

CL142 ENVIRONMENTAL SCIENCES

UNIT 2 – ENVIRONMENTAL POLLUTION

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POLLUTION

- ✖ For normal and healthy living, a proper environment is required by all living beings
- ✖ This favorable environment has certain composition
- ✖ When such composition changes by addition of harmful substances, the environment is called polluted whereas the harmful substance is termed as pollutant

POLLUTION

- ✖ Environmental Pollution can therefore be defined as:

“Any undesirable change in the physical, chemical or biological characteristics of any components of the environment (water, air , land) which can cause harmful effects on living organisms and property”.

AIR POLLUTION

- ✖ We breathe about 22000 times a day on an average inhaling about 16 kg of air per day
- ✖ But due to rapid industrialization and overpopulation the quality of air has deteriorated a lot thereby affecting humans, plants and materials



AIR POLLUTION

- ✖ Effects of other types of pollution such as water, noise etc. are localized
- ✖ Whereas air pollution is a problem which is local and global in nature
- ✖ Air pollutants after being emitted into air travels to a considerable distance depending upon atmospheric conditions



AIR POLLUTION

✕ It can be defined as follows:

*“Air Pollution is the presence in ambient atmosphere of substances, generally resulting from the activity of man in **sufficient concentration**, present for a **sufficient time** causing **harmful effects** on humans, plants, animals and materials”.*

SOURCES OF AIR POLLUTION

They can be majorly classified into two categories:

- 1) Natural Sources
- 2) Man made Sources or Anthropogenic Sources

× Examples of Natural Sources include :

- Pollen grains
- Volcanic Eruptions
- Forest Fires
- Dust Storms
- Microorganisms

NATURAL SOURCES OF AIR POLLUTION



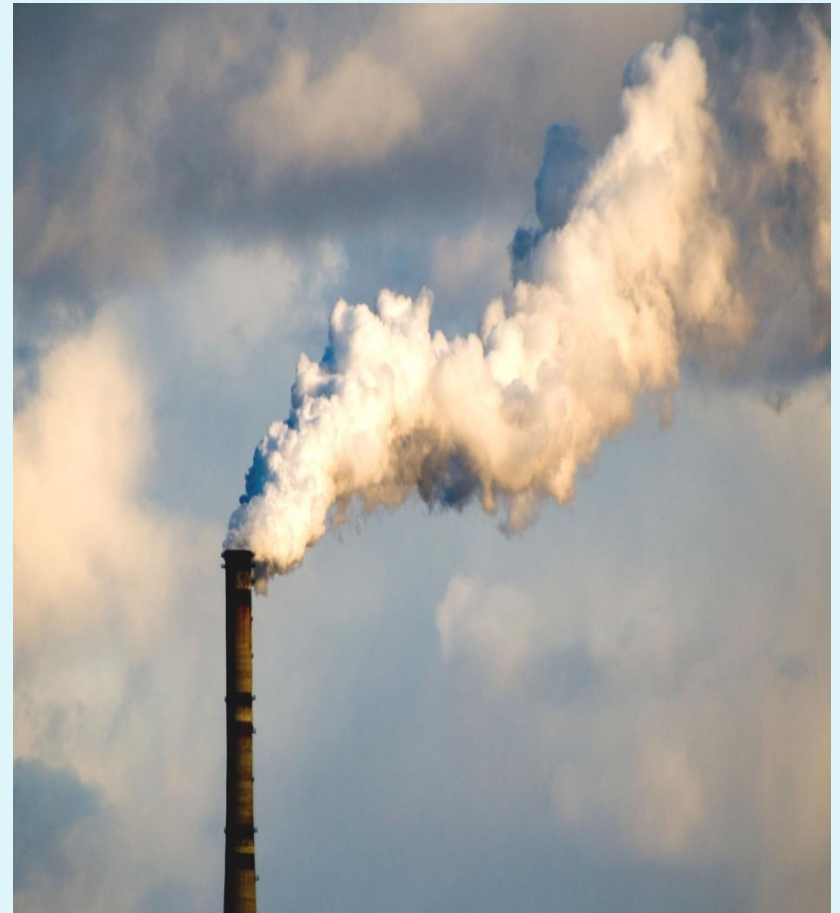
MAN MADE SOURCES OF AIR POLLUTION

They are generally classified into 3 parts:

- 1) Point or Stationary Source
- 2) Line or Mobile Source
- 3) Area Source

POINT SOURCE OR STATIONARY SOURCE

- × Such types of sources add pollutant from a single point
- × They are stationary in nature
- × Example of point source is chimneys of industrial units
- × They majorly affect the areas in which they are released



LINE OR MOBILE SOURCES

- × Such types of sources add pollutant in the form of a line
- × They are mobile/moving in nature
- × Example of line source is automobiles which add pollutant along narrow belts over huge distance



AREA SOURCES

- × Such types of sources add pollutant in the form of a total area
- × Example of area source is towns and cities adding smoke and gases over wide areas



CLASSIFICATION OF AIR POLLUTANTS

- a) **Classification based on origin of air pollutants**
 - 1) **Primary Pollutants** – They are emitted directly from the source and are found in the atmosphere in the form in which they were emitted. Example - SO_x, NO_x, Hydrocarbons etc.
 - 2) **Secondary Pollutants** – These are formed in the atmosphere by chemical interactions between primary pollutants and atmospheric constituents. Example – Ozone, PAN, Aldehydes

CLASSIFICATION OF AIR POLLUTANTS

b) Classification based on states of matter

- 1) **Gaseous Pollutants** – CO, CO₂, NO_x, SO_x
- 2) **Particulate Pollutants** – These are suspended solid particles present in atmosphere. Examples – Dust, Mist, Fumes etc.

SOURCES AND EFFECTS OF AIR POLLUTANTS

Carbon Monoxide

Sources:

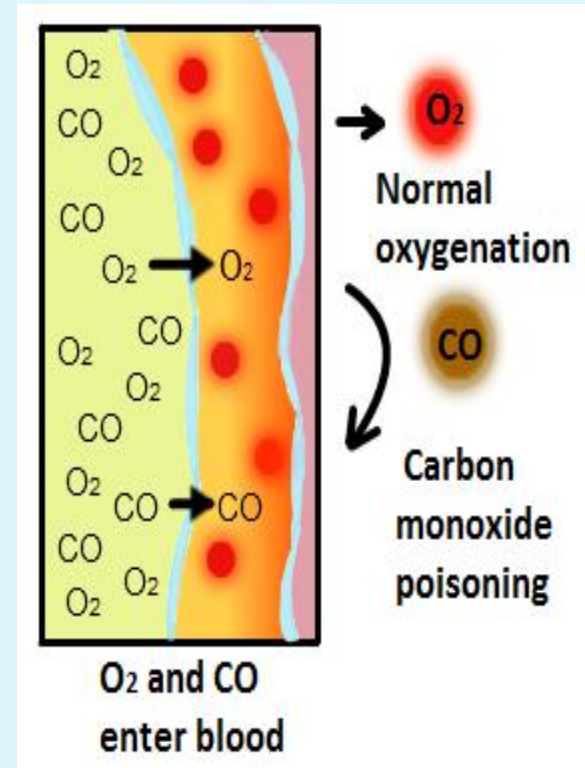
- × Natural process such as volcanoes, electrical discharge during cloud formation, etc
- × Transportation contributes 64% of CO in air
- × Forest fires and agricultural burning contributes 17% of CO in air
- × Industrial process such as petroleum refining, blast furnaces in iron and steel industry etc. contributes 9.6% of CO in air

SOURCES AND EFFECTS OF AIR POLLUTANTS

Carbon Monoxide

Effects:

- × It reduces the oxygen carrying capacity of blood by combining with hemoglobin (Hb) forming CoHb (carboxy- hemoglobin) which causes laziness and exhaustion
- × It reduces vision and causes cardiovascular diseases



SOURCES AND EFFECTS OF AIR POLLUTANTS

Carbon Dioxide

Sources:

- × Fossil fuel combustion
- × Jet planes
- × Deforestation

Effects:

- × It causes nausea and headache
- × It has a major role in global warming thereby melting glaciers



SOURCES AND EFFECTS OF AIR POLLUTANTS

Oxides of Nitrogen

- × NO_x group includes eight possible oxides of nitrogen whereas majorly NO, NO₂ and N₂O are responsible for air pollution

Sources:

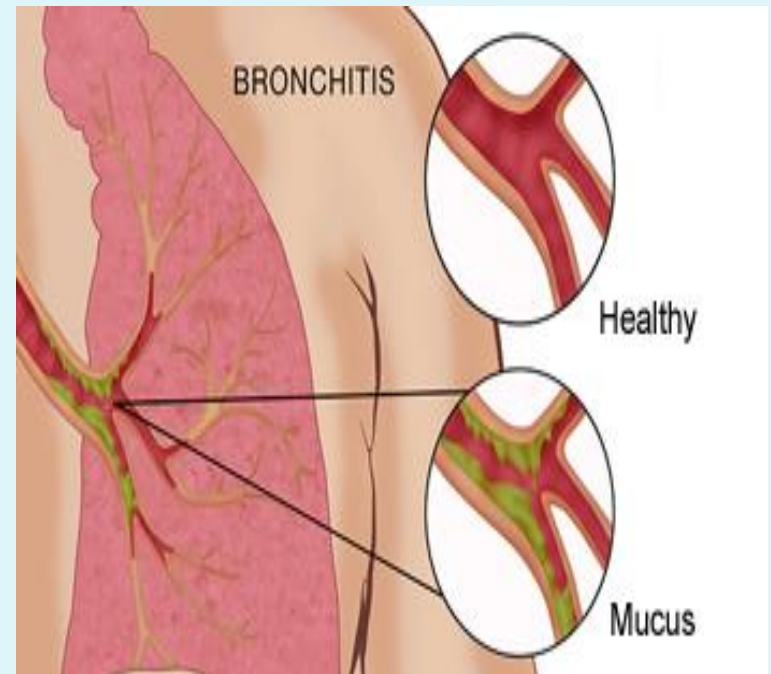
- × Fuel Combustion
- × Lightening
- × Forest fires
- × Bacterial decomposition of organic matters

SOURCES AND EFFECTS OF AIR POLLUTANTS

Oxides of Nitrogen

Effects:

- × Like CO, NO can also combine with Hb and reduce oxygen carrying capacity of blood
- × NO₂ is more toxic, it irritates respiratory system and high concentration may cause acute bronchitis



SOURCES AND EFFECTS OF AIR POLLUTANTS

Oxides of Sulphur

- × It is generally called as SO_x, which includes majorly sulphur dioxide and sulphur trioxide

Sources:

- × 67% of Sox pollution is due to volcanic activities
- × Remaining 33% is due to – burning of fossil fuels, transportation, Industries such as sulphuric acid plants, paper manufacturing plants etc.

SOURCES AND EFFECTS OF AIR POLLUTANTS

Oxides of Sulphur

Effects:

- × They tend to irritate respiratory system
- × Higher concentration may cause bronchitis
- × Marble and mortar statues are affected
- × Clothes, leather and paper are also affected
- × Plants sensitive to sulphur dioxide often suffer from chlorosis and even death

SOURCES AND EFFECTS OF AIR POLLUTANTS

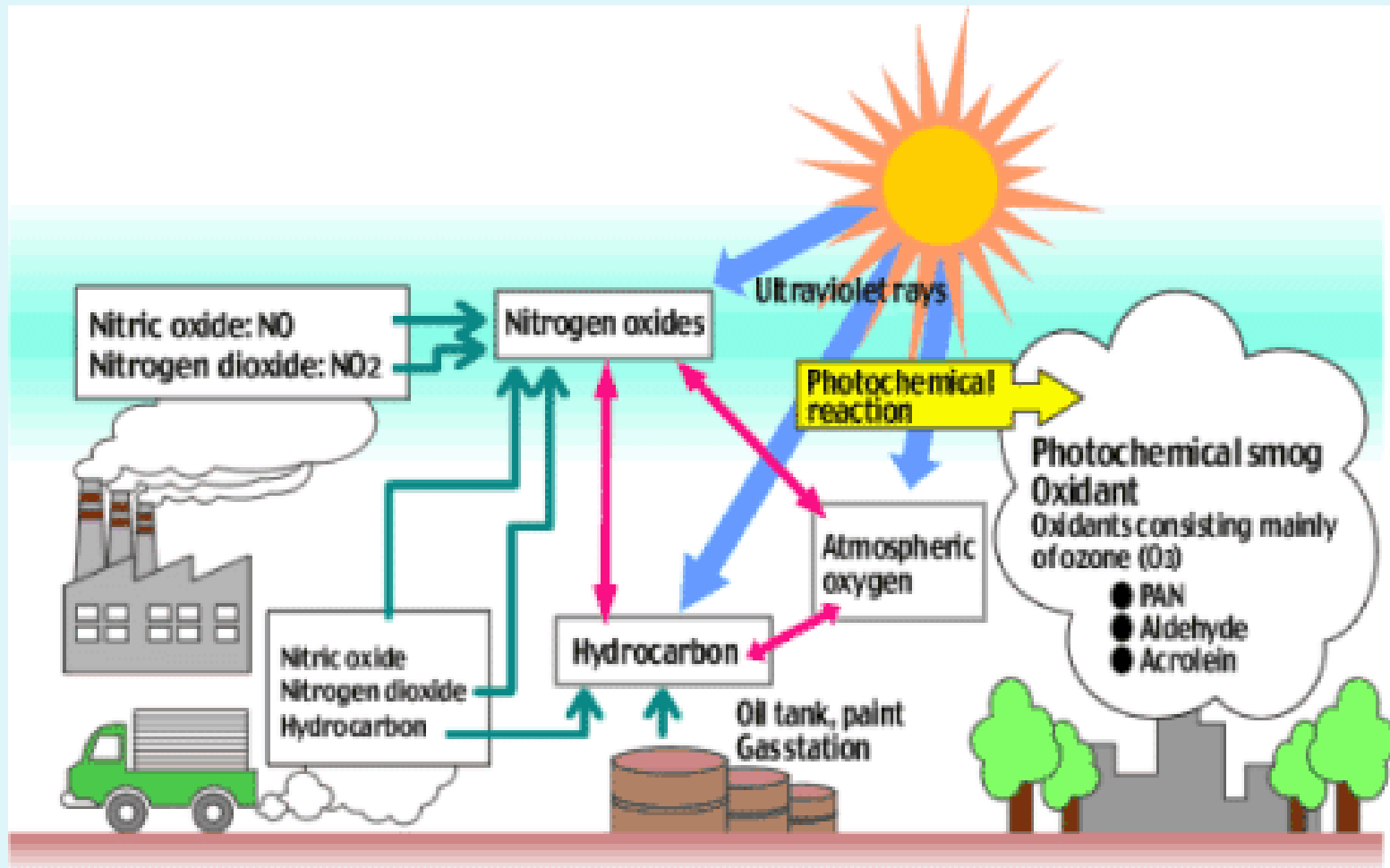


SOURCES AND EFFECTS OF AIR POLLUTANTS

Photochemical Oxidants

- × Major photochemical oxidant is ozone
- × It is produced by solar reaction of oxygen molecules
- × In the presence of sunlight, NO_x reacts with unburnt hydrocarbon and produces secondary pollutants such as PAN, Ozone, Aldehydes etc. which ultimately forms photochemical smog

SOURCES AND EFFECTS OF AIR POLLUTANTS



SOURCES AND EFFECTS OF AIR POLLUTANTS

Photochemical Oxidants

Effects:

- × They cause irritation of eye, nose, throat, headache etc.
- × Ozone interferes in damaging chromosomes in living organisms
- × Both Ozone and PAN causes yellowing and premature falling of leaves
- × They also affect materials such as rubber, textile fibers etc.

SOURCES AND EFFECTS OF AIR POLLUTANTS

Particulate Air Pollutants

- × It includes aerosols, dust, fumes, mist, soot fog etc.

Sources:

- × Numerous natural processes such as volcanoes, blowing of dust and wind etc. inject particulate into atmosphere
- × Man made sources such as flyash from power plants, mining operations and smoke resulting from incomplete combustion also forms particulate air pollutants

SOURCES AND EFFECTS OF AIR POLLUTANTS

Particulate Air Pollutants

Effects:

- × Particulates less than 10μ can enter deep into lungs and cause problems such as asthma, chronic bronchitis etc.
- × Lead, Nickel etc affects respiratory system
- × Particulates accelerates corrosion of metals, damage buildings etc
- × Dust coating on leaves affect photosynthesis and affects plant growth
- × Particulates in atmosphere reduces visibility thereby influencing the climate

SOURCES AND EFFECTS OF AIR POLLUTANTS



Asthma



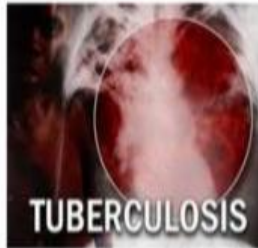
Bronchitis



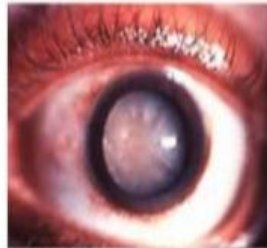
Lung cancer



Nose irritation



Tuberculosis



Cataract

