



Research paper

## Electrical Trash is a Recent Problem for the Environmentalists

Sanjoli Mobar<sup>1</sup>, Pradeep Bhatnagar<sup>1</sup>

<sup>1</sup>The IIS deemed to be University, Jaipur

Address for correspondence: IIS University, SFS Mansarovar, Gurukul Marg, Jaipur

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#### \*Corresponding Author:

Sanjoli Mobar  
[sanjolimobar23@gmail.com](mailto:sanjolimobar23@gmail.com)

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### ABSTRACT

Electrical trash is one of the quickly increasing problems on the earth. Electrical trash includes considerable elements, some including toxic substances, which could have a damaging influence on human health and even on the environment. Quick economic development in Asia and the growing transboundary action of secondary sources would rise, which demand both 3R endeavors i.e., Decrease, Reutilize and Recycle in every nation. In India, Electrical trash control considers more significant according to the electrical trash generation due to the dumping of Electrical trash from developed countries. This study emphasizes India's recent electrical trash scenario, i.e. importance of the issue, environmental and health dangers, recent removal and recycling process, available legal frame, association operating on the problem, and suggestions for steps with regulatory bodies in India.



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### Introduction

Electrical trash extensively contains trash from the electrical and electrical instruments and includes things like computers, phones, digital music recorders or players, refrigerators, and all electrical devices that use the power plug, batteries, that evolve outdated according to advancements in technology, fashion changes, style and quality approaching the end of their normal life. The growing 'market penetration' in the developing countries, 'replacement market' in the developed countries, and 'high obsolescence rate' make electrical trash one of the quickest trash current (Radha 2002, DIT 2003) in our nation's trash current (Kumar 2010). In India, the electrical trash market is mainly disorganized (Sinha- Khatriwal et al. 2005) and some corporations in India are registered or certified illegally whereas work not formally (Mundada et al. 2004, CII 2006). India doesn't have reliable law for electrical trash control which causes it regaled as municipal trash in some areas (Devi et al. 2004).

Presently, electrical trash management is handled via "The Hazardous Materials (control, management, and Transboundary Movements) Rules, 2008". Under these regulations, there are

several organizations in India, for the scientific and environmentally friendly control and treatment of electrical trash that are approved by country agents. While there is inappropriate management of electrical trash in India according to the contention of inexperienced employees and lack of acceptable technologies by considering the disorganized sector in electrical trash managing (Wath et al. 2010). Furthermore, there is a deficiency of social and environmental involved due to corporations that are more highlighted on the economic earnings. Therefore, there is a powerful demand for adapting sustainability approaches to attack and eliminate the rising threat of electrical trash (Kumar et al. 2011). India encountering the IT revolution, the government is beginning for choking under a pile of electrical trash produced (Cairns 2005) from outdated computers and disposed electrical parts. Regular advancements in technology need substitutes instead of restoration of older electrical appliances. The disposable electricals have constructed an electrical trash problem, which is uncontrollable and has created the control of this trash an environment and healthy trouble. The electrical includes some dangerous and poisonous subsequences (Widmer et al. 2005) such as lead,

mercury, cadmium, PVC plastics, and brominated flame-retardants that are to induce extreme imperfections in the body (Ramachandra & Saira 2004). While one tone electrical trash is sliced and has other split actions throughout mechanic recycling, around forty kg of dust-like substance is induced having special metals that are poisonous if they are in nature in this high concentration (Brandl et al. 2001). It obviously indicates that a hidden jewel exists under this massive mountain of electrical trash. If metals are removed appropriately from electrical trash, this will produce a new recycling business possibility. Some corporations have recognized the possibility of this successful trade. Assets in this new part would cause a win-win condition for the corporation and the country. Furthermore, the ground that is destroyed as a trash yard could be set for additional constructive utilization such as farming, infrastructural growth, and etc. these materials while thrown away and in a random way, contaminate the environment. For avoiding the dangers of electrical trash recycling act was inscribed in regulation in 2004. SB 50 (Senate Bill) founded and funded a schedule for users' rescues, recycling, and ensuring safe and environmentally proper removal of the covered electrical devices.

### Electrical Trash Category

Electrical contains an increasing range of outdated electrical appliances like computers, servers, mainframes, monitors, TVs and presentation appliances, telecommunication appliances like cellular phones and pagers, calculators, audio and video appliances, printers, scanners, copiers, and fax machines also refrigerators, air conditioners, washing machines, and microwave ovens. Electrical trash furthermore protects recording devices like DVDs, CDs, floppies, tapes, printing cartridges, military electrical trash, automobile catalytic converters, and electrical parts like chips, processors, motherboards, printed circuit boards, and industrial electronics like sensors, alarms, sirens, security devices, and automobile electrical appliances.

### Indian procedure

It is calculated in India that the electrical trash is 0.1-0.2percent of the municipal trash. The business part is mostly accountable for the trash production. The reasoning is that the business part reports 78 percent of electrical trash and 83 percent of indoor consumers are first-time shoppers. In the case of the personal computer, 22 percent of the electrical trash is produced in homes. Furthermore, computer trash contains 1050 tons every year arriving from dealers. This is essential for noting that despite international arrangements, electrical trash from growth countries is imported from developed countries such as India (Pinto 2008,

Williams et al. 2008, Mundada et al. 2004). In the year 2005, calculated electrical trash production was 1, 46,180 tons/year that has increased to 8,00,000 tons by 2012. The north, south, and east areas produce smaller value of electrical trash containing 21percent, 30percent, and 14percent in compressing to west areas that produce the highest value of electrical trash, that is 35percent, in India (Sinha-Khetriwal et al. 2005, Jain 2009, Wath et al. 2010). As far as computers and mobile phones' deals are related, the computers and laptops' deal has been raised at 18 percent in 2009-10 as have compared with 2008-09 (MAIT 2010). While the mobile user is involved, the whole wireless users have gained 391.76 million. There existed just 261 million users in 2007-08 whereas in 2008-09 further 130.69 million users were counted by annual increasing of 50.06 percent (TRAI 2009). India currently produces about 4,00,000 tons of electrical trash yearly just 19,000 tons are being recycled considering the current information by the hardware manufacturing organization (MAIT 2011-2012). The first exhaustive investigation for estimating the yearly years of electrical trash in India is existing launched by the National WEEE undertaking staff and the whole WEEE production in India is about 146000 tons annually. Nations such as Maharashtra, Andhra Pradesh, Tamil Nadu, Uttar Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh, and Punjab include the highest subscription to WEEE. The nations such as Mumbai, Delhi, Bangalore, Chennai, Kolkata, Ahmedabad, Hyderabad, Pune, Surat, and Nagpur are subscribing highest ratings of the most extensive WEEE producers. There is an assessment about two million tons of total outdated computers that are from offices of government, businesses offices, industries, and families. Fabricates in a single calendar year, are calculated for producing about 1200 tons of electrical trash. The outdated rate of PC is one in every 2 years. The customer discovers it suitable for buying a new computer rather than upgrading the outdated one because of the shifting configuration, technology, and the appealing suggestions of the factories (Ramesh & Joseph 2006). According to the governmental legislation absence of electrical trash, disposal criteria, and a good technique to handle the poisonous hi-tech productions, mainly finished in trash yards or partially recycled in unclean circumstances and partially expelled in trash streamlets. Particular families; the country, general and personal parts; computer dealers; factories; foreign embassies; obsolete PC's second markets of total these are helping for computers dissipation. Foreign nations that are the largest resources of personal computers trash, which publish enormous computer trash in the shape of reusable pieces. India requires easier, low-cost technology being insight of the highest source resumption in environmentally friendly procedures.

E-Parisaraa, an eco-friendly recycling unit, considers the applicable perspective of the electrical processes.

### Intervention on Electrical Trash

A poisonous link has been confronted with the problem of electrical trash from 2002 to 2003 and was the first one to introduce the corresponding troubles in India. Poisonous link performed an exhaustive analysis on the trading and recycling of utilized and useless personal computers in Delhi from 2002- to 2003. This investigation concentrated on the poisonous pollutants in computer trash, the recycling processes, and its effect on the environment. The reporting has been named "Discarding the Hi-Tech Myth. Computer trash in India" and sent out each impressive information in the public that catalyze the attraction of numerous nationals and experts. We have carried out the problem of secure managing of electrical trash in India via different searches, information, and construction activity. Poisonous links have been so actively concerned in driving the national government for individual laws on electrical trash that eventually caught achievement by the assignment of electrical trash Control and management Regulations, 2011.

### Electrical Trash Dangers

Inappropriate recycling and removal of families devices, IT and telecommunications tools, lighting tools, electronic devices, playthings, social tools, medical instruments, and monitoring machines could cause danger is health and make the environment dangerous from poisonous chemicals and continuous contaminants (Mehra 2004, Sharma et al. 2012). Electrical trash creates an area in the nations it exceeds and could be so dangerous for humans and creatures, specifically according to the existence of poisonous and carcinogenic implications if moved inappropriately (Saoji 2012). These poisonous tools could have a negative effect on the environment and human health, if not recycled in the proper manner. For instance, cathode ray tubes contain a high number of carcinogens like lead, barium, phosphor, and other heavy metals. While disposing of intently in a managed environment, they don't have any severe risk for health and environment. Inappropriate management and recycling cause dangerous side effects for the employees and set free poisons to the soil, air, and groundwater that change the electrical features of the environment. Investigating the environment and social influence of electrical trash displays a mosaic of advantages and expenses (Alastair 2004). Another hazardous procedure is the parts recycling including dangerous combinations like halogenated chlorides and bromides utilized as flame-retardants in plastics that form continuous dioxins and furans on combustion at low temperatures. The copper that

is current in published course panels and cables, works as catalysts for dioxin formation while flame-retardants are burned. The PVC sheathing of wires is favorably corrosive while burnt and furthermore causes the dioxin shape. An investigation on burning published wiring panels in India demonstrated bad attention to dioxins in the environment of available burning areas getting thirty times the Swiss guidance level. The long-term direction of these imports harms the anxious techniques, kidneys and bones, and the reproductive and endocrine organs, and some are carcinogenic and neurotoxin (Saoji 2012). The other most extensively utilized approach of removal is landfilling electrical trash, whereas it is tending to be dangerous, due to leachate, which leaches some heavy metals such as mercury, cadmium, and lead (Townsend et al. 2004). Old trash yards and disorderly trash yards state a considerable risk of discharging dangerous releases. For instance, mercury leaches while specific electrical appliances like circuit breakers are wasted. Lead has been discovered for leaching from damaged lead including glass, like the cone glass of cathode ray tubes from TVs and monitors. While brominated flame lagged plastics or plastics including cadmium are landfilled, both PBDE and cadmium might leach to soil (Envocare 2001, Osako et al. 2004, Takigami et al. 2006) and groundwater. The cadmium from one mobile phone battery is sufficiently for polluting 600m<sup>3</sup> of water (Trick 2002). Furthermore, trash yards are inclined to disorderly fire that could emit poisonous fumes (Ramachandra & Saira 2004).

### Electrical Trash: Duty on Health of Humans and Ecosystem

The health risks, which individuals that dismount or recycle electrical trash are revealed to be destructive, and usually cause them to unable of functioning once they get 40. By considering the center for professional and environmental health at Maulana Azad Medical College in New Delhi, recyclers and dismantlers have registered hazardous high levels of lead, mercury, and chromium in the bodies. The poisonous chemicals seriously harm the recessional, urinary, and digestive organs reduce the immune system, and have been connected to specific kinds of cancer. The hazardous metals and poisonous chemicals, which electrical trash includes don't organically Overwhelm and could over time, influence the surroundings around the trash yard, polluting local groundwater or obtaining attracting the environment, therefore extremely threatening the health of close residents and populations of animal. The investigation has demonstrated that it is particularly harmful due to of bioaccumulation procedure referring to the uptake of a chemical in systems over time, and bio magnifications, while there is a growth in the attention of a chemical in the

food because of ingestion of other organisms, in the ecosystem environment of a trash yard.

### **Electrical Trash throwing away**

Our new digitalized life standards that are causing life easier while it is making various kinds of problems. Therefore, it is needed for good control and removal of electrical trash by the greatest seriousness. The demand for electrical trash removal derives from the old and ineffective electrical things that aren't biodegradable. In some developed countries, trash sellers gather these electrical trash circumstances. They end in uncontrolled recycling locations. Removal isn't correctly done according to a deficiency of proper technology (Mundada et al. 2004, Wath et al. 2010). The utilized method for the removal of electrical trash is acid baths, trash yard, and open-air burning. While electrical tools are burned, they emit many fumes that are harmful to circumstances outside of our vision and calculation. Stewart & Lemieux (2003) proposed the incineration that could be a possible choice for electrical trash removal, delivering a suitable particle management machine utilized for controlling the metal release.

### **Aspects of Management**

Fundamental regulations: The regulation of "Decrease, Reutilize, and Recycle" uses in this study. Decrease the production of electrical trash by intelligent preparation and good keeping. Reutilize yet operating electrical tools by presenting or marketing them to somebody that could yet utilize it. Recycle elements, which couldn't be restored.

### **General Education**

General education might nicely be the numerous essential element. it is due to what infrastructure is obtainable and developed, what the regulations are, and what the options are, no one would be cognizant of it without General education.

### **Dangerous Trash Solutions**

- Trash Control: Minimize the effect
- Trash Prevention: Minimize the volume
- Decrease trash and pollution
- Reutilize as considerable things as conceivable
- Recycle and compost as much trash as conceivable
- Chemically or biologically treat or burn
- Bury what is remained

### **International solutions**

- prohibition of dangerous trash exports
- Get the toxins release
- Exercise protection-no new toxins
- Create the maker responsibly
- Demand producers to retake

- Designing for longevity, update, restoration, and reutilize

There is a requirement for governmental support for establishing recycling structures for managing electrical trash with strict environmental regulations, which could provide us a more suitable model. Currently, electrical trash recycling is mostly performed in Delhi, Meerut, Bangalore, Mumbai, Chennai, and Firozabad. The process of metal exploitation such as manual classification, magnetic split; invert osmosis, electrolysis, condensation, electrolytic restoration, filtration, and centrifugation. These techniques are less efficient and damaging for both the environmental and human health. The biohydrometallurgical methods deliver us by a more suitable solution such as applying a bacterial leach procedure (bioleaching) for rallying metals from the fine-grained electrical trash. Microorganisms such as bacteria and fungi have been utilized to rally Pb, Cu, and Sn from published course boards (Haun et al. 1993). In the electrical trash attention of 5 to 10 g/L on the average, Thiobacillus thiooxidans and Thiobacillus ferrooxidans could leaching more than 90 percent of the general Cu, Zn, Ni, and Al. Aspergillus niger and Penicillium simplicissimum could be mobilizing Cu and Sn by 65 percent and Al, Ni, Pb, Zn by more than 95 percent at trash attention of 100 g/L on the average (Brandl et al. 2001). Metals that are leached and recovered may be recycled and reutilized as natural materials by metal constructing industries. This approach has the possibility to decrease trash removal and natural material prices and supply earnings from electrical trash (Gupta et al. 2008). Utilizing biological methods, recovery proficiency could be improved and physicochemical and thermal techniques are less prosperous. Comprehensive producer duty (Hanisch 2000) for recycling electrical trash would soon evolve into an economic and material essential if we were continuing by our present living standard.

### **Industries connected with the electrical trash control in India**

#### **Electrical Parisaraa**

It is the first recycle of the government-authorized eco-friendly unit that produces maximum utilization of electrical trash. The plant that is India's first scientific electrical trash recycle unit, wants reducing contamination, trash yard, and recovering beneficial metals, plastics, and glass from the trash in an eco-friendly way. The thing that causes Electrical Parisaraa to be various is that, unlike the trash yard managing electrical trash, there is no melt in the sort. It covers information from trown-away personal computers and warrants consumers' confidence (Saoji 2012).

#### **Earth Sense Recycle Private Limited**

Earth Sense Recycle Private Limited is a joint experience of the Electrical Parisaraa Private Limited and M/s. GJ Multiclave India Private Limited is a biomedical trash handling and control corporation. This corporation was created in 2000 and they have recycled whole kinds of electrical trash containing de-bound investments and other electronic tools.

#### **Trishyiraya Recycling India Pvt. Ltd (TPL)**

It is an Indian corporation, which delivers secure and trustworthy removal of electrical trash. The Indian Government, the Contamination Management Board have authorized this corporation. It has persistent management tools such as CCTV monitors. TPL feels proud about its creative technology, which allows the recycling of electrical trash. Add a feather to the cap is the 'Total Termination Process' which is totally contamination free. There is no water pollution or noise and air pollution. Plug-into electrical cycling.

It is a collaboration of the Environmental Protection Agency (EPA) and user electrical factories, dealers, and service presenters, which deliver more chances for donating or recycling - to "electrical cycle" utilized in electronics. Electrical cycling contains recycling and recovering useful materials from elder electrical that could be utilized for making new productions. It contains decreasing greenhouse gas release, reduces contamination, preserving power and sources by dragging fewer natural materials from the earth. Secure recycle of obsolete electrical objects enables sound control of poisonous chemicals like lead and mercury (Saoji 2012).

#### **Installing electrical bins in Bangalore city**

For ensuring, the safe removal of electrical trash developed at government is becoming a fact soon. Saahas, a non-governmental association concerned in this pioneering action, plans for holding movements in government offices for creating understanding about electrical trash and the needing for disposing of it securely. A toll-free telephone number is supplied for getting electrical trash gathered from the house and recycled.

#### **MAIT**

The Factory Organization for Information Technology has set an Electrical Recycler's Organization for organizing electrical trash controlling in an eco-friendly way. The ERA would originally include 9 associates, of which 6 are electrical trash processors and 3 are administrative members (Saoji 2012).

#### **India Legislation**

In India, the Environment Ministry and Forests are reliable for reasonable control of dangerous trash. The electrical trash control was first comprised in the List-A and List-B of Schedule-

3 of "Dangerous Trash Laws, 1989". The rule was improved in 2000 and 2003 (Pinto 2008). Eventually, subsequent to improvements in 2007 and 2008, electrical trash has been contained in "The Dangerous Materials Laws, 2008. Placing the commitment to recycling electrical trash on the makers, Environment and Forest Ministry has for the first time reported electrical trash control laws 2011 will determine the makers' disadvantage for recycle and decrease electrical trash in the government. The regulations would generate from May 1, 2012 (Saoji 2012). The laws would reach through the Environment Protection Act (EPA). "These regulations would involve every maker, user and bulk buyers concerned in manufacture, deal, buy and processing of electrical tools or elements". By the new laws, producers would have to push users familiar with the dangerous elements in the production. They would have to provide a data book for preventing electrical trash from being settled in trash bins. For controlling the electrical trash, a government should create an adaptive method, which could manage the variability in quantity and quality of electrical trash circulation (Sinha-Khetriwal et al. 2005). Current legislation requires to be converted for activating procedures that would produce way for a more hopeful contamination-free future in the nation. Electrical trash is a significant challenge for environmentalists and technologists as the growth rate is higher in comparison with the rate it is removal, reutilized, or recycled. There is an urgent requirement for advancement in electrical trash control surrounding technological progress, process plan, implementation of a defensive protocol for the employees working in electrical trash removal, and education public regarding this emerging problem creating a danger to the environment and public health. The lowest standards and improved understanding are required for recycling electrical trash in India. Substitution to recycle technologies and materials should be improved. Harmonization is required among governments regarding environmental problems and trading in the world. The casual parts, which are extremely elaborate in the materials cycle, should develop more traditional parts, particularly in improving nations. This is a big problem for downstream businesses. Production of electrical trash should be decreased. This might be attended by the advancement of suitable utilization. Furthermore, fundamental sustainability techniques such as decreasing, reutilizing, and recycling, mustn't be dismissed. Sustainability control must be begun from the production stage. The problem of electrical trash demands critical international effort.

#### **Conflict of interest**

The authors declare that they have no conflict of interest.

## References

- Alastair, I. 2004. Mapping Environmental Justice in Technology Flows: Computer Waste Impacts in Asia. *Global Environmental Politics* 4, Massachusetts Institute of Technology.
- Brandl, H., Bosshard, R. and Wegmann, M. 2001. Computer-munching microbes: Metal leaching from electronic scrap by bacteria and fungi. *Hydrometallurgy*, 59: 319-326.
- Cairns, C.N. 2005. E-waste and the consumer: Improving options to reduce recycle and reuse. *Proceedings of International Symposium on Electronics and the Environment*, May 16-19, New Orleans, U.S.
- CII 2006. E-waste Management, Green Business Opportunities, Confederation of Indian Industry, Delhi, 12(1).
- CPCB 2008. The Hazardous Materials (Management, Handling and Transboundary Movements) Rules, 2008, Central Pollution Control Board, Available at: [www.cpcb.nic.in/divisionsofheadoffice/hwmd/mhtrules2008.pdf](http://www.cpcb.nic.in/divisionsofheadoffice/hwmd/mhtrules2008.pdf).
- Devi, B.S., Shroba, S.V. and Kamble, R.K. 2004. E-Waste: The hidden Vol. 13, No. 2, 2014 · *Nature Environment and Pollution Technology* 338 Manoj Kumar Jhariya et al. harm of technological Revolution. *IAEM*, 31: 196-205. DIT 2003. Environmental management of information technology industry in India. Department of IT, GoI, pp. 122-124.
- Envocare, 2001. Mobile Phone Recycling. [www.envocare.co.uk](http://www.envocare.co.uk) accessed on 28th August 2005.
- Gupta, V., Laul, P. and Syal, S. 2008. E-waste - A waste or a fortune? *Current Science*, 94(5): 554-555.
- Hanisch, C. 2000. In *Environ. Sci. Technol.*, 34: 170A-175A.
- Haun, M.S., Eillscher, S. and Straube, G. 1993. In: *Biohydrometallurgical Technologies* (Eds. Troma, A.E. et al.). The Minerals, Metals and Material Society, Warrendale, pp. 99-108.
- Jain, A. 2009. Development and evaluation of existing policies and regulations for E-waste in India. *IEEE, International Symposium on Sustainable Systems and Technology*, 18-20 May, 2009, pp. 1-4.
- Kirsten 2013. E-Waste: A Burden on Human Health and our Ecosystem Alike. <http://in.reset.org/blog/e-waste-burden-human-healthand-our-ecosystem-alike>.
- Kumar, V., Garg, R., Rahman, Z. and Kazmi, A.A. 2011. Sustainability and E-waste management scenario in India. *International Journal of the Computer, the Internet and Management*, 19(SP1): 43.1-43.5.
- Kumar, R. 2010. E-waste management and existing legislation in India. *Int. Res. J. Lab to Land*, 2(8): 500-504. MAIT 2010. Manufacturers Association for Information Technology Annual Report 2010. Available at: [www.mait.com/mait-AnnualReport-20-9-10.pdf](http://www.mait.com/mait-AnnualReport-20-9-10.pdf), Accessed on 2nd October, 2010.
- MAIT 2011-12. Manufacturers Association for Information Technology, Annual Report 2011-12.
- Mehra, H.C. 2004. PC waste leaves toxic taste. *The Tribune*, 22nd March.
- Mundada, M.N., Kumar, S. and Shekdar, A.V. 2004. E-waste: A new challenge for waste management in India. *International Journal of Environmental Studies*, 61(3): 265-279.
- Osako, M., Yong-Jin, K. and Shin-ichi, S. 2004. Leaching of brominated flame retardants in leachates from landfills in Japan. *Chemosphere*, 57: 1571-1579.
- Pinto, V.N. 2008. E-waste Hazard: The impending challenge. *Indian Journal of Occupational and Environmental Medicine*, 12(2): 65-70.
- Radha, G. 2002. A study of the performance of the Indian IT sector. At [www.nautilus.org](http://www.nautilus.org), accessed on 21st June 2005.
- Ramachandra, T.V. and Saira, V.K. 2004. Environmentally sound options for waste management. *Envis. J. Hum. Settlements*, pp. 3-11.
- Ramesh, S. and Joseph, K. 2006. Electronic waste generation and management in an Indian city. *Journal of Indian Association for Environmental Management*, 33(2): 100-105.
- Saoji, A. 2012. E-waste management: An emerging environmental and health issues in India. *National Journal of Medical Research*, 2(1): 107-110.
- Sinha-Khetriwal, D., Kraeuchi, P. and Schawninger, M. 2005. A comparison of electronic waste recycling in Switzerland and in India. *Environmental Impact Assessment Review*, 25(5): 492-504.
- Sharma, P., Fulekar, M.H. and Pathak, B. 2012. E-waste - A challenge for tomorrow. *Res. Jour. of Recent Sciences*, 1(3): 86-93.
- Stewart, E.S. and Lemieux, P.M. 2003. Emission from the incineration of electronics industry waste. *Proceedings of Electronics and Environment. IEEE International Symposium*, pp. 271-275.
- Tagigami, H., Hirai, Y., Matsuzawa, Y. and Sakai, S. 2006. Brominated flame retardants and brominated dioxins in the working environment and environmental emission - A case study at an electronics recycling plant. *Organohalogen Compounds*, 68: 2190-2193.
- TRAI 2009. Telecom Regulatory Authority of India, Annual Report 2008-09. Available at:

- [www.trai.gov.in/annualreport/TRAIAR2008\\_09E Add.pdf](http://www.trai.gov.in/annualreport/TRAIAR2008_09E_Add.pdf), accessed on 2nd October, 2010.
- Townsend, G.T., Musson, S., Jang, Y.C. and Chung, I.H. 2004. Leaching of Hazardous Chemicals from Discarded Electronic Devices. Prepared for US EPA Region 4 and Region 5. Florida Center for Solid and Hazardous Waste Management.
- Trick, J. 2002. A mobile is not just for Christmas, Tuesday 24th December 2002. <http://news.bbc.co.uk> accessed on 19th August 2005.
- Wath, S.B., Dutt, P.S. and Chakrabarti, T. 2010. E-waste Scenario in India, its management and applications. *Environment Monitoring and Assessment*, Published Online, 12 February, 2010
- Widmer, R., Heidi, Oswald-Krapf, Sinha-Khetriwal, D., Schnellmann, M. and Boni, H. 2005. Global perspectives on e-waste. *Environmental Impact Assessment Review*, 25: 436-458.
- Williams, E., Kahhat, R., Allenby, B., Kavazanjian, E., Kim, J. and Xu, M. 2008. Environmental, Social and Economic Implications of Reuse and Recycling of Personal Computers. *Environment Science and Technology*, 42(17): 6446-6454.