CHAPTER – 6

ENVIRONMENTAL POLLUTION AND CONTROL

* AIR POLLUTION *

→ Air Pollution is the Presence of unwanted materials in the air in large quantities that directly (or) indirectly affects living organisms.

Air Pollution definition:— The presence of excessive unwanted foreign substances in the air which adversely effect the quality of air and causing damage to human , animals and plants

the Composition of Air is:—

Major Components → O2 , N2 , water vapour.

Minor Components → Co2 , Argon.

Trace Components → He , Ne , Kr , Xe , H2 , So2 , NOx , O3 , H2S.

 # Classification of Air Pollutants:—

Based on the origin. The air Pollutants are classified into two types. They are

1) Primary Pollutants;— The Pollutants which are liberated directly from an identifiable source are called Primary Pollutants.

They exist as such after being released into the environment.

eg:— Co , So2 , Co2 , CH4 , CFC's.

2) secondary Pollutants;— The Pollutants which are formed by the chemical reaction of Primary Pollutants are called secondary Pollutants.

eg:— Peroxy Acetyl nitrate (PAN)

Peroxy Benzoyl nitrate (PBN),

Photo chemical smog.

II. classification of air Pollutants based on the Physical state (or) state of matter:—

Based on the Physical state, the air Pollutants are classified into twotypes. They are.

i) Gaseous Pollutants;— They are present in Gaseous state.

eg:— Co, Co2, So3, Nox, H2S, Hydro carbons, O3,

ii) Aerosols;— The solid (or) liquid Particles of microscopic Size dispersed inthe air are called aerosols.

eg:— Dust, smoke, smog, fog, fumes, Pollen grains.

*** Causes of Air Pollution ***

1) Transportation services;— The fuels used for running of vehicles include kerosene, diesel, petrol, etc. During the combustion of these fuels large amount of Poisonous gases like Co, Co2, Nox, So2, HydroCarbons are released into the atmosphere. 75% of Air pollution is due to vehicles.

2) Industries;— The most common Pollutants of industries are Co, Co2, So2, H2S, Cl2, HCl, No2, CFC's. they cause air pollution in addition to them industries may also release dust, carbon metal Particulates etc. which also cause air Pollution

3) Deforestation;— cutting of Plants (or) trees is called deforestation. Green plants use Co2 and liberate O2 in Photo synthesis.

→ Deforestation results in increasing of Co2 inthe atmosphere which causes global warming.

4) Agricultural Activities;—

The Pesticides, insecticides etc, are used in agriculture. some of these Poisonous chemicals spread into the atmosphere Causing air Pollution.

5) Radioactive Materials;—

Radioactive rays Coming out from atomic reactors, hospitals and nuclear explosions pollute the atmosphere.

6) Wars;—

Many synthetic toxic chemicals used during the war, released into the atmosphere cause the air Pollution.

7) Accidents (or) Errors in industries;—

Sometimes Poisonous chemicals are released into the atmosphere due to human errors.

eg:— Methyl isocyanate liberated from Union Carbide factory on 02-12-1984 in Bhopal city killed approximately 5800 People and effected severely more than 50,000 people.

8) Natural Reasons;—

1) Volcanic eruptions releases poisonous gases like So2, H2 S, Co, Cl2.

2) Forest fires

3) Dust and Sand storms.

4) Bacteria, Viruses.

5) Pollen grains of flowers.

EFFECTS OF AIR POLLUTION ON HUMAN BEINGS;—

1) The Presence of So2 in the air causes asthma, Bronchitis and Eye irritation.

2) The nitrogen oxides can cause respiratory illness among the children.

3) Carbon Monoxide [CO] is a very toxic gas and it combines with haemoglobin of blood and reduces the oxygen carrying Capacity of blood.

4) Peroxy acetyl nitrate (PAN) causes irritation of skin, nose, eyes, throat. It may also cause cancer.

5) Coal miners normally suffer with black-lung disease.

6) Asbestos workers suffer with Pulmonary Fibrosis.

7) Stone Crushers suffer with Silicosis, caused by Powder of stones.

8) Tetra ethyl lead is used in the Petrol for the control of ignition, most of traffic policemen suffer with lead Poisoning.

9) Hydrocarbons cause much irritation to the mucous membrane. as a result respiratory tracts are blocked and the man coughs regularly.

10) Arsenic dust from processing industries causes arsinosis (or) skin cancer.

EFFECTS OF AIR POLLUTION ON ANIMALS AND PLANTS *

The Pollutants and contaminants accumulates in the vegetation. The animals get Poisoned when they consume the contaminated vegetation.

1) Fluorine causes lameness, loss in weight and diarrhoea.

2) Lead causes loss of appetite.

3) Arsenic dust (or) spray causes, loss of appetite and death.

4) Sulphur dioxide causes bleaching of leaves.

5) Acid rain destroys Crops and forests. It severely retards the growth of Crops.

6) Nitrogen dioxide causes leaf bleaching and reduced fruit Production.

GREENHOUSE EFFECT

The increasing of temperature of atmosphere is called as global warming (or) Green-House effect.

The Pollutants responsible for global warming are Co2, CH4, CFC's O3, Nox, water vapors. Among these Pollutants, Co2 has much effect These gases absorb more light from the sunlight. Hence the temperature increases. If the global temp increases by 1'c, the following effects are Predicted.

Consequences;—

1) The ice caps of polar regions melt, there by increasing of sea water level. hence low-lying areas are submerged in these a water (Bangladesh, Netherlands, Chennai, Goa).

2) The rate of evaporation of water from the hydrosphere increase which leads to cyclones, un seasonal rains.

3) The agricultural production decreases due to the fast evaporation of surface water.

Control Methods;—

1) By Promoting renewable Energy sources like solar and wind Energy instead of burning fossil-fuels.

2) By Encouraging factories to use cleaner technologies that reduce greenhouse gas Emissions.

3) By Controlling deforestation.

4) By Encouraging afforestation and reforestation.

5) By Providing awareness about global warming among People.

*** ACID RAIN ***

→ The rain water Containing more amount of acids is called as "acid rain".

→ It is due to oxides of Nitrogen and sulphur.

The nitrogen and sulphur oxides dissolve in the rain water & form nitrous acid, nitric acid, sulphurous acid & sulphuric acid. These acids in more quantity in industrial areas.

$SO2 + H2O \rightarrow H2SO3$

$SO3 + H2O \rightarrow H2SO4$

$N2O5 + H2O \rightarrow 2\ HNO3$

$NO2 + H2O \rightarrow 2\ HNO2$

Consequences;—

1) The life span of buildings and structures will be reduced.

2) The glossy appearance of the TajMahal is diminishing due to acid rain.

3) Aquatic animals are affected.

4) Soil fertility decreases, which leads to the lower agricultural Production.

5) Increased acidity in drinking water can cause health issues in humans.

CONTROL METHODS:—

1) By Promoting renewable Energy sources like solar and wind Energy instead of burning fossil-fuels.

2) By Encouraging tree Planting, which absorbs Co2 and other Pollutants.

3) By Providing awareness about acid rain among People.

4) By Promoting the use of Public transportation instead of Personal vehicles.

5) By Encouraging factories to use cleaner technologies that reduce harmful gas Emissions.

METHODS TO CONTROL AIR POLLUTION;— (REDUCE THE AIR POLLUTION)

1) Pollution Control at the Source;—

a) change of raw materials. Eg:— desulphurised coal is used for Combustion.

b) Modification of the process so as to eliminate the Pollutant.

c) Developing of new equipment. eg:— 2 stroke engines are replaced by 4 stroke engines,

d) Emission of Co from vehicles is reduced by using Catalytic Converters.

e) using Chemical Scrubbers;— A suitable chemical reagent is used to absorb the Pollutant

eg:— So2 is removed by using lime water.

2) Control of Air Pollution by Reduction of Smoke from vehicles;—

Smoke can be reduced from vehicles by following steps:—

1) Correct method of firing.

2) Admitting required amount of air.

3) Maintaining high temperature.

4) Using the fuel continuously.

5) Using modern fuels.

3) Control of Pollution by dilution;—

By using tall stacks (or) chimneys the Concentration of air Pollutants is reduced at ground level.

4) Control of Pollution by Plantation;—

By planting more trees air pollution can be Controlled.

5) Control of Pollution by Zoning of industries;—

It is one of the important step to control the air Pollution.

In a town (or) city, the areas is divided into different zones like residential zones and industrial zones and both are separated by buffer zones ie plantations . so that air Pollution can be reduced.

6) control of Pollution by using modern fuels;—

By using modern and Conventional fuels like wind , solar Energy, Hydro Energy, Nuclear Power, geo thermal Energy etc, should be used to Control air Pollution.

7) control of Pollution by Reducing smoke from industries;—

smoke may be reduced by installing "Cottrell electro-static Precipitator".

definition:— * WATER POLLUTION *

→ Alteration in Physical, Chemical and Biological Properties of water as well as Contamination with any foreign substances which would Cause harmful effects (or) otherwise decrease the utility of water.

Causes of water Pollution;—

1) Domestic Sewage;— This Contains different Pollutants like Salts, soaps, detergents, organic Compounds, human feces etc, the disposal of Sewage into rivers & lakes Causes the water Pollution. Improper drainage system increase the water Pollution 90% water Pollution is due to domestic sewage in developing & under developed countries.

2) Industrial Effluents;— water gets Polluted by the Industrial waste, this contain many harmful Compounds like acids, bases, detergents, salts like chlorides, nitrates, phosphates, sulphates.

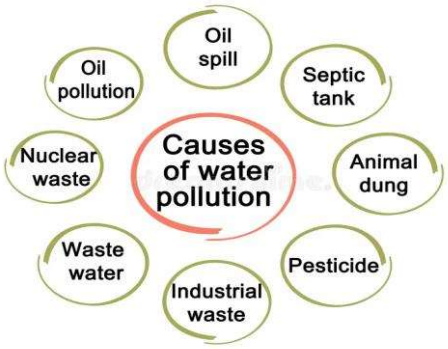
3) Unhygienic Practices;— In village people and washermen wash clothes and animals are allowed to bath in drinking water lakes, ponds, rivers. the water gets Polluted.

4) Agricultural wastes;— Fertilizers, Pesticides, farm wastes cause heavy Pollution to water sources.

3) Radioactive pollutants;— These Enter into water streams from nuclear power Plants, nuclear reactors, nuclear tests, hospitals etc. Radio nuclides are extremely toxic in water.

6) Biological pollution;— Caused bythe Excretory Products of warm blooded mammals including human beings, wild and domestic animals, birds etc. It is also caused by micro-organisms like bacteria, viruses, algae, protozoa.

7) Oil transportation;— Petroleum products are transported from one country to another country by oceans (or) seas. oil spill occurs during the transportation, which results in Pollution of water.



Effects of water Pollution on Living organisms;—

1) Polluted water causes Contaminated diseases like typhoid, Jaundice, Cholera, diarrhoea amoebiasis, skin diseases.

2) water containing fluoride causes 'fluorosis'.

3) The toxic metals like lead, mercury, arsenic etc. in water causes mental disorders, lung cancer, kidney and liver damage. They may kill aquatic organisms.

eg:— many people in Japan suffered with a disease known as minamata due to eating of fish which Contain Hg salts.

4) The Pesticides and insecticides reach human body through food chains and effect the nervous system.

5) Oil Pollutants kill birds, fishes and other aquatic Organisms.

6) Polluted water is not suitable for Plantation , this reduces agricultural Production if used.

7) Polluted water effects the Plant metabolism and disturb the ecosystem.

8) Food Chains;— The concentration of these pollutants goes on increasing by the time they reach human beings. The increasing of Concentration of Pollutants from lower to higher animals is called Bio Amplification & the carriers of these substances are called as 'foodchains'. the birds, goats acts as food Chains.

Effects of water Pollution on Non-living things;—

1) Polluted water reduces soil fertility by killing bacteria and soil micro-organisms and increasing alkalinity.

2) Polluted water reduces the strength of concrete structures.

3) Polluted water corrodes ships, Piping pumps and machinery Parts.

4) Phosphates, nitrates and organic compounds, if passed into a Pond or lake, the water becomes over nutrients for algae. then eutrophication takes place. In this lake, sediment or solid forms more due to growing & decaying of algae. It results drying of the lake quickly. This Property is called "Eutrophication".

CONTROLLING METHODS OF WATER POLLUTION:—

1) Treatment of drainage water;— A good drainage system prevents mixing of polluted water with drinking water & decreases severity of diseases.

2) Treatment of Industrial Effluents;—

Industrial Effluents must be treated before released into water bodies by using Common Effluent treatment Plant (CETP).

3) Control over unhygienic Practices;—

Unhygienic Practices like washing of clothes, washing of animals should be avoid.

4) Volume reduction;—

This method involves ↓ in the Quantity of Pollutants by following alternative methods for Preparation of Compounds.

5) Stabilization of Eco-system;—

Stabilization of Eco-system can be achieved by ↓ing Pollutants from water bodies, plants like Chlorella are absorbs some organic Pollutants from polluted water & ↓ pollution level.

6) use of modern techniques;—

modern methods like reverse osmosis (R.O) Adsorption, Ion Exchange method electolysis, are used to remove Pollutants from polluted water.

*** SOIL POLLUTION ***

The decreasing of soil fertility due to the addition of toxic chemical substances in excessive quantity of the soil'.

CAUSES OF SOIL POLLUTION:—

1) Industrial waste;— Improper and untreated disposal of industrial waste is the cause of soil Pollution. The industrial wastes mainly consist organic compounds along with inorganic complexes.These Pollutants effect & alter the chemical and Biological Properties of soil.

2) Sewage disposal;— Disposal of plastic and other solid waste causes soil Pollution. Disposal of electrical items such as batteries causes soil Pollution. eg:— Lithium Batteries.

3) Agricultural Activities;— The use of insecticides and pesticides for a long period can cause soil Pollution. Plants absorb many of these Pesticides and after decomposition cause soil pollution.

4) Radioactive Pollutants;— Radioactive wastes discharged from industries, research centres and hospitals Penetrate into the soil and cause soil Pollution.

5) Other sources of soil Pollution are acid rain;—

It is caused when Pollutants present in the air mix with the rain and fall back on the ground and change the structure of the soil as a result soil Pollution occurs.

6) Heavy metals;— Heavy metals (lead and mercury) in high Concentrations present in soil causes soil Pollution.

7) Oil spills;— oil leaks occurs during the storage and transportation.The chemicals present inthe oil deteriorates the Quality of soil.

General Effects of Soil Pollution;—

Soil Pollution Effects the health of Plants, animals and humans

1) Effects on plant growth;— Soil Pollution may alter Plant metabolism and reduce Crop yields.

2) Effect on human health;— this pollution cause starting with headaches, skin rash, eye irritation & resulting in more serious conditions like kidney, liver damage.

3) Changes in soil structure;— Soil Pollutants may causes death of many micro organisms in soil, which can lead to alter-ion in Soil Structure.

4) Pollution of Underground water;— Soil Pollution also Poisons the Underground water. Polluted water, if used for a long time, it causes many ill effects on our health.

5) Soil Pollution cause imbalance in the ecosystem.

Control method of Soil Pollution;—

1) land farming should be Promoted for waste treatment

2) Proper maintenance of the Sewage system.

3) Recycling of Industrial waste before disposal.

4) Use of natural manure instead of Chemical fertilizers and Pesticides.

5) Use of modern techniques to extract heavy metals.

6) Proper disposal method of household and industrial waste

7) Reforestation and Afforestation should be Promoted.

8) Reducing weed growth helps reduces soil Pollution.

Concept of Carbon Credit and Trading:—

*** Carbon Credits:—**

Carbon Credits are Permits that allow companies to release a certain amount of Co2 (or) other greenhouse gases. one Carbon Credit equals one tonne of Co2.

*** Carbon Trading:—**

Carbon trading is the buying and selling of the Permits (Carbon Credits) allowing companies to release a certain amount of Co2 with the goal of reducing overall Emissions.

1) The need for carbon credits comes from global warming, which is caused by the excessive Carbon dioxide in the atmosphere.

2) Carbon Credits are part of a system called "cap and trade".

3) Governments set limit (or "cap") on the total amount of greenhouse gases companies can release. Each Company gets a certain no of Carbon Credits based on this limit. If a Company releases less Co2 than allowed, it can sell its extra credits to another company that needs.

Advantages of carbon trading:—

1) Reduces Pollution;— carbon trading encourages companies to release less greenhouse gases, which helps to the environment

2) Promotes clean technology;— companies may use cleaner Energy (or) technology to reduce emissions and sell extra Credits.

3) Financial Benefit;— companies can earn money by selling unused carbon credits.

4) New market :- It provides a new market for investments.

Disadvantages of carbon trading:—

1) Partial solution;— Carbon trading is a cost effective partial solution to the problem of greenhouse gases.

2) Rich companies;— Some big Companies may buy Extra credits instead of reducing pollution.

3) Not a global solution;— since all the countries are not using cap and trade, pollution may still be an issue in some places.

4) Complex system;— carbon trading is difficult to understand and manage, especially for smaller companies.