

# **AIR POLLUTION**

# CONTENT

Definition, Composition of atmospheric air, Classification and sources of air pollutants. Effects of air pollution on human, plant and material, Air pollution control methods, equipment and safety.

- “Any *substance introduced* into the environment that *adversely affects the usefulness* of a resource”.

## AIR POLLUTION

- Air pollution defined as the of *one or more contaminants or combinations* in such quantities and of such durations as may be or tend to be *injurious to human, animal or plant life, or property*, or which *unreasonably interferes with the comfortable enjoyment of life or property or conduct of business.*

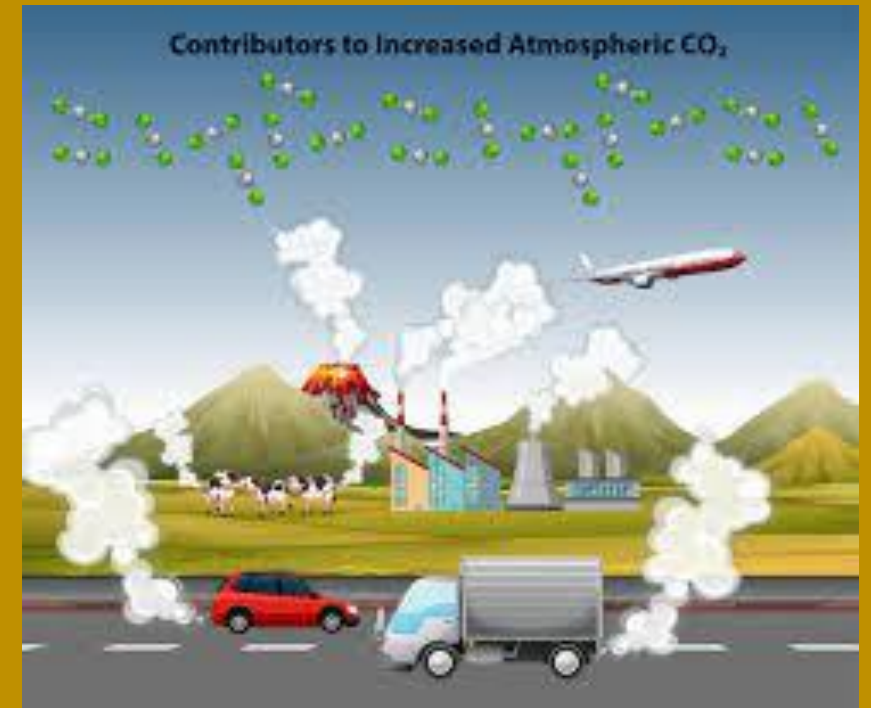
## SOURCE AND CLASSIFICATION

- Natural
- Man- made or anthropogenic

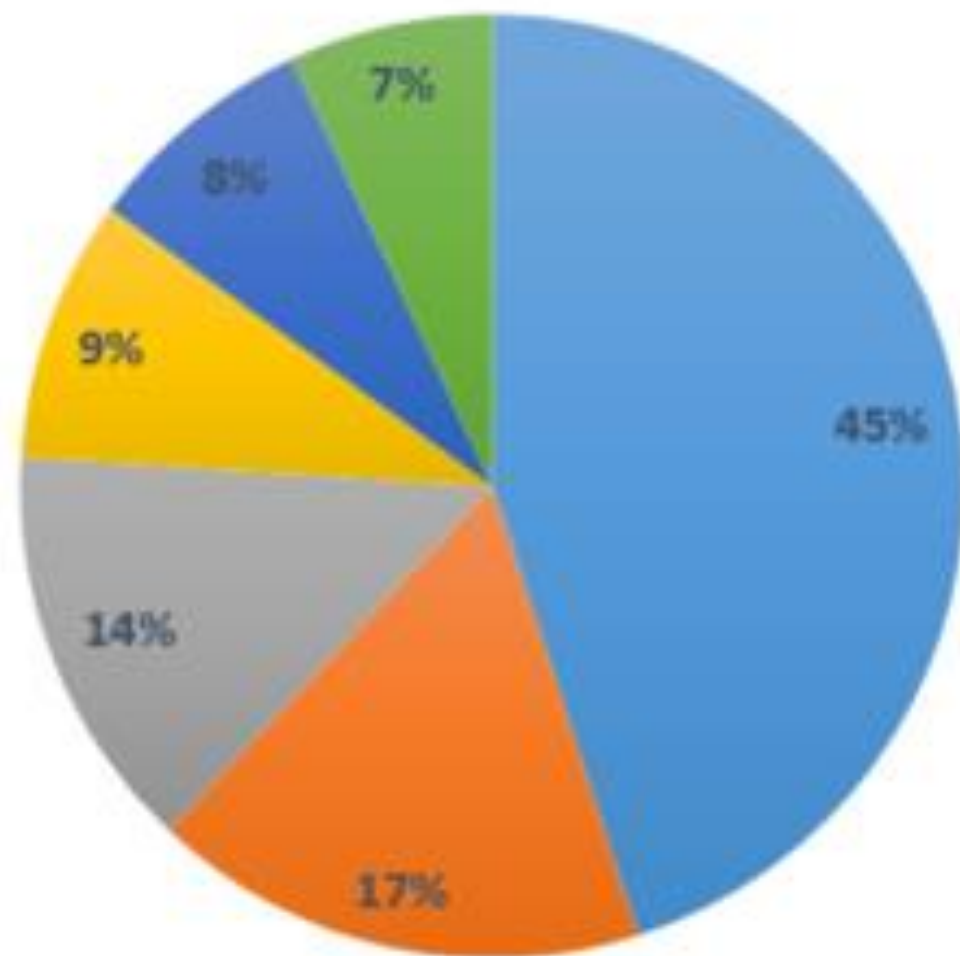
- Natural- pollen grains, volcanic eruptions, forest fires, dust storms, spores, bacteria and other microorganisms.
- Man- made- industrial units, thermal power plants, automobile exhausts, fossil fuel burning, mining, nuclear explosions,

## SOURCE AND CLASSIFICATION

- Stationary
  - Mobile
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- Point source- large stationary source
  - Area source- small stationary source and mobile source with indefinite routes
  - Line source- mobile source with definite routes



## Sources of Air Pollution



■ Dust & Construction ■ Waste Burning ■ Transport  
■ Diesel Generator ■ Industries ■ Domestic Cooking

## AIR POLLUTANTS

- **Substance dwelling** temporarily or permanently in the air.
- Alters the environment by interfering with the health, the comfort, or the food chain, or by interfering with the property values of people.
- A pollutant can be solid (large or sub-molecular), liquid or gas .
- It may originate from a natural or anthropogenic source (or both).

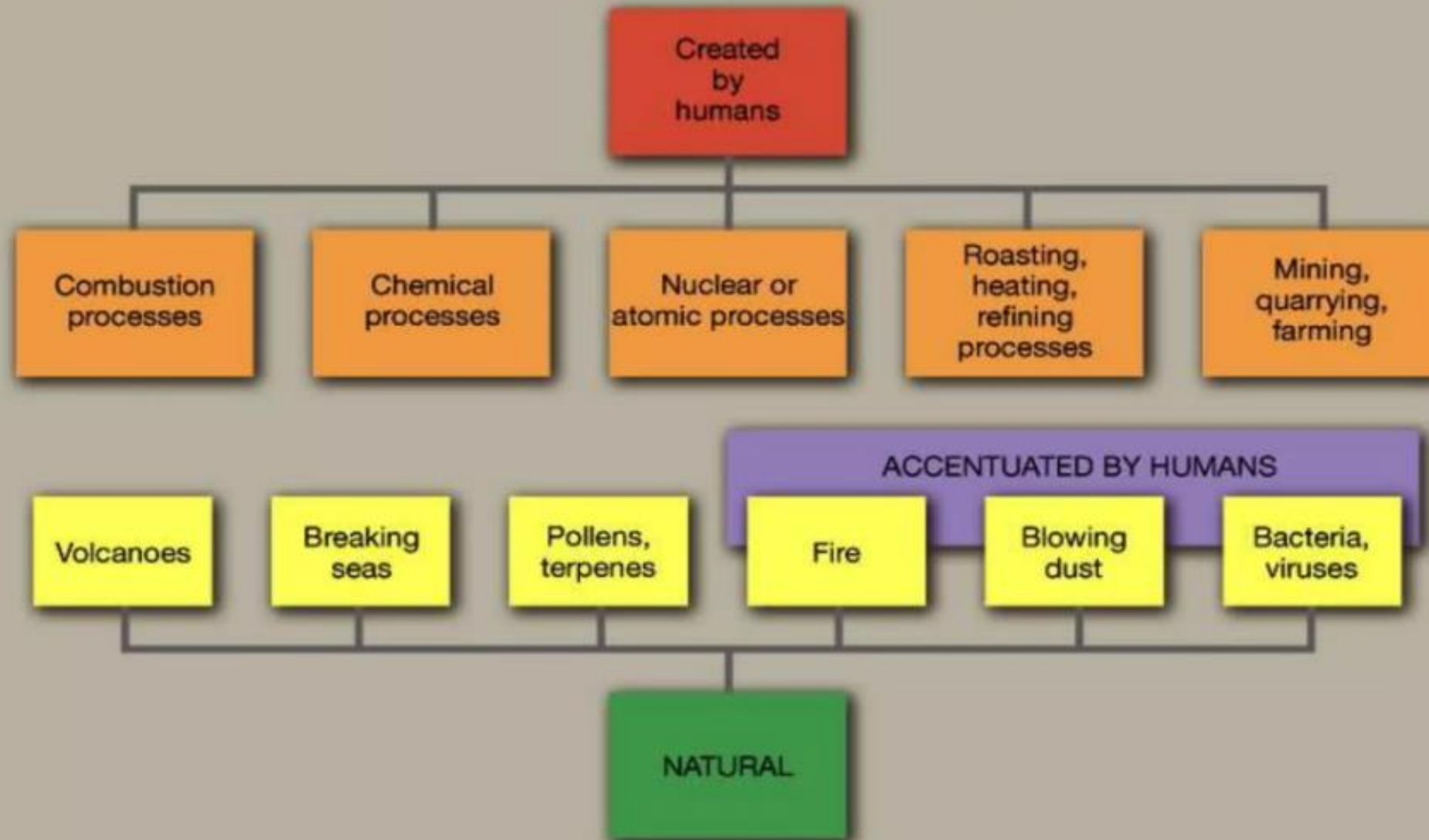
## PRIMARY POLLUTANTS

The major primary pollutants include:

- particulate matter (PM),
- sulfur dioxide,
- nitrogen oxides,
- volatile organic compounds (VOCs),
- carbon monoxide, and
- lead.



# SOURCES OF PRIMARY POLLUTANTS



## SECONDARY POLLUTANTS

- Some primary air pollutants react with one another or with other chemicals to form secondary pollutants.

- Atmospheric **sulfuric acid** is one example of a secondary pollutant.
- Air pollution in urban and industrial areas is often called **smog**.
- **Photochemical smog**, a noxious mixture of gases and particles, is produced when strong sunlight triggers **photochemical reactions** in the atmosphere.
- The major component of photochemical smog is **ozone**.

## MAJOR POLLUTANTS SOURCES AND EFFECTS

- Carbon monoxide (CO)- colorless, odorless, tasteless gas.
- No effect at normal conc. (0.1ppm) but higher conc. seriously affect.
- Volcanoes, natural gas emissions, seed germination contribute to CO.
- Transport sector contribute 75% CO.
- Residential wood burning 10%, industrial process 15% CO.



### Effects:

- Reduce oxygen carrying capacity of blood.
- Decrease in vision and causes cardio vascular disorders.
  
- Carbon dioxide (CO<sub>2</sub>)- Fossil fuel combustion.
- Jet plane use O<sub>2</sub> and release CO<sub>2</sub>.
- Burning

### Effects:

- Causes headache and nausea.
- Effect on climate, increase global temp.



- Oxides of nitrogen – NO<sub>x</sub> group contains NO, NO<sub>2</sub>, N<sub>2</sub>O.
- Fuel combustion in automobiles and industries.
- Lightening.
- Forest fires.
- Natural ionizing radiations.



Effects:

- Reduce blood carrying capacity.
- Causes lung problems.



- Oxides of sulphur – generally called SO<sub>x</sub>, include SO<sub>2</sub>, SO<sub>3</sub>.
- 67% SO<sub>x</sub> pollution due to volcanic activities and other natural sources.
- Remaining due to fossil fuel burning, transportation.
- Industrial activities.

Effects:

- Respiratory problems
- Marbles, clothes, paper, leather also affected.
- Plants also heavily affected.

- Hydrocarbons (HC) – these include methane, ethylene, acetylene, terpenes etc.
- Sources include coal fields, natural fires.
- Incomplete combustion
- Forest fires
- Agricultural burning



### Effects:

- Carcinogenic effect
- Form ozone and PAN which are harmful.
- Damage plants, rubber materials, fabric and paints.



## PARTICULATE MATERIALS

- Particles of different substances suspended in the air
- In the form of solid particles and liquid droplets
- Particles vary widely in size
- Different particulate materials are aerosols, dust, smoke, fumes, mist, fog, fly ash etc.

- Fine particles come from a variety of sources:

- diesel trucks and buses

- construction equipment

- power plants

- woodstoves

- wildfires




- Also, Chemical reactions in the atmosphere can transform gases into fine particles.

## Effects:

- Premature death
- Aggravated asthma
- Acute respiratory symptoms
- Chronic bronchitis
- Decreased lung function (shortness of breath)
- People with existing heart and lung disease, as well as the elderly and children, are particularly at risk

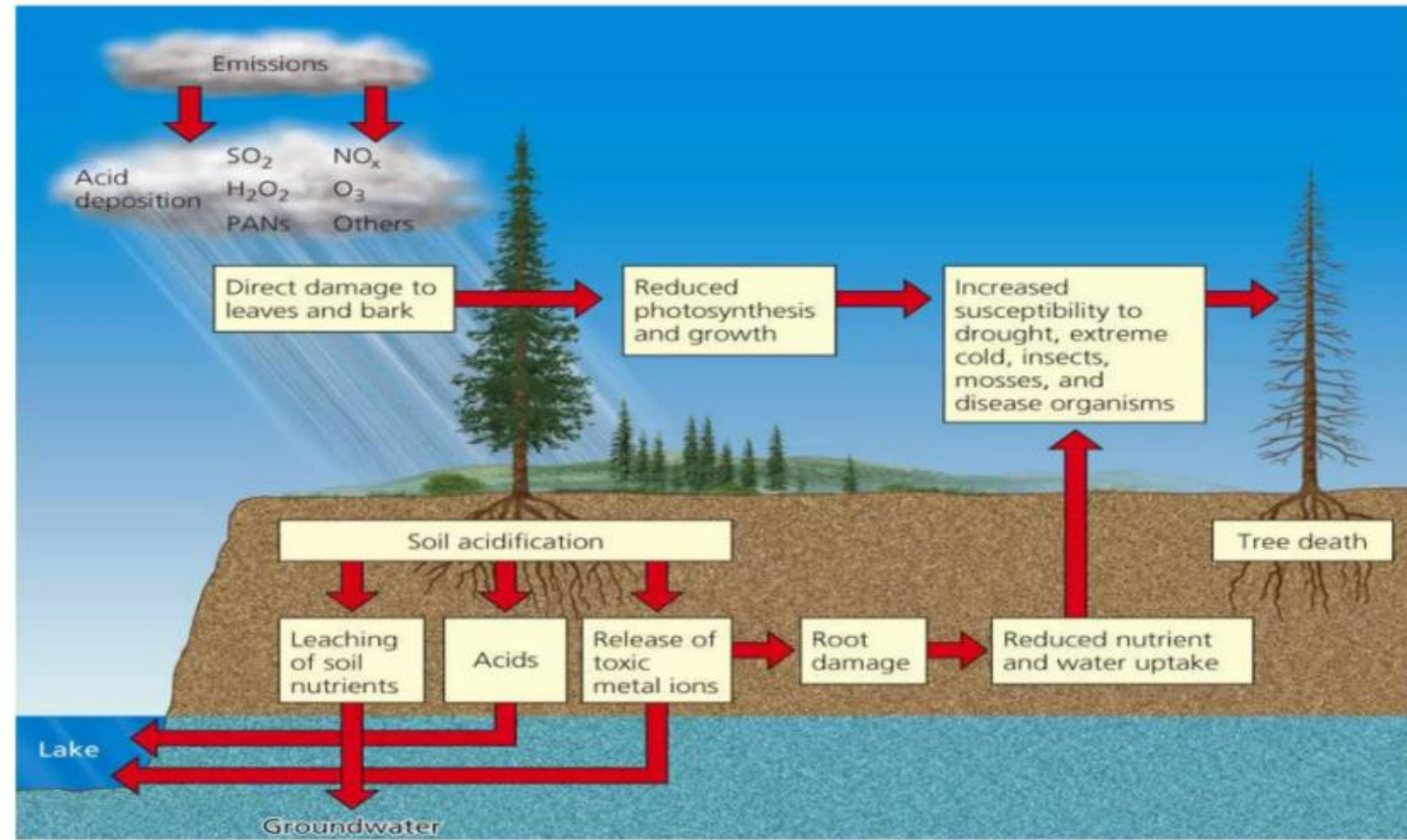
- around 30-40% of cases of asthma and 20-30% of all respiratory disease.
- effect our health in many ways with both short term and long term effect.
- Short term effect are: irritation to nose, eye, throat, bronchitis, headache etc.
- Long term affect are: lung disease, chronic respiratory problem, damage to heart, brain, eyes etc.
- Eye irritation due to NO<sub>x</sub>, O<sub>3</sub>, PAN, particulates.
- Nose and throat due to SO<sub>2</sub>, NO<sub>x</sub> etc.

- Gaseous pollutants like  $\text{H}_2\text{S}$ ,  $\text{SO}_2$ ,  $\text{NO}_2$  and hydrocarbons cause odor nuisance.
  - Irritation of respiration tract caused by  $\text{SO}_x$ ,  $\text{NO}_x$ ,  $\text{CO}$ ,  $\text{O}_3$ .
  - Increase in mortality.
  - High conc. of  $\text{SO}_2$ ,  $\text{NO}_2$  and SPM causes bronchitis and asthma.
  - $\text{CO}$  and  $\text{NO}$  react with haemoglobin and reduce  $\text{O}_2$  carrying capacity of blood.
  - Heavy metals like lead can cause poisoning. High conc. cause damage to liver and kidney.
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## FACTORS AFFECTING HUMAN HEALTH

- Nature of the pollutants
- Concentration of the pollutants
- Duration of exposure
- State of health of receptor
- Age group of the receptor

# EFFECTS OF AIR POLLUTION ON PLANT



- Decrease yield in agriculture.
- Suppressed growth of vegetables.
- Leaf injury and damage to young plants.
- Decreased growth rate and increased death rate.





## EFFECTS OF AIR POLLUTION ON MATERIALS

- Corrosion of metals due to  $\text{SO}_2$  in presence of oxygen and moisture is converted into  $\text{H}_2\text{SO}_4$  acid.
- $\text{H}_2\text{SO}_4$  acid react with limestone, marble and other building materials to cause deterioration.
- Soiling and eroding of building materials.
- $\text{SO}_2$ ,  $\text{O}_3$ ,  $\text{H}_2\text{S}$  and aerosols damage protective coating and paints of the surface.
- $\text{O}_3$  and PAN causes cracking of rubber and various electrical insulations.
- Deterioration of art work due to SPM.

## AIR POLLUTION CONTROL

- Cannot be fully prevented but can be controlled.
  1. Preventative measures
  2. Control measures using equipments.



### Preventative measures (source control)

- Selection of suitable fuel. (Low sulphur coal in power plant, using of CNG)
- Modification in industrial process.
- Selection of suitable site and zoning for industrial unit.

## Control measures

- When source control not possible some measures taken to prevent pollution.
- Collecting pollutants by using equipments.
- Destroying the pollutants by thermal or catalytic combustion.
- Changing the pollutants to less toxic form.
- By releasing the pollutants through tall chimneys for greater dispersion.

## PREVENTATION BY LAWS

- Various laws has been established for the menace of air pollution.
- Air (Prevention & control of pollution ) Act,1981.
- Air (Prevention & control of pollution ) Amendment Act,1987.
- Motor vehicle Act, 1988.
- Air (Prevention & control of pollution) Union Territories Rules, 1983.
- Environment Protection Act, 1986.

The government is trying to

- remove the use of leaded petrol, a major cause of air pollution.
- the industrial acts are implemented to control the harmful emission of gases.
- the natural management team work to minimize the effect of various natural disaster like forest fire, volcanic eruption that are causes of air pollution.