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The Problems of E-Waste And Its Management in Current Education Systems

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Abstract: ***With increase in the computerization and digitization of all the institutions including education, the e-waste is a now a serious problem to tackle. Now in class room teachers are equipped with various teaching tools like laptop or computer, UPS, DLP projector, Remote control. Every electronic component has fixed life span . Later on you have to modify or replace it, causing electronic waste. We are purchasing new systems , at the same time we have to deal with old computer systems because it becomes useless for us . This new digital revolution infiltrated in our education system with more effective, easy and powerful knowledge comforts the same technology has made our education better, which is on the down side creating more toxic problems for us. With the growth of IT and related industries the usage and disposal of computer system and other electronic equipments are increased with incremental quantity of e waste. Therefore it has become necessary to study e waste management practices that are being adopted. The paper gives the list of various hazadous substances amd their impact and also provides the existing strategies for its solution in the current world.***

Key Words: E waste, Computer Education, E waste recycling, waste mitigation strategies.

1.0 INTRODUCTION

The computers have changed the face of human kind and made the life more efficient, organised and productive. As computer literacy became mandatory and almost all the countries have created policy of providing computer education on a massive scale to produce a useful man power to work in this world. This triggered the purchase of all sort of electronic goods like computer , DLP projector, Audio ,video system, tapes, drives, coolants air conditioners etc. Along with that the necessity to use internet created the demand of Computer broad band system and fibre optics, dish antennas etc. Education has reached far flung areas by using satellite systems like BISAG. NME-ICT a government initiative are already implementing these practices and IIT Mumbai has successfully completed several workshops through several remote centers. All this created huge demand of electronic goods . No doubt it is very good to manage such excellent education using Information and Communication Technology, experts have limitation to deliver lectures in the classroom teaching with limited students it may become history. In the current situation of COVID19 lockdown, we saw that how the whole education was shifted online and all teaching fraternity was teaching the subjects using computer gadgets. So it is quite clear that the usage of electronic and electrical goods are going to increase and there will be an exponential rise in the electronic gadgets. The gadgets will expire after their life cycle and will convert int e-Waste which is to be tackled and disposed in a environmental friendly manner. If not than this will be a disaster in future as most of the electrical and electronic goods are non degradable and will result in soil, air and water pollution.

2.0 ENVIRONMENTAL IMPACT OF E-WASTE

As per Mireike Buth's statement "The environmental impact of e waste", he has mentioned the e-waster generated by electronic goods and the substances they generate which can do environmental damage[2].

Table : 1 List of substances, e-waste and environmental impact by Mireike Buth [2]

Substance	Occurrence in e-waste	Environmental and health relevance
HELOGENATED 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-accumulative.
TBBA (tetrabromo-bisphenol-A) PBB (polybrominated biphenyls) PBDE	Fire retardants for plastics (thermoplastic components , cable insulation). TBBA is	Can cause long-term period injuries to health. Acutely poisonous when burned.

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(polybrominated diphenyl ethers)	presently the most widely used flame retardant in printed wiring boards and covers for components.	
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 , beam line components	Harmful if inhaled.
Cadmium	Printer inks, toners , fluorescent layer (CRT screens) Rechargeable NiCd-batteries , Photocopying machines.	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.
Lithium	Li- batteries	May develop explosive gases (Hydrogen) if wetted.
Mercury	Fluorescent lamps that provide backlighting in LCDs, some alkaline batteries and mercury wetted switches	Acutely poisonous and injurious to health on a long term perspective
Nickel	Rechargeable Ni Cd-batteries , NiMH-batteries, electron gun	May cause allergic reactions.
Rare earth elements	Fluorescent layer (CRT- screen)	Irritates skin and eyes/
Selenium	Older photocopying-machines (photo drums)	High levels may cause adverse health effects
Zinc sulphide	Interiors of CRT screens, mixed with rare earth metals	Toxic when inhaled
Gallium arsenide	Light-emitting diode(LED)	Injurious to health.

3.0 FIGHT AGAINST PROBLEMS OF E-WASTE

The fight against the e-waste should not be for just one community but for the society as a whole. Every possible alternative can be thought of. Many people discard the use of electronic and electrical devices much before their life time as for them its utility is over. Such items can be given or donated to needy ones or society offices to elongate the generation of e-waste. The rechargeable alkaline batteries can be disposed easily as they don't have any heavy metals in them[3]. The operable parts of computers can be retrieved and reused somewhere else. Disposing toxic material needs extra care and specialists to do so. One need to approach designated agencies before disposing such waste.

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4.0 HOW COMPUTER MANUFACTURER COMPANIES DEALING WITH E WASTE.

E waste is global phenomenon and it is computer manufacturer company's basic duty to give the solution regarding e waste problems. Many companies are supporting solutions for this e waste problem. Wipro company is also dealing with e waste. They are taking following actions to deal with e waste problems [5]

- Wipro will collect the discarded systems from customers on behalf of the recycling agency.
- Provide the discarded computers to vendors certified by Pollution control board to recycle the parts.
- Ensure collection and transport of systems from customer to final waste recycling point. This support is limited to recycling of e-waste related to Wipro products being retired by the customer.
- Monitor the recycling of e-wastes by agency according to guidelines given by the relevant pollution control boards.
- Wipro will submit Form 9 and other documents required by Pollution Control Board to ensure compliance to standards set by Pollution Control Board.
- Wipro will collect documentary proof that these items have been recycled in a safe manner by the vendor as recommended by Pollution control board.
- Customer contacts any one of 17 Wipro contact centers or delivers the e-waste to one of the 17 locations.
- Wipro acknowledges the receipt of e-waste to customer.
- Wipro ensures delivery of e-waste to disposal agencies certified by pollution control board.
- Wipro monitors the disposal of e-waste by disposal agency (in eco friendly way) and shares the proof of disposal with customer.

5.0 STRATEGIES OF E-WASTE MANAGEMENT

The e-waste generated over the time is a serious issue and developed countries have come up with various strategies to deal with them. Some the popular strategies are as under

1. Life Cycle Analysis
2. Multi Criteria Analysis
3. Extended Product Responsibility

We shall look into them one by one as how they can be helpful to deal with e-waste management.

5.1 Life cycle assessment (LCA)

Under ISO 14040, 2006 provision has been made to have a systematic approach to understand, evaluate and quantify the performance of environment protection steps involving all stages of manufacturing product , its processes and various actions performed. LCA can help supervise and identify and verify the e-waste criteria in every process of its creation, storage, supply and accessories. e However life cycle analysis is not limited to just the product creation life cycle but must emphasize on the environmental impact it is creating on soil, air and chemical wastes (solid and liquid). The heat emissions and radioactive counts must also be observed with the product life cycle. The Moto of this strategy is if we can minimize the environmental impact at the production and delivery cycle we have solved most of the environmental issues regarding the product. E waste management life cycle must be carefully chalked out at the time of manufacturing itself as the manufacturer know the best regarding the materials which can impact environment.

5.2 Multi-Criteria Analysis

This is another of looking at E-Waste management. This requires a function which encompasses all possible criteria required for e-waste assessment and e-waste management. To name a few the critical like heavy metals used, water used, gases emitted, degradability duration, radio activity, chemical toxicity of materials used etc can be listed and every criteria can be assigned a mathematical weightage. Even manufacturing operations, storage options, delivery mechanisms can be also given weightages. This will allow us to assess the possible environmental damage in a more analytic and realistic way. [2] has highlighted a sample case where multi criteria analysis has been used. Analysing and assessing strategies and choosing the good strategy for a e-waste-management system are possible using quantitative criteria only. These criteria are the consequences of the effectiveness of particular waste management strategies and the degree to which established targets are met, which are formulated in general terms

5.3 Extended Producer Responsibility (EPR)

This is the legal side of E-waste management [3]. The E-Waste Rules, 2016 clearly specify that the E-waste to be generated is the responsiblity of producer to handle it. The supervising agency Central Pollution Control Board (CPCB) will ensure that every producer comes with a plan of e-waste management before manufacturing and delivery to consumers. They have to procure

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EPR authorization from CPCB. A producing organization has responsibility of collection and channelization of e-waste. In case of Importers of such products they have to submit EPR plan providing mechanisms as how they are going to tackle e-waste.

5.0 CONCLUSIONS

This paper focuses on the aspect of e-waste management for the grand initiative of computer based education system. The problem of different kinds of waste generated at the end of life of electronic goods is discussed in detail. It also mentions the effort done by various organisation to deal with this issue. Lastly paper discusses the global strategies like life cycle management, multi criteria analysis and Extended product responsibilities to deal with precautionary and realistic methods to assess and mitigate the damage done to environment with the piling up of e-waste.

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