E-waste Management

Unit-04

The discarded electronic and electrical equipments like mobile phones, television, refrigerator, home appliances etc. are commonly called as e -waste. India is considered as fifth largest producing country. As technology is rapidly changing, electronic appliances are becoming obsolete day by day. Electronic products that are discarded after their life time also contribute to the growing of E - waste issue.

Sources of E - waste:

The following are the sources of E - waste:

- Big household appliances like refrigerators/freezers, washing machines, dishwashers, televisions.
- Small household appliances like toasters, coffee makers, irons, and hairdryers.
- Information Technology (IT) and Telecommunications equipments like computers, telephones, mobile phones, laptops, printers, scanners, photocopiers etc.
- Lighting equipments
- Electrical tools i.e. handheld drills, saws, screwdrivers etc.
- Toys, leisure and sports equipment.
- Monitoring and control instruments.
- Automatic dispensers.

Toxic materials used in manufacturing electronic and electrical products:

In the manufacturing process of any types of electrical and electronic products, various categories of materials or chemicals have been used. Among which few materials may be toxic and remaining may be non - toxic. As a result of this, exposure to these toxic materials may cause sevier adverse effects to both mankind and aquatic life.

The following are the toxic materials or chemicals involved in electronic and electrical products, their constituents and respective health effects.

Problems of E-waste on environment and human health:

E - waste Sources	Constituents	Health effects
1.Solder in printed circuit boards and gaskets in computer monitors	Lead	a)Damage to nervous systems and kid damage b) Adverse effects on of children dam to brain and kidney.
2. Chip resistors and semi-conductors	Cadmium	a) Accumulates in kidney, liver neural damage
3. Relays and switches, and printed circuit boards	Mercury	a) Chronic damage to the brain b) Respiratory and skin disorders du bioaccumulation in fishes
4. Galvanized steel plates	Chromium	a) Causes bronchitis
8. Copper wires, Printed circuit board tracks.	Copper	a) Stomach cramps, nausea, liver dam or Wilson's disease
9. Nickel–cadmium batteries	Nickel	a) Asthma
10. Lithium-ion battery	Lithium	a) Lithium can pass into breast milk may harm a nursing baby

1. E-waste can be toxic and hence pose negative impact on both mankind and aquatic system.

2. It is non - biodegradable and accumulates in the environment, in the soil, air, water and living things which can lead to irreversible health effects, including cancers, miscarriages, neurological damage.
3. The dismantling, shredding or melting of waste materials can release dust particles to the environment which cause air pollution and damage respiratory health.
4. The disposal of e-waste in regular landfills or in places where it is dumped illegally can seep directly into the soil, causing contamination of underlying groundwater or contamination of crops that may be planted near by or in the area in the future.
5. After soil contamination, heavy metals from e-waste, such as mercury, lithium, lead and barium, then leak through the earth even further to reach groundwater. When these heavy metals reach groundwater, they eventually make their way into ponds, streams, rivers and lakes. Through these pathways, acidification and toxification are created in the water, which is unsafe for animals, plants and communities even if they are miles away from a recycling site. Clean drinking water becomes problematic to find.

Methods of disposal of e-waste:

Land Filling: In this method, the e-waste materials are filled into the digged massive hole in the earth and covering it back with soil.

Acid bath washing: In this method, the e-waste material is washed with acids like hydrochloric acid, sulphuric acid and nitric acids which separates toxic metals from e-waste.

Incineration: In this method, the e–waste materials are subjected to high temperature burning process which reduces the volume of e-waste and also converts the high hazardous organic compounds to less hazardous environmental friendly organic substances.

Reuse: It is nothing but second hand use after slight modification.

Recycling: It is the process of collection, storage, dismantalling, mechanical separation of important components of e–waste and can be used in developing new material which will be useful for many pruposes.

Advantages of recycling:

The following are the advantages of e–waste.

1 Save land filling

2 Save natural resources

3 Increase employment

4 Increase affordability

5 Removes data appropriately

6 Saves the environment.

Extraction of gold from E-waste: (Hydrometallurgy)

Any metals can be recovered from the e-waste through pyro metallurgy, hydrometallurgy and bio hydrometallurgy.

Principle: the recovery of gold from e – waste involves leaching of metal present in the e–waste in presence of acid or strong oxidizing agents and its recovery via solvent evaporation process.

Procedure: After dismantalling of e-waste materials, the electronic circuit boards are leached or treated with concentrated acids i.e. 3 M nitric acid such that all metals (in particular copper and gold in case of printed circuit boards) present in the board gets dissolved and gives an extract so called leach extract. First, the copper is separated from leach extract by the solvent extraction method using hydroxyl oxime. Finally the copper is recovered by evaporating the solvent. Then the residual leach extract contains gold is treated with a mixture of sulphuric acid and sodium bromide. The gold is recovered from the leach extract by the solvent extraction method using tertiary amide. Finally solvent is evaporated and gold is recovered.

Model Questions:

1. What are E – wastes ? List out the major sources of E - wastes.
2. Explain the health effects caused by the following toxic metal present in the E – waste. a). Lead b) Cadmium c) Arsenic d) Mercury.
3. Describe the problems of E-waste on environment and human health.
4. Explain the methods of disposal of e-waste.
5. What is recycling. Explain the advantages of recycling.
6. Explain the hydrometallurgical process of recovery of gold from E - waste.