Types of Air Pollutants

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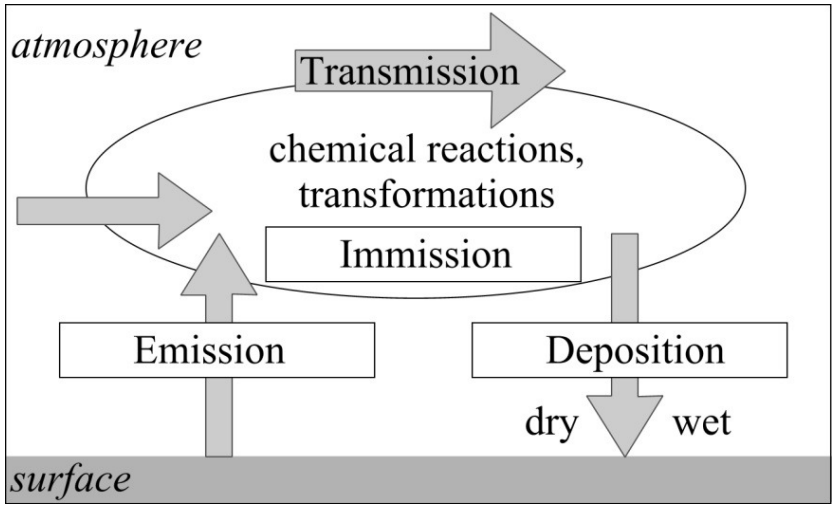
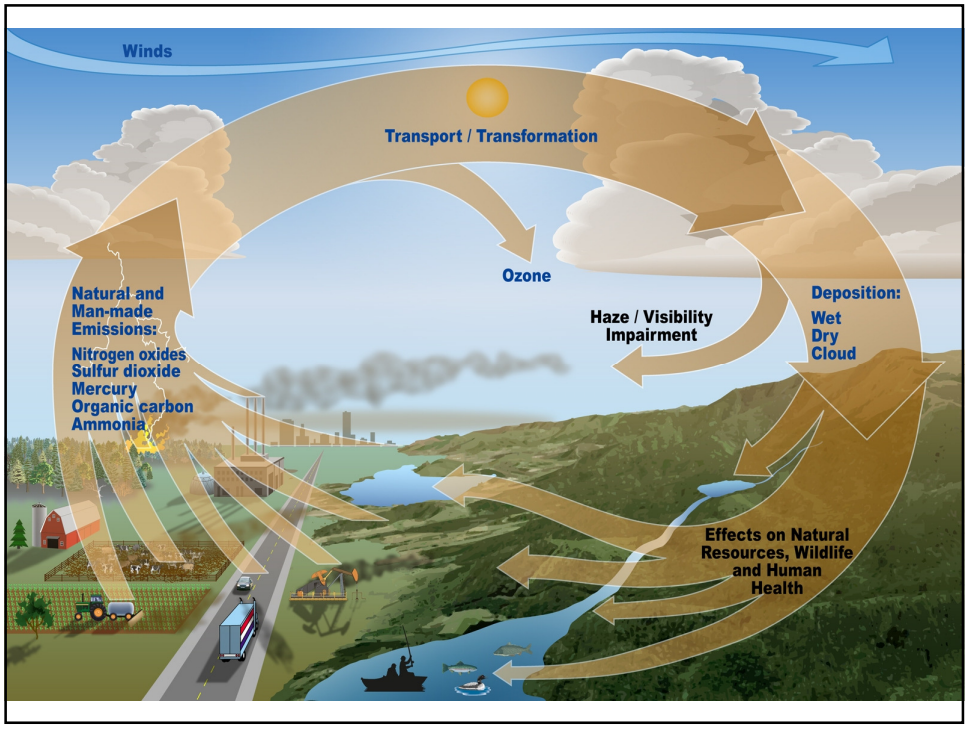
- Clean air is vital to sustain the delicate balance of life on Earth. However the quality of air can be affected by air pollution.
- Air pollution occurs when certain gases and particles build up in the atmosphere to such levels that they can cause harm to our health, causing breathing and respiratory problems, and even resulting in premature death, as well as damaging the environment around us. These gases and finely divided solid and liquid aerosols (known as pollutants) tend to come from man-made sources, including the burning of fossil fuels such as coal, oil, petrol, or diesel, but can also come from natural sources such as volcanic eruptions and forest fires.

- Pollutants emitted to the atmosphere can be transported from emission sources to long distances (transmission) in the function of their properties and weather conditions. In the atmosphere, complex chemical reaction processes can be realised, which can produce secondary air pollutants.
- The main air pollutants are reviewed according to: 1) description, 2) occurrence in air, and 3) major sources





- **Primary air pollutants** are the ones that are emitted directly into the atmosphere from identifiable sources, such as power-generating plants, factories or vehicles;
- **Secondary air pollutants** are the ones that are produced as a result of chemical reactions between primary pollutants and other elements in the atmosphere, such as ground-level ozone, nitric acid, and peroxyacyl nitrates (PAN).

There are six primary air pollutants:

- Carbon monoxide;
- Nitrogen oxides;
- Sulfur dioxide;
- Volatile organic compounds;
- Particulate matter; and
- Ammonia.

Important secondary pollutants include:

- Ground-level ozone;
- Peroxyacyl nitrates.

Ground level ozone

- Ozone (O_3), when present naturally in the form of a layer in the earth's upper atmosphere, helps screen out harmful ultraviolet radiations coming from the sun. However, at ground level it can be harmful to human health as it increases the risks of respiratory and cardiovascular diseases;
- Ground level ozone is a colourless gas that is a major component of atmospheric smog;
- Some ground level ozone also comes from higher in the atmosphere;
- It is formed by chemical reactions between nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight.

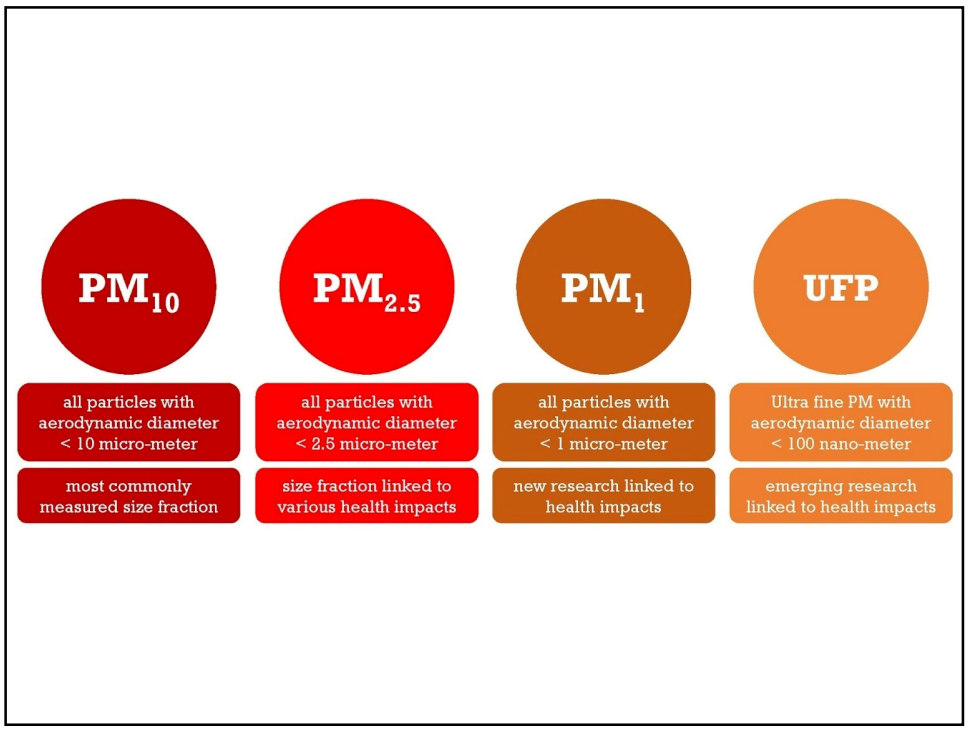
PAN

- Peroxyacyl nitrates (PAN) are powerful respiratory and eye irritants present in photochemical smog.
- They are nitrates produced in the thermal equilibrium between organic peroxy radicals by the gas-phase oxidation of a variety of volatile organic compounds (VOCs), or by aldehydes and other oxygenated VOCs oxidising in the presence of NO_2.

Indoor air pollution

- Indoor Air Quality refers to the quality of air within and around buildings and structures, especially as it relates to the health and comfort of the people who are living in the building. Indoor pollution sources that release gases or particles into the air are the primary cause of deteriorating indoor air quality. Inadequate ventilation can increase indoor pollutant levels by not bringing in enough outdoor air to dilute emissions from indoor sources and by not carrying indoor air pollutants out of the area.

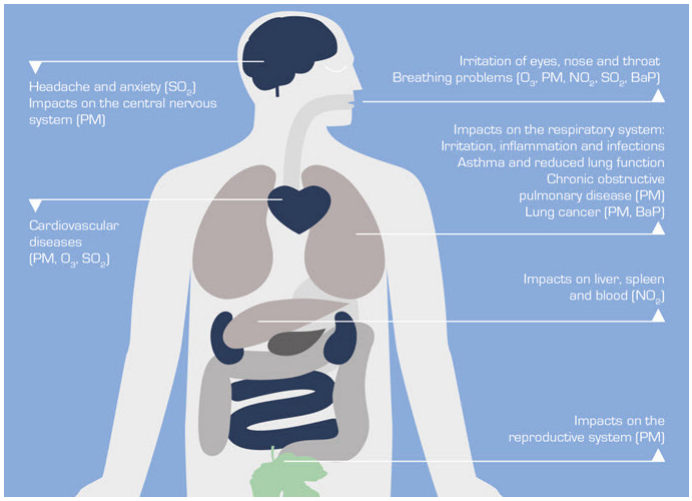
- Asbestos;
- Biological pollutants (moulds and fungal spores);
- Carbon monoxide (CO);
- Pesticides;
- Radon gas (Rn);
- Indoor particulate matter;
- Second-hand smoke (tobacco smoke);
- Volatile organic compounds (VOCs) etc.



Health impacts of Air pollutants

- Good air quality is fundamental to our well-being. On average, a person inhales about 14,000 litres of air every day, and the presence of contaminants in this air could adversely affect people's health.
- People with pre-existing respiratory and heart conditions, diabetes, the young and older people are particularly vulnerable to air pollution.

- Specific health risks and their severity depend upon the amount of pollutant to which an individual is exposed, the duration of the exposure, and the sensitivity of the individual exposed.
- Acute exposure to air pollution can cause an irritation of the eyes, nose, throat, coughing, difficulty breathing, inflamed lung tissue, and other health-related problems.
- Chronic exposure to air pollution could have more severe effects on human health, including cancer, reduced immune defences, and cardiovascular and lung diseases.



Air pollution control

- Devices that control particulate matter; and
- Devices that control gas emissions.

Fabric filter

- **Fabric filters** are simple method that can be used to remove dust or particulate matter from flue gases. This method simply uses some sort of fabric, generally felt is used as a woven cloth would allow dust to make its way through is placed so that flue gasses must pass through it before exiting the smokestacks. When the gas passes through, dust particles are trapped in the cloth.

cyclone separator

- A **cyclone separator** is a separation device that uses the principle of inertia to remove particulate matter from flue gases. In these separators, dirty flue gas enters a chamber containing a vortex (circular motion), similar to a tornado. Due of the difference in inertia of gas particles and larger particulate matter, the gas particles move up the cylinder while larger particles hit the inside wall and drop down. This separates the particulate matter from the flue gas, leaving cleaned flue gas.

electrostatic precipitator

- An **electrostatic precipitator** is a type of filter that uses principle static electricity (positive/negative charges) to remove particulates from exhaust fumes before they exit the smokestacks. A high voltage of direct current (DC) of 1,00,000 volts, is applied to the discharge electrodes to charge the particles, which then are attracted to oppositely charged collection electrodes, on which they become trapped, leaving clean, and hot air to escape the smokestacks.

- **Absorption** involves the transfer of a gaseous pollutant from the air into a contacting liquid, such as water. The liquid must be able, either, to serve as a solvent for the pollutant, or to capture it by means of a chemical reaction.

- **Scrubbers** are a type of system that is used to remove harmful materials from industrial exhaust gases before they are released into the environment. These pollutants are generally gaseous, and when scrubbers are used to specifically remove SO_x (flue gas desulfurisation). There are two main types of scrubbers, wet scrubbers and dry scrubbers.

- **Incineration** is used to convert volatile organic compounds (VOCs) emissions into carbon dioxide and water through combustion. Incineration of VOCs and hydrocarbon fumes is accomplished in a special incinerator called an afterburner, built to create the conditions necessary for complete combustion (such as sufficient burn time, sufficient air, and a high temperature).

- **Adsorption**, in contrast to absorption, is a surface phenomenon. The gas molecules are sorbed: attracted to and held, on the surface of a solid. Gas adsorption methods are used for odour control at various types of chemical-manufacturing and food-processing facilities, in the recovery of a number of volatile solvents (benzene), and in the control of VOCs at industrial facilities. Activated carbon (heated charcoal) is one of the most common adsorbent materials.