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E-WASTE GENERATION AND ITS MANAGEMENT – A REVIEW

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ABSTRACT

Electronic waste or e-waste is one of the emerging problems in developed and developing countries worldwide. It comprises of a multitude of components with valuable materials, some containing toxic substances that can have an adverse impact on human health and the environment. Previous studies show that India has generated 0.4 million tons of e-waste in 2010 and now it has been increased to 1.7Mt as per UN report 2014. Coupled with lack of appropriate infrastructural facilities and procedures for its disposal and recycling have posed significant importance for e-waste management in India. In general, e-waste is generated through recycling of e-waste and also from dumping of these wastes from other countries. More of these wastes are ending up in dumping yards and recycling centers, posing a new challenge to the environment and policy makers as well. This review article provides a concise overview of global and India's current e-waste scenario, regulations and management practices.

Keywords: Disposal, E-Waste, Environment, Recycle, Reuse.

I. INTRODUCTION

Electronic equipmentis being produced in huge amounts nowadays and this quantity is constantly increasing due to increase in the consumption of these goods by the population as well as the relatively short life time of this equipment. Table.1 shows the estimated life span of some commonly used electronic items [1]. Wastes from electrical and electronic equipment(WEEE) are the fast growing waste category [2]. The rapidly developing technology has also led to increased E-waste volumes. The majority of e-waste elements are led to landfills. However, their partial recyclability, due to their material composition along with the unavoidable restrictions in landfills, has led to the development of retrieval techniques for their recycling and reuse, highlighting the significance of e-waste recycling, not only from a waste management point of view but also from valuable materials retrieving point of view [3].

E-waste poses a serious challenge in disposal and recycling both developed and developing countries. The dumping of e-waste from developed countries to developing countries like India has made E-waste management an issue of environment and health concern compared to conventional municipal wastes, certain components of electronic products contain toxic substances, which pose threat to both health and environment [4]. For example, Personal computers (PC's) 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 content of these materials poses threat to human health and environment [5].

This paper reviews about the E-waste generation strategies in India and worldwide by highlighting the environmental and health hazards caused during handling, disposal and recycling of e-waste. The E-waste management legislations in India towards the disposal and recycling practices of e-waste are` discussed.

Table.1 Estimated Life Span and Weight of Electrical and Electronic Equipment

s.no	Equipment	Life span in years	Mean weight in kg
1	Personal computer and Monitor	5 to 8	25
2	Laptop	5 to 8	5
3	Printer	5	8
4	Mobile phone	4	0.1
5	Television	8	30
6	Refrigerator	10	45

Source: UNEP and UNU (2009)

II. ELECTRONIC WASTE

Electronic waste commonly known as E-waste is the most popular name given to electronic products nearing or at its end of its useful life. E-waste in short is a generic term embracing various forms of electrical and electronic equipment that have ceased to be of any value to their owners [4]. According to European directive 2002/96/EC "Waste electrical and electronic equipment, including all components, sub-assemblies and consumables which are part of the product at the time of discarding" is termed as E-waste. Basel Action Network (www.ban.org) states that "E-waste includes a wide and developing range of electronic appliances ranging from large household appliances, such as refrigerators, air conditioners, cell phones, stereo systems and consumable electronic items to computers discarded by their users". The Organization for Economic Co-operation and Development (OCED) (www.oced.org) defines "Any household appliance consuming electricity and reaching its lifecycle end" is an E-waste [3].

2.1. Different Categories of E-Waste

E-waste is divided into different categories according to the Environmental Protection Act (1986) (Fig.1)[6]. All types of waste containing electrically powered components such as computers, consumer electronics, fridges etc., comes under the E-waste category. Table.2 lists the different categories of E-waste according to European Union (EU) Directive [3].

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Figure.1

Table.2 E-Waste Categories Pursuant to the EU Directive 2002/96/EC

S. No	Category	Label
1	Large household appliances	LHA
2	Small household appliances	Small HA
3	IT and telecommunication equipments	ICT
4	Consumer equipments	CE
5	Lighting equipments	Lighting
6	Electrical and Electronic tools	E&E tools
7	Toys, leisures and sports equipments	Toys
8	Medical devices	Medical devices
9	Monitoring and control instruments	M&C
10	Automatic dispensers	Dispensers

2.2 Composition of E-Waste

The composition of E-waste is very diverse and differs in products across different categories. It contains more than 1000 different substances, which fall under 'hazardous' and 'non-hazardous' categories. Broadly it consists of ferrous and non-ferrous metals, plastics, rubber, glass, wood and plywood, printed circuit boards (PCBs), concrete and ceramics and other items. Iron and steel constitute about 50% of the E-waste followed by plastics (21%), non-ferrous metals (13%) and other constituents. Non-ferrous metals consist of metals like copper (Cu),

aluminum (Al), and precious metals like silver (Ag), gold (Au), platinum, palladium etc. The presence of elements like lead, mercury, arsenic, cadmium, selenium and hexavalent chromium and flame retardants beyond threshold quantities of e-waste classifies them as hazardous waste [13-15]. Some of the selected material compositions of electronic devices are mentioned in Table.3 and Table.4 lists the material composition of common electronic devices [7].

Table.3 Selected Material Composition of Main Four E-Waste Categories

Material	**Large household appliances**	**Small household appliances**	**ICT and consumer electronics**
Ferrous metal	43	29	36
Aluminium	14	9.3	5
Copper	12	17	4
Lead	1.6	0.57	0.29
Cadmium	0.0014	0.0068	0.018
Mercury	0.000038	0.000018	0.00007
Gold	6.7E-07	6.1E-07	0.00024
Silver	7.7E-06	0.000007	0.0012
Palladium	3E-07	2.4E-07	0.00006
Indium	0	0	0.0005
Brominated plastics	0.29	0.75	18
Plastics	19	37	12
Lead glass	0	0	19
Glass	0.017	0.16	0.3
Other	10	6.9	5.7
Total	100	100	100

Source: EMPA (http://ewasteguide.info, 2015) [9]

Table.4 Material Composition of Common Electronic Devices

S.No	Type of device	Contents %				Contents, ppm		
		Fe	Al	Cu	Plastic	Ag	Au	Pd
1	TV boards	30	15	10	28	280	20	10
2	PC boards	7	5	18	23	900	200	80
3	Mobile phones	7	3	13	43	3000	320	120
4	DVD	62	2	5	24	115	15	4
5	Calculator	4	5	3	61	260	50	5
6	Others	8, 3	0, 7	8, 5	0	290	124	0

III. HEALTH AND ENVIRONMENTAL HAZARDS OF E-WASTE

Electrical and Electronic equipment contain a large number of hazardous substances including heavy metals (eg. Mercury, cadmium, lead etc), flame retardants (eg. Pentabromophenol, polybrominated diphenyl, ethers(PBDEs), tetrabromobisphenol-a(TBBPA) etc) and other substances which made them as hazardous materials [6]. Majority of these components containtoxic substances that have adverse impacts on human health and the environment if not handled properly. Often, these hazards arise due to the improper recycling and disposal processes that are in practice in most of the developing countries including India. Such offensive practices can have serious after math for those staying in proximity to the places where E-waste is recycled or burnt. Table 5 lists various hazardous substance occurrences in e-waste and its health hazards.

Table.5Hazardous substances and its occurrence in E-waste [9]

Substance	**Occurrence in e-waste**	**Environmental and Health relevance**
Halogenated compounds:		
PCB (polychlorinated biphenyls)	Condensers, Transformers	Cause cancer, effects on the immune system, reproductive system, nervous system, endocrine system and other health effects. Persistent and bio-accumulation.
TBBA (Tetrabromo-bisphenol-A) PBB (Polybrominated biphenyls) PBDE (Polybrominateddiphenyl ethers)	Fire retardants for plastics (thermoplastic components, cable insulation) TBBA is presently the most widely used flame retardant in printed wiring boards and casings.	Can cause long-term period injuries to health acutely poisonous when burned
Chlorofluorocarbon (CFC)	Cooling unit, Insulation foam	Combustion of halogenated substances may cause toxic emissions
PVC (polyvinyl chloride)	Cable insulation	High temperature processing of cables may release chlorine, which is converted to dioxins and furans.
Heavy metals and other metals:		
Arsenic	Small quantities in the form of gallium arsenide within light emitting diodes	Acutely poisonous and on a long-term perspective injurious to health
Barium	Getters in CRT	May develop explosive gases (hydrogen) if wetted
Beryllium	Power supply boxes which contain silicon controlled rectifiers and x-ray lenses	Harmful if inhaled

Cadmium	Rechargeable Ni-Cd batteries, fluorescent layer (CRT screens), printer inks and toners, photocopying-machines (printer drums)	Acutely poisonous and injurious to health on a long-term perspective
Chromium VI	Data tapes, floppy-disks	Acutely poisonous and injurious to health on a long-term perspective causes allergic reactions
Lead	CRT screens, batteries, printed wiring boards	Causes damage to the nervous system, circulatory system, kidneys causes learning disabilities in children
Lithium	Li-batteries	May develop explosive gases (hydrogen) if wetted
Mercury	Fluorescent lamps that provide backlighting in LCDs, in some alkaline batteries and mercury wetted switches	Acutely poisonous and injurious to health on a long-term perspective
Nickel	Rechargeable Ni-Cd batteries or NiMH-batteries, electron gun in CRT	May cause allergic reactions
Rare Earth elements (Yttrium, Europium)	Fluorescent layer (CRT-screen)	Irritates skin and eyes
Selenium	Older photocopying-machines (photo drums)	
Zinc Sulphide	Interior of CRT screens, mixed with rare earth metals	Toxic when inhaled
Others:		
Toner Dust	Toner cartridges for laser printers / copiers	Health risk when dust is inhaled risk of explosion
Radio-active substances		
Americium	Medical equipment, fire detectors, active sensing element in smoke detectors	Bone cancers

Source: http://www.ewasteguide.info (2015) [9]

Disposal of E-wastes is an unembellished problem faced by many regions across the globe. Electronic wastes that are land filled produces contaminated leachates which eventually pollute the ground water. Acids and sludge obtained from melting computer chips, if disposed on the ground causes acidification of soil. Mercury leaches when certain electronic devices, such as circuit breakers are destroyed. The same is true for polychlorinated biphenyls (PCBs) from condensers. When brominated flame retardant plastic or cadmium containing plastics are landfilled, both Polybrominated Diphenyl Ethers (PBDE) and cadmium may leachin to

the soil and ground water. It has been found that significant amounts of lead ion are dissolved from broken lead containing glass, such as the cone glass of cathoderay tubes, gets mixed with acid waters and are a common occurrence in landfills.

In addition, uncontrolled fires may arise at landfills and this could be a frequent occurrence in many countries. When exposed to fire, metals and other chemical substances, such as the extremely toxic dioxins and furans (TCDD tetrachlorodibenzo-dioxin, PCDDs- Polychlorinated dibenzo dioxins. PBDDs-polybrominated dibenzo-dioxin and PCDFs-polychlorinated dibenzo furans) from halogenated flame retardant products can be emitted. 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 the local environment and broad erglobal air current; depositing highly toxic byproducts in many places throughout the world Incineration of E-waste possesses another threat. It can emit toxic fumes and gases, there by polluting the surrounding air. Moreover, shipping of hazardous waste to developing countries is a major alarm. It happens because of cheap labour and lack of environmental legislations in developing countries[8].

IV. GLOBAL SCENARIO OF E-WASTE GENERATION

Electronic waste continues to increase dramatically amid growing global demand for electronic goods. The escalating global E-waste problem is driven by the rising sales and shortening lifecycles of electrical and electronic equipment. As per United Nations 'Global E-waste Monitor 2014' report compiled by United Nations University the United States and China produced the most e-waste overall in 2014 of about 32%. India stands in fifth position in e-waste generation behind United States, China, Japan and Germany. Most e-waste in the world in 2014 was generated in Asia at 16 million tons about 3.7kg per inhabitant, of which China, Japan and India contributes about 6.0Mt, 2.2Mt and 1.7Mt respectively. The top per capita producers by far are the wealthy nations of Northern and Western Europe in that the top five being Norway, Switzerland, Iceland, Denmark and the United Kingdom. The lowest amount of e-waste per inhabitant was generated in Africa (1.7/inhabitant), which produced 1.9Mt of e-waste in total. The global volume of e-waste is expected to rise by 21% to 50Mt in 2018 as per the report concerning the World's fast growing e-waste problem.

In 2014, People Worldwide discarded all but a small fraction of estimated 41.8Mt which comprises of 1.0Mt lamps, 3.0Mt of small IT, 6.3Mt of screens and monitors, 7.0Mt of temperature exchange equipment (cooling and freezing equipment), 11.8Mt large equipment and 12.8Mt of small equipment. In 2013, about 7% of e-waste was made up of mobile phones, calculators, PC's, printers and small IT equipment almost a 60% was a mix of large and small equipment used in home and business, such as vacuum cleaners, toasters, electric shaves, video cameras , washing machines, electric stoves, mobile phones, calculators, personal computers and lamps. Only about 6.5Mt of total e-waste generated were collected by official take-back systems like Municipality, private collection companies and collection stores. In the European Union 0.7 Mt of e-waste end up in waste bins which is around 8% of the total e-waste. Table.6 lists the global quantity of E-waste generated in 2014.

E-waste generated in 2014 is almost an urban mine which contained an estimated 16500 kilotons of Iron, 1900 kilotons of Copper, 300 tons of gold (equal to 11% of the world's total 2013 gold production), as well as silver, aluminium, palladium, plastic and other resources with a combined estimated value of USD 52 billion. But in the same way it's also a toxic mine too, which includes 2.2Mt of lead glass, 0.3Mt of batteries as well as

mercury, cadmium, chromium and 4400 tons of ozone depleting substances like chloroflurocarbons (CFCs) [9]. These toxins can cause health problems like impaired mental development, cancer, damage to liver, kidneys and even hair loss. Many European countries banned E-waste from dumping into landfills long before in the 1990's as they produce more toxins and are not biodegradable. E-waste is disposed of unsafely in developing countries, leaving an environmental and health problem in these regions. Meanwhile recycling and disposal of e-waste are also grown in regions beyond Asia, particularly in certain African countries.[4]. Safe disposal and recycling of e-waste become an important concern in both economic and environmental wise and many eco-friendly disposal practices and green recycling technologies have been in practice in many developed countries.

Table.6 Global Quantity of E-waste Generated in 2014 [9]

Year	e-waste generated (Mt)	Population (billion)	E-waste generated (Kg/inch)
2010	33.8	6.8	5
2011	35.8	6.9	5.2
2012	37.8	6.9	5.4
2013	39.8	7	5.7
2014	41.8	7.1	5.9
2015	43.8	7.2	6.1
2016	45.7	7.3	6.3
2017	47.8	7.4	6.5
2018	49.8	7.4	6.7

Source: UNU report, 2014

Table.7 Total E-waste per category [9]

Component	Tons(million)
Lamps	1
Small IT	3
Screens	6.3
Temperature Exchange eq.	7
Large equipment	11.8
Small equipment	12.8

Source: UNU report, 2014

V. INDIAN SCENARIO OF E-WASTE GENERATION

India is one of the fastest growing economics of the world and the domestic for consumer durables in India has been sky rocketing. According to the United Nations report 'Global E-waste Monitor', India stands is the biggest producer of E-waste in the World. India has discarded 1.7Mt of e-waste in 2014. It is expected to increase by 21% in the next three years [9]. In India, e-waste is a major issue owing to the generation of domestic e-waste, as well as imports from developed countries. India's electronic industry is one of the fastest growing industries in the world. The Indian information technology industry has a prominent global presence today largely due to the software sector. More recently, policy changes have led to a tremendous influx of

leading multinational companies into India to set up manufacturing facilities, R&D centres and software development facilities. The domestic market is getting revitalized due to buoyant economic growth and changing consumption patterns. 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.

At the consumer end disposal of e-waste or used product is a big issue. In India computers and peripherals are recycled / reused much more than they are in developed countries. Till the last decade affordability of computers was limited to only a socio- economically advantaged section of the population. In Indian Scenario, electronics industry has emerged as the fastest growing segment both in terms of production and exports. The share of software services in electronics and IT sector has gone up from 38.7% in 1998-99 to 61.8% in 2003-04. A review of the industry statistics show that in 1990-91, hardware accounted for nearly 50% of total revenues while software's share was 22%. The scenario changed by 1994-95, with hardware share falling to 38% and software's share rising to 41%. This shift in the IT industry began with liberalization, and the opening up of Indian markets together with which there was a change in India's import policies vis-à-vis hardware leading to substitution of domestically produced hardware by imports. Since the early 1990s, the software industry has been growing at a compound annual growth rate of over 46% (supply chain management, 1999). Output of computers in value terms, for example, increased by 36.0, 19.7 and 57.6% in 2000-01, 2002-2003, and 2003-04, respectively. Within this segment, the IT industry is prime mover with an annual growth rate of 42.4% between 1995 and 2000. By the end of financial year 2005-06, India had an installed 4.64 million desktops, about 431 thousand notebooks and 89 thousand servers. According to the estimates made by Manufacturers Association of Information Technology (MAIT) the Indian PC industry is growing at a 25% compounded annual growth rate.

The e-waste inventory based on this obsolescence and rate and installed base in India for the year 2005 has been estimated to be 146180-00 tons. This is expected to exceed 800,000 tons by 2012. There is a lack of authentic and comprehensive data on e-waste availability for domestic generation of e-waste and the various State Pollution Controls Boards have initiated the exercise to collect data on e-waste generation. Sixty-five cities in India generate more than 60% of the total e-waste generated 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, Gujarath, 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. There are two small e-waste dismantling facilities are functioning in Chennai and Bangalore. There is no large scale organized e-waste recycling facility in India and the entire recycling exists in un-organized sector. From the Table.8, it is noted that Andhra Pradesh and Karnataka stands 3rd and 7th respective in the list among the e- waste generators. As regards to the cities, Bangalore is 2nd and Hyderabad is 5th in generation of e- waste. Northern India is not a leading generator, it happens to be the leading processing center of e-waste in the country. There are three formal recyclers in the South of India (at Chennai, Hyderabad and Bangalore) and one in Western India. The authorized e-waste recycling facilities in India capture only 3% of total e-waste generated, the rest makes its way to informal recycling yards in major cities like Delhi, Mumbai, Hyderabad and Bangalore. This is because businesses sell

their discarded equipment to informal recyclers for quick money without realizing the hazardous implications it causes to health and environment. E-waste contains over 1,000 different substances, many of which are toxic, and creates serious pollution upon disposal. Due to the extreme rates of obsolescence, e-waste produces much higher volumes of waste in comparison to other consumer goods. The increasingly rapid evolution of technology combined with rapid product obsolescence has effectively rendered everything disposable due to which e-waste is generated at alarming rates.[10]

Table.8 Indian scenario of E-waste generation

E-Waste / WEEE Generation in Top Ten States

S. No.	States	WEEE(Tones)	Percentage %
1.	Maharashtra	20270.59	18.49
2.	Tamil Nadu	13486.24	12.30
3.	Andhra Pradesh	12780.33	11.66
4.	Uttar Pradesh	10381.11	9.47
5.	West Bengal	10059.36	9.18
6.	Delhi	9729.15	8.87
7.	Karnataka	9118.74	8.32
8.	Gujarath	8994.33	8.20
9.	Madhya Pradesh	7800.62	7.11
10.	Punjab	6958.46	6.35
	Total	109578.93	100

Source: EMPTRI

VI. E-WASTE REGULATIONS IN INDIA

In India, e-waste is a major issue owing to the generation of domestic e-waste, as well as imports from developed countries. India's electronic industry is one of the fastest growing industries in the world. It is estimated that per capita ownership of personal computers grew by 604% during the period 1993–2000 compared with the world average of a 181% increase during the same period [16]. A study conducted byDwivedy and Mittal (2010) on future trends in computer waste generation in India estimated that around 41–152 million computers will become obsolete in India in 2020 [17]. It also estimated that total annual e-waste generation in India is between 1,46,000 and 3,30,000 tonnes, and is expected to reach 4,70,000 tonnes by 2011.Another estimate states that in 2007 India generated 380,000 tonnes of e-waste from computers, televisions and mobile phones only, and that figure is set to reach 800,000 tonnesby 2012 [18]. The same study also estimates that India has 15 million new mobile phone users every month, and the total mobile subscriber base is expected increase from current 652 million to 1.159 billion by 2013. In 2005, India's Central Pollution Control Board developed guidelines for ESM of e-waste in India. E-waste in India is not regulated at the present time. However, the Ministry of Environment and Forest as part of the Environmental Protection Act of India has enacted the 'E-waste (Management and Handling) Rule of 2011' which took effect on 1 May 2012. The rule mandates producers to be responsible for the collection and financing the systems according to extended producer responsibility concept. The rule clearly defines the responsibilities of the producer, collection centres, consumer or bulk consumers, dismantlers and recyclers.[11]

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VII. RECYCLE OF E-WASTE

Presently, the e-waste is treated by both informal and formal recyclers sharing total e-waste quantity in 95 to 5 ratios in the country.From the total e-waste generated in the country 60% e-waste remains in warehouses/storages and only 40% is made available for recycling process. In recycling process 95% E-waste is being used for the refurbishment and only 5% need process of disposal [MAIT]. The enormous energy may be saved by adapting recycling of e-waste. The informal recyclers get the e-waste from local waste collectors at very cheap price and recover the targeted metals like copper, aluminium, iron and steel with rudimentary and primitive methods and put a heavy environmental loading of pollutants on atmosphere. They are using open burning, acid leaching for the recovery of metals, which are non-environment friendly methods. The informal recyclers treat 95% of the e-waste generated by all sources. These activities of e-waste treatment are cause of concern of the ambience and society as these are detrimental to the air quality, human health as the pollutants persist in the environment years together and harm it continuously. The dispersion of pollutants due to treatment in uncontrolled conditions and further transportation ahead, resulting various kinds of diseases to the human beings effecting kilometers distant human being and environment.

The recovery of materials: metals etc. are a lucrative business and acts as feedstock for the manufacturing of the new equipment, which is going to meet the user equipment demand at very cheap rate .The state of the art is available to recover metals to the maximum from the e-wasted equipment easily. Umicore in Belgium and Attero in India are the appropriate examples recovering gold up to 99% efficiently. The formal recycling in the country is in the transition and CPCB is registering recyclers every year and presently registered 23 recyclers have been registered for the treatment of e-waste produced in the country. The registered recyclers have to comply the e-waste management guidelines and adhere to rule 2012[E-waste (M&H) rule 2011].A fixed quantity of e-waste is being allotted to them; however they are not getting it easily and always strive to get it from import channels so that the state of the art facility may be run at full load. The informal recovery system is less environ efficient comparably to the formal in terms of the state of the art technology.

For example: for the recovery of 1 g gold and 6 g of silver, the informal recyclers are using more than 50 litres water, 3 and 21 Kg Chemicals and explode 1.3 g and 3 g of mercury in the environment due to uncontrolled treatment. However, the metal yield by using chemical processes 10 to 20% more if it is carried out by informal recyclersbut they are not carrying out it in the ambit of ESM. The e-waste generated reporting process is not in place. The inadequate record keeping by all e-waste stakeholders made the e-waste treatment very tedious task. The infrastructure cannot be created based on estimated quantity of e-waste.

Table.9 Registered Recyclers and E-waste Allotments [MoEF Recyclers][12]

Sr. No.	States	No. of Registered Recyclers	Total Quantity of E-waste Allotted for recycling by CPCB
1.	Andhra Pradesh	02	11800 MTA
2.	Karnataka	07	3140.6 MTA and 120000 nos. cartridges
3.	Gujarat	01	12000 MTA (Shredded PCBs and mother boards.
4.	Maharashtra	03	8060 MTA
5.	Haryana	01	1200 MTA
6.	Rajasthan	01	450 MTA
7.	Tamil Nadu	06	38927 MTA
8.	Uttar Pradesh	01	1000 MTA
9.	Uttarakhand	01	12000 MTA

People should look forward to hand over the e-waste to the registered recyclers rather than treat it themselves otherwise they would be victimized by the toxic and hazardous substances in the e-waste. However, for the informal recycler‘s research scholar are striving to get environment friendly, low cost, effective, handy e-waste processing and treating techniques. New techniques may bridge the informal and formal processing methods and environmentally sound e-waste management may be established easily.

VIII. CONCLUSION

India is placed fifth among the other global nations which have generated more E-waste in quantity and especially urban India needs an urgent approach to tackle this issue. Technical and policy-level interventions, implementation and capacity building and increasing the public awareness can convert this challenge into an opportunity to show the world that India is ready to deal with future problems and can set global credible standards concerning environmental and occupational health. Recycling is the key to reduce the E-waste and it has environmental benefits at every stage in the life cycle of a computer product, from the raw material from which it is made to its final disposal. As a result we should know the ways and means of disposing the waste with the help of the available or new technology for a convincing betterment of our environment.

REFERENCES

[1] S. Herat, “Waste Management & Research,” no. July, 2012.

[2] S. Ilyas, M. A. Anwar, S. B. Niazi, and M. A. Ghauri, “Bioleaching of metals from electronic scrap by moderately thermophilic acidophilic bacteria,” vol. 88, pp. 180–188, 2007.

[3] G. Gaidajis, K. Angelakoglou, and D. Aktsoglou, “E-waste : Environmental Problems and Current Management,” vol. 3, no. 1, pp. 193–199, 2010.

[4] S. Needhidasan, M. Samuel, and R. Chidambaram, “Electronic waste – an emerging threat to the environment of urban India,” *J. Environ. Heal. Sci. Eng.*, vol. 12, no. 1, p. 36, 2014.

[5] S. V. K. Ramachandra T.V., **Ramachandra T.V., * Saira Varghese K.* 2004.

[6] S. Pramila, M. H. Fulekar, and P. Bhawana, “E-Waste- A Challenge for Tomorrow,” vol. 1, no. 3, pp. 86–

93, 2012.

[7] A. Fornalczyk, J. Willner, K. Francuz, and J. Cebulski, "E-waste as a source of valuable metals," vol. 63, no. 2, pp. 87–92, 2013.

[8] A. Borthakur, P. Singh, and I. Policy, "Electronic waste in India : Problems and policies," vol. 3, no. 1, pp. 353–362, 2012.

[9] j. Balde, c.p., Wang, F., Kuehr, R., Huisman, *E-WASTE MONITOR*. 2015.

[10] K. Jahan and A. Begum, "Electronic Waste (E-Waste) Management in India : A Review," vol. 10, no. 4, pp. 46–57, 2013.

[11] S. Herat and P. Agamuthu, "E-waste: a problem or an opportunity? Review of issues, challenges and solutions in Asian countries," *Waste Manag. Res.*, vol. 30, no. 11, pp. 1113–1129, 2012.

[12] M. C. Vats and S. K. Singh, "Status of E-Waste in India - A Review," vol. 3, no. 10, pp. 16917–16931, 2014.

[13] Puckett J, Byster L, Westervelt S, Exporting Harm: The high-tech trashing of asia, the basel action network (BAN) and Silicon Valley Toxics Coalition (SVTC).2002.http://www.ban.org/E-waste/technotrashfinalcomp.pdf.

[14] Sinha-Khetriwal D: The management of electronic waste: A comparative study on India and Switzerland. St. Gallen, Switzerland: M.S. thesis, University of St. Gallen; 2002.

[15] Widmer R, Oswald-Krapf H, Sinha-Khetriwal D, Schnellmann M, Böni H: Global perspectives on e-waste. Environ Impact Assess Rev 2005, 25(5):436–458.

[16] Sinha-Khetriwal D, Kraeuchi P and Schwaninger M (2005) A comparison of electronic waste recycling in Switzerland and in India. Environmental Impact Assessment Review 25: 492–504.

[17] Dwivedy M and Mittal RK (2010) Future trends in computer waste generation in India. Waste Management 30: 2265–2277.

[18] Rathore P, Kota S and Chakrabarti A (2011) Sustainability through remanufacturing in India: a case study on mobile handsets. Journal of Cleaner Production 19: 1709–1722.