Environmental pollution (UNIT-3)

* **Environmental pollution/Pollution:** Any undesirable change caused in the physical, chemical or biological characteristics of any component of the environment (air, water, soil) which can cause harmful effects on various forms of life (or) property is called Environmental pollution.

* **Pollutant:** The substance released in to the environment and which effect the environment is called pollutant.

Ecologically pollutants are classified in to two types. Non-biodegrable pollutants and Biodegrable pollutants.

i) Non-biodegrable pollutants: The pollutants which can not be decomposed are called Non-biodegrable pollutants.

Ex: Plastic, DDT, mercury salts, aluminium cans etc..

ii) Biodegradable pollutants: The pollutants which can not be decomposed by natural process are called biodegrable pollutants.

Ex: Leaves, vegetable waste etc....

On the basis of physical properties, pollutants are classifies in to four categories. They are solid pollutants, liquid pollutants, gaseous pollutants, pollutants without weight (Heat, temperature, noise, heat etc..)

* Classification of Pollution:

Pollution can be classified according to the environment (air, water, and soil) in which it occurs or according to the type of pollutant (lead, mercury, carbon dioxide, solid waste, noise, biocide, heat, etc.) by which pollution is caused.

Sometimes, pollution is made to classify into two broad categories:

1. Natural Pollution:

It originates from the natural process.

2. Artificial Pollution:

It originates artificially by the interaction in between humanity and environment.

Different types of pollutions are as follows:

1. Air pollution

2. Water pollution

3. Soil pollution

4. Thermal pollution

5. Marine pollution

6. Noise pollution

7. Radiation pollution

* Air pollution

Definition: The undesirable changes occurring in the air which harmfully affects the life activities of living organisms is called air pollution.

Sources of Air pollution

Sources of air pollution are of two types.
Natural sources and **Artificial sources**

Natural sources: 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 etc...

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

Classification of Air Pollutants:

Depending on the form of pollutants present in the environment**,** they are classified as:

1. Primary pollutants and
2. Secondary pollutants

1. Primary pollutants: Primary pollutants are those that are directly emitted in the atmosphere in the harmful form
Ex:CO, NO, CO_2, SO_2 etc.

2. Secondary pollutants: Secondary pollutants are those that are formed by reacting with other components or some basic component of the atmosphere to form new pollutants.
Ex: Oxides of Nitrogen (NO_2 or NO_3) react with moisture in the atmosphere to give Nitric acid.

Reasons that cause Air Pollution:

- Burning of fuels like wood, cow dung cakes, coal and kerosene in homes pollute the air.
- Exhaust gases emitted by motor vehicles which pollute the air are the major source of air pollution in big cities.
- Industries pollute air by releasing various types of pollutants such as sulphur dioxide, oxides of carbon, nitrogen oxide, chlorine, asbestos dust and cement dust.
- Thermal power plants pollute air by emitting sulphur dioxide and fly-ash.
- Nuclear power plants pollute air by releasing radioactive rays.
- Use of fertilisers and pesticides in agriculture pollute the air.
- Mining activities releases particulate matter into the air and pollutes it.
- Indiscriminate cutting of trees and clearing of forests increases the amount of carbon dioxide in the atmosphere and thereby pollutes it.
- Use of chlorofluorocarbons in refrigeration, fire extinguishers and aerosol sprayers pollutes air by depleting the ozone layer.
- Smoking pollutes air by emitting carbon monoxide and nicotine.

Harmful Effects of Air Pollution:

- Air pollution affects respiratory system causing breathing difficulties and diseases such as bronchitis, asthma, lung cancer, tuberculosis and pneumonia.
- It affects the central nervous system causing carbon monoxide poisoning. CO has more affinity for haemoglobin than oxygen and thus forms a stable compound carboxy haemoglobin(COHb), which is poisonous and causes suffocation and death.
- It causes depletion of ozone layer due to which ultraviolet radiations can reach the earth and cause skin cancer, damage to eyes and immune system.
- It causes acid rain which damages crop plants, trees, buildings, monuments, statues and metal structures and also makes the soil acidic.
- It causes greenhouse effect and global warming which leads to excessive heating of earth's atmosphere, further leading to weather variability and rise in sea level. The increased temperature may cause melting of ice caps and glaciers, resulting in floods.

- Air pollution from certain metals, pesticides and fungicides causes serious ailments.
- Lead pollution causes anaemia, brain damage, convulsions and death.
- Certain metals cause problem in kidney, liver, circulatory system and nervous system.
- Fungicides cause nerve damage and death.
- Pesticides like DDT(Dichloro diphenyl trichloroethane) which are toxic enter into our food chain and gets accumulated in the body causing kidney disorders and problems of brain and circulatory system.

Prevention and Control of Air Pollution:

- **Methods of controlling gaseous pollutants-**The air pollution caused by gaseous pollutants like hydrocarbons, sulphur dioxide, ammonia, carbon monoxide, etc can be controlled by using three different methods-Combustion, Absorption and Adsorption.
- **Methods of controlling particulate emissions-**The air pollution caused by particulate matter like dust, soot, ash, etc can be controlled by using fabric filters, wet scrubbers, electrostatic precipitators and certain mechanical devices.
- Tall chimneys should be installed in factories.
- Better designed equipment and smokeless fuels should be used in homes and industries.
- Renewable and non-polluting sources of energy like solar energy, wind energy, etc should be used.
- Automobiles should be properly maintained and adhere to emission control standards.
- More trees should be planted along roadsides and houses.
- Implementing strict laws to prevent and control of air pollution.
- Public awareness regarding the importance of air.
- The forest cover should be protected. Adequate forest cover is essential for maintaining the quality of air. Trees absorbs carbon-dioxide (CO_2) and releases oxygen (O_2).
- 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 redesigned in such a way that their emissions cause minimum pollution. Old automobile engines should be replaced by new ones. People should be encouraged to share the vehicle, and to avoid vehicles for short distances.
- Use of railway steam engine should be stopped. The burning of combustible materials such as coal produces poisonous gases that are released into the air. Electric engines should be used instead of steam or diesel engines.
- Industrial areas should be located at a safe distance from the residential areas.
- Newly designed smoke free furnaces should be used.
- In industries there should be the arrangement for pollution control.
- Cheap devices for controlling air pollution should be developed.
- Air pollution can be checked only through the joint efforts of the government,non-government organizations and the general public.

Case studies of air pollution:

*** 1. Bhopal gas tragedy:**

- The Bhopal gas tragedy occurred in 1984 at Bhopal. On Dec. 3, a dangerous chemical reaction occurred in the plant. As a result, water entered into the tank containing methyl isocyanate gas. This resulted in the increase of temperature and pressure inside the tank. This led to the release of methyl isocyanate gas from the tank.
- The gas spread within the radius of eight kilometers. The gas caused coughing, breathlessness, stomach pain, burning in the respiratory tract. By the morning, thousand of people had died.
- Many people who survived this disaster, suffered from various diseases for the rest of their lives. People still suffer from cancer, tuberculosis, gynecological disorders etc as the result of the inhalation of the gas.

*** 2. Chernobyl nuclear disaster:**

At 1:23 a.m. on April 26th, 1986, reactor four at the nuclear power plant near Chernobyl, Ukraine exploded, releasing more than a hundred times the radiation of the bombs dropped on Hiroshima and Nagasaki. Thirty-one people died shortly after the explosion and thousands more are expected to die from the long-term effects of radiation. The Chernobyl nuclear disaster dramatically changed the world's opinion about using nuclear reaction for power.

* Water pollution

Definition: The undesirable changes occurring in the water which harmfully affects the life activities of living organisms is called water pollution.

Sources of water pollution: There are two types of sources for water pollution.

1) Point sources and

2) Non-point sources of water pollution

1) Point sources: These are pollutants that are discharged at specific locations through pipes, ditches or sewers into bodies of surface waters.

Ex: Factories, sewage treatment plants, abandoned underground mines and oil tankers.

2) Non point sources: These pollutants cannot be traced to a single point of discharge. They are large land areas or air-sheds that pollute water by runoff, subsurface flow or deposition from the atmosphere.

Ex: Acid deposition, runoff of chemicals into surface water from croplands, livestock feedlots, logged forests, urban streets, lawns, golf courses and parking lots.

Causes of water pollution:

There are numerous causes of water pollution. The main ones are listed below.

- **Industrial process:** When manufacturers and factories are simply allowed to pour toxic chemicals into water bodies before treatment, the water becomes polluted. The oxygen levels in the water also decreases. The toxic chemicals include: lead, sulphuric acid, mercury and used oil.
- **Inorganic Industrial waste:** Inorganic wastes such as acids, mercury, lead and heavy metals can destroy the normal body processes. The presence of these toxic and corrosive substances in water is dangerous to living things. Factories and other industries dump waste products into water at an alarming rate.
- **Agricultural fertilizers:** By a process known as leaching, agricultural chemicals such as fertilizers and pesticides can wash into rivers and lakes, poisoning them.
- **Untreated sewage from households:** Dye, lotion, soap, hair oil, shampoo, powder, deodorant, moisturizer and many other such products also contribute in water pollution. These products go to the sewage without any treatment. Untreated sewage from households can contaminate different water bodies in the process. When sewage pipes break, there is a

chance that the wastes will contaminate drinking water. Sometimes, poorly treated sewage is released into water bodies. Domestic cleaning products can be very dangerous pollutants.

- **Garbage:** Plastics are non-biodegradable. Mass plastics clog water bodies and contaminate water.
- **Urbanization:** Urbanization is a key factor in increasing the amounts of water pollution.
- **Dumping solid waste:** Humans often carelessly dump their trash in the sea or near rivers.
- **Oil spills:** Accidental oil spills have a devastating effect on seas.
- **Dissolved gases:** Polluting gases in the air can dissolve into salt and fresh water and pollute it.
- **Boat fuels:** Fossil fuels used in the shipping industry are one of the largest causes of both air and water pollution.
- **Heated water from power plants:** Some power plants release the heated water into water bodies. This reduces the oxygen content in water. Power plants normally use heated water to cool their machines.

Effects of water pollution:

The following are the effets of the water pollution.

- **Water becomes dangerous to drink:** Humans have less safe drinking water.
- **Less clean water for agriculture:** we need unpolluted water to irrigate crops, too.
- **Economic costs:** When water has been polluted, there is money needed to purify water, remove plastics from water bodies and so on.
- **Change in water color:** Polluted water becomes visibly different.
- **Water-borne diseases:** Living near to polluted water can put humans at risk of diseases. Water-borne diseases: When sewage combines with drinking water, there is a likelihood of a breakout of diseases. If people end up drinking this water, they might suffer from diseases such as typhoid, cholera and dysentery.
- **Treatment plants.** Treatment plants should be set up especially in cities where huge amount of water goes to drain daily. Water flowing through the drainage system should be properly treated and harmful pollutants removed.
- **Fewer possibilities for leisure:** Swimming, sailing, surfing and other water sports are definitely not advised in polluted water.

❖ **Acidic rain:** When toxic gases and smoke is released from industries, cars and homes, the gases lead to formation of acid rain. Acidic rain is a threat to human health and it also affects the living organisms in soil.

❖ **Genetic mutations:** The genes of marine and freshwater plants and animals mutate

❖ **Acid oceans:** pollution causes the oceans to acidify.

❖ **Algae bloom**: An excess of oxygen in waters due to a change in the chemical composition causes algae to bloom in overabundance and block out the light in pools and river.

❖ **Damage to the ecosystems:** Ecosystem is the interaction of living things, depending on each other for life. When their habits become polluted, marine and freshwater organisms are at risk of extinction. When aquatic life is threatened the entire ecosystem is disturbed.

❖ **Avoid pouring medicine and insecticides in toilets and sinks:** Throw such waste in the bathroom toilet. This is important because if poured in toilets and sinks, these products could combine to form harmful products.

❖ **Use manure instead of fertilizers.** Manure should be used instead of fertilizers because unlike fertilizers, it does not contain harmful chemicals.

Control measures/Solutions to water pollution.

It is in our power to halt water pollution. Some of the key solutions that can be applied are outlined below.

1. **Stop using harmful chemicals at home:** Opt for environmentally friendly household cleaners.
2. **Prevent industrial waste reaching water:** Dispose of industrial waste by burying or neutralizing it instead.
3. **Sewage treatment:** Household water should be properly treated to make it environmentally safe. Raw sewage should never be pumped into water. This may seem like a convenient way of disposing of it but it is highly dangerous for health. Effective sewage treatment processes should be put in place.
4. **Treatment of industrial wastes before discharge:** Factories should treat wastes before discharge and toxic substances should be converted into harmless materials.
5. **Recycle:** Recycle domestic and commercial waste safely rather than dumping it in the sea or near rivers.
6. **Promote a love for waterways:** That way, everyone in the community will be motivated to stop pollution. When we all work together, we can achieve great things.

7. **Go organic:** Organic agriculture uses far fewer chemical pesticides and fertilizers.

8. **Adherence to water laws.** Laws and legislation regarding water pollution should be strictly followed. There should be heavy penalties for those who fail to adhere to the rules.

9. **Avoid using paper bags:** Carry a shopping bag whenever you expect to go shopping. This will minimize the chances of you using a paper bag. You can also buy a portable shopping bag and always have it with you.

10. **Improve oil tanker safety:** Avoiding oil spills would remove a key cause of environmental pollution.

11. **Routine cleaning:** Wells, and lakes should be regularly cleaned and treated to ensure that they remain safe for human use. There should also be system of regularly testing pond and lake water.

* Soil Pollution

Definition: The undesirable changes occurring in the soil which harmfully affects the life activities of living organisms is called soil pollution.

Causes of soil pollution:

1. Soil erosion: Soil erosion can be defined as the movement of topsoil from one place to another. Soil erosion is a natural process due to wind, flood and due to human activities like-construction, overgrazing, farming and deforestation.

2. Industrial wastes: Various pollutants exists in environment from industrial wastes. Discharge from Chemical industries, Fertilizer Company, pharmaceutical companies are highly polluting.

3. Urban wastes: Because of modem life style and eating habits the urban wastes are becoming very dangerous to the human beings. Urban wastes include both which is a non-degradable

material and harmful to the society in long run.

4. Agricultural practice:

Use of strong fertilizer, pesticides and inorganic chemicals for increasing productivity.

5. Biological agents: Human and animal excreta wastes enter the soil pores and decompose pathogenic bacterial present in those wastes spread infection.

Effects of Soil Pollution:

The harmful effects of soil pollution are briefly described below:

i) Reduction in the fertility of soil.

(ii) Obstruction in the public passage (road, railway lanes etc.) by solid waste

(iii) Contamination of underground and surface drinking water.

(iv) Fluorosis occurs as a result of consumption of fluoride containing maize, jawar crops. The fluoride is absorbed by the crops from the fluoride contaminated soil.

(v) Emission of toxic gases (from dumped solid wastes on land) is detrimental to health.

(vi) The unpleasant smell and spread of insects cause inconvenience to people.

(vii) Poisoning of the ecosystem take place by soil pollution.

(viii) Soil erosion occurs due to shifting cultivation.

Control measures of soil pollution:

1. Soil erosion can be controlled by a variety of forestry and farm practices.

Ex: Planting trees on barren slopes

Contour cultivation and strip cropping may be practiced instead of shifting cultivation.

Terracing and building diversion channels may be undertaken.

Reducing deforestation and substituting chemical manures by animal wastes also helps arrest soil erosion in the long term.

2. Proper dumping of unwanted materials: Excess wastes by man and animals pose a disposal problem. Open dumping is the most commonly practiced technique. Nowadays, controlled tipping is followed for solid waste disposal. The surface so obtained is used for housing or sports field.

3. Production of natural fertilizers: Bio-pesticides should be used in place of toxic chemical pesticides. Organic fertilizers should be used in place of synthesized chemical fertilizers. Ex: Organic wastes in animal dung may be used to prepare compost manure instead of throwing them wastefully and polluting the soil.

4. Proper hygienic condition: People should be trained regarding sanitary habits.

Ex: Lavatories should be equipped with quick and effective disposal methods.

5. Public awareness: Informal and formal public awareness programs should be imparted to educate people on health hazards by environmental education.

Ex: Mass media, Educational institutions and voluntary agencies can achieve this.

6. Recycling and Reuse of wastes: To minimize soil pollution, the wastes such as paper, plastics, metals, glasses, organics, petroleum products and industrial effluents etc should be recycled and reused.

Ex: Industrial wastes should be properly treated at source. Integrated waste treatment methods should be adopted.

7. Ban on Toxic chemicals: Ban should be imposed on chemicals and pesticides like DDT, BHC, etc which are fatal to plants and animals. Nuclear explosions and improper disposal of radioactive wastes should be banned.

8. Formulation and effective implementation of stringent pollution control legislation also helps in controlling soil pollution.

9. Proper treatment of liquid wastes from industries and mines must be done.

10. Faulty sanitation practices must be improved.

11. Polluted soil can be treated by bioremediation. It uses microorganisms (yeast, fungi or bacteria) to breakdown, or degrades hazardous substances into less toxic or nontoxic substances (such as CO_2 and H_2O).

* Thermal pollution

Defination: The degradation of water quality by any process that changes ambient water temperature is called thermal pollution.

Causes of thermal pollution/Sources of thermal pollution:

The following are the causes for thermal pollution.

1. Water as Cooling Agent in Power, Manufacturing and Industrial plants: Production and Manufacturing plants are biggest source of thermal pollution. These plants draw water from nearby source to keep machines cool and then release back to the source with higher temperature. When heated water returns to the river or ocean, the water temperature rises sharply. When oxygen levels are altered in the water, this can also degrade the quality and longevity of life in wildlife that lives underwater.

2. **Soil Erosion:** Soil erosion is another major factor that causes thermal pollution. Consistent soil erosion causes water bodies to rise, making them more exposed to sunlight. The high temperature could prove fatal for aquatic biomes as it may give rise to anaerobic conditions.

3. Deforestation: Trees and plants prevent sunlight from falling directly on lakes, ponds or rivers. When deforestation takes place, these water bodies are directly exposed to sunlight, thus absorbing more heat and raising its temperature.

4. Runoff from Paved Surfaces: Urban runoff discharged to surface waters from paved surfaces like roads and parking lots can make water warmer. During summer seasons, the pavement gets quite hot, which creates warm runoff that gets into the sewer systems and water bodies.

5. Natural Causes: Natural causes like volcanoes and geothermal activity under the oceans and seas can trigger warm lava to raise the temperature of water bodies. Lightening can also introduce massive amount of heat into the oceans. This means that the overall temperature of the water source will rise, having significant impacts on the environment.

Effects of Thermal Pollution:

The following are the effects of thermal pollution.

1. Decrease in DO (Dissolved Oxygen) Levels: The warm temperature reduces the levels of DO (Dissolved Oxygen) in water. The warm water holds relatively less oxygen than cold water. The decrease in DO can create suffocation for plants and animals such as fish, amphibians and copepods, which may give rise to anaerobic conditions. Warmer water allows algae to flourish on surface of water and over the long term growing algae can decrease oxygen levels in the water.

2. Increase in Toxins: With the constant flow of high temperature discharge from industries, there is a huge increase in toxins that are being regurgitated into the natural body of water. These toxins may contain chemicals or radiation that may have harsh impact on the local ecology and make them susceptible to various diseases.

3. Loss of Biodiversity: A dent in the biological activity in the water may cause significant loss of biodiversity.

4. Ecological Impact: A sudden thermal shock can result in mass killings of fish, insects, plants or amphibians. Hotter water may prove favorable for some species while it could be lethal for other species. Small water temperature increases the level of activity while higher temperature decreases the level of activity.

5. Affects Reproductive Systems: A significant halt in the reproduction of marine wildlife (although this may be true, reproduction can still occur between fish – but the likelihood of defects in newborns is significantly higher) can happen due to increasing temperatures as reproduction can happen with in certain range of temperature.

6. Increases Metabolic Rate: Thermal pollution increases the metabolic rate of organisms as increasing enzyme activity occurs that causes organisms to consume more food than what is normally required, if their environment were not changed. It disrupts the stability of food chain and alter the balance of species composition.

7. Migration: The warm water can also cause particular species of organisms to migrate to unsuitable environment that would not cater to its requirements for survival.

Control measures of thermal pollution:

The following methods can be adapted to control high temperature caused by thermal discharges:

1. Cooling towers: Use of water from water systems for cooling systems for cooling purposes, with subsequent return to the water way after passage through a condenser, is called cooling process. Cooling towers transfer heat from hot water to the atmosphere by evaporation. Cooling towers are of two types:

(i) **Wet cooling tower:** Hot water coming out from the condenser (reactor) is allowed to spray over baffles. Cool air, with high velocity, is passed from sides, which takes away the heatand cools the water.

(ii) **Dry cooling tower:** Here, hot water is allowed to flow in long spiral pipes. Cool air with the help of a fan is passed over these hot pipes, which cools down hot water. This cool water can be recycled.

2. Cooling ponds: Cooling ponds are the best way to cool thermal discharges. Heated effluents on the surface of the water in cooling ponds maximise dissipation of heat to the atmosphere and minimise the water area and volume. The warm water wedhe acts like a cooling pond.

3. Spray ponds: The water coming out from condensers is allowed to pass into the ponds through sprayers. Here water is sprayed through nozzles as fine droplets. Heat from the fine droplets gets dissipated to the atmosphere.

4. Artificial lakes: Artificial lakes are manmade water bodies that offer once-through cooling. The heated effluents can be discharged into the lake at one end and water for cooling purposes may be withdrawn from the other end. The heat is eventually dissipated through evaporation.

* Marine pollution

Defination: The undesirable changes occurring in the sea which affects the living organisms is called marine pollution.

Causes/Sources of Marine Pollution

1. Toxic chemicals in water:

Chemical runoff from industry can really endanger marine life. Industrial waste pumped into the sea, household cleaners poured down the sink, and even chemicals in the atmosphere (for instance due to the discharge of industrial wastes through factory chimneys) that dissolve into the sea can pollute our oceans significantly.

2. Oil spillages:

This is usually an accidental form of industrial dumping, whereby leaks in oil tankers cause vast quantities of oil to pour into the ocean. Accidental oil spills can devastate marine life.

3. Small particles:

The tiny plastic beads in exfoliating creams and other small particles that we pour down the drain without thinking wind up polluting the ocean.

4. Plastic, Litter, and human waste:

Plastic bags, aluminum cans, trash and other human waste constitute a major pollutant of the world's oceans. A huge 'island' of trash roughly the size of Texas was recently found in the Pacific ocean for instance, demonstrating the vast scale of this problem.

5. Sewage:

Whether or not it is treated with toxic chemicals, sewage pollutes the clear, clean water of the oceans. This is another type of industrial dumping. Sometimes, sewage is not pumped directly into the sea but into rivers, and then the untreated water of rivers carries it into the sea.

6. The shipping industry:

Gases (which dissolve in the sea), chemicals and sewage from container ships are major pollutants.

7. Dissolved greenhouse gases: Greenhouse gases from human fossil fuel consumption are making the sea more acidic.

Effects of Marine Pollution:

1. Oxygen depletion:

Seawater is full of dissolved oxygen, however decomposing sewage and other biomatter in oceans can result in a condition known as 'hypoxia' or oxygen depletion. This makes it hard for oxygen loving marine life – plants, fish and animals – to survive in the oceans.

2. Higher acidity:

Toxic chemicals make our oceans more acidic. Again, this makes them poisonous to marine life and causes harm to fish and marine mammals as well as marine plants and corals.

3. Choking marine life:

Small pieces of plastic and other litter are increasingly being found in the stomach of fish, turtles and other marine animals. These pieces of trash choke marine animals and hamper their digestion, with an often fatal result.

4. Spoiling birds' feathers:

Oil spills coat the feathers of marine birds and strip them of the natural oils that birds use to keep their feathers waterproof and to maintain their own body temperatures. As a result, marine birds can overheat or get too cold, and they find it hard to stay afloat as their feathers get soggy. They will also find it difficult to fly when their feathers are clogged with oil.

5. Blocking out the sunlight:

Pollutants such as oil or litter can block out the sunlight from sea plants which need sunlight for photosynthesis.

6. Dangers to human health:

Human swimmers and water sports lovers can become endangered by swimming in a polluted sea.

Control measures of marine pollution:

The following are the control measures of marine pollution.

1. Introduction of sewage treatment plants to reduce BOD of final product before discharging into sea.

2. Cleaning oil from surface waters and contaminated beaches can be accelerated through the use of chemical dispersants which can be sprayed on the oil.

3 Load on top system reduce oil pollution cleaned with high pressures jets of water.

4. Crude oil washing: The clingage is removed by jets of crude oil while the cargo is being unloaded.

5. Skimming off the oil surface with a section device.

6. Spreading a high density powder over the oil spill, so that oil can I be sunk to the bottom.

7. Stop using plastic and littering garbage as they not only choke up the drains but also releases into the oceans.

8. Ensure that chemicals are not used anywhere near the streams of water and try cutting down on the usage of such chemicals.

9. For farmers, they need to switch from chemical fertilizers and pesticides and move towards the usage of organic farming methods.

10. Use public transport and reduce the carbon footprint by taking small and substantial measures that will not help in reducing the pollution from the environment but will ensure a safe and healthy future for the upcoming generations.

11. Prevent from any oil or chemical spill in the oceans and if in case there is an oil or chemical spill near you volunteer and help in cleaning out the ocean water.

12. Volunteer or initiate beach cleanup activities and spread awareness about the same in the nearby vicinity.

* Noise pollution

Defination: Noise is defined as, "the unwanted, unpleasant or disagreeable sound that causes discomfort to all living beings".

Sources/Causes of Noise Pollution:

The sources of noise pollution are divided into two categories:

Natural sources:

The natural environment is filled with various sounds – thunderstorms, lightning, tornado, cyclone, volcanic eruptions, earthquakes, landslides, sounds produced by animals, and rapidly falling water.

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.

Commercialization of residential areas: Even in non-industrial areas, there is noise in the surrounding environment due to printing, dyeing machines, repairing cars, grinding etc.

Domestic Noise: As the houses in the cities are quite adjacent, the amount of domestic noise is increasing. The noise of radio, television, instrumentation and various types of sounds are constantly occurring around us, which cause mental health problems, stress, deafness etc. Other domestic sources include noise in the kitchen, and domestic discord including scolding, shouting, crying, etc.

Construction activities: Unbridled construction is also a reason for noise pollution outside the home. Sound pollution is also caused due to poor urban planning because industrial and residential buildings are quite close by in many cities.

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

Noisy Hospitals: Noise pollution also occurs in hospitals. Rocking of trolleys, wheelchairs, surgical instruments, oxygen cylinders, sounds from plants, uncontrolled conversations

among patients, relatives, emergency noise and screams, mourning followed by death are some of the sources of noise pollution in medical centres.

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

Other Reasons: Noise pollution inside and outside the house includes car alarms, emergency services siren, machine tools, compressed air horn, equipment, electrical equipment, megaphone etc.

Effects of Noise Pollution/Diseases Caused by Noise Pollution:

- Noise pollution may cause temporary or permanent hearing impairment. The most direct harmful effect of excessive noise falls on the ears. Many times, extreme noise ruptures the ear drums.
- You cannot only be deaf but can also come in the grip of deadly illnesses like impotence and cancer, besides problems such as lack of memory, concentration, and interruption in speech, irritation, irritability, stress and depression.
- The noise not only creates irritability, anger, but also accelerates the heart rate by increasing blood flow in the arteries. The constant noise increases the amount of cholesterol in the blood, which contracts blood vessels, increasing the likelihood of cardiovascular disease.
- Health experts believe that rising noise gives rise to neurological disease, nervous breakdown, hypertension, vision, dizziness, excessive sweating, exhaustion
- As rapid noise hinders sleep, insomnia has adverse effects on human functioning. The person becomes irritable, angry, tired and tense, and he even becomes neurotic or crazy.
- Exposure to the noise of 180 decibels intensity may result in the death of man.
- Due to excessive noise, there is a decrease in the production of digestive juices.
- Noise pollution has a lot of adverse effect on infants and women, sometimes due to loud velocity of sound, women also undergo miscarriage or the foetus's heart stops and the entire behaviour of the infant can change. Children imbibe forgetful tendencies.
- The effect of noise is dangerous for animal life too. Due to continuous noise, their habitat decreases and the threatened creatures reach the brink of extinction. The most notable of the deadly effects of noise pollution is that some species of whale die due to noise.

- Noise pollution has extremely harmful effects on other organisms and vegetation. Due to frequent noise, animals and birds leave their habitat and move away. Animals and birds migrate from the forest areas near the mining areas and high traffic roads. Due to acute sound waves, birds may even stop laying eggs.
- Because of excessive noise, many violent creatures cannot find their prey, while other creatures cannot survive being hunted.
- Many microbes are destroyed by acute sound, which inhibit decomposition of wastes.
- There are adverse effects of pollution on pets such as turbulence, and decrease in their milk content.
- Similarly, due to noise pollution, the growth of the vegetation is hindered; the fruits and flowers of the trees get withered and decayed.
- With excessive sound the walls of windows of the buildings are broken, the roofs rattle and get cracked.
- Due to blasts in the mining areas, or sound of jet aeroplanes sometimes high-rise buildings collapse or cracks develop in them, dams, bridges, etc.
- The sound effects of noise pollution caused by nuclear explosions spread through hundreds of kilometres so that biodiversity is threatened.
- Rocks, snowflakes and landslide incidents rise in snowy and mountainous areas.
- Because of the noise, many creatures also speak loudly, which is called Lombard Vocal Response. Their vocal intensity increases in the presence of noise. It occurs as a response to ambient noise.
- Due to excessive noise, there is a disruption in the studies of children too, as they do not get peaceful environment for study even in their homes.

Measures for Prevention/Control of Noise Pollution:

- Considering the widespread ill-effects of noise pollution, measures need to be taken to control them.
- Increasing noise pollution is very harmful for the health, efficiency and productivity of animals, organisms, flora etc. as well as the adaptation and balance of the environment.
- It has become necessary to control it and also to make people aware of this.
- Factories, which mainly produce noise pollution, should be established far away from settlements, forests, reservoirs and hilly areas.

- Settlements should not be located at least within 20 kilometres from mining areas, and airports.
- Explosives should be not used in mountainous, forest and mining areas.
- With proper maintenance of vehicles, along with the restriction of high sound horns, the use of advanced technology silencer should be used inevitably.
- Use of horn in public places (hospital, teaching institutes etc.) should be banned.
- The sound of musical instruments should be controlled to desirable limits.
- The use of sound amplifiers of high power, DJ, etc should be banned in religious, social, political events.
- There should be control over noise generated from machine and equipment.
- The use of sound absorber acoustic tiles should be encouraged in the construction of multi-storeyed buildings.
- In industrial, commercial and hospital buildings, adequate soundproof systems should be installed.
- Intensive plantation should be made in the entire building complex.
- Planting green trees along the road side reduces the intensity of noise pollution.
- Dense tree cover is very useful in the prevention of noise pollution. Such trees help in absorbing high sound waves, as well as deflecting them into the atmosphere.
- Therefore, cities, highways, industrial settlements should be fully lined with the green belt of trees.
- Protective tools (ear plugs etc.) should be provided for workers.
- Limits should be set on noise and control over noise pollution by legal provisions.
- Adequate health education on pollution should be provided through government agencies and voluntary institutions.

* Nuclear hazards (Radioactive pollution/Radiation pollution)

Nuclear hazard is an environmental pollution caused by ionizing radiations. Atom bomb explosion, nuclear power plant accident etc are nuclear hazards.

It is a radioactive pollution. It is caused by radioactive substances called radioactive isotopes or radionuclides. eg. Uranium, Thorium, Plutonium etc.

Radioactive pollution (also radioactive contamination) is the presence of radioactive substances in the environment. These substances are known as pollutants because they can

cause damage to the environment. Animals, plants and humans can all fall ill due to radioactive pollution.

Alternative names for radioactive pollution include ‘radioactive contamination’ and ‘radiological contamination’. These terms all mean the same thing: radioactive matter polluting the environment.

Defination: The undesirable change caused by the release of radiations into the air from radioactive substances is called radioactive pollution.

Sources/Causes of radioactive pollution:

The following are the sources of the radioactive pollution. Sources may be natural or manmade activities.

The natural sources of radiation may be:

1. Radioactive minerals;

2. Cosmic rays;

3. Radio nuclides.

1. Radioactive Minerals:

The minerals containing Uranium- 235 (U^{235}), Uranium-238 (U^{238}), Thorium-232 (Th^{232}), Plutonium- 239 (Pu^{239}) etc. are capable of emitting energetic radiations causing pollution.

2. Cosmic Rays:

The cosmic rays containing highly energetic particles reach the surface of the earth causing pollution. The intensity of cosmic rays depends on latitudes and altitude of the place. The intensity is maximum at the poles and minimum at the equator.

3 .Radio nuclides:

The unstable radio-nuclides in the atmosphere can be splitted up into smaller parts emitting energetic radiation. The smaller radio-nuclides enter into the body of organism along with air during respiration.

The various sources of manmade radiation pollutions may be:

1. Nuclear power plants;

2. Radio-active wastes;

3. Nuclear explosions; and

4. Radio-isotopes.

1. Nuclear Power Plants:

Nuclear power plants emit radiation to a very smaller extent except accidental leaks (Chernobyl accident of undivided USSR).

2. Radio-active Wastes:

The nuclear power plants produce a lot of nuclear radio-active wastes. The disposal of these wastes has become a global problem. Some countries producing large quantity of nuclear wastes dump them in ocean near other countries.

3. Nuclear Explosion:

During nuclear explosion, a large number of radio-nuclides are generated in the atmosphere. The radio nuclides settle down with rain contaminating the soil and water bodies. Finally, these enter into food chain causing serious problem to the living organisms.

4. Radio-isotopes:

Radio-isotopes are also prepared artificially either by nuclear fusion or by nuclear fission. If these radio-isotopes are not properly handled, these emit radiations causing pollution.

5. Television Set:

Television sets produce radiations which can also cause cancer.

Effect of Radiation Pollution:

When radiation passes through different living organisms the following dis-orderness takes place:

1. Radiation splits the molecules of the tissues into ions and free radicals and causes mutation by breaking DNA (Deoxy ribonucleic acid) molecules in the nucleus.

2. Radiation in bone marrow may cause leukemia.

3. Radiation may cause skin burns which may lead to skin cancer.

4. Radiation at pelvic regions of pregnant ladies, cause damage to the foetus.

5. Still birth- Birth of dead babies.

6. congenital deformities – defects in new born babies.

7. Microcephaly – Abnormal small head in babies.

8. Destruction of cities.

9. Destruction of plants and animals

10. It causes radiation sickness.

11. Cumulative radiation damage and death.

12. Cataract in the eye.

13. Reduced fertility.

14. Damage to liver, spleen, thyroid etc.

15. Carcinoma (cancer)

16. Leukemia (blood cancer)

17. General malaise (discomfort)

18. Nausea, vomiting, headache, Anaemia, mental retardation, throid cancer, bone cancer,

19. Inhibition of mitosis (Cell division)

20. Inhibition of enzyme secretion.

Control of Radiation Pollution:

Radiation pollution can be controlled in the following ways:

1. Care should be taken to check manmade radiation pollution at source.

2. Nuclear reactor should be perfectly maintained to avoid accidental leakage.

3. Nuclear tests should be banned.

4. **Waste disposal:** Radioactive waste must be stored in underground tanks where they gradually decay in a harmless manner.

5. **Protective garments:** Workers in atomic power plant and industries using radioactive materials should wear protective garments and should be screened from radioactive materials by radiation resistant walls or cases.

6. **Radiation indicators:** The workers should wear radiation indicators to know the total amount of radiation to which they have been exposed.

7. **Exposure to visible light:** Visible light neutralizes UV damage considerably. Therefore exposing the UV radiation affected persons to sunlight can treat him.

8. **Glass spectacles:** Use of glass spectacles will protect the eyes from ultraviolet light because UVL cannot penetrate the glass.

9. Public awareness

10. Implementation of strict laws.

* Solid waste management

Solid waste management is a term that is used to refer to the process of collecting and treating solid wastes. It also offers solutions for recycling items that do not belong to garbage or trash. As long as people have been living in settlements and residential areas, garbage or solid waste has been an issue. Waste management is all about how solid waste can be changed and used as a valuable resource.

Types of solid wastes: Depending on the nature of origin, solid wastes are classified into

1. Urban or municipal wastes
2. Industrial wastes and
3. Hazardous wastes

Sources of urban wastes

Urban wastes include the following wastes:

Domestic wastes containing a variety of materials thrown out from homes

Ex: Food waste, Cloth, Waste paper, Glass bottles, Polythene bags, Waste metals, etc.

Commercial wastes: It includes wastes coming out from shops, markets, hotels, offices, institutions, etc.

Ex: Waste paper, packaging material, cans, bottle, polythene bags, etc.

Construction wastes: It includes wastes of construction materials.

Ex: Wood, Concrete, Debris, etc.

Biomedical wastes: It includes mostly waste organic materials

Ex: Anatomical wastes, Infectious wastes, etc.

Classification of urban wastes

Urban wastes are classified into:

Bio-degradable wastes - Those wastes that can be degraded by micro organisms are called bio-degradable wastes

Ex: Food, vegetables, tea leaves, dry leaves, etc.

Non-biodegradable wastes: Urban solid waste materials that cannot be degraded by micro organisms are called non-biodegradable wastes.

Ex: Polythene bags, scrap materials, glass bottles, etc.

Sources of industrial wastes

The main source of industrial wastes are chemical industries, metal and mineral processing industries.

Ex:

Nuclear plants: It generated radioactive wastes

Thermal power plants: It produces fly ash in large quantities

Chemical Industries: It produces large quantities of hazardous and toxic materials.

Other industries: Other industries produce packing materials, rubbish, organic wastes, acid, alkali, scrap metals, rubber, plastic, paper, glass, wood, oils, paints, dyes, etc.

Effect of improper solid waste management

1. Due to improper disposal of municipal solid waste on the roads and immediate surroundings, biodegradable materials undergo decomposition producing foul smell and become a breeding ground for disease vectors.
2. Industrial solid wastes are the source for toxic metals and hazardous wastes that affect soil characteristics and productivity of soils when they are dumped on the soil
3. Toxic substances may percolate into the ground and contaminate the groundwater.

4. Burning of industrial or domestic wastes (cans, pesticides, plastics, radioactive materials and batteries) produce furans, dioxins and polychlorinated biphenyls that are harmful to human beings.
5. Contaminates water and air, resulting into diseases and dysentery in Human beings.
6. Mosquitoes breed in the stagnant water, blocked due to waste choked in the drains.
7. Decomposition of solid waste spreads obnoxious odour in the air, thus polluting it.
8. Garbage dumps and decomposed waste helps many harmful species to breed in them.
9. The infected water supply also leads to large scale epidemics.

Solid waste management involves waste generation, mode of collection, transportation, segregation of wastes and disposal techniques.

Steps involved in solid waste management:

Two important steps involved in solid waste management are:

Reduce, Reuse and Recycle of Raw Materials

Discarding wastes

Reduce - If usage of raw materials is reduced, the generation of waste also gets reduced

Reuse - Refillable containers that are discarded after use can be reused

Rubber rings can be made from discarded cucle tubes and this reduces waste generation during manufacture of rubber bands.

Recycle- Recycling is the reprocessing of discarded materials into new useful products

Ex: Old aluminium cans and glass bottles are melted and recast into new cans and bottles

Preparation of cellulose insulation from paper

Preparation of automobile body and construction material from steel cans

This method (**Reduce, Reuse & Recycle**), i.e, **3R's** help save money, energy, raw materials and reduces pollution.

Discarding wastes:

The following methods are adopted for discarding wastes:

1. Sanitary Landfill
2. Incineration
3. Recovery and recycling
4. Composting
5. Pyrolysis

Sanitary Landfill

This is the most popular solid waste disposal method used today. Garbage is basically spread out in thin layers, compressed and covered with soil or plastic foam. Modern landfills are designed in such a way that the bottom of the landfill is covered with an impervious liner which is usually made of several layers of thick plastic and sand. This liner protects the ground water from being contaminated because of leaching or percolation. When the landfill is full, it is covered with layers of sand, clay, top soil and gravel to prevent seepage of water.

Incineration

This method involves burning of solid wastes at high temperatures until the wastes are turned into ashes. Incinerators are made in such a way that they do not give off extreme amounts of heat when burning solid wastes. This method of solid waste management can be done by individuals, municipalities and even institutions. The good thing about this method is the fact that it reduces the volume of waste up to 20 or 30% of the original volume.

Recovery and Recycling

Recycling or recovery of resources is the process of taking useful but discarded items for next use. Traditionally, these items are processed and cleaned before they are recycled. The process aims at reducing energy loss, consumption of new material and reduction of landfills.

Composting

Due to lack of adequate space for landfills, biodegradable yard waste is allowed to decompose in a medium designed for the purpose. Only biodegradable waste materials are used in composting. Good quality environmentally friendly manure is formed from the compost and can be used for agricultural purposes.

Pyrolysis

This is method of solid waste management whereby solid wastes are chemically decomposed by heat without presence of oxygen. This usually occurs under pressure and at temperatures of up to 430 degrees Celsius. The solid wastes are changed into gasses, solid residue and small quantities of liquid.

In summary, proper solid waste management is an integral part of environmental conservation that should be observed by individuals and companies globally. This will keep the environment clean and reduce health and settlement problems.

* Role of an individual in prevention of pollution:

Environment protection has been burning issue in last half century. In order to tackle the menace of pollution, urgent steps have to be taken at not only global or country level, but also at local level. In fact, the role of individuals in prevention of pollution is of critical importance, because it is the individuals that make a community or country. Effort by each

individual at his or her level can have a significant effect on global level. It has been aptlysaid “charity begins at home”.

Ways in Which a Individual can Help in Prevention of Pollution

- Individuals should minimize wastage of resources such as electricity. Every unit of electricity saved is equivalent unit of electricity produced as it not only saves the fuel that would be used to produce that electricity, but also help to prevent pollution that isaccompanied by burning of that fuel. Therefore, person should always switch off appliances when not in use.
- Individuals should prefer walking or use cycles instead of using motor vehicles, especially when distances to be travelled are small.
- Individuals can make considerable contribution by using mass transport (buses, trains,etc) instead of using personal vehicles.
- When going to workplace, colleagues from nearby localities should pool vehicles instead of going in individual personal vehicles.
- Taking personal vehicles for periodic pollution checks at centres approved by authorities.
- Individuals should reuse items whenever possible.
- Products that are made of recycled material should be given preference.
- Use gunny bags made of jute instead of plastic bags.
- Take part in environment conservation drives such as tree planting drives.
- Use water resources efficiently.
- Use renewable resources by installing equipment such as solar heaters and using solarcookers.
- Dispose potentially harmful products such as cells, batteries, pesticide containers, etcproperly.
- Use of refrigerators should be minimised wherever possible as they are main sourceof CFC, which is responsible for Ozone layer depletion.
- Follow and promote family planning, as more population means more resourcesutilized and more resources utilized imply more pollution.
- Avoid making noise producing activities such as listening to loud music.
- Use handkerchiefs instead of paper tissues.

Organize drives to clean streets and clean drains with help of other people of locality.