UNIT 5 : ENVIRONMENTAL POLLUTION

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5.1 LEARNING OBJECTIVES

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

- define environmental pollution
- classify the different forms environmental pollution like air, water, soil, noise and thermal pollution
- identify the various sources of environmental pollution
- list the pollutants causing pollution to the environment
- describe the effects of different forms of pollution on men, animals, and vegetation and on physical structures like historical monuments
- explain the different pollution control measures.

5.2 INTRODUCTION

Environmental pollution has become a major concern today. You have heard very frequently about the global warming, climate change, melting

of ice in the poles, extinction of some species etc. All these are due to environmental pollution caused mainly by human activities. In this unit we shall discuss environmental pollution, the causes and sources of various forms of pollution, its effects on human and other organisms. Also, some preventive measures for pollution control will be discussed. Thus, this unit will give you a comprehensive idea about environmental pollution.

5.3 ENVIRONMENTAL POLLUTION-DEFINITION

An undesirable change in the physical, chemical, or biological characteristics of the natural environment brought about by man's activities may be termed as environmental pollution. Such a change may be harmful to human and the environment. Pollution may affect all kinds of essential substances for man like soil, water and air etc.

5.4 AIR POLLUTION

Air pollution is the contamination of air by the addition of some harmful substances. Air pollution can cause damage to all plants, animals and men as well as the entire habitat.

- **Sources of Air Pollution:** Air pollution occurs mainly from two types of sources. These are:
  - Natural Sources
  - Manmade Sources
  - *Natural Sources:* The natural sources include many natural environmental events like forest fire ,volcanic eruption ,soil erosion, landslide, loss of biomass and radiation etc. These contribute to air pollution.
  - *Manmade Sources:* Manmade sources include the various kinds of human activities which cause air pollution. These sources are:
    - Industrialization: With increasing urbanization the rate of industrialization is also rising each day. The smoke emitted from the chimneys of the industries contain huge amount of CO, CO_2, SO_2, H_2S etc. Especially coal, petroleum industries and thermal

plants emit these gases in high amount. Many chemical industries also release high amount of HCI, CL,$N_2$0, Zn,As,Cu_2O,H_2S etc. and thereby cause air pollution.

- Combustion of Fuels: The combustion of coal and petrol generates high amount of CO_2 in the air and if the combustion is incomplete then it releases CO, CH_4 and many other hydrocarbons. These gases contribute to air pollution.
- Vehicular Traffic: With the increase of vehicular traffic the amount of combustion of petroleum also increases and the emission of high amount of smoke from the vehicles containing CO, CO_2, and SO_2 penetrates into air, water, soil and settles on the food chain. This causes severe air pollution.
- Explosion: Explosion occurs on account of wars that take place between two or more countries and also for various nuclear research activities. As a consequence, high amount of toxic radioactive substances are mixed with the air and thereby cause air pollution.
- Agricultural Activities: The use of pesticides for agricultural activities starting from fungicide to herbicides which are composed of highly toxic chemicals like phosphate, chlorinated hydrocarbon and, arsenic and lead. These are mixed with the air and cause damage to the environment. Besides, the clearing of forests and grasslands for agriculture produces about 60%-65% of CO_2 that causes air pollution.
- Suspended Particulate Matter (SPM): These types of pollutants mainly include pollens, germs, bacteria, viruses ,aerosols and small particulates which are released by the splintering of rocks.

- **Air Pollutants - Their Types:** The air pollutants may be divided into two groups:
  - *Primary Pollutants :* Primary pollutants are those substances which enter into the air without any physical and chemical change and pollute the air. Examples of this type of pollutant are - CO, NO, SO_2 VOCs and suspended particulate matter (SPM).

- *Secondary Pollutants :*These are produced from the various types of interactions among the primary pollutants in the atmosphere e.g. ground level ozone, Chlorofluorocarbons (CFC) etc.

- **Effect of Air Pollution on Animals:** Air pollutants affect the health of the animals in various ways. These are described below-
  - Carbon dioxide enters in the blood stream through lungs and produces carboxyheamoglobin. As a consequence, the oxygen carrying capacity of blood is reduced.
  - NO_2 causes various respiratory diseases besides producing acid rain in the environment .Absorption of this chemical causes eye irritation, oedema etc.
  - SO_2 increases the possibility of the incidence of some diseases like asthma, bronchitis etc.
  - Benzene is known as a main cause of Cancer. The temporary elements may cause irritation to eyes, nose and throat.
  - Some smoky substances (aerosols) may cause breathing problems for a long time besides producing skin, throat and nose irritation as allergens.
  - Lead damages the liver, the nervous system and the reproductive system. It also causes anemia, neurological problem, eccentric behaviour and high blood pressure.
  - Due to the toxicity of mercury and cadmium the central nervous system, liver, heart and fetus get damaged.

- **Air Pollution and its Effects on Plants:**
  - Because of the absorption of hydrocarbon, the leaves of trees become yellowish and along with the fruits fall off in an immature stage.
  - ***Lichens*** are very sensitive to pollution and these are a pollution indicator.
  - Ozone destroys the chlorenchima in plants and thereby causes the rotting of a plant.
  - Fluoride causes necrosis of the side and front portion of the tree leaves and helps in the rotting and falling of the leaves.



Lichens : moss; a simple composite plants consisting of a fungus typically growing on rocks, wall and tree.

- **Air Pollution and its Effects on Climate:**
  - *Greenhouse Effect and Global Warming:* The radiation from the sun controls the earth's weather and climate and after heating the earth's surface the remaining amount is radiated back into the space. The atmospheric greenhouse gases (water vapour, carbon dioxide and other gases) trap some of the outgoing energy, retaining the heat somewhat like the glass panels of a glasshouse. These gases are called green house gas and the phenomenon is known as "greenhouse effect." However, the problem arises when atmospheric concentration of greenhouse gases increases .Since the beginning of the industrial revolution, atmospheric concentrations of carbon dioxide and CFS has increased 50% and 20% respectively. These increases have enhanced the heat-trapping capability of the earth's atmosphere resulting in global warming and change in climate.
  - *The Negative Aspects of Global Warming :*
    - Glaciers in the poles will melt by the end of this century and the sea level will rise upto 1-3 meters. As a consequence, the cities in the coastal areas like Mumbai, Chennai, Kolkata, London, New York, Shanghai, Dhaka, Venice will be submerged. Many island nations like Maldive, West Indies etc. and Southern part of Bangladesh, Coastal areas of India will be drowned.
    - Production of crops will be highly affected.
    - Forests, national parks will be affected and loss of biodiversity will be noticed.
    - Intensity and frequency of the occurrence of cyclones, tsunami in the sea shore area will increase.
    - The Indian Monsoon system will be affected which in turn will affect major crops like rice and wheat.
- **Control of Air Pollution:** It is to be noted that once the air gets polluted, it is almost impossible to purify it. The best way to control air pollution is to prevent the pollutants at source from being mixed up with air. This involves the following strategies:

- All those fuels used in vehicles should be free from sulfur and lead. It can reduce air pollution upto 50%.
- The height of the chimneys in the industries should be increased.
- When smokes emitted from the chimneys are allowed to pass through a filter or a small metalic room some amount of pollutants are absorbed in the walls and the rate of pollution is decreased.
- Rate of afforestation should be increased.
- The sources of incombustible energy should be found.



CHECK YOUR PROGRESS

Q 1. What are the main sources of air pollution?

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Q 2. What are the major air pollutants?

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Q 3. What are the greenhouse gases?

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5.5 WATER POLLUTION

When the biotic and abiotic substances are mixed into water and bring about physical, chemical and biotic changes into it then the water becomes impure. This is called water pollution, which causes harm to human health.

- **Causes of Water Pollution:** Water pollution spans a wide range of chemical, physical and microbial factors. The major causes of water pollution are the raw sewage, garbage, fertilizers and pesticides used in agriculture, oil spills and wastes from industrial units. Sewage and fertilizers bring in nutrients to the water bodies. In excess levels, nutrients overstimulate the growth of aquatic plants and algae causing eutrophication. Excess growth of these types of harmful plants consequently clog the waterways, use up dissolved oxygen as they decompose and block penetration of light into the deeper level of water. This in turn proves very harmful to the aquatic organisms.

- **Major Water Pollutants-their Sources and Effects:** The sources can be categorized as –
  - Effluents from Industries
  - Excessive Heat
  - Agricultural Activities
  - Domestic Wastes
  - *Effluents from Industries:* The effluents from the chemical industries carry high amount of various heavy metals, mercury, lead, copper, arsenic, cadmium which are highly toxic .When these are disposed in the water bodies, the quality of the entire aquatic system is affected and environment is polluted.

    Effects of industrial wastes:
    - Nitrates(more than 90 ppm) from the industrial wastes cause "Blue baby syndrome" disease .
    - Hg,As,Pb cause damage to the central nervous system.
    - When the mercury-toxicated fishes in the Minamata bay of Japan were eaten by people they suffered from the disease called 'Minamata disease".
    - The fibers of asbestos cause a form of Lung cancer known as Asbestosis.
    - Cadmium causes lung cancer and bone deformation.
    - Excessive nitrate causes methamoglobenamea.
  - *Excessive Heat:* Due to certain human activities, rising of water temperature is very common. High amount of heated water from is thermal plants and nuclear plants is released to the nearby water bodies as wastes as a result of which the water bodies get heated and the aquatic organisms there like fish and plants are severely affected.
  - *Agricultural Activities:* The pesticides and chemical fertilizers used in the agricultural fields flow to streams thereby polluting the entire water system. P.C.B, D.D.T types of chemicals found in the bones of organisms and even in the endocrine gland do not decompose and consequently cause serious damage to the organs. The

increase of nitrates causes algal bloom in the water body for which the aquatic system is degraded.

- *Domestic Wastes:* The organic decomposition of human, animal and domestic wastes, garbage, soap, detergent,bacteria and viruses etc are mixed with water and the whole system is polluted .
  - The domestic sewage drains supply high amount of algae, fungi, virus ,bacteria which are the root cause of certain diseases like cholera, jaundice etc.
  - Phosphate in the detergents causes the increase of algal blooms.

- **Control of Water Pollution:**
  - It is possible to control water pollution at the point of generation in the plant. Water cooling pond, tower may help in this regard.
  - The waste water can be reused by applying some chemical techniques. Soda, bleaching powder can be used for cleaning the water used for domestic purposes.
  - Toxic and dirty water from drains and canals should be prevented from being released into the water bodies.
  - Instead of using chemical pesticide, people should be encouraged to use herbal ones which do not have side effects.

5.6 SOIL POLLUTION

The fertility of soil decreases owing to the addition of some toxic elements into it**.** This leads to the pollution of the environment and it is called soil pollution.

- **Sources of Soil Pollution:**
  - *Domestic Wastes:* All household wastes that include kitchen wastes, broken bottles, plastic, polythene bags and miscellaneous waste materials when indiscriminately thrown into the land cause the gradual loss of fertility of the soil.
  - *Industrial Wastes:* Industrial wastes are basically the effluents released by industries. These effluents cause the pollution of the

soil. Some industries and their pollutants are mentioned below.

Industries	*Pollutants*
Oil industry	Unrefined oil, hydrocarbons
Plastic industry	Dioxine
Refinery centers	potassium salt
Cloth industry	chloride ion

- *Agricultural Activities:* Varieties of pesticides, fungicides, herbicides etc. cause the decrease in fertility of soil.
- *Germs:* Viruses, bacteria etc. disposed by hospitals, laboratories etc. contribute to the pollution of the soil.

- **Effects of Soil Pollution:**
  - Varieties of soil transmitting diseases like giardiasis, tetanus etc are caused by soil pollution.
  - Some metals like As,Hg,Cd etc mix with soil and toxicity occurs. When the crops are treated with these chemicals, the chemicals enter the plant body and destroy the body functions.In 1970, 200 people in Japan died due to cadmium toxicity caused by the itai-iti disease.
  - The pesticides not only decrease the fertility of the soil but also enter into the food chain and thus cause diseases.
  - The capacity of crop production of the soil is decreased gradually.
  - The excessive use of chemical pesticide destroys the natural bacteria of the soil.
- **Control of Soil Pollution:**
  - Proper action should be taken before the disposal of domestic wastes and chemical wastes into the soil.
  - Solid wastes can be segregated from the garbage dumps and can be reused by using chemical techniques.
  - High level of technology should be used to improve the agricultural production instead of using chemical pesticides.
  - Afforestation will help in soil fertility.
  - Microbial degradation of biodegradable substances is also one of the scientific approaches for reducing soil pollution.

- Necessary enactment of laws should be made for penal action against those who indulge in the act of polluting the soil.



CHECK YOUR PROGRESS

Q 4. What are the main causes of water pollution?

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Q 5. Write two major effects of water pollution?

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Q 6. Write one of the control measures of soil pollution.

.....

5.7 NOISE POLLUTION

Noise is a loud or unpleasant sound or series of sounds. Noise pollution is caused by such unpleasant sounds created by man, animals or machines. Such noises sometime create an unbearable situation affecting the peace and tranquility of a place. Since noise travels through air, all forms of noise are considered an air pollutant.

- **Measurement of Noise:** The intensity of sound is measured in sound pressure levels (SPL) and common unit of measurement is decibel, dB.
- **Sources of Noise:** The sources of noise may vary according to our daily activities. The sources may be
  - *Domestic*: It involves the sound created by the air conditioner, home appliances, pressure cooker, television etc.
  - *Natural:* Wind, earthquake, volcano, storm, landslide, waterfalls are the natural sources of noise.
  - *Commercial*: Various types of construction works, automobiles, aeroplanes, factories, machinery etc.
  - *Industrial*: generator sets, boilers, plant operations, trolley movement, transport vehicles, pumps, motors etc..

    In Indian conditions, indiscriminate use of the public address system and diesel generator set, has given a new dimension to the noise pollution problem.

- **Effects of Noise:**
  - *Annoyance:* It creates annoyance to the receptors due to the fluctuations in the sound level. It annoys and frightens the hearer besides causing discomfort and headache to him.
  - *Physiological Effects:* The increasing physiological effects include blood pressure, sleeplessness, heart-beat and acute headache.
  - *Loss of Hearing:* Continuous exposure to high sound levels causes loss of hearing besides affecting the airdrum.
  - *Nervous System:* Pain in ears, feeling of tiredness, disorder of nervous system.
  - *Suicide Cases:* Sleeplessness, high blood pressure, suicidal cases are also evidenced. Accidents may occur due to the trauma sleeplessness caused by noise pollution. There are instances of suicides attributed to noise pollution.
- **Control of Noise Pollution:**
  - Educational institutions,hospitals,residential areas should be declared as Silent Zones and there should be no noise pollution in those areas.
  - New techniques should be used to reduce the sounds from the heavy machines.
  - Use of radio, television in low volume.
  - Airports, industries should be established in areas away from residential places.
  - Increase of afforestation .
  - The playing of high volume speakers, microphones should banned. To invoke legal provisions in banning the use of loud speakers and bursting crackers at night.

5.8 THERMAL POLLUTION

Thermal pollution is a temperature change in natural water bodies caused by human influence especially by the waste water of power plants which is disposed in the lake, river or ocean .Thus, the whole aquatic system

is polluted and organisms are affected. This phenomenon is known as thermal pollution

- **Effects of Thermal Pollution:** All plant and animal species that live in water are adapted to temperature within a certain range. A slight change in temperature by one or two degrees may have tremendous effect on the aquatic community leading to threats to biodiversity.
  - ➢ High temperature destroys the quality of the gastric juice. It decreases the rate of photosynthesis and thus affects the primary producers (plants).
  - ➢ Salmon and Trout fish cannot lay eggs in high temperature.
  - ➢ Rate of dissoloved oxygen in the water body is decreased by thermal pollution.
  - ➢ Decreasing reproductive capacity of fishes.
  - ➢ Increasing toxicity of chemical pesticides.
- **Control of Thermal Pollution:**
  - ➢ The hot water used in power plants and industries should be routed through the cooling pond or cooling tower so that the evaporation causes the cooling of the water.
  - ➢ The cooling of water can also be done by the use of cooling tower. These cooling techniques are of two types.
    - a) Dry cooling
    - b) Wet cooling
  - ➢ Necessary awareness is to be created among people regarding the effects of thermal pollution.



CHECK YOUR PROGRESS

Q 7. How is noise pollution measured?

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Q 8. What are the major domestic sources of noise pollution?

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Q 9. State True or False

(a) High temperature causes the quality of the digestive juice.

(b) Salmon and Trout fish can lay eggs in high temperature

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5.9 ROLE OF INDIVIDUAL IN PREVENTION OF POLLUTION

The role of individuals in preventing pollution is very important because if every individual is conscious about the ill effects of pollution, there will be less impact of pollution. The following measures at citizen-level will help in reducing pollution:

- **Preventing Air Pollution:**
  - Use of public transport to workplace or sharing vehicles
  - Walking or cycling for relatively short distance travels
  - Economic use of electricity and fuel
  - Use of low-energy or energy saving light bulbs
  - Turning off the engine of the car when waiting.
- **Preventing Water Pollution:**
  - Reducing unnecessary water use
  - Not allowing any type of waste or dirty clothes to go to the drains
  - Removing any stagnant pool of water in the backyard
  - Ensuring hygiene and proper sanitation
  - Using biodegradable or environmentally friendly soap and other cleaning supplies
- **Preventing Soil Pollution:**
  - Using reusable containers and bags
  - Use of biodegradable materials
  - Controlling the use of hazardous chemicals such as pesticides
  - Taking precaution while disposing used goods such as radio, TV, other electronicgoods,mobiles,cameras, electrical bulbs, plastic furniture. etc.
- **Preventing Noise Pollution:**
  - Keeping the volume of musical instruments to low level when playing

- Avoiding the unnecessary use of loud speakers at residential places.



5.10 LET US SUM UP

- An undesirable change in the physical, chemical, or biological qualities of the natural environment brought about by man's activities is termed as environmental pollution. From this unit we have learnt about all kinds of pollution and their sources, their effects and the measures to control them.
- This unit describes all kinds of health problems and loss and damage caused by the pollution of air, soil, water, noise.The major soil pollutants are domestic and industrial wastes, pesticides, petroleum hydrocarbons, plastics, heavy metals, acid rain, fly ash etc. Besides, the control measures for all these kinds of pollution have been briefly dealt with.
- Due to the increasing urbanization and industrilization, the rate of pollution is increasing day by day degrading the quality of the environmental components.Therefore each and every citizen should be aware about the harmful effects of environmental pollution and the measures to be adopted for its control.



5.11 FURTHER READING

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5) Heywood, W.H. and Watson, R.T. (1995). *Global Biodiversity Assessment.* London: Cambridge University Press.

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5.12 ANSWER TO CHECK YOUR PROGRESS

Ans to Q No 1: i) Natural Sources ii) Manmade Sources

Ans to Q No 2: CO, NO_2, SO_2, VOCs, suspended particulate matter etc

Ans to Q No 3: These include CH_4,water vapour, carbon dioxide, CFCS etc.

Ans to Q No 4: a) Effluents from Industries,

b) Excessive Heat

c) Agricultural Activities

d) Domestic Wastes.

Ans to Q No 5: i) Nitrates(more than 90 ppm) from the industrial wastes cause “Blue baby syndrome” disease .

ii) Hg, As, Pb cause damage to the central nervous system.

Ans to Q No 6: i) Proper action should be taken before the disposal of domestic wastes, chemical wastes into the soil.

Ans to Q No 7: The intensity of sound is measured in sound pressure levels (SPL) and common unit of measurement is decibel, dB.

Ans to Q No 8: Domestic (movement of utensils, home appliances, pressure cooker, television, air cooler, air conditioners etc.),

Ans to Q No 9: a) true b) false



5.13 POSSIBLE QUESTIONS

VERY SHORT ANSWER QUESTIONS

Q 1. Define “Environmental Pollution”.

Q 2. What are the major Air Pollutants?.

SHORT ANSWER QUESTIONS

Q 1. What do you mean by Greenhouse Effect?

Q 2. Write notes on

(a) Noise Pollution (b) Thermal Pollution (c) Water Pollution

LONG ANSWER QUESTIONS

Q 1. What are the major sources of water pollution? How does water pollution affect man and other animals?

Q 2. Enumerate the measures that can be adopted at citizen level to prevent air, water and noise pollution.

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