

# E-waste Management-Suggested Solutions

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**Abstract**— *Electronic waste has been identified as discarded computers, old television sets, electronic equipment, entertainment devices, mobile phones, and refrigerators. This definition mostly include used electronics. Because loads of surplus electronics are frequently not eliminated including goods, recyclable, and non-recyclable so several people apply the term "e-waste" broadly to all surplus electronics. Rapid changes in technology, changes in media, falling prices, and planned obsolescence have resulted in a fast-growing surplus of electronic waste around the globe. This paper has an objective to present an overview of the problem and tries to advocate some concrete solutions to tackle the issue.*

**Keywords**— *e-waste, media, electronics, computer.*

## I. INTRODUCTION

Electronic waste may be defined as discarded computers, office electronic equipment, entertainment device electronics, mobile phones, television sets and refrigerators. e-wastes are considered dangerous, as certain components of some electronic products contain materials that are hazardous, depending on their condition and density [3]. E-waste is a popular, informal name for electronic products nearing the end of their useful life. Anything that runs on electricity/battery or has wire and completed its life is e-waste [1][2]. The hazardous content of these materials pose a threat to human health and environment. Discarded computers, televisions, VCRs, stereos, copiers, fax machines, electric lamps, cell phones, audio equipment and batteries if improperly disposed can leach lead and other substances into soil and groundwater. Electronic waste, e-waste, e-scrap, or Waste Electrical and Electronic Equipment (W.E.E.E) [7] describes discarded electrical or electronic devices. There is a lack of consensus as to whether the term should apply to resale, reuse, and refurbishing industries, or only to product that cannot be used for its intended purpose.

In most part of the world, underground water is not drinkable directly. Long ago, people simply used to draw up water from wells and drink it. But now, you have to use some sort of filter to purify the water and make it drinkable. It is just one of the many problems and hazards of **E-waste**. The electronic devices, dead cells and batteries you throw away with other garbage contain lead that easily mixes with underground water, making it unfit

for direct consumption. That is just the tip of the iceberg – the problems of e-waste disposal. [13]

Informal processing of electronic waste causes serious health and pollution problems. Some of categories include: Mobile Phones, Computers, Servers, Telecom, TV, Calculators, Audio, Scanners, Printers, Air Conditioner, Microwave, Washing Machine, Cartridges, Military electronic, Mother board, Alarm, Sirens, Automobile Catalytic Converter, Sensor, CD, Security Device etc.

The technical prowess acquired during the last century has posed a new challenge in the management of wastes. For example, personal computers (PCs) contain certain components, which are highly toxic, such as chlorinated and brominated substances, toxic gases, toxic metals, biologically active materials, acids, plastics and plastic additives. The hazardous contents [6] of these materials pose an environmental and health threat. Thus proper management is necessary while disposing or recycling e-wastes. The paper highlights these issues.

## II. RECENT STUDIES

our environment will be 3x more congested with e-waste by end of 2017. The reason why e-waste is increasing, is that technology is growing fast and in an attempt to get better devices, we casually get rid of old electronics – the best examples being that of smartphones. Debate continues over the distinction between "commodity" and "waste" electronics definitions [9]. Some major points worth mentioning are [3]:

- An estimated 50 million tons of E-waste are produced each year. [4]
- The United States is the world leader in producing electronic waste, tossing away about 3 million tons each year [8]
- China already produces about 2.3 million tons (2010 estimate) domestically, second only to the United States [10].
- USA discards 30 million computers each year and 100 million phones are disposed of in Europe each year [5]
- The Environmental Protection Agency estimates that only 15-20% of e-waste is recycled, the rest of these electronics go directly into landfills and incinerators [5]
- Legal framework, proper collection system missing.

- Imports regularly coming to the recycling markets.

### III. INDIAN SCENARIO

IT and telecom are two fastest growing industries in the country. India, by 2016 has achieved 246 per 1000 compared to 2011 PC penetration of **95 per 1000** from the 14 per 1000 in 2008. At present, India has 95 million One of the most threatening substances is lead, of which only 5 percent is recycled in India [12]. Indians will not junk their mobiles, but pass them on to a new low-end user who will, in turn, junk them in the flea market from where the instruments make their way to the Kabadiwallas. Major issues related to Indian scenario are:

- India's hospitals to see patients with 10 times the expected level of lead in their blood
- In India, a water sample revealed levels of lead 190 times as high as the drinking water standard set by the World Health Organization.
- Thousands of children throughout the India are attending schools that were built on or near toxic waste sites, with increased risk of developing asthma, cancer, learning disorders and other diseases linked to environmental pollutants.
- 1-20 kg per person/p.a and growing at 3 times faster than the municipal waste
- Over 200 million current mobile users
- Preliminary estimates suggest that total WEEE generation in India is approximately 1,46,000 tonnes per year.
- 20 million electronic household appliances including TV, washing machines, PCs etc) and 70 million cell phones reach end-of-life every year. Memory devices, MP3 players, iPods, ipads etc. are the newer additions.
- About 70% of the heavy metals (mercury and cadmium) and 40% lead, in landfills in India come from e-waste
- 22% of the yearly world consumption of mercury is used in electronics manufacture
- More of acid content flow into the land contaminating the soil and land value.
- About 70 percent, of heavy metals in India landfills comes from E-Waste.
- World's 80% population live in areas of cell phone reception
- Indians upgrade or exchange their cell phones every 18 months, meaning there are approximately 16 million unused mobile phones stashed away at home or in the office
- Average working life of a mobile phone is 7 years but worldwide the average consumer changes their mobile every 11 months

**e-waste is exported to India because of major reasons as:**

- Cheap labour : rates are approximately  
US - \$ 30/ computer  
India - \$ 2/ computer  
Saving - \$ 28/ computer
- Weak environmental laws
- Excess dumping of CRT tubes due to the ramp walk of flat screen monitors
- Driven by the potential for corporate profits

### IV. E-WASTE HEALTH PROBLEMS AND MANAGEMENT

E-waste is very valuable as it (a) recover precious metals (b) recover plastic etc. Three categories of WEEE account for almost 90% of the generation:

Large Household appliances:	42.1%
Information and communications: technology equipment	33.9%
Consumer Electronics:	13.7%

Inhalation of open fire emissions can trigger asthma attacks, respiratory infections, and cause other problems such as coughing, wheezing, chest pain, and eye irritation [11]. example : burning PVC releases hydrogen chloride, which on inhalation mixes with water in the lungs to form hydrochloric acid. This can lead to corrosion of the lung tissues, and several respiratory complications. Table 1 gives a view of e-waste health hazardous.

Table I: 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)	<ul style="list-style-type: none"> <li>Damage to central and peripheral nervous systems, blood systems and kidney damage.</li> <li>Affects brain development of children.</li> </ul>
Chip resistors and semiconductors	Cadmium (CD)	<ul style="list-style-type: none"> <li>Toxic irreversible effects on human health.</li> <li>Accumulates in kidney and liver.</li> <li>Causes neural damage.</li> <li>Teratogenic.</li> </ul>
Relays and switches, printed circuit boards	Mercury (Hg)	<ul style="list-style-type: none"> <li>Chronic damage to the brain.</li> <li>Respiratory and skin disorders due to bioaccumulation in fishes.</li> </ul>

Corrosion protection of untreated and galvanized steel plates, decorator or hardner for steel housings	Hexavalent chromium (Cr) VI	<ul style="list-style-type: none"> <li>• Asthmatic bronchitis.</li> <li>• DNA damage.</li> </ul>
Cabling and computer housing	Plastics including PVC	Burning produces dioxin. It causes <ul style="list-style-type: none"> <li>• Reproductive and developmental problems;</li> <li>• Immune system damage;</li> <li>• Interfere with regulatory hormones</li> </ul>
Plastic housing of electronic equipments and circuit boards.	Brominated flame retardants (BFR)	<ul style="list-style-type: none"> <li>• Disrupts endocrine system functions</li> </ul>
Front panel of CRTs	Barium (Ba)	Short term exposure causes: <ul style="list-style-type: none"> <li>• Muscle weakness;</li> <li>• Damage to heart, liver and spleen.</li> </ul>
Motherboard	Beryllium (Be)	<ul style="list-style-type: none"> <li>• Carcinogenic (lung cancer)</li> <li>• Inhalation of fumes and dust. Causes chronic beryllium disease or beryllicosis.</li> <li>• Skin diseases such as warts.</li> </ul>

Av PC of Appx 31 kg wt contains		Two million obsolete Pcs would mean
7.24 kg	Plastics	14,427,000 kg
1.98 Kg	Lead	3,962,700 kg
0.693 g	Mercury	1,386 kg
0.4095 g	Arsenic	819 kg
2.961 g	Cadmium	5,922 kg
1.98 g	Chromium	3,969 kg
9.92 g	Barium	19,845 kg
4.94 g	Beryllium	9, 891 kg

**V. PROPOSED SOLUTIONS**

As of now, there are no proper methods being implemented even in the first world to eliminate the problem of e-waste. The general methods for proper treatment of e-waste are **recycling** and **refurbishing**.

For recycling, there may be products that cannot be recycled completely. PVC layers, for example, stay as such for ages and cannot be recycled. It would be better if the manufacturers use recyclable material so that the e-waste is converted into something that can be used again without harming the planet and its inhabitants. Thus, one of the major factors in treating e-waste is to compel manufacturers to use green elements.

A number of websites offers links to recycling centers:

- International Association of Electronics Recyclers
- Electronic Industries Alliance
- Electronics Recycling Initiative

If electronics are refurbished, they can be sold again at a lower price. Thus, both the society and environment will benefit. Instead of simply dumping your old TV into the garbage bin, you might want to think about calling the vendor and ask him where to present the item for refurbishing. Other solutions can be

**1. Donate :** Give an operable computer to a local family, friend, school, or nonprofit such as Goodwill or Technology Training Foundation.[14]

**2. Involve businesses :** The IBM PC Recycling Service allows consumers and businesses to recycle any computer for a small fee, including shipping. Hewlett Packard offers a similar service. Or businesses can consult with a company such as Newtech Recycling, which provides equipment resale, donations, or recycling.

- [www.ibm.com/ibm/environment/products](http://www.ibm.com/ibm/environment/products)
- [www.hp.com/hpinfo/globalcitizenship/environment](http://www.hp.com/hpinfo/globalcitizenship/environment)
- [www.newtechrecycling.com](http://www.newtechrecycling.com)

- Ban on total imports of e- waste.
- Domestic legal framework to address these gaps in import of E Waste
- Need to address safe disposal of domestic waste.
- Tie recycling in with take-back product
- The Framework should address the issue of E waste imports for reuse and recycling.
- Attract investment in this sector
- Link up activities of informal sector with formal sector
- Provide for appropriate framework for processes
- Promote adequate ESM technologies for recycling
- Incorporate precautionary principles and polluter pays
- Adopt Consultative process
- Picked over Junk, Obsolete and burnt
- Insist on domestic processing
- Then make sure the company you select has capacity to handle either type of E-Scrap.
- Promote recycling units to ease process and to encourage generators to have proper e-waste disposal

- Impart training to generators on e-waste handling
- Awareness program on recycling
- Fix duties and responsibilities to recyclers
- Tax incentives for scrap dealers
- Reward and reprimand schemes for performance and non-compliance of e-waste management
- To make recycling business viable one
- Government should encroach legal import of e-waste
- Should subsidize recycling and disposal industry
- Incentive schemes for garbage collectors, general public
- Disposal fee from manufacturers and consumers

Some organizations already helping the cause are:

- mineralpolicy.org, mpi.org.au, USGS.gov, moles.org, ban.org, copper.org
- www.antigraymarket.org, other links www.retroworks.com
- Over 1,000 parts requests per day via internet parts exchange www.10.tradeloop.com
- Contact with over 200 international repair shops via exporters.com.sg, alibaba.com, globalrecycle.net, recycle.net, etc. www.exporters.com/sg
- Sales of parts and refurbishment on ebay.com, www.ebay.com
- Scrap copper, alum, plastic sold directly to end users www.globalrecycle.net

**Also some more points that can be considered while buying electronic products are:**

- are made with fewer toxic constituents
  - use recycled content
  - are energy efficient
  - are designed for easy upgrading or disassembly
  - utilize minimal packaging
  - offer leasing or take back options
  - have been certified by regulatory authorities.
- Customers should opt for upgrading their computers or other electronic items to the latest versions rather than buying new equipments.

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