

# SULFUR DIOXIDE ENVIRONMENTAL FACTORS

## General

Sulfur dioxide (SO<sub>2</sub>) is a gas that is colorless, nonflammable, and has a strong odor. Worldwide, sulfur dioxide causes major pollution problems and man-made emissions of sulfur dioxide is responsible for about one third of the total emissions of sulfur compounds in the atmosphere. When sulfur dioxide has a concentration from 0.3 to 1.0 parts per million (ppm), it can be tasted. When the gas is above 3.0 ppm, it has a strong and irritating odor. Sulfur dioxide dissolves in water easily and turns into sulfurous acid when combined with water. Sulfur dioxide is emitted mainly from stationary sources, such as power plants and refineries that burn fossil fuels. Sulfur dioxide is also found in smelters, steel mills, and pulp and paper mills. Diesel fuel and gasoline contain sulfur and contribute to sulfur dioxide in the surrounding air. Common fuel sources such as wood, natural gas, and propane and fuels to heat homes do not contain large amounts of sulfur and do not add to the sulfur dioxide in the surrounding air.

Large amounts of sulfur dioxide are emitted from natural sources such as volcanic eruptions, but they do not play an important role in sulfur dioxide pollution in cities. Natural sources of sulfur dioxide are mostly in the form of hydrogen sulfide, which releases from the decay of organic matter or sulfate particles in sea spray. When there are small amounts of sulfur dioxide in the atmosphere, hydrogen sulfide oxidizes to sulfur dioxide, and then into sulfuric acid or sulfate particles. These sea spray particles are not harmful to humans.

## Effects

Sulfur dioxide irritates lungs and is a cause of respiratory sickness. It can also worsen existing heart disease and change how the lungs respond to irritants. Children, the elderly, people with asthma, heart disease, or chronic lung diseases are more affected by high sulfur dioxide concentrations. Sulfate particles irritate the lower respiratory system. Breathing can become difficult due to irritated airways when exposed to 1.5 ppm of sulfur dioxide for only a few minutes. Sulfur dioxide that is inhaled can be carried deep into the lungs where conditions are favorable to form sulfuric acid. Studies have shown that sulfuric acid droplets and metallic sulfates are stronger lung irritants in humans and animals than sulfur dioxide in the air.

Sulfur dioxide damages plants and nonliving materials. Trees and agricultural crops can be injured by high levels of sulfur dioxide. Sulfur oxides speed up the corrosion decay by first forming sulfuric acid, either in the air or on the metal's surface. Sulfuric acid can also damage building materials such as limestone, marble, roofing slate, and mortar. Sulfur dioxide and nitrogen dioxide are the main parts of acid rain. Acid rain is formed when sulfur dioxide and nitrogen dioxide rise high into the atmosphere and combine with water and oxygen. Acid rain can lead to many forms of stress on the environment. If water becomes more acidic, aquatic life can have bodily changes. Sulfuric acid and sulfate particles formed in the atmosphere from sulfur dioxide emissions are usually less than 1.0 micrometer in diameter. These small particles can make the air appear hazy.

## Standards

There are two National Ambient Air Quality Standards (NAAQS) for sulfur dioxide:

1. The primary standard is a one-hour average of 75 parts per billion (ppb).
2. The secondary standard is a three-hour average of 0.50 ppm. For a site to be considered in attainment, the 3-year average of annual 99th percentile one-hour average daily maximum concentrations must not exceed 75 ppb. The secondary standard must not be exceeded more than once per year.

Oklahoma Department of Environmental Quality. (2020, April). *Sulfur Dioxide*.

<https://www.deq.ok.gov/documents/?deqattkeyword=sulfur&deqdivisions=all&documenttags%5B%5D=fact-sheets>