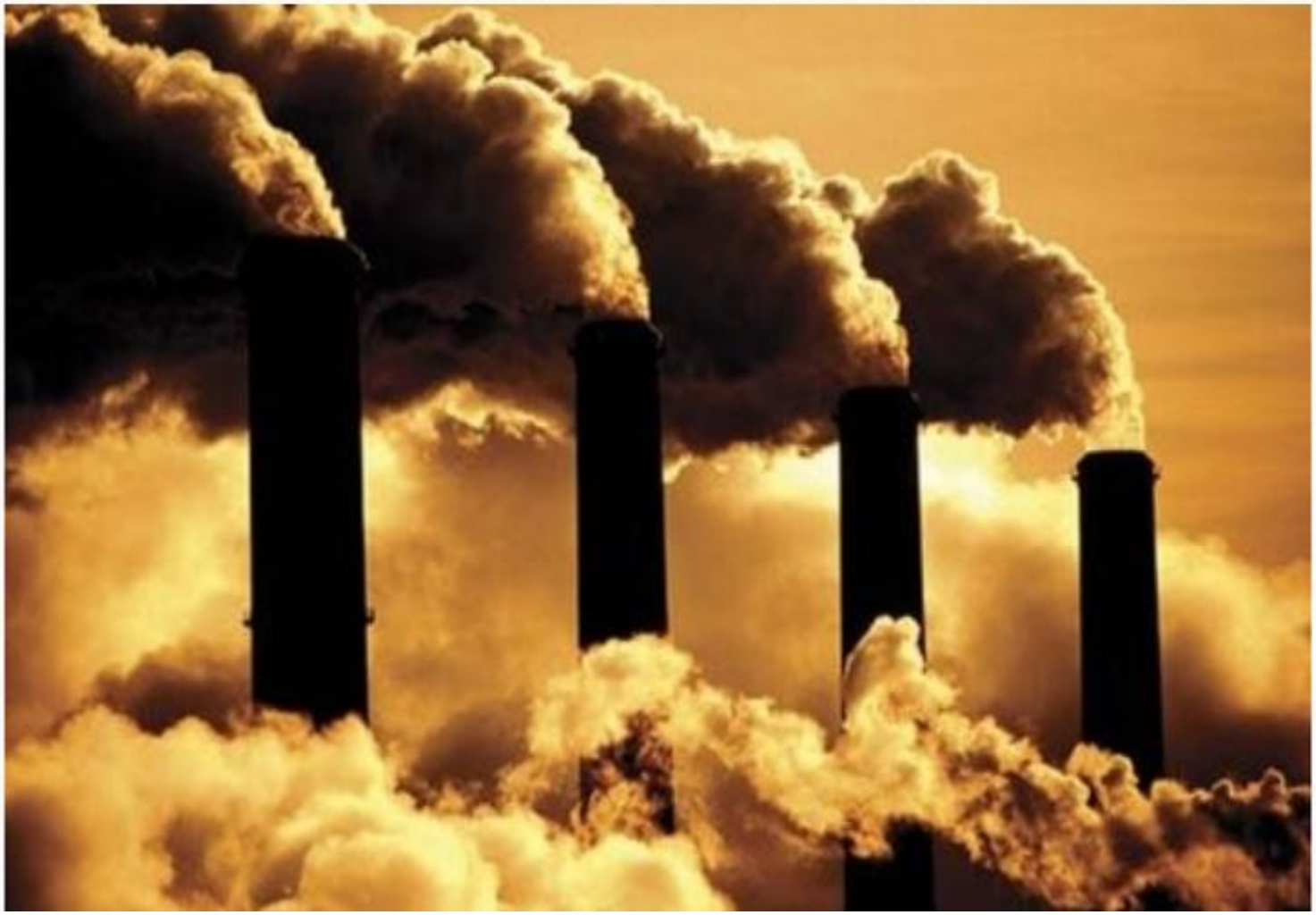
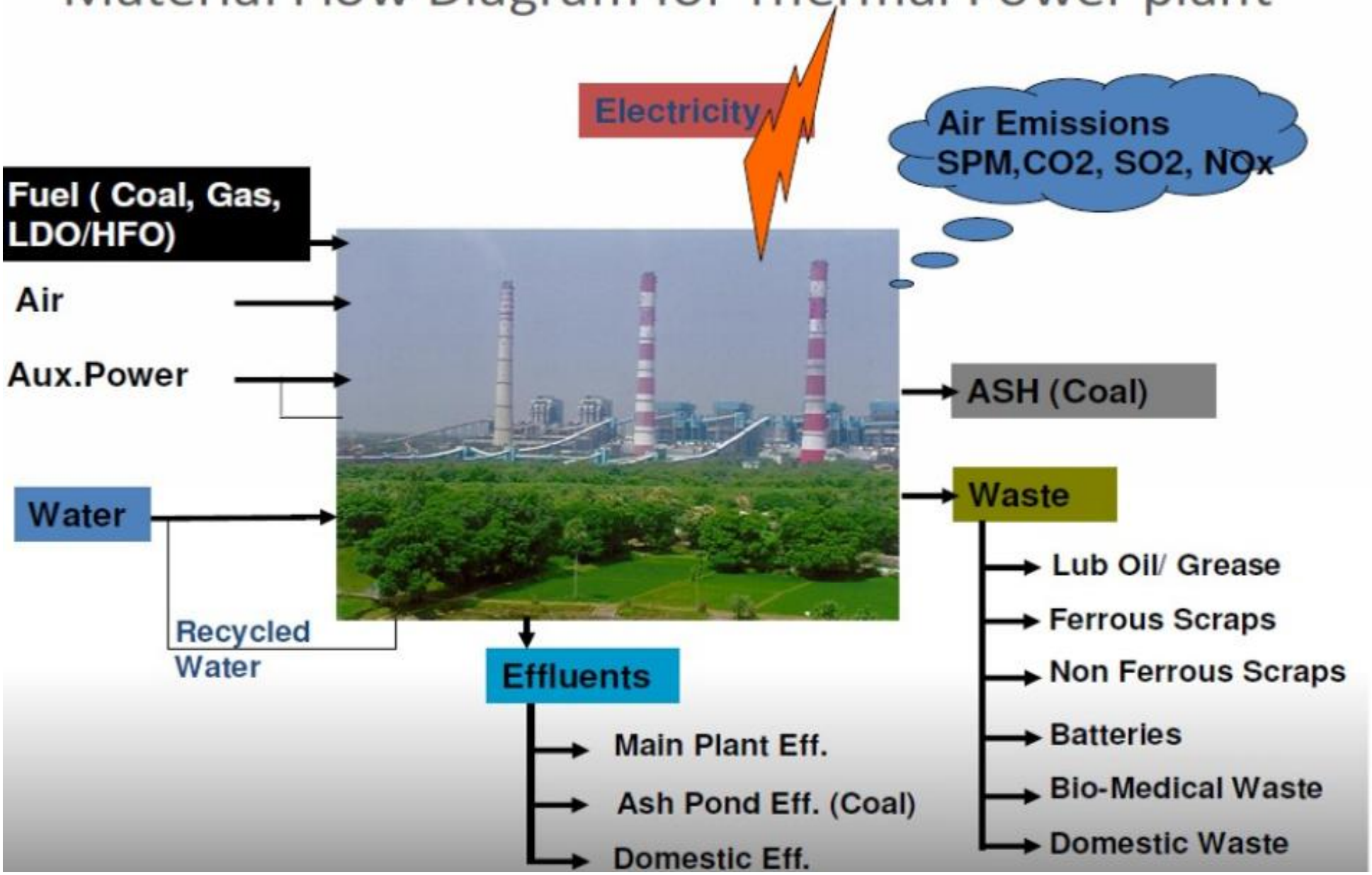
ENVIRONMENTAL IMPACT OF EMISSIONS OF THERMAL POWER PLANTS



Material Flow Diagram for Thermal Power plant



ENVIRONMENTAL ISSUES IN COAL BASED POWER GENERATION

Air Pollution :- High particulate matter emission levels due to burning of inferior grade coal which leads to generation of large quantity of fly ash.

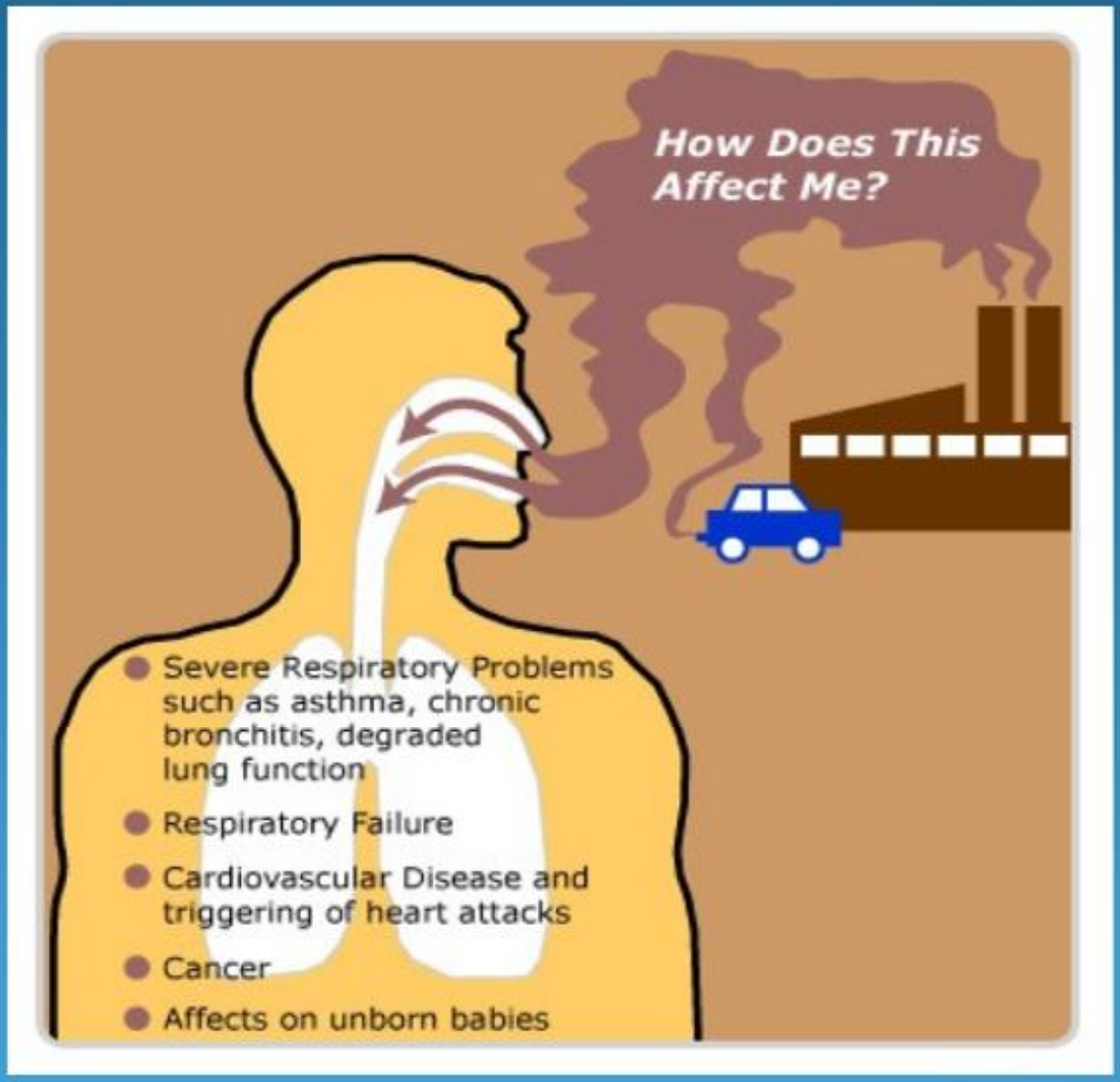
Emissions of SO_2, NOx & Green house gas (CO_2) are also matter of concern.

Water Pollution :- Mainly caused by the effluent discharge from ash ponds, condenser cooling /cooling tower, DM plant and Boiler blow down.

Noise Pollution :- High noise levels due to release of high pressure steam and running of fans and motors

Land Degradation :- The disposal of large quantity of ash has occupied thousands hectares of land which includes agricultural and forest land too.

AIR POLLUTION IN THERMAL POWER PLANTS



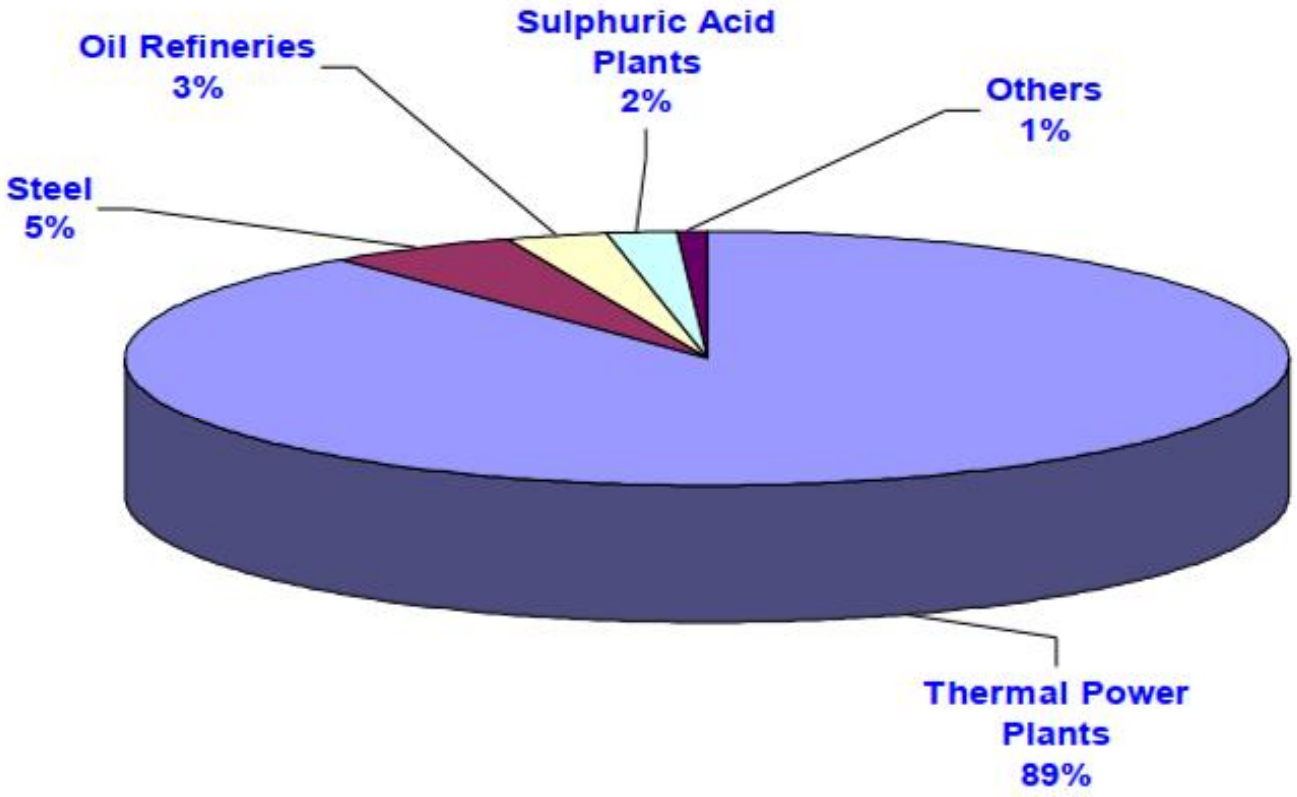
The major pollutants are

- Particulate matter(fly ash)
- CO_2 Emission
- Sulfur oxides (SOX)
- Oxides of nitrogen(NOX)
- Probability of emission of CO and unburnt carbon.

SPM Emission Estimates

Share of Suspended Particulate Matter Load (tonnes/day) by Different Categories of Industries (With Control Device), Total Load = 5365 tonnes/day

Share of Sulphur Dioxide Load (Tonnes / day) By different categories of Industries (Total Load = 3715 Tonnes / day)



- Fly ash contains a toxic brew of dangerous chemicals and is the largest contributor to mercury pollution

- **Composition of Fly ash**

  It contains as main chemical components SiO_2 (51.4 wt%), Al_2O_3 (22.1 wt%) and Fe_2O_3 (17.2 wt%)

  Considerable amounts of toxic elements and heavy metals

  Be (16.4 ppm), Cu (106 ppm), Zn (578 ppm), As (40.4 ppm),

  Cd (2.6 ppm), Hg (18 ppm), Pb (71 ppm), and U (21.8 ppm) is found in Fly ash.

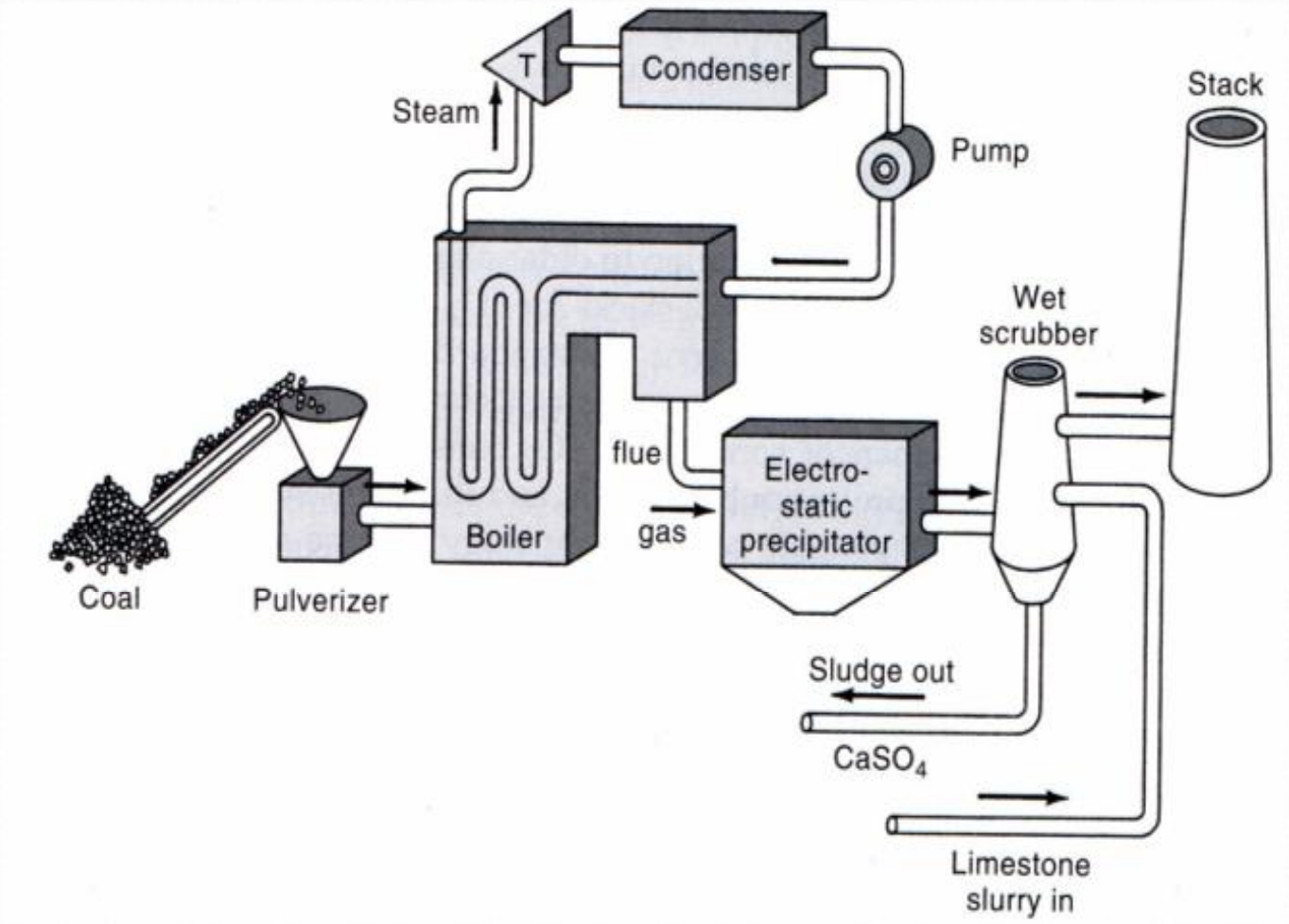
EFFECTS OF POLLUTANTS

Pollutants	Effects (On Man)
SOX	Suffocation, irritation of throat and eyes, respiratory, asthma, lung cancer
NOX	Irritation, bronchitis, oedema of lungs
H2S	Irritation, disease of bone, mottling of teeth, respiratory disease
CO	Poisoning, cardiovascular diseases
Particulates (Dust fume mist	Respiratory diseases like

EFFECTS OF POLLUTANTS

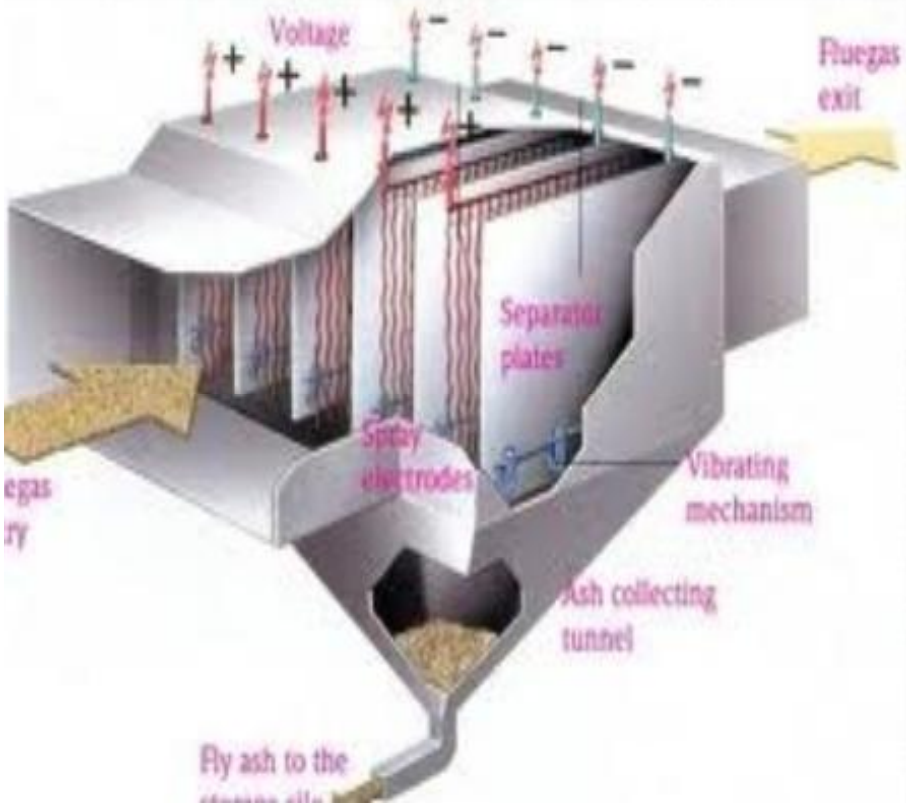
Pollutant	Effects on environment
SO2/NO2	On Vegetation: Acidic rains destruction of sensitive crops and reduced yields On Materials: Corrosion
CO2(Green house gas)	GLOBAL WARMING
Particulate (Dust fume mist and soot)	On Material: Soiling and corrosion

wer plant pollution control



Electrostatic precipitator

n **electrostatic precipitator** (**ESP**), or **electrostatic air cleaner** is a rticulate collection device that removes particles from a flowing gas (such s air) using the force of an induced electrostatic charge.

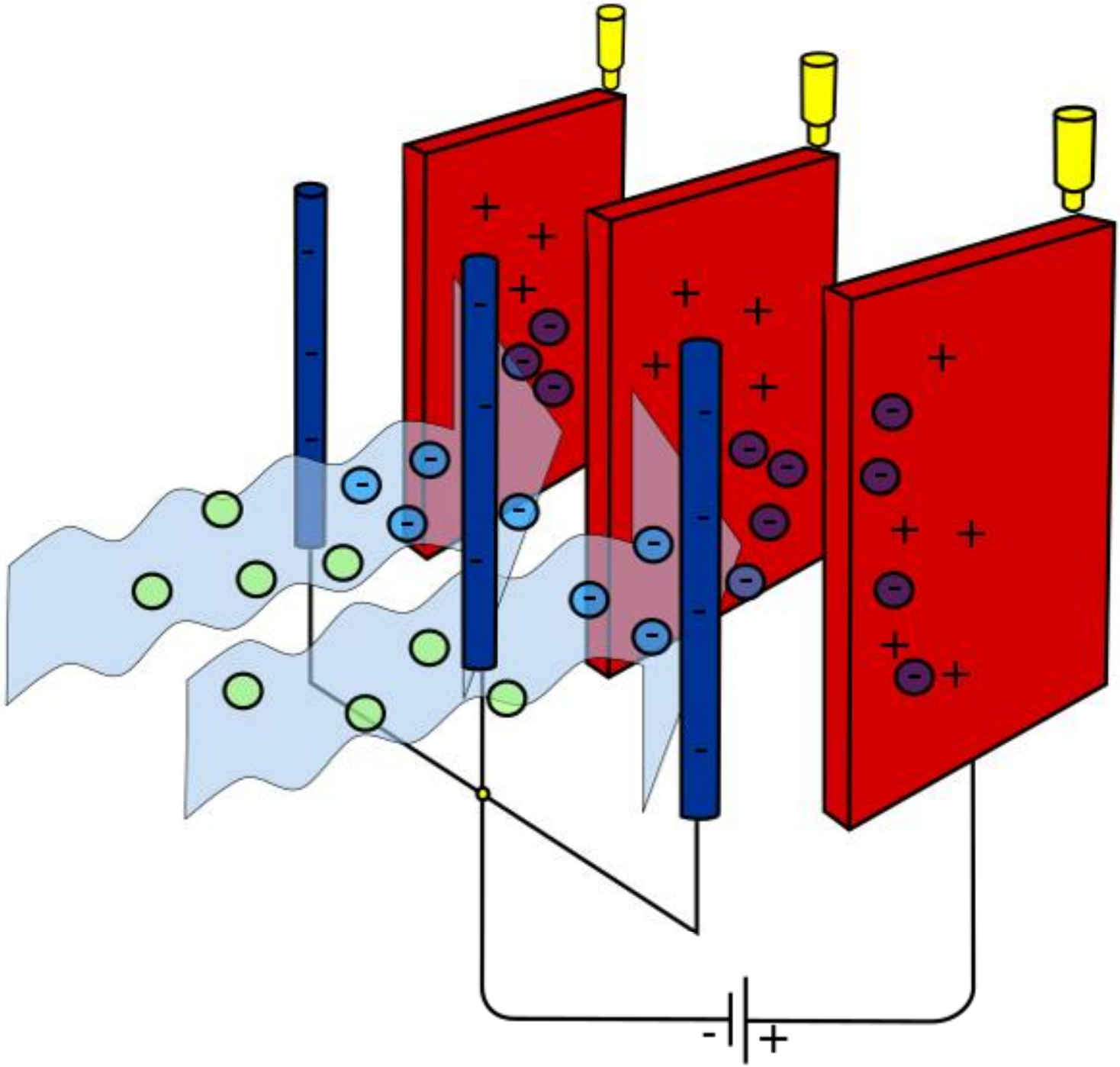


w of thin vertical wires, and followed by a stack of large fl
cm apart, depending on the application. The air stream fl
ugh the stack of plates.

olts is applied between wire and plate. If the applied volta
trodes, which then ionizes the particles in the air stream.

tatic force, are diverted towards the grounded plates. Pa

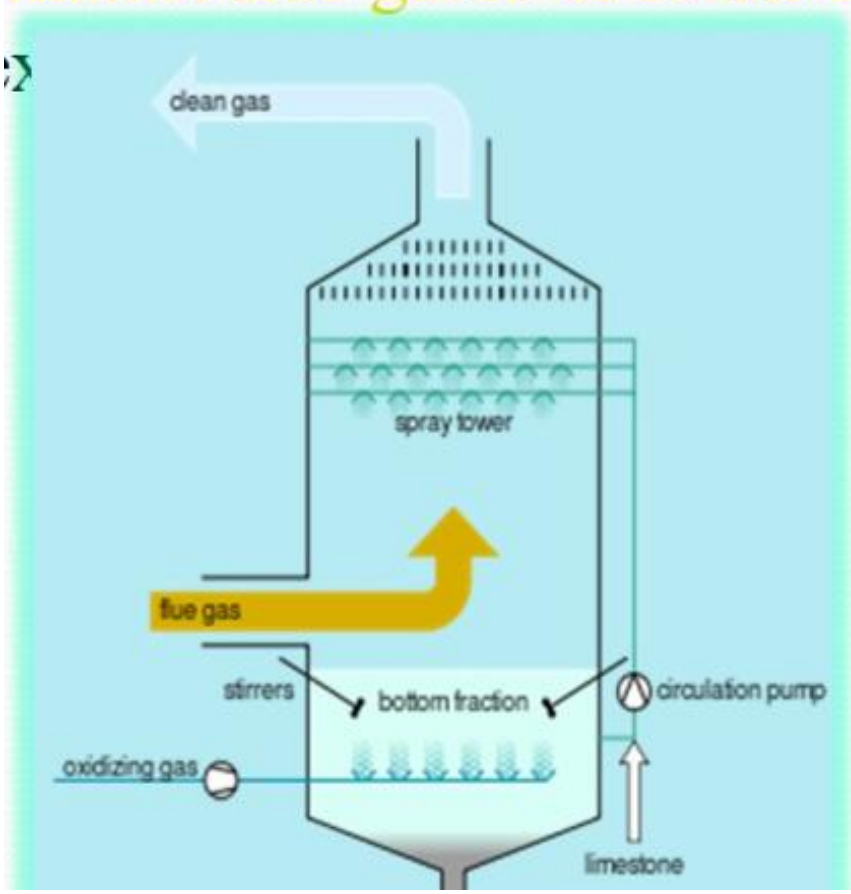
ection ahead of collecting section) has the benefit of mini
ing in enclosed spaces. For shipboard engine rooms wh
proving the operating environment and preventing buildu
ating system.[*citation needed*]



SO_x CONTROL

FGD – Flue Gas Desulfurization

Flue-gas desulfurization (FGD) is a set of technologies used to remove sulfur dioxide (SO_2) from exhaust flue gases of fossil-fuel power plants if sulfuer content



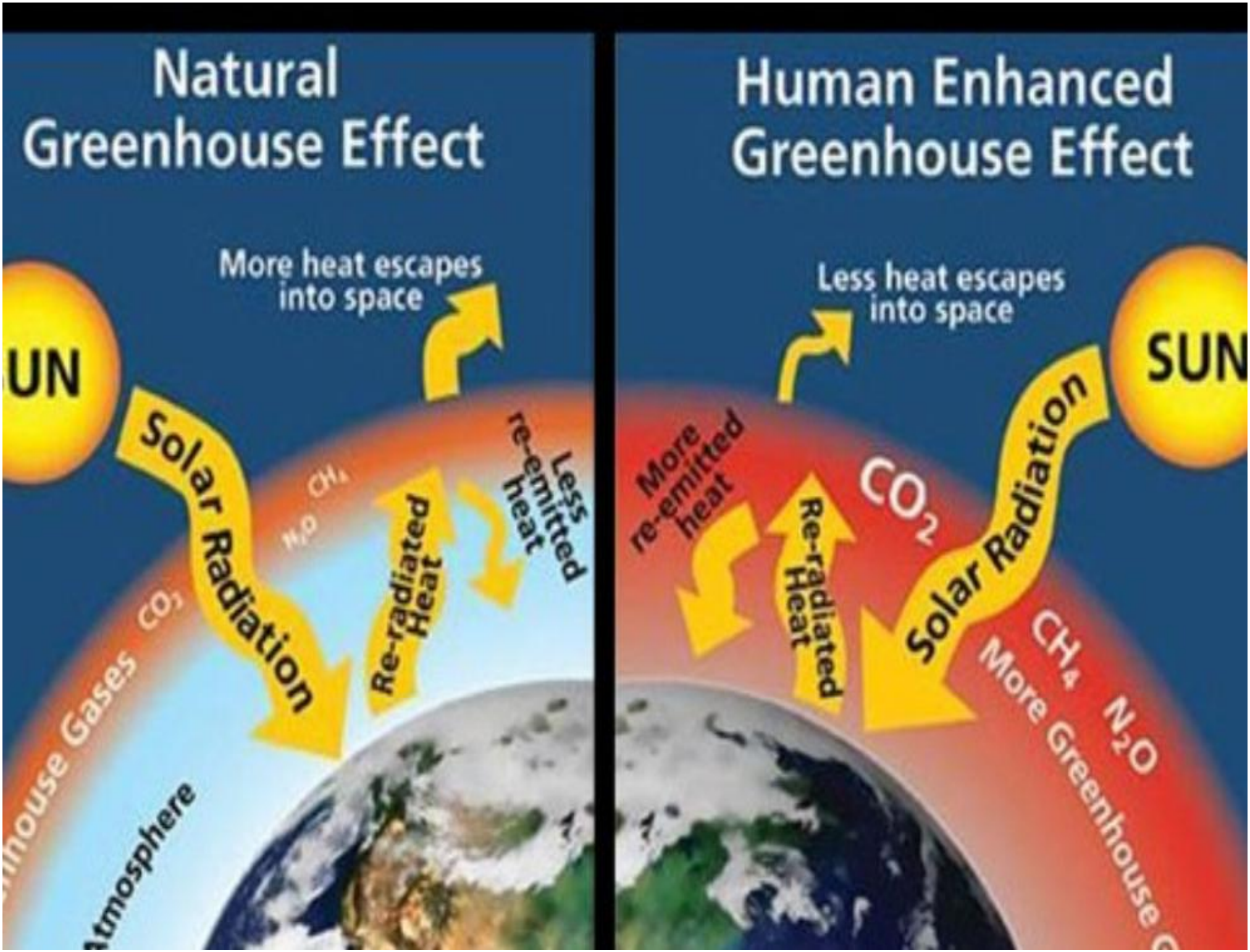
Limestone slurry is sprayed on the incoming flue gas. The sulfur dioxide gets absorbed The limestone and the sulfur dioxide react as follows :

$CaCO_3 + H_2O + 2SO_2 \longrightarrow Ca^{+2} + 2HSO_3^- + CO_2$

$CaCO_3 + 2HSO_3^- + Ca^{+2} \longrightarrow 2CaSO_4 + CO_2 + H_2O$

Control Of Nox Emissions

- NOx control can be achieved by:
  - Reduce Oxygen concentration in the flame one. This can be accomplished by:
    - decreasing the excess air
    - controlled mixing of fuel and air
    - Using high quality coal


Natural
Greenhouse Effect
More heat escapes
into space
SUN
Solar Radiation
Re-radiated
Heat
Less
re-emitted
heat
Human Enhanced
Greenhouse Effect
Less heat escapes
into space
SUN
Solar Radiation
More
re-emitted
heat
Re-radiated
Heat
CO_2
CH_4 N_2O

ATURAL GREEN HOUSE EFFECT

recipitation of water, formation of clouds, rainfall etc. life
the biosphere depend on these resources.

he warm atmosphere helps in the growth of vegetation
nd forest etc. These are sources of food, shelter etc.

his effect helps in rapid bio-degradation of dead plants
nd animals.

HUMAN ENHANCED GREEN HOUSE EFFECT

- Rising sea levels
- Change in climate
- Heat stress in Humans
- Alteration of habitats and ecosystems

STACK HEIGHT REQUIREMENTS

For the proper dispersion of SO_2 emission from thermal power plant, stack height criteria have been adopted in country. However, for larger capacities boilers (500MW and above) space provision for installing FGD system has been recommended.

Power generation capacity	Stack Height (mts.)
Less than 200/210 MW	$H = 14 (Q)^{0.3}$, where Q is emission rate of SO_2 in kg/hr, H= Stack Height
200/210 or less than 500 MW	220
500 MW and above	275

Pollution control by Combustion technologies

Pre-combustion Technologies:

Ash, sulphur and other impurities (coal beneficiation) can be reduced from the coal before it is burned

Combustion technologies : (FBC , AFBC,PFBC, IGCC)

Generation of emissions of SO_2, NOx and CO_2 can be minimised by adopting improved combustion technologies

Post combustion technologies :

End of pipe treatment (installation pollution control equipments such as ESP, De NO_x & De SO_x systems)

EMISSION STANDARDS AS PER MOEFCC

Emission Standards for SOX

Pollutants	Older Units		Older New		Future
	before December 31, 2003		*After 2003 to 2006*		*from January, 2017*
	<500 MW	*≥ 500 MW*	*<500 MW*	*≥ 500 MW*	
SO_2	600 mg/ Nm³	200 mg/ Nm³	-	200 mg/ Nm³	100 mg/ Nm³

Emission Standards for PM

Pollutants	Older Units		Older New		Future
	before December 31, 2003		*After 2003 to 2006*		*from January, 2017*
	<500 MW	*≥ 500 MW*	*<500 MW*	*≥ 500 MW*	
PM	100 mg/ Nm³		50 mg/ Nm³		30 mg/ Nm³

Emission Standards for NOX

Pollutants	Older Units		Older New		Future
	before December 31, 2003		*After 2003 to 2006*		*from January, 2017*
	<500 MW	*≥ 500 MW*	*<500 MW*	*≥ 500 MW*	
NOx	600 mg/ Nm³		300 mg/ Nm³		100 mg/ Nm³

EFFECTIVE H S E

Communication: Must be a loop system

Dedication: From everyone

Partnership: Between Management and [illegible]es

Participation: An important part of team working