POLLUTION

Air Pollution

POLLUTION

- 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
- Thermal Pollution
- Radioactive Pollution

AIR 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 AIR 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 needs 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, aldehydes, etc.

AIR POLLUTANTS - CLASSIFICATION

Pollutants are also classified according to the type of matter.

- Gaseous pollutants – Such as oxides of C, N, S, H_2S, Hydrocarbons, etc

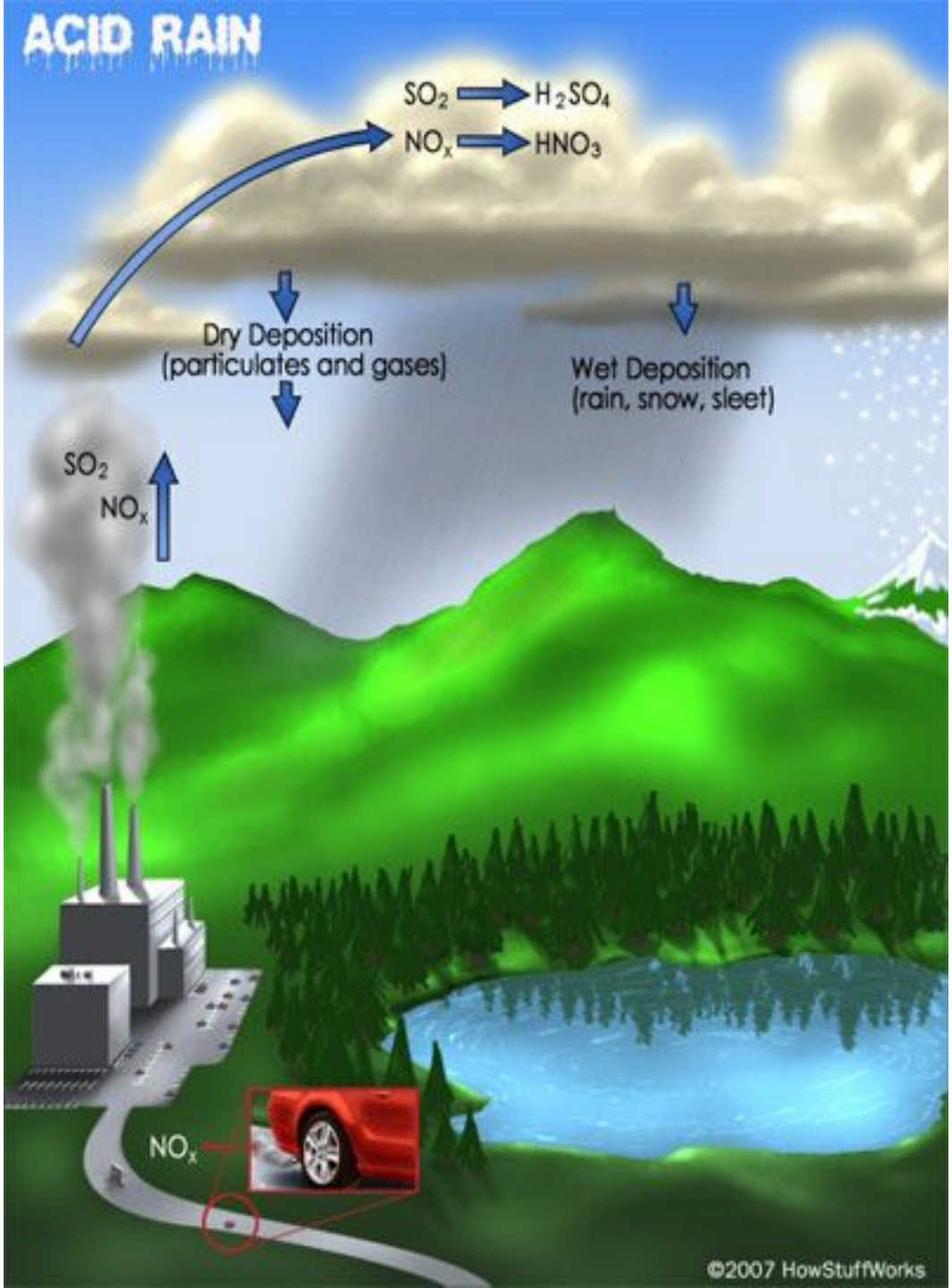
- Particulate matter – These are finely divided solids which exist in the form of aerosols such as smoke, dust, fumes, smog, fog, etc.

IMPORTANT AIR POLLUTANTS

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
- Climatic changes
- **Acid rain** causes great damage to buildings, plants and the environment
- Global warming due to **green house effect**
- **Ozone layer depletion**


ACID RAIN
$SO_2 \rightarrow H_2SO_4$
$NO_x \rightarrow HNO_3$
Dry Deposition
(particulates and gases)
Wet Deposition
(rain, snow, sleet)
SO_2
NO_x
NO_x
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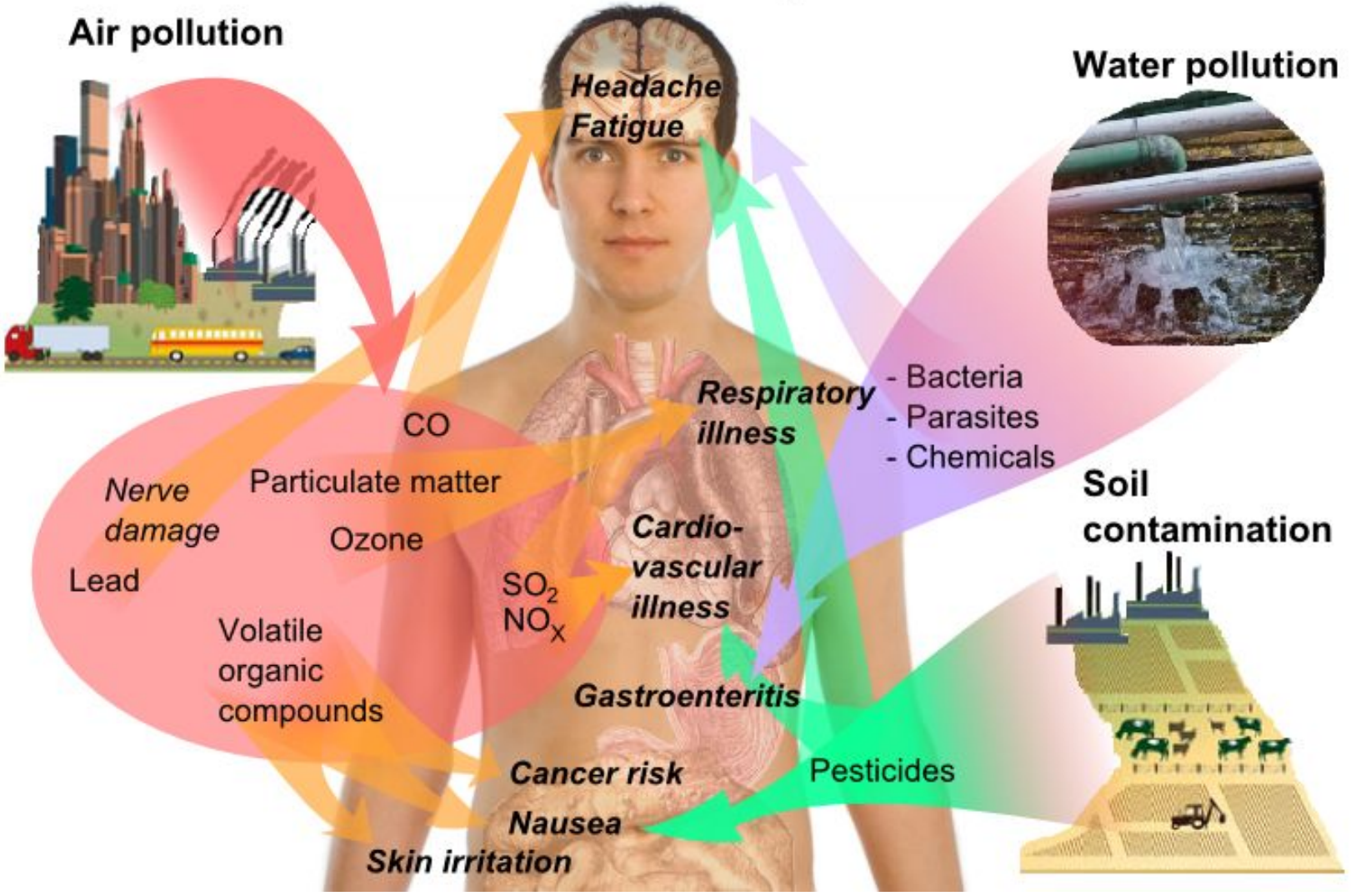
ACID RAIN EFFECTS

SMOG IN LA, CALIFORNIA

TREES AFFECTED BY SULPHUR EMISSION

Health effects of pollution



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

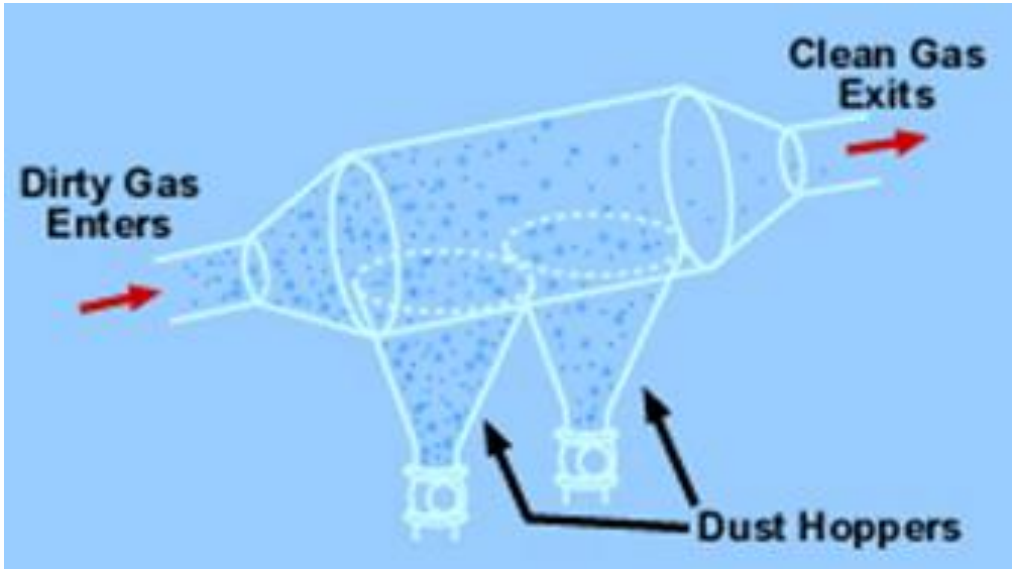
CONTROL DEVICES

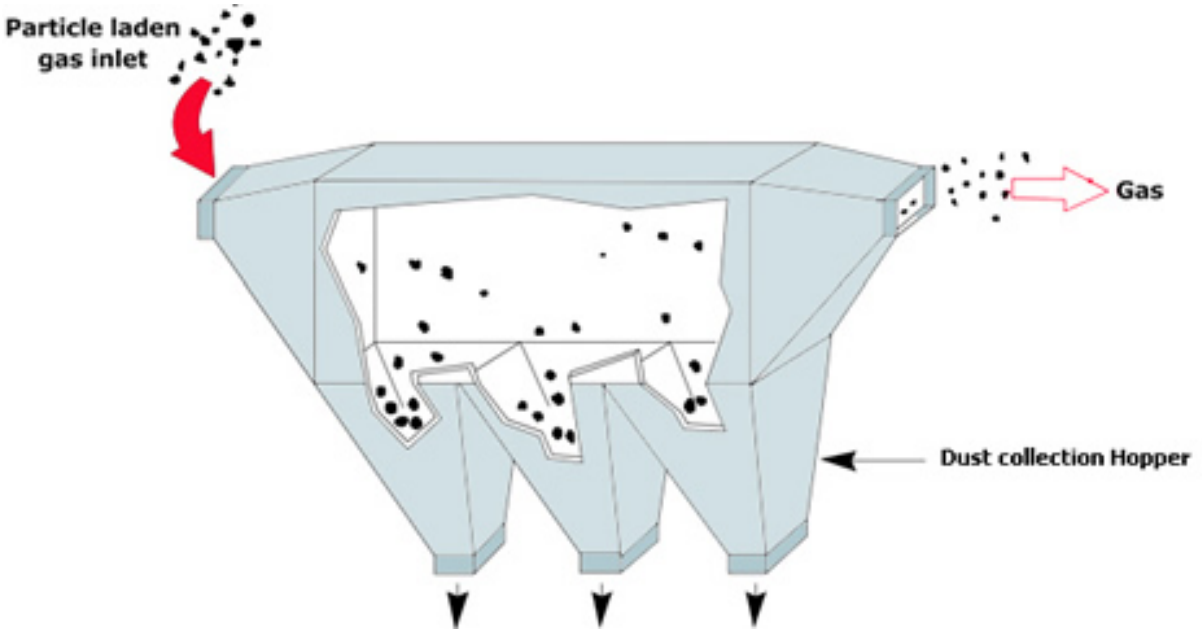
There are several control devices that are used to clean particulate contaminants.

- Gravity settling chamber
- Cyclone collector/separator
- Bag house/Fabric filters
- Electrostatic Precipitators
- Wet Scrubbers

GRAVITY SETTLING CHAMBER

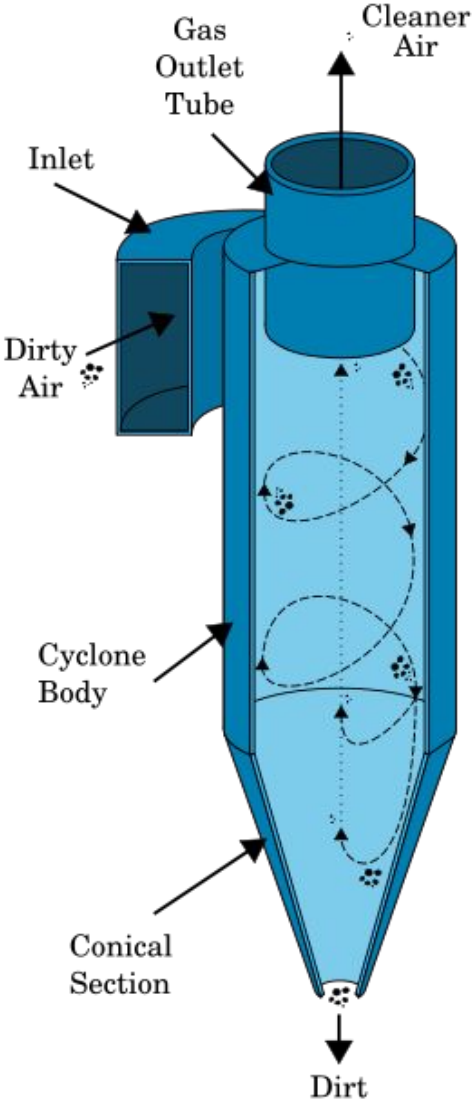
- Settling chambers use the force of gravity to remove solid particles.
- The gas stream enters a chamber where the velocity of the gas is reduced.
- Large particles drop out of the gas and are recollected in hoppers.

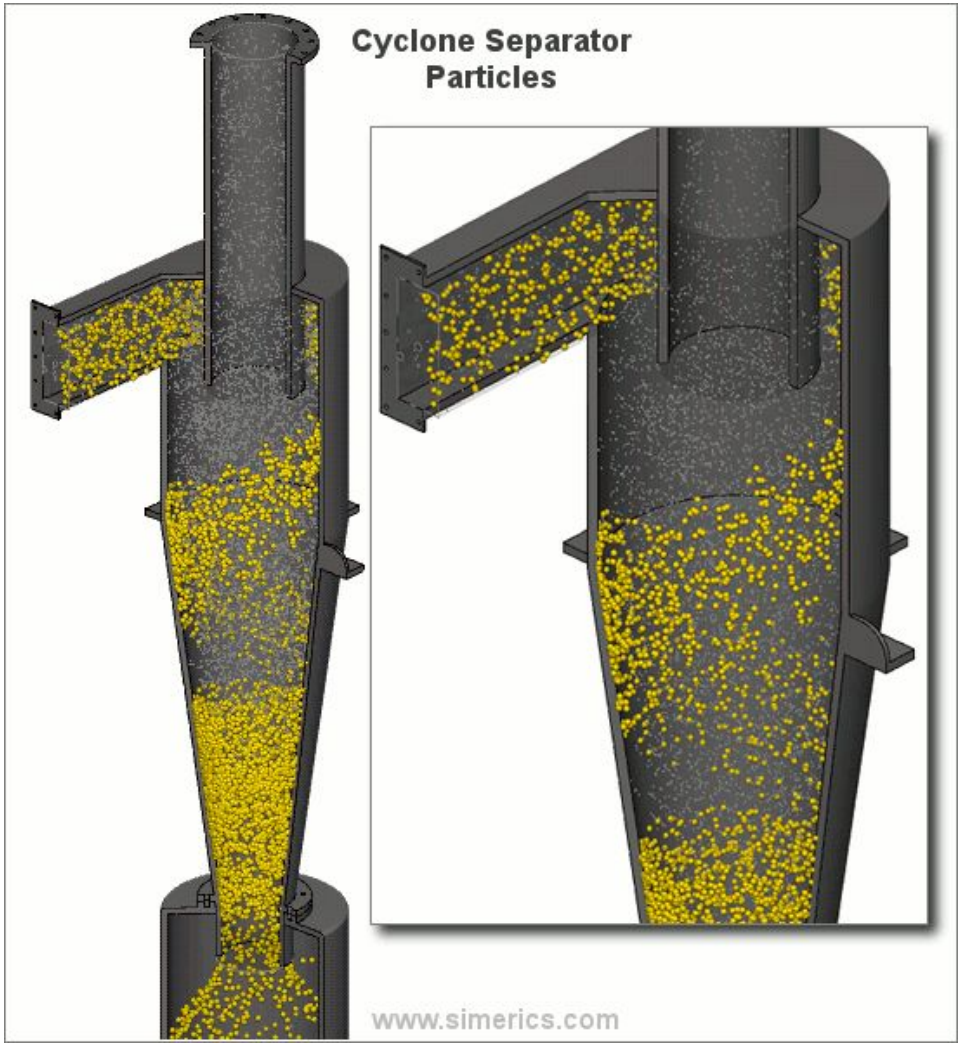

Clean Gas
Exits
Dirty Gas
Enters
Dust Hoppers


Particle laden
gas inlet
Gas
Dust collection Hopper

CYCLONE SEPARATOR

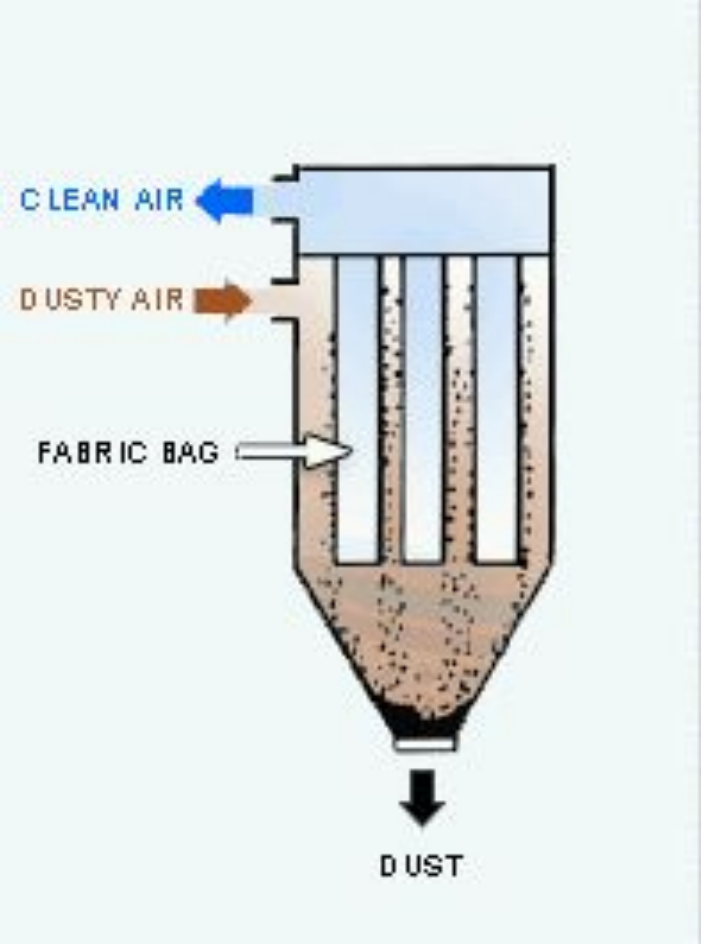
- Cyclone separators remove particulate matter by centrifugal force.
- Dust laden gas is forced into a chamber and the swirling motion creates centrifugal force.
- This causes particles to be thrown against the walls and to drop down into a hopper.
- Clean air passes out from the top.

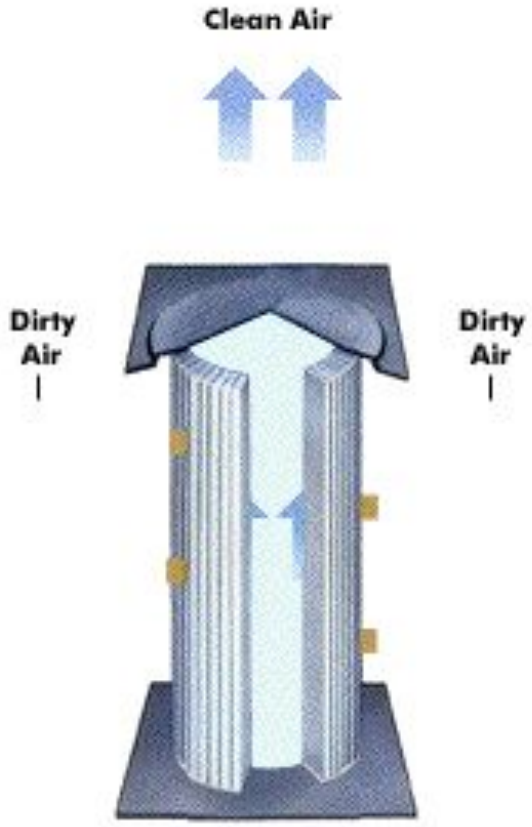

Gas
Outlet
Tube
Cleaner
Air
Inlet
Dirty
Air
Cyclone
Body
Conical
Section
Dirt


Cyclone Separator
Particles
www.simerics.com

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.


CLEAN AIR
DUSTY AIR
FABRIC BAG
DUST


Clean Air
Dirty Air
Dirty Air

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.

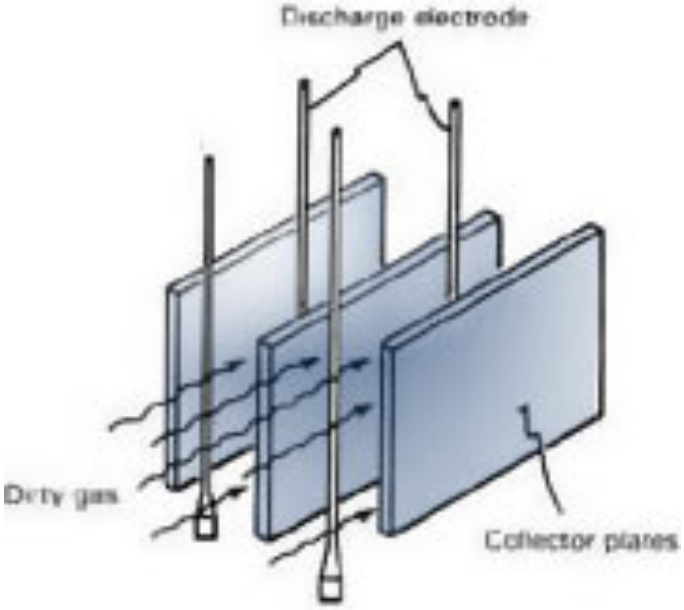
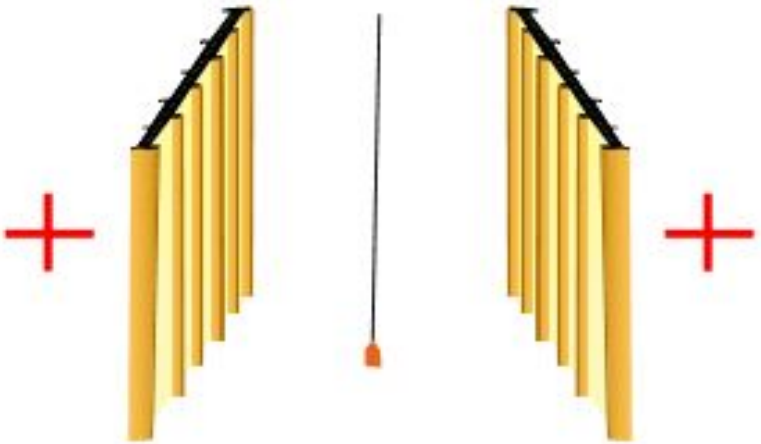


Plate-Type Precipitator



Electrostatic Precipitators

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 is allowed to pass out.
- These are specially useful when the gases are combustible or requires cooling before being let out into the atmosphere.