Environmental Pollution

- Phenomenon of an undesirable change in the physical, chemical, or Biological characteristic of Air, Water, and Land affecting human life, the lives of desirable species, industrial processes, living condition and raw material resources is termed as EP

ENVIRONMENTAL POLLUTION

- **Pollution**
- **Types of pollutants**
- **Classification of pollution**

POLLUTANT

A contaminant that adversely alters the physical, chemical, or biological properties of the environment.

Examples: solid waste, chemical wastes, radioactive materials, industrial, agricultural waste, etc.

POLLUTION

- Introduction of contaminants into a natural environment that causes harm or discomfort to the ecosystem.
- It changes the quality of air, water and land which interferes with the health of humans and other life on earth.

TYPES OF POLLUTANT

BIODEGRADABLE POLLUTANT

Decomposes rapidly by natural processes.

NON-BIODEGRADABLE POLLUTANT

Do not decompose or decompose slowly in the environment

TYPES OF POLLUTANTS

- **Biodegradable Pollutants:**

  Decompose rapidly by natural processes.

- **Non- biodegradable Pollutants:**

  Do not decompose or decompose slowly in the environment.

CLASSIFICATION OF POLLUTION

- Air Pollution
- Water Pollution
- Soil Pollution
- Noise Pollution
- Marine Pollution
- Thermal Pollution
- Nuclear Hazards

AIR POLLUTION

- Definition
- Composition of Atmospheric air
- Sources of Air Pollution
- Classification of Air Pollutants
- Sources of indoor air pollutants
- Sources and effects of outdoor air pollutants
- Prevention and control of air pollution

DEFINITION

Introduction of contaminants (like chemicals, particulate matter, etc.) in the atmosphere that cause harm to humans or other living organisms or cause damage to the natural or built environment.

AIR POLLUTANT

- **Any substance in the air that can cause harm to humans and the environment is known as an air pollutant.**

CAUSES

- Rapid industrialization
- Fast urbanization
- Rapid growth in population
- Drastic increase in vehicles on the road
- Other activities of human beings

COMPOSITION OF ATMOSPHERIC AIR

Constituents	Percentage
Nitrogen	78
Oxygen	21
Argon	<1
CO_2	0.037
Water Vapour	Remaining
Ozone, Helium, Ammonia	Trace amount

SOURCES OF AIR POLLUTION

- **NATURAL SOURCES:**
- **Examples: Volcanic eruptions, forest fires, biological decay, dust storms etc.**

- **MAN-MADE (Anthropogenic) SOURCES:**
- **Examples: Thermal power plants, vehicular emissions, fossil fuel burning, etc.**

Vehicle exhaust emissions

Classification of Pollutant

Primary Pollutant

Emitted directly in the atmosphere

Example: CO, NO, SO_2, etc.

Secondary Pollutant

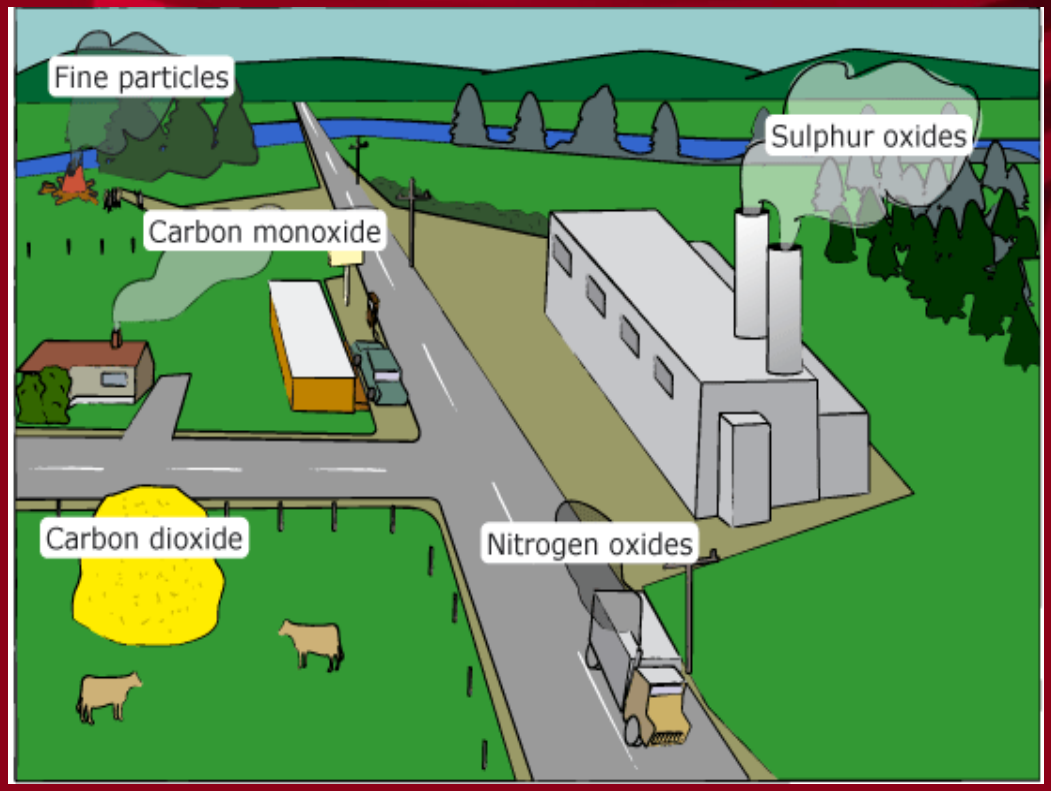
Not directly emitted as such, but formed in the atmosphere through chemical and photochemical reactions from the primary pollutants

Example: O_3, Smog, PAN,etc.

- **PRIMARY AIR POLLUTANTS –**

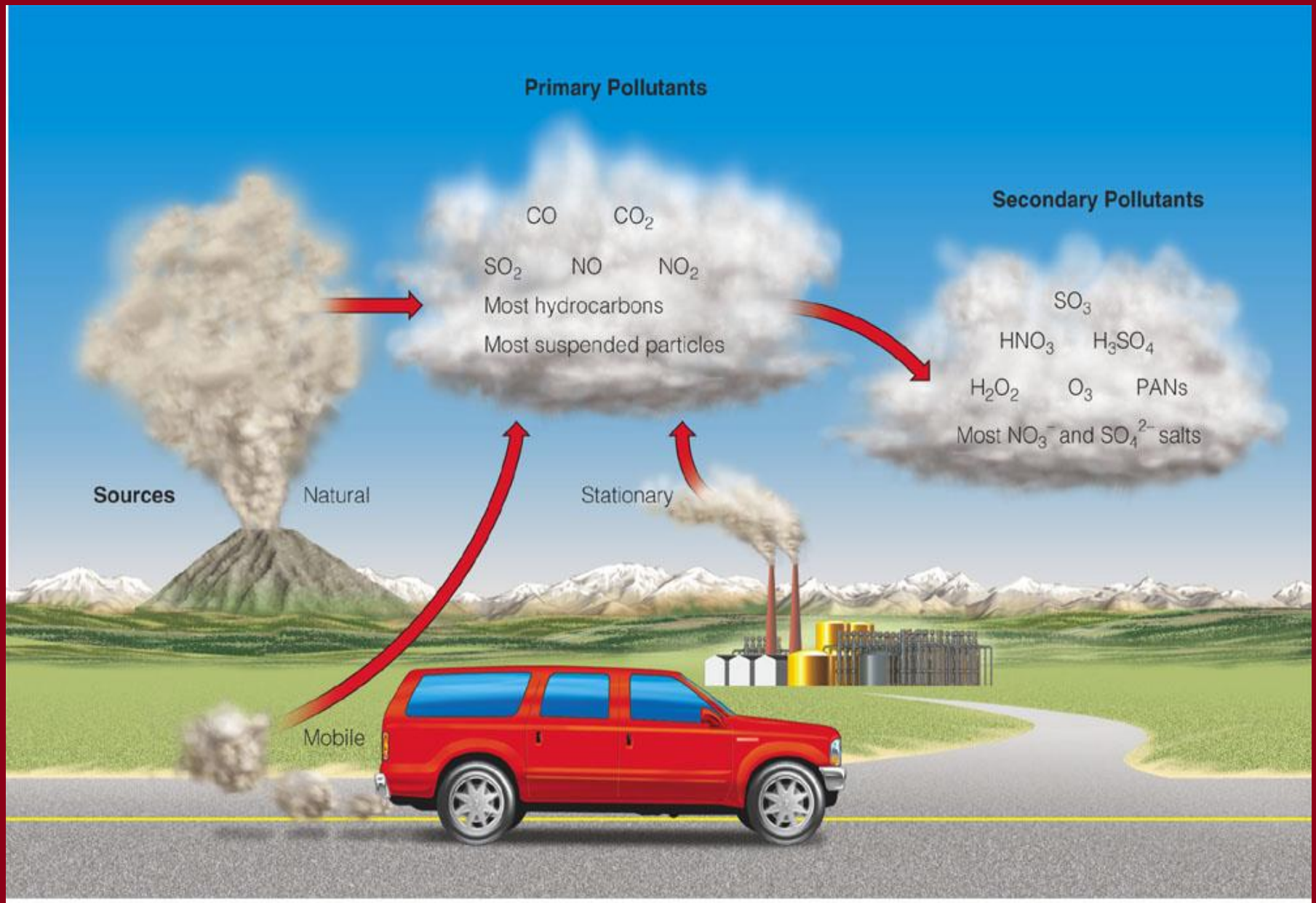
Emitted directly in the atmosphere in harmful form.

Examples: CO, NO, SO_2, etc.



- **SECONDARY AIR POLLUTANT - Primary air pollutant react among themselves or with atmospheric air and produce new and harmful compounds.**
- **Example: Ozone, Photochemical smog, PAN (peroxy acetyl nitrate),etc.**

$$NO/NO_2 \xrightarrow{\text{moisture}} HNO_3/NO_3$$



INDOOR AIR POLLUTANT

- **Primary pollutant**
- **Important indoor air pollutant is radon gas.**

INDOOR AIR POLLUTION SOURCES

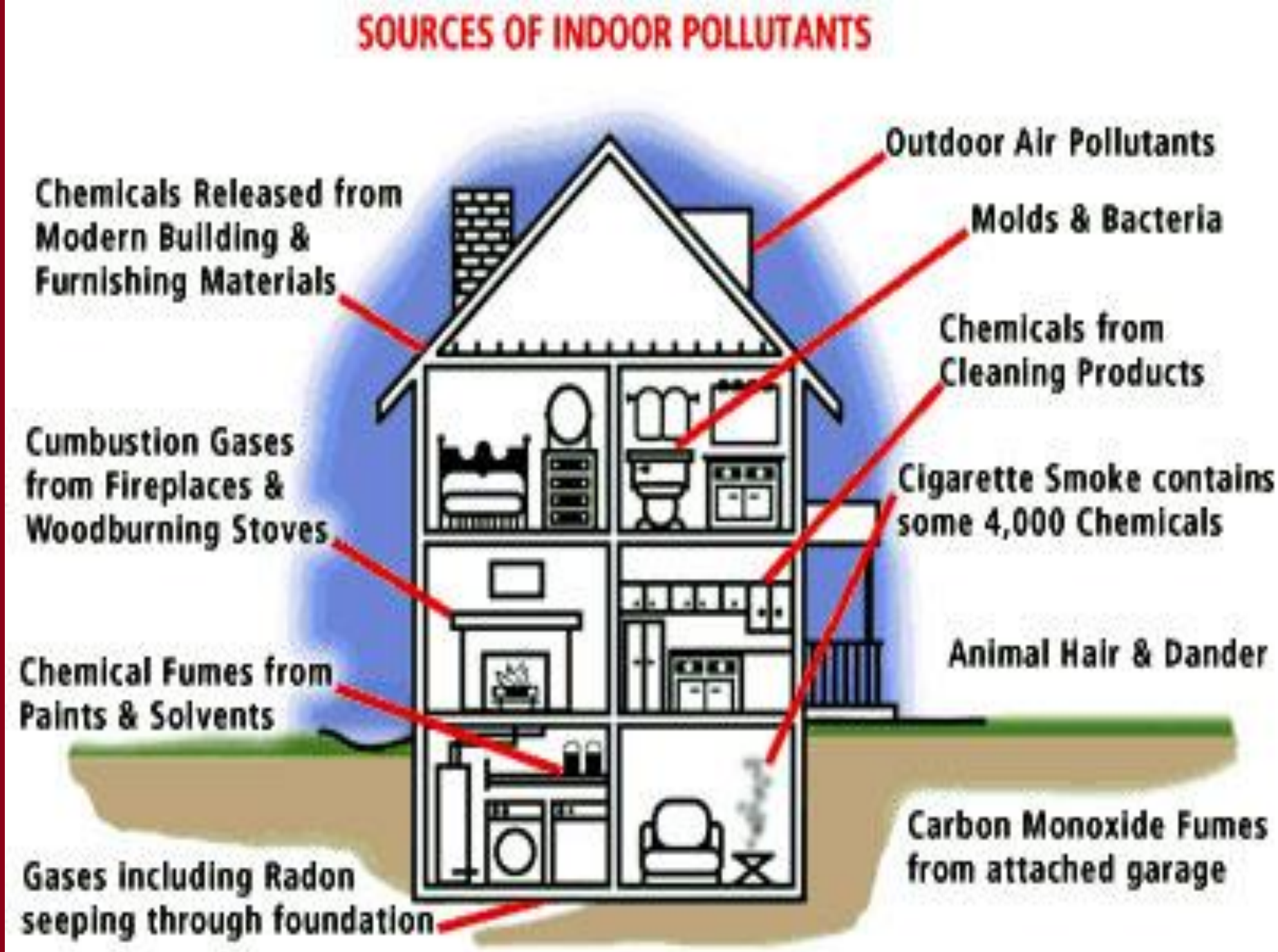
Pollutants	Sources and side effects
Chloroform	**Sources:** disinfectants **Side effects:** cancer
Para-dichlorobenzene	**Sources:** air fresheners, camphors **Side effects:** cancer
Tetrachloroethylene	**Sources:** vapour from cloth-dryer liquid that left in clothes **Side effects:** heart disorder, damages to kidney and cancer

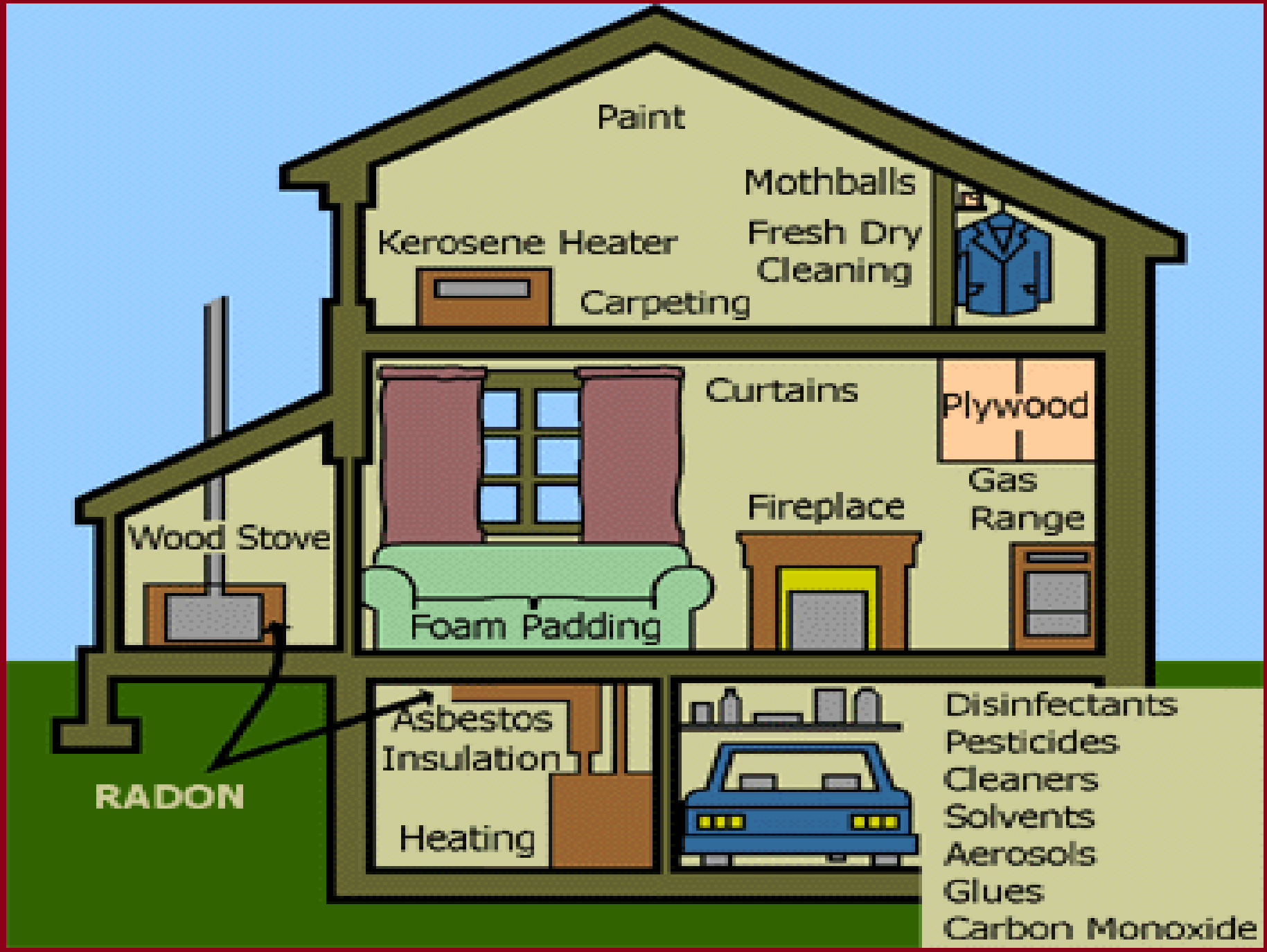
Formaldehyde	Sources: wood board frame and sofa containment Side effects: eye, skin, throat and lung irritations, headache
Benzo-a-pyrene	Sources: smoke from cigarettes and wood board Side effects: lung cancer
Styrene	Sources: carpets and plastics Side effects: damages to kidney
Radon-222	Sources: radioactive soil and foundation stone Side effects: lung cancer

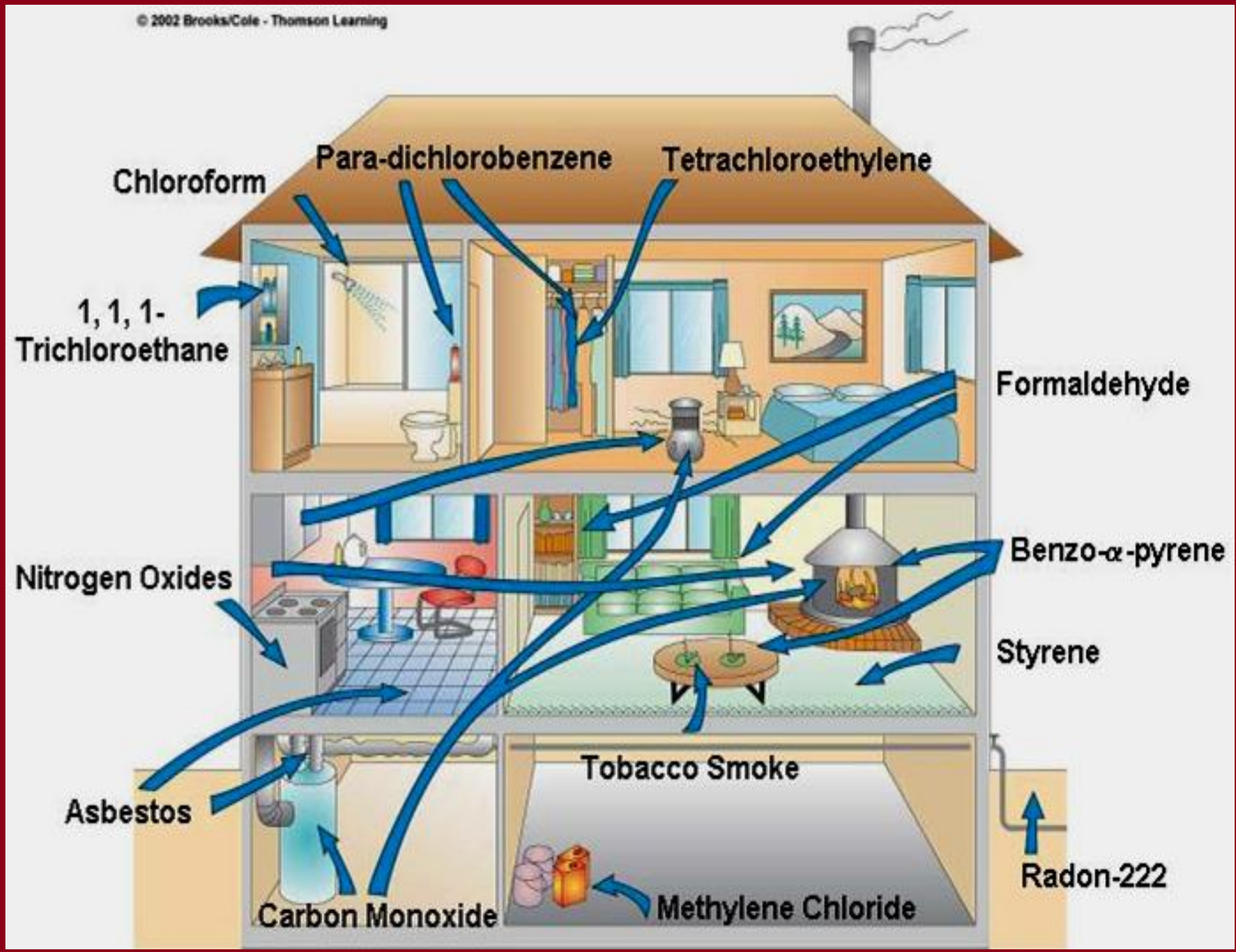
Methylene chloride	Sources: peeling paints Side effects: neural disorder and diabetes
Smoke from cigarettes	Sources: cigarettes Side effects: lung and respiratory system cancer, heart damage
Carbon monoxide	Sources: kerosene cooking stove, board, damaged fire stove (in living room) Side effects: headache, improper heartbeats, excessive sleepiness

Nitrogen oxide	**Sources**: wood board **Side effects**: lung irritation, fever to children, headache
1,1,1-Trichloroethane	**Sources**: aerosol spray **Side effects**: headache and respiratory difficulties
Asbestos	**Sources**: pipe isolation and tile **Side effects**: lung damages and cancer

SOURCES OF INDOOR POLLUTANTS




Paint
Mothballs
Fresh Dry Cleaning
Kerosene Heater
Carpeting
Curtains
Plywood
Gas Range
Fireplace
Wood Stove
Foam Padding
Asbestos Insulation
Heating
RADON
Disinfectants
Pesticides
Cleaners
Solvents
Aerosols
Glues
Carbon Monoxide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Chloroform
Para-dichlorobenzene
Tetrachloroethylene
1, 1, 1-
Trichloroethane
Formaldehyde
Nitrogen Oxides
Benzo-α-pyrene
Styrene
Tobacco Smoke
Asbestos
Radon-222
Carbon Monoxide
Methylene Chloride

PRIMARY AIR POLLUTANTS

- **CARBON MONOXIDE (CO)**
- **NITROGEN DIOXIDE (NO_2)**
- **SULPHUR DIOXIDE (SO_2)**
- **SUSPENDED PARTICULATE MATTER**

CARBON MONOXIDE

- **Description:** Colourless, odourless and poisonous gas.
- **Sources:** Incomplete combustion of fossil fuels, cigarette smoking and motor vehicle exhaust.
- **Effects:** Reduces ability of blood to carry oxygen which causes headache, anemia, coma and brain cell damage.

NITROGEN DIOXIDE

- **Description:** Reddish-brown chemical found in smog.
- **Sources:** Burning fossil fuels and industrial processes.
- **Impacts:** Lung irritation, aggravates asthma and reduces visibility.

SULPHUR DIOXIDE

- **Description:** Colourless gas, major source of acid deposition.
- **Sources:** coal burning power plants
- **Impacts:** Acid deposition, breathing problems, property damage, soil, aquatic life damage.

SUSPENDED PARTICULATE MATTER (SPM)

- **Description:** Particles in the air, range from small to large size.
- **Sources:** Burning fossil fuels (diesel), dust, smoke, fog, unpaved roads.
- **Impacts:** lung damage, asthma, increases risk of respiratory infection.

OZONE

- At upper level, ozone shields Earth from sun's harmful UV rays
- At ground level, ozone is harmful pollutant.
- **Description**: Highly reactive irritating gas with an unpleasant odour.

- **Sources: Formed by chemical reaction with VOCs and NOx from cars, power and chemical plant exhaust**
- **VOCs + NOx + heat + Sunlight = Ground Level Ozone (O_3)**

- **Impacts: Breathing problems, eyes, nose , mouth irritation, lung disease, and crop damage.**

HYDROCARBONS

- **Description: It can be gases, liquids, waxes or polymers.**
- **Sources: Decay of plants, burning of wet logs and agricultural wastes.**
- **Impacts: Carcinogenic. It causes plant damage even at low concentrations.**

LEAD

- **Description: Solid toxic metal and its compounds emitted as PM**
- **Sources: Paint, smelters, storage battery , leaded petrol.**
- **Impacts: Neurological problems, carcinogen.**

PHOTOCHEMICAL SMOG

SMOG (smoke + fog)

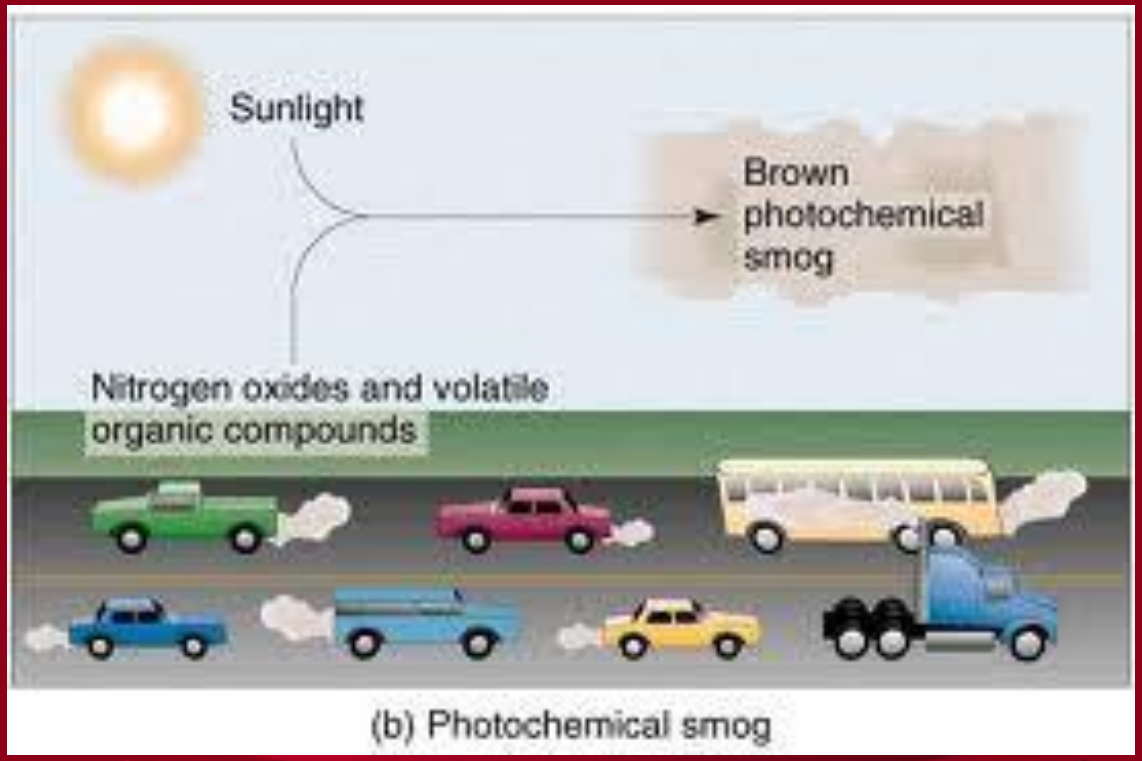
- **Description: Brownish smoke like appearance forms on clear sunny days over large cities with lot of automobile traffic.**

- **Sources:** Chemical reaction among Nitrogen oxide and hydrocarbon by sunlight.
- **Impacts:** Breathing problems, cough, eye, nose and throat infection.

(a) (b)

Photochemical smog can cause serious haze in a city

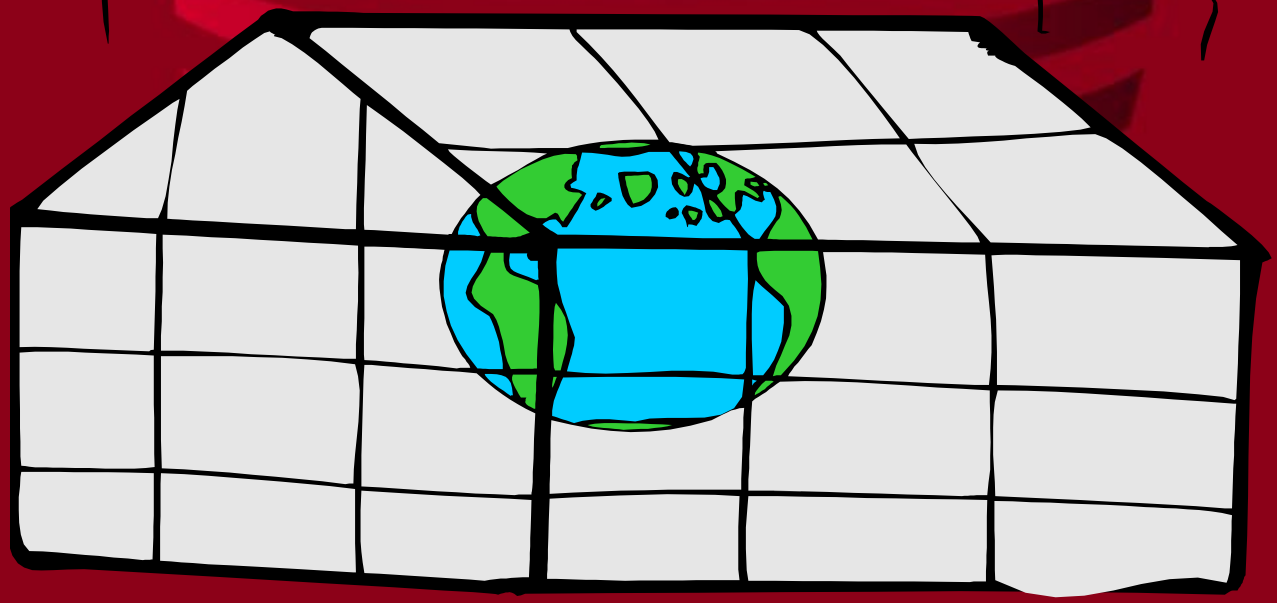
(a) Smoggy condition (b) Clean condition



(b) Photochemical smog

The other problems.....

The Greenhouse Effect




Global Warming

Thinning of Upper OZone Layer

Acid Rain

Indoor Air Pollution

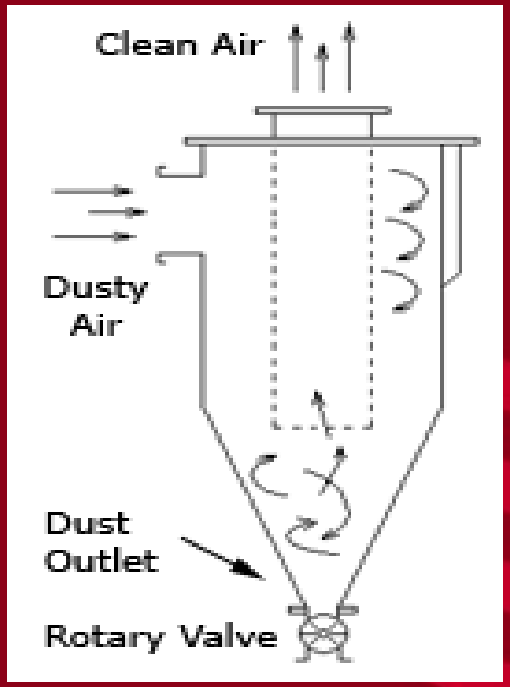
CONTROL OF AIR POLLUTION

- Controlling of coal dust by sprinkling water on it before handling in a thermal power plant.
- Preventive maintenance by repairing leaky valves in advance so as to prevent the leakages of the harmful gases in air.
- Selection of proper material.

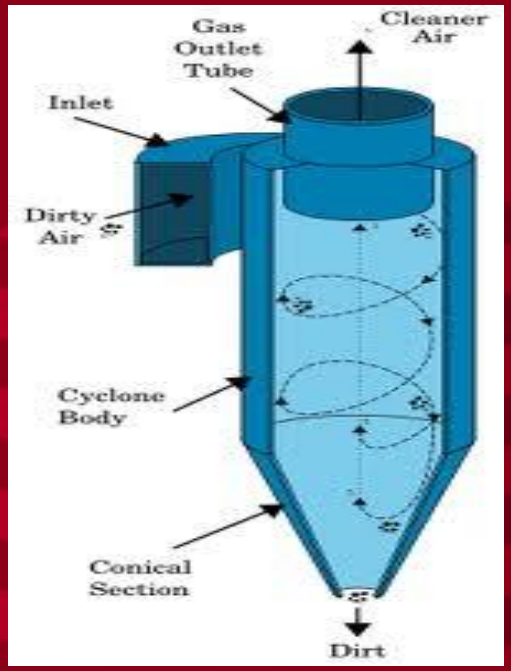
  Example: using low sulfur coal reduces the Sulfur dioxide problem

For particulate matter the following control technologies are used

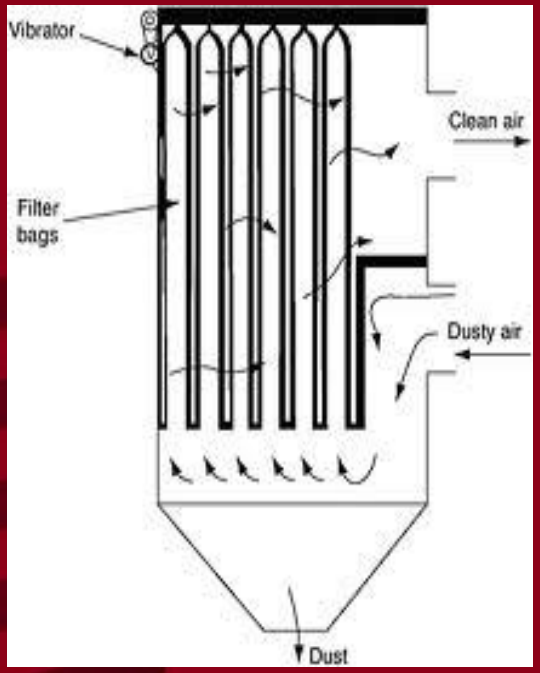
- Settling chambers
- Cyclone separators
- Fabric filters
- Electrostatic precipitators
- wet collector



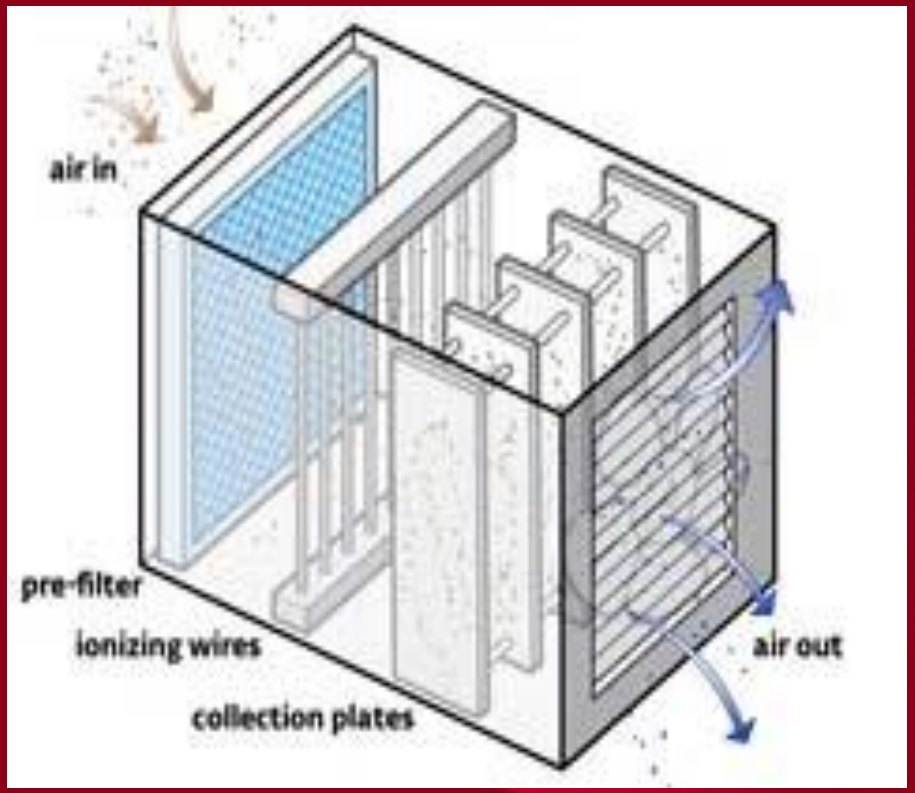
Settling Chambers

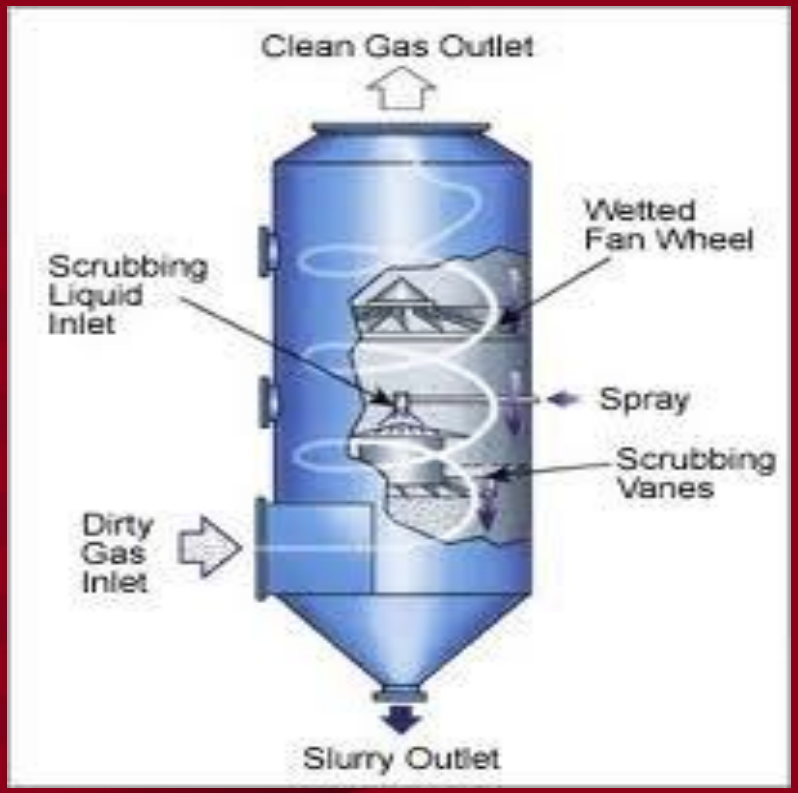


Cyclone Separators



Fabric filters





Electrostatic precipitator

Wet scrubber

For gaseous pollutants the following control technologies are used

- **Condensation**
- **Absorption**
- **Adsorption**
- **Combustion**

THE END