



UGC-NET

Environmental Science

NATIONAL TESTING AGENCY (NTA)

PAPER – 2 || VOLUME – 4

**ENVIRONMENTAL POLLUTION
& CONTROL**



CONTENT

UNIT-6

Environmental pollution & Control

1. Air pollution	1
2. SO ₂	16
3. NO _x	18
4. CO	19
5. CO ₂	20
6. Hydrocarbons	21
7. Tobacco smoke	22
8. Air pollution Meteorology	31
➤ Adiabatic lapse rate	
➤ Environmental Lapse rate	
9. Central government Act	48
10. Criteria pollutants	54
11. Volatile organic compounds	62
12. Photochemical smog and ozone	63
13. Source's effect of photochemical oxidants	73
14. Size & Chemical Composition	77
15. Acid Deposition	84
16. Health & welfare impacts	86
17. Toxic Air pollutants	91
18. Air pollution in the world Megacities	93
19. Motor vehicle envision	95
20. Major chemical pollutants in photochemical smog sources & environmental effects.	96
21. Aerosol	99
22. Sources of particles	99
23. Particles size & Distribution	102

Soil Pollution

➤ Types of soil	113
➤ Effects of soil pollution	113
1. Layers of soil	117
2. Types of crop	129
3. Mass flow	131
4. Gravitational water	132
5. Hygroscopic water	132
6. Capillary water	133
7. Water vapour	133
8. Combined water	133
9. Inorganic Colloids	136
10. Chemical Methods	141

Noise Pollution

1. Noise pollution	145
2. Ambient noise level Monitoring	146
3. Impacts of noise	148
4. Control	149
5. Noise pollution Act	151
6. Radio Active Pollution	152
7. Types of Radiations	152
8. Type of Radiation Particles	153
9. Sources	153
10. Effects	154
11. Control measurement	157

Water Pollution

1. Water pollution	158
2. Source of water pollution	158
3. COD	160

4. Types of water pollutions	165
5. Surface water pollution	168
6. Sources of surface water pollution	169
7. Sources types of water pollutants pathogens	171
8. Sources of Arsenic Contamination	179
9. Method of softening of water	189
10. Types of ion exchange Material	191
11. Suspended growth treatment	196
12. BOD	205
13. COD	207
14. TOC	208
15. Salinity Measurement	210
16. Turbidity determination	212
17. Water prevention Control of pollution act	224

Air pollution

Pollution

It is any undesirable change in the physical, chemical or Biological features of air, H₂O or soil caused by excessive accumulation of pollutants

→ The chemical agent which is responsible for the undesirable change is known as pollutant.

→ The government of India in 1986 pass Environment (Protection) Act. The objective of this act is to protect the environment (Soil, water and Air) and improve the quality of environment

→

Pollution

(Sources of pollution)

Origin	Physical Nature	Part of environment	Emission
→ Natural (Eg:- Marsh gases Pollen, dust)	→ Noise → Thermal → Radioactive	→ Soil → Air	→ Point Source Pollution (Emission from single point) Eg:- Sewage
→ Anthropogenic Eg:- utilisation of Pesticide, Insecticide etc	→ Gaseous → Dust	→ Water	→ Non-point Source Pollution (Emission from the large area) Eg:- Agriculture, sun etc.

Air pollution

Air pollution is defined as the presence of one or more contaminants such as dust, gas, mist, odour, smoke, smog or vapour in the atmosphere.

→ The air pollution is caused due to addition of unwanted substances or gases.

→ Source of Air pollution may be

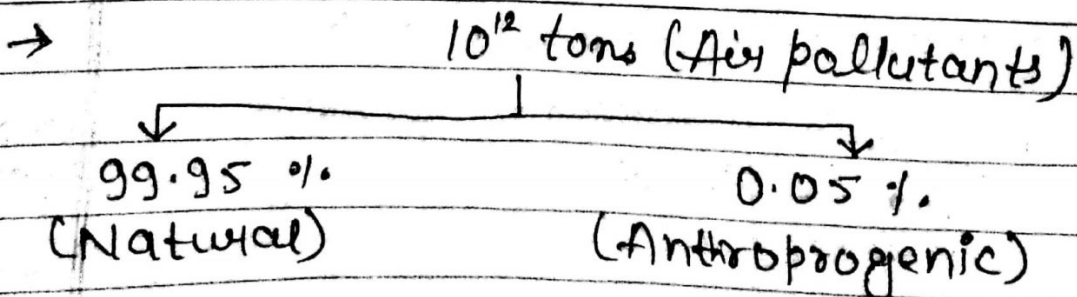
① Natural Sources :-

Natural sources of air pollution include Marsh gases, pollen, dust and smoke emitted into atmosphere.

② Anthropogenic sources :-

These are man made sources of air pollution.

It includes power plants, mineral smelters, factories, and transport vehicles etc.



→ Types of Air pollutants .

Air pollutants can be classified into two categories .

① Primary .

② Secondary .

① Primary Air pollutants .

primary air pollutants enter the atmosphere directly from various sources .

primary air pollutants and their effects
Among the primary air pollutants most important are :-

① Particulate matter

② Carbon monoxide (CO)

③ Hydrocarbons (HCs)

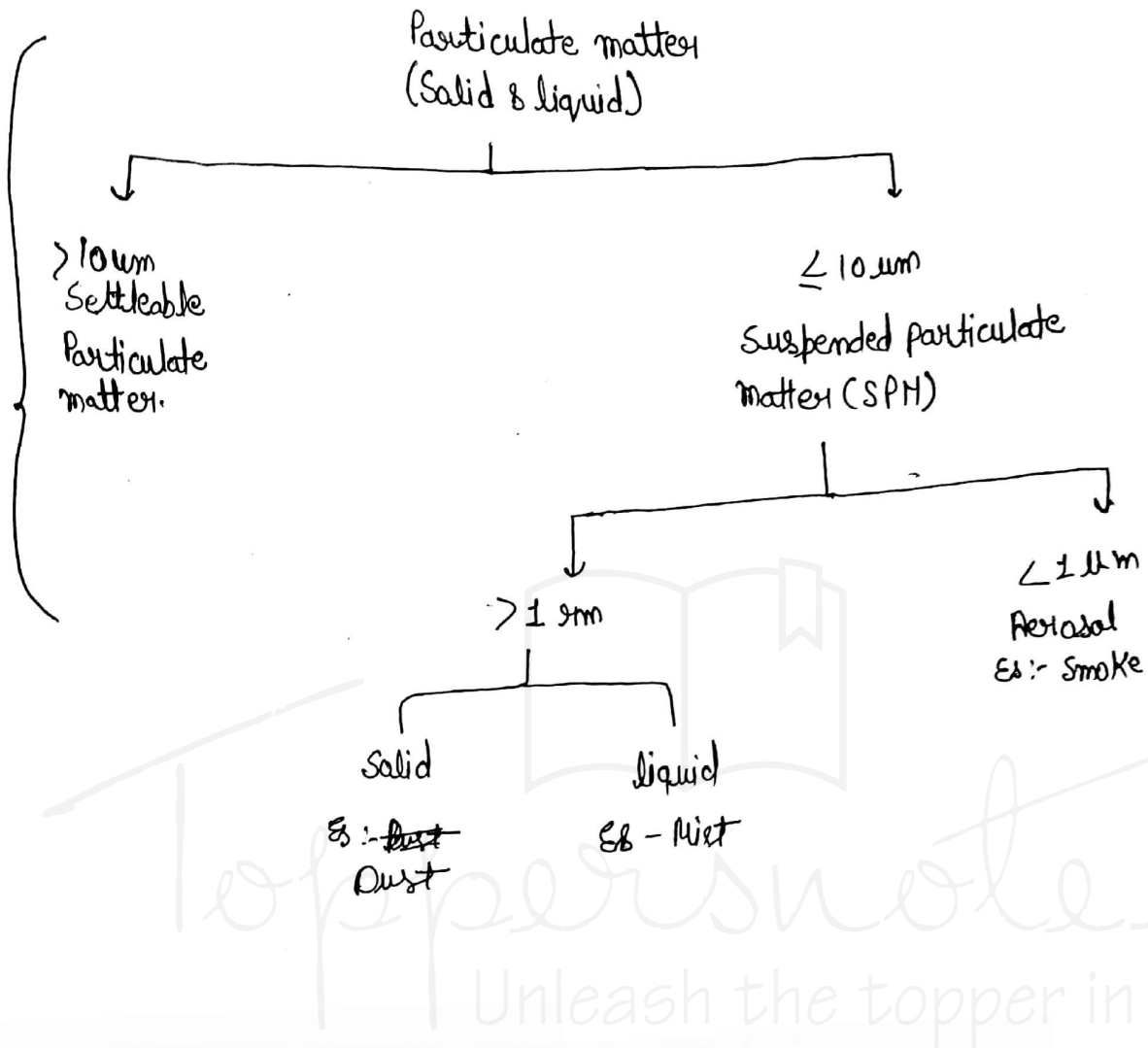
④ Sulphur dioxide (SO₂)

⑤ Nitrogen oxides (NO_x) .

① Particulate matter

particulate matter consist of solid particles or liquid droplets (aerosols) small enough to remain suspended in air

Eg:- Soot, smoke, dust, asbestos, fibres, pesticides, etc.



→ According to Central Pollution Control Board (CPCB).

The particulate matter which is about less than and equivalent to $2.5 \mu\text{m}$ ($\leq 2.5 \mu\text{m}$) are more harmful and this particulate matter cause irritation, inflammation and lungs problems.

→ Continuous exposure of this particulate matter cause serious lung problems (pneumoconosis).

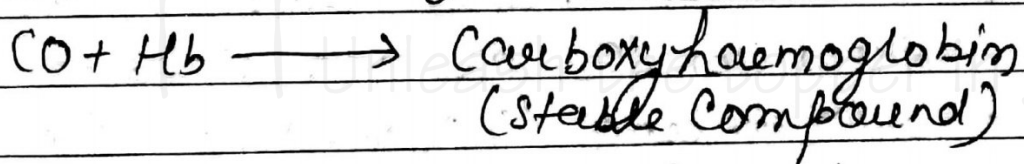
Byssinosis (due to inhalation of cotton fibers)
Siderosis (" " " " Iron) etc.

(2) Carbon Monoxide :-

Carbon monoxide (CO) is a product of incomplete combustion of fossil fuels. Nearly 50% of CO emission from automobiles.

CO shows 200 times affinity for Hb as compare to oxygen.

it is highly poisonous, when inhaled it reacts with Hb (Haemoglobin) of RBC and forms Carboxyhaemoglobin.



and decrease / reduce oxygen carrying capacity of blood.

(3) Hydrocarbon and Volatile organic compounds (VOC).

→ Hydrocarbon are composed of hydrogen and carbon;

Methane (CH₄) is emitted from flooded rice fields.

→ Formaldehyde responsible for indoor pollution because it is released from newly form carpets or woods materials.

(4) Sulphur dioxide (SO_2).
Sulphur oxide (SO_2, SO_3)

Source :- These are most harmful gaseous pollutants, main source of sulphur oxides are coal burning, smelters, oil refineries.

Effect :-

- Lichen and mosses do not grow in SO_2 polluted areas.
- Lichen and mosses are indicator of SO_2 pollution.
- Sulphur oxides causes chlorophyll destruction.

(Sulphur oxide have ability to remove Mg^{+2} from chlorophyll.

$\text{Chl} \xrightarrow{\text{Mg}^{+2}}$ phaeophytin.

(due to phaeophytin formation structure of chlorophyll is destroyed and decrease the photosynthesis).

⑤ Nitrogen Oxide (NO , NO_2) .
Source :- Burning (Combustion) of fossil fuel in Automobiles .

Effect :-

These Nitrogen Oxide form photochemical smog in atmosphere and release Ozone

This photochemical smog first appeared in 1946 at Los Angeles. That's why it is also known as Los Angeles smog

→ Nitrogen Oxide also responsible for acid rain.

→ Entry of these Nitrogen Oxides causes respiratory trouble such as Emphysema, bronchitis, Swelling of lungs and lungs cancer etc.

② Secondary Air pollutants .

Secondary air pollutants are formed by the reactions between the primary air pollutants .

~~Primary~~ Secondary Air pollutants and their effects .

Amongst the Secondary air pollutants most imp. are .

① Photochemical Smog:-

photochemical smog is formed in traffic congested metropolitan cities where pollution conditions and intense solar radiation are present.

- It was first observed in Los Angeles.
- In this process, smoke, fog, NO_x , HC, Ozone, UV light & high temp. are essential.
- These components react with each other and form reddish brown smog ($\text{PAN} + \text{O}_3 + \text{NO}_x$) are brown air.
- photochemical smog causes irritation in eyes and harm the lungs.

② Acid Rain.

This word was given by Robert August.

NO_x and SO_x released from different sources in form of smoke and dissolved in atmospheric water vapour to form sulphuric acid and nitric acid ($\text{H}_2\text{SO}_4 + \text{HNO}_3$)

These acids come down on earth with rain water. This is called Acid rain.

→ Wet deposition :-

if Acid Comes down on earth with rain, fog and smog, it is known as wet deposition.

→ Dry deposition :-

if acid settled on earth surface through solid dust particles with nitrate or sulphate this is called dry deposition.

→ The pH of acid rain is lesser than 5.6.

→ In acid rain the ratio of H_2SO_4 and HNO_3 is 7:3 (70% H_2SO_4 + 30% HNO_3) other 2%.

Effects :-

- ① Stone leprosy are due to Acid Rain
- ② due to acid rain acidity of soil and water increase.
- ③ Acid Rain also cause damages historical monuments.
E.g :- Taj Mahal
Red Fort.

Air pollution

- * Undesirable change in natural char. of atm due to contaminant of indoor s' outdoor envir. pollutants.
- * 6-9 Billion tonnes of carbon is being added to atm every yr. annually on an average.

Sources of Air pollu.

(a) NATURAL SOURCE :-

Eg:- Forest fires

→ Common features of tropical areas or area of ^{high} temperature throughout the yr.

* V. large quantities of smoke s' PM released.

(b) Volcanic Eruptions :-

→ lava is produced, Minute solid particles, gases s' Radiation.

(c) Dust Storms

→ due to movement of Hot wind around the Earth s' are concentrated in certain places at a Particular time.

(d) Pollen Grains

→ Released in spring season.

* Cause severe allergy related diseases in humans:-

② ManMade Source of pollutants :-

① Domestic Pollutants :-

↳ Insecticides in home for cleaning.

* Burning of fuel in home

② Agricultural chemicals as pollutants :-

↳ Pesticides, insecticides & herbicides.

These chemicals get emitted in air as small droplets.

③ Industrial Air pollutants

↳ Chemical industry, cement plants, paper mills & tanneries.

* Some Industrial pollutants :-

* Benzyopyrene

↳ Carcinogen Agent

Produced in tobacco smoke,

Automobile exhausts & Industrial effluents.

* Hydrogen sulphides :-

↳ Causes Mottled chlorosis & defoliation of plants, decolourises paints, silver wire & jewellery, Produces eye irritation, throat irritation & Nausea.

* Hydrogen Fluoride :-

↳ Produced by Aluminium & Steel Plants, blast furnaces, tiles and Superphosphate manufacturing units.

* CAUSE FLUOROSIS.

* AMMONIA :-

↳ Escapes from fertilizer, dye & lacquer units

* Bleaching, Rusty spots on leaves & flowers browning & softening of fruits.

* Irritation & inflammation of respiratory tract.

* Hydrogen Cyanide.

↳ Produced by metal plating & chemical industries.

* Attacks Nerve cells, impairs vision, produces giddiness and dry throat.

* Mercury

↳ Escapes from paints, fungicides, burning of coal, smelting etc.

* In excess, causes infant deformity, loss of appetite, lesions of mouth & skin, damages of eyes, liver & Nervous syst.

* ZINC :-

↳ From smelters, furnaces & scrap Refineries.

* Causes Cramps, Vomiting & Kidney damage.

* Cadmium :-

→ Released in Welding, Electroplating, Metal Refineries, Pesticides and Phosphate fertilizer industries.

* Respiratory Poison

* Causes hypertension & Renal trouble -

* Chlorine.

→ Released from Chemical industries.

eg:- Bleaching, Deodorant & Germicidal formulations.

* CAUSE :- Eye Respiratory ailments (Pulmonary edema).

* Accidents :-

→ Chemicals plants release a lot of Pollutants into atm.

* Bhopal gas disaster of 1984 (Dec 3-4) caused by bursting of storage tank having 36 tonnes of Methyl isocyanate (MIC) used for manufacture of Pesticides.

Types of Air pollutants :-

Divided on the Basis of form in which they persist & on the Basis of degradation.

* Basis of form :-

Primary pollutants :-

* Directly emitted from source.

Eg:- Smoke, fumes, ash, dust, Nitric oxide (NO_x) & Sulphur dioxide (SO₂).

Secondary pollutants :-

* Formed by chemical rxn b/w the Primary pollutants and constituents of the enviro.
(Eg:- smog, ozone, Sulphur trioxide, Nitrogen dioxide, Ammonia, Ammonium Sulphate).

* Basis of degradation. pollutant are :-

* Biodegradable pollutants :-

↳ Broken down into simpler, harmless substances.

* Broken-down by Micro-organisms.

Eg:- Domestic waste → urine, faecal matter, sewage, Agricultural Residue, paper,

wood & cloth etc.

* Non-Biodegradable pollutants :-

↳ stronger chemical bondage, do not breakdown into simpler & harmless products.

Eg :- Insecticides, Pesticides, Mercury, lead, Arsenic, Aluminium, Plastics, Radioactive waste etc.

Criteria Air pollutants :-
(CAP)

* 6-pollutants that account for most of the Air Pollution worldwide are called CAP.

Eg :- Carbon monoxide (CO),
Sulphur dioxide (SO₂)
Nitrogen oxide (NO_x)
Ozone (O₃)
PM (PM₁₀)
Lead (Pb).

* CAP emitted from mining, transportation, electricity generation & Agriculture.

* CAP accounts for most of Air pollu. world wide.