic waste worldwide.The increasing use of electrical and electronic equipment, the amount of electrical and electronic waste produced each day, is growing enormously around the globe equally. Recycling of valuable elements contained in e-waste such as copper and gold has become a source of revenue mostly in the informal sector of developing or emerging industrialized countries. Recycling techniques like burning cables to retain the inherent copper, however, expose both adult and child workers and their families to a range of hazardous substances.

E- WASTE IN INDIA

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Consequence of e-wastes[3] in India is 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 smoke which is irritable to eyes and cause respiratory problems. 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 labor but also for the profit from recovered metals of circuit boards 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 (Fig. 1 and Table 1).

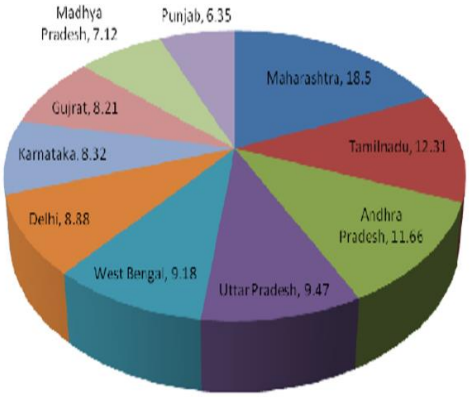

Fig. 1: E-waste generation in top ten states of India

SOURCES OF E-WASTE

Table 1: Effects of E-Waste constituent on health

Source of e-wastes	Constituent	Health effects
Solder in printed circuit boards, glass panels and gaskets in computer monitors	Lead (PB)	• Damage to central and peripheral nervous systems, blood systems and kidney damage. • Affects brain development of children.
Chip resistors and semiconductors	Cadmium (CD)	• Toxic irreversible effects on human health • Accumulates in kidney and liver
		• Causes neural damage
Relays and switches, printed circuit boards	Mercury (Hg)	• Chronic damage to the brain. • Respiratory and skin disorders due to bioaccumulation in fishes.
Corrosion protection of untreated and galvanized steel plates, decorator or hardner for steel housings	chromium (Cr)	• Asthmatic bronchitis. • DNA damage.
Cabling and computer housing	Plastics including PVC	• Reproductive and developmental problems • Immune system damage • Interfere with regulatory hormones
Front panel of CRTs	Barium (Ba)	• Muscle weakness • Damage to heart, liver and disturbed sleep pattern
Motherboard	Beryllium (Be)	• Carcinogenic (lung cancer) • Inhalation of fumes and dust causes chronic beryllium disease or beryllicosis • Skin diseases such as warts.

MANAGEMENT OF E-WASTE

It is estimated that 80 % of electronic items are stored due to doubt about how to manage it. These electronic junks lie unattended in houses, offices etc. and generally 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[4] 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 materialsused 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 achieved in two ways, by creating check and control protocols for the material-purchase and by monitoring the inventory. The first step in developing an inventory management system is the implementation of analysis procedures for all the material purchased. Procedures require prior approval of all materials before purchase. All processing products are tested in this process and analyzed whether they contain dangerous constituents[5].Another waste-reduction inventory management technique is to ensure that only the necessary amounts of products are purchased. That requires a strict system of inventory tracking to be established. Purchase procedures must be implemented in such a way as to ensure that materials are ordered on an as-needed basis only and that only the required amount is ordered for a specific time period. Modification of production processes Changes are made in the manufacturing process which will reduce the waste generated. The reduction can be accomplished through the alteration of 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 process equipment operation and maintenance will lead to significant reduction in waste. This can be done by evaluating existing operating processes or analyzing the manufacturing process for ways to improve their performance. The establishment of standard operating procedures can optimize the use of raw materials in the production process and thereby reduce the potential for loss of materials 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[6] may be substituted by a less hazardous or non-hazardous substance in either a drug formulation or a production process. This technique is widely used and applies to most of the manufacturing processes. Implementation of this technique of waste reduction may require only minor adjustments to the process. For example, it may require extensive new process equipment, a circuit board manufacturer can replace solvent-based product with water-based flux, while simultaneously replacing solvent vapor degreaser with detergent parts washer.

Modifying existing equipment to leverage better manufacturing techniques can significantly reduce waste generation. New or updated equipment can make more efficient use of raw materials which produce less waste. It also reduces the number of rejectedgoods and thus reduces the quantity of content that needs to be disposed of. Modification of existing process equipment can also be a cost-effective way to reduce waste generation[7]. In decreasing the number of parts that need to be reworked the amount of waste can be reduced considerably.Volume reduction includes those techniques that remove thehazardous 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.

Recovery and reuse:

This strategy will reduce the costs of waste disposal, reduce the costs [8]of raw materials and provide revenue from the waste. Waste can be collected on-site or off-site or through inter-industry exchange. There are several physical and chemical techniques available for reclaiming a waste material such as reverse osmosis, electrolysis, condensation, electrolyte recovery, filtration etc. Recycling of hazardous products, however, has no environmental benefit if it simply transfers the hazards into secondary products that must eventually be disposed of. Unless the goal is to reinvent the product for the use of non-hazardous materials, then recycling is not an appropriate solution.

- 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[9] 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.
- Set the door-to-door e-waste[10] 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 and informal collectors keeping the incentives to the informal as per minimum monetary expectations.
- The separated equipments, 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.

CONCLUSION

E-waste is in every corner of our culture. They are distinguished by a complex chemical composition and difficulties at local and international level in quantifying their flows. The pollution caused by their erratic management has mostly degraded the atmosphere in poorer countries, obtaining it for the processing and recovery of valuable metals. Motivated by minimizing environmental effects caused by the e-waste produced, numerous technological changes were made. They are:

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

To summarize the above, the separation of e-wastes from the rest of solid waste and their successful recycling are of great importance for the recovery of valuable raw materials. The management system has to be constructed with reason. The environmental benefits of collecting, transporting, managing and the financial benefits of recovery should not be set-off for system operation by the required resources and energy consumption.

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