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Hydrocarbons:

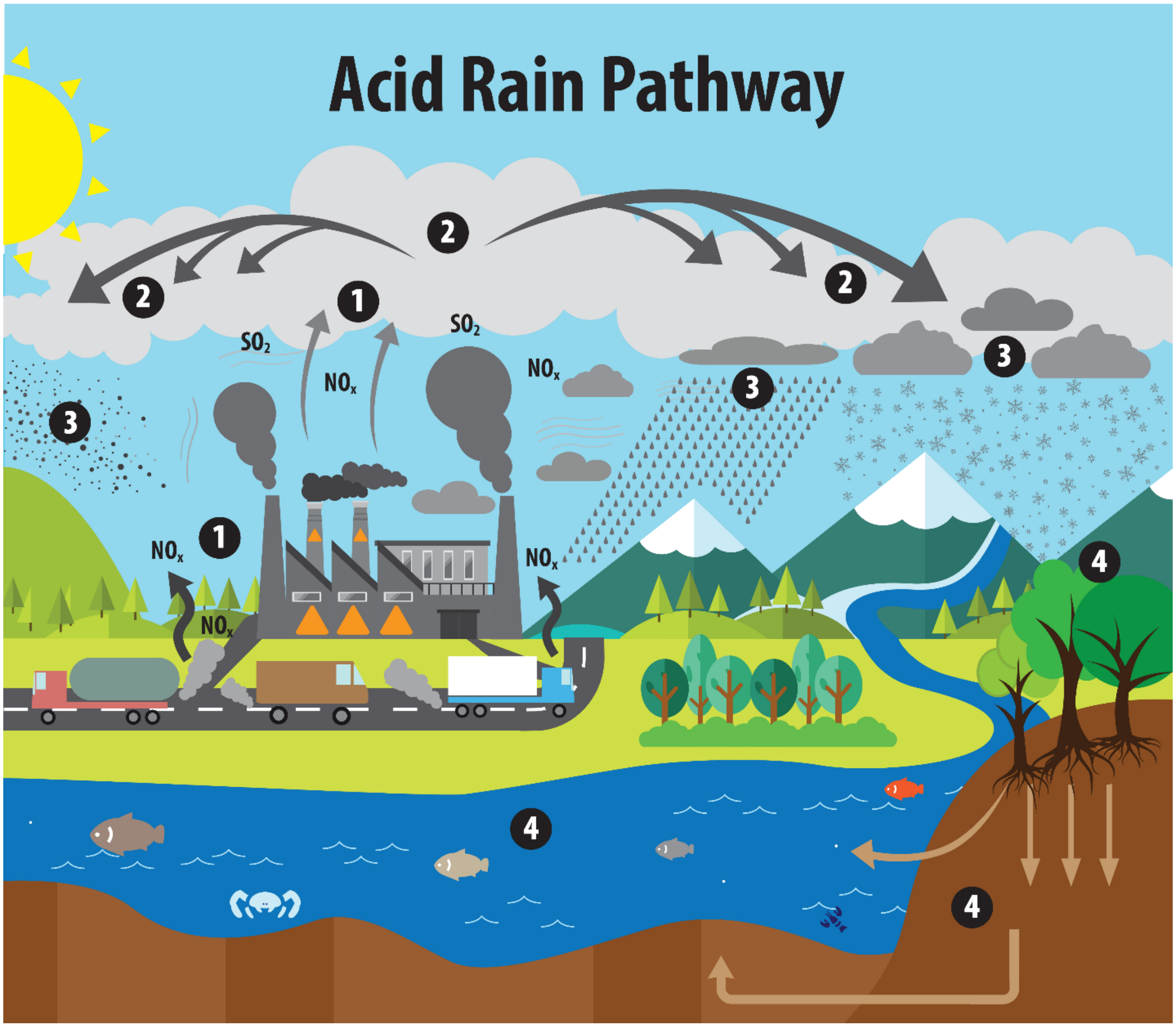
Hydrocarbons (HCs) are organic compounds consisting of carbon and hydrogen atoms, the term hydrocarbons is also used for functionalized organic compounds, including oxygen, halogen (chlorine, bromine, iodine), nitrogen, phosphorous, sulfur … atoms. They can be present in the atmosphere in two physical conditions, depending on their volatility or vapor pressure. If they are rather volatile, they are present as free molecules in the atmosphere. These types of hydrocarbons are classified as Volatile Organic Compounds (VOCs). On the other hand, if a compound's vapor pressure is low enough so that it partitions between the gas phase and aerosols, they are denoted as semi-volatile organic compounds (SVOCs). There is no global consensus on defining the exact boundary of the group of volatile organic compounds. In European and Australian legislation, volatile organic compounds are organic compounds with a vapor pressure at 25°C of, at least, 10 and 270 Pa respectively, whereas in the USA volatile organic compounds are defined as organic compounds which have negligible photochemical reactivity. Within the group of hydrocarbons, methane takes a somewhat special position due to its relatively low reactivity and consequently high ambient mixing ratios. Therefore, hydrocarbons with exclusion of methane are sometimes considered as one group: the non-methane hydrocarbons (NMHCs). Figure 1 gives an overview of hydrocarbons with their environmental relevance.

Atmospheric production of nitric and sulfuric acids rain, snow and fog

Acid rain, or acid deposition, is a broad term that includes any form of precipitation with acidic components, such as sulfuric or nitric acid that fall to the ground from the atmosphere in wet or dry forms. This can include rain, snow, fog, hail or even dust that is acidic.

Acid rain results when sulfur dioxide (SO_2) and nitrogen oxides (NO_X) are emitted into the atmosphere and transported by wind and air currents. The SO_2 and NO_X react with water, oxygen and other chemicals to form sulfuric and nitric acids. These then mix with water and other materials before falling to the ground.

While a small portion of the SO_2 and NO_x that cause acid rain is from natural sources such as volcanoes, most of it comes from the burning of fossil fuels.



The major sources of SO_2 and NO_x in the atmosphere are:

- Burning of fossil fuels to generate electricity. Two thirds of SO_2 and one fourth of NO_x in the atmosphere come from electric power generators.
- Vehicles and heavy equipment.
- Manufacturing, oil refineries and other industries.

Winds can blow SO_2 and NO_x over long distances and across borders making acid rain a problem for everyone and not just those who live close to these sources.

Forms of Acid Deposition

Wet Deposition

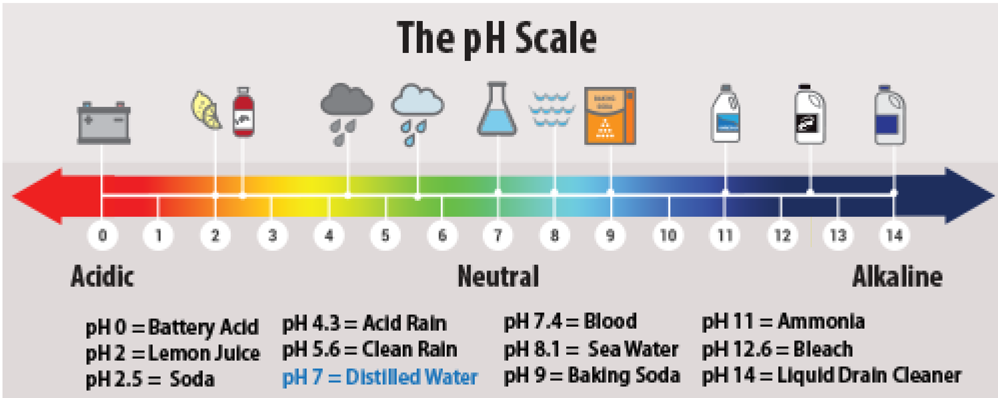
Wet deposition is what we most commonly think of as ***acid rain***. The sulfuric and nitric acids formed in the atmosphere fall to the ground mixed with rain, snow, fog, or hail.

Dry Deposition

Acidic particles and gases can also deposit from the atmosphere in the absence of moisture as ***dry deposition***. The acidic particles and gases may deposit to surfaces (water bodies, vegetation, buildings) quickly or may react during atmospheric transport to form larger particles that can be harmful to human health. When the accumulated acids are washed off a surface by the next rain, this acidic water flows over and through the ground, and can harm plants and wildlife, such as insects and fish.

The amount of acidity in the atmosphere that deposits to earth through dry deposition depends on the amount of rainfall an area receives. For example, in desert areas the ratio of dry to wet deposition is higher than an area that receives several inches of rain each year.

Measuring Acid Rain



Acidity and alkalinity are measured using a pH scale for which 7.0 is neutral. The lower a substance's pH (less than 7), the more acidic it is; the higher a substance's pH (greater than 7), the more alkaline it is. Normal rain has a pH of about 5.6; it is slightly acidic because carbon dioxide (CO_2) dissolves into it forming weak carbonic acid. Acid rain usually has a pH between 4.2 and 4.4.

Policymakers, research scientists, ecologists, and modelers rely on the National Atmospheric Deposition Program's (NADP) National Trends Network (NTN) for measurements of wet deposition. The NADP/NTN collects acid rain at more than 250 monitoring sites throughout the US, Canada, Alaska, Hawaii and the US Virgin Islands. Unlike wet deposition, dry deposition is difficult and expensive to measure. Dry deposition estimates for nitrogen and sulfur pollutants are provided by the Clean Air Status and Trends Network (CASTNET). Air concentrations are measured by CASTNET at more than 90 locations.

When acid deposition is washed into lakes and streams, it can cause some to turn acidic. The Long-Term Monitoring (LTM) Network measures and monitors surface water chemistry at over 280 sites to provide valuable information on aquatic ecosystem health and how water bodies respond to changes in acid-causing emissions and acid deposition.