Impacts and Challenges of Electronic Waste in India

Veena Bhalla
P.G Department of Zoology, DAV College,
Sector-10, Chandigarh

Abstract - Electrical and electronic equipment which is briefly known as EEE is always on the rise and with advent of newer and newer technologies; we are going to witness an upward trend in their usage in future as well. Along with the increased usage of EEE, there is increasing amount of waste electrical and electronic equipment (WEEE) it generates at its end-of-life. The management of this waste or what is widely termed as E waste poses a big challenge to the current world. Parallel to the growth of e waste, there should have been advancement in systems and legislation to handle and control e waste as well for the sustainable development. But sadly this parallel growth in control systems has not matched the upsurge in e waste throughout the world and more so in developing countries. In order to raise awareness about the situation in which the generation, composition, management or final treatment of this kind of waste currently finds itself, an attempt is made in this review that will address the important issues, strategies and major challenges in E Waste management.

I. INTRODUCTION

The increasingly rapid growth of production and consumption of electrical and electronic equipment (EEE) has led to a sharp rise in the volume of waste that these products generate at the end of their life, leading as a result to a growing problem of pollution worldwide. E waste appears in the literature with different names (e-waste or waste electrical and electronic equipment (WEEE)) and with different definitions.. E-waste is described as electronic goods, such as computers, televisions and cell phones, while WEEE also includes traditionally non-electronic goods, such as refrigerators and ovens. One definition that could encompass all of the above is that given by Step Initiative (StEP, 2014), which considers that e-waste is a term used to cover almost all types of EEE that has or could enter the waste stream, including televisions, computers, mobile phones, white goods (e.g. fridges, washing machines, dryers, etc.), home entertainment and stereo systems, toys, toasters, kettles and almost any household or business item with circuitry or electrical components with power or a battery supply. The current practices of e-waste management in India suffer from a number of drawbacks like the difficulty in inventory management of e waste, unhealthy conditions of informal recycling, inadequate legislation, poor awareness and reluctance on part of the corporate to address the critical issues.

The important consequences are that

i. Toxic materials enter the waste stream with no special precautions to avoid the known adverse effects on the environment and human health
ii. Resources are wasted when economically valuable materials are dumped or unhealthy conditions are developed during the informal recycling.

The electronic industry is the world's largest and fastest growing manufacturing industry. In the last few years specially, it has acquired 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.

II. E- WASTE: EMERGING PROBLEM AND A RISING BUSINESS OPPORTUNITY..!!!

E waste 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. Composition of e waste is a mix of various harmful materials which pose a major threat to environment as well. The fraction including iron, copper, aluminium, 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%. Solid waste management, which is already a mammoth 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 is further complicating the problems associated with waste management

III. Current Scenario of E waste In India

E-waste in India is very tough to quantify as 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. 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 of Indian Industries(CII), the total waste generated by obsolete or broken down electronic and electrical equipment in India has been estimated to be 1,46,000 tons per year. The results of a field survey conducted in the Chennai, a metropolitan city of India to assess the average usage and life of the personal computers (PCs), television (TV) and mobile phone showed that the average household usage of the PC ranges from 0.39 to 1.70 depending on the income class. Although there is some awareness (about 50%) among the general public about the hazardous effects of e waste on general health and environment but when it comes to willingness to pay for e-waste management, there is very poor compliance level (less than 5%) The willingness of public to pay for e-waste management ranges from 3.57% to 5.92% of the product cost for PC, 3.94 % to 5.95 % for TV and 3.4 % to 5 % for the mobile phones. Additionally considerable quantities of e-waste are reported to be imported.

IV. Impacts of E waste

Electronic wastes can cause widespread environmental damage due to the use of toxic materials in the manufacture of electronic goods. Although it is hardly known, e-waste contains toxic substances such as Lead and Cadmium in circuit boards; lead oxide and Cadmium in monitor, computer batteries, Cathode Ray Tubes (CRTs); Mercury in switches and flat screen monitors; 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 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 12% by weight). 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. 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. 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. 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.

V. Impacts of Informal Recycling

Recycling of e waste in India is highly unorganized, unskilled and poses serious health threat to all the people directly involved in its process. It is a livelihood for unorganised 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. On a broader scale, analyzing the environmental and societal impacts of e-waste reveals a mosaic of benefits and costs. Proponents of e-waste recycling claim that greater employment, new access to raw materials and electronics, and improved infrastructure will result. These will further boost the region's advance towards prosperity. Yet the reality is that the new wealth and benefits are unequally distributed, and the contribution of electronics to societal growth is sometimes illusory. Most e-waste "recycling" involve small enterprises that are numerous, widespread, and difficult to regulate. They take advantage of low labour costs due to high unemployment rates, internal migration of poor peasants, and the lack of protest or political mobilization by affected villagers who believe that e-wastes provide the only viable source of income or entry into modern

development pathways. They are largely invisible to state scrutiny because they border on the informal economy and are therefore not included in official statistics.

VI. Status of E-Waste Management in India

Despite a wide range of environmental legislation in India there are no specific laws or guidelines for electronic waste or computer 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 Waste electronic assemblies in A1180 and mirror entry in B1110, mainly on concerns of mercury, lead and cadmium. Electronic waste is included under List-A and List-B of Schedule-3 of the Hazardous Wastes (Management & 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. Several Workshops on Electronic Waste Management was organised by the Central Pollution Control Board (CPCB) in collaboration with Toxics Link, CII etc. Action has been initiated by CPCB for rapid assessment of the E-Waste generated in major cities of the country. 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 wastes 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 environment 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. The Swiss State Secretariat for Economic Affairs mandated the Swiss Federal Laboratories for Materials Testing and Research (EMPA) to implement the programme “Knowledge Partnerships in e-Waste Recycling" and India is one of the partner countries. The programme aims at improving e-waste management systems through Knowledge Management and Capacity Building. It has analysed e-waste recycling frame works and processes in different parts of the world (Switzerland, India, China, South Africa) in its first phase (2003-04) and all results of the project are documented on the website http://www.ewaste.ch/. The major concerns related to e waste may be summarised as:

- Due to faster adoption of newer technologies thus higher obsolescence rate of EEE like mobile phones etc is contributing significantly to the higher e waste generation.
- There is lack of any standardised method to check or even quantify the e waste generated.
- Composition of e waste is a complex assembly of different toxic materials which impact both, on health and environment.

VII. Conclusion

Solid waste management, which is already a mammoth task in India, is becoming more complicated by the invasion of e-waste. The existing system for managing e-waste is generally not sustainable because mechanisms for collecting, sorting, reuse, refurbishing, repairing, and remanufacturing are not well developed and/or implemented. Problems associated with market issues, obsolescence issues, feedstock collection, feedstock management, and product-design need to be addressed. Establishment of e-waste collection, exchange and recycling centres 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. Given the complexity, uncertainty and diversity of the e-waste problem, a rigorous multidisciplinary academic approach targeting Sustainable Electronic Initiative is necessary to develop and implement systems that effectively utilize and recycle these products.

References

[1] Aggarwal R. (1998) India: The World's Final Dumpyard!, January, Basel Action News, Vol.1 at www.ban.org accessed on 14th September 2006. [2].Alastair I. (2004) Mapping Environmental Justice in Technology Flows: Computer Waste Impacts in Asia Global Environmental Politics 4:4, Massachusetts Institute of Technology

[2] Asia-Pacific Regional Scoping Workshop on Environmentally Sound Management of Electronic Wastes, 19-22 November, 2002, Tianjin, China

[3] Ammons J and Sarah B. (2003) 'Eliminating E-waste: Recycling through Reverse Production' at www.lionhrtpub.com accessed on 7th September 2005. [5].CII (2006). "E-waste management", Green Business Opportunities, Vol.12, Issue 1, Confederation of Indian Industry, Delhi.

[4] Devi B.S, Shobha S. V, Kamble R. K. (2004). E-Waste: The Hidden harm of Technological Revolution, Journal IAEM, Vol.31, pp.196-205.

[5] DIT (2003). Environmental management for Information Technology industry in India, Department of Information Technology, Government of India, pp.122-124.

[6] Envocare (2001). Mobile Phone Recycling at www.envocare.co.uk accessed on 28th August 2005

[7] Kiddee P, Naidu R and Wong MH (2013) Electronic waste management approaches: An overview. Waste Management 33: 1237–1250

[8] Mehra H.C. (2004). PC waste leaves toxic taste, The Tribune, 22nd March.

[9] Priyadharshini S and Meenambal T (2014) Strategies for sustainable management of end-of life electrical and electronic equipments. Pollution Research 33: 153–160.

[10] Radha G. (2002). A Study of the Performance of the Indian IT Sector' at www.nautilus.org accessed on 21st June 2005.

[11] Ramachandra T.V and Saira V. K. (2004). Environmentally sound options for waste management, Envis Journal of Human Settlements, March 2004.

[12] Robinson BH (2009) E-waste: An assessment of global production and environmental impacts. Science of the Total Environment 408: 183–191.

[13] Sergio J. and Tohru M. (2005) Waste management of electric and electronic equipment: comparative analysis of end-of-life strategies, J. Mater. Cycles Waste Management. 7:24–32

[14] Shobana Ramesh and Kurian Joseph (2006). Electronic waste generation and management in an Indian city, Journal of Indian Association for Environmental Management, Vol. 33, No.2, pp 100-105

[15] Toxic links (2003). Scrapping the Hi-Tech Myth Computer Waste in India, www.toxiclink.org accessed on June 2006.

[16] Toxics Link. (2004). E-Waste in Chennai Time is running out, www.toxicslink.org accessed on 14th June 2006.

[17] Trick J. (2002). A mobile is not just for Christmas, Tuesday, 24th December 2002, http://news.bbc.co.uk accessed on 19th August 2005.

[18] Widmer R, Heidi Oswald-Krapf , Deepali Sinha-Khetriwal, Max Schnellmann, Heinz Bo¨ni (2005), Global perspectives on e-waste, Environmental Impact Assessment Review 25 436– 458

[19] www.step-initiative.org/