IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 12, Issue 11 Ver. I (November. 2018), PP 08-16
www.iosrjournals.org

Status Of E-Waste In India- A Review

Israel Cherukuri[1], Nazia Sultana[2] And Sankara Pitchaiah Podila[3]
[1,2 ,3] *Department of Geology, Acharya Nagarjuna University, Nagarjuna Nagar,Guntur -522510, Andhra Pradesh, India*
**Corresponding Author-Israel cherukuri*

Abstract: *Technological development and enormous increase in using electrical and electronic appliances resulted large quantities of e-waste. In India, e-waste issue is emerged as one of the global challenges. 4.1 Mt of e-waste was generated during 2015 and is expected to reach 8 Mt by 2025. Poor collection mechanisms, informal processing methods, illegal dumping, poor awareness among the users cause serious threats to human health and environment in the country. Upgrading and obsolescence of appliances left no way to the people except to go for new products, which cause more e-waste. Systematic collection and processing methods shall be developed and awareness programs shall be arranged for the users. e-Waste (Management) rules, 2016 shall be revised as per the experts suggestion and be implemented properly.*
Keywords: *e-waste, categorization, composition, human health, management, legislation*

Date of Submission: 30-10-2018 Date of acceptance: 15-11-2018

I. Introduction

Electronic waste or e-waste describes discarded electrical or electronic devices. Used electronics which are destined for reuse, resale, salvage, recycling, or disposal are also considered e-waste. Informal processing of e-waste in developing countries can lead to adverse human health effects and environmental pollution.

The increasing use of electrical and electronic equipments has led to a significant rise in e-waste worldwide over the past two decades. e-Waste is today the fastest growing component of the municipal solid waste stream and currently comprises more than 5% of its total flow, which is equivalent to 20-50 million tons a year worldwide. Electrical and electronic equipment contain different hazardous materials which are harmful to human health and the environment. Even as India has been and continues to be a dumping ground of e-waste from western countries, no serious effort has been made to arrest the situation (Swarnil and Tarakanta, 2014). The present study is concentrated to review the status of e-waste in India.

II. Categorization of e-waste

e-Waste includes computer and its accessories, monitors, printers, keyboards, central processing units; typewriters, mobile phones and chargers, remotes, compact discs, headphones, batteries, LCD/Plasma TVs, air conditioners, refrigerators and other household appliances. The composition of e-waste is diverse and falls under 'hazardous' and 'non-hazardous' categories. Broadly, it consists of ferrous and non-ferrous metals, plastics, glass, wood and plywood, printed circuit boards, concrete, ceramics, rubber and other items. Iron and steel constitute about 50% of the waste, followed by plastics (21%), non-ferrous metals (13%) and other constituents. Non-ferrous metals consist of metals like copper, aluminium and precious metals like silver, gold, platinum, palladium and so on. The presence of elements like lead, mercury, arsenic, cadmium, selenium, hexavalent chromium, and flame retardants beyond threshold quantities make e-waste hazardous in nature. It contains over 1000 different substances, many of which are toxic, and creates serious pollution upon disposal. Obsolete computers pose the most significant environmental and health hazard among the e-wastes (https://rajyasabha.nic.in).

As per the European Council the e-waste is classified into the following categories;

- Large household appliances
- Small house hold appliances
- IT and telecommunications equipment
- Consumer equipment
- Industrial tools
- Lighting equipment
- Toys, leisure and sports equipment
- Medical devices (with the exception of all implanted radiotherapy equipment)
- Monitoring and control instruments

- Automatic dispensers

Components / Parts of some Electrical and Electronic devices

Various components/parts of computers, TV and Mobile phones are given below.

Computers: Motherboard, Power Supply, Central Processing Unit (CPU), Random-access Memory (RAM), Hard Disk Drive / Solid State Drive, Video Card, Optical Drives and Input, Output devices etc (https://www.houk- consulting.com).

Television: The television consists of four principle sets of parts, including the exterior or housing, the audio reception and speaker system, the picture tube, and a complicated mass of electronics including cable and antenna input and output devices, a built-in antenna in most sets, a remote control receiver, computer chips, and access buttons (http://www.madehow.com).

Mobile Phone: Lens, internal antenna, aerial, speakers, earpiece, microphone, microphone connectors, loud speakers, buzzers, ringers, charging blocks, system connectors, chassis, slide mechanism, ribbon cables, sim slot covers, readers, backup, battery, battery clip, covers, battery contacts, connectors and kea pad membrane etc., (Shivaprasad et al., 2016). Quantity of metals present in mobile Phones and run of mine ore are shown in Table 1.

Table 1 Quantity of metals present in mobile phones and run of mine ore

	Quantity (kg)	**Mobile phones**	**Run of mine ore**
Gold	24	1 million units ~ 148.4 tons	23,762.4 tons of gold ore
Silver	250		1160.1 tons of silver ore
Palladium	9		3333.3 tons of palladium ore
Copper	9000		1500.0 tons of copper ore

Source: Electronics Take Back Coalition, (2014)

III. Composition of e-waste

Electronic appliances are composed of hundreds of different materials that can be both toxic and of high value. Materials such as iron, aluminum, plastics and glass account for over 80 weight % of e-waste, whereas valuable and toxic materials are found in smaller quantities but are still of high importance (Sushant et al., 2010 and Cui and Zhang, 2008). Metal composition of various electronic appliances is given in Table 2.

Table 2 Metal composition of e-waste (Jha et al., 2011)

S.No	**E-Waste**	**Weight (%)**					**Weight (ppm)**		
		Fe	**Cu**	**Al**	**Pb**	**Ni**	**Ag**	**Au**	**Pd**
1	TV board scrap	28	10	10	1	0.3	280	20	10
2	PC board scrap	7	20	5	1.5	1	1000	250	110
3	Mobile phone scrap	5	13	1	0.3	0.1	1380	350	210
4	Portable audio scrap	23	21	1	0.14	0.03	150	10	44
5	DVD player scrap	62	5	2	0.1	0.05	115	15	4
6	Calculator scrap	4	3	5	0.1	0.5	260	50	5
7	PC main boar scrap	4.5	14.3	2.8	2.2	1.1	639	566	124
8	Printed circuit board scrap	12	10	7	1.2	0.85	280	110	NR
9	TV scrap (CRTs removed)	NR	3.4	1.2	0.2	0.038	20	<10	<10
10	Electronic scrap	8.3	8.5	0.71	3.15	2.0	29	12	NR
11	Pc scrap	20	7	14	6	0.85	189	16	3
12	Typical electronic scrap	8	20	2	2.	2	2000	1000	50
13	E-scrap sample	37.4	18.2	19	1.6	NR	6	12	NR
14	E-scrap sample	27.3	16.4	11.0	1.4	NR	210	150	20
15	Printed circuit board	5.3	26.8	1.9	NR	0.14	3300	80	NR
16	e – scrap (1972 sample)	26.2	18.6	NR	NR	NR	1800	220	30
17	E-waste mixture	36	4.1	4.9	0.29	1.0	NR	NR	NR

NR: not reported

IV. Health and Environmental Impacts of e-waste

e-Waste is a diverse combination of various types of toxic elements, which are capable of creating an irreversible impact to the human health and environment. Hence, it should be handled properly. The hazardous substances, their occurrences and impacts on human health and environment (Begum, 2013) are incorporated in Table 3.

Table 3 Hazardous substances in e-waste,their occurrence and impacts

e-Waste components	Toxic metals	Limit, ppm	Disease caused by the exposure to above permissible limit
Ceramic capacitors, switches, batteries	Ag[a]	5.0	Excessive amount causing blue pigments on body, damages brain, lung, liver, kidney
Gallium arsenide is used in light emitting	As[b]	5.0	Chronic effect and causes skin disease and lung cancer and impaired nerve signaling.
Electron tube, lubricant, fluorescent lamp, CRT gun	Ba[b]	< 100	Causes brain swelling, muscle weakness, damage to the heart
Power supply boxes, motherboard	Be[b]	0.75	Causes lung cancer, beryllicosis, skin disease, carcinogens
PCBs, casing, PVC cables	Br[b]	0.1	Thyroid gland damage, hormonal issues, skin disorder, DNA damages, hearing loss
PCBs, battery, CRTs, semiconductors, infrared detectors, printer ink, toners	Cd[b]	1.0	Pose a risk of irreversible impacts on human health particularly the kidney
Printed circuit boards (PCBs)	CN[b]	< 0.5	Cyanide poisoning, > 2.5 ppm may cause to coma and death
Plastic computer hosing, cabling, hard discs, as a colorant in pigments,	Cr(VI)[b]	5.0	Toxic in the environment, causing DNA damage and permanent eye impairment
Batteries, LCD, switches, backlight bulbs or lamps	Hg[b]	0.2	Damages brain, kidney and foetuses
Mobile, telephone, batteries	Li[a]	< 10d	Diarrhea, vomiting, drowsiness, muscular weakness
Batteries, semiconductor, CRT, PCB	Ni[a]	20.0	Causes allergic reaction, bronchitis, reduces lung function, lung cancers
Transistor, LED lead-acid battery, solder, CRT, PCBs, florescent tubes	Pb[c]	5.0	Damages brain, nervous system, kidney, and reproductive system, causes acute and chronic effects on human health
CRT glass, plastic computer housing and a solder alloy	Sb[b]	< 0.5	Carcinogen, causing stomach pain, vomiting, diarrhea and stomach ulcer
Fax machine, photoelectric cells	Se[b]	1.0	High concentration causes selenosis
CRT, batteries	Sr[c]	1.5	Somatic as well the genetic changes due to this cancer in bone, nose, lungs, skin
Batteries, luminous substances	Zn[b]	250.0	nausea, vomiting, pain, cramps and diarrhea
Cooling units and insulation foam	CFCs[b]	< 1.0 for 8 h/day	Impacts on the ozone layer which can lead to greater incidence of skin cancer
Transformer, capacitor, condensers	PCBs[b]	5.0	PCB causes cancer in animals and can lead to liver damage in human
Monitors, keyboard, cabling and plastic computer housing	PVC[b]	0.03	Hazardous and toxic air contaminants, release of HCl causes respiratory Problems

Source : Pathak et al.,(2017), [a] Critical; [b] Hazardous and toxic; [c] Radioactive waste; [d] limit in serum/blood.

From the above Table we can understand that there are many dangerous effects on human health from e-waste.

V. Status of e-waste in India

Central Pollution Control Board (CPCB) in 2005 estimated 0.147 million tons (Mt) of e-waste in the country and simultaneously had projected 0.80 Mt of e-waste generation in the year 2010. India has emerged as fifth biggest producer of e-waste in the world; discarding 1.7 Mt of electronic and electrical equipment in 2014 (Economic Times, 2015). The e-waste quantity reached 2.0 Mt during 2016 (Narain, 2018). In Indian Scenario, electronics industry has emerged as the fastest growing segment in terms of production, exports and imports. Since 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 bae of 4.64 million desktops, about 431 thousand notebooks and 89 thousand servers. According to survey of Confederation of Indian Industries, 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 (CII, 2006). According to the estimates made by Manufacturers Association of Information Technology (MAIT, 2007) the Indian PC industry is growing at a 25% compounded annual growth rate in 2007. In India e-waste is increasing at the rate of 10% per annum (Ravi Agarwal, 2010).

According to Pathak et al., 2017, the volume of waste is growing at an estimated 21 per cent annually. This report predicts that by 2020, e-waste from old computers in India will increase by 500%; from discarded mobile phones will be about 18 times higher; from televisions will be 1.5 to 2 times higher; from discarded refrigerators will double or triple; than their respective 2007 levels.

India generates about 4.1 million tons of e-waste and it is expected to reach 8 million tons by 2025. The yearly e-waste generation, per capita generation and e-waste prediction from electronics are given in Tables 4, 5 and 6.

Table 4 e-Waste generation per year

countries	**e-Waste generation Per year (10^5x tons)**
Mexico	11.38
Brazil	14
Russia	15.56
Japan	27
India	30.33
China	73
USA	94
EU	109.33
Germany	19
France	13
Australia	6
South Africa	3

Source: StEP Initiative 2012

Table 5 e-Waste generation

Country	**Kg per Capita**
USA	29.8
Australia	25.2
Germany	23.2
United Kingdom	21.8
Japan	21.5
France	21.1
Brazil	7.1
South Africa	6.6
China	5.4
India	1.0

Source: StEP initiative, 2012

Table 6 e-Waste prediction (million Kg)

Year	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Desktop	37.25	38.04	39	39.83	40.75	41.66	42.5
Laptops	10.8	12	13.2	14.4	15.6	16.8	18
Mobile phones	14.62	16.35	18.1	19.84	21.58	23.33	25.07
Television	140.04	147.9	155.76	163.62	171.48	179.34	187.2
Total	**2216.71**	**2229.29**	**226.06**	**237.69**	**249.41**	**261.13**	**272.77**

Source: Yunus and Sengupta, 2016

Sixty-five cities generate more than 60% of the total e-waste generated in India and ten states generate 70% of the total. Maharashtra ranks first followed by Tamil Nadu, Andhra Pradesh, Uttar Pradesh, West Bengal, Delhi, Karnataka, Gujarat, Madhya Pradesh and Punjab (https://www.financialexpress.com). Quantity of e-waste generation from various states and union territories is shown in Table 7.

Table 7 State wise quantity of e-waste

States/Union Territory	**WEEE (Tons)**	**States/Union Territory**	**WEEE (Tons)**
Andaman and Nicobar Islands	92.2	Lakshadweep	7.4
Andhra Pradesh	12,780.3	Madhya Pradesh	7.800.6
Arunachal Pradesh	131.7	Maharashtra	20,270.6
Assam	2,176.7	Manipur	231.7
Bihar	3,055.6	Meghalaya	211.6
Chandigarh	359.7	Mizoram	79.6
Chhattisgarh	2,149.9	Nagaland	145.1
Dadra and Nagar Haveli	29.4	Orissa	2,937.8
Daman and Diu	40.8	Puducherry	284.2
Delhi	9,729.2	Punjab	6,958.5
Goa	427.4	Rajasthan	6,326.9
Gujarat	8,994.3	Sikkim	78.1
Haryana	4,506.9	Tamilnadu	13,486.2
Himachal Pradesh	1,595.1	Tripura	378.3
Jammu and Kashmir	1,521.5	Uttar Pradesh	10,381.1
Jharkhand	2,021.6	Uttarakhand	1,641.1
Karnataka	9,118.7	West Bengal	10,059.4
Kerala	6,171.8	Total	146,180.7

Source: Country Level WEEE assessment study by IRGSSA (2005)

VI. Management of e-waste

For effective management of e-waste we shall have knowledge about the challenges, imports from other countries, systematic disposal and treatment methods. Here, these issues are briefly addressed.

Challenges

Challenges related to e-waste management are (Diaz et al., 2004; Renteria and Mozos, 2012);

- The high cost associated to the collection and recycling of used products
- The lack of harmonized cross-national legislation which means that a company must comply with regulations of varying rigour
- The free-rider threat, i.e. companies importing products from countries having a less strict legislation, thus enjoying lower prices
- Consumer awareness to return e-waste to separate collection points Warehousing
- Transportation
- Recovery and reuse
- Product dismantling
- Separation of materials
- Elimination of waste

Imports

India became dumping ground of e-waste by many developed nations. Figure 1 shows % share of e-waste imports in India from different countries. US has a maximum share of around 42%, China 30% followed by Europe 18% and rest 10% from other countries like Taiwan, South Korea, Japan etc (Rajesh and Karishma 2016).

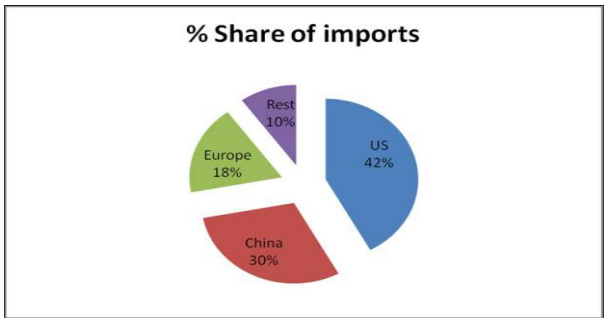

Fig. 1 Percentage share of e-waste imports

Source: Economic Times, 2015

Hazardous Waste Disposal Methods

Common methods for the disposal of e-waste are Land filling, Incineration and Acid baths. Balde et al., (2015) classified the current practices into four categories.

- Official take-back system
- Disposal with mixed residual waste
- Collection outside official take-back systems
- Informal collection and recycling in developing countries

Treatment Methods

Recycling Methods

According to Swarnil and Tarakanta, 2014 despite its economic importance, research on e-waste recycling has never been seen as a priority and gets little respect within companies in India. Electronic brand companies in India are laggard rather than leaders in adopting new technologies and innovation on e-waste recycling. This aversion to innovation has left consumers and workers associated with e-waste exposed to dangers that have not been addressed. To reverse this, most of these companies will need to venture out of their comfort zone which in turn may be ensured by implementation of effective laws.

e-Waste contains valuable constituents such as precious and strategic metals like silver, gold and copper and hence is economically viable to recycle. A general flow sheet for the recycling operations and a

recycling schemes for the recovery of valuable and precious metals are given by Pathak et al., (2017). There are two common steps used in the recycling of e-waste around the world (Namias, 2013).

a) Pre-processing that includes dismantling, shredding, mechanical separation
b) End-processing that includes pyro/hydro/bio/electro metallurgical treatment

a) Pre-processing

This step usually deals with manual disassembly of electronic devices, removing hazardous materials and separating various streams such as metals, glass, and plastics. The remaining material that can't be manually separated is sent for shredding and then separation of metals from plastics and glass is achieved by using processes such as magnetic and gravity separation.

b) End-processing

End-processing involves processes to recover valuable metals from the concentrate obtained after pre-processing and mostly used to recover and purify copper, gold, silver and palladium. The most widely used processes are pyro-metallurgy, hydro-metallurgy, bio-metallurgy and electro-metallurgy.

There are 178 dismantling/recycling units with a capacity of 441085.6 metric tons per annum. Table 8 shows the State-wise details of installed recycling/dismantling facilities operating in the country.

Table 8 The State/UT wise details of authorized dismantlers/recyclers

S. No.	State	Number of registered Dismantler and Recycler	Registered Capacity in tonne per Annum
1.	Chhattisgarh	2	1650.0
2.	Gujarat	12	37262.12
3.	Haryana	16	49981.0
4.	Karnataka	57	44620.5
5.	Madhya Pradesh	3	8985.0
6.	Maharashtra	32	47810.0
7.	Odisha	1	3000.0
8.	Punjab	1	150.0
9.	Rajasthan	10	68670.0
10.	Tamil Nadu	14	52427.0
11.	Telangana	4	11800.0
12.	Uttar Pradesh	22	86130.0
13.	Uttarakhand	3	28000.0
14.	West Bengal	1	600.0
	Total	178	441085.6

Source: Lok Sabha, 2017

VII. Legislation

According to Borthakur and Govind, (2017) for the first twenty years of the economic liberalization in India, e-waste observed no significant hindrance in its expansion. This period ensured increasing penetration of EEEs into the market due to the evolution of the IT and electronics sector. For most part of these years, e-waste was an unnoticeable and silent stream of waste observing a remarkable growth in the country.

One of the first steps toward e-waste regulation was made in 1988 when 4000 tons of toxic waste from Italy was dumped in Koko Port, Nigeria. This led to the promotion of the Harmful Waste Decree 4, which criminalized the transportation, deposit, import, selling, buying, or negotiating that involved trade of harmful waste in Nigeria. Failing to abide by this decree could lead to a life sentence in prison (Perkins et al., 2014).

A growing number of international organizations and initiatives have been formed to encourage adequate monitoring and regulation e-waste recycling, including the StEP Initiative; the Basel Action Network; the Silicon Valley Toxics Coalition; Toxics Link India; SCOPE Pakistan; and Greenpeace China. UNEP, United Nations University (UNU), PACE, the Federal Ministry for the Environment (Germany), the Nature Conservation and Nuclear Safety (Germany), and the National Institute of Environmental Health Sciences (US) are all involved with international research, advocacy, and regulation. The World Health Organization's Children's Environmental Health team is working on e-waste and the effects on child health. This coordinated effort seeks to raise awareness, develop tools, and investigate solutions to children's exposures (WHO, 2013).

There are several suggested methods to help guide the improvement and strengthening of e-waste policy. These methods entail Extended Producer Responsibility (EPR), Life Cycle Assessment (LCA), Material Flow Analysis (MFA) and Multi Criteria Analysis (MCA) (Gagliardi and Mirabile).

India has actively participated in, and ratified, many of the international environmental agreements into national regulations in the past. Despite such a history India lacked specific e-waste management rules until mid-2012 (Subramanian, 2014).

The government has joined with The German Technical Cooperation Agency (GTZ), Toxic Links, Greenpeace and others in 2007 and initiated a consultation for seeking a separate e-waste policy from the MoEF. These consultation workshops, resulted in development of a draft policy in June 2009 e-waste Management and Handling Rules 2011 came into force in May 2012 (MoEF, 2011).

Some researchers, such as Wath et al. (2010, 2011), have explored the use of market-based mechanisms like advanced recycling fees (ARF) for consumers and tax credits for producers and recyclers for effective implementation of an EPR based rule in India and have recommended ARF as part of EPR for its effectiveness. The 'new rule' however, does not acknowledge such market-based mechanisms. The exemption of micro and small enterprises from the purview of this rule, the exemption of producers from collection targets (which would make monitoring difficult) and non-recognition of reuse and refurbishment, which in the Indian context is high, are some of the shortcomings of this rule.

Past e-waste regulations have been focused on environmental protection. Now the focus is changed to health aspects and the related initiatives (Perkins et al., 2014) are mentioned below.

- The Libreville Declaration framed during the first Inter-Ministerial Conference on Health and Environment in Africa in 2008.
- The Busan Pledge for Action on Children's Environmental Health (2009).
- The Strategic Approach to Integrated Chemical Management's expanded Global Plan of Action, issued at the International Conference on Chemical Management (2012) and
- The Geneva Declaration on E-waste and Children's Health (2013) (Perkins et al., 2014).

On March 14, 2018 the Hon'ble High Court had directed Sunita Narain, DG, Centre for Science and Environment to submit a report on e-waste management. He has submitted his report in May 2018. It reviews the current status of e-waste in the country and based on this, recommends urgent actions that need to be taken and directions for the consideration of the Hon'ble High Court (https://cdn.downtoearth.org).

In 2016, the Central Government notified the e-waste (Management) Rules, which now supersede the e-waste (Management and Handling) Rules, 2011. The 2016 Rules came into force from October 1, 2016.

Highlights

- A key highlight of the 2016 Rules is the concept of Extended Producer Responsibility (EPR). Under this, producers of electrical and electronic equipment have register and then have mandatory targets to collect e-waste that they generate and to ensure that it channelized to authorized recyclers.
- The target is set by the Rules. In March 2018, the Rules were amended and the target was reduced to 10 per cent for 2016-17 (as against 20 per cent). This year's target (2017-18) remains 20%. This target progressively goes up to 70 per cent in the seventh year.
- Under the Rules the penalty for non-compliance is stringent – companies would not be allowed to sell their products if they are found to be non-compliant with the set targets.
- The onus has been set on the companies for meeting the collection target. They can adopt schemes like Deposit Refund – where consumers can leave a deposit, which is re-funded at the time of return.
- As per the Rules, the manufacturer must provide addresses, e-mail address, toll-free telephone numbers to inform consumers where they can return their e-waste.
- Import is permitted legally if material is "used" and will be "re-exported"

Under this provision, parties do not require prior permission for import. However, the import of these goods requires custom authorities to verify documents specified in Schedule VIII. Under this, customs has to check if there is an undertaking for export; and the copy of the annual return filed with SPCB for import in the last financial year.

Recommendations for the consideration of the Hon'ble High Court

Clearly, as given above, the situation of e-waste management requires much improvement. There is no data on the current generation of e-waste. Then miniscule amount of the massive quantities of e-waste that is generated is recycled in authorized centres. The 2016 Hazardous Waste and E-Waste Rules provide for provisions to ensure collection and authorized recycling. However, the implementation of these rules needs significant improvement. It is also not clear if we are allowing import of e-waste – as regulated waste and as 'used' material for refurbishment and re-export. Clearly, this would only add to the challenge of safe recycling and reprocessing. The role of the informal sector in the recycling business needs to be re-positioned so that it can provide cost-effective opportunities but without discounting environmental safety and labour conditions. In all this, it is difficult to assess if the 2016 Rules have led to any improvement in this situation on the ground. There is no data on the authorized recycling done of e-waste in Delhi. The data on the EPR registration of

companies has not been compiled, nor is it independently verified. Therefore, this is no information available on the compliance with EPR provisions of the Rules. Given this situation, the Hon'ble High Court could consider directing the Union Ministry of Environment, Forests and Climate Change (MoEF&CC) to respond to the following and to suggest the plan for improvement with timelines:

1. The need for inventorization of e-waste so that the challenge of management is better understood;
2. The need to ensure that import of e-waste is better regulated and that there is data on what permissions have been given and what is the status of recycling of this imported waste.
3. The need to ensure that 'used' material, which imported without restrictions, is regulated and that information is provided through Harmonized trade System (HS) codes so that there is monitoring of this material – quantities and points of use and disposal.
4. The need to ensure that there is stringent monitoring and enforcement of the provisions of the E-Waste Rules 2016 so that ERP targets are met and that there is independent information about where this collected waste is 'recycled'.
5. The need to ensure that there is monitoring of the health and environmental conditions of informal e-waste hubs in the country so that people who are employed here get compensation for ill health. There is also need to ensure that producers of electronic material are held liable for this environmental toxicity.
6. The need to improve and incentivize recycling through mandatory (not voluntary) deposit refund schemes by companies.

The fact is that unsafe recycling of such hazardous e-waste could end up adding massive toxicity to the environment. It is also extremely unsafe for people who work in this informal sector and is adding to their health burden.

A regulatory framework needs to enable proper collection and recycling and to 'set the rules' therein. Similarly, legal framework needs to ensure health and safety of the people involved in the operations.

VIII. Conclusion

e-Waste impact assessment on health and environment shall be carried to understand the current and future damage. Collection centers be established for clearing the e-waste from the users. Government shall start the repair centers throughout the country. e-Waste issue shall be dealt seriously to avoid the future consequences.

References

[1]. Balde K, Wang F, Huisman J, Kuehr R, (2015), The Global E-waste Monitor. United Nations University, IAS – SCYCLE, Bonn, Germany.

[2]. Begum Kousar Jahan Ara (2013) Electronic Waste (E-waste) Management in India: A Review. IOSR Journal of Humanities and Social Science (IOSR-JHSS), Vol. 10, Issue 4, pp 46-57.

[3]. Borthakur Anwesha and Madhav Govind (2017) How well are we managing E-waste in India: evidences from the city of Bangalore. Energ. Ecol. Environ. 2(4), 225–235.

[4]. Cui Jirang, Zhang Lifeng (2008), Metallurgical recovery of metals from electronic waste: A review, Journal of Hazardous Materials 158, 228–256.

[5]. Diaz A, Álvarez M.J, González P., Logística inversa y medio ambiente, aspectos estratégicos y operativos, McGraw-Hill, 2004, pp. 323-336.

[6]. Economic Times, (2015). 76% of e-waste workers suffer from respiratory ailments: Study. Retrieved October 15, 2015, from http://econo mictimes.indiatimes.com/: http://economictimes.indiatimes.com/news/politics-and-nation/76-of-e-waste-workers-suffer-from-respiratory-ailments-study/ articleshow/47531421.cms.

[7]. Electronics Take Back Coalition, (2014), Facts and Figures on E-waste and Recycling.

[8]. IRGSSA (2005). Country Level WEEE Assessment study by IRG Systems South Asia Pvt. Ltd. New Delhi: IRGSSA (www.irgssa.com).

[9]. Jha M. K., Kumar A., Kumar, V. (2011), Prospective Scenario of E-waste Recycling in India, Recycling of electronic waste II, proceedings of the second symposium, TMS the minerals, metals and materials society.

[10]. Lok Sabha (2017), Unstarred Question No. 1376, Government Of India , Ministry Of Environment, Forest And Climate Change. www.indiaenvironmentportal.org.infilesfileDisposal%20of%20e-Waste_0.pdf.

[11]. MAIT GTZ-:"A study on E-waste assessment in the country",The German Technical Cooperation Agency (GTZ) and Manufacturer's Association for Information Technology Industry (MAIT) press release on date December 13, 2007. Available online at [http://www.mait.com/admin/press_images/press77-].

[12]. Ministry of Environment and Forest (MoEF) (2011), E-waste (management and handling) rules 2011, Government of India, [Online] Available: http://envfor.nic.in/downloads/rules-and-regulations/1035e_eng.pdf [Accessed 8/7/2011].

[13]. Namias J (2013), The Future of Electronic Waste Recycling in the United States: Obstacles and Domestic Solutions. Columbia University, New York, United States.

[14]. Narain Sunita (2018) Report E-waste management: generation; collection and recycling, https://cdn.downtoearth.org.in/library/0.00599000_1527080032_e-waste-report-for-hc-final.pdf.

[15]. Pathak P, Rajiv Ranjan Srivastava and Ojasvi (2017), Assessment of legislation and practices for sustainable management of waste electric and electronic equipment in India, published in Renewable and Sustainable Energy Reviews 78, 220-243.

[16]. Perkins Devin N, BS, Marie-Noel Brune Drisse, MS, Tapiwa Nxele, MS, and Peter D. Sly, MD (2014), E-waste: A Global Hazard. Icahn School of Medicine at Mount Sinai. Annals of Global Health 2014;80:286-295.

[17]. Rajesh Kumar and Karishma (2016) Current Scenario of e-waste management in India: issues and strategies. International Journal of Scientific and Research Publications, Volume 6, Issue 1, January 2016, ISSN 2250-3153.
[18]. Ravi Agarwal, 'A Policy? Rubbish', The Hindustan Times, 4 May 2010.
[19]. Renteria, A, Álvarez-de los Mozos, E., in: Environmental Issues in Supply Chain Management, Springer-Verlag, 2012, pp.91-105.
[20]. Shivaprasad H , N T Manjunath , D P Nagarajappa , N T Shanmukha (2016), Evaluation of E-waste Generation and Disposal Mechanism in Davanagere City, Journal of Remote Sensing, GIS & Geotechnical Engineering Vol. 1, Issue 1, pp 1-17.
[21]. StEP-Initiative-2012-https://www.researchgate.net/figure/E-Waste-Generation-per-year-in-10-5-x-tonnes-in-2012-_fig1_274721600
[22]. Subramanian Logakanthi (2014), Management of Electronic Waste by Bulk Consumers: The Case of India's IT Service Sector. A thesis submitted to the University of Manchester for the degree of Doctor of Philosophy in the Faculty of Humanities.
[23]. Sushant B. Wath P. S. Dutt and T. Chakrabarti (2010) E-waste scenario in India, its management and implications. Environmental Monitoring and Assessment.
[24]. Swarnil Dey and Tarakanta Jana (2014), E – waste Recycling Technology Patents filed in India - An Analysis. Journal of Intellectual Property Rights, Vol. 19, pp 315-324.
[25]. Wath, S. B., Dutt, P. S., & Chakrabarti, T. (2011), E-waste scenario in India, its management and implications, Environmental Monitoring and Assessment, 172(1-4), 249-262.
[26]. Wath, S. B., Vaidya, A. N., Dutt, P. S., & Chakrabarti, T. (2010). A roadmap for development of sustainable E-waste management system in India, Science of the Total Environment, 409(1), 19-32.
[27]. WHO. E-waste and child/vulnerable populations' health initiative concept note. 2013. Available at: http://www.step-initiative.org/tl_ files/step.
[28]. Yunus P A and Sengupta B (2016), E-Waste Indian Perspective and Recovery of Valuable Metals From E-Waste-A Review. International Refereed Journal of Engineering and Science (IRJES) ,Vol. 5, Issue 4, PP.70-80.
[29]. http://www.madehow.com/Volume-3/Television.html
[30]. https://rajyasabha.nic.in/rsnew/publication_electronic/E-waste_in_india.pdf
[31]. https://www.houkconsulting.com/2017/03/standard-computer-components/
[32]. https://www.financialexpress.com/archive/ten-states-contribute-70-of-e-waste-generated-in-india/283644/

Israel cherukuri "Status Of E-Waste In India- A Review " IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT) 12.11 (2018): 08-16.