**Air Pollution**

From natural sources such as dust, forest, fires, and geological processes

Humans add air pollutants through burning of Fossil Fuels, erosion of land, factory emissions

- **Major outdoor air pollutants**

-Carbon oxides (CO, CO2)

-Nitrogen oxides (NO, NO2, N2O)

-Sulfur oxides (SO2, SO3)

-Suspended Particulate Matter

-Solids (dust, soot, lead, nitrate and sulfate salts)

-Liquids (sulfuric acid, PCBs, pesticides, dioxins

-Photochemical Oxidants (ozone)

-VOCs (Hydrocarbons like methane & benzene from incomplete combustion)

-Hazardous Air Pollutants

-Cause cancer, birth defects, nervous system damage

-HAPs: benzene, formaldehyde, chloroform, lead, radioactives)

- **Primary pollutants**: directly put in trophosphere

* + Examples:
  + CO2 & NOx gases from car exhaust
  + Ash produced from burning coal
  + SO2 gas from volcanoes or burning coal

- **Secondary pollutants**: when primary pollutants react with air to form new pollutants

Ex: Acid Rain

-Sulfur based from coal: SO2 + H2O 🡪 H2SO4 (ACID RAIN)

-Nitrogen based from cars NO2 + H20 🡪 2HNO3 (ACID RAIN)

-leads to acid deposition in soil and rocks (Al) and acidification of water

Ex: Photochemical Smog (ozone in the troposphere… BAD):

-From car emissions: VOC + NOx + heat + light 🡪 OZONE (resp. irritant)

-Smog:

-Photochemical smog = orange smog and associated with car emissions: ozone!

-Industrial Smog = grey smog (soot)

-Due to burning large amounts of coal (China) … SO2… ACID RAIN

**Thermal Inversions**

-warm air convers cool air and no movement occurs forming a “blanket”…. Traps pollution!

-big problem in cities (worsened in mountainous areas)

**Technologies for Removal of Air Pollution**  
 -Baghouse filter – remove very fine particulates  
 -Cyclone collector – particulate removal; cheap! Like a dyson vacuum cleaner  
 -Electrostatic precipitator – removal of particulates based on charge separation  
 -Wet Scrubber - removes particulates and gases such as SOx; goes through mist of liquid chemicals (water)  
 -Catalytic converter (on cars) – transform toxic pollutants into less harmful forms (CAA 1973)

**Natural Factors that Reduce Air Pollution**   
-rain and snow  
-salty spray from the ocean  
-winds

**Indoor Air Pollution**

-Cigarette smoke: Lung cancer! Also creates CO, CO2, sulfur and particulates

-CO (reduces O2 in your blood): burning fire places, car emissions, cig smoke

-formaldehyde: “new” smell from building materials, carpet; dizziness

-radon-222: trapped in radioactive uranium rocks; carcinogen

-asbestos and fine particulates: fire retardants in old homes; carcinogen

**Clean Air Acts**: 1973 (NAAQS: set 6 criterion air pollutants: CO, NO2, SO2, particulates, Ozone, Lead)

1990 (SO2 cap and trade program)