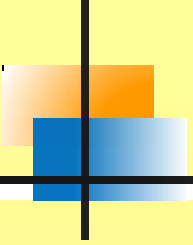
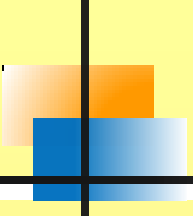
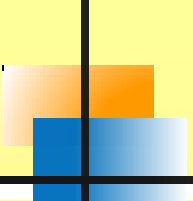




# **POLLUTION AND ENVIRONMENTAL CHANGES**

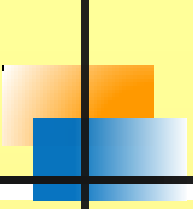
- 
- **Pollution is an undesirable change in the physical, chemical or biological characteristics of air, land and water that will harmfully affect the human life.**
  - **Pollutant is a chemical, geochemical substance or a biological product that deteriorates our natural environment.**
  - **Pollutants can be divided into non-degradable pollutants and biodegradable pollutants.**
  - **Non-degradable pollutants such as aluminium cans, mercury salts , DDT etc. either do not degrade or degrade extremely slowly in the natural environment.**
  - **Biodegradable pollutants are rapidly decomposed by the natural process or some artificial systems that enhance nature's great capacity to decompose and recycle.**

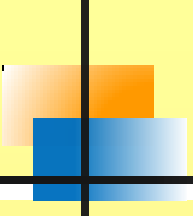
- 
- **Air pollution is the release of any foreign materials or gases which are harmful to man, animals, vegetation or buildings into atmosphere.**
  - **Carbon monoxide is the most poisonous gas which is released from motor vehicles and industries. It is harmful to man because it competes with O<sub>2</sub> for haemoglobin.**
  - **Carbon monoxide has 200 times greater affinity for haemoglobin than oxygen.**
  - **Carbon monoxide makes the most stable combination with haemoglobin of RBCs and form carboxyhaemoglobin.**
  - **Sulphur dioxide (SO<sub>2</sub>) is a gaseous pollutant released during burning of fossil fuels like coal and petroleum etc.**
  - **Taj Mahal of Agra is affected by SO<sub>2</sub> and other air pollutants released by oil refinery of Mathura.**
  - **Sulphur dioxide causes membrane damage, plasmolysis, chlorophyll destruction, metabolic inhibition, growth and yield reduction.**

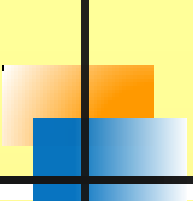
- 
- **Acid rain is the result of  $\text{SO}_2$  and  $\text{NO}_2$  pollution in atmosphere.**
  - **Lichens are bioindicators for air pollution especially  $\text{SO}_2$  pollution.**
  - **Due to  $\text{SO}_2$  pollution , lichens start disappearing from the habitat.**
  - **Therefore absence of lichens indicates atmospheric pollution by sulphur dioxide ( $\text{SO}_2$ ).**
  - **Smog is a mixture of smoke and fog ,which arises from factories, oil refineries , chemical plants etc.**
  - **In bright sunlight, nitrogen oxides hydrocarbons and oxygen interact chemically to form secondary pollutants like ozone and Peroxy Acetyl Nitrate (PAN), which lead to formation of photochemical smog.**
  - **Green House effect is selective energy absorption by carbon dioxide in atmosphere, which allows short wavelength energy to pass through but absorbs longer wavelengths and reflects heat back to earth.**



<b>TYPES OF AIR POLLUTION</b>	<b>GASEOUS USED IN SOURCE</b>	<b>PARTICULATE IMPORTANT POLLUTANTS</b>
	<b>Chemical Plants/ Petroleum Refineries/ Cement Factories Paper Mills/ Fertilizer Factories / Glass Manufacture</b>	<b>H<sub>2</sub>S, SO<sub>2</sub> , fluorides, organic vapours, dust.</b>
<b>Waste recovery</b>	<b>Scrap metals, rendering plants</b>	<b>Smoke, odorous metal fumes, soot , etc.</b>
<b>Transportation (mobile combustion sources)</b>	<b>Automobile, aeroplanes , railways.</b>	<b>Aerosols (CCl<sub>2</sub>, F<sub>2</sub> and CC<sub>13</sub>F) , smoke, CO,NO, Pb, etc., particulate lead Pb(CH<sub>3</sub>)<sub>4</sub> and Pb (C<sub>2</sub>H<sub>5</sub>)<sub>4</sub>, Peroxyacetyl nitrate (PAN) , benzopyrene.</b>
<b>Spray painting, solvent extraction, inks, solvent cleaning.</b>	<b>Furniture appliances dyeing/ printing /dry cleaning.</b>	<b>Hydrocarbons and organic vapours.</b>
<b>Nuclear explosion</b>	<b>A- and H- Bomb testing</b>	<b>Radioactive fallouts , Sr-90, C<sub>3</sub>- 137, C-14.</b>
<b>Crop spraying</b>	<b>Pest and weed control</b>	<b>Organophosphates , Chlorinated hydrocarbons , lead, arsenic.</b>
<b>Burning of fossil fuels</b>	<b>Domestic use, thermal power plant</b>	<b>CO, CO<sub>2</sub>, SO<sub>2</sub>,SO<sub>3</sub>, NO, and NO<sub>2</sub>.</b>
<b>Ore preparation</b>	<b>Crushing/grinding and screening</b>	<b>Uranium and Beryllium dust, other particulates Argon-41, I-131 metal dust , fly ash, soot Cd, Hg, Ni, As etc.</b>
<b>Metallurgical plants</b>	<b>Metallurgical industries, Aluminium refineries, Zn smelters.</b>	<b>Metal fumes , Zn , Pb, Cd, fluoride and particulate matter.</b>
<b>Burning of plastics and its processing</b>	<b>Steel plants in industries</b>	<b>Toxic polychlorinated biphenyl (PCBs).</b>

- 
- **Green house effect is caused by carbon dioxide , methane, nitrogen dioxide and water vapour.**
  - **Green house effect is related to global warming.**
  - **Ozone layer present in stratosphere protects us from harmful ultra violet radiations.**
  - **Such ozone layer is being destroyed by some pollutants like chlorofluorocarbons.**
  - **Water Pollution is the undesirable presence of some foreign organic , inorganic , biological, radiological or physical substances in water.**
  - **Mercury poisoning is the cause of Minamata disease. This disease was first observe from Minamata city, Japan in 1953, when more than 100 persons died or suffered serious nervous damage from eating fish taken from Minamata Bay.**
  - **Cadmium poisoning is the cause of itai-itai disease in Japan. This disease is characterized by bone softening.**

- 
- **Excess nitrate with haemoglobin forms nonfunctional methaemoglobin that inhibits O<sub>2</sub> transport. It is known as methaemoglobinemia or Blue-baby syndrome.**
  - **Skeletal fluorosis is caused by excess amount of fluoride in drinking water.**
  - **Black-foot disease is caused by chronic exposure or arsenic.**
  - **Biological Oxygen Demand (BOD) is the amount of oxygen used for biochemical oxidation by micro-organisms in a unit volume of water. Polluted water has higher BOD.**
  - **Chemical Oxygen Demand (COD) indicates total oxygen requirement of all the O<sub>2</sub> consuming pollutant materials present in water. Its value is higher than BOD.**
  - **Both BOD and COD are used in measurement of polluted water.**
  - **Eutrophication is increase in amount of nutrients in water. It leads to organic loading and depletion of oxygen.**

- 
- **Persistent pesticides such as DDT, have a long life time in the environment.**
  - **They are fat soluble and generally non-biodegradable, therefore they can get incorporated into the food chain and ultimately deposited in the fatty tissues of animals and humans.**
  - **The magnification of these pesticides in successive higher trophic levels is known as biological magnification.**
  - **Soil pollution is alternation in soil caused by removal or addition of substances and factors, which decrease its productivity, quality of plants and ground water.**
  - **Three types of soil pollutants may be found in nature-**
    - **Pollutants that are washed out of atmosphere, when came in contact with it, may pollute the soil.**
    - **Pesticides ,insecticides and biocides sprayed over the crops may find their way alongwith water to the soil.**





## WATER POLLUTION

### Waste water

From houses, commercial and industrial establishments connected to sewerage system carry human excreta ,left over of food, detergents , antiseptics, etc.

It is rich in organic matter, bacteria and other biological pollutants and is decomposable only by aerobic microbial action. This reduces  $O_2$  in water and is the cause of death of fish; and foul smell.  $O_2$  is measured in terms of Biochemical Oxygen Demand (BOD) and is expressed as mg/L of water.

### Industrial Wastes

(i) Chemical and metallurgical industries

Suspended solids, iron cyanide, oil , phenol, naphtha. Thiocyanate, Cd, Hg, Cr, Cu, acids ,alkalis, nitrates of metals, aromatic, compounds, organic acids, dyes, etc.

(ii) Pharmaceutical

Proteins, organic solvent, intermediate products, antibiotics, drugs.

(iii) Paper and pulp Industry

Cellulose fibres, organic acids, bleaching colours, sulphides.

(iv) Soap and detergents

Fats/fatty acids, hydrocarbons, glycerol, tertiary ammonium compounds.

(v) Food Processing

Highly putrescible organic matter.

### Agriculture sources

Synthetic fertilizers, pesticides.

### Thermal

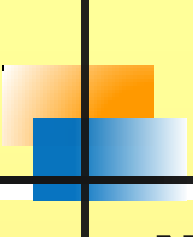
Water used for cooling of nuclear and thermal plants industrial machines.

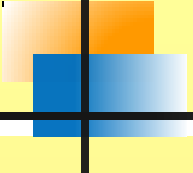
### Underground water pollution

Use of fertilizers/pesticides, septic tank sewerage.

### Marine pollution

Garbage disposal, radioactive waste, oil slicks ,grease, detergents etc.

- 
- **Nitrogenous fertilizers , mixed with soil to increase its productivity may sometimes have negative effect on the soil.**
  - **One of the major soil pollution problem in large cities is the disposal of plastics because plastic articles are non-biodegradable.**
  - **Over-grazing is an example of negative pollution ,in which , desirable substances or plants are removed.**
  - **Excessive use of fertilizers , biocides, etc. causes positive pollution. Abundance of these substances causes reduction in soil fertility.**
  - **Noise pollution means the unwanted sound dumped into the atmosphere.**
  - **The main sources of noise pollution are factories and industries , transportation (air, rail and road), community and religious activities.**



## **TYPES OF POLLUTANTS**

## **CHARACTERISTICS AND EFFECTS**

**Pesticides**

Insecticides , fungicides, algicides , rodenticides etc., reduce pest population but also other biota. Degraded products of pesticides are bioaccumulated by plants and passed on to food chain/web.

**Fertilizers**

Excessive use of fertilizers kills useful microbes, increases salinity, reduces soil productivity.

**Manures**

Excreta of live stock/humans/sewage, sludge pollutes/contaminates soil; crops from such areas if consumed are an important health hazard.

**Radioactive Waste**

Of nuclear plants, laboratories using them and from mining activities gets into soil and causes mutations/genomic changes, acid rain; weathering of rocks pollute soil.

**Other pollutants**

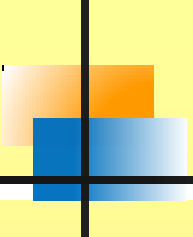
Heavy metal toxicants e.g., Hg, Zn, Ni, Cd, Ca, Cyanide.

**Industrial waste**

Thiocyanate acids, alkalies ,effluent water used for thermal cooling kill biota.

**Salination**

Salts in flood water,  
Excessive use of alkaline fertilizer, poor drainage of soil.

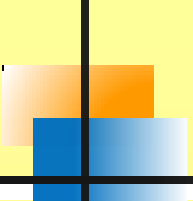
- 
- **Loudness is the strength of sensation of sound perceived by the individual. It is measured in decibels (dB).**
  - **Sounds beyond 80 dB can be safely regarded as pollutant as it harms hearing system.**
  - **The WHO has fixed 45 dB as the safe noise level for a city.**
  - **Loudness is also expressed in sones.**

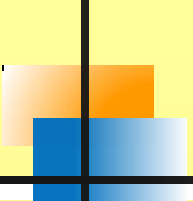
**1 sone = loudness of 40 dB sound pressure at 1000 Hz**

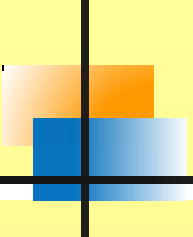
- **Frequency is the number of vibrations per second. It is denoted in hertz (Hz).**
- **The noise has adverse effects on man. It reduces the hearing capacity, flushing the skin and constriction of stomach muscles of man.**
- **Deafness can be caused due to continuous noise exposure.**
- **Noise also produces ulcers, headache, heart diseases, high blood pressure, nervousness, etc.**



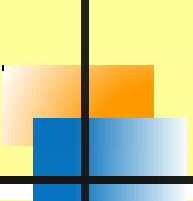
<b>Sources</b>	<b>Sound Level in (dB)</b>	<b>Sound Level</b>
<b>Audible sound</b>	<b>10 dB</b>	<b>Very quiet</b>
<b>Audible whisper</b>	<b>20 dB</b>	<b>Very quiet</b>
<b>Library place</b>	<b>30 dB</b>	<b>Very quiet</b>
<b>Normal conversation</b>	<b>35- 60 dB</b>	<b>Moderately loud</b>
<b>Heavy street traffic</b>	<b>60 - 80 dB</b>	<b>Very loud</b>
<b>Boiler factories</b>	<b>120 dB</b>	<b>Uncomfortably loud</b>
<b>Jet planes</b>	<b>About 150 dB</b>	<b>Painful</b>
<b>Rocket engine</b>	<b>About 180 dB</b>	<b>Painful</b>

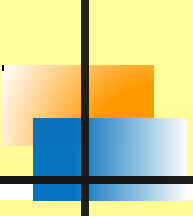
- 
- **Green-house effect is a naturally occurring phenomenon that is responsible for heating of earth's surface and atmosphere.**
  - **Without green-house effect the average temperature of earth surface would have been a chilly  $-18^{\circ}\text{C}$  rather than the present average of  $15^{\circ}\text{C}$ .**
  - **Main gases responsible for green-house effect are Carbon dioxide (60% contribution), Methane (20% contribution), Chlorofluoro Carbon [CFCs] (14% contribution), and  $\text{N}_2\text{O}$  (6% contribution).**
  - **Increase in the level of green-house gases has led to considerable heating of earth leading to Global warming.**
  - **During the past century, the temperature of earth has increased by  $0.6^{\circ}\text{C}$  most of it during the last three decades.**
  - **Scientists believe that global warming is leading to deleterious changes in the environment and resulting in odd climatic changes, thus leading to increased melting of polar ice caps as well as of other places like Himalayan snow caps.**

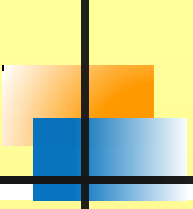
- 
- **Reducing use of fossil fuels, improving efficiency of energy usage, reducing deforestation, planting trees and slowing down the growth of human population can control the global warming.**
  - **Increase in the amount of ozone in the lower atmosphere (troposphere), where it is formed from oxygen is responsible for ozone depletion.**
  - **Ozone gas is formed by the action of UV rays on molecular oxygen, and also degraded into molecular oxygen in the stratosphere.**
  - **Increase in the amount of ozone in the upper atmosphere (stratosphere) is useful because it acts as a shield absorbing ultra violet radiations from the sun.**
  - **Ultra violet rays are highly injurious to living organisms since DNA and proteins of living organisms preferentially absorb UV rays and its high energy breaks the chemical bonds within these molecules.**

- 
- **Ultra violet-B radiations damage DNA and can cause mutation.**
  - **Ultra violet rays can cause ageing of skin , damage to skin cells and various types of cancers.**
  - **In human eye, cornea absorbs UV-B radiation, and high dose of UV-B causes inflammation of cornea, called snow-blindness cataract. Such exposure may also permanently damage the cornea.**
  - **Chlorofluorocarbons (CFCs) , methane and  $\text{NO}_2$  are responsible for degradation of ozone layer's in stratosphere or formation of ozone hole.**
  - **Ozone hole is present maximum over the Antarctic region, where ozone depletion resulted in the formation of a large area of thinned ozone layer.**
  - **CFCs widely used as refrigerants, discharged in the lower part of atmosphere move upward and reach in stratosphere.**
  - **In stratosphere ,UV rays act on CFCs and release Cl atoms.**



- 
- **Cl degrades ozone releasing molecular oxygen with these atoms acting merely as catalysis.**
  - **Cl atoms are not consumed in the reaction and they have permanent and continuing effects on ozone levels.**
  - **Montreal protocol was signed at Montreal (Canada) in 1987 to control the emission of ozone depleting substances.**
  - **Deforestation is the conversion of forested areas to non-forested ones.**
  - **In India at the beginning of 20<sup>th</sup> century, forests covered about 30% of total land but at end of the century , it was shrunk to 19.4%.**
  - **National Forest Policy in 1988 of India has recommended 33% forest cover for plains and 67% for hills.**
  - **Cutting of trees for timber, fire wood, cattle ranching and Jhum cultivation are responsible for deforestation.**
  - **Slash and burn agriculture, commonly called as Jhum cultivation is common in North-Eastern states of India.**

- 
- **In Jhum cultivation, the farmers cut down the trees of the forest and burn the plant remains.**
  - **The ash is used as a fertilizer and the land is then used for farming or cattle grazing.**
  - **After cultivation ,the area is left for several years so as to allow its recovery.**
  - **The farmers then move on to other areas and repeat this process.**
  - **Reforestation is the process of restoring a forest that once existed but was removed in the past.**
  - **In 1973 , the Chipko Movement was launched by Chandi Prasad Bhatt and Sunder Lal Bahuguna in Chamoli district of Garhwal Himalayas.**
  - **By this movement ,local women showed enormous bravery in protecting trees from the axe of contractors by hugging the trees.**

- 
- **Fly ash is absent in automobile exhausts.**
  - **The atmosphere in big cities is polluted mostly by automobile exhausts.**
  - **Extensive use of chemical fertilizers may lead to Eutrophication of nearby water bodies.**
  - **In Stratosphere of the atmosphere , ozone depletion is most harmful.**
  - **Montreal Protocol was signed to recognize the deleterious affects of ozone depletion.**
  - **In a coal fired power plant, electrostatic precipitators are installed to control emission of SPM.**
  - **Indicator plants, which can be used to indicate atmospheric pollution by SO<sub>2</sub> are Lichens like *Usnea*.**
  - **Pseudomonas is a genetically engineered micro-organism used successfully in biomediation of oil spills.**
  - **CO<sub>2</sub> is normally not an important atmospheric pollutant.**



**Thanks...**