

Electronic Waste - A Literature Review

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Abstract: *Electronic waste is informally known as e-waste for the electronic products nearing the end of their useful life. The e-waste products contain materials that are hazardous to the human beings, depending on their condition & density. The hazardous content of these materials pose a threat to human health and environment. In India electronic waste is producing in a huge quantity, since it has emerged as an it giant and due to modernization of lifestyle. Fridge, cell phones, discarded computers, mobiles & batteries etc, if not disposed properly, can leach lead & other substances to soil & underground water. This paper highlights the issues related to e-waste disposal methods & management of e-waste.*

Keywords: sources, disposal methods, national scenario, management & legislation

1. Introduction

India is a developing country, from the last decades increase in population & change of lifestyle, the demand of using electronic products is increased. In India e-waste generation is growing at 15% & is expected to cross 8000000 tonnes per year in 2012. A Central pollution control board (CPCB) report said 65 cities in India generate more than 60-70% of the total e-waste, which comes from 10 states, that's are followed by Maharashtra, Tamilnadu, Andhra Pradesh, Uttar Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh and Punjab in the list of e-waste generating states in India [1], [2].

This paper highlights the various sources of e-waste, disposal methods and management strategies for e-waste management. "Electronic waste" or "e-waste" consists of obsolete electronic devices. It is an emerging problem as well as a business opportunity of increasing significance, given the volumes of e-waste being generated and the content of both toxic and valuable materials in them. The fraction including iron, copper, aluminum, gold and other metals in e-waste is over 60%, while plastic account for about 30% and the hazardous pollutants comprise only about 2.70% [3].

2. Sources of Electronic Waste in India

The main sources of electronic waste in India are:

- A. Solder in printed circuit, glass panels & gaskets in computer monitor
- B. Chip resistors & Semiconductors
- C. Refrigerators & Batteries
- D. Mobiles
- E. Microwave & Air Conditioners etc.

3. Disposal Methods

The toxic materials, which are used in manufacturing of electronic goods can damage to the environment. It contains cathode ray tubes (CRTs), printed board assemblies, capacitors, mercury switches and relays, batteries, liquid crystal displays (LCDs), cartridges from photocopying

machines, selenium drums (photocopier) and electrolytes. The Disposal methods are as follows.

3.1 Land filling- this method is suitable for quantitatively small e-waste i.e. domestic & small users. E-Waste is piled up & covered with other domestic waste & soil.

3.2 Incineration- e-waste is burnt in controlled environment. The Toxic gases or smoke is released into atmosphere.

3.3 Reuse- the spares & components are removed from the device & with some modification, they are used for other applications.

3.4 Recycle- the important ingredients of e-waste is collected & sent to manufacturing companies producing similar components.

4. National Scenario of Electronic Waste

The growth of electronic waste is high in India, since it has emerged as an it giant and due to modernization of lifestyle. However, there is no proper disposal system in our country that has led to enormous amount of electronic waste. There is a need to find a proper recycling and disposal technique, so that reduce the environmental pollution and health hazards [4]. Estimated the total number of personal computers (PCs) emanating each Year from business and individual households in India will be around 1.38 million, according to a report of confederation of Indian industries, the total waste generated by obsolete electronics and electrical equipment (EEE) in India has been estimated to be 146,000 tons per year. The results of field survey conducted in Chennai, metropolitan cities of India to assess the average usage and life of PC, television (TV) and mobile phone shows that the average household usage of the PC ranges from 0.39 to 1.70 depending on their income. In case of TV, it varied from 1.07 to 1.78 and for mobile phones it varied from 0.88 to 1.70. The low income households use the PC for 5.94 years, TV for 8.16 years and the mobile phones for 2.34 years while, the upper class income use the PC for 3.21 years, TV for 5.13 years and mobile phones for 1.63 years. Although the per capita waste production in India is still relatively small, the total absolute volume of waste generated will be huge. The growth rate of the mobile

phones 80% is very high compared to PC 20% and t.v 18% [5].

According to trai, India added 113.26 million new cellular customers in 2008, with an average of 9.5 million customers added every month. Cellular market grew from 168.11 million in 2003-04 to 261.97 million in 2007-08. Microwave ovens and air conditioners registered a growth about 25% and refrigerator sales amounted to 4.2 million in 2006-07. Washing machines have always seen poor growth and the penetration level of colored televisions are increased three times in 2006-07. Solid waste management, which is already a mammoth task in India, has become more complicated by the invasion of e-waste, particularly computer waste in India. The preliminary estimates suggest the total waste in electrical & electronics generation In India is approximately 146,180 tons per year and which is exceeded 800,000 tons in 2012 [6]. The City wise ranking of largest waste of electronics & electrical generators is Mumbai, Delhi, Bangalore, Chennai, Kolkata, Ahmedabad, Hyderabad, Pune, Surat, Nagpur is shown below. The quantity of waste of electronics & electrical generation in different states in India as shown in table 1[6].

Table 1: E waste generation in top 10 cities of India

Sr No	City	Electronics & Electrical waste tonnes per year
1	Mumbai	11017.1
2	Delhi	9790.3
3	Bangalore	4648.8
4	Chennai	4132.2
5	Kolkata	4025.3
6	Ahmadabad	3287.5
7	Hvderabad	2833.5
8	Pune	2584.2
9	Surat	1836.5
10	Nagpur	1768.9

5. Management of Electronic Waste in India

Despite a wide range of environment legislation in India, there are no specific laws of guidelines for electronic waste or computers waste. As per the hazardous waste rules (1989), e-waste is not treated as hazardous unless proved to have higher concentration of certain substances. Though pcbs and crts would always exceed these parameters, there are several grey areas that need to be addressed. Basel convention has handling) rules, 1989 as amended in 2000 & 2003. The import of this waste therefore requires specific permission of the ministry of environment and forests. As the collection and re-cycling of electronic wastes is being done by the informal sector in the country at present, the government has taken the following action /steps to enhance awareness about environmentally sound management of electronic waste (confederation of Indian Industry Cii-,2006): several workshops of electronic waste management was organized by the central pollution control board(cpcb) in collaboration with toxic link, (cii)etc. Action has been initiated by Central pollution control Board (cpcb) for rapid assessment of the e-waste generated in major cities of the country[7].

A national working group has been constituted for formulating a strategy for e-waste management. A comprehensive technical guide on “environmental management for information technology industry in India” has been published and circulated widely by the department of information technology (DIT), ministry of communication and information technology. Demonstration projects have also been set up by the DIT at the Indian telephone industries for recovery of copper from printed circuit boards. Although awareness and readiness for implementing improvements is increasing rapidly, the major obstacles to manage the E-waste safely and effectively remain. These include - the lack of reliable data that poses a challenge to policy makers wishing to design an e-waste management strategy and to an industry wishing to make rational investment decisions. Only a fraction of the e-waste (estimated 10%) finds its way to recyclers due to absence of an efficient take back scheme for consumers, The lack of a safe e-waste recycling infrastructure in the formal sector and thus reliance on the capacities of the informal sector pose severe risks to the environmental and human health.

The existing e-waste recycling systems are purely business-driven that have come about without any government intervention. Any development in these e-waste sectors will have to be built on the existing set-up as the waste collection and pre-processing can be handled efficiently by the informal sector, at the same time offer numerous job opportunities[8].

6. Electronic Waste Legislation

The issue of electrical & electronics waste disposal, import and recycling has become the subject of serious discussion and debate among the government organizations, environmentalist groups and the private sector manufacturers of computers and consumer electronic equipment's[9].

India enacted its first comprehensive environmental law namely environmental production act (epa) in 1986. The rules under the epa gives upon the union government comprehensive powers to “take all such measures as is necessary or expedient for the purposes of protecting and improving the quality of environment and preventing, controlling and abating environmental pollution”. The implementation of the objectives of the epa, the hazardous waste management and handling rules were enacted in 1989. It was felt that it was essential to have a dividing line between waste and by product streams. Bringing further amendments to the hazardous wastes management and handling rules, 1989, the draft amendment rules, 2002 were notified as “the hazardous wastes management and handling rules, 2003” on 20 May 2003.

Since e-waste or its constituents fall under the category of ‘hazardous’ and ‘non-hazardous waste’, they have been covered under its purview. As per the rules, ‘hazardous waste’ is defined as any waste which by Reason of any of its physical, chemical, reactive, toxic, flammable explosive or corrosive characteristics causes danger or is likely to cause

danger to health or environment ,weather alone or when in contact with other wastes or substances[10]

India

Ministry of Environmental and Forest (moef) is the national authority responsible for legislation regarding waste management and environmental production. The guidelines for environmentally sound management of e-waste with an objective to provide guidance for identification of various sources of E waste and prescribed producers for handling e-waste in an environmentally sound manner. The Ministry of environment and forests (moef) has issued the following notifications related to hazardous wastes:

- 1) Hazardous wastes (management and handling) rules, 1989/2000/2002
- 2) Moef guidelines for management and handling of hazardous wastes,1991
- 3) Guidelines for safe road transport of hazardous chemicals,1995
- 4) The public liability act, 1991
- 5) Batteries (management and handling) rules, 2001
- 6) The national environmental tribunal act, 1995
- 7) Bio-medical wastes (management and handling) rules, 1998
- 8) Municipal solid wastes (management and handling) rules, 2000 and 2002[10]

7. Conclusion

Based on the literature survey, the following are the salient conclusions:

- 1) Modern Facilities are to be established for the collection of e-waste & for the disposal methods of e-waste.
- 2) E-Waste is increasing day by day more than the reuse & recycle.
- 3) Awareness Programmes about e-waste can be initiated nationwide, so that people may help in reducing it.
- 4) Electronic goods Manufacturing Companies must be legally ensured to mention the disposal methods of their product in their user manual.
- 5) Some Refund schemes can be taken by the government for collection of solid waste, to encourage the consumers, while the consumers return the electronic devices.
- 6) The Export of e-waste must be minimized & instead more number of recycling plants must be set up in India.
- 7) Government has to arrange workshops, seminars for the people who live in villages.
- 8) Banners can be laid in large quantity everywhere. Also Display Do's & Dont's on the banners.

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