ENVIRONMENT POLLUTION.

POLLUTION.

It is defined as the excessive discharge of undesirable substances into the environment. It alters the natural quality of the environment causing damage to human plants and animals.

Pollutant: Toxic substances which adversely changes the environment.

TYPES OF POLLUTANTS

1. Biodegradable- Decompose rapidly by natural processes.
2. Non-degradable- Do not decompose

CLASSIFICATION OF POLLUTION

1. Air pollution
2. Water pollution
3. Soil pollution
4. Marine Pollution
5. Noise pollution
6. Thermal Pollution
7. Nuclear Hazards (Radio Active Pollution)

AIR POLLUTION

It is defined as the presence of toxic substances in the atmosphere which cause undesirable effects on man and environment.

Causes of pollution

- Rapid industrialization
- Exploitation of nature by man
- Rapid urbanization
- Increase in population
- Natural calamities like volcanic eruptions, storms, cyclones etc.,

SOURCES OF AIR POLLUTION

The two main sources of air pollution are

- **Natural sources** - volcanic eruptions, forest fires, extra terrestrial bodies, pollen grains

from flowers etc.,

ᘓ **Man-made or anthropogenic sources** - thermal power plants, industrial units, vehicular emissions, fossil fuel burning, agricultural activities etc.,

Classification of air pollutants

Air pollutants are classified into three different ways

a) Based on origin

b) Based on chemical composition

c) Based on state of matter

a) **Based on origin**

The air pollution is classified into two categories

- Primary pollutants
- Secondary pollutants

PRIMARY AIR POLLUTANTS

Primary pollutants are those emitted directly from the source into the atmosphere in a potentially harmful form. Example:

ᘓ Sulphur compounds

ᘓ Oxides of nitrogen

ᘓ Carbon monoxide

ᘓ Halogen compounds

ᘓ Ammonia

ᘓ Organic compounds

ᘓ Radioactive compounds

SECONDARY AIR POLLUTANTS

These are formed in the atmosphere by chemical interactions between primary pollutants and atmospheric constituents by photochemical or oxidation reaction. Example: Ozone, SO3, Peroxyl acetyl nitrate (PAN), Aldehydes, Ketones etc.,

(b) **Based on chemical composition**

Pollutants are classified into

- Organic Pollutants - composed of organic compounds e.g. Hydrocarbons
- Inorganic Pollutants – composed of inorganic compounds e.g. CO, CO2, N2O, NO2

(c) **Based on state of matter**

Gaseous air pollutants - occur in gaseous state at normal temperature and pressure.

Example:

Carbon-di-oxide CO2

Nitrogen Oxide NOx

Sulphur Oxide SOx

Hydrocarbons, Photochemical Oxidants.

Particulate air pollutants – finely divided solids and liquids dispersed in air. E.g. Aerosols such as dust, smoke etc…

Common Air pollutants and their effects

CARBON MONOXIDE

- It is a colourless, odourless, tasteless gas which is chemically inert under normal conditions of temperature and pressures.
- It is produced by the incomplete combustion of carbon.

SOURCES

- Automobile exhaust
- Forest fires
- Solid waste disposal
- Industrial sources
- Cigarette smoking

EFFECTS

- CO has a high affinity for haemoglobin and forms carboxyhaemoglobin.
- This affects the oxygen carrying capacity of blood causing giddiness and anaemia.

ꕥ CO reduces vision, causes cardiovascular disorders. At high levels it causes coma, collapse, irreversible brain cell damage and death.

CARBON DIOXIDE

CO_2 is comparatively less dangerous than CO.

SOURCES

ꕥ Fossil fuel combustion

ꕥ Jet planes use O_2 and release CO_2

ꕥ Agricultural practices (eg.) deforestation

ꕥ Forestry – Increase in CO_2 concentration increases the temperature of earth's surface.

Effects

ꕥ Excess CO_2 causes respiratory disorders and suffocation.

OXIDES OF NITROGEN

In nature, these include Nitrogen monoxide (NO) and nitrogen dioxide (NO_2).

NO is a colourless, odourless gas which is oxidized to NO_2 through secondary photochemical reactions. NO_2 is a reddish- brown irritating gas.

SOURCES

ꕥ Fuel combustion in automobiles

ꕥ Lightening

ꕥ Forest fires

ꕥ Power industrial plants

ꕥ Bacterial decomposition of organic matter

ꕥ Natural ionizing radiation

EFFECTS

ꕥ Being heavier than air, NO_2 readily dissolves in water resulting in acid rain.

ꕥ Acid rain damages trees, soils and aquatic life in lakes.

ꕥ It corrode metals, eat away stone on buildings, statues and monuments.

ꕥ NO combines with haemoglobin to reduce the oxygen carrying capacity of blood.

OXIDES OF SULPHUR

ꕥ These include SO_2 and SO_3

ꕥ In nature SO_2 is a colorless gas having a characteristics sharp, pungent and suffocating

odour.

- It is photochemically oxidized to SO3
- SO2 is highly soluble in water.
- Along with SO3 it forms sulphuric or sulphurous acid and is quickly washed out of atmosphere by rain.

SOURCES

- Burning of solid and fossil fuels.
- Coal burning in power plants and industrial processes.
- Transportation.

EFFECTS

- They irritate the mucous membrane of the respiratory tracts.
- Higher concentration causes bronchitis.
- They readily attack building materials.
- SO2 along with particulate matter reduces visibility.

HYDROCARBONS

- E.g. Methane, Acetylene, Ethylene, terpenes
- Comparatively harmless hydrocarbons like ethylene undergo chemical reactions in the presence of sunlight and nitrogen oxide forming photochemical oxidants (like ozone) which are harmful.

SOURCES

- Coal field
- Natural fires
- Industrial sources
- Incomplete combustion from car engines
- Agricultural burning

Effects :

- Carcinogenic
- Affects the ozone layer
- Contributes to photochemical smog

PHOTOCHEMICAL OXIDANTS

- In nature**,** the major photochemical oxidants is ozone
- Ozone is produced in the upper atmosphere by solar reaction.
- Small quantities diffuse downwards and cause air pollution

ꕥ Sunlight/air: In the presence of sunlight oxides of nitrogen react with unburned hydrocarbons resulting in secondary pollutants like PAN (peroxy acyl nitrate), Ozone, aldehydes, ketones etc..

ꕥ Unburnt hydrocarbon + NOx

ꕥ photochemical smog

EFFECTS

ꕥ Photochemical oxidants cause irritation of eye, nose and throat.

ꕥ Ozone is known to damage chromosomes

ꕥ Both O3 and PAN cause damage to plants by interfering with plant cell metabolism.

SUSPENDED PARTICULATE MATTER (SPM)

ꕥ SPM includes solid particles and tiny droplets of liquids.

ꕥ Suspended particulate matter (SPM) is a complex mixture of small and large particles with less than 100μ varying origin and chemical composition.

ꕥ Particulate pollutants are categorized according to size, mode of formation or physical state into the following

a) Aerosols

b) Dust

c) Smoke

d) Fumes

e) Mist

f) Fog

g) Fly ash

h) Soot

i) Natural particulates.

SOURCES

ꕥ Burning coal in power and industrial plants.

ꕥ Agriculture

ꕥ Exhaust of automobiles

EFFECTS

- Nose and throat irritation
- Lung damage
- Reduces visibility
- Cause mutation and cancer

Water Pollution

- It is defined as any undesirable change in the quality of water which is harmful to living organisms.
- The two categories of water pollution are:

- Point sources
- Non- point sources

Point sources

- Those sources which can be identified at a single location are point sources.
- Identification, monitoring and control of point sources discharge are easy.

Examples

- Factory out lets
- Power plant outlets
- Under ground mines
- Oil wells
- Sewage treatment plants

Non-point sources

- Those sources which discharge pollutants in large and scattered area.
- Identification, monitoring and control of non-point source discharge are not that easy.

Example

- Urban streets, Agricultural lands, Run off from lawns, gardens.
- Soil erosion, Acid deposition from atmosphere.

Classification of Water pollution

- Suspended matter, Thermal discharges ,Pathogens
- Natural Organic pollutant
- Synthetic organic compounds (Detergents, pesticides, fertilizers)
- Inorganic chemicals (acids, alkalis, metals)

ꕥ Oil, Sediments

Effects of Water pollution

ꕥ Spread of water- borne diseases like cholera, typhoid fever, hepatitis, dysentery.

ꕥ The oxygen demanding waste depletes the oxygen content of water.

ꕥ Presence of acids, alkalis, and toxic substances affect the growth of aquatic plants and fishes.

ꕥ The organic chemicals such as detergents, pesticides, plastics damages the central nervous system and causes birth defects and genetic disorders.

ꕥ Sediments increase the turbidity in water reducing photosynthesis.

ꕥ Artificial fertilizers introduce more amount of nitrate into water. This causes methemoglobinemia known as ***blue baby.***

ꕥ Disposal of coolant water increases the temperature of water.

ꕥ Biological activity increases with increase in temperature.

ꕥ Increased temperature decreases the dissolved oxygen content in water.

ꕥ Dumping of solid wastes results in surface water and ground water pollution.

ꕥ Presence of radioactive materials causes genetic disorders, birth defects and cancers.

ꕥ Pollutants such as heavy metals, pesticides, and cyanides and harmful to aquatic organisms.

ꕥ The demand of oxygen (DO) increases with addition of biodegradable organic matter which is expressed as biological oxygen demand (BOD).

Control of Water Pollution

ꕥ Proper use of agro chemicals like pesticides and fertilizers which will reduce their surface run-off.

ꕥ Using more biological control pests instead of pesticides.

ꕥ Supplement use of fertilizers using nitrogen fixing plants.

ꕥ Proper treatment of industrial and municipal wastes.

ꕥ Planting more trees to prevent soil erosion.

ꕥ The radioactive substances can be removed by ion exchange method.

ꕥ Reusing treated waste water for irrigation purposes.

ꕥ Proper treatment of effluents from industries.

ꕥ Waste water should be treated properly to reduce their BOD and COD levels.

ꕥ Removal of nitrates and phosphates prevents eutrophication (the condition of excessive growth of plants in a water body).

ꕥ Proper chlorination should be done to prevent spreading of waterborne diseases.

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