WORKING DEFINITION OF ATMOSPHERIC POLLUTION:

Substances that are released into the atmosphere, deliberately or inadvertently, from natural or anthropogenic sources and that have the potential to be toxic or cause harm

Receptors and routes of exposure for atmospheric pollution
- Direct exposure from the air – inhalation, entry through pores, stomates etc. or contact with skin, leaf surfaces etc.
- The atmosphere as a vector – local deposition of dust etc.
- The atmosphere as a vector – long range transport (LRTAP)

Types of compounds that contribute to air pollution
- Gases – CH₄; CO; CO₂; SO₂; NOₓ; VOCs; some chlorinated hydrocarbons; BTEX; dimethylmercury
- Aerosols – sulphates, fine droplets of organic material
- Particulates – soot (carbon); various oxides and salts of metals and other inorganics; chemical mixtures of particles with organic substances adsorbed onto them
Risks to human and environmental health from substances that are air-borne

• Oxides of sulphur $\text{SO}_x$
  
  Direct fumigation – plant damage, especially forests and crops; human and animal health effects through inhalation

  Smog - Combination with soot in air and high humidity, producing REDUCING SMOG – the old industrial type of smog (“pea souper”)

  Long-range transport, formation of sulphuric acids followed by deposition – ACID RAIN

• Oxides of nitrogen $\text{NO}_x$

  Long-range transport, formation of nitric acids followed by deposition – ACID RAIN

  Leading to nitrating formation and enrichment of land or water - overfertilization

  Photochemical reactions leading to OZONE formation

• Hydrocarbons, VOCs

  Direct inhalation, toxicity, carcinogenicity

  Photochemical reactions leading to OZONE formation

The formation of ozone:

1. From oxides of nitrogen

   $\text{NO}_2 + h\nu = \text{NO} + \text{O}$ (Photolysis)

   $\text{O} + \text{O}_2 = \text{O}_3$

   (reversible reaction – $\text{NO} + \text{O}_3 \leftrightarrow \text{NO}_2 + \text{O}_2$)

2. From hydrocarbons $[\text{RO}_2]$

   $\text{RO}_2 + \text{NO} = \text{RO} + \text{NO}_2$
• Metallic particulates

Health effects on vertebrates through inhalation, varies according to metal

Deposition onto soil and surface waters, leading to major contamination – size of particles determines distance travelled

• Ozone

damage to plants, especially varieties of beans and Tobacco

respiratory and eye irritations

Major contributor to PHOTOCHEMICAL SMOG

• CFCs (chlorofluorocarbons)

implicated in destruction of the stratospheric ozone layer
GOOD and BAD ozone

- Tropospheric (low-level) ozone is a secondary pollutant and is harmful to living organisms; it is the main constituent of photochemical smog.
- Stratospheric ozone provides a beneficial shield that protects the earth from potentially damaging ultra violet radiation from external sources. CFCs destroy ozone.

Greenhouse gases

CO₂ - carbon dioxide; CH₄ - methane, are not generally considered to be toxic except at very high concentrations, but they are pollutants nevertheless, contributing to the “Greenhouse effect.”

Major processes that contribute to air pollution

- Combustion of fossil fuels, including automobile exhausts
- Smelting
- Waste incineration
- Landfills
- Forest fires
- Volcanoes
- Geological faults
- Wetlands

Regulation of air pollutants [Typically Provincial responsibility]

Various parameters and modes of control to manage the RISK from atmospheric pollutants – e.g., individual industries monitor indoor and outdoor air quality; ambient air quality is regulated and there are point of impingement standards.

Smog alerts

The Ontario Ministry of the Environment’s anti-smog plan

The Smog alerts refer to ozone and particulates

The Ambient Air Quality criterion for ozone is 80 ppb.

Goal is 75% reduction in the number of times the criterion is exceeded.