Unit - II - Air Pollution.

1. Definition, ~~sources~~ sources.
2. ~~Se~~ classification of Air Pollution.
3. Ambient Air quality standards.
4. climate change, Global warming / Pollutio from combustion system.
5. Acid rain.
6. Photo chemical smog.
7. Green house effect.
8. Formation and depletion of Ozone.
9. Bopal Gas ~~disaster~~. ~~Tr~~ Tragedy.
10. Instrumental technique to monitor Pollution / controoling methods of Air Pollution.

1) Photo chemical smog :-

Photochemical smog is a type of air pollution formed when sunlight reacts with pollutetants like nitrogen oxides (NO_x) and volatile organic compounds (VOCs) of vechicles and strong sunlight.

Key reaction :-

$$NO_2 \xrightarrow{h\nu} NO + O$$

$$O + O_2 \longrightarrow O_3$$

$$O_3 + NO \longrightarrow NO_2 + O_2$$

$$R - \overset{\overset{O}{\|}}{C}\cdot + O_2 \longrightarrow R - \overset{\overset{O}{\|}}{C} - O - O\cdot \; (RCO_3\cdot)$$

$$R - CO_3\cdot + NO_2 \longrightarrow RCO_3NO_2$$

$$R - CO_3\cdot + \text{Hydrocarbon} \longrightarrow R - CHO \cdot R_2CO$$

$$CH_3 - \overset{\overset{O}{\|}}{C} - O - O - NO_2$$

PAN

$$H - \overset{\overset{O}{\|}}{C} - O - O - NO_2$$

PEN

(Peroxy Formyl nitrate

$$\phi - \overset{\overset{O}{\|}}{C} - O - O - NO_2$$

PB_2N

peroxy benzoyl nitrate

Note:- This ground level ozone is harmful unlike the protective ozone layer in the stratosphere.

It also forms other harmful compound like PAN (peroxy Acetalde Nitrate).

Harm full effects:-

=> Eye and throat
=> breathing problems
=> damage the respivatory system
=> lung infections
=> cancers
=> asthama

Reduction:-

=> To reduce smog, to improve vechicle emissions standerds and use public transports are clean fuells Electric bikes.
=> limit industrial emissions
=> Encourage use of eco-friendly products.

(2) classification of Air Pollution.

Air Pollution means the presence of harmful substances in the air that we breath. These substances can harm living beings and the environment. Air Pollutants may comes natural sources like Volcanic eruption, forest fires (or) Man made sources like vechicles, Industries are burning of fossil fuells.

Air Pollutants are generally classified into 3 types.

A) Based on the physical state of Pollutants

1) Gaseous Pollutants

These are present in gases form in the atmosphere.

Ex:- ① CO / release from vechicles exgestes. incomplete combustion.

② Sulphur dioxide (H_2S) / from burning of coal or oil.

③ Nitrogen oxisides (NO and NO_2) from vechicles and power plants Emissions.

④ Ozone / Formed by reaction of sunlight with Nitrogen oxide and Hydrogen carbons

(ii) Particulate Pollutants.

These are solids are liquid Parti-
-les suspended in air They include d

(1) Dust / from roads, construction

(2) smoke / from burning wood or trash

(3) ~~Aero~~ Aerosols / Tiny liquid. droplets (sp

(4) soot / from ~~desiel~~ diesel engines.

(B) Based on the origin of pollutants.

(i) Primary Pollutants

These are directly emitted into the air.

Ex:- CO, SO_2, NO, NO_2, Particulate Matter

PM_{10}, $PM_{2.5}$

(ii) Secondary Pollutants

These are formed in the atm
-osphere by the chemical reaction betwee
Primary pollutants.

Ex:- Ozone, PAN, H_2SO_4, HNO_3 (Nitric acid)
formed from NO_x react with water vapour.

(c) Based on source of emission.

(i) Natural sources

Volcanic eruption (release SO_2, Ash), forest fires (release CO_2, CO, PM), Pollen, sea spray)

(ii) Anthropogenic sources (Man made)

Industries and factories, vechicles, power plants, house hold burning of wood and waste.

6/8/25

short Ozone depletion:

The ozone layer in the stratosphere protect earth from harmful UV rays

Ozone depletion :- ozone depletion occurs when chlorofluro carbons (CFC) from air conditioner, ~~fridge~~ refrigerator and sprays break down ozone.

Reaction :-

$$CF_2Cl_2 \xrightarrow{h\nu} CF_2Cl + \dot{Cl}$$

$$CFCl_3 \xrightarrow[UV]{h\nu} CFCl_2 + \dot{Cl}$$

$$\dot{Cl} + O_3 \longrightarrow ClO^{\circ} + O_2$$

$$Cl^{\circ} + [O] \longrightarrow Cl^{\circ} + O_2$$

a single chlorine atom can distroy thou of ozone molecules.

$$NO + O_3 \longrightarrow NO_2 + O_2$$

$$NO_2 + O_3 \longrightarrow NO + 2O_2$$

Nitrogen oxide coming out of the supersa gets directly enters in the stratosphere and decomposes the ozone present there

Ozone holes especially observed in Antartica, increases UV exposer Leading to

i) skin cancer
ii) Eye problems
iii) harm to plants and Animals
iv) reduce the soil fertility
v) Egg shells are ~~fragel~~ fragail

Note:- The montral protocal (1987) sep 16th helped phase out CFC's showing Global coparation insolving Environmental issues.

(3) Bhopal gas tragedy.

The Bhopal gas tragedy occured on December 3rd 1984 in Bhopal at madhapradhesh. A pestiside plant owned by union carbide leaked a highly toxic gas called methyl isocyanate (MIC)

Chemical formula:-

$$MIC = CH_3NCO$$

In the early morning Dec 3rd just outside the city of bhopal a massive rease raise of MIC from a storage tank of union carbide plant. The dense gas flotted across the surroundings, landscape killing more than 15,000 people and living more than 3 lakh effected severly by the exposer.

Causes for the acident:-

1. Poor maintaness, failure the cooling unit.
2. leakage of water into the tank.
3. failure of several safety devices.
4. loss of nitrogen pressure above the MIC.
5. negligency.

MIC is a viotaile liquid extremely hygroscopic. It is stored in moisture free refrigerator tank.

Adverse effects:-

(1) It causes burning sensation in eyes

(2) Expells oxygen out lungs causing death due to ~~shocking~~ choking

(3) Thousands of suffered + health issues (long term) (lung damage, blindness, birth diffects)

Note:- It is consided the worlds worst industrial ~~desbesster~~ disaster. so, that tragedy leads to streeter environmental laws in India and the formation of the Environmental Protection act (1986). It remains a powerfull lesson on the importance of industrial safety and Environmental responsibity.