

## IMPACT OF ELECTRONIC WASTE LEADING TO ENVIRONMENTAL POLLUTION

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### ABSTRACT

Electronic waste or e-waste is one of the rapidly growing problems of the world. E-waste comprises of a multitude of components, some containing toxic substances that can have an adverse impact on human health and the environment if not handled properly. In India, e-waste management assumes greater significance not only due to the generation of its own e-waste but also because of the dumping of e-waste from developed countries. This is coupled with India's lack of appropriate infrastructure and procedures for its disposal and recycling. The production of electrical and electronic equipment (EEE) is one of the fastest growing global manufacturing activities. Rapid economic growth, coupled with urbanization and a growing demand for consumer goods, has increased both the consumption and the production of EEE. The Indian information technology (IT) industry has been one of the major drivers of change in the economy in the last decade and has contributed significantly to the digital revolution being experienced by the world. New electronic gadgets and appliances have infiltrated every aspect of our daily lives, providing our society with more comfort, health and security and with easy information acquisition and exchange. The knowledge society however is creating its own toxic footprints.

The same hyper technology that is hailed as a 'crucial vector' for future modern societal development has a not-so-modern downside to it: electronic waste.

**Key words:** e-waste, recycling;

### 1. INTRODUCTION

E-Waste broadly covers waste from all electronic and electrical appliances and comprises of items such as computers, mobile phones, digital music recorders/players, refrigerators, washing machines, televisions and many other household consumer items. This includes used electronics which are destined for reuse, resale, salvage, recycling, or disposal. Others are re-usables (working and repairable electronics) and secondary scrap (copper, steel, plastic, etc.) to be "commodities", and reserve the term "waste" for residue or material which is dumped by the buyer rather than recycled, including residue from reuse and recycling operations. Electronic waste is a name given to any piece of electronic equipment that is at the end of its useful life. Some of these products can be resold, refurbished, or dismantled to rescue resalable goods. Others, however, serve no "useful" purpose and are discarded.

E-Waste has been categorized into three main categories, i.e., Large Household Appliances, IT and Telecom and Consumer Equipment. Refrigerator and washing machine represent large household appliances; PC, monitor and laptop represent IT and Telecom, while TV represents Consumer Equipment. Each of these e-waste items has been classified with respect to 26 common components found in them. These components form the 'building blocks' of each item and therefore they are readily 'identifiable' and 'removable.'

### 2. PROBLEMS FACED

E-waste and environmental pollution is a global problem. The United Nations suggests that global e-waste is set to exceed 40 million tons per year. End of product life recycling is highly polluting, non-cost effective and unregulated in many countries. The burden of e-waste not only pollutes the land-fill it is having serious health implications due to chemical leaching into the water table, eventually making its way to agricultural produce and into people. According to a recent report by the BBC, e-waste pollution is causing severe health concerns for millions of people around the world, mostly in the developing nations of Africa, Europe and Asia. Approximately 23 percent of deaths in these nations are linked to pollution and other environmental impacts. The report also concluded that more than 200 million people worldwide are at risk of exposure to toxic waste.

With the usage of electrical and electronic equipment (EEE) on the rise, the amount of electrical and electronic waste (e-waste) produced each day is equally growing enormously around the globe. Recycling of valuable elements contained in e-waste such as copper and gold has become a source of income mostly in the informal sector of developing or emerging industrialized countries. However, primitive recycling techniques such as burning cables for retaining the inherent copper expose both adult and child workers as well as their families to a range of hazardous substances. E-waste-connected health risks may result from direct contact with harmful materials such as lead, cadmium, chromium, brominated flame retardants or polychlorinated biphenyls (PCBs), from inhalation of toxic fumes, as well as from accumulation of chemicals in soil, water and food. In addition to its hazardous components, being processed, e-waste can give rise to a number of toxic by-products likely to

affect human health. Furthermore, recycling activities such as dismantling of electrical equipment may potentially bear an increased risk of injury.

Children are especially vulnerable to the health risks that may result from e-waste exposure and, therefore, need more specific protection. As they are still growing, children's intake of air, water and food in proportion to their weight is significantly increased compared to adults, - and with that, the risk of hazardous chemical absorption. Furthermore, their bodies' functional systems such as the central nervous, immune, reproductive and digestive system are still developing and exposure to toxic substances, by hampering further development, may cause irreversible damage. Many children are exposed to e-waste-derived chemicals in their daily life due to unsafe recycling activities that are often conducted at their home- either by family members or by the children themselves. Furthermore, children may be exposed through dump sites located close to their homes, schools and play areas.

### **3. AMOUNT OF ELECTRONIC WASTE WORLD-WIDE**

Rapid changes in technology, changes in media (tapes, software, MP3), falling prices, and planned obsolescence have resulted in a fast-growing surplus of electronic waste around the globe. Display units (CRT, LCD, LED monitors), processors (CPU, GPU, or APU chips), memory (DRAM or SRAM), and audio components have different useful lives. Processors are most frequently out-dated and are more likely to become "e-waste", while display units are most often replaced while working without repair attempts, due to changes in wealthy nation appetites for new display technology.

An estimated 50 million tons of E-waste are produced each year. The USA discards 30 million computers each year and 100 million phones are disposed of in Europe each year. The Environmental Protection Agency estimates that only 15-20% of e-waste is recycled, the rest of these electronics go directly into landfills and incinerators.

The increasing 'market penetration' in the developing countries, 'replacement market' in the developed countries and 'high obsolescence rate' make e-waste one of the fastest waste streams. This new kind of waste is posing a serious challenge in disposal and recycling to both developed and developing countries. While having some of the world's most advanced high-tech software and hardware developing facilities, India's recycling sector can be called medieval. The dumping of e-waste, particularly computer waste, into India from developed countries has further complicated the problems with waste management.

All this has made e-waste management an issue of environment and health concern.

### **4. LONG TERM EFFECTS ON HUMAN HEALTH & ENVIRONMENT**

The degree of hazard posed to workers and the environment varies greatly depending on the individuals involved and the nature of operations. What is known is that the pollution generated by e-waste processing brings about toxic or genotoxic effects on the human body, threatening the health not only of workers but also of current residents and future generations living in the local environment. It is evident from several studies that the rudimentary recycling techniques coupled with the amounts of e-waste processed have already resulted in adverse environmental and human health impacts, including contaminated soil and surface water. Health problems have been reported in the last few years, including diseases and problems related to the skin, stomach, respiratory tract and other organs. Workers suffer high incidences of birth defects, infant mortality, tuberculosis, blood diseases, anomalies in the immune system, malfunctioning of the kidneys and respiratory system, lung cancer, underdevelopment of the brain in children and damage to the nervous and blood systems.

Long-range transport of pollutants has also been observed, which suggests a risk of secondary exposure in remote areas. Atmospheric pollution due to burning and dismantling activities seems to be the main cause of occupational and secondary exposure. Informal sector e-waste activities are also a crucial source of environment-to food-chain contamination, as contaminants may accumulate in agricultural lands and be available for uptake by grazing livestock. In addition, most chemicals of concern have a slow metabolic rate in animals, and may bio accumulate in tissues and be excreted in edible products such as eggs and milk. E-waste-related toxic effects can be exacerbated throughout a person's lifetime and across generations. E-waste therefore constitutes a significant global environmental and health emergency, with implications far broader than occupational exposure and involving vulnerable groups and generations to come.

The electronic and electrical goods are largely classified under three major heads, as: 'white goods,' comprising of household appliances like air conditioners, dishwashers, refrigerators and washing machines; 'brown goods,' comprising of TVs, camcorders, cameras, etc.; 'grey goods,' like computers, printers, fax machines, scanners, etc. The grey goods are comparatively more complex to recycle due to their toxic composition. EEEs are made of a multitude of components, some containing toxic substances that have an adverse impact on human health and the environment if not handled properly. Often, these hazards arise due to the improper recycling and disposal processes used. It can have serious repercussions for those in

proximity to places where e-waste is recycled or burnt. Waste from the white and brown goods is less toxic as compared with grey goods. A computer contains highly toxic chemicals like lead, cadmium, mercury, beryllium, BFR, polyvinyl chloride and phosphor compounds.

**Lead:** It exerts toxic effects on various systems in the body such as the central (organic affective syndrome) and peripheral nervous systems (motor neuropathy), the hemopoietic system (anemia), the genitourinary system (capable of causing damage to all parts of nephron) and the reproductive systems (male and female).

**Mercury:** It causes damage to the genitourinary system (tubular dysfunction), the central and peripheral nervous systems as well as the fetus. When inorganic mercury spreads out in the water, it is transformed into methylated mercury, which bio-accumulates in living organisms and concentrates through the food chain, particularly by fish.

**Cadmium:** It is a potentially long-term cumulative poison. Toxic cadmium compounds accumulate in the human body, especially in the kidneys. There is evidence of the role of cadmium and beryllium in carcinogenicity.

**Polycyclic aromatic hydrocarbons (PAH):** It affects lung, skin and bladder. Epidemiological studies in the past on occupational exposure to PAH provide sufficient evidence of the role of PAH in the induction of skin and lung cancers.

## **5. POSSIBLE SOLUTIONS TO THE E-WASTE ISSUE**

- 1. Technical interventions:** The solution for the e-waste crisis lies in 'prevention at the manufacturing source' or the 'precautionary principle.' This can be done by employing waste minimization techniques and by a sustainable product design.

Waste minimization in industries involves adopting:

- Inventory management
- Production process modification
- Volume reduction
- Recovery and reuse
- Sustainable product design involves:
  - Rethinking on procedures of designing the product (flat computers)
  - Use of renewable material and energy
  - Creating electronic components and peripherals of biodegradable material
  - Looking at a green packaging option
  - Utilizing a minimum packaging material
- 2. Take back policies:** Producers must be responsible for the entire lifecycle of their products. In developed countries, several efforts have been made on this front. Several dozen cities in the states of California and Massachusetts, including San Francisco, also have passed resolutions supporting 'producer take back' rules. Wipro Infotech has launched an e-waste disposal service for end customers. Others offering recycling options include Dell, HP and Apple.

## **5. IMPLEMENTATION AND CAPACITY BUILDING**

### **5.1 Technical advantage of processes improvement (restructuring recycling)**

At Ash Recyclers, one of just two authorized recycling plants in Bangalore, hazardous metals are safely extracted at a special plant and everything else – down to the keys – is recycled.

### **5.2 Protective protocol for workers in e-waste disposal**

Workers are given formally recognized jobs where they can use skills and where occupational health safety (information about their occupation-related health hazards involved and self-protection, protective gear and equipment and periodic medical checkups) is assured.

## **6. AWARENESS BUILDING**

The current awareness regarding the existence and dangers of e-waste are extremely low, partly because the e-waste being generated is not as large as in developed countries. Urgent measures are required to address this issue.

The role of citizens in e-waste management includes:

- Donating electronics for reuse which extends the lives of valuable products and keeps them out of the waste management system for a long time.
- While buying electronic products, opting for those that are made with fewer toxic constituents, use recycled content, are energy efficient, are designed for easy upgrading or disassembly, use minimal packaging and offer leasing or take back options.

- Building of consumer awareness through public awareness campaigns is a crucial point that can attribute to a new responsible kind of consumerism.

#### **7. CONCLUSION**

India is placed in a very interesting position. The need of the hour is an urgent approach to the e-waste hazard by technical and policy-level interventions, implementation and capacity building and increase in public awareness such that it 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.