Research Paper Public Health

E - Waste:- its Effects and Management in Indian Perspective

* Shubhi Tomar ** Sushil Kumar

* Masters in Public health, manipal university, Karnataka

** Masters in Hospital Administration, Manipal university, Karnataka

ABSTRACT

Electronic waste or e-waste is the emerging problems due rapidly increasing IT sector and modern life style . E-waste consists of many things, some of which are highly hazardous and can cause human health and the environment problems. E-waste problem and its management assumes greater significance in India due to large amount of e-waste which is generated here as well as the dumping of e waste from other countries. India also lacks in proper infrastructure and procedures to handle it. This review article gives an overview of current e-waste scenario environmental and health problems related to it and disposal as well as recycling operations. It also tries to explains existing legal framework and organizations working on this issue.

Keywords : E waste, environmental hazards, occupational hazards, disposal

Introduction:-

The manufacturing of electrical and electronic equipment (EEE) is one of the emerging global activities. Electronic waste or E-waste is relatively a new addition to the ever-growing hazardous waste stream. The EU defines this new waste stream as 'Waste Electrical and Electronic Equipment' (WEEE). The main characteristics of the WEEE include definition of 'EEE', its classification into 10 categories and its extent as per voltage rating of 1000 volts for alternating current and 1500 volts for direct current. The EEE has been further classified into 'components', 'sub-assemblies' and 'consumables'. Since there is no definition of the WEEE in the environmental regulations in India, it is simply called 'e-waste'. According to the Organization for Economic Cooperation and Development (OECD), any appliance using an electric power supply that has reached its end-of-life would come under WEEE (EU 2002).

Burden of E waste:-

The growth of electronic waste is comparatively high in India due to development of IT sector and modernization of lifestyle. However, there is no proper disposal system in that has led to enormous amount of electronic waste. In 2006, the International Association of Electronics Recyclers (IAER) projected that 3 billion electronic and electrical appliances would become WEEE or e-waste by 2010. That would tantamount to an average e-waste generation rate of 400 million units a year till 2010. Globally, about 20-50 MT (million tonnes) of e-wastes are disposed off each year, which accounts for 5% of all municipal solid waste. There is a need to find a proper recycling and disposal technique, so that reduce the environmental pollution and health hazards.

According to the Comptroller and Auditor- General's (CAG) report, over 7.2 MT of industrial hazardous waste, 4 lakh tonnes of electronic waste, 1.5 MT of plastic waste, 1.7 MT of bio medical waste, 48 MT of municipal waste is produces annually. In 2005, e waste is estimated at 1.47 lakh tonnes or 0.573 MT per day by Central Pollution Control Board (CPCB).

According to TRAI, India added 113.26 million new cellular customers in 2008, with an average of 9.5 million customers added every month. Cellular market grew from 168.11 million in 2003-04 to 261.97 million in 2007-08. Microwave ovens and air conditioners registered a growth about 25% and refrigerator sales amounted to 4.2 million in 2006-07. Solid waste management, which is already a mammoth task in India, has become more complicated by the invasion of e-waste, particularly computer waste in India.

70 per cent of the total e-waste generated in the country is contributed by 10 countries , while 65 cities generate more than 60 per cent of the total e-waste in India.

Table 1 : Top ten cities in E waste generation

City	WEEE Tons per year
Mumbai	11017.1
Delhi	9790.3
Bangalore	4648.4
Chennai	4132.2
Kolkata	4025.3
Ahmadabad	3287.5
Hyderabad	2833.5
Pune	2584.2
Surat	1836.5
Nagpur	1768.9

Environment and health effects of e waste:-

India's environment faces a serious threat due to annual growth rate of 10 % annually in e waste which is one of the highest in the world. E-waste is highly complex to handle due to its composition. It is made up of multiple components some of which contain toxic substances that have an adverse impact on human health and environment if not handled properly. Often, these problems arise out of improper recycling and disposal methods. Pollutants or toxins in e-waste are typically concentrated in circuit boards, batteries, plastics, and LCDs (liquid crystal displays).

E-waste typically contains complex combinations of materials and components down to microscopic levels. Some of the recoverable materials such as plastic, iron, aluminium, copper and gold is recovered through breaking down these wastes. But e-waste also contains many other substances that are

dangerous to human health and surrounding environment. These dangerous materials includes heavy metals and halogenated substances which in small amounts also causes many health problems.

Some of these substances leach into the surrounding soil, water bodies and ambient air during treatment or when dumped in landfills or even when left to lie around near it.

There are many studies showing several lethal and severely debilitating health effects of chemicals present in e waste , including cancer, neurological and respiratory disorders, and birth defects. This condition is worse in developing countries like India where people engaged in recycling e-waste are mostly in the unorganized sector, living and working in close proximity to dumps or landfills of untreated e-waste without any protection or safeguards. Most of the workers who are engaged in handling e waste are the urban poor and unaware of the hazards associated with them. For instance, such recycling activities lead to the deterioration of local drinking water which can result in serious illnesses. It was found that a river water sample from the Lianjiang river near a Chinese "recycling village" had lead levels that were 2400 times higher than the World Health Organization Drinking Water Guidelines thereby involving a serious health hazard.

Table 2: harmful elements in compositions of electrical and electronic appliances that can be hazardous to health and environment:-

Metal	Occurrence and Danger
Lead	Found in Lead rechargeable batteries, solar, transistors, lithium batteries, PVC stabilizers, lasers, LEDs, thermoelectric elements, circuit boards .A neurotoxin that affects the kidneys and the reproductive system. High quantities can be fatal. It affects mental development in children. Mechanical breaking of CRTs and removing solder from microchips release lead as powder and fumes
Plastics	Found in Transformers, capacitors, softening agents for paints, glue, plastic . BFRs or brominated flame retardants give out carcinogenic brominated dioxins and furans. Dioxins can harm reproductive and immune systems. Burning PVC, a component of plastics, also produces dioxins. BFR can leach into landfills. Even the dust on computer cabinets contains BFR
Chromium	Used to protect metal housings and plates in a computer from corrosion . Inhaling hexavalent chromium or chromium 6 can damage liver and kidneys and cause bronchial maladies including asthmatic bronchitis and lung cancer.
Mercury	Found in Components in copper machines and steam irons: batteries in clocks and pocket calculators, switches, LCDs . Affects the central nervous system, kidneys and immune system. It impairs foetus growth and harms infants through mother's milk. It is released while breaking and burning of circuit boards and switches. Mercury in water bodies can form methylated mercury through microbial activity. Methylated mercury is toxic and can enter the human food chain through aquatic.
Beryllium	Found in electron tubes, filler for plastic and rubber, lubricant additives, switch boards and printed circuit boards .It is carcinogenic and causes lung diseases.
Cadmium	Occur in Batteries, pigment, soldier, alloys, circuit boards, computer batteries, monitor cathode ray tube . A carcinogen. Long-term exposure causes Itai-itai disease, which causes severe pain in the joints and spine. It affects the kidneys and softens bones. Cadmium is released into the environment as powder while crushing and milling of plastics, CRTs and circuit boards. Cadmium may be released with dust, entering surface water and groundwater.
Acid	Sulphuric and hydrochloric acids are used to separate metals from circuit boards.. Fumes contain chlorine and sulphur dioxide, which cause respiratory problems. They are corrosive to the eye and skin.

E waste management :-

For the recycling of e-waste, India heavily depends on the unorganized sector as only a handful of organized e-waste recycling facilities are available. Over 95% of the e-waste is treated and processed in the majority of urban slums of the country, where untrained workers carry out the dangerous procedures without personal protective equipment, which are detrimental not only to their health but also to the environment.

Indian e waste flow

In Indian context, primarily recycling, reuse and recovery are done as measures to treat E-waste. The recycle and recovery includes the unit operations like dismantling, segregation of ferrous metal, non-ferrous metal and plastic by shredder process, refurbishment and reuse, recycling / recovery of valuable materials and treatment/disposal of dangerous materials and waste.

As most of the electrical and electronic equipment contain many precious metals, this process is an important step in the management of E waste. The materials of potential hazard are disposed of in landfill sites or sometimes incinerated but incineration process is quite expensive. CFCs are treated thermally, PCB and Mercury is often recycled or disposed of in underground landfill sites. In India, primarily two types of disposal options based on the composition are in practice. These are Land filling and Incineration.

The assessment of E-waste recycling sector in India indicates that E-waste trade starts from formal dismantling sector and moves to informal recycling sector (Guidelines for Environmentally Sound Management of E-waste, 2008). The entire E-waste treatment is being carried out in an unregulated environment, where there is no control on emissions. There are two E-waste formal dismantling facilities in India. They includes M/s. Trishiraya Recycling facilities, Chennai and M/s E-Parisara,Bangalore

Legislation dealing with e-waste in India:-

Putting the onus of re-cycling of electronic wastes (e waste) on the producers, the Ministry of Environment and Forest (MoEF) has for the first time notified e waste management rules. The e-waste (management and handling) Rules, 2011 would recognize the producers' liability for recycling and reducing e-waste in the country. From May 1, 2012 these rules will come into effect.

Some of such policy level initiatives regarding E-waste in India:

1. The Hazardous Wastes (Management and Handling) Amendment Rules, 2003
2. Guidelines for Environmentally Sound Management of E-waste, 2008
3. The e-waste (Management and Handling) Rules, 2011

Conclusion:-

In India, the amount of E-waste generated is rising rapidly and there is large import of E waste from developed countries. With the increasing dependence on electronic and electrical equipment, the rise of E-waste generation is well expected in the country. However, the management of the same is a major challenged faced by the country. There is no large scale organized E-waste recycling facility in India and the entire recycling exists in unorganized sector the management practices are often poorly designed and have a lot of health and environmental repercussions. The lack of public awareness regarding the disposal of electronic goods and inadequacy of policies to handle the issues related to E-waste enhance the problem in India. Effective implementation of "e-waste (Management and Handling) Rules, 2011" is exceedingly essential to address the ever growing pile of E-waste in the country

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