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Effect of Electronic Waste on Environmental and it's Management

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ABSTRACT: Electronic waste may be defined as discarded computers, office electronic equipment, entertainment device electronics, mobile phones, television sets and refrigerators. This definition includes used electronics which are destined for reuse, resale, salvage, recycling, or disposal. Because loads of surplus electronics are frequently commingled (good, recyclable, and non-recyclable), several public policy advocates apply the term "e-waste" broadly to all surplus electronics. Rapid changes in technology, changes in media (tapes, software, MP3), falling prices, and planned obsolescence have resulted in a fast-growing surplus of electronic waste around the globe. This paper presents an overview of the problem and suggests some concrete solutions to tackle the issue.

KEYWORDS: E-waste, media, electronics, computer.

I.INTRODUCTION

The electronic industry is the world's largest and fastest growing manufacturing industry (Radha, 2002; DIT, 2003). During the last decade, it has assumed the role of providing a forceful leverage to the socio - economic and technological growth of a developing society. The consequence of its consumer oriented growth combined with rapid product obsolescence and technological advances are a new environmental challenge - the growing menace of "Electronics Waste" or "e waste" that 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 plastics account for about 30% and the hazardous pollutants comprise only about 2.70% (Widmer et al., 2005).

Solid waste management, which is already a critical task in India, is becoming more complicated by the invasion of e-waste, particularly computer waste. E-waste from developed countries find an easy way into developing countries in the name of free trade (Toxics Link, 2004) is further complicating the problems associated with waste management. The paper highlights the associated issues and strategies to address this emerging problem, in the light of initiatives in India. Industrial revolution followed by the advances in information technology during the last century has radically changed people's lifestyle. Although this development has helped the human race, missmanagement has led to new problems of contamination and pollution. 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 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 and pose some concrete suggestions.

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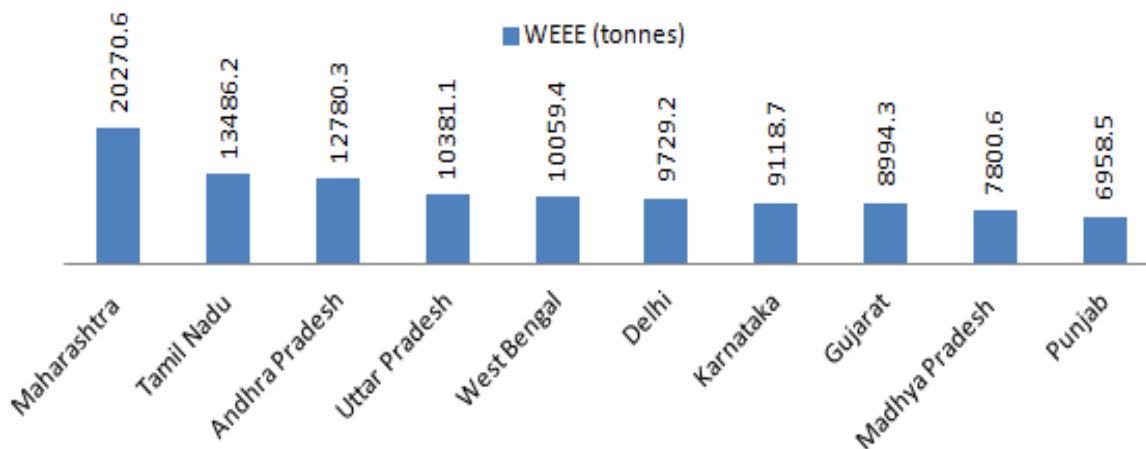
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II.RELATED WORK

As there is no separate collection of e-waste in India, there is no clear data on the quantity generated and disposed of each year and the resulting extent of environmental risk. The preferred practice to get rid of obsolete electronic items in India is to get them in exchange from retailers when purchasing a new item. The business sector is estimated to account for 78% of all installed computers in India (Toxics Link, 2003). Obsolete computers from the business sector are sold by auctions. Sometimes educational institutes or charitable institutions receive old computers for reuse. It is estimated that the total number of obsolete personal computers emanating each year from business and individual households in India will be around 1.38 million. According to a report of Confederation

At present, India has 95 million one of the most threatening substances is lead, of which only 5 percent is recycled in India [11]. 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:

- 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.
- Preliminary estimates suggest that total WEEE generation in India is approximately 1,46,000tons 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, iPod’s 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.Over 200 million current mobile users.
- 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.



10 largest E-waste generating states
Fig.1 Most WEEE (Waste Electrical and Electronic Equipment) state in India.

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III. IMPACT OF E-WASTE

Electronic wastes can cause widespread environmental damage due to the use of toxic materials in the manufacture of electronic goods (Mehra, 2004). Hazardous materials such as lead, mercury and hexavalent chromium in one form or the other are present in such wastes primarily consisting of 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. Although it is hardly known, e-waste contains toxic substances such as Lead and Cadmium in circuit boards; lead oxide and Cadmium in monitor Cathode Ray Tubes (CRTs); Mercury in switches and flat screen monitors; Cadmium in computer batteries; polychlorinated biphenyls (PCBs) in older capacitors and transformers; and brominated flame retardants on printed circuit boards, plastic casings, cables and polyvinyl chloride (PVC) cable insulation that releases highly toxic dioxins and furans when burned to retrieve Copper from the wires. All electronic equipments contain printed circuit boards which Sardinia 2007, Eleventh International Waste Management and Landfill Symposium are hazardous because of their content of lead (in solder), brominated flame retardants (typically 5-10 % by weight) and antimony oxide, which is also present as a flame retardant (typically 1-2% by weight) (Devi et al, 2004). Landfilling of e wastes can lead to the leaching of lead into the ground water. If the CRT is crushed and burned, it emits toxic fumes into the air (Ramachandra and Saira, 2004).

These products contain several rechargeable battery types, all of which contain toxic substances that can contaminate the environment when burned in incinerators or disposed of in landfills. The cadmium from one mobile phone battery is enough to pollute 600 m³ of water (Trick, 2002). The quantity of cadmium in landfill sites is significant, and considerable toxic contamination is caused by the inevitable medium and long-term effects of cadmium leaking into the surrounding soil (Envocare, 2001). Because plastics are highly flammable, the printed wiring board and housings of electronic products contain brominated flame retardants, a number of which are clearly damaging to human health and the environment. Impacts of informal recycling the accrued electronic and electric waste in India is dismantled and sorted manually to fractions such as printed wiring boards, cathode ray tubes (CRT), cables, plastics, metals, condensers and other, nowadays invaluable materials like batteries. It is a livelihood for unorganized recyclers and due to lack of awareness, they are risking their health and the environment as well. The valuable fractions are processed to directly reusable components and to secondary raw materials in a variety of refining and conditioning processes. No sophisticated machinery or personal protective equipment is used for the extraction of different materials.

All the work is done by bare hands and only with the help of hammers and screwdrivers. Children and women are routinely involved in the operations. Waste components which does not have any resale or reuse value are openly burnt or disposed off in open dumps. Pollution problems associated with such backyard smelting using crude processes are resulting in fugitive emissions and slag containing heavy metals of health concern. CRT breaking operations result in injuries from cuts and acids used for removal of heavy metals and respiratory problems due to shredding, burning etc. They use strong acids to retrieve precious metals such as gold. Working in poorly ventilated enclosed areas without masks and technical expertise results in exposure to dangerous and slow poisoning chemicals. Polychlorinated biphenyls (PCBs) in older capacitors and transformers; and brominated flame retardants on printed circuit boards, plastic casings, cables and polyvinyl chloride (PVC) cable insulation can release highly toxic dioxins and furans when burned to retrieve copper from the wires.

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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"> •Damage to central and peripheral nervous systems, blood systems and kidney damage. •Affects brain development of children.
Relays and switches, printed circuit boards	Mercury (Hg)	<ul style="list-style-type: none"> •Chronic damage to the brain. •Respiratory and skin disorders due to bioaccumulation in fishes.
Chip resistors and semiconductors	Cadmium (Cd)	<ul style="list-style-type: none"> •Toxic irreversible effects on human health. •Accumulates in kidney and liver. •Causes neural damage.
Corrosion protection of untreated and galvanized steel plates, hardener for steel housings	Hexavalent chromium (Cr VI)	<ul style="list-style-type: none"> •Asthmatic bronchitis. •DNA damage.
Cabling and computer housing	Plastics including PVC	<ul style="list-style-type: none"> •Reproductive and developmental problems. •Immune system damage. •Interfere with regulatory hormones

3.1-Impacts of E-waste on the environment

Effects on air- One of the most common effect of E-waste on air is through air pollution. For example, a British documentary about Lagos and its inhabitants, called Welcome to Lagos, shows a number of landfill scavengers who go through numerous landfills in Lagos looking for improperly disposed electronics which includes wires, blenders, etc., to make some income from the recycling of these wastes. These men were shown to burn wires to get the copper (a very valuable commodity) in them by open air burning which can release hydrocarbons into the air.



Fig.2 Burning of electronic device for extracting of metals.

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Effects on water- When electronics containing heavy metals such as lead, barium, mercury, lithium (found in mobile phone and computer batteries), etc., are improperly disposed, these heavy metals leach through the soil to reach groundwater channels which eventually run to the surface as streams or small ponds of water. Local communities often depend on these bodies of water and the groundwater. Apart from these chemicals resulting in the death of some of the plants and animals that exist in the water, intake of the contaminated water by humans and land animals results in lead poisoning. Some of these heavy metals are also carcinogenic.



Fig.3 Heavy metals leach through the soil to reach groundwater channels which eventually run to the surface as streams or small ponds of water.

Effects on soil- Burning of e-waste on an open landfill for obtaining gold and other precious metals produce fine particulate matter from the smoke produced and cause cardio-vascular and pulmonary ailments for children in that specific area. The wind pattern of a particular area carry toxic particles and they enter the soil-crop-food pathway affecting both humans and animals as they enter the food chain. The mother boards have abnormal level of mercury and improper disposal may cause skin and respiratory diseases. Drinking water contaminated with lead affects the central and nervous system and causes poor brain growth, dwarfism, hearing disability and impaired formation and function of blood cells. Toxic heavy metals and chemicals from e-waste enter the “soil-crop-food pathway,” one of the most significant routes for heavy metals’ exposure to humans. These chemicals are not biodegradable—they persist in the environment for long periods of time, increasing the risk of exposure. These dangers posed by improper disposal on the environment ultimately have impacts on human beings -human cost; the health effects of these toxins on humans include birth defects (irreversible), brain, heart, liver, kidney and skeletal system damage. They also significantly affect the nervous and reproductive systems of the human body. When computer monitors and other electronics are burned, they create cancer-producing dioxins which are released into the air we breathe. If electronics are thrown in landfills, these toxins may leach into groundwater and affect local resources. Thus improper disposal of e-waste not only has effects on the environment, it indirectly and ultimately poses grave dangers to humans and livestock.

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Fig.4Because of Heavy metals leach through the soil and burning of electronic device soil loss its fertility.

IV. WASTE MANAGEMENT STRATEGIES

The best option for dealing with E wastes is to reduce the volume. Designers should ensure that the product is built for re-use, repair and/or upgradeability. Stress should be laid on use of less toxic, easily recoverable and recyclable materials which can be taken back for refurbishment, remanufacturing, disassembly and reuse. Recycling and reuse of material are the next level of potential options to reduce e-waste (Ramachandra and Saira, 2004). Recovery of metals, plastic, glass and other materials reduces the magnitude of e-waste. These options have a potential to conserve the energy and keep the environment free of toxic material that would otherwise have been released. The Policy shall address all issues ranging from production and trade to final disposal, including technology transfers for the recycling of electronic waste. Clear regulatory instruments, adequate to control both legal and illegal exports and imports of e-wastes and ensuring their environmentally sound management should be in place. There is also a need to address the loop holes in the prevailing legal frame work to ensure that e – wastes from developed countries are not reaching the country for disposal. The Port and the Custom authorities need to monitor these aspects.

The regulations should prohibit the disposal of e-wastes in municipal landfills and encourage owners and generators of e-wastes to properly recycle the wastes. Manufactures of products must be made financially, physically and legally responsible for their products. Policies Sardinia 2007, Eleventh International Waste Management and Landfill Symposium and regulations that cover Design for Environment and better management of restricted substances may be implemented through measures.

All vendors of electronic devices shall provide take-back and management services for their products at the end of life of those products. The old electronic product should then be sent back to be carefully dismantled for its parts to be either recycled or re-used, either in a separate recycling division at the manufacturing unit or in a common facility. Collection systems are to be established so that e-waste is collected from the right places ensuring that this directly comes to the recycling unit. Collection can be accomplished through collection centers. Each electronic equipment manufacturer shall work cooperatively with collection centers to ensure implementation of a practical and feasible financing system. Collection Centers may only ship wastes to dismantlers and recyclers that are having authorization for handling, processing, refurbishment, and recycling meeting environmentally sound management guidelines.

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Many discarded machines contain usable parts which could be salvaged and combined with other used equipment to create a working unit. It is labor intensive to remove, inspect and test components and then reassemble them into complete working machines. Institutional infrastructures, including e-waste collection, transportation, treatment, storage, recovery and disposal, need to be established, at national and/or regional levels for the environmentally sound management of e-wastes. These facilities should be approved by the regulatory authorities and if required provided with appropriate incentives. Establishment of e-waste collection, exchange and recycling centers should be encouraged in partnership with governments, NGOs and manufacturers.

V. PROPOSED SOLUTION

- Need to address safe disposal of domestic waste.
- The Framework should address the issue of E waste imports for reuse and recycling.
- Link up activities of informal sector with formal Sector.
- Provide for appropriate framework for processes and attract investment in this sector.
- Promote adequate ESM technologies for recycling.
- financial responsibility for actions and schemes.
- Picked over Junk, Obsolete and burnt.
- Promote recycling units to ease process and to encourage generators to have proper e-waste disposal. Tax incentives for scrap dealers.
- Awareness program to Increasing public awareness by labeling products as 'environmental hazard'.

VI. CONCLUSION

Solid waste management, which is already a critical task in India, is becoming more complicated by the invasion of e-waste, particularly computer waste. It is urgent need for a detailed assessment of the current and future scenario including quantification, characteristics, existing disposal practices, environmental impacts etc. Institutional infrastructures, including e-waste collection, transportation, treatment, storage, recovery and disposal, need to be established, at national and/or regional levels for the environmentally sound management of e-wastes. Establishment of e-waste collection, exchange and recycling centers should be encouraged in partnership with private entrepreneurs and manufacturers. Model facilities employing environmentally sound technologies and methods for recycling and recovery are to be established. Criteria are to be developed for recovery and disposal of E Wastes. Policy level interventions should include development of e-waste regulation, control of import and export of e-wastes and facilitation in development of infrastructure. An effective take-back program providing incentives for producers to design products that are less wasteful, contain fewer toxic components, and are easier to disassemble, reuse, and recycle may help in reducing the wastes. It should set targets for collection and reuse/recycling, impose reporting requirements and include enforcement mechanisms and deposit/refund schemes to encourage consumers to return electronic devices for collection and reuse/recycling. End-of life management should be made a priority in the design of new electronic products.

On behalf of the study it is state that awareness on this subject of risk and management of E-Waste is extremely less and urgent measure is required to resolve this issue. Being a responsible citizen we should play an important role in E-Waste management as donating electronic items to reuse.

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