

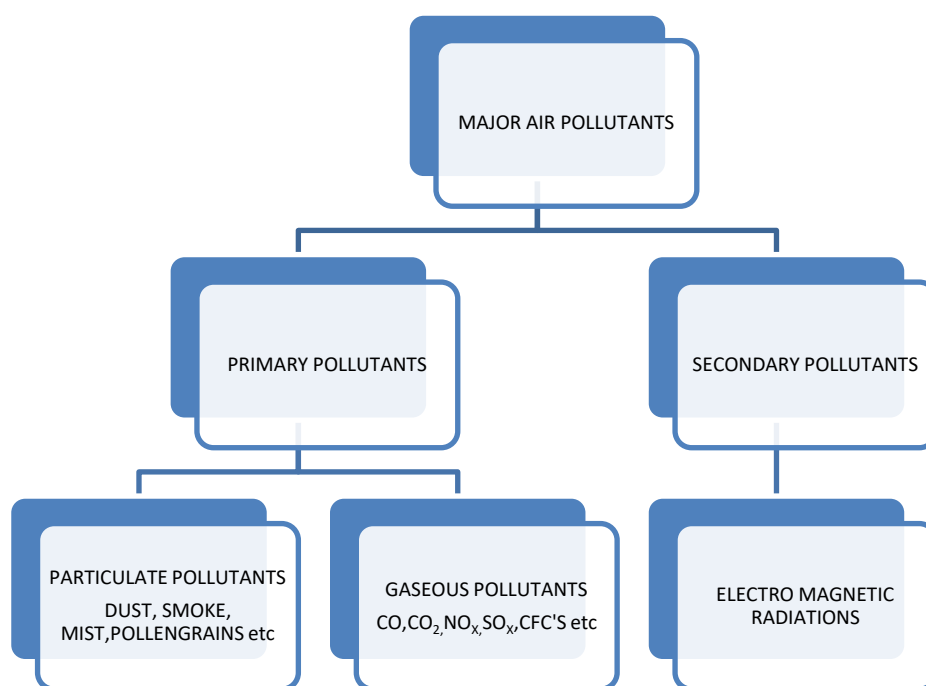
Unit-3

POLLUTION

Addition of different harmful gases to the environment (or) atmosphere which adversely affect the quality of atmosphere and make it unfit for life is called pollution.

AIR POLLUTION

Air is a mixture of gases. The presence of different harmful substances in air which causes injury to Human life and other living beings is called air pollution.



-Major air pollutants are of two types i.e. primary air pollutants & secondary air pollutants. Secondary air pollutants are under the influence of Electromagnetic radiations from the sun.

- Rapid industrialization, motorization, power production from thermal and atomic plants, domestic fuels are the major sources for producing pollutants.

- Coal & cement factories release dust; power plants release fly ash, iron oxides, zinc oxides.

- Industrial fumes produce mist & fog.

- Vehicles release smoke, SO_2 , NO_2 , Co and chlorine.

- Air pollution causes diseases like asthma, bronchitis, lung cancer, irritation of eyes, heart & brain damage.

CARBON MONOXIDE:

-It is colourless, odourless, highly toxic gas.

- It is released from burning of coal, gasoline, tobacco products.

- It is very harmful to humans causing serious heart and respiratory problems.

- It causes headache and irritation in mucous membranes.
- It combines with haemoglobin and forms carboxyhaemoglobin.

$$\text{Co} + \text{Hb} \rightarrow \text{COHb}$$
- Increase in the level of COHb (100 ppm) leads to coma and death of human beings.
- Co has affinity for haemoglobin 210 times more than oxygen.

CARBON DI OXIDE:

- It is the gas that is released from burning of fossil fuels, domestic cooking etc.
- Heavy exposition to CO₂ causes respiratory problems, irritation in respiratory track and reddishness of eyes.
- Excess flow of CO₂ into the atmosphere causes an increase in global temperature.

NITROGEN OXIDES:

- The important oxides of nitrogen like nitrogen oxide and nitrogen dioxide are emitted from motor vehicles, burning of soft coal and acid manufacturing industries.
- Nitrogen oxides effect the human life seriously.
- It causes bronchitis in humans.
- It causes respiratory problems.
- Nitrogen oxides dissolve in rain water and causes acid rains.
- It also causes photo chemical smog.
- Smokers may readily develop lung diseases and cancers as the cigarettes contain 330 to 350 ppm nitrogen.

SULPHUR OXIDES:

- It is a colorless gas with suffocating and strong pungent odor.
- It is released from burning of fossil fuels, thermal power stations, smelting industries , fertilizer industries, petroleum refineries and automobiles.
- SO₂ causes irritation of eyes and respiratory tract.
- IT causes broncho- constrictions in asthmatics.
- SO₂ is also involved in erosion of building materials as lime stone marbles.
- It deteriorate the adjoining historic monuments.
- It causes bleaching of leaves, chlorosis, injury and necrosis of leaves.
- It causes bronchitis, irritation in throat, headache, vomtings and even death.
- In atmosphere it combines with oxygen and water to form sulphuric acid.
- This sulphuric acid in atmosphere dissolves in rain water and causes acid rains.

CHLORO FLUORO CARBONS:

- These are widely used as coolants in air conditioners and refigirators.
- These are also used in fire extinguishing equipments.
- These escapes as aerosols.
- These are also release from jet planes.
- These depletes ozone layer.

-

FLUORO CARBONS:

- These are emitted from industrial process of phosphate fertilizers, aluminium, ceramics etc.
- It causes fluorosis which is a major health problem.

HYDRO CARBONS:

- These are emitted from three wheelers.
- They have carcinogenic effects on lungs.
- It causes cancer .Benz –a- pyrene is potent cancer inducing hydro carbon.
- Benzo-a- pyrene (BAP) : a house wife using wood as fuel inhales BAP equivalent to 20 packers of cigarette a day.

COTROL OF AIR POLLUTION:

- Siting of industries after proper environ mental impact assessment studies.
- Modification of process and or equipments.
- Use of appropriate materials.
- Using low sulphur coal in industries.
- Using mass transport systems, bicycles etc.
- Shifting to less polluting fuels.
- Using biological filters and bio scrubbers.
- Planting more trees.

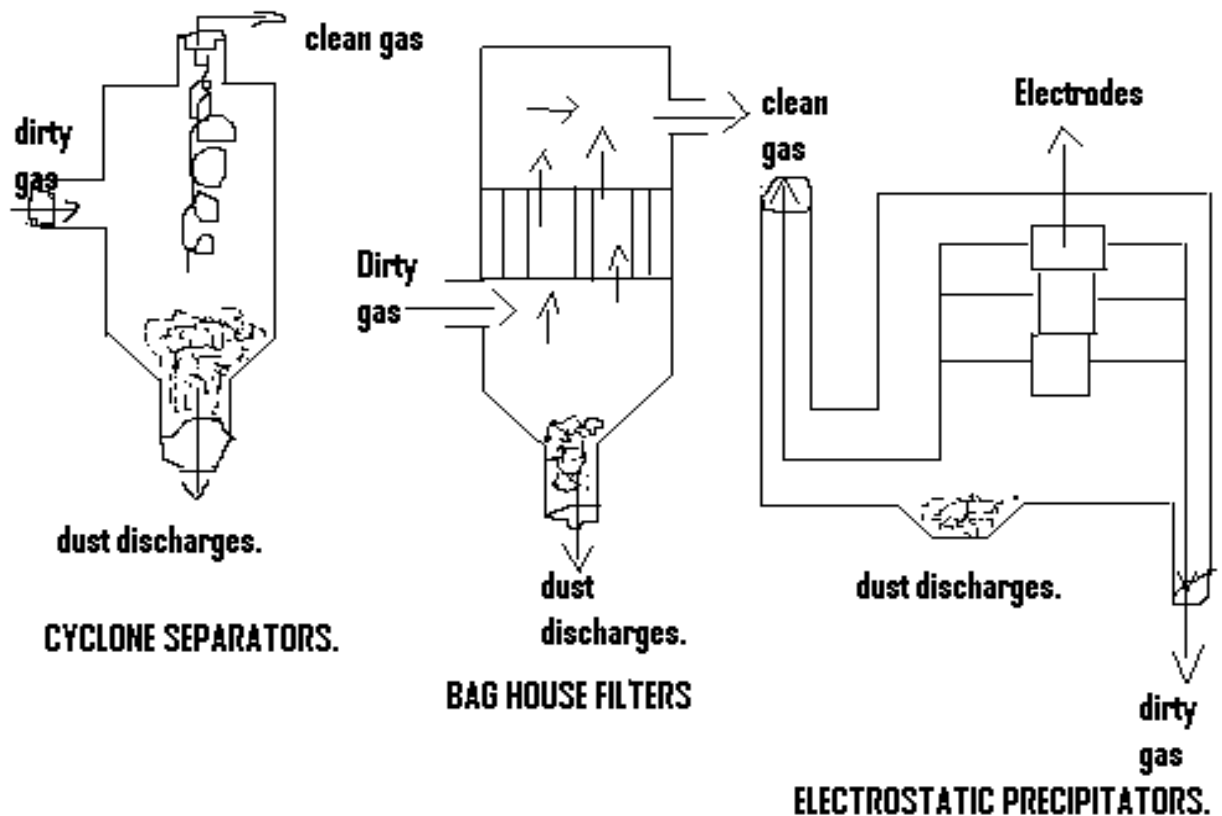
Reduction of air pollutants at source

CYCLONES:

- It consists of cylinder with an inverted cone.
- The gas with particles in it enters tangentially at the top of the cylinder and spins.
- Due to centrifugal force, the particles strike the wall of cylinder.
- Then particles fall in the hopper due to gravity were removed.

BAG HOUSE FILTERS:

- It consists of a large number of filter bags made of fabric.
- Dry gas is passed through the filter bags.
- The dust particles gets deposited on the inner surface of the bag filters and forms a cake which can be removed by shaking.



ELECTRO STATIC PRECIPITATORS:

- These are plate type or cylinder type.
- Vertical wires or plates is hung along the axis of the cylinder.
- High negative voltage is applied to the wire.
- Dust particles while passing get negatively charged and are collected on the positive charged surface.
- The deposited dust particles fall down in the dust collectors are removed by scrapping.

WATER POLLUTION

Water is very important to life. Water covers about 70% of earth's surface. If water is polluted, it affect the entire life on earth. Water is vital to our basic existence, but due to technological revolution, it is facing considerable threats.

Chemical and toxic wastes from industries, residues of fertilizers, pesticides and insecticides from agriculture uses, residues from washing and cleaning pollute water.

The primary sources of water pollution are of three types. They are

- (a) Industrial wastes
- (b) Agricultural wastes
- (c) Sewage wastes.

INDUSTRIAL WASTES:

- A wide variety of both, inorganic and organic pollutants are present in effluents.
- The pollutants include oils, grease, plastics, plasticizers, metallic wastes, phenols, acids, salts, dyes, cyanides etc. Many of these are not readily degradable and causes pollution.
- H_2SO_4 as acid wastes from coal mines is a serious pollutant that increases the hardness of water, has serious affect on living organisms.

AGRICULTURAL WASTES:

- It includes the pesticides that sprayed on crops, as well as sediments, fertilizers and plant & animal debris.
- These are carried out to water bodies during rain fall.
- Since these wastes are organic these increases the BOD of water.
- In fresh water and marine water systems they enter the food chain, undergo concentration in non target organisms and increase in animal tissues to alarming levels.(biomagnifications)
- Through ground water systems they may also enter the drinking water.
- In 1953 people of Japan suffered from Minimata disease due to consumption of fish contaminated with methyl mercury.
- Nitrate when present in excess in drinking water causes Blue baby syndrome or methamoglobinemia.
- Excess of fluorides in water causes defects in teeth and bones called fluorosis.

SEWAGE WASTES:

- Sewage is the water borne waste derived from house and animal or food processing plants.
- It includes excreta, paper, cloth, soap, etc.
- This water becomes unfit for drinking.
- As the amount of organic matter increases the micro-organisms that use the nutrients rapidly increase.
- The inorganic nutrients released by decomposition serve as nutrients for algae which form waterblooms .(Eutrication)
- This consume most of available oxygen and decreases O_2 level in water.
- Eventually aerobic organisms die with lack of oxygen.
- Pollution due to heavy metal cadmium accumulated in rice caused the diseased in Japan called Itai-Itai.

Eutrication:

- Due to addition of domestic waste phosphates, nitrates etc. from wastes or their decomposition products and nitrate ions. Thus with the passage of these nutrients through such organic wastes, then water bodies become highly productive or eutrophic and the phenomenon as eutrophication.

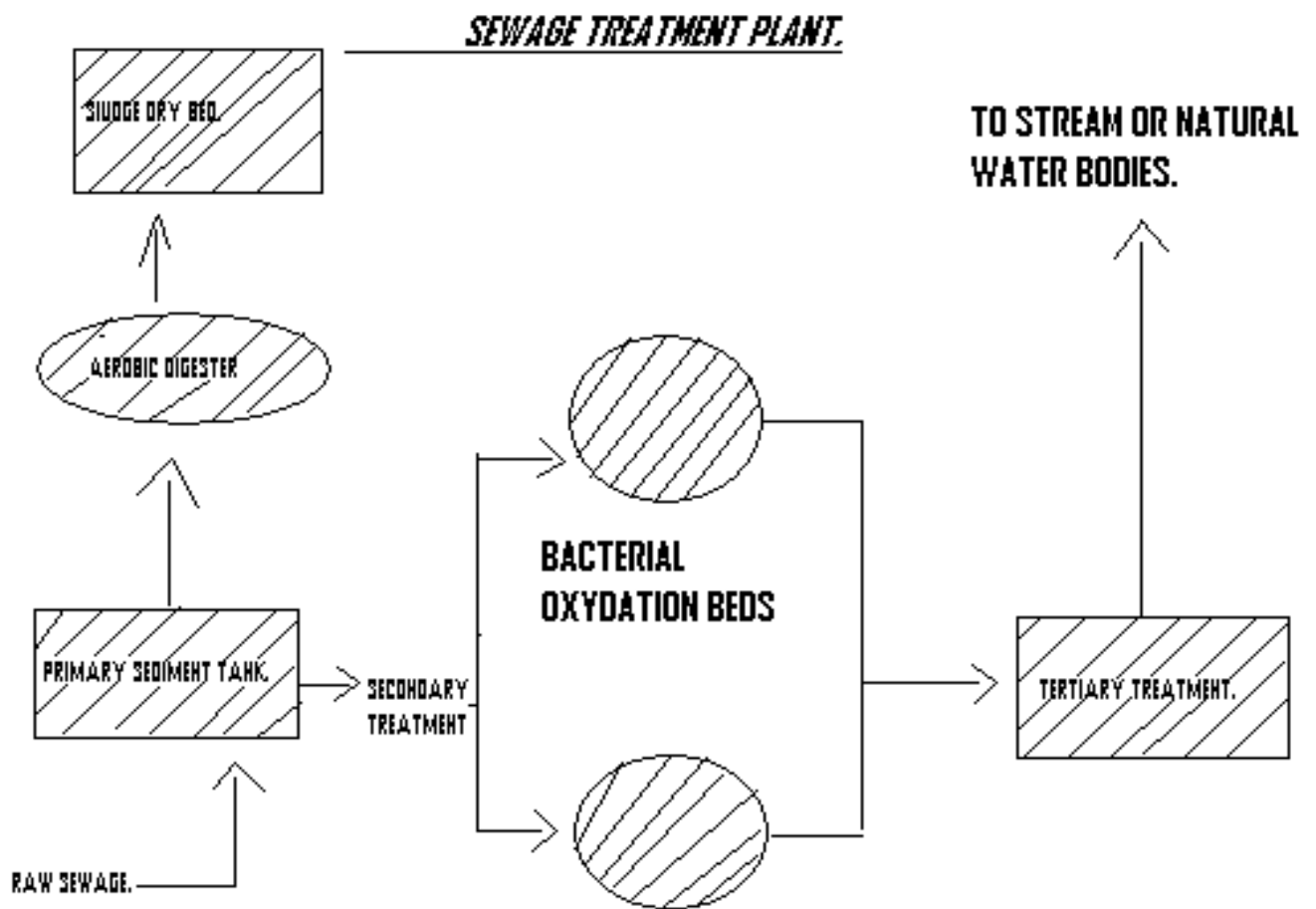
WASTE WATER TREATMENT:

- The purpose of waste water treatment is to remove or reduce organic and inorganic substances, nutrients, toxic substances, kill pathogenic organisms, etc.

- The waste water treatment plant contains primary, secondary, and tertiary tanks.

Primary tank: it involves the physical removal of debris, large particles with the help of screen. The waste water after screening is passed to the grit chamber where sand grit and other solids settle down. The floating particles are passed to anaerobic digester. Then the materials digested are passed to sludge drying bed where the sludge is dried and removed.

Secondary tank: it is the biological process which involves micro organisms. It removes up to 90% of BOD and 90% of suspended solids. Biodegradable oxygen demanding wastes are stabilized.



Tertiary tank: After the primary and secondary treatment many undesirable substances remained are to be removed. The materials to be removed include nitrates, phosphates, color, bacteria, viruses, pesticides. Chlorination of water is generally done to kill harmful bacteria and viruses. The sludge produced after this process is used as a fertilizer in the fields.

SOIL POLLUTION

- Industrial, agricultural and urban wastes are major pollutants of soil.
- Industries like textile, power plants, pharmaceuticals, cement, rubber, plastics food processing release wastes on the land.

- Industrial solid wastes like paper plastic, metal, glass, ash etc are also dumped on the land, as a result land gets polluted .

Case study: the love canal which is dug by Willam love was used to dump sealed steel drums of chemicals in 1953. The dump site was sold to city board of education which built an elementary school. In 1976 the residents started complaining of foul smelling. Nearly 26 toxicants were identified which distressed the total village.

- Urban wastes like garbage, hospital wastes, hotel wastes are also damage land.
- Plastics and carry bags dumped on open land pollute land.
- This decreases the ground water level as the plastic obstructs the sinking of rain water.
- Plastic pollutants also restrict the plant growth.
- Agricultural effluents increases the soil acidity and becomes unfit for plant growth.
- Strontium -90 gets deposited in the bones and tissues, cause bone cancer.

CONTROL:

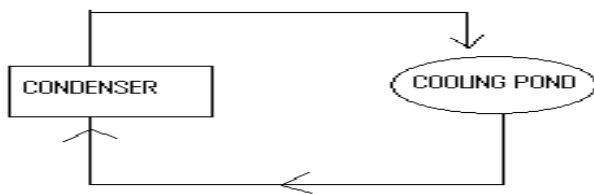
- Toxic pollutants from industries and sewage plants should not be discharged in coastal waters.
- Dumping of toxic , hazardous waste should be banned.
- Oil and grease from service stations should be processed for reuse.
- Oil ballast should not be dumped in to sea.

THERMAL POLLUTION

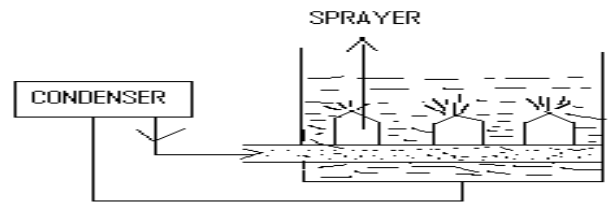
- Thermal pollution can be defined as presence of waste heat in the water which can cause undesirable changes in the natural environment.
- Heat producing industries i.e thermal power plants, nuclear power plants, refineries, steel mills etc are the major sources of thermal pollution.
- Thermal pollution affects the dissolved oxygen content of water.
- High temperature becomes a barrier for oxygen penetration.
- Toxicity of pesticides , detergents and chemicals in the effluents increases with increase in temperature.
- Discharge of heated water near the shores can disturb spawning and kills young fishes.

CONTROL

- **COOLING PONDS:** Water from condensers is stored in ponds where natural evaporation cools the water and then discharged to nearby water body.



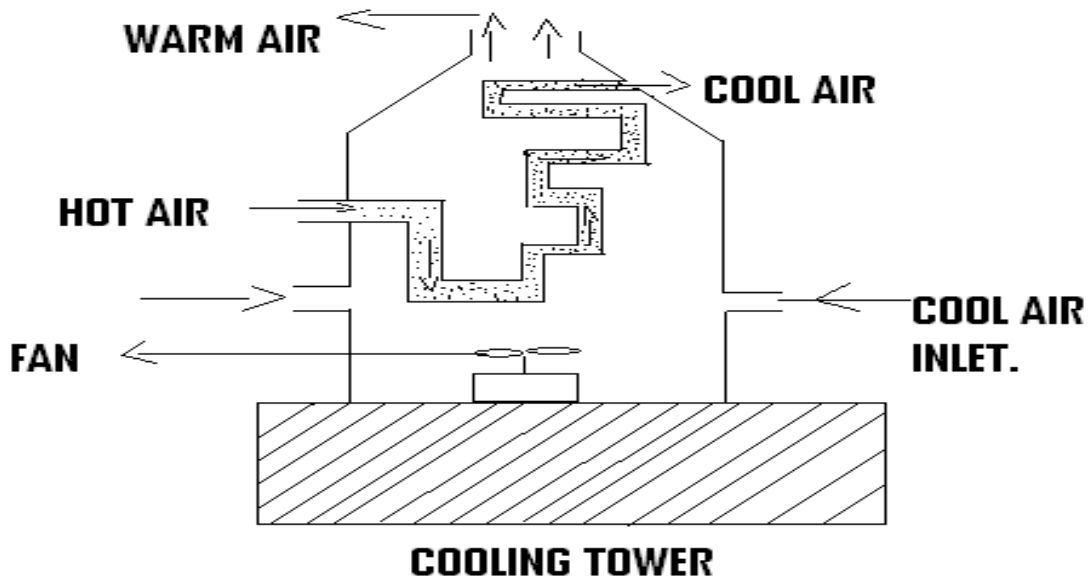
COOLING PONDS.



SPRAYING PONS.

SPRAY PONDS: The water from the condenser is received in spray ponds. Here the water is sprayed through the nozzles where fine droplets are formed. Heat from these fine droplets is dissipated to the atmosphere.

COOLING TOWERS: The heated water flows in a system of pipes. Air is passed over these hot pipes with fans. There is no water loss in this method.



NOISE POLLUTION

- Noise can affect the human ear because of its loudness and frequency (pitch).
- Human ear is able to tolerate the sound frequency of 20 Hz.
- Above 85 dB sound frequency is treated as noise.
- The main sources of sound are industrial operations, construction activities, celebrations, and electric home appliances.
- In a noisy areas communication is severely affected.
- It can cause temporary or permanent hearing loss.
- Continuous exposure to noise affects the functioning of various systems of body.
- It may results in hypertension, insomnia (sleeplessness), gastro intestinal problems, digestive disorders, peptic ulcers, blood pressure, emotional changes etc.

Control:

- Heavy vehicles may not be able to ply.
- Noise making machines should kept in container.
- Proper oiling will reduce the noise from machinery.
- Silencer can reduce noise by absorbing sound.
- Planting more trees.

NUCLEAR POLLUTION

- Radioactive substances are present in nature.
- Nuclear power plants, nuclear accidents, x-rays diagnostic –kit etc are radioactive substances.
- Ionization radiations can affect living organisms by causing harmful changes in the body cells and also changes at genetic level.
- These causes mutations in the DNA.
- Radioisotopes enter the environment during mining of uranium.
- Radioactive **iodine (I^{131})**
- Accumulates in thyroid gland and causes cancer.
- Strontium-90 accumulates in the bones and causes leukemia or cancer of bone marrow.

Case study- In 1986 Chernobyl nuclear accident occurred in ukraine, due to faulty shutting down the plant. Nearly 5,76,000 people were recorded with thyroid cancer and leukemia. 31 persons killed and 239 people were hospitalised.

Control of pollution:

- Siting of nuclear power plants should be done.
- Proper disposal of wastes from laboratory involving the use of radioactive isotopes should be done.

ROLE OF AN INDIVIDUAL IN PREVENTION OF POLLUTION

- A small effort made by each individual at his own place will have pronounced effect at the global level.
- It aptly said "think globally act locally".
- Use eco friendly products.
- Cut down the use of chloro fluoro carbons.
- Do not use polystyrene cups that have CFC'S molecules.
- Adopt and popularize renewable energy resources.
- Promote Reuse, Recycling and Reduce strategy.
- Use mass transport system.
- Use rechargeable batteries.
- Use organic manure instead of commercial fertilizes.
- Plant more trees, as they absorb many toxic gases
- .

SOLID WASTE MANAGEMENT

Discharges from houses like metal tins, bags, aluminium cans, glass bottles, waste paper, industrial wastes like rubbish, packing materials acids metals etc are the solid wastes.

Management:

- For waste management we stress on three R's strategy i.e Reduce, Reuse, and Recycle.

REDUCE: Reduce the demand for any metallic products will decrease the mining of their metal can cause less production of waste.

REUSE: The refillable containers which are discarded after use can be reused. Villagers make silos from waste paper and other waste materials.

RECYCLING: It is the reprocessing of discarded materials into new useful products. Old aluminium cans and bottles are melted and recast into new cans and bottles.

-

- **COMPOSTING:** Biodegradable garbage wastes are allowed to degrade in an oxygen rich medium. Good quality nutrient rich and environmental friendly manure is formed, which improves the soil conditions and fertility.

-

- **SANITARY LAND FILLS:** Garbage is spread out in thin layers, compacted and covered with clay or plastic foam. After degradation which is collected out and used.