ENVIRONMENTAL ISSUES

Pollution:

❖ Any undesirable change in the physical, chemical or biolgical features of air, land and water is called **pollution.** Any physical, chemical or biotic components/agents or nonliving substance that are responsible to bring about an undesirable change in the environment is called **pollutant**. **e.g. heat, noise, SO_2 etc.**

Types of pollutants :

(I) On the basis of persistence or form of occurrence :

(i) Primary pollutants : They remain in the environment in the same form in which they are released
e.g. CO, Glasses, Plastic, DDT.

(ii) Secondary pollutants: These are synthesized by the reaction amongst the primary pollutants. **e.g. PAN (peroxyacyl nitrates), O_3 .**

(II) On the basis of natural degradation:

(i) Biodegradable : These are decomposed by natural action or micro organisms. **e.g. Sewage, Livestock, Garbage.**

(ii) Non biodegradable : They do not decompose naturally or their degradation is quite slow. **e.g. plastics, broken glass, DDT, cans, phenolic compounds.**

(III) On the basis of quantity or nature :

(i) Qualitative pollutants : These do not occur in nature but are added in nature only by human activites. **e.g. DDT, fungicides, herbicides,**

(ii) Quantitative pollutants: These become pollutants only when their concentration reaches beyond a threshold value in the environment. **e.g. CO, CO_2, NO_x.**

Types of pollution:

(I) On the basis of origin :

(i) Natural : It is due to natural sources like carbon monoxide from plants and animals, nitrogen oxides, ozone from volcanic eruptions, methane by cattle and paddy fields, emission of natural gas, ultraviolet rays. It is about 99.95% of pollution.

(ii) Man made or anthropogenic: It is due to human activites like burning of fossil fuels, deforestation, sewage effluents, mining, fertilizers, and pesticides. It is about 0.05% of pollution.

(II) On the basis of physical nature of the pollutants:

(A) Air pollution:

❖ It is any undesirable change in the quality of air due to addition of foreign particles or gases or pollutants in the air is called air pollution that have adverse effect on man, animals and vegetation.

Causes of Air pollution:

❖ There are two main categories of air pollutants
(I) Gases
(II) Particulate matter

❖ **52%** pollution takes place through **CO, 18%** by **SO_2, 12%** by **Hydrocarbons**, **10%** by **Particulate matter, 6%** by **Nitrogen oxides** and **2%** by **others**.

Primary Air pollutants and their effect:

(1) CO:

- **Source :** Incomplete combustion of fossil fuel, metallurgical operation plants as well as animals. Other sources are cigaratte, 50% CO emission by Automobiles.
- In human **CO** combines with **haemoglobin** in blood and form **carboxyhaemoglobin** that reduces oxygen carrying capacity of blood.
- CO causes headache, Giddyness, cardiovascular malfunctioning, Asphyxia.

(2) Hydrocarbons or VOC, (Volatile organic carbons) :

Source : Released by combustion of fossil fuel or by naturally.

- Benzene is carcinogenic.
- **PAH (Polynuclear aromatic Hydrocarbons) and formaldehyde** cause irritation of eyes, burning in mucous membrane, bronchial constriction, excessive secretion of mucus, tearing of alveoli.
- **Methane** is released in atmosphere by **paddy field (40%)**, Cattles or by combustion of fossil fuel in vehicles, industries, kitchen etc. In atmosphere methane is converted in to CO_2 so, Methane is green house gas.

(3) SO_2:

Source : It is released by smelting of metallic ores containing sulphur, paper making, refining of petroleum volcanic eruption, burning of petroleum, coal industries, motor vehicles thermal plants. In the atmosphere SO_2 oxidises to SO_3 and combines with water to form **H_2SO_3 and H_2SO_4**. It is the cause of **acid rain**.

- It causes chlorosis and necrosis of vegetation, in human it causes irritation to eyes and injury to mucous membrane and respiratory tract (asthma, bronchitis, emphysema). It is also responsible for discoluration and deterioration of buildings, sculptures, painted surfaces, fabrics, paper, leather.

Resonate the Concept

(1) Lichen is indicator of SO_2 pollution.

(2) The reported threat toTajmahal of Agra from nearby oil refinery of Mathura is on account of SO_2.

(4) Oxides of Nitrogen (NO_x) :

Source : Formed naturally by biological and nonbiolgical activities from nitrates, nitrites, electric storms, high energy radiations and solar flares. Combustion process of industries, automobiles, incinerators, forest fire, denitrifying bacteria and nitrogen fertilizers.

- Nitrogen oxides produce necrosis, defoliation, lesions, die back and death of many plants. They form **photochemical smog** along with **Hydrocarbons** in the presence of sun light. They form **HNO_3** that causes **acid rain**. In human it causes eye irritation, blood congestion, respiratory troubles, lung edema. They form **brown air** in traffic congested city.

(5) Particulate matter : It involves following types

(i) Settleable : It is larger than **10μm**, persist in air for less than one day.

(ii) Suspended : Diameter is **less than 10μm** remain suspended for weeks **Ex: dust (more than 1μm), aerosol (less than 1μm), mist (liquid, more than 1μm), flyash, soot, smoke, spores, fibres, pollen grains. Suspended particulate matter (SPM)** of **2.5μm or less** in troposphere cause breathing problems like chronic bronchitis, bronchial asthma & even death.

Secondary Air pollutants and their effects:

- These are produced by reaction amongst the primary pollutants.

Key concept for AIIMS & NEET

(1) Smog (smoke + fog) :

It is opaque or dark fog containing condensed water vapours, smoke, gases (SO_2, H_2S, NO_2, etc) dust. The term **smog** coined by **Des voeux, (1911).** Smog is of two types.

(i) Classical smog (London smog) :

It is dark brown and opaque formed in **reducing atmosphere**. It requires **low temperature, oxides of sulphur, smoke, dust particles, H_2S fuel combustion of coal.**

- It was first reported in London in 1952. About 4000 people died in London in 1952 due to inhalation of H_2SO_4 vapour with fog.

(ii) Photochemical smog(Los Angeles smog) :

It is grey / yellowish brown and opaque formed in **oxidising atmosphere.** It is **light induced smog.**

- It requires **high temperature, solar energy, oxides of nitrogen and hydrocarbons** combining from automobile exhausts. It forms around mid day of summer months in congested metropolitan cities. It has **O_3, PAN, oxides of nitrogen (NO_x).**
- **PAN** inhibits the **photosystem II**, spoil enzyme systems, inhibit the chlorophyll formation in plants. Irritation in eyes & respiratory distress in human.
- **O_3** corrodes the heritage building surface and damages marble statue.

Control of Air pollution:

(1) Control of Particulate Matter: It is performed by two types of devices

(a) Arresters **(b) Scrubbers**

(a) Arresters: They are used to separate particulate pollutants.

Arresters involve following types

(i) Cyclonic Separators : Centrifugal force is used for settling of particulates. For this purpose, particulate rich air is passed into a chamber clean air is released after settling of particulates.

(ii) Trajectory Separators : Dirty air is thrown into a collecting chamber in the form of an oblique jet.

(iii) Electrostatic Precipitators (ESPs) : They are the most efficient devices where particles present in dirty air are first charged electrically and then allowed to settle down over differently charged platforms.

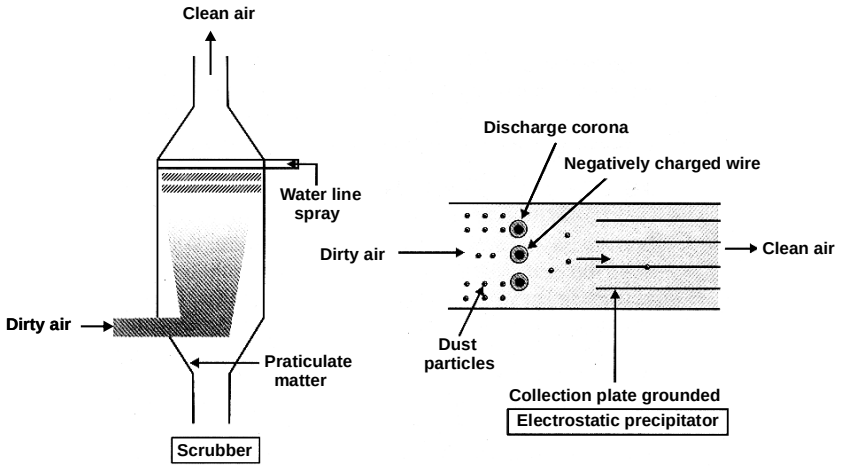

Fig : Electrostatic precipitator

It can remove over 99 per cent particulate matter present in the exhaust from a thermal power plant. It has electrode wires that are maintained at several thousand volts, which produce a corona that releases electrons.

These electrons attach to dust particles giving them a net negative charge. The collecting plates are grounded and attract the charged dust particles. The velocity of air between the plates must be low enough to allow the dust to fall.

(b) Scrubbers : These are employed to clean both dust and gases they are of two types dry and wet.

A scrubber can remove gases like sulphur dioxide. In a scrubber, the exhaust is passed through a spray of water or lime.

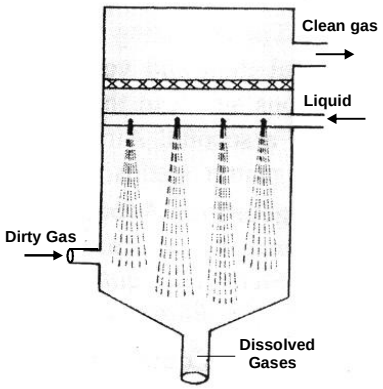

Fig:- Scrubber

Controlling Vehicular air pollutants (Case study of Delhi) :

The maximum number of vehicles are found in Delhi in India. Daily 200 new vehicles are added. In 1990 the total number of cars in delhi were more than the combined number of the states of West bengal and Gujrat. **80% of air pollution** in **urban areas** is due to **automobiles**, Delhi ranks fourth amongst the **41 most polluted** cities of the world. It causes burning eyes and respiratory discomforts.

- A public interest litigation (PIL) was filed in supreme Court.The latter directed the government to take suitable measures for reducing pollution caused by automobiles through.
  (a) Switch over of public transport from diesel / petrol to **CNG**.
  (b) Unleaded petrol should be used in vehicles.
  (c) Old vehicles must be banned.
  (d) Catalytic converters are fitted in the vehicles.
- Delhi became the first city of the world to use **CNG** for its public transport system and autorickshaws by the end of 2002.
- The main problem with CNG is in laying down pipelines to deliver CNG through distribution pipes/pumps to ensure uninterrupted supply.
- Government of India has formulated a new fuel policy to reduce vehicular pollution. As per **Euro II norms. sulphur** content of **diesel** should not be more than **350 ppm** while that of **petrol** should not be more than **150 ppm**. **Aromatic hydrocarbon** content is pegged at **42%** of **fuel**. These norms (initially in 11 cities) have been applicable throughout the country from **I April 2005**. From this date **Euro III norms** have become applicable in **eleven cities–Delhi, Agra, Kanpur, Ahmedabad, Surat, Mumbai, Pune, Hyderabad, Banglore, Chennai and Kolkata.** By **I April 2010, Euro IV norms** will be applicable in these cities while **Euro III** complaint automobiles and fuel will be applicable in rest of the country from this date. Sulphur content of petrol is to be reduced to 50 ppm while that of diesel is to be brought down to 35 ppm.

Resonate the Concept

- Catalytic converters, having expensive metals namely Platinum-Palladium and Rhodium as the catalysts, are fitted into automobiles for reducing emission of poisonous gases. As the exhaust passes through the catalytic converter, unburnt hydrocarbons are converted into carbon dioxide and water, and carbon monoxide and nitric oxide are changed to carbon dioxide and nitrogen gas, respectively. Motor vehicles equipped with catalytic converter should use unleaded petrol because lead in the petrol inactivates the catalyst.

Acid rain :

- Term acid rain was coined by **Robert August**.
- It is other form of precipitation with a **pH of less 5.** (pH of Normal rain is 5·6 – 6·5).
- Acids of Atm is deposited over earth in two forms.

  (a) Wet deposition **(b) Dry deposition**

  Causes of acid rain :

  Large scale emission of Acidic gases in to the atmosphere from thermal power plants, industries & automobiles. The common emissions are SO_2, NO_X. volatile organic carbons (VOC_S) and Hydrogen chloride, NO_X are also formed in atmosphere through lightening.
- SO_2 & NO_X are converted into sulphuric acid & Nitric acid by combining with O_2 & water in atmosphere.

  $2SO_2 + O_2 \longrightarrow 2SO_3$

  $SO_3 + H_2O \longrightarrow H_2SO_4$

  $2NO + [0] \longrightarrow N_2O_5$

  $N_2O_5 + H_2O \longrightarrow 2HNO_3$
- Acid rain demages plants by direct effect on foliage and growing points-Chlorosis, Necrosis, Defoliation, Dieback.
- Acid rain corrodes metals, marble, Painted surfaces slate, stone,The phenomenon is called **'stone leprosy'**

Key concept for AIIMS & NEET

Ozone depletion:

- Ozone layer is found in stratosphere as ozonosphere at altitude of **23-25km** over equator.
- **'Bad ozone'** lies in **troposphere** that harms plants & animals **'Good ozone'** is formed in upper part of atmosphere called the **stratosphere.**
- It absorbs ultraviolet radiation from the sun.
- UV rays are injurious to living organisms. These rays are absorbed by DNA & proteins of living beings and high energy of UV rays breaks the chemical bonds with in these molecules. Ozone is continuously formed by the action of UV rays on molecular oxygen, and also degraded in to molecular oxygen in the stratosphere.
- The balance between production & degradation of ozone has been disrupted due to enhancements of ozone degradation by CFCs (chlorofluoro carbons).

Ozone Hole:

- Depletion in the concentration of ozone over a restricted area as spring time decline over antarctica is called ozone hole.
- Ozone hole discovered over antarctica by Farmen at.at 1985 & also coined this term. It is quite large (23 million square km in 1992 and 28·3 million square km in 2000).

Year	Thickness of ozone over antarctica
1956–70	280–325 DU (1DU = 1 PPb)
1979	225 DU
1985	136 DU
1994	94 DU

ODS (OZONE DEPLETION SUBSTANCES)

- These substance are responsible to destroy ozone present in the stratosphere.
  The **major ODS** are **CFCs (14% of total depletion), Nitrogen oxides (3·5% depletion), Sulphur dioxide, Halon, Carbon Tetra Chloride, Methyl Chloroform, Chlorine** etc, some of them are released by jets flying in the stratosphere & rockets being fired into space.
- Miximum ozone depleting potential or ODP is of CFCs due to release of chlorine by it.
  A single chlorine atom converts 1 lakh molecules of ozone into oxygen (reaction discovered byh Molina and Rowland), chlorine action over ozone is chainmictic.
- Consequently, Chlorofluorocarbons (CFCs) are being replaced by hydrofluorocarbons (HFCs) and Hydrochlorofluorocarbons ($HCIFC_5$), CCl_4, halon & methyl chloroform also deplete ozone by a similar method.
  Nitric oxide (NO) and other gases released by jets directly react with ozone to form oxygen.

(i) $CFCl_3 \xrightarrow{UV-C} CFCl_2 + Cl$ **(ii)** $CFCl_2 \xrightarrow{UV-C} CFCl + Cl$

(iii) $Cl + O_3 \longrightarrow ClO + O_2$ **(iii)** $ClO + O_3 \longrightarrow Cl + 2O_2$

Effects of ozone depletion:

(i) It causes skin cancers.
(ii) Cornea absorbs UV-B radiations and produce **snow blindness** (cornea becomes inflamed), cataract
(iii) Many land animals would become blind.
(iv) Damage to nucleic acids will increase resulting in higher number of mutations.
(v) It reduces Immune System

(B) Water pollution:

Defination : Any undesirable change in physical, chemical and biological properties of water resulting the letter is unfit for human use and growth and development of aquatic organisms.

Factors :

(i) Biological : e.g. virus, bacteria, Protozoans, Helminths.
(ii) Chemical : e.g. Organic waste, pesticides (DDT, BHC), Industrial effluents, Detergents etc.
(iii) Physical : e.g. Hot water, oil spills.

Sources of water pollution :

(1) Natural : Clay and silt from soil erosion. Leaching of Minerals etc.
(2) Anthropogenic : Menmade pollution.
(a) Domestic waste : Sewage. **(b) Industrial waste :** Hotwater.
(c) Surface run off : From agriculture field. **(d) Oil spills :** Leakage of oil tankers.

Domestic sewage & its effects:

It contains Human and animal wastes, industrial effluents, Detergents.

Raw sewage has variety of pathogen and Micro-organisms. The former initiates growth of micro-organism that represent sewage fungus.

The decomposition of organic waste by microbial activity is called **putrescibility**. Degree of impurity of water due to organic matter is measured in terms of BOD.

Key concept for AIIMS & NEET

- **BOD (Biochemical oxygen Demand) :** Amount of oxygen in milligrams required for five days in one litre water at 20C^{o} for micro-organisms to metabolise organic waste.
- High value of BOD (Biochemical Oxygen Demand) indicates water is highly polluted. **(AIPMT -2015)**
- **COD (Chemical oxygen Demand) :** It is amount of oxygen required to oxidized all the reducing substances present in water BOD also involves in COD.
- Both BOD and COD decrease the amount of dissolved oxygen or **DO** in water, The value of **DO** in less polluted water is **8 mg / L and < 4mg / L** in highly polluted water.

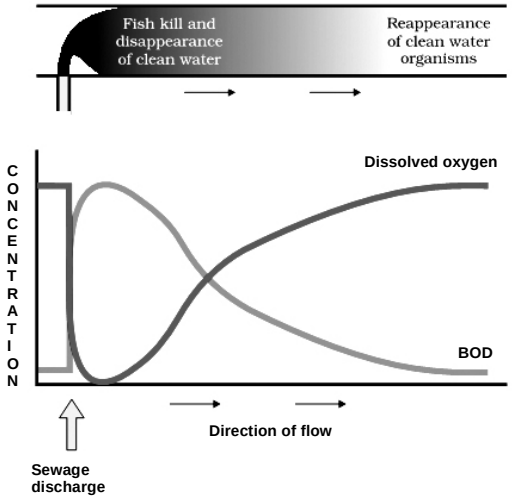

Fig : Effect of sewage discharge on some important characteristics of a river

- **Eutrophication :** Nutrient enrichment of a water body due to natural ageing is called eutrophication. Nutrients present in sewage, agriculture wastes and fertilizers cause dense growth of plants and planktonic algae. It is called **algal bloom.**
- Algal blooms and floating plants cut off light from submerged plants. The latter die, there is drastic decrease in oxygen replenishment inside water. It causes organic loading of water, decreased oxygen level also kills aquatic animals, further adding to organic loading.

Resonate the Concept

- World's most problematic aquatic weed *Eichornia crassipes* (Terror of Bengal) is the another example of eutrophication.

Effuent treatment :

- Sewage pollution can be prevented by treating sewage before passing into water, in sewage or **effluent treatment plant (ETP).**
  - **(1) Primary treatment :** Shredding, churning, Floatation, screening, sedementation.
  - **(2) Secondary treatment :** Living (Micro) organisms involve.
    - **(a) Trickling filter method :** Sewage is passed through Gravel.

(b) Activated sludge method : Aeration of Biosolids.

(3) Tertiary treatment : Water is treated with chlorine or perchlorate or ozonized or irradiated by UV rays.

❖ Salts and suspended solids remains in the water then latter is treated with alum, ferric chloride, lime for their precipitation. This water is passed through activated carbon for the removal of dissolved organics. Desalinated water is passed from a chamber for the removal of salt.

A Case study of Integrated Waste Water Treatment:

❖ In the town of Arcate situated on Northern Coast of California an integrated waste water treatment process was developed with the help of biologists from **Humboldt State University**.

It is a combination of artificial and natural processes. There are two stages.

(i) Conventional method of filtering, sedimentation and chlorine treatment for removing large organic remains, grit and microbes. The treated water contained lots of heavy metals and other dangerous pollutants.

(ii) Innovative approach consisted of developing a series of six connected marshes in 60 hectares of marshland seeded with bacteria, algae, fungi and plants. The biota absorbs, assimilates and neutralises the pollutants. The naturally purified water is then allowed to flow out.

❖ Along with functioning in water treatment, the marshes have been converted into a sanctuary where a number of fishes, other aquatic animals have observed. A citizen group called **Friends of Arcata Marsh (FOAM)** looks after the project.

Industrial Effluents and their effects :

❖ Waste water from small and large industries, has variety of organic and inorganic pollutants including toxic heavy metals (defined as elements with density > 5g / cm^3) like Mercury, Cadmium, Copper, Lead and acids, alkalies and hot water. Some important pollutants and their effects are as follow :

Key concept for AIIMS & NEET

(i) Minamata disease is caused by **mercury in water**. first reported in 1952 in japan.

(ii) Black-foot disease is due to **arsenic**.

(iii) Itai-Itai (ouch-ouch) is due to **cadmium.** First reported in 1947 in Toyoma city of Japan.

(iv) Methaemoglobinaemia (Blue baby syndrome / cyanosis) : It is due to NO_3 in drinking water. Excess nitrate combines with haemoglobin to form non functional methaemoglobin that prevents O_2 transport in infants. It is called methaeamoglobinemia.

(v) Fluorosis and knock knee : If concentration of fluoride in drinking water is 10 or above 10ppm. It causes **fluorosis and knock knee**. In the major rivers of India the **fluoride level is > 1.5 mg/ l**.

Key concept for AIIMS & NEET

Biomagnification / Biological magnification :

Persistent pesticides like DDT and Heavy metals like Hg are accumulated in tissue in increasing concentration along the food chain is called **Biological / Biomagnification/ Biological amplification**. The highest level is found in **top consumer.**

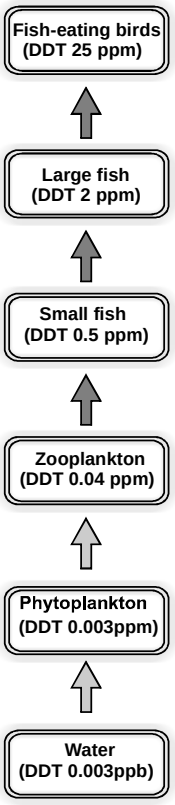

Fig : Biomagnification of DDT In aquatic food chain

Resonate the Concept

(1) In higly polluted water some organisms survive **e.g. Annelid worm Tubifex, Insect larva of chironomous .**They are pollution indicators.

(2) Occurence of **E.Coli** in water indicates **sewage pollution** in water body.

(3) Ecological sanitation for human excreta : A lot of water (5–10 litres) is wasted to flush the toilet at one time. It can be saved. Ecological sanitation is a sustainable system for handling human excreta using dry composting toilets. This is a practical, hygienic, efficient and cost effective solution to human waste disposal. By this method, human excreta can be recycled into a resource (as natural fertilizer) which reduces the need for chemical fertilizers. There are working EcoSan toilets in Kerala and Srilanka.

(C) Soil Pollution :

- It is change in soil due to removal or addition of substances and factors that decreases its productivity, quality of plants and ground water. It involves following types.
  - **(i) Positive soil pollution :** The quality of soil is decreased due to addition of undesirable substances **e.g. industrial wastes, agrochemicals**.
  - **(ii) Negative soil pollution :** Reduction in soil productivity is caused by erosion and over-use.
  - **(iii) Landscape / third pollution :** It is conversion of fertile land into barren one by dumping wastes **(e.g. ash, sludge, garbage, rubbish, industrial wastes, broken cans, bottles, etc)** over it.
- Polyethylene carry-bags, petbottles, waste plastic sheets are non-biodegradable materials that persist in soil for long periods.

  Soil deterioration and decrease the natural microflora occur due to Excessive use of fertilizers. Flyash from thermal power plants pollute the surrounding land. Mine dust deteriorates top soil and contaminates the area with toxic metals and chemicals.

Case Study of Organic Farming:

- Intergrated organic farming is a cyclic zero waste procedure of farming where wastes of one process are cycled as nutrients for next process.
- A farmer Ramesh Chander Dagar of Sonipat, Haryana, has developed one such system. He has integrated bee keeping, dairy management, water harvesting, composting and agriculture in a sustainable venture where different components support one another.
- Cattle dung is used as manure. Crop waste is composted. Both are also used to generate bio:gas and manure to meet the needs of the farm. Harvested water is used for irrigation. Farm provides sufficient fodder to cattle. Bees help in pollination of crop plants. **There is no need to use chemical fertilisers for crops, as cattle excreta (dung) are used as manure. Crop waste is used to create compost, which can be used as a natural fertiliser or can be used to generate natural gas for stisfying the energy needs of the farm.** Enthusiastic about success of his integrated organic farming, Dagar has set Haryana Kisan Welfare Club with a membership of some 5000 farmers.

Solid Wastes:

These are discarded solid materials formed due to human activities. sources of solid wastes are as follow.

- **(i) Municipal Solid Wastes :** Garbage of homes, offices, shops,street and road sweeping, discards from construction sites, sludge from sewage treatment plant, vegetable and fruit market.
- **(ii) Industrial Wastes :** Effluents, sludge, scrap and flyash.
- **(iii) Mining Wastes :** Mine dust, rock tailings, slack and slag.

(iv) Electronic Wastes (e–wastes) : Irreparable computers, Television, mobiles and other electronic goods

(v) Hospital wastes : Disinfectants and other harmful chemicals and also pathogenic micro-organisms, syringe, cotton, bandage etc.

Control / Disposal of solid Wastes :

(i) Recovery and Recycling : Waste articles can be recycled with the help of rag pickers. These articles are tins, cans and other metal wastes, glass, plastic, polyethylene, rags, paper and cardboard. Wastes polyethyene is recycled to form new polyethylene. Plastic on recycling, forms new but somewhat inferior plastic.

(ii) Dumping (Landfilling) : It is piling of waste on selected low lying land. It is of two types.

(a) Open landfilling : Dumping of waste on uncovered low lying area.

(b) Sanitary Landfilling : The waste is pulverised, compacted and dumped in a sanitary landfill (trench) in covered over by a layer of earth every day.

(iii) Construction Material : Ahmed Khan, a plastic sack manufacturer in Bangalore has developed a fine powder of recycled modified plastic, called **polyblend** that is mixed with the Bitumen and used to lay roads blend of polyblend and bitumen, when used to lay roads, enhanced the bitumen's water repellant properties and helped to increase road life.

(iv) Burning : It involves two methods.

(a) Pyrolysis : Anaerobic combustion of solid waste inside chambers at a temperature of 1650^{o}C is called pyrolysis.

(b) Incineration : Controlled aerobic combustion of solid wastes inside chambers at temperature of 900-1300^{o}C is called incineration.

(v) Source Reduction : Garbage and other organic biodegradable wastes are taken out of urban areas and used for formation of compost, biogas and manure.

(D) Noise pollution :

- Unwanted / unpleasant loud sound of **80 dB or more** is called **noise pollution. Frequency of sound** is measured in **Hz** and **unit of sound level is deciBel (dB). Range of human hearing is 50 Hz to 15000 Hz.**
- Moderate conversation produces 60 dB sound, loud conversation 70 dB, scooter 80 dB, truck/bus 90 dB, jet aeroplane 150 dB, rocket 180 dB.

Effect of Noise pollution:

(i) It causes anxiety, stress and emotinal disturbances.

(ii) A sudden loud sound may permanently damage ear drum or dislocates ear ossicles.

(iii) It may cause insomnia or sleeplessness.

(iv) It causes headache by dilating blood vessels of the brain, dilating the pupil of eye, high blood pressure by increasing cholesterol level in the blood.

(v) It can impair the development of nervous system of unborn babies which leads to abnormal behaviour in their life.

Control of Noise Polllution :

(i) Green muffler or greenbelt vegetation : It is specially planted along roads and railway tracks for absorption of noise, pollutant gases and dust generated by moving vehicles.

(ii) Restricted use of loud speakers.

(iii) Sound proof insulating jackets or filters for reducing noise from machines.

(iv) Delimitation of acoustic zoning.

(v) Use of cotton plugs or ear muffs in occupational exposure.

Permissible ambient Noise levels in different zones

Zones	Day (6.00 - 21.00 hr.)	Night (21.00 - 6.00 hr.)
Industrial Zone	75 dB	70 dB
Commercial Zone	65 dB	55 dB
Residential Zone	55 dB	45 dB
Silence Zone	50 dB	40 dB

***** Noise pollution involved in air pollution in 1987.

(E) Radioactive wastes:

Initially, nuclear energy was used for generating electricity. The use of nuclear energy has two very serious inherent problems. The first is accidental leakage **e.g. Three Mile Island and Chernobyl incidents, second is safe disposal of radioactive wastes.**

Radiation, that are released by nuclear waste, is extremely damaging to biological organisms & cause mutations.

Nuclear radiations is lethal at high doses whereas lower dose creates various disorders, the most common disorder is cancer.

After sufficient pre-treatment, nuclear waste, are stored in shielded containers and buried within the rocks, about 500m deep below the earth's surface. **NEET-2019**

Test your Resonance with concept

1. Genetically altered bacterium used in the control of environment pollution is
(1) E. coli (2) Bacillus anthracis
(3) Pseudomonas (4) Agrobacterium

2. Increasing concentration of DDT in organisms of a food chain in higer trophic levels is known as
(1) Biologica chain (2) Biotic potential
(3) Biological value (4) Biologica amplification

3. Which is not a pollutant from exhaust of motor vehicle -
(1) SO_2 (2) CO
(3) Fly ash (4) Hydrocarbon gas

4. Major pollution causing agent is
(1) Animals (2) Hydrocarbon gases
(3) Man (4) None of the above

5. A rapid growth of photosynthetic algae in water develops 'bloom'. How would it affect the environment of water
(1) The environment become comfortable for all form of life
(2) O_2 level is decreased or BOD becomes high
(3) O_2 level of water is increased
(4) Fish production is increased

Answers

1. (3) **2.** (4) **3.** (3) **4.** (3) **5.** (2)

Global Environmental Changes :

In addition of green house gases and pollutants in the atmosphere are responsible for the global climate change.

Key concept for AIIMS & NEET

(1) Green house effect :

Warming effect for keeping earth warm due to presence of certain radiatively active gases in the atmosphere is called **green house effect**. It was reported by **Fourier (1827**) & the term green house effect coined by **Arrhenius.**

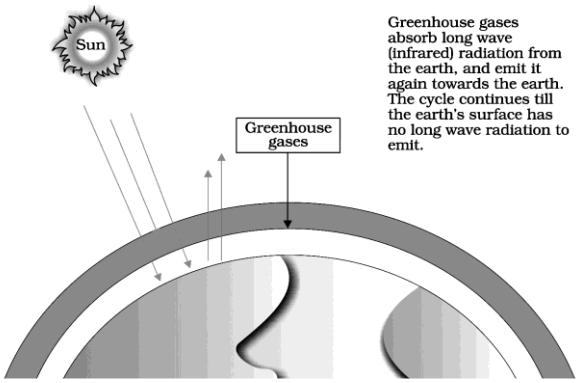

Fig. Greenhouse effect in keeping the earth warm

The gases which are transparent to solar radiation but retain and partially reflect back long wave heat radiations are called **green house gases (GHGs). e.g. CO_2, CH_4, CFCs, N_2O.** They inhibit a part of long radiations emitted by earth to escape into space. Although green house gases radiate a part of this energy back to the earth. The phenomenon is called **green house flux**. The latter maintains mean annual temperature of earth at 15ºC. In its absence it will fall to –18ºC.

The concentration of green house gases has started rising that causes enhanced green house effect followed by increasing the mean global temperature. It is called **global warming**. **(AIIMS - 2015)**

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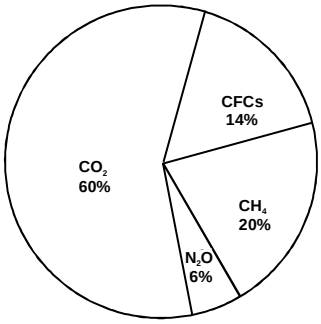

Fig:- Contribution of different gases to green house effect

Increase in Concentration of Greenhouse Gases					
S. No.	Greenhouse Gas	Pre-industrial Concentration	Concentration in 2000 AD	Increase since 1750 AD,%	Atmospheric life time (yrs)
1	Carbon dioxide (CO_2)	280 ppm	368 ppm	31	5–2000
2	Methane (CH_4)	700 ppb	1750 ppb	151	12
3	Nitrous oxide (N_2O)	270 ppb	316 ppb	17	114
4	Chlorofluorocarbons (CFC –11) Hydrofluorocarbons (HFC–23)	0	282 ppt.	–	45 – 260

Effects of green house gases:

(i) CO_2 Fertilisation effect : Increase in CO_2 concentration is harmful globally but it increases prouductivity and stress tolerance of plants (increases the rate of photosynthesis especially in C_3 plants and decrease the rate of transpiration by closing of stomata) called CO_2 fertilization effect.

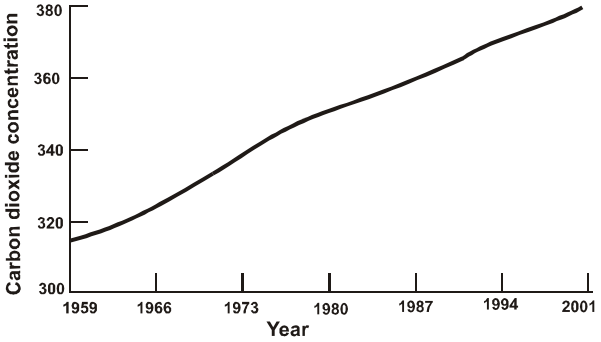

Fig: Mean rise in CO_2 concentration in atmosphere between 1959 and 2001.

(ii) Global Warming : Increasing concentration of green house gases causes rise in atmospheric temperature that was about some 2.5ºC since industrial revolution and 0.6ºC in the twentieth century. There will be melting of polar ice caps and mountain snow caps. The effects of global warming are as follow

(a) Changes in Sea Level : Rise in temperature will increase sea level due to thermal expansion of sea water, melting of glaciers and Greenland ice sheet. The whole of Maldives, several thousands of other islands, 11.5% of Bangladesh and several important cities of the world will be submerged.

(b) Effect on Weather and Climate : Frequency of droughts and floods will increase. Odd climate changes like EL Nino effect would become common. Change in rainfall pattern.

(c) Effect on Atmosphere: Warming of troposphere and cooling of stratosphere and thermosphere.

We can control global warming by cutting down use of fossil fuel, reducing deforestation, planting trees, improving efficiency of energy usage, slowing down the growth of human population.

Resonate the Concept

- The concentration of **CO_2** in atmosphere was 280 ppm in 1750, 368 ppm in 2000, 380 ppm in 2007 and 400 ppm in 2013.

Key concept for NEET

International efforts for mitigating global change:

(i) Viena convention of 1985 for protection of ozone layer.

(ii) Montreal Protocol : Montreal (Canade; 16 September 1987). 27 industrialised countries agreed to **limit use and production of ozone depleting substances like chlorofluorocarbons** to half the level of 1986 with an aim to protect ozone layer.

(iii) Intergovernmental Panel on Climate Changes (IPCC, 1988): Prepared a world climatic programme (WCP).

(iv) UNCED (United nations Conference on environment and Development, 1992): It is called **Earth Summit**. It was held in **Rio-de-Janeiro (Brazil)** and adopted the recommendations of CCC for **reducing greenhouse gases**. Their recommendations were singed by 154 nations. They pledged to maintain emission of green house gases at 1990 level.

(v) Kyoto Protocol (Dec. 1997) : International conference held in Kyoto (Least polluted city of world), japan concerning with mitigation of climate changes caused by green house gases obtained commitments from different countries for **reducing overall greenhouse gas emission** at a level 5% below 1990 level by 2008–2012. **Kyoto Protocol was endorsed at CoP–3 (NEET-2013)**

(vi) Beiging Protocol (1999) : The protocol lays down steps to **reduce emission of CFCs and other ozone depleting substances.** It separates the efforts to be made by developing and developed countries.

(vii) World earth Summit 2002: At **Johannesburg (S. Africa)** on sustainable development without **depletion of Biodiversity.**

(viii) UN convention on climate change (CCC 2004) : At **BuenosAires, Argentina** for **reducing global warming**.

Resonate the Concept

UN summits on global warming

1. Durbon - South Africa - 2011 (Rejected AIPMT-2015)
2. Doha - Katar - 2012 (Re-AIPMT-2015)
3. Varsa - Polland - 2013
4. Lima - Peru - 2014
5. Peris - France - 2015
6. Marrakesh - Moracco - 2016
7. Bonn - Germany - 2017
8. Katavice - Polland - 2018

Degradation by Improper Resource Utilisation and Maintenance:

❖ Both pollution and improper utilisation parctices are responsible for degradation of natural resources. It involves.

(i) Soil Erosion and Desertification: Fertile top soil can remove by faulty utilisation practices within a few years resulting the area is converted in to an arid pitch. It occurs due to deforestation overgrazing, overcultivation leaving tilled soils without seedling and improper irrigation.

(ii) Waterlogging and soil Salinity : A waterlogged soil has poor aeration.The former condition occurs due to excessive irrigation, Kutcha irrigation channels, presence of impermeable underground soil pans and poor drainage result in water logging of soil. Evaporation of water from surface draws salt to the surface. A crust of salt is formed both over surface as well as upper layers of the soil. Such soils becomes saline and unfit for growth of crops.

- **Deforestation :** It is the conversion of forested areas to non forested ones. Forest cover has been removed by 40% in tropics but only 1% in temperate areas. In India, one third of the land was covered by forests in late nineteens, **In 1980s it was 19.4% but is 20.64% in 2003**.
- **Causes of deforestation : Slash and burn agriculture (Jhum cultivation or shifting cultivation)** was prevalent in early periods in north-east India. It takes place through lopping, burning the remainder, mixing the ash with soil and sowing the cleared land with crop seeds. The land is used for 2–3 years without manuring. It causes nutrient depletion, reduced moisture retention and increased soil erosion.
- Other factors of deforestation are forest fires, Overgrazing, Canals, Hydroelectric projects, Requirement of wood. One of the major effects of deforestation is enhanced carbon dioxide concentration in the atmosphere because trees that could hold a lot of carbon in their biomass are lost with deforestation. It also causes loss of biodiversity due to habitat destruction, disturbs hydrological cycle, soil erosion, desertification.
- **Reforestation :** It is the process of restoring a forest. It may occurs naturally in a deforested area or we can speed it up by planting trees.

People's Participation in Saving and Conserving Trees and Forests:

(i) Bishnois: In 1731, the king of Jodhpur (Rajasthan) asked his ministres to arrange wood for construction of a new palace. The ministers and workers went to a forest near a village inhabited by Bishnois for cutting down the trees. A Bishnoi Woman **Amrita Devi** hugged up a tree and asked king's men to fires cut her before cutting the tree, The kings men cut down the tree along with Amirta Devi. Her three dughter and hundreds of other Bishnois lost their lives in saving trees. Such a commitment for saving environment is found nowhere else. The Government of India has recently instituted Amrita Devi Bishnoi Wildife Protection Award for individuals and rural communities who show extraordinary courage and dedication in protecting wildlife.

(ii) Chipko Movement: It is movement initially meant for protecting trees but now meant for preservation of environment including habitat and wildlife. Chipko movement was born in March 1973 in Gopeshwar in Chamoli district when trees were not allowed to be cut by village folk by hugging them first near village Mandal, the Rampur phata and in 1974 near village Reni (led by Gaura Devi) The movement has two leaders, **Chandi Prasad Bhatt** of Gopeshwar and **Sunder Lal Bahuguna** of Silyara in Tehri region. A similar movement was undertaken by Pandurang Hegde in the South. It is known as **Appiko Movement**.

(iii) Joint Forest Management : Village and tribal communites are being involved in development and protection of degraded forests on share basis (fruits, gums, rubber, medicines). It is called **Joint Forest Management or JFM.** It started in1980. **(NEET-I 2016)**

Read & Digest

(1) El Nino effect : It is a hot water current, appears after every 5 to 8 years in the east of Peru and Equador. It kills fish and other biota over thousands of kilometers in oceans.

(2) Common dust disease is called Pneumoconiosis :

- **(i) Asbestosis (pulmonary fibrosis) :** Inhalation of Asbestos causes fibrosis in lungs / lung cancer.
- **(ii) Byssinosis :** It is due to cotton dust in textile workers.
- **(iii) Sillicosis :** It occurs due to sillica dust.
- **(iv) Siderosis :** In Iron mill it is caused by iron dust.
- **(v) Anthracosis :** It is due to coal dust.

(3) Strontium-90 : It is radioactive element that as responsible for Leukamia and bone cancer.

(4) Environment law for controlling pollution.
- **(i) The National Environmental policy Act (NEPA) 1969**
- **(ii) The insecticide Act, 1968**
- **(iii) The water (Prevention and control of pollution) Act. 1974**
- **(iv) The air (Prevention and control of Pollution) Act. 1981**
- **(v) The Environment (Protection) Act, 1986**
- **(vi) The Forest (Conservation) Act, 1980**

(5) Chernobyl (Ukraine) disaster occured on **26 april 1986** due to melting of nuclear reactor that released **radioactive substances** all over the Europe**.**

(6) Bhopal gas disaster occured on **2 dec.1984,** due to leakage of **poisonous gas MIC (Methyl isocyanate)** in air from **a pesticide plant of union carbide Bhopal. MIC** is used in making **insecticide (savin)** this gas caused death of about 2500 people in Bhopal. **2 Dec.** is observed as **National Pollution Prevention day** in India**.**

(7) Skeletal fluorosis: In which hardened bones, stiff and painful joints, teeth deformity or molting of teeth occur due to excess of fluorides in drinking water.

(8) CPCB : Central pollution control board.

(9) NEERI : National Environmental Engineering Research Institute, nagpur.

(10) I.A.P. : Indices of atmospheric pollution. Prepared with the help of lichens (sensitive to SO_2).

(11) I.W.P. : Indices of water pollution. Daphnia and trout are sensitive to water pollution.

(12) Emission Norms: Emission norms for petrol driven cars have been designated as euro - I (June 1999) and euro-II (april 2000). They are concerned to mainly three parameters– CO, hydrocarbons, and particulate matter.

S. No.	Pollutants	Old	Euro I	Euro II
1	CO	6·68–12·00	2·72	2·2
2	Hydrocarbons & Nitrogen Oxides	3–4·6 ppm	0·97	0·5
3	Particulate matter	–	0·14	Nil

(13) Iodine isotope-131 : It causes damage to bone marrow, RBC Lymphnodes and Skin Cancer.

(14) Grey Snow : Occurred in Norway due to soot from industrial Ruhr area of Germany**.**

(15) Biodegradable plastic : It is being formed from low density polyethylene mixed with starch. It degrades inside the soil with in 2 months.

(16) Ecomark : Central Pollution control Board of India has introduced the idea of ecomark on the lines of ISI mark to ensure that goods are produced by industries in environment friendly manner. The logo of ecomark in India is “Earthen Pot”.

(17) Waldsterben : It is called forest sickness. Due to acid rain and air pollution (mainly due to SO_2, NO_X and O_3), there is decline of forests an trees.

(18) ABS (Alkyl benzene sulphonate) : It is most harmful substance of detergents causing water pollution.

(19) Ecological boomerang : Negative effects caused by weedicides after a long period.

(20) Sonic Boom : It is a shock wave generated by supersonic jet flying at a speed of more than 1 mach, Sonic boom is like a cone covering an area of 10–100 km. There is sudden rustling of doors and windows. Buildings may also get damaged.

(21) La Nina : It is cold ocean surge occuring periodically in the equatorial pacific.

(22) Cesium-137 : It brings about functional and genetic changes.

(23) Silent spring : Novel written by **Rachel Carson** (1962) mentioning the effect of DDT on birds. DDT use has been banned in USA since then. **(AIPMT - 2015)**

Test your Resonance with concept

1. Government of India has introduced a concept to work closely with local communities for protection and management of forests called
(1) Jhaum cultivation (2) Chipko movement
(3) Appiko movement (4) Joint Forest management

2. Which of the following conference obtained commitments from different countries for reducing overall green house gas emission at a level 5% below 1990 level by 2008-2012.
(1) Kyoto Protocol, 1997 (2) Earth Summit, Rio-de-janeiro, 1992
(3) Montreal Protocol, 1987 (4) Helsinki Declaration, 1989

3. Major pollutant in Jet plane emission is
(1) SO_2 (2) CFC (3) CO (4) CCl_4

4. "Chipko movement" started from
(1) U.P.- Garhwal (2) M.P. Gwalior
(3) Rajasthan- Jodhpur (4) Rajasthan - Alwar

5. Most hazardous metal pollutant of automobile exhaust is:
(1) Mercury (2) Lead (3) Cadmium (4) Copper

6. Peeling of ozone umbrella is due to
(1) CFCs (2) PAN (3) CO_2 (4) Coal burning

Answers

1. (4) **2.** (1) **3.** (2) **4.** (1) **5.** (2) **6.** (1)