UNIT 7 : ENVIRONMENTAL POLLUTION

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7.1 LEARNING OBJECTIVES

After going through this unit, you will be able to-

- describe the meaning of environmental pollution
- identify the sources of different types of environmental pollution
- list the different types of environmental pollution
- interprete the adverse effects of different types of environmental pollution
- tell how to prevent and control the various types environmental pollution.

7.2 INTRODUCTION

One of the greatest challenges that the world is facing today is that of environmental pollution, increasing with every passing year and causing grave and irreparable damage to the earth. We shall, here, discuss the

meaning and different types of environmental pollution. Again, here we shall discuss the causes, types, and adverse effects of different types of environmental pollution. Further, we shall discuss how to prevent or control various environmental pollution discussed.

7.3 MEANING OF ENVIRONMENTAL POLLUTION

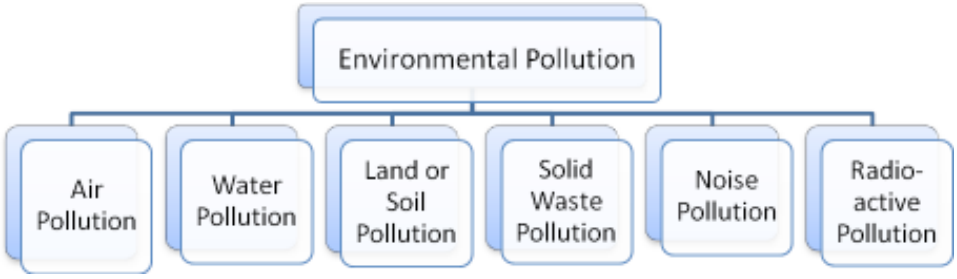
Man's attempt to conquer nature has upset the natural relationship between man and his environment. Man's reckless and indiscriminate exploitation of nature has disturbed the ecological balance between living and non-living components of the environment. By his reckless acts, man is not only threatening his own survival on this planet, but also the survival of other living organisms. It is needless to mention here that for normal and healthy living a conducive environment is required by all living beings, including humans, livestock, plants, micro-organisms and the wildlife. The favourable unpolluted environment has a specific composition. When this composition gets changed by addition of harmful substances, the environment is called polluted environment and the substances polluting it are called pollutants. Therefore, environmental pollution can be defined as any undesirable change 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. According to the Environment (Protection Act), 1986 also "environment pollution" means the presence in the environment of any environmental pollutant.

Though environmental pollution is not a modern phenomenon but present environmental pollution is caused mostly by human activities. It is commonly agreed that pollution is, without doubt, the outcome of urban industrial technological revolution and rapacious and speedy exploitation of natural resources, increased rate of exchange of matter and energy and ever increasing industrial wastes, urban effluents and consumer goods. The problem of environmental pollution is global and concerns all countries irrespective of their size, level of development or ideology. For example, if the nuclear test is carried out in one part of the world the fall out may be carried by winds to any other part of the world and such fall out of

irresponsible disposal of radioactive from a remote energy plant in one country may turn out to have greater of full-fledged war.

7.4 TYPES OF ENVIRONMENTAL POLLUTION

The classification of Environmental Pollution is a difficult task because the pollutants and the media through which the pollutants are transported are all interconnected and inter-related. However, pollution may be classified from the point of view of object which is polluted. From this point of view, pollution may be classified as follows:



Let us now discuss all these types below:



CHECK YOUR PROGRESS

Q 1: Define environmental pollution.

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Q 2: Mention the different types of environmental pollution.

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7.4.1 Air Pollution

The problem of air pollution came into existence in the prehistoric times when man discovered fire for cooking, heating and to provide light in his cave. Air pollution is an atmospheric condition in which certain substances (including the normal constituents in

excess) are present in concentrations which can cause undesirable effects on man and his environment. These substances include gases, particulate matter, radioactive substances etc.

Sources of Air Pollution:

There are two main sources of air pollution as follows:

- Natural Sources: These include volcanic eruptions, deflation of sands and dust, sea salt sprays, biological decay, wild or forest fires in natural vegetation etc.
- Man-made Sources: Man-made sources include thermal power plants, industrial units, vehicular emissions, fossil fuel burning, agricultural activities etc.

Apart from these, a variety of pollutants are released into the air from different sources. Some of them are as follows:

- Carbon Compounds: These are mainly carbon dioxide and carbon monoxide, the former released by complete combustion of fossil fuels and the latter by automobile exhausts.
- Sulphur Compounds: These include SO2, H2S and sulphuric acid, mostly released by fossil fuel (coal etc.), based power generating plants (Thermal plants) and industrial units (refineries).
- Nitrogen Oxides: These include chiefly nitrogen monoxide, nitrogen oxide, nitric acid and mostly released by automobiles, power plant and industries.
- Ozone: Its level may rise in atmosphere due to human activities.
- Fluorocarbons: These come from industries, insecticides spray etc.
- Hydrocarbons: These are chiefly benzene, benzpyrence, etc which are mostly discharged by automobiles and industries.
- Metals: These include chiefly lead, nickel, arsenic, beryllium, tin, vanadium, titanium, cadmium etc. present in air as solid particles or liquid droplets or gases. They are produced mostly by metallurgical processes, automobiles, seaspray etc.

Types of Air Pollution:

Regarding classification, air pollution is divided on two bases. Such as

- On the basis of types of pollutants, and
- On the basis of types of sources of pollutants.

On the basis of types of pollutants air pollution can be further subdivided into two types such as-

- Gaseous pollution and
- Particulate air pollution.

Again on the basis of types of sources of pollutants, air pollution can be further subdivided into four types such as-

- Automobile air pollution
- Industrial air pollution
- Thermal power plants pollution
- Nuclear pollution.

Adverse Effects of Air Pollution:

Air pollution causes several kinds of damages to man, animal, plants and also on weather, climate and atmospheric processes. Some of them are mentioned below:

- Air pollution has very serious types of pathological effect on man. It causes several types of diseases to man.
- Air pollution has damaged both agricultural crops and natural plants and vegetation.
- There has been injury to agricultural livestock, particularly from air borne fluoride and arsenic pollution.
- Air pollutants mixing up with rain can cause damage high acidity in fresh water lakes. This affects aquatic life especially fish.
- Air pollution also takes its role of buildings and other manmade objects such as famous building, monuments and art treasures.
- Air pollution also effects weather and climate on regional, continental or global basis.
- The increased amount of carbon dioxide in atmosphere cause

to increase the temperature of earth. It is known by the phrase 'Green house effect'.

- It causes obstruction to vision of pilots and has caused air craft accidents.

Prevention and Control of Air Pollution:

Air pollution can be minimised by following methods:

- Using mass transport system, bicycles etc.
- Vehicular pollution can be checked by taking steps like regular tune-up of engines, replacement of more polluting old vehicles and installing catalytic converters etc.
- Shifting to less polluting fuels like hydrogen gas.
- Using non-conventional sources of energy like solar, wind etc.
- Using biological filter and bio-scrubbers.
- Siting of industries after proper Environmental Impact Assessment studies.
- Using low sulphur coal in industries.

7.4.2 Water Pollution

Water pollution can be defined as alteration in physical, chemical or biological characteristics of water making it unsuitable for designated use in its natural state.

Sources of Water Pollution:

There are two main sources of water pollution. These are as follows:

- Natural sources: Water pollutants include soil erosion, volcanic eruption, landslides, coastal and cliff erosion, floods, decomposition of plants and animals etc.
- Man-induced Sources: Water pollutants include industries, power plants, underground coal mines, urbanisation, and surface run-off from agricultural fields, cultural activites (religious fairs and pilgrimage) etc.

The main source of surface water pollution are-

- Sewage and other wastes generated in the cities and towns.

- Effluents and wastes generated by industries, especially chemical industries.
- Chemical fertilisers and pesticides used in agricultural activities.
- Oil spillage into sea-water during drilling and shipment pollute it.
- Waste generated by thermal power plants and nuclear power plants.

Ground water seems to be less prone to pollution as the soil mantle through which water passes helps to retain various contaminants due to its cation exchange capacity. However, there are number of potential sources of ground water pollution. Septic tanks, industry (textile, chemical, tanneries), deep well injection, mining etc. are mainly responsible for ground water pollution, which is irreversible. Ground water pollution with arsenic, fluoride and nitrate are posing serious health hazards.

Types of Water Pollution:

Based on the types of sources and storage of water, water pollution may categorise as follows:

- River water pollution
- Lake water pollution
- Sea water pollution
- Surface water pollution
- Ground water pollution

Based on the sources of pollution, water pollution may be categorised as follows:

- Industrial waste water pollution
- Solid waste water pollution
- Sewage water pollution
- Domestic water pollution

Harmful Consequences of Water Pollution:

Following are some important effects of various types of water pollutants:

- Human infectious diseases are among the most serious effects of water pollution, especially in developing countries where the sanitation is usually inadequate or non-existent.
- The discharge of nitrogen, phosphorus and other nutrients coming from various man-made sources stimulates the algae growth in these run offs and coastal zones to dangerous levels. This excess in algae is harmful to the local habitat and uses all the oxygen, killing off the native aquatic life. Nutrient pollution can also cause unusual outbreaks in fish diseases.
- Exposure to oil or its chemicals can alter the ecology of aquatic habitats and the physiology of marine organisms. Evidence strongly suggests that components of crude oil persist in the marine environment for years and are extremely toxic to the aquatic life.
- Pesticides are carried into water systems by rain water runoff and are sometimes even sprayed directly into waterways as part of pest-control. Pesticides are used for protecting the farmer's crops. When enough of these pesticides get carried into the water, they can have serious effects on our health as well.
- Dangerous chemicals used in mining processes are carried into rivers and lakes and have devastating effects on the water. When rain or surface water flows over exposed rock and soil, it can combine with naturally occurring sulphur to create sulphuric acid.
- Industry machinery is cooled by water from lakes and rivers. This water then returns to the water sources in a heated state. Fish and other organisms that have adapted to a particular temperature can be killed from thermal shock, and the extra heat can disrupt the spawning. Warmer water temperatures also reduce the oxygen content in the water, which increases the organism's susceptibility to disease, parasites, and the effects of toxic chemicals.

- Excess of fluoride in drinking water causes defects in teeth and bones called fluorosis.

Prevention and Control of Water Pollution:

The following measures are recommended for checking water pollution:

- Judicious use of agrochemicals like pesticides and fertilisers which will reduce their surface run-off and leaching. Avoid use of these on sloped lands.
- Use of nitrogen fixing plants to supplement the use of fertilizers.
- Adopting integrated pest management to reduce reliance on pesticides.
- Prevent run-off manure. Divert such run-off to basin for settlement. The nutrient rich water can be used as fertilizers in the fields.
- Separate drainage of sewage and rain water should be provided to prevent overflow of sewage with rainwater.
- Before the discharge of wastewater, it should be disinfected to kill the disease-causing organisms like bacteria.
- Proper treatment of industrial wastewaters is essential before being discharged.

7.4.3 Land or Soil Pollution

Soil pollution, which can also be called soil contamination, is a result of acid rain, polluted water, fertilizers, deforestation, dumping of solid wastes etc., which leads to bad crops. Soil contamination occurs when chemicals are released by spill or underground storage tank leakage which releases heavy contaminants into the soil.

Causes of Soil Pollution:

There are different causes of soil pollution. Some of them are mentioned below:

- **Industrial Activity:** Most industries are dependent on extracting minerals from the Earth. As a result, the industrial waste lingers

in the soil surface for a long time and makes it unsuitable for use.

- **Agricultural Activities:** Chemical utilization has gone up tremendously since technology provided us with modern pesticides and fertilizers. They are full of chemicals that are not produced in nature and cannot be broken down by it. As a result, they seep into the ground after they mix with water and slowly reduce the fertility of the soil.
- **Waste Disposal:** Every human produces a certain amount of personal waste products by way or urine and faeces. While much of it moves into the sewer the system, there is also a large amount that is dumped directly into landfills in the form of diapers. Even the sewer system ends at the landfill, where the biological waste pollutes the soil and water. This is because our bodies are full of toxins and chemicals which are now seeping into the land and causing pollution of soil.
- **Accidental Oil Spills:** Oil leaks can happen during storage and transport of chemicals. This can be seen at most of the fuel stations. The chemicals present in the fuel deteriorate the quality of soil and make them unsuitable for cultivation.
- **Acid Rain:** Acid rain is caused when pollutants present in the air mixes up with the rain and fall back on the ground. The polluted water could dissolve away some of the important nutrients found in soil and change the structure of the soil.

Effects of Soil Pollution:

- Considering how soil is the reason we are able to sustain ourselves, the contamination of it has major consequences on our health. Crops and plants grown on polluted soil absorb much of the pollution and then pass these on to us. This could explain the sudden surge in small and long term illnesses.
- The ecological balance of any system gets affected due to the widespread contamination of the soil. Most plants are unable to adapt when the chemistry of the soil changes so radically in

a short period of time. Fungi and bacteria found in the soil that bind it together begin to decline, which creates an additional problem of soil erosion.

- The toxic chemicals present in the soil can decrease soil fertility and therefore decrease in the soil yield. The contaminated soil is then used to produce fruits and vegetables which lacks quality nutrients and may contain some poisonous substance to cause serious health problems in people consuming them.
- The emission of toxic and foul gases from landfills pollutes the environment and causes serious effects on health of some people. The unpleasant smell causes inconvenience to other people.
- The death of many soil organisms in the soil can lead to alteration in soil structure. Apart from that, it could also force other predators to move to other places in search of food.

Control of Soil Pollution:

To check soil pollution, the following measures are suggested:

- Initiate control measures to check soil pollution.
- Make judicious use of chemical fertilisers, pesticides and insecticides.
- The use of DDT should be restricted.
- Integrated Pest management should be adopted.
- Organic farming practices should be encouraged.
- Industrial and urban wastes should be disposed properly.
- Stress should be laid on crop management and land use.
- Farmers should be educated on the harmful effects of the excess use of chemical fertilizers and other farming practices that are harmful to soil.



CHECK YOUR PROGRESS

Q 3: Mention the types of air pollution.

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Q 4: Write two causes of soil pollution.

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7.4.4 Solid Waste Pollution

All solid and semi-solid wastes arising from human and animal activities and are discarded as useless or unwanted are included in the term 'solid wastes'. Solid waste is often called the third pollution after air and water pollution. It includes garbage, rubbish, ashes and residues, demolition and construction wastes, dead animals, radioactive wastes. The amount of solid waste produced in urban India is steadily and rapidly increasing.

Source of Solid Wastes:

Different sources of solid wastes pollution are:

- **Domestic Wastes:** Waste that arises from household activities of human beings includes garbage, rubbish and Ashes.
- **Industrial Wastes:** Wastes which arises from industrial activities includes construction and demolition wastes, discarded equipment and tools, mining wastes etc.
- **Agricultural Wastes:** These include agricultural residues and poultry and diary wastes. Further, agricultural wastes may also include packing and cans of fertilizers, pesticides and soil conditioners used in modern agricultural practices.
- **Commercial Wastes:** Wastes those arise from public places such as offices, markets, restaurants, streets etc. includes building wastes, garbage, hazardous waste, ashes and rubbish.

Types of Solid Wastes:

Different types of solid wastes are:

- **Biodegradable Wastes:** Wastes which can be broken down into simpler and harmless substances by nature in due course of time using biological means.
- **Non-Biodegradable Wastes:** Wastes that cannot be broke down into simpler and harmless substances by biological means. For example- plastics, polythene bags, glass objects etc.
- **Toxic Wastes:** These can pose a substantial danger to the health of living beings and environment, immediately or over a period of time. For example- pesticides, heavy metals like mercury and sulphur dioxide etc.
- **Non-toxic Wastes:** Wastes that do not pose any problem to the health of living beings or to the environment. These are generally domestic wastes which are easily biodegradable. For example- papers, rags, boards etc.
- **Biomedical Wastes:** Wastes generated from hospitals, health centres, medical and dental colleges and laboratories. For example- biological cultures, used syringes etc.

Harmful Effects of Solid Waste:

- Improper handling of solid wastes is dangerous to health and environment.
- Improper disposal of solid wastes are resulted in the deaths of humans and animals through contamination of crops of water supplies.
- Uncontrolled dumping of urban wastes destroys the beauty of the countryside.
- Uncontrolled burning of open dumps can cause air pollution.
- Solid wastes are also responsible for water pollution.

Control of Solid Waste Pollution:

There is an urgent need to control solid waste pollution. The following methods are suggested in this regard- (i) Recycling method,

(ii) Burning of waste and utilisation for heat, (iii) Generating electricity, (iv) Composting of organic waste for preparation of manures and biogas.

In big cities and towns, solid waste are purchased by Kabaries, thus, nothing goes waste and throw away as waste materials.

7.4.5 Noise Pollution

Noise pollution is an excessive or annoying degree of noise in a particular area. High level noise is a disturbance to the human environment. Because of urbanization, noise in all areas in a city has increased considerably.

Sources of Noise Pollution:

Different sources of noise pollution are as follows:

- **Household Sources:** Food Mixer, Grinder, Vacuum Cleaner, Washing machine and Dryer, Air Conditioner, Straightners and curlers, Cooler, TV, iPods and Earphones, Loud speaker, Neighbour's Barking Dog.
- **Social Events:** Places of Worship, Discos and Gigs, Parties, Markets where people sell goods with, loudspeaker. When these events are not often, they can be termed as nuisance rather than noise pollution.
- **Commercial and Industrial Activities:** Printing Presses, Manufacturing Industries and Construction Sites.
- **Transportation:** Road Traffic Noise, Aircraft Noise, Noise from Rail Roads.

Causes of Noise Pollution

Different causes of noise pollution are:

- Poor Urban Planning
- Sounds from Motor Vehicles
- Sounds from Musical Instruments
- Car Alarms

- Office Equipment
- Factory Machinery
- Construction Work
- Barking Animals
- Appliances
- Audio Instruments
- Loud Speakers
- Noise Created by People

Effects of Noise Pollution

- **Interference with man's communication:** In a noisy area communication is severely affected.
- **Hearing damage:** Noise can cause temporary or permanent hearing loss. It depends on intensity and duration of sound level. Auditory sensitivity is reduced with noise level of over 90 dB in the mid high frequency for more than a few minutes.
- **Physiological and Psychological changes:** Continuous exposure to noise affects the functioning of various systems of the body. It may result in hypertension, insomnia, gastro-intestinal and digestive disorders, peptic-ulcers, blood pressure changes, behavioural changes, emotional changes etc.
- **Effect on Animals:** Animal are badly affected by noise pollution which are as follow:
  - Damages Nervous system
  - Altering Prey/predator detection
  - Creates problems in Navigation
  - They become Dangerous and Attacking
  - Raise Metabolism
  - Reduction of useable Habitat
  - Death of Certain Species
  - Genetic and Evolutionary Problems

Control of Noise Pollution:

Following are the methods to control and reduce the noise pollution:

- **Source Control:** The gadgets are to be developed to control

noise at source.

- **Transmission Control:** The room walls can be covered with sound absorbers.
- **Protect Exposed Persons or Workers:** The devices as ear plugs and ear muffs can be provided to workers of industries.
- **Through Law:** Legislation can ensure that sound production is minimized at various social functions. Unnecessary horn blowing should be restricted especially in vehicle-congested areas.
- **Tree Plantation:** Planting more trees having board leaves.

7.4.6 Radio-active Pollution

Radioactive pollution, like any other kind of pollution, is the release of something unwanted into the environment and, in this case, the unwanted thing is radioactive materials. It is also called radiological contamination.

Causes of Radioactive Pollution:

There are many causes of radioactive pollution, such as:

- **Production of nuclear weapons:** Radioactive materials used in this production have high health risks and release a small amount of pollution.
- **Decommissioning of Nuclear Weapons:** The decommissioning of nuclear weapons causes slightly more radioactive pollution than in the production, however, the waste (alpha particles) is still of low risk and not dangerous unless ingested.
- **Mining of radioactive ore:** Mining involves crushing and processing of the radioactive ores and this generates radioactive waste which emits alpha particles.
- **Coal ash:** It may come as a surprise that coal ash can be very dangerous. Some coal contains more radioactive material than usual and is often referred to as 'dirty' coal; when this is burnt the ash becomes more radioactive as the radioactive particles do not burn well.

- **Medical waste:** A number of radioactive isotopes are used in medicine, either for treatment or diagnostics. These can be left to decay over a short period after which they are able to be disposed of as normal waste.
- **Nuclear power plants:** Nuclear power plants under current standards produce little radioactive pollution due to safety precautions that must be adhered to.

Type of Radioactive Pollution

- **Continuous Pollution:** This type of condition exists in uranium mines, nuclear reactors, test labs etc. where the humans are under continuous exposure to radioactive contaminants and protective clothing is required to avoid radiation exposure.
- **Accidental Pollution:** This type of condition exists during accidental exposure to radiations by virtue of equipment failure, radiation leak, faulty protective equipment etc.
- **Occasional Pollution:** This condition exists during isolated experiment or test of nuclear substance.

Effects of Radioactive Pollution:

When radiation passes through different living organisms, the following disorderness takes place:

- Radiation splits the molecules of the tissues into ions and free radicals and causes mutation by breaking DMA molecules in the nucleus.
- Radiation in bone marrow may cause leukaemia.
- Radiation may cause skin burns which may lead to skin cancer.
- Radiation at pelvic regions of pregnant ladies causes damage of the foetus.

Control of Radioactive Pollution:

Radioactive pollution may be controlled in the following ways:

- Care should be taken to check manmade radiation pollution at source.
- Nuclear reactor should be preferably maintained to avoid accidental leakage.

- Nuclear tests should be banned.



CHECK YOUR PROGRESS

Q 5: What are the sources of solid waste?

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Q 6: How to control radioactive pollution?

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7.5 LET US SUM UP

In this unit we have discussed the following matters:

- Pollution is the process of making air, water, soil contaminated or dangerously dirty and not suitable for people to use.
- The classification of Environmental Pollution is a difficult task because the pollutants and the media through which the pollutants are transported are all interconnected and inter-related.
- In simple terms air pollution can be defined as any ambient condition in which substances are present at concentrations high enough above their normal levels to produce measurable effect.
- Water gets polluted by the contamination, of water bodies such as lakes, rivers, oceans, and groundwater, caused by human activities, which can be harmful to organisms and plants which live in these water bodies.
- Soil pollution, which can also be called soil contamination, is a result of acid rain, polluted water, fertilizers, deforestation, dumping of solid wastes etc., which leads to bad crops.
- All solid and semi-solid wastes arising from human and animal activities and are discarded as useless or unwanted are included in

the term 'solid wastes'. Solid waste is often called the third pollution after air and water pollution.

- Noise pollution is an excessive or annoying degree of noise in a particular area. High level noise is a disturbance to the human environment.
- Radioactive pollution, like any other kind of pollution, is the release of something unwanted into the environment and, in this case, the unwanted thing is radioactive material.



7.6 FURTHER READING

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7.7 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q No 1: Environmental pollution can be defined as any undesirable change 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.

Ans to Q No 2: Different types of environmental pollution are air pollution,

water pollution, land or soil pollution, solid waste pollution, noise pollution and radio-active pollution.

Ans to Q No 3: Regarding types, air pollution is divided on two bases. Such as

- On the basis of types of pollutants, and
- On the basis of types of sources of pollutants.

  On the basis of types of pollutants air pollution can be further subdivided into two types such as-
  - Gaseous pollution and
  - Particulate air pollution.

  Again on the basis of types of sources of pollutants, air pollution can be further subdivided into four types such as-
  - Automobile air pollution
  - Industrial air pollution
  - Thermal power plants pollution
  - Nuclear pollution.

Ans to Q No 4: Two causes of soil pollution are:

- **Industrial Activity:** Most industries are dependent on extracting minerals from the Earth. As a result, the industrial waste lingers in the soil surface for a long time and makes it unsuitable for use.
- **Acid Rain:** Acid rain is caused when pollutants present in the air mixes up with the rain and fall back on the ground. The polluted water could dissolve away some of the important nutrients found in soil and change the structure of the soil.

Ans to Q No 5: Different sources of solid wastes pollution are:

- **Domestic Wastes:** Waste that arises from household activities of human beings includes garbage, rubbish and Ashes.
- **Industrial Wastes:** Wastes which arises from industrial activities includes construction and demolition wastes, discarded equipment and tools, mining wastes etc.
- **Agricultural Wastes:** These include agricultural residues and poultry and dairy wastes. Further, agricultural wastes may also include packing and cans of fertilizers, pesticides and soil conditioners used in modern agricultural practices.