

ATMOSPHERIC POLLUTION

Atmospheric pollution or air pollution is the grave environmental problem facing in the 21st century. It also instigates the global warming and climate change.

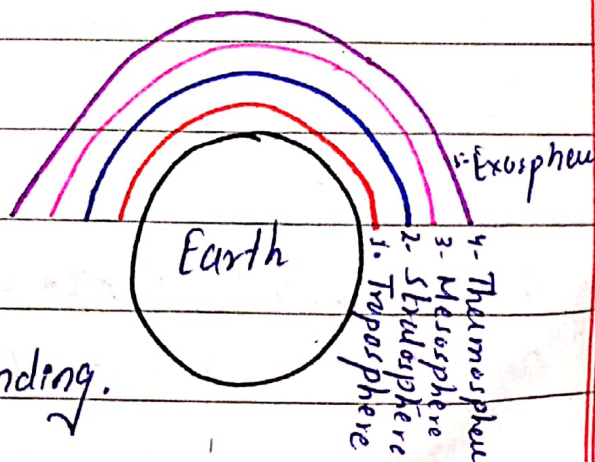
Atmosphere:-

Earth is surrounded by a mixture of gases or envelop of gases known as the atmosphere. The gases present in the atmosphere includes Nitrogen (78%), Oxygen (21%), CO₂, Argon, Neon, Krypton and hydrogen collectively constitutes about 0.04%.

Atmosphere is divided into 5 layers -

- 1- Troposphere
- 2- Stratosphere
- 3- Mesosphere
- 4- Thermosphere
- 5- Exosphere

• Atmospheric pollution is related to the Earth's surrounding.



Definition of Atmospheric pollution :-

According to WHO; Atmospheric pollution is about the situations in which the outdoor atmosphere contain pollutants in such concentrations which remains harmful to the human health, plants, animals, microorganisms, aquatic life and to the environment.

Types of Air pollutants :-

There are two types of Air pollutants.

1. Primary Air pollutants:

Those pollutants which comes directly from their sources and directly pollutes the atmosphere. Vehicles, industries, refrigerators, air conditioners etc are the sources of the primary pollutants.

For example:

CO_2 , CO , NO_x , SO_x (sulphur dioxide SO_2), CH_4 , CFCs, Nitrous oxide (N_2O)

2. Secondary Air pollutants :-

Those pollutants which comes from the primary air pollutants as a result of a chemical reaction.

For example: Acid rain

HNO_3 (Nitric acid), H_2SO_4 (sulphuric acid)

Causes / Factors responsible for the atmospheric pollution :-

Following ^{are} the some causes which are responsible for the atmospheric pollution.

1. Combustion of fossil fuel
2. Population explosion
3. Massive deforestation
4. Rapid urbanization.
5. Generation of Solid waste (SW)
6. Rapid industrialization
7. Electric appliances
8. Eruption of wild fires
9. Weapons / Warfare.
10. Volcanic eruption / Volcanism (Natural)

1) Combustion of fossil fuels:-

Fossil fuels are the non-renewable source of energy. The non-renewable sources of energy includes coal, diesel, natural gas and oil etc. Combustion releases CO_2 , CO , SO_2 into the environment. Fossil fuels are utilized by the

following sectors: energy sector, agricultural sector, industrial sector and transport sector etc (According to the IPCC). Energy sector is responsible to contribute about **35%** towards the global emissions. Agricultural sector contributes about 25% towards global emissions, which includes fertilizer industry, pesticide industry, agro-chemicals development, generation and machinery all require fossil fuels. Similarly, industrial sector and transport sector contributes about 21% and 15% respectively.

2) Population Explosion :-

The rapid increase of human population is putting an incredible strain on our environment. Humans also put a great demand on the natural resources of Planet Earth. As per **US census bureau (1960)** the population of world was 3 billion. By 2000 it was about 6 billion and by 25 Nov, 2022 it was 8 billion. The world population will be crossing 9 billion in coming 8-10 years.

Increase in no. of people increases the rate of consumption, production, deforestation, urbanization, transportation, industrialization and addition

of pollutants into the atmosphere. A ticking time bomb of population growth threatens Pakistan, joining the league of the world's top five most populous countries, with a staggering 225 million people and country. According to UN, Pakistan's population is projected to reach **403 million by 2050** if the current growth rate continues unchecked.

3) Massive deforestation :-

Earth is riched with many natural resources which are essential to fulfill the human requirements. According to WWF, forests cover about 31% of the total land surface. As per **Global Forest Watch** more than 10 million hectares have been deforested in the world over the past 4 years only. The major reasons of deforestation are: expansion in housing, industrial requirements and road infrastructure etc. Deforestation is the major cause of air pollution leads to global warming. As plants are carbon sinks (absorb CO_2), utilize CO_2 during the photosynthesis and prepare their food. In this way, more deforestation leads to high level of CO_2 in the environment. In **COP-26 and COP-27** many countries pledged to

end the deforestation. The private sector also coming forward and pledged to provide 7.2 billion USD for the causes of deforestation in the world.

According to NOAA (National Oceanic and Atmospheric Administration) by 2023 the level of CO₂ will be 424 ppm.

4) Rapid Urbanization :-

Urbanization means increasing number of people in the city. According to UN report of 2015, 54% of global population was living in the urban areas/cities back in 2014. Currently, it reached upto 60%. The Urban process includes the grey infrastructure or concrete infrastructure (Roads, flyover, under passes, industries etc), which lead to the addition of pollutants into the atmosphere. Rapid and poorly planned expansion of cities can also leave urban populations exposed to the effects of climate change. It is true that migration from rural areas to cities is at least partially motivated by the increasing prevalence of extreme weather and other environmental crises connected to air pollution, climate change and global

warmness. United Nations predicting that 68% of the global population will live in the urban areas by 2050.

5) Rapid Industrialization :-

Industrialization is the cause of global warming due to higher levels of hazardous emissions. A higher population leads to increasing product demand, as well as increased levels of consumption and output. This correlates to increasing activity including industrialization, which eventually results in higher quantities of green house gases. There are different industries which produce/different types of pollutants such as;

Thermal power industry emits CO_2 , CO , SO_2 .

Steel industry emits CO_2 and VOC's (volatile organic compounds)

Fertilizer industry emits CH_4 , N_2O , CO_2 .

Paper industry emits CO_2 , NO_x , SO_2 .

Pesticide industry emits CO_2 , CH_4 , N_2O

Textile industry emits CO_2 , SO_2 , N_2O

6) Electric Appliances :-

Electrical appliances such as refrigerators, air conditioners causes green house gas emissions especially CFCs. Green house gases trap the Sun's rays within the Earth's atmosphere and are considered one of the main culprits behind global warming.

According to UNEP (United Nations Environment Program), more than 15 million tons of CFCs have been produced over the past 120 years.

Chlorofluoro carbons (CFCs) are the major source of air pollution. Its sources include manufacturing of foams, spray cans etc.

7) Weapons / Warfare :-

Production of weapons, testing of weapons and practical usage of weapons in warfare emits CO₂ and toxics etc. COP-27 climate conference

in Sharm-el-Sheikh, Egypt was presented with another compelling argument: Warfare is bad for global warming. International Law Commission proposed draft principles in 2019 for the protection of environment in relation to armed conflicts.

Russia's invasion of Ukraine has elevated warfare-related emissions as an issue in international climate diplomacy.

8) Eruption of wild fires:-

Extreme wildfires are devastating communities and ecosystems. Every year, wildfires or forest fires destroy acres of land around the world. The wildfire emits CO_2 , ash (result in haze) and heat. In the near future wildfire could turn the forest from a carbon sink to a source of atmospheric CO_2 .

Examples of wildfire / wildfire events in World:

Greece wildfire eruption in 2023

Canadian wildfire in 2023 in about 250 locations

Brazilian wildfire in 2022

Turkish wildfires in 2021

California wildfires in 2021

Amazon wildfires in 2020

Australian wildfires in 2019

9) Volcanic eruption or Volcanism:-

Volcanic eruption or volcanism is a natural phenomenon and a major cause of air pollution

The most significant climate impacts from volcanic eruptions into the stratosphere comes from the conversion of sulphur dioxide into the sulphuric acid, which condenses rapidly in stratosphere and deplete the Earth's ozone layer. The gases emitted during the volcanic eruption includes CO_2 , SO_2 , ash, HCl(g) and also release of heat.

10) Generation of Solid waste :

Solid waste generation is also a major cause of air pollution. Solid waste emits CO_2 , CH_4 and N_2O into the atmosphere. Untreated solid waste not only affect the environment but also have negative impact on the human health. As CO_2 is a green house gas and has potential to promote the air pollution lead to the global warming. The major sources of solid wastes are household, buildings, industries etc with improper handling of waste.

EFFECTS OF ATMOSPHERIC POLLUTION

Atmospheric pollution or air pollution has negative impacts on the plants, animals, microorganisms, and aquatic life.

EFFECTS ON PLANTS :-

Air pollution causes number of diseases on the plants which are as follows.

1. Abscission
2. Necrosis
3. Chlorosis
4. Stunted growth
5. Discolorization of the flowers
6. Lead the plants towards gradual death and decay.

Abscission:

Abscission is the yellowing, withering and weakening of the leaves and eventually death. It is the nitrogen oxides also the sulphur dioxide which causes the disruption on the leaves.

Necrosis:-

Necrosis is about the breakdown of plant tissues. Sulphur dioxide is responsible for the phenomenon of necrosis.

Chlorosis:-

Chlorosis is about the weakening of chlorophyll.

As the chlorophyll contributes the green color to the plant and is mainly responsible for the absorption of sunlight. Chlorosis happens due to the deficiency of calcium, magnesium and potassium.

Stunted growth:

Stunting describes a plant disease that results in dwarfing and loss of vigor. Stunted growth can affect foliage and crop yields, as well as eating quality in edible plants. Stunted growth is the result of absorption, necrosis and chlorosis.

Discolorization of flowers:

The tropospheric ozone gas (O_3) causes curling of petals which possess chromoplast in them. Chromoplast is responsible to give colors to the flowers except green.

All the above diseases lead the plant towards gradual decay and death. Mostly affected plants includes wheat, cotton, barley, oats, apples, grapes, tobacco plant, beans etc.

Atmospheric pollution affects the plants which in result increases food insecurity.

EFFECTS ON HUMAN HEALTH :-

Air pollution is a major problem of recent decades, which has a serious toxicological impact on human health. Long-term effects of air pollution on the onset of diseases such as:

- 1- Asthma
- 2- Bronchitis
- 3- Lung cancer
- 4- Dizziness, drowsiness, blurred vision, reduction in supply of oxygen, comma, these diseases are caused due to carbon monoxide.
- 5- Death.

Air pollution causes irritation of skin and eye. It is the nitrogen oxides and sulphur dioxide which causes inflammation in the airways which results into the turbulent breathing such as asthma and bronchitis.

According to WHO, 6-7 million deaths take place on annual basis in world. The average life expectancy reduced in Pakistan due to the bad air quality, Rawalpindi - Islamabad life expectancy is reduced to 2-3 years, Lahore - Faisalabad life expectancy reduced to 3-5 years and in Karachi 5-7 years life expectancy is reduced. (USAID). Lung cancer

is mainly caused due to heavy metals such as As, Pb, Chromium and mercury.

EFFECTS OF AIR POLLUTION ON AQUATIC LIFE / MICROORGANISMS

When the aerial pollutants transfer towards the land and water bodies under the action of rainfall, they may contribute towards excessive algal (phytoplankton) growth, oxygen depletion, degradation of marine habitats and loss of both biodiversity and commercially valuable fish and shell fish species.

EFFECTS OF AIR POLLUTION ON ENVIRONMENT

Air pollution has adversely effect on the environment.

- It causes depletion of ozone layer
- It causes global warming / climate change
- It causes biodiversity loss
- It causes smog formation (smog = smoke + fog)
- It also contributes in acid rain.