1. ENVIRONMENTAL SEGMENTS

Environment is defined as the social, cultural and physical conditions that surround, affect and influence the survival, growth and development of people, animals or plants. Environment includes everything around us. It encompasses both the living (biotic) and non-living (abiotic) components of the Earth.

Environment is divided into the following segments:

1. Lithosphere
2. Hydrosphere
3. Atmosphere
4. Biosphere

1. Lithosphere:

Lithosphere is related with edaphic factor. The solid component of earth is known as lithosphere. Lithosphere means the mantle of rocks constituting the earth's crust.

- It includes the soil, which covers the rock crust.
- Soil plays an important role as it provides food for man and animals.
- Soil is usually defined as "any part of earth's crust in which plants root."
- Muddy bottoms of ponds, ravines or glacial deposits, porous rock surface, bottoms of lakes peat etc., all are thus soil.
- A typical productive soil contains approximately 95 per cent inorganic matter and 5 per cent organic matter. Organic matter in the soil provides food for microorganism. This matter includes amino sugars, organic sulphur, organic phosphate, and polysaccharides.
- Soil contains silicate minerals, which includes nearly 74 % Silicon and Oxygen, common elements in the soil are Oxygen 46.4 %, Silicon 27.7 %, Aluminium 8.1 %, Iron 5.6 %, Calcium 3.6 %, Sodium 2.8 %, Potassium 2.6 %, Magnesium 2.1 %. In some soils, manganese oxide and titanium oxide are also available.

2. Hydrosphere:

This includes all the surface and ground water resources such as oceans, seas, rivers, streams, lakes, reservoirs, glaciers, polar ice caps, ground water and water locked in rock and crevices and minerals laying deep below the earth's crust.

- Earth is called blue planet because 80 % of its surface is covered by water (97 % of the earth's water resources is locked up in the oceans and seas, 2.4 % is trapped is giant glaciers and polar ice caps.)
- Water is universal solvent.
- Water is also the main medium by which chemical constituents are transported from one part of an ecosystem to others.
- Water has high specific heat, latent heat and relatively high freezing point.
- Surface water contains a lot of organic matter and mineral nutrients, which feed large bacteria population and algae.

3. Atmosphere:

The gaseous envelope surrounding the earth is composed of an entire mass of air containing N_2, O_2, H_2O, CO_2 and inert gases is known as atmosphere.

- The atmosphere is a reservoir of several elements essential to life and serves many purposes and functions.
- The atmosphere is mobile, elastic, compressible and expansible.
- Atmosphere serves many purposes and functions.
- It absorbs most of the harmful radiations.
- It maintains the heat balance of the earth.
- Different cycles those are present in the atmosphere in the form of water cycle, carbon, oxygen, nitrogen cycle etc. related to the movement of matter been an organism and its environment.
- Atmosphere can be divided into several layers on the basic of temperature variations. They are troposphere, stratosphere, mesosphere and thermosphere.

4. Biosphere:

The biosphere is the global sum of all the ecosystems.

- Biosphere is biological envelope that surrounds the globe, containing and able to support.
- It penetrates and is dependent on the atmosphere, hydrosphere and lithosphere. This denotes the relating of living organism and their interactions with the environment. The biosphere is a relatively thin and incomplete envelope covering most of the world.

STRUCTURE OF ATMOSPHERE

The Atmosphere is divided into layers according to major changes in temperature. Gravity pushes the layers of air down on the earth's surface. This push is called air pressure. 99% of the total mass of the atmosphere is below 32 kilometers.

1. Troposphere: (0 to 12 km) It Contains 75% of the gases in the atmosphere. This is where you live and where weather occurs. As height increases, temperature decreases. The temperature drops about 6.5 degrees Celsius for every kilometer above the earth's surface.

Tropopause: It is located at the top of the troposphere. The temperature remains constant here. This layer separates the troposphere from the stratosphere. We find the jet stream here. These are very strong winds that blow eastward.

2. Stratosphere: (12 to 50 km) It is in the lower part of the stratosphere; the temperature remains constant (-60 degrees Celsius). This layer contains the ozone layer. Ozone acts as a shield for in the earth's surface. It absorbs ultraviolet radiation from the sun. This causes a temperature increase in the upper part of the layer.

Stratopause: The boundary between the stratosphere and the mesosphere, located at an altitude of about 50 km above the Earth's surface. The transitional zone of maximum temperature is between the stratosphere and the mesosphere.

3. Mesosphere: (50 to 80 km) The temperature drops in this layer to about -100 degrees Celsius. This is the coldest region of the atmosphere. This layer protects the earth from meteoroids. They burn up in this area.

Mesopause: The boundary between the upper **mesosphere** and the lower **thermosphere**, approximately 80 km above the Earth's surface. It is the site of the coldest temperatures in the Earth's

atmosphere, with temperatures of -100°C. In the top of the mesosphere which is determined by the appearance of a temperature minimum near an altitude of 80 km.

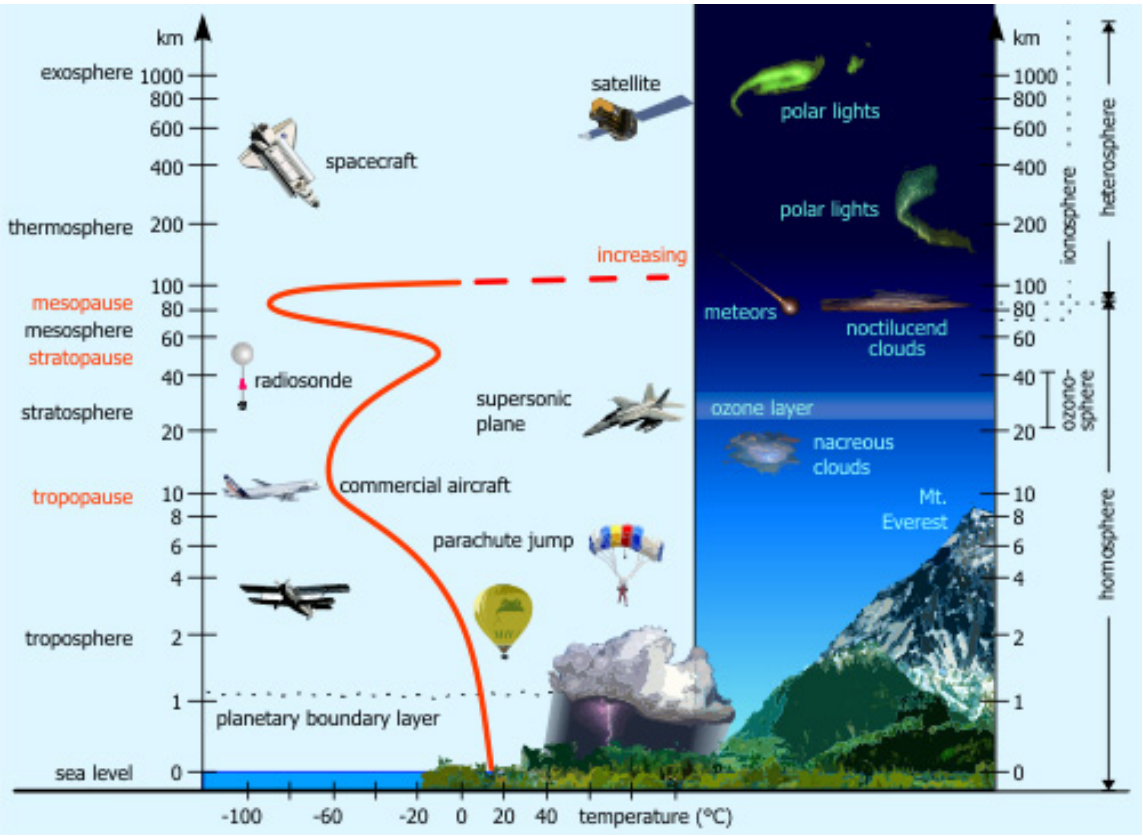
4. Thermosphere - 80 km and up - The air is very thin. Thermosphere means "heat sphere". The temperature is very high in this layer because ultraviolet radiation is turned into heat. Temperatures often reach 2000 degrees Celsius or more.

Thermosphere layer contains:

(i) Ionosphere - This is the lower part of the thermosphere. It extends from about 80 to 550 km. Gas particles absorb ultraviolet and X-ray radiation from the sun. The particles of gas become electrically charged (ions). Radio waves are bounced off the ions and reflect waves back to earth. This generally helps radio communication. However, solar flares can increase the number of ions and can interfere with the transmission of some radio waves.

(ii) Exosphere - the upper part of the thermosphere. It extends from about 550 km for thousands of kilometers. Air is very thin here. This is the area where satellites orbit the earth.

(iii) Magnetosphere - the area around the earth that extends beyond the atmosphere. The earth's magnetic field operates here. It begins at about 1000 km. It is made up of positively charged protons and negatively charged electrons. This traps the particles that are given off by the sun. They are concentrated into belts or layers called the Van Allen radiation belts. The Van Allen belts trap deadly radiation. When large amounts are given off during a solar flare, the particles collide with each other causing the aurora borealis or the northern lights.



COMPOSITION OF ATMOSPHERE

Nitrogen - 78% - Dilutes oxygen and prevents rapid burning at the earth's surface. Living things need it to make proteins. Nitrogen cannot be used directly from the air. The Nitrogen Cycle is nature's way of supplying the needed nitrogen for living things.

Oxygen - 21% - Used by all living things. Essential for respiration. It is necessary for combustion or burning.

Argon - 0.9% - Used in light bulbs.

Carbon Dioxide - 0.03% - Plants use it to make oxygen. Acts as a blanket and prevents the escape of heat into outer space. Scientists are afraid that the buring of fossil fuels such as coal and oil are adding more carbon dioxide to the atmosphere.

Water Vapor - 0.0 to 4.0% - Essential for life processes. Also prevents heat loss from the earth.

Trace gases - gases found only in very small amounts. They include neon, helium, krypton, and xenon.

POLLUTION

Definition

- Environmental pollution is the introduction of contaminants into the environment that causes harm or discomfort to the ecosystem.
- Pollution endangers life on earth.
- A pollutant is any undesirable foreign matter added to the environment.

Types of pollution

Different types of pollution are

- Air Pollution
- Water Pollution
- Soil/Land Pollution
- Radioactive Pollution
- Thermal Pollution

Sources of pollution

- Natural Pollution – Can be caused by natural processes like volcanoes, earthquakes, dust storms, etc.
- Artificial Pollution – Due to human activities

Reasons for pollution

- Population explosion
- Unplanned urbanization
- Deforestation
- Industrial growth
- Domestic and Industrial Wastes
- Harmful emissions

AIR POLLUTION

- Air pollution is the presence of contaminants in the atmosphere which can be injurious to human, animal or plant life.
- Air pollutants are substances in the air which can cause harm to the environment.
- Air pollution is one of the world's worst pollution problems that need to be solved immediately.

Causes of Air Pollution

- Automobile exhausts
- Industrial emissions
- Forest fires
- Fossil fuel burning
- Chlorofluorocarbons

AIR POLLUTANTS – CLASSIFICATION

Pollutants are classified into two types depending upon the form in which they are present after being released into the **environment**.

- Primary pollutants – These are emitted directly into the environment. E.g. smoke, dust, SO_2, CO_2, hydrocarbons, etc
- Secondary pollutants – These are not emitted directly, but form in the air when primary pollutants react. E.g. ground level ozone, PAN (Peroxy Acyl Nitrates), aldehydes, etc.

Pollutants are also classified according to the type of **matter.**

- Gaseous pollutants – Such as oxides of C, N, S, H_2S, Hydrocarbons, etc
- Particulate matter – These are finely divided solids which exist in the form of aerosols such as smoke, dust, fumes, smog, fog, etc.

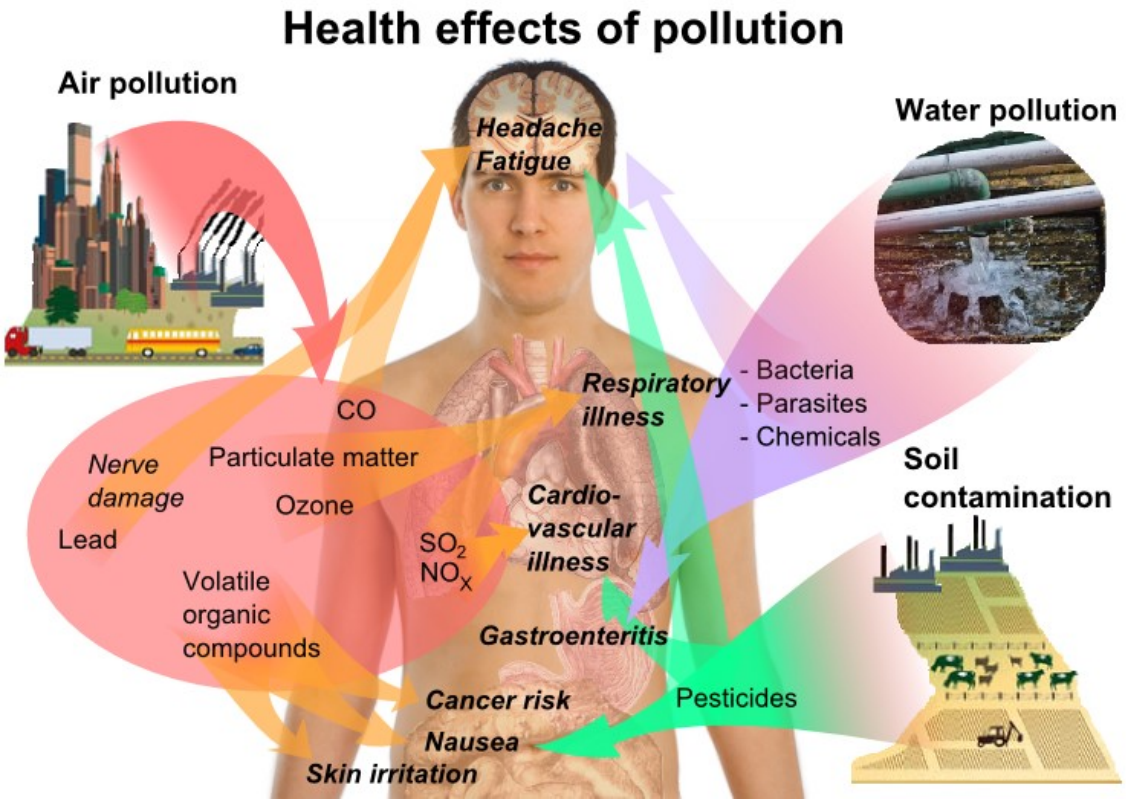
IMPORTANT AIR POLLUTANTS – SOURCES AND EFFECTS

POLLUTANT	SOURCES	EFFECTS
$SO_{2,3}$	Fossil fuels, sulphide ore roasting plants, oxidation of SO_2 in air, etc	Respiratory, cardiac problems, suffocation, etc.
CO, CO_2	Fossil fuel combustion, automobile exhausts, etc	Poisoning, cardiac problems, highly toxic, corrosive, etc
H_2S	Decomposition of wastes, organic matter, petroleum refining, etc.	Corrosive, bad odour, conjunctivitis, poisoning, etc.
NO_x (N_2O, NO, NO_2)	Fuel combustion, explosives industry, acid manufacture, etc.	Plant damage, acid rain, respiratory tract infection, bronchitis, etc.

EFFECTS OF AIR POLLUTION

- Major health effects
- Cardiopulmonary diseases
- Respiratory problems

- Asthma and pneumonia
- Plant growth is affected
- Photochemical smog
- Acid rain causes great damage to buildings, plants and the environment
- Global warming due to green house effect
- Depletion of ozone layer
- Climatic changes



CONTROL OF AIR POLLUTION

- Reducing automobile exhausts
- Strict imposition of laws on factories to curb emission
- Cleaning of exhaust gases after combustion
- Modification of internal combustion engines
- Development of pollution free power sources
- Removing particulate matter from emission

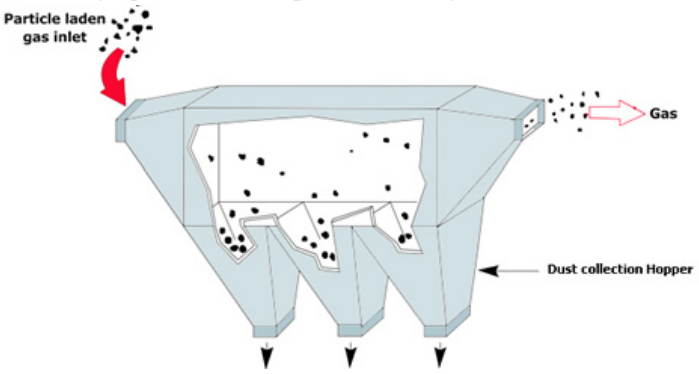
CONTROL DEVICES

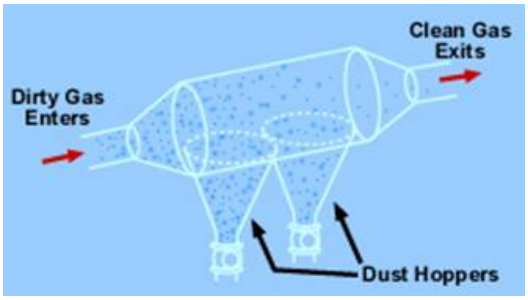
There are several control devices that are used to clean particulate contaminants.

1. Gravity settling chamber
2. Cyclone collector/separator
3. Bag house/Fabric filters
4. Electrostatic Precipitators
5. Wet Scrubbers

1. GRAVITY SETTLING CHAMBER

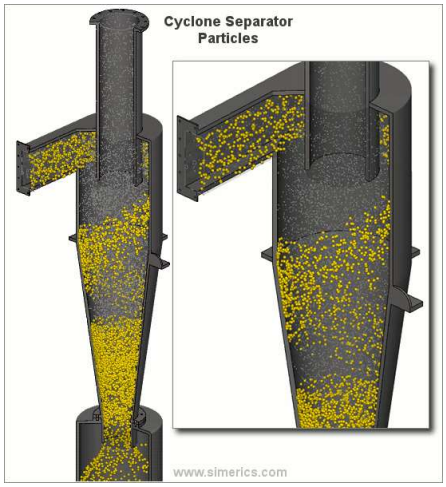
- Settling chambers use the force of gravity to remove solid particles.
- The gas stream enters a chamber where the velocity of the gas is reduced.
- Large particles drop out of the gas and are recollected in hoppers.

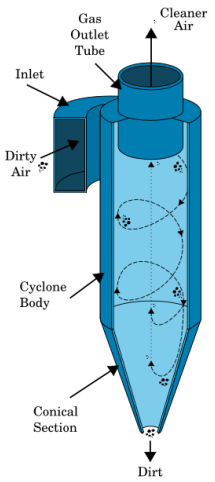




2. CYCLONE SEPARATOR

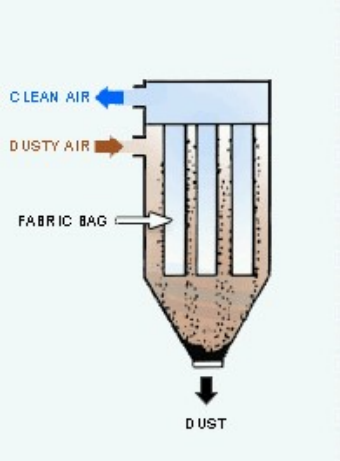
- Cyclone separators remove particulate matter by centrifugal force.
- Dust laden gas is forced into a chamber and the swirling motion creates centrifugal force.
- This causes particles to be thrown against the walls and to drop down into a hopper.
- Clean air passes out from the top.

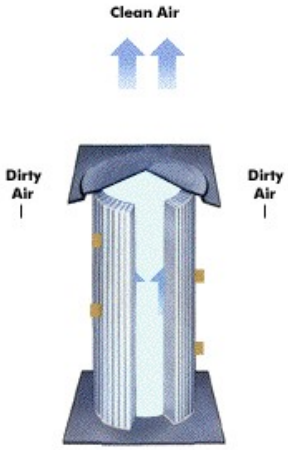




3. BAGHOUSE / FABRIC FILTERS

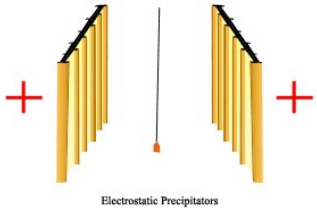
- Dust particles are trapped by filters made of cloth, paper, etc.
- Particles are shaken or blown from the filters down into a hopper.
- Clean gas escapes from the top.





4. ELECTROSTATIC PRECIPITATORS

- Exhaust gases are passed between electrodes which are positively charged.
- This neutralizes the negative charge on the dust particles which are attracted to the electrodes because of the opposite charges.
- Thus, the dust particles settle at the bottom of the chamber.



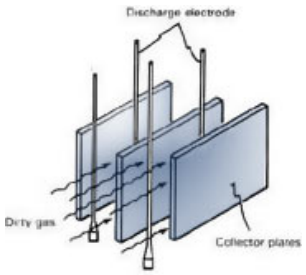
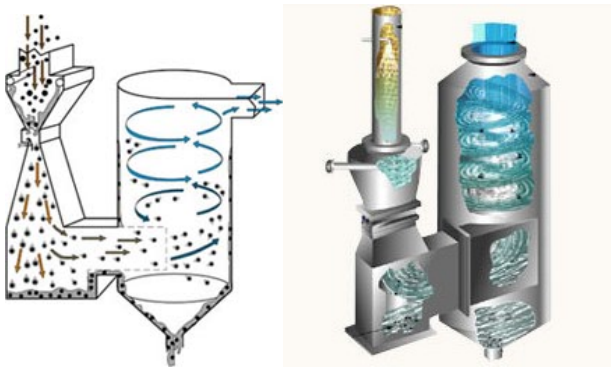


Plate-Type Precipitator

5. WET SCRUBBERS

- In the scrubber, the exhaust gases are controlled by passing the gas stream through a liquid solution.
- The liquid is sprayed onto the incoming gas and the dust particles are mopped up by the liquid.
- The cleaned gas can pass out.
- These are especially useful when the gases are combustible or requires cooling before being let out into the atmosphere.



ENVIRONMENTAL EFFECTS OF AIR POLLUTION

1. ACID RAIN

- The term acid rain means any form of precipitation like rain, fog, snow, or hail that contains harmful substances such as nitrogen and sulphur oxides.
- It is a precipitation that is very acidic – pH<5 which has harmful effects on plants, aquatic animals and buildings.

CAUSES OF ACID RAIN

- Oxides of sulphur (SO_x)
- Oxides of nitrogen (NO_x)

- These are emitted primarily from automobiles and industries.
- It is due to fossil fuel burning which emits these dangerous air pollutants.

Effect of Pollutants

- These pollutants coming down with rain is called wet deposition.
- The same pollutants reaching the ground by gravity during dry intervals are called dry deposition.
- They are carried over thousands of km by wind and get deposited on soil, vegetation, water and property causing great damage.

$$SO_2\ (G) + H_2O\ (L) \rightarrow H_2SO_3\ (L)$$
$$SO_3\ (G) + O_2 + H_2O\ (L) \rightarrow H_2SO_4\ (L)$$
$$NO_3\ (G) + O_2 + H_2O\ (L) \rightarrow HNO_3\ (L)$$
$$HCL\ (G) + H_2O\ (L) \rightarrow HCL\ (AQ)$$

EFFECTS OF ACID RAIN

- Affect the growth of aquatic life
- Retardation of terrestrial growth
- Contamination of air, water and food
- Corrosive to metals, buildings, limestone, marble, etc
- Increases acidity of the soil
- Accumulation of toxic elements

2. OZONE LAYER DEPLETION

Ozone

- Ozone is a bluish gas that is formed by 3 atoms of oxygen.
- When found in the troposphere, it is a dangerous secondary pollutant.
- The highest region of the stratosphere contains about 90% of all ozone.

Ozone Layer

- The ozone layer found in the stratosphere protects the Earth from the UV rays sent down by the sun.
- It absorbs the sun's rays in the stratosphere and thus they do not reach the earth.
- The ozone layer protects both plant and animal life on the planet from the intense heat of the sun.

Ozone Layer Depletion

- **Ozone depletion** refers to the slow, steady decline in the total volume of ozone in the Earth's stratosphere.
- The area in the stratosphere with the thinning ozone is called the OZONE HOLE.
- Ozone layer depletion was first discovered in the 1980s.

Ozone formation

- Dissociation of oxygen in the presence of light to give nascent oxygen.

  $O_2 \rightarrow O + O$

  $O_2 + O \rightarrow O_3$

  $O_3 + O \rightarrow 2O_2$

  Thus, the overall amount of ozone is balanced in the atmosphere.

Causes of Ozone layer Depletion

- Production and emission of CFCs is the major cause.
- A chemical found in spray aerosols used by many industries is another major cause.
- These aerosols contain the oxides of sulphur, nitrogen, etc and CFCs.
- Ozone can be destroyed by free radicals like $OH\cdot$, $NO\cdot$, atomic Cl, atomic Br, etc.

  $O_3 + NO \rightarrow NO_2 + O_2$

  $O_3 + Cl \rightarrow O_2 + ClO$

  $O_3 + ClO \rightarrow Cl + 2O_2$
- The overall effect is a decrease in the amount of ozone.
- Both chlorine and bromine contribute significantly to the destruction of ozone.

Chlorofluoro carbons

- CFCs are used in air conditioning or cooling units, etc
- They do not occur naturally and their presence in the atmosphere is entirely due to human manufacture.
- When they reach the stratosphere, they dissociate to give chlorine atoms.
- These act as catalysts and can destroy thousands of ozone molecules before being removed from the atmosphere.

Health Effects of Ozone Depletion

Health Effects

- Ozone depletion causes more UV light to reach the earth.
- This causes skin cancer
- Genetic abnormalities
- Eye irritations and cataract problems
- Mutation
- Other infectious diseases

Environmental Effects

- Increase in temperature
- More exposure to solar radiation
- Formation of photochemical smog
- Affects the food chain
- Decreases crop yield

Solutions

- Limit the use of CFCs
- In the Montreal Protocol, 31 countries agreed to reduce usage of CFCs.
- Use of alternate chemicals for cooling and air-conditioning units
- Grow plants to increase amount of oxygen
- Use products labeled "Ozone friendly"

3. Green House Effect

Greenhouse

- Greenhouse is a building constructed mainly of glass to grow and protect plants.
- Glass allows visible light to pass through but not infra red rays.
- When light is absorbed into the greenhouse, it is converted to IR radiation which cannot escape.

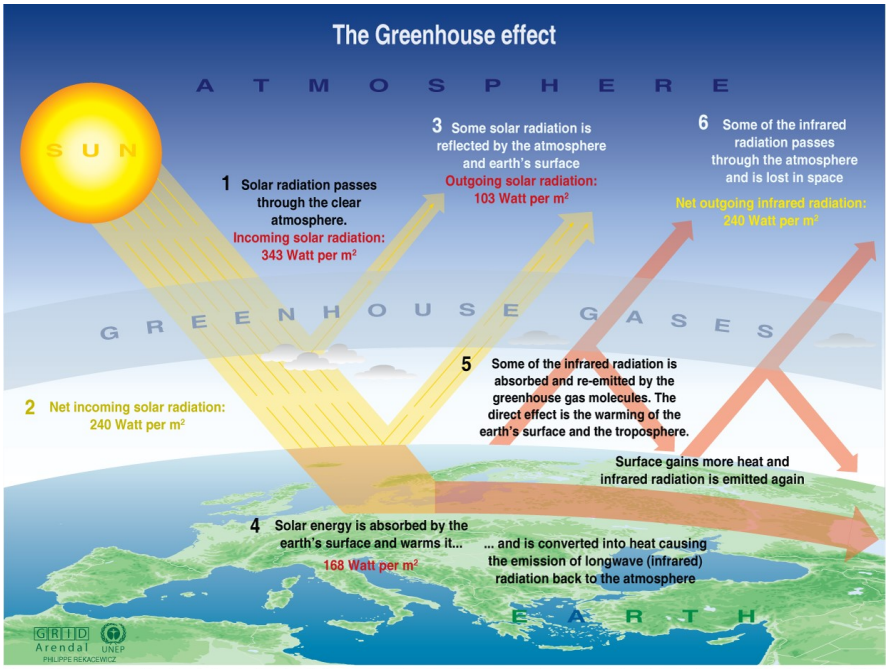
Greenhouse Gases

Major Greenhouse gases are

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Chlorofluoro carbons (CFCs)
- Hydro chlorofluoro carbons (HCFCs)
- Ozone (O_3)
- Oxides of nitrogen (N_2O, NO, NO_2)
- Carbon tetrachloride (CCl_4)

Greenhouse Effect

- Solar energy passes through the atmosphere and reaches the earth.
- About 50% of it is reflected back.
- The absorbed energy is converted to IR radiation and emitted upwards.
- This IR radiation is trapped by the greenhouse gases and thrown back onto the earth's surface.
- This warms up the earth's surface.
- Warming up of the earth's surface due to greenhouse gases is called **Greenhouse Effect**.



Sources: Okanagan university college in Canada, Department of geography, University of Oxford, school of geography; United States Environmental Protection Agency (EPA), Washington; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.

Direct Effects of Global Warming

- Heat waves and periods of unusually warm weather.
- Ocean warming, sea-level rise and coastal flooding.
- Glaciers melting
- Arctic and Antarctic warming
- Unpredictable climatic changes

Indirect Effects

- Spreading disease
- Earlier spring arrival
- Plant and animal range shifts and population changes
- Downpours, heavy snowfalls, and flooding
- Droughts and fires

Solutions

- Stop carbon emission
- Reduce greenhouse gas emissions
- Recycle, reduce and reuse
- Eco-driving and car pooling
- Save electricity
- Grow plants
- Use solar heating
- Conserve natural resources

4. Temperature Inversions

During daylight hours, the sun warms the ground which warms the air near the Earth's surface. The warm air rises as more dense cool air displaces it. Any pollution in the air normally disperses in the turbulence caused by the mixing of the air. When a layer of cool air traps the layer of warm air near the Earth's surface, then the situation is known as a temperature inversion. In this case, pollutants are not dispersed but continue to build up in the still, stagnant air.

Effects of Temperature Inversions

- Inversions play an important role in determining cloud forms, precipitation, and visibility.
- An inversion acts as a cap on the upward movement of air from the layers below. As a result, convection produced by the heating of air from below is **limited** to levels below the inversion. **Diffusion** of dust, smoke, and other air pollutants is likewise limited.
- In regions where a pronounced low-level inversion is present, convective clouds **cannot** grow high enough to produce showers.
- Visibility may be greatly reduced below the inversion due to the accumulation of dust and smoke particles. Because air near the base of an inversion tends to be cool, **fog** is frequently present there.
- Inversions also affect diurnal variations in temperature. Diurnal variations tend to be very **small**.

5. Photochemical smog:

Photochemical smog is a type of smog produced when ultraviolet light from the sun reacts with nitrogen oxides in the atmosphere. It is visible as a brown haze, and is most prominent during the morning and afternoon, especially in densely populated, warm cities. Cities that experience this smog daily include Los Angeles, Sydney, Mexico City, Beijing, and many more.

Sources/Causes:

- Nitric oxide (NO) and nitrogen dioxide (NO_2) are emitted from the combustion of fossil fuels, along with being naturally emitted from things such as volcanoes and forest fires (it is the *immense concentration* of these pollutants within cities that is of the most concern however, as natural emissions tend to spread out over larger areas).
- When exposed to ultraviolet radiation, NO_2 goes through a complex series of reactions with hydrocarbons to produce the components of photochemical smog -- a mixture of **ozone**, **nitric acid**, **aldehydes**, **peroxyacyl nitrates** (**PANs**) and other secondary pollutants.

Effects:

- NO_2, ozone and PANs are called **photochemical oxidants** because they can react with and oxidize certain compounds in the atmosphere or within a person's lungs that are not normally oxidized. Even small traces of these chemicals can affect the respiratory tract of humans and animals, and damage crops and trees.
- Photochemical smog has many adverse effects. When combined with hydrocarbons, the chemicals contained within it form molecules that cause eye irritation. Radicals in the air interfere with the nitrogen cycle by preventing the destruction of ground level ozone. Ground level ozone is also produced which has various effects on the human body Other effects include reduced visibility and respiratory ailments.

WATER POLLUTION

SOURCES OF WATER POLLUTION

- Point Sources
- Non-point Sources

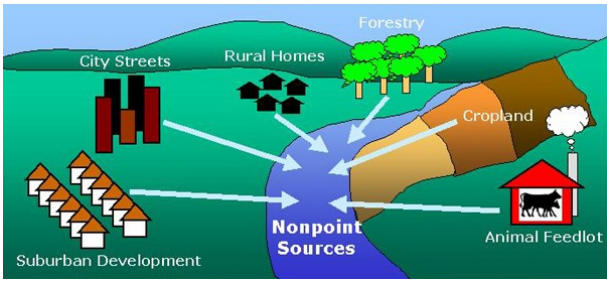
POINT SOURCE POLLUTION

- A point source of pollution is a single identifiable localized source of water pollution.
- It enters the water body through a discrete and confined source such as pipe, ditch, tunnel, etc.
- They include municipal sewage treatment plant discharges and industrial plant discharges, etc.

NONPOINT SOURCE POLLUTION

- Non-point sources are those that affect a water body from several sources.
- As water moves across the land it picks up pollutants, which can then be deposited in water bodies.
- Nonpoint-source pollution is usually found spread out throughout a large area and is difficult to trace the exact origin of these pollutants.

- Nonpoint pollutants include sediment, nutrients, microorganisms and toxics.



Definition

Water pollution: Presence of foreign substances or impurities in water which lowers the water quality and makes it unfit for use.

Sewage: Wastewater released from domestic, commercial and municipal institutions are called Sewage

Effluents: Discharge of wastewater from various industries is termed as Effluents

CAUSES OF WATER POLLUTION

- Sewage and Wastewater
- Eutrophication
- Oil spill
- Industrial waste
- Marine dumping
- Atmospheric deposition
- Underground storage leakages
- Radioactive waste

SIGNS OF WATER POLLUTION

- ✓ Bad taste
- ✓ Offensive odour
- ✓ Decrease in number of fishes
- ✓ Unchecked growth of plants and weeds
- ✓ Oil and grease floating on water surfaces

WATER POLLUTANTS

- Organic and Inorganic compounds
- Mineral salts and toxic chemicals
- Oils and detergents
- Suspended/colloidal/dissolved impurities
- Bacteriological impurities
- Radioactive Pollutants

EFFECTS OF WATER POLLUTION

- Colour, taste, odour, turbidity, alteration of pH, hardness, etc
- Water borne diseases due to the presence of bacteria, virus, fungi, etc
- Presence of heavy metal sulphates, chlorides, nitrates, etc is injurious to health
- Dissolved Oxygen content is removed

CONTROL OF WATER POLLUTION

- ✓ Water management strategies
- ✓ Enforcement of laws to curb water pollution
- ✓ Monitoring pollutant level in water bodies
- ✓ Appropriate treatment methods
- ✓ Judicious use of pesticides and fertilizers

Eutrophication

"Eutrophication is an enrichment of water by nutrient salts that causes structural changes to the ecosystem such as: increased production of algae and aquatic plants, depletion of fish species, general deterioration of water quality and other effects that reduce and preclude use".

Causes

(i) Use of fertilizers: Agricultural practices and the use of fertilizers in the soil contribute to the accumulation of nutrients. When these nutrients reach high concentration levels and the ground is no longer able to assimilate them, they are carried by rain into rivers and groundwater that flow into lakes or seas.

(ii) Discharge of wastewater into water bodies: In various parts of the world, and particularly in developing countries, wastewater is discharged directly into water bodies such as rivers, lakes and seas. The result of this is the release of a high quantity of nutrients which stimulates the disproportionate growth of algae.

(iii) Reduction of self-purification capacity: Over the years, lakes accumulate large quantities of solid material transported by the water (sediments). These sediments are such as to able to absorb large amounts of nutrients and pollutants. Consequently, the accumulation of sediments starts to fill the basin and, increasing the interactions between water and sediment, the resuspension of nutrients present at the bottom of the basin is facilitated. This phenomenon could in fact lead to a further deterioration of water quality, accentuating the processes connected with eutrophication.

Effects

- Abundance of particulate substances (phytoplankton, zooplankton, bacteria, fungi and debris) that determine the turbidity and coloration of the water.
- Abundance of inorganic chemicals such ammonia, nitrites, hydrogen sulphide etc. that in the drinking water treatment plants induce the formation of harmful substances such as nitrosamines suspected of mutagenicity.
- Abundance of organic substances that give the water disagreeable odors or tastes, barely masked by chlorination in the case of drinking water. These substances, moreover, form complex chemical compounds that prevent normal purification processes and are deposited on the walls of the water purifier inlet tubes, accelerating corrosion and limiting the flow rate.
- The water acquires disagreeable odors or tastes (of earth, of rotten fish, of cloves, of watermelon, etc.) due to the presence of particular algae.

- Disappearance or significant reduction of quality fish with very negative effects on fishing.
- Possible affirmation of toxic algae with potential damage to the population and animals drinking the affected water.
- Prohibition of touristic use of the lake and bathing, due to both the foul odor on the shores caused by the presence of certain algae, as well as the turbidity and anything but clean and attractive appearance of the water. bathing is dangerous because certain algae cause skin irritation.
- Reduction of oxygen concentration, especially in the deeper layers of the lake at the end of summer and in autumn.

Control

- Improvement of the purifying performance of wastewater treatment plants, installing tertiary treatment systems to reduce nutrient concentrations.
- Implementation of effective filter ecosystems to remove nitrogen and phosphorus present in the run-off water (such as Phyto-purification plants).
- Reduction of phosphorous in detergents.
- Rationalization of agricultural techniques through proper planning of fertilization and use of slow release fertilizers.
- Use of alternative practices in animal husbandry to limit the production of wastewater.
- Removal and treatment of hypolimnetic water (deep water in contact with the sediments) rich in nutrients since in direct contact with the release source.
- Drainage of the first 10-20 cm of sediment subject to biological reactions and with high phosphorus concentrations.
- Oxygenation of water for restore the ecological conditions, reducing the negative effects of the eutrophic process, such as scarcity of oxygen and formation of toxic compounds deriving from the anaerobic metabolism.
- Chemical precipitation of phosphorous by the addition of iron or aluminium salts or calcium carbonate to the water, which give rise to the precipitation of the respective iron, aluminium or calcium orthophosphates, thereby reducing the negative effects related to the excessive presence of phosphorus in the sediments.