

ENVIS

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FROM EDITOR'S DESK

*Electronic products have made our life easy by saving time and being efficient that now it has become difficult for us to function without electronic equipments. A house wife can save her time by using mixer and grinder for grinding ingredients and cook food in microwave oven in few minutes. Communication systems have revolutionalised by way of mobile phones, ipods, internet etc. Entertainment products like television and music system have added enjoyment to our life. Electronic products, which were once thought to be luxury, has presently become a need. From villages to cities, all of them have electronic products either in the form of 2-band radio or a high tech computer. There are places in India where people do not have access to electricity but they still have electronic products operated with battery. Increase in the use of electronic products have resulted in increase in production of these products and hence created a new waste which is termed as **ELECTRONIC WASTE** or **E-WASTE** or **Waste Electrical and Electronic Equipment (WEEE)**.*

Hence, "E-Waste has no more remained a new and unique terminology to India which used to be a common thing in the west after IT development. It has become more important for a country like India as it can not afford to pollute its environment and damage human health, and then plan to clean up. Western countries have learnt from their mistakes and have made serious attempts to bring an order so that their environment is kept clean. India has dual task of first plan for taking care of its E-waste and also address issue of illegal import.

This newsletter makes an attempt to address some of these issues and I am sure readers will find it interesting."

Contents in the article -

- **What is E-waste?**
- **The Indian scenario of E-Waste.**
- **Environment and Health Hazards caused by E-waste.**
- **Management of E-waste.**
- **E-waste recycling in India.**
- **Conclusion.**

E-waste - Indian perspective

What is E-waste?

E-waste generally refers to scrap materials of electronic products consisting of any broken or unwanted electrical or electronic appliance. E-waste contains potentially toxic components which are hazardous in nature. The toxic components in the E-waste includes lead, mercury cadmium, printed circuit boards, arsenic, silicon, chromium, barium, bromine, poly vinyl chloride and other heavy metals. It is estimated that, the average computer or television monitor contains four pounds of lead within the cathode ray tube and comprises the largest single source of lead in Municipal Solid Waste. Hence, improper handling of E-waste leads to environment and health hazards.

Rapid technology change, low initial cost and even planned obsolescence have resulted in a fast growing problem of E-waste. People use electronic products extensively but they do not realize about the waste created when electronic products are discarded.



The electronic products which form the E-waste are classified as :

- Appliances
- IT equipments
- Entertainment equipments
- Telecommunication equipments



- Data, audio and video media
 - o CDs
 - o DVDs
 - o Tape recorders
- Printer consumables
 - o Ink cartridge
 - o Toner cartridge
 - o Laser printer, developer units
- PCB (Printed Circuit Boards)
- Batteries

Among top 10, consumer electronics equipment producing countries includes:

1. Japan-29.1%
2. China-10.4%
3. South Korea-8.4%
4. U.S.A-7.8%
5. Malaysia-7.0%
6. Germany-3.5%
7. Brazil-3.0%
8. Mexico-2.8%
9. Hong Kong-2.7%
10. Singapore-2.6%

Electronic industry can be generally divided into four distinct areas:

1. Consumer electronics, mainly relating to audio/video entertainment sector.
2. Telecommunication, radars, and other communication equipments.
3. Industrial applications, process control, test and measurement, medical and other areas.
4. Computer and office equipments.

The Indian scenario

IT and Telecom are two fastest growing industries in India. The Indian IT industry has a prominent global presence today largely due to the software sector. Promotion of the software industry and protection of the hardware industry from external competition has resulted in this skewed growth. More recently however, policy changes have led to a tremendous influx of leading multinational companies into India to set up manufacturing facilities, R&D centers and offshore software development facilities. The domestic market is getting revitalized due to buoyant economic growth and changing consumption patterns have led to an addition of wide range of E-waste churned out from Indian households, commercial establishments, industries and other public sectors, into the waste stream. Solid waste management, which is already a mammoth task in India, has become more complicated by the invasion of e-waste, particularly computer waste to India, from different parts of the world. By the end of financial year 2005-06, India had an installed base of 4.64 million desktops, about 431 thousand notebooks and 89 thousand servers. As per MAIT estimates, the Indian PC industry are growing at a 25% compounded annual growth rate.

This growth has significant economic and social impacts. The increase of electronic products, consumption rates and higher obsolescence rate leads to higher generation of electronic waste (e-waste). The increasing obsolescence rates of electronic products added to the huge import of junk electronics from abroad create complex scenario for solid waste management in India. Ten states generate 70% of the total e-waste generated in India. Maharashtra ranks first followed by Tamil Nadu, Andhra Pradesh, Uttar Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh and Punjab in the list of e-waste generating states in India. Among top ten cities generating e-waste, Mumbai ranks first followed by Delhi, Bangalore,

Chennai, Kolkata, Ahmedabad, Hyderabad, Pune, Surat and Nagpur. As per country level Waste Electrical and Electronic Equipment (WEEE) assessment study, Mumbai and Pune falls under the top ten cities that are generating maximum quantities and Mumbai alone generates maximum among all the cities of India. Total WEEE waste generation in Maharashtra is 20270.6 tons, out of this Navi Mumbai contributes 646.48 tons, Greater Mumbai 11017.06 tons, Pune 2584.21 tons and Pimpri-Chinchwad 1032.37 tons.

Environment and Health hazards caused by E-waste

E-waste creates a change and hence an impact on environment when disposed. When e-waste is land filled or incinerated, toxic substances are released causing environmental pollution and health hazards. Improper recycling and disposal operations found in different cities of India often involve the open burning of plastic waste, exposure to toxic solders, river dumping of acids, and widespread general dumping. As a result, pollutants are dumped into the land, air and water. Computer wastes that are land filled produces contaminated leachates which eventually pollute the groundwater. Acids and sludge obtained from melting computer chips, disposed on the ground causes acidification of soil. When brominated flame retardant plastic or cadmium containing plastics are land filled, both Poly Brominated Diphenyl Ethers (PBDE) and cadmium may leach into the soil and groundwater. It has been found that significant amounts of lead ion are dissolved from broken lead containing glass, such as the cone glass of cathode ray tubes, gets mixed with acid waters in landfills. The most dangerous form of burning e-waste is the open-air burning of plastics in order to recover copper and other metals. The toxic fall-out from open air burning affects both the local environment and global air currents. The following table summarizes environment and health effects of certain constituents in e-wastes.

E-waste components	Process
CRTs/Picture tube	Breaking and removal of Copper yoke and dumping
PCB (Printed Circuit Board)	Desoldering and removing computer chips
Dismantled PCB Processing	Open burning of boards to remove metals
Chips and other gold plated components	Chemical stripping using nitric and sulphuric acid along river banks
Plastics	Shredding and low temperature melting to manufacture poor grade plastics
Wires	Open burning to recover copper
Miscellaneous parts	Open burning to recover steel and other metals
Toner cartridges	Use of paint brushes to recover toner without any protection
Secondary steel or copper or precious metals	Furnace recovery of steel or copper from waste
Aluminium	Used in PWB,CRT connectors
Selenium	Send picture signals over wire
Zinc	Picture tubes, glass plate of television cameras has coating of ZnS
Iron	Inductors in PCB
Copper	Conductors
Solder (Constituent in lead)	PCB, glass panel and gasket in monitor
Mother board(Constituent in Beryllium)	Removal of plastics and metal by breaking the parts
Lead	Soldering of PCB

Health Hazards	Potential Environmental Hazards
<ul style="list-style-type: none"> • Silicosis • Cuts from CRT glass • Inhalation of Phosphor, Cadmium etc. 	<p>Lead, barium and other heavy metals leaching into ground water, release of toxic phosphor</p>
<ul style="list-style-type: none"> • Tin and lead inhalation. Possible brominated dioxins, beryllium, cadmium, mercury inhalation • Causes neural damage and accumulates in kidney and liver 	<p>Air emission of the same substances causes air pollution</p>
<ul style="list-style-type: none"> • Toxicity to workers and nearby residents from tin, lead, beryllium, mercury inhalation 	<p>Surface and ground water pollution and air pollution</p>
<ul style="list-style-type: none"> • Acid contact with eyes, skin may result impermanent injuries • Inhalation of fumes of acid can cause respiratory irritation like pulmonary edema, circulatory failure and death 	<p>Hydrocarbons, heavy metals discharged to river and bank, acidifies river destroying aquatic life</p>
<ul style="list-style-type: none"> • Probable hydrocarbon, Brominated dioxins and heavy metals exposure Disrupts endocrine system functions 	<p>Air emission of brominated dioxins and heavy metals and hydrocarbons</p>
<ul style="list-style-type: none"> • Aromatic hydrocarbons (carcinogenic) exposure to workers. 	<p>Aromatic hydrocarbon discharged to air, water and soil</p>
<ul style="list-style-type: none"> • Aromatic hydrocarbons and potential dioxins exposure 	<p>Hydrocarbon ashes discharged to air, water and soil</p>
<ul style="list-style-type: none"> • Respiratory tract irritation • Carbon black leads to possible human carcinogen 	<p>Cyan, tallow and magenta toners unknown toxicity</p>
<ul style="list-style-type: none"> • Exposure to dioxins and heavy metals causes asthmatic bronchitis and DNA damage 	<p>Air emission of dioxins and heavy metals</p>
<ul style="list-style-type: none"> • Alzheimer's disease and Parkinson's disease 	<p>Disposal leads to water pollution</p>
<ul style="list-style-type: none"> • Nausea, diarrhea, fatigue, hair loss and diseased nails 	<p>Disposal causes environmental threat</p>
<ul style="list-style-type: none"> • Vomiting diarrhea and damage to kidney 	<p>Disposal causes water pollution and disturbs aquatic environment</p>
<ul style="list-style-type: none"> • Siderosis disease 	<p>Disposal in land fill causes water pollution</p>
<ul style="list-style-type: none"> • Wilson's disease 	<p>Disposal inland fill causes water pollution</p>
<ul style="list-style-type: none"> • Damage to central and peripheral nervous system • Kidney damage • Affects brain development of children 	<p>Leaching in soil and water causes pollution</p>
<ul style="list-style-type: none"> • Berylliosiss • Skin disease like warts 	<p>Disposal leads to environmental damage</p>
<ul style="list-style-type: none"> • Negative effect on children's brain development 	<p>Acute and chronic toxic effects on plants, animals, and microorganisms</p>

Management of E-Waste

It is estimated that 75% of electronics items are stored due to uncertainty of how to manage it. This necessitates implemental management measures. There must be coordination between the consumers, industry and government to form policies for reducing e-waste generation

Role of Industries in E-waste management:

In industries management of e-waste should begin at the point of generation. This can be done by waste minimization techniques and by sustainable product design.

Waste minimization in industries involves adopting:

- Inventory management,
- Production-process modification,
- Volume reduction,
- Recovery and reuse.

Sustainable product design

- Rethink on procedures of designing of the product (flat computers)
- Use of renewable material and energy
- Create electronic components and peripherals of biodegradable material
- Look at green packaging option
- Utilization of minimum packaging material
- Offer lease or taken by option

Role of Government in E-waste management:

- Governments should set up regulatory agencies for e-waste management.
- Collect basic information on the materials from manufacturers, processors and importers and to maintain an inventory of these materials. The information should include toxicity and potential harmful effects.
- Encourage beneficial reuse of "E-waste" and encouraging business activities that use "E-waste". Set up programs so as to promote recycling among citizens and businesses.
- Educate e-waste generators on reuse/recycling options
- Governments should explore opportunities to partner with manufacturers and retailers to provide recycling services
- Governments should enforce strict regulations against dumping e-waste in the country by outsiders. Where the laws are flouted, stringent penalties must be imposed. In particular, custodial sentences should be preferred to paltry

finances, which these outsiders / foreign nationals can pay.

- Governments should encourage and support NGOs and other organizations to involve actively in solving the nation's e-waste problems.

Role of Citizens in E-waste management:

Donating electronics for reuse extends the lives of valuable products and keeps them out of the waste management system for a longer time. By donating used electronics, schools, non-profit organizations, and lower-income families can afford to use equipment that they otherwise could not afford.

E-wastes should never be disposed with garbage and other household wastes. This should be segregated at the site and sold or donated to various organizations.

While buying electronic products opt for those that:

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

Recycling of E-Waste:

Recycling is the best option for E-waste as most of the components found in e-waste are recyclables. As country is developing the latest techniques are in use hence different electronic items are in market as a result electronic piles are growing and simultaneously their pollution potential. Growing segment of E-waste is becoming a substantial concern because of its hazardous and toxic material content. Hence, there is need for recycling E-waste which in return will reduce solid waste disposal problem. This is also a main issue of concern to most of the urban municipalities as the existing dumping grounds in India are full and overflowing beyond capacity and it is difficult to get new dumping sites due to scarcity of land. There is no large scale organized E-waste recycling facility in India and the entire recycling exists in un-organized sector. Some of the recycling processes are extremely harmful and have negative impacts on the workers 'health and the environment'. A study on the burning of printed wiring boards that was conducted in the year 2004



showed an alarming concentration of dioxins in the surrounding areas in which open burning was practiced.

There are two small WEEE/E-waste dismantling facilities functioning in Chennai and Bangalore. The HAWA project as a part of its E-waste activity carried out a survey in 2003, through an NGO (SAHAS), to identify the informal E-waste recyclers in Bangalore. It was thus estimated that there are about 200 recyclers in the city. The project aimed to create an awareness on the hazards related to their work. The project team with its utmost efforts was successful in forming the informal recycling association which was the first informal association in the country. Once the association was formed than several training programs were conducted on environment, health and safety and inventory management etc. The recyclers were happy to enjoy the status of an association. Finally through massive effort by Indo-German-Swiss E-waste initiative and M/s Paradigm Environmental Strategies Private Limited the recyclers were brought together to form a company named "The Edward and Co". The challenge therefore was not to take the business away from the people, but to integrate them in a transparent and fully organized system.

China is the second largest producer of consumer electronic equipments in the world. Beijing, the capital city of China promotes recycling of electronic garbage by setting up a network of recycling centers for electronic products such as home appliances. The project had received investment from a private company and is already underway. It has a designed annual capacity of dismantling 1.2 million units of discarded home appliances. In 2006, Beijing households produced 110,000 tons of "electronic garbage", including 2.3 million cell phones. By 2010, the city is estimated to produce 150,000 tons of "electronic garbage", according to Zhang. Thus, the city will have a formal collection and recycling system in near future.

Conclusion

We are using electronic products for last 60 years however, there is no proper disposal system followed in the country which has led to enormous amount of e-waste. The situation is becoming alarming day by day also due to the fact that large quantity of waste is getting imported in the country. There is a need to find proper disposal and recycling technique so that environmental pollution and health hazards can be reduced. Today if large amount of e-waste is kept away from the dumpsites, it is due to the informal recyclers. It is a large and complex network of small family business, playing an important role in minimizing e-waste. Very few researches have been carried out to manage e-waste in a sustainable manner like the one experienced in the Bangalore city. E-waste management and recycling should be an integral part for the manufacturing industries too. Recycling these electronic products in an organized manner not only reduces the cost of raw material use to manufacture other goods, but also provides employment to hundreds of people. It reduces the problem of e-waste disposal and increases the life cycle of the components found in e-waste. Various technical solutions are available but a legal framework, proper collection system, logistics and other services need to be implemented before a technical solution can be applied. There is urgent need for E-waste legislation given the fact that almost unregulated management of E-waste is being continued leading to environment and health hazards in the country. NGOs and Government should adopt a participatory approach in forming the legislation on e-waste management.

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- Greenpeace

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City Waste Asia

17-06-2008
Harbourfront Tower 1 Singapore
<http://www.terrapinn.com/2008/citywaste/index.stm>

E-sessions Food Waste Recycling

02-04-2008
Web: <http://swanastore.stores.yahoo.net/foware.html>

Indian International Recycle & Waste Management Exhibition and Conference

28-03-2008
New Delhi,
India
Web: www.iirwm.com

31st Annual Landfill Gas Symposium

10-03-2008
Houston Texas
USA
Web: <http://lfg.swana.org/>

Irish Recycling & Waste Management

05-03-2008
Dublin, Ireland
Web: [//www.environment-ireland.com/](http://www.environment-ireland.com/)

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