Research Paper Engineering

E-Waste Management and Handling in Indian Context: Strategies and Urgent Measures

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ABSTRACT

Continual development in Science and Technology is being witnessed across the globe. Every second newer and innovative version of electronic gadgets like mobile phones, tablets, I-pods, note-book, LED TV, Plasma TV are being launched, making the earlier and prevailing model obsolete. With increasing inventions and cheaper technologies, more and more gadgets are becoming available and affordable to the common man. Due to increased usage and dependency, we are becoming slaves of these e-gadgets. To meet up with the increasing demand of these devices, there is an uncontrolled scale up in the production and up gradation of these gadgets. The actual problem arises when gadget becomes unusable and has to be disposed off. Thus, leading to greater accumulation of E-waste. E-wastes contain varied components, many of which are toxic and potentially deleterious to environment and human health, if not treated and managed properly. This paper gives a detailed account on the measures and the strategies that needs to be employed for E-waste management and handling in order to curb this growing threat to the mankind.

KEYWORDS E-waste management, strategies, health, human, toxic, obsolete.

SECTION I: INTRODUCTION

The incessant and constant upsurge in the scientific, technical and procedural advances and inventions which has existed in past, has to a great extent underwrote to the ease of human existence in all upshots. However, these triumphs and victories are not without their short-comings. The major problem is unrestrained generation of used electronic appliances or gadgets. This is mainly in developing countries and is generally referred to as E-waste, which is created from electrical and electronic equipment's. Owing to technological advancement and increased awareness on the importance of information technology has triggered colossal generation of electronic wastes throughout the globe and is more prominent in developing countries where the use of electronic gadgets is on the increase in recent times without apt and right method of recycling. These electronic wastes include obstinate and toxic materials which facade distinct challenges that differ from other types of wastes to the environment (Lincoln et al, **2007**). The hazardous materials contained in electronic wastes include; cadmium, arsenic, antimony, chromium, cobalt, lead, mercury, selenium, beryllium and brominated flame retardants among others which pose threats to human health and milieu. (Musson et al, **2006**).The present system in developing countries relating to E-waste is not in place where the substantial consumers live. Majorly most of the e-waste is either used as landfills, predisposed and left to falloff naturally or burnt. The result of these waste disposing practices, the components which are present in the E wastes either leach into underground water bodies or escape into the atmosphere. These pose a great vigour peril to aquatic lives and humans who are persistently exposed to them, that is why; Africa has been tagged "hub of diseases" as poor procedures of disposal practiced in African countries where out-dated electronic equipment are abandoned, leading to never-ending generation of the wastes which have become a major issue of concern to environmental safety and waste management (Cui and Forssberg, **2003**, Sharma et al **2014**). Owing to these factors there is an imperative need for a more proficient, able and robust e-waste disposal technology in the developing countries, so that these challenges of e-waste can be controlled to contain and preserve the environment.

The objective of this paper is to give detailed account on the measures and the strategies that needs to be employed for E-waste management and handling in order to curb this growing threat to the mankind. To achieve the objective of the study the paper is divided into following sections. Section I i.e. the present section gives the insights on E-waste, its impact on environment and details of components of E-waste material. Section II gives E-waste management strategies, followed by summary and conclusions and references in Section III.References forms the part of last section.

SECTION II: MEASURES AND STRATEGIES TO CURB E-WASTE

2.1 Meaning of E-Waste

E-waste comprises of wastes which is produced from used electronic devices and household appliances which are not fit for their original projected use and are meant for resurgence, reprocess or dumping. It includes broad variety of electrical and electronic devices such as computers, hand held cellular phones, personal stereos, together with household appliances such as refrigerators, air conditioners etc.

2.2 Effect of E-Waste on environment

It contaminates soil, air, and ground water, if not disposed properly. When it is disposed off on the ground the dangerous substances mix with the soil and lower the pH of the soil making the soil acidified. The presence of metals like cadmium, mercury, lead etc causes air pollution leading to stern impacts on environment like global warming, hole in the ozone layer. The heavy metals like cadmium, lead etc may filter from the waste and may pollute the ground water.

2.3 Treatment of E-Waste: There are mainly three ways in which E-waste has been treated out of which none has been found to be fully satisfactory.

1.2.1 Land filling: One of the most widely used methods for disposal of E- Waste. In land filling, ditches are made on the flat surfaces. Soil is excavated from the trenches and waste material is buried in it, which is covered by a thick layer of soil. Land filling does not appear to be an environmentally sound treatment method for substances, which are volatile and not biologically degradable (Cd, Hg,), persistent (Poly Chlorinated Biphenyls) or with unknown behaviour in a landfill site (brominated flame retardants).

1.2.2 Incineration: It is a controlled and complete combustion process, in which the waste material is burned in specially designed incinerators at a high temperature (900-1000 ^{o}C). Incineration of E- waste is advantageous as it reduces the waste volume and the energy content of combustible materials is utilized. Some incineration plants remove iron from the slag for recycling. By incineration some environmentally hazardous organic substances are converted into less hazardous compounds. Disadvantage of incineration are the emission to air of substances escaping flue gas cleaning and the large amount of residues from gas cleaning and combustion. E-waste incineration plants contribute considerably to the annual emanation of cadmium and mercury. In addition, heavy metals not emitted into the atmosphere are relocating to slag and exhaust gas residues and can re-enter the environment on disposal. Therefore, e-waste incineration will increase these emissions, if no reduction measures like removal of heavy metals are taken.

1.2.3 Reuse of e-waste: It constitutes direct second hand use or use after slight modifications to the original functioning equipment. It is commonly used for electronic equipments like computers, cell phones etc. Inkjet cartridge is also used after refilling. This method also reduces the volume of E-waste generation. We can use above mentioned methods for treatment and disposal of E-waste. The better option is to avoid its generation.

1.3 STRATEGIES TO MANAGE THE E-WASTE

1.3.1 Nation-wide e-waste assessment: It is very important to have a complete understanding of description and assessment of e-waste management practices in the formal and the informal sector assessment of mass flows potential impact to human health and the environment an assessment of needs to ensure environmentally sound management also to see regulatory infrastructures in place Recommendations for the development of an environmentally sound management policies for e-waste management The results of the country assessments must be shared with all stakeholders and highlighted to spread awareness.

1.3.2 Tackling the problem from its different aspects (education, legal, technical, economic, etc.) will give an intelligent solution to save the environment.

1.3.3 A Framework has to be developed for a National Strategy (Example) Consume Collect Recover Dispose F unction Material Energy Private Consumer System Boundary Middlemen (Auctions) Informal Dumping & Burning Policy & Legislation Business & Finance Technology & Skills Intervention Mechanisms: Licensing Legislation Technical control and fixed contracts New business models Knowledge and technology transfer Formalizing the informal sector Trainings Marketing & Awareness Information Campaigns on all levels Monitoring & Control Standards Audits Monitoring Mass flows Importers Manufacturers Retailer Informal Collector Large Recyclers Imports (Donations) Corporate Consumer Authorized Dealers Landfill Repair & Refurbish Smelter Refinery Small recyclers.

1.3.4 Buy back of old electronic equipments shall be made mandatory.

1.3.5 Large companies should purchase the used equipments back from the customers and ensure proper treatment and disposal of E-waste by authorized processes. This can considerably reduce the volume of E- waste generation. Monitors & CRT, keyboards, laptops, modems, telephone boards, hard drives, floppy drives, Compact disks, mobiles, fax machines, printers, CPUs, memory chips, connecting wires & cables can be recycled. Recycling involves removal of different parts of e-waste containing hazardous material like PCB, Hg, separation of plastic, removal of CRT, segregation of ferrous and non-ferrous metals and printed circuit boards. Recyclers use strong acids to remove precious metals such as copper, lead, gold. The value of recycling from the element could be much higher if appropriate technologies are used. The recyclers working in poorly– ventilated enclosed areas without mask and technical expertise results in exposure to dangerous and slow poisoning chemicals. The existing dumping grounds in India are full and overflowing beyond capacity and it is difficult to get new dumping sites due to scarcity of land. Therefore recycling is the best possible option for the management of e-waste.

REGULATORY REGIME FOR E-WASTE

Indian Government introduced the E-waste (Management and Handling) Rules, 2010 with effect from 1.5.2012, keeping in mind the public interest of enabling the recovery and reuse of useful material from E-waste, thereby decreasing the hazardous wastes destined for disposal, and ensuring the environmentally sound management of all types of waste electrical and electronic apparatus. The rules are applied to every producer, dealer, and collection centre, refurbished, dismantler, recycler, auctioneer, consumer or bulk consumer involved in the manufacture, sale, and purchase and processing of electrical and electronic equipment or components. According to the Rules, the producers of electrical and electronic equipments including large and small household appliances, computers, toys, leisure and sports equipments, and medical devices shall be liable for collecting any E-waste generated during manufacture and will have to channelize the same for recycling or disposal. They will set up collection centres for e-waste generated from the 'end of life' products in line with the principle of the 'Extended Producer Responsibility' and ensure that such e-waste is channelized to a registered refurbisher or dismantler or recycler. They have to ensure that all electrical and electronic equipments are provided with a unique serial number or individual identification code for product tracking in the e-waste management system. The finance and organization of such a system that meets comprehensive management of e-waste produced from the 'end-of life' of its own products from which the rules come into force is managed by them. The producers will also have to provide contact details of dealers and authorized collection centres to consumers so as to facilitate return of e-waste. Dealers have to make provision for collecting e-waste by providing the consumer a box, bin or a demarcated area to deposit e- waste and ensure the same is transported back safely to the producer or the authorized collection centre. The dealers, refurbishers, dismantlers and recyclers have to get registered with the SPCB or CPCB, whichever may apply, and ensure that the storage, transport, dismantling and refurbishing of e-waste does not cause any adverse effect on health or environment. All the stakeholders have to register with the concerned SPCB or Pollution Control Committee (PCC), maintain records of the e-waste handled and also file annual returns to the concerned SPCB or PCC. The Rules also clearly stated the responsibilities of the consumers and bulk consumers. They have to ensure that e-waste is deposited with the dealers or authorized collection centres. They may also avail the pick-up or take back services provided by the producers. As per these Rules, any person operating a collection centre, individually or collectively, is required to obtain authorization from the SPCB or PCC concerned. To ensure e-waste management in an environmentally sound manner, they have to make certain that the storage system is secure and that the transportation to the producer, refurbished or to the registered recycler is safe.

SECTION IV SUMMARY AND CONCLUSIONS

Rapid technology change, low initial cost, increased purchase power, high obsolescence rate have resulted in a fast growing problem of E waste. Bringing E waste in regulatory regime alone will not solve the problem of E-waste. There is need to make aware people also about the environmental aspects of E-waste. Awareness campaign about e- waste should be arranged in schools and college highlighting the measures that an individual can take to reduce the E-waste. Government should also take stringent actions to enforce the "E-waste (Management and Handling) Rules, 2010". Poor quality electronic gadgets which do not last long like Chinese gadgets should not be allowed in the market.

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