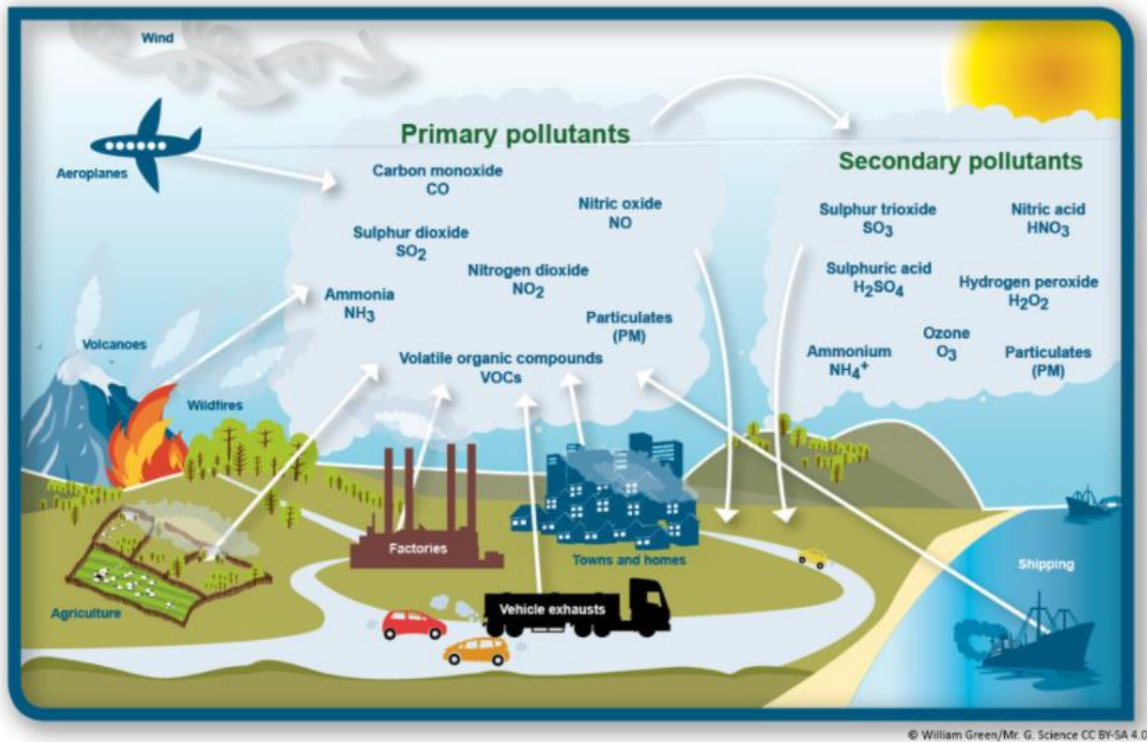


PG Sem 2 Unit 5.1

Secondary Pollutants in air

Secondary pollutants are defined as the pollutants which form in the atmosphere. These secondary pollutants do not come directly from a source (like vehicles or power plants). It forms as a result of the pollutants the sources emit and reacting with the molecules in the atmosphere. Pollutants which emits into the environment directly from a source are primary pollutants.



Formation of Secondary Pollutants

Secondary pollutants are of much concern as they can be formed from many different compounds. The phenomena of photochemical smog (seen in high-density cities) are a result of the interactions of primary pollutants with other molecules in the air such as molecular oxygen, water, and hydrocarbons. The combination of these forms yellow clouds which is very harmful to humans.

Now let us study briefly about the types of secondary pollutant and their formation.

1) Photochemical Smog

When ultraviolet light from the sun reacts with nitrogen oxides in the atmosphere, photochemical smog is produced. Brown haze is commonly seen, and is most prominent during the morning and afternoon, especially in densely populated, warm cities.

This fog forms in the morning when a large number of people are driving their vehicles to work. [Nitrogen oxides](#) emitting from the car engine come into the [atmosphere](#), which may combine with water to form nitric acid or react with sunlight to produce singular oxygen atoms.

These atoms combine with molecular oxygen to produce ozone. As the nitrogen oxide directly comes from the vehicles, the smog forms over cities where many people may encounter adverse health effects.

2) Ground-level ozone

It is a highly reactive secondary pollutant. This formation occurs when primary pollutants, like hydrocarbons and nitrogen oxides, react with sunlight. Ozone irritates people's lungs. High temperatures and sun both act as catalysts to this reaction. Ground-level ozone has adverse effects on people.

The effects are breathing problems, coughing, and irritation to the eyes, nose, and throat. Ground-level ozone causes aggravated symptoms to people with asthma, bronchitis, emphysema when they were exposed to that. It also reduces the body's immune system, increasing the tendency for more colds and flu.

3) Acid Deposition

It is a type of precipitation – rain, snow, sleet, hail, or fog – that has a lower pH (and is, therefore, more acidic) than normal. This higher acidity causes problems in ecosystems and the environment and remains one of the major environmental concerns.

Acid rain forms when water in the air combines with nitrogen oxides and sulfur dioxide (two types of pollutants) and then falls down the surface of the Earth. It has many damaging effects on vegetation, lakes, fish, buildings and other structures. It also causes respiratory diseases in humans, especially those that have bad health.

4) Particulate Matter

Particulate matter or simply PM is a combination of solid particles and liquid droplets that can be found in the air. PM contains hazardous elements such as arsenic, beryllium, cadmium, chromium,

lead, manganese, and nickel. PM causes significant health problems in humans—specifically, particles that are smaller than 10 micrometers.

These particles are harmful as they can penetrate past a lung's barrier defenses and lodge themselves deep in the lungs. Chronic exposure to these particles increases the risk of developing cardiovascular and respiratory diseases as well as increasing the risk of developing lung cancer.

5) Nitrogen Oxide

Nitrogen oxide or NO_x is a family of poisonous, highly reactive gases that form when fuel is burned at high temperatures. It is brown in color and emits from vehicles as well as industrial sources such as power plants, industrial boilers, cement kilns, and turbines.

Nitrogen oxides have problematic chemical reactions in the atmosphere with volatile organic compounds. These reactions produce smog on hot summer days.

Nitrogen dioxide is potentially toxic to vegetation. High levels of NO_x can injure leaves, stunt growth, and reduce yield. It is a greenhouse gas that contributes to ozone depletion in the stratosphere. NO_x is an important component of acid rain.

6) Peroxyacyl Nitrate

It is produced in the atmosphere when oxidized volatile organic compounds combine with nitrogen oxide. It is a component of photochemical smog. PANs create health problems such as reduced respiratory function and eye irritation, and may also be linked to emphysema, impaired breathing and other lung problems.

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