International Journal of Engineering Research
Volume No.7, Issue Special 4, pp : 509-513
ISSN:2319-6890 (online),2347-5013(print)
9,10 March 2018

Environmental Pollution: Introduction to E-Waste and Medical Waste

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Abstract: Environmental pollution is a global problem for the past few decades influencing living and non living organisms. It is the most formidable dangers that confront mankind today. Unfortunately overambitious pursuit for technological and industrial progress has created harmful consequences. Hence living organisms are responsible for multidirectional environment issues but at the same time human beings are making stringent efforts to control pollution. E-waste is considered hazardous and it possesses threat to human health and environment. Medical waste is contaminated byproduct of medical treatment or other healthcare activity. This paper covers different types of environmental pollution, E-waste, Medical waste and their preventive measures.

Keywords: Climate Change, E-Waste, Environmental Pollution, Global Warming, Medical Waste

1. Introduction

Environmental pollution is the addition of any substance (solid, liquid, or gas) or any form of energy (such as heat, sound, or radioactivity) to the environment at a rate faster than it can be dispersed, diluted, decomposed, recycled, or stored in some harmless form [1]. The major kinds of pollution are (classified by environment) air pollution, water pollution, and land pollution. Modern society is also concerned about specific types of pollutants, such as noise pollution, light pollution, and even plastic pollution [2].

The problem of pollution today is one of the most serious problems facing human society. In the past few decades, the rapidly growing pollution has started questioning the existence of life in the future. All the countries of the world are concerned about the losses incurred by it. Until a few decades ago, no pollution was taken seriously. It was normal for humans to get resources from nature. At that time very few people could think that indiscriminate use of resources could also bring harm. Whatever nature we take, nature produces such resources again. It seemed as if the stock of nature is unlimited, it will never end. But as the population started to grow, the exploitation of the natural resources increased [3].

Industrially produced chemicals containing chlorine or bromine are damaging the earth's protective stratospheric ozone layer. Along with that carbon dioxide, methane, and other greenhouse gases are altering the global climate system [4]. When climate change occurs; temperatures can increase a dramatically. When temperature rises, many different changes can occur on Earth. A warmer climate can bring changes that can affect our water supplies, agriculture, power and transportation systems, the natural environment, and even our own health and safety [5].

In India, the quantity of "e-waste" or electronic waste has now become a major problem. Disposal of e-waste is an emerging global environmental and public health issue, as this waste has become the most rapidly growing segment of the formal municipal waste stream in the world [12]. E-waste or Waste Electrical and Electronic Equipment (WEEE) are loosely discarded, surplus, obsolete, broken, electrical or electronic devices [13]. In India most of the waste electronic items are stored at households as people do not know how to discard them. This ever-increasing waste is very complex in nature and is also a rich source of metals such as gold, silver, and copper, which can be recovered and brought back into the production cycle. So e-waste trade and recycling alliances provide employment to many groups of people [14] in India. Around 25,000 workers including children are involved in crude dismantling units in Delhi alone where 10,000–20,000 tonnes of e-waste is handled every year by bare hands. Improper dismantling and processing of e-waste render it perilous to human health and our ecosystem. Therefore, the need of proper e-waste management has been realized [15]. It is necessary to review the public health risks and strategies to combat this growing menace [16].

These days computer has become most common and widely used gadget in all kinds of activities ranging from schools, residences, offices to manufacturing industries. E-toxic components in computers could be summarized as circuit boards containing heavy metals like lead & cadmium; batteries containing cadmium that release highly gases. The average 14-inch monitor uses a tube that contains an estimated 2.5 to 4 kgs of lead. The lead can seep into the ground water from landfills thereby contaminating it. If the tube is crushed and burned, it emits toxic fumes into the air [6].

In country like India, where there is big and complex health care system, mixed economy, private and Government hospitals working together; while providing services generate waste. It is estimated that the quantity of waste generated from hospitals in our country ranges between 0.5 and 2.0 kg/bed/day and annually about 0.33 million tons of waste are generated in India [17]. WHO fact sheet reported that from total of waste generated by health care activities 20% are hazardous [18][19].

2. Types Of Pollution: Causes, Effects & Control

Based on the nature and type of environment affected, pollutions are mainly classified as:

- **Air Pollution**

Air is a mixture of various gases in which nitrogen content is 78 percent, while 21 percent oxygen and 0.03 percent carbon dioxide are found and the remaining 0.97 percent contains hydrogen, helium, argon, neon, krypton, janan, ozone and water vapour it occurs. The above quantity of different gases in the air keeps it balanced. It becomes unbalanced when there is a slight difference in it and proves harmful to

ISSN:2319-6890 (online),2347-5013(print)
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health. Oxygen is essential for respiration. Whenever the oxides of carbon dioxide, nitrogen in the air increases, such air pollution is called air pollution and this type of pollution is called air pollution. The Sources of air pollution are of two types-

Natural sources of pollution are those that are caused due to natural phenomena. Ex: Volcanic eruptions, Forest fires, Biological decay, Pollen grains, Marshes, Radioactive materials.

Artificial sources are those which are created by man. Ex: Thermal power plants, Vehicular emissions, Fossil fuel burning, agricultural activities etc.

The composition of Air is given below:

Table 1: Composition of Air

Nitrogen	78%
Oxygen	21%
Argon	Less than 1%
Carbon dioxide	0.037%
Water vapour	Remaining
Ozone, helium & ammonia	Trace amount

Causes of air pollution:

- Smoke and chemicals coming out of industrial units.
- Gases and dust particles emitting from molecular plants.
- Due to the burning of tree plantation in the jungles, burning of coal and burning from oil refineries etc.
- Use of electrical equipment in household work, such as refrigerators, air conditioners etc.

Control Methods:

The forest cover should be protected. Adequate forest cover is essential for maintaining the quality of air. Green belts should be created. Such areas should be developed around densely populated cities. There should be strict restriction for establishment of large buildings and industries along the Green belt areas. Automobile engines should be replaced by electric vehicles. People should be encouraged to use electric vehicle, and to avoid vehicles for short distances.

- **Water Pollution**

The presence of an external substance in water, which changes the natural properties of water in such a way that the water becomes harmful to health or its usefulness becomes less water pollution. In other words, such water is harmful and damages to public health or public safety or to domestic, commercial, industrial, agricultural or other medical use or to the health and livelihood of animals or plants or to aquatic life, is called water pollution.

Causes of Water Pollution:

- Humans bathing in rivers, washing clothes, washing animals, immersing stool etc.
- There is no proper management of cleaning and sewer.
- Diversion of waste and dirty water by rivers and canals in various industrial units.
- Immersion in the nearby water source of every household material used in the rivers following litter, man-mortem and traditional practices.
- Dissolving toxic chemicals and fertilizers in water used in agriculture.

Control Methods:

Do not flush contaminated drugs, liquids, medications, or pills down the drain. Do not use your toilet as a bin. Always use environmentally friendly products. Avoid the use of plastics. Participate actively in water conservation and pollution prevention.

- **Soil Pollution**

Soil pollution is defined as, "contamination of soil by human and natural activities which may cause harmful effect on living organisms". Composition of soil is listed below:

Table 2: Composition of soil

Component	%
Organic mineral matter	45%
Organic matter	5%
Soil water	25%
Soil air	25%

Causes of Soil pollution:

- **Industrial wastes** – Disposal of Industrial wastes is the major problem for soil pollution.

Sources: Industrial pollutants are mainly discharged from various origins such as pulp and paper mills, chemical fertilizers, oil refineries, sugar factories, tanneries, textiles, steel, distilleries, fertilizers, pesticides, coal and mineral mining industries, drugs, glass, cement, petroleum and engineering industries etc.

Effect: These pollutants affect and alter the chemical and biological properties of soil. As a result, hazardous chemicals can enter into human food chain from the soil or water, disturb the biochemical process and finally lead to serious effects on living organisms.

- **Urban wastes** – Urban wastes comprise of both commercial and domestic wastes consisting of dried sludge and sewage. All the urban solid wastes are commonly referred to as refuse.

Constituents of urban refuse: This refuse consists of garbage and rubbish materials like plastics, glasses, metallic cans, fibres, paper, rubbers, street sweepings, fuel residues, leaves, containers, abandoned vehicles and other discarded manufactured products. Urban domestic wastes though

ISSN:2319-6890 (online),2347-5013(print)
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disposed off separately from industrial wastes, can still be dangerous. This happens because they are not easily degraded.

- **Agricultural practices** – Modern agricultural practices pollute the soil to a large extent. With the advancing agro-technology, huge quantities of fertilizers, pesticides, herbicides and weedicides are added to increase the crop yield. Apart from these farm wastes, manure, slurry, debris, soil erosion containing mostly inorganic chemicals are reported to cause soil pollution.

- **Biological agents** – Soil gets a large amount of human, animal and bird excreta which constitute a major source of land pollution by biological agents.

- **Noise pollution**

Noise pollution means an unwanted or undesirable sound that leads to physical and mental problems. Noise pollution is dependent on the loudness and frequency of the sound. In fact, when the sound exceeds its limit, it becomes fatal for human and other organisms. The noise intensity is measured in decibels or dB. A person can bear the noise up to 85 decibels, after which his hearing power can be damaged.

Causes of Noise pollution:

- **Human sources**

Rapid industrialization, urbanization, use of modern means of transport, population growth, and increasing scale of human activities are some of the human factors responsible for noise pollution. Both types of noise pollution, affect sleep, listening ability, physical and mental health.

- **Vehicular Noise**

The modern means of traffic including vehicles such as buses, trucks, scooters, cars, motorcycles, trains, aircraft, firecrackers, explosives etc, pollute the atmosphere. Sound of other automated vehicles and horn, excessive use of loudspeakers for religious purposes also generate jarring noise.

- **Industrial Noise**

Industry-businesses, factories and commercial establishments produce a variety of raucous sounds that bump into our ears and disturb our mind. Noise pollution is an integral part of the industrial environment with heavy machines used in the industries; it is on the rise with the increase in industrial urbanization.

- **Political Activities**

Noise pollution is also generated by dharna, demonstrations, slogans, election propaganda, processions, and rallies frequently organized in cities.

- **Fireworks**

Fireworks are another source of pollution. Uncontrolled fireworks in festivals, fairs, or crackers after victory in matches and elections produce unbearable noise [7].

3. E-Waste

Electronics waste, commonly known as e-waste, is the trash we generate from surplus, broken and obsolete electronic devices. E-waste or electronics recycling is the process of recovering material from old devices to use in new products. We are creating e-waste at a rapid rate. Some of the most commonly replaced electronics include cell phones, desktop computer, portable music players, DVD player, printer, and televisions.

In India, solid waste management, with the emergence of e-waste, has become a complicated task. The total waste generated by obsolete or broken down electronic and electrical equipment was estimated to be 1,46,000 tonnes for the year 2005, which is expected to exceed 8,00,000 tonnes by 2012 [13]. However, according to the Greenpeace Report, in 2007, India generated 380,000 tonnes of e-waste. Only 3% of this made it to the authorized recyclers' facilities. One of the reasons for this is that the India has also become a dumping ground for many developed nations. The Basel Action Network (BAN) stated in a report that 50-80% of e-waste collected by the USA is exported to India, China, Pakistan, Taiwan, and a number of African countries.

What happens to devices at the end of their useful life?

Unfortunately, the majority of these electronic products end up in landfills and just a tiny percentage comes back as/in new electronic devices. According to a UN study, in 2014 alone, 41.8 million tons of electronic waste (e-waste) was discarded worldwide, with only 10 to 40 percent of disposal done properly.

Electronics are full of valuable materials including copper, tin, iron, aluminum, fossil fuels, titanium, gold, and silver. Many of the materials used in making these electronic devices can be recovered, reused and recycled, including plastics, metals, and glass. In a report, Apple revealed that it recovered 2,204 pounds of gold —worth $40 million—from recycled iPhones, Macs and iPads in 2015.

Benefits of E-waste recycling

Recycling e-waste has various environmental and economic benefits:

According to EPA, recycling one million laptops can save the energy equivalent of electricity that can run 3,657 U.S. households for a year. EPA also states that by recycling one million cell phones, we can recover 75 lbs of gold, 772 lbs of silver, and 35,274 lbs of copper and 33 lbs of palladium.

According to the Electronics TakeBack Coalition, it takes 1.5 tons of water, 530 lbs of fossil fuel and 40 Ibs of chemicals to manufacture a single computer and monitor.
81 percent of energy associated with a computer is used during production and not during operation.

Electronics contains various toxic and hazardous chemicals and materials that are released into the environment if we do not dispose of them properly.

ISSN:2319-6890 (online),2347-5013(print)
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Recycling e-waste enables us to recover various valuable metals and other materials from electronics, saving natural resources (energy), reducing pollution, conserving landfill space, and creating jobs [8].

Effects on environment and human health

Disposal of e-wastes is a particular problem faced in many regions across the globe. Computer wastes that are landfilled produces contaminated leachates which eventually pollute the groundwater. Acids and sludge obtained from melting computer chips, if disposed on the ground causes acidification of soil. This is due to disposal of recycling wastes such as acids, sludges etc. in rivers. Now water is being transported from faraway towns to cater to the demands of the population. Incineration of e-wastes can emit toxic fumes and gases, thereby polluting the surrounding air [7].

4. Medical Waste

Medical waste is any kind of waste that contains infectious material (or material that's potentially infectious). This definition includes waste generated by healthcare facilities like physician's offices, hospitals, dental practices, laboratories, medical research facilities, and veterinary clinics.

Medical waste can contain bodily fluids like blood or other contaminants. The 1988 Medical Waste Tracking Act defines is as waste generated during medical research, testing, diagnosis, immunization, or treatment of either human beings or animals. Some examples are culture dishes, glassware, bandages, gloves, discarded sharps like needles or scalpels, swabs, and tissue.

Types of medical wastes:

- **Sharps**. This kind of waste includes anything that can pierce the skin, including needles, scalpels, lancets, broken glass, razors, ampules, staples, wires, and trocars.

- **Infectious Waste**. Anything infectious or potentially infectious goes in this category, including swabs, tissues, excreta, equipment, and lab cultures.

- **Radioactive**. This kind of waste generally means unused radiotherapy liquid or lab research liquid. It can also consist of any glassware or other supplies contaminated with this liquid.

- **Pathological**. Human fluids, tissue, blood, body parts, bodily fluids, and contaminated animal carcasses come under this waste category.

- **Pharmaceuticals**. This grouping includes all unused, expired, and/or contaminated vaccines and drugs. It also encompasses antibiotics, injectables, and pills.

- **Chemical**. These are disinfectants, solvents used for laboratory purposes, batteries, and heavy metals from medical equipment such as mercury from broken thermometers [9].

Treatment and Disposal of Medical Wastes

- **Incineration:** Before 1997, over 90% of all infectious medical waste was disposed of by incineration. Changes to EPA regulations have led providers to seek other disposal means. This is still the only method used on pathological waste, for example body parts and recognizable tissues.

- **Autoclaving**: Steam sterilization renders biohazardous waste non-infectious. After it's been sterilized, the waste can be disposed of normally in solid waste landfills, or it can be incinerated under less-stringent regulation.

- **Microwaving**. Another way to render hazardous healthcare waste non-hazardous is to microwave it with high-powered equipment. As with autoclaving, this method opens up the waste to normal landfill disposal or incineration afterward.

- **Chemical**. Some kinds of chemical waste may be neutralized by applying reactive chemicals that render it inert. This is generally reserved for waste that's chemical in nature.

- **Biological**. This experimental method of treating biomedical waste uses enzymes to neutralize hazardous, infectious organisms. It's still under development and rarely used in practice.

5. Conclusion

The hazardous nature of e-waste is one of the rapidly growing environmental problems of the world. The ever-increasing amount of e-waste associated with the lack of awareness and appropriate skill is deepening the problem. For e-waste management many technical solutions are available, but to be adopted in the management system, prerequisite conditions such as legislation, collection system, logistics, and manpower should be prepared.
There is lack of knowledge about waste management among the doctors, which affects the safe practices for managemet. The policy makers should undertake vigorous training programme for the doctors and the supportive staff, to tackle the problem. It is the high time that the subject is included in the curricula of the medical education. The research and development wings of the Government and private sector should be encouraged to produce new technologies that help in minimization4 of waste and new waste disposal methods that are low cost and non-hazardous.

Considering the severity of the problem, it is imperative that certain management options be adopted to control pollution. Governments should be responsible for providing an adequate system of laws, controls and administrative procedures for hazardous waste management. Companies can and should adopt waste minimization techniques, which will make a significant reduction in the pollution generated and thereby lessening the impact on the environment. An individual can play his role by proving himself to be a good citizen. The widespread use of polythene bags should be stopped as they are one of the main causes of pollution; the option of cloth bags is safer. Garbage should be recycled instead of throwing

ISSN:2319-6890 (online),2347-5013(print)
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it away. Dry garbage can be used in construction of roads and wet garbage can be used as urea in our lawns. Segregate waste at source. In conclusion, we need to take part and try to stop global warming and other effects on climate change to make this world a better place.

References

i. *S.M.Shafi "Environmental Pollution", Atlantic Publishers and Dist. 2005*

ii. *https://www.britannica.com/science/pollution-environment*

iii. *http://icsehindi.com/essay-on-pollution-in-hindi*

iv. *https://www.canada.ca/en/environment-climate-change/services/air-pollution/issues/ozone-layer/depletion-climate-change.html*

v. *https://www.ukessays.com/essays/environmental-sciences/causes-of-climate-change.php*

vi. *Ramachandra T.V. and Saira Varghese K., Environmentally Sound Options for E-Wastes Management. Envis Journals for Human Settlements, March 2004.*

vii. *Freeman M. H. 1989. Standard Handbook of Hazardous Waste Treatment and Disposal, McGraw-Hill Company, USA.*

viii. *Third World Network. 1991. Toxic Terror: Dumping of Hazardous Wastes in the Third World, Third World Network, Malaysia.*

ix. *http://www.indiacelebrating.com/environmental-issues/noise-pollution/*

x. *https://www.thebalance.com/introduction-to-electronics-e-waste-recycling-4049386*

xi. *https://www.medprodisposal.com/what-is-medical-waste-medical-waste-definition-types-examples-and-more/*

xii. *Dahl R. Who pays for e-junk? Environ Health Perspect. 2002;110:A196–9.*

xiii. *CPCB. Guidelines for environmentally sound management of e-waste (As approved vide MoEF letter No. 23-23/2007-HSMD) Delhi: Ministry of Environment and Forests, Central Pollution Control Board, March 2008. Available from: http://www.cpcb.nic.in*

xiv. *Baud I, Grafakos S, Hordjik M, Post J. Quality of life and alliances in solid waste management. Cities. 2001;18:3–12.*

xv. *Pandve HT. E-waste management in India: An emerging environmental and health issue. Indian J Occup Environ Med. 2007;11:116*

xvi. *E-Waste Management: As a Challenge to Public Health in India,Monika and Jugal Kishore, Indian Journal of Community Medicine.2010 Jul; 35(3): 382-385*

xvii. *Patil AD, Shekder AV. Health care management in India. Journal of Environmental Management,*

xviii. *October 2001; 63 (2): 211-220.*

xix. *WHO fact Sheet No 253, Waste from health care activities. http://www.who.int/mediacentre/ factsheets/fs253/en/.*

xx. *N. B. Pandit1, H. K. Mehta, G. P. Kartha, S. K. Choudhary, Management of Bio-medical Waste: Awareness and Practices in a District of Gujarat, Indian Journal of Public Health Vol.XXXXIX No.4 October-December, 2005: 245-247*