

Chemical Profile: Sulfuric Acid



What is sulfuric acid?

Sulfuric acid (H_2SO_4) is a colorless, odorless, oily liquid that is very corrosive and reacts chemically with many materials.

Sulfuric acid is one of the world's most widely used industrial chemicals. About 40 million tons of sulfuric acid are manufactured for industrial use each year in the United States. It is used to fabricate metals; to make fertilizers, chemicals, textiles, explosives, and paints; and to refine petroleum products.

How is sulfuric acid released by electric power plants?

Sulfur is present in coal and oil. When electric power plants burn these fuels, some of the sulfur is released. This sulfur combines with oxygen to form sulfur dioxide and small amounts of sulfur trioxide. Sulfur trioxide combines with water vapor released during combustion to form sulfuric acid vapor. As it cools, some of this sulfuric acid vapor forms tiny liquid droplets or thin films on tiny ash particles.

Vapor, liquid droplets, and ash particles containing dilute sulfuric acid can enter the air in gases leaving power plant stacks. The U.S. Environmental Protection Agency (EPA) refers to sulfuric acid-bearing "mists, vapors, gas, fog, and other airborne forms of any particle size" as "sulfuric acid aerosols." For its Toxics Release Inventory (TRI), EPA requires electric power companies to report sulfuric acid aerosols released from power plant stacks.

Some coal-burning power plants use pollution control devices to remove sulfur from gases leaving their stacks. Sulfur-bearing wastes captured by pollution control devices are usually sent to ash ponds or land disposal sites.

According to published reports, usually less than 3% of the sulfur in fuels burned by power plants is released into the air as sulfuric acid. The amount of sulfuric acid released by an individual power plant depends on the sulfur content of the fuel it burns, the type of fuel, and the operating and air pollution control practices at the plant. Power plants reporting to EPA released 63,666 tons of sulfuric acid aerosols into the environment in 2005. This was about 81% of all the sulfuric acid aerosols released by industries reporting to EPA that year.

Is sulfuric acid also released by other sources?

Most sulfuric acid released into the air by natural sources comes from volcanoes.

Sulfuric acid released into the environment by human activities outside the electric power industry comes mainly from plants that manufacture it, pulp and paper mills, phosphate fertilizer factories, copper smelters, and steel fabrication facilities. Industries reporting to EPA released 79,015 tons of sulfuric acid aerosols into the environment in 2005.

What happens to sulfuric acid after it is released by electric power plants?

Power plants release both sulfuric acid and sulfur dioxide into the air from their stacks. In the air, sulfur dioxide can change chemically to form dilute sulfuric acid. Some of the sulfuric acid formed in the air quickly loses its acidity by combining with ammonia that is naturally present there. Some forms tiny liquid droplets or thin films on tiny dust particles. As droplets and particles—formed in the air or released from power plant stacks—incorporate more water, the sulfuric acid they contain becomes more dilute. By the time these droplets and particles reach surface soil and water by settling to the ground or washing out of the air in rain and snow, the sulfuric acid they

contain is very dilute. The amount of sulfuric acid that stays in the air or falls to the ground depends on local wind, rain, and moisture in the air.

Sulfuric acid that is captured in pollution control devices is no longer present as an aerosol, so it is not reported as a release to EPA's TRI Program. Most of the sulfuric acid produced when power plants burn fuel ends up in the form of salts such as calcium sulfate (gypsum). These salts are sent to land disposal sites or placed in ash ponds.

Ash pond wastewater may contain small amounts of sulfur. Wastewater discharge to public waterways is overseen by federal, state, and local regulators who place limits on the amount released to protect human health and the environment.

How might people be exposed to sulfuric acid?

People are commonly exposed to trace amounts of dilute sulfuric acid when they breathe airborne droplets or particles that contain it. In their homes, people may breathe sulfuric acid fumes or touch the sulfuric acid solution created when toilet bowl cleaners mix with water. When they cut onions, their eyes may tear as a chemical from the onions mixes with eye moisture to form dilute sulfuric acid. Industrial workers may be exposed to concentrated sulfuric acid fumes or solutions.

What are the potential effects of sulfuric acid on human health?

Sulfuric acid fumes can irritate people's eyes, skin, and breathing passages, and concentrated fumes can permanently damage the nose and lungs. Direct contact with concentrated sulfuric acid solutions can burn the skin and destroy eyesight, and swallowing them can be fatal. However, there is no evidence that common exposures to dilute sulfuric acid in airborne droplets or particles can harm human health.

Sulfuric acid has not been found to cause cancer in animals or to affect their reproduction.

How likely is it that electric power plant releases pose a risk to human health?

It is unlikely that sulfuric acid from power plants poses a significant risk to human health. Airborne sulfuric acid from power plants is very dilute by the time it reaches the ground

where people might be exposed to it. When people breathe tiny droplets or particles, the sulfuric acid they contain is further diluted by mixing with moisture and ammonia naturally present in the breathing passages. To date, research has not shown a health risk from any acid aerosols at strengths common in U.S. air. Researchers continue to study the possible health effects of breathing particles, including sulfuric acid aerosols.

EPA has not classified sulfuric acid as a hazardous air pollutant. For this reason, sulfuric acid was not included in EPA's 1998 analysis of health risks from power plant releases of hazardous air pollutants.

How is sulfuric acid regulated?

The Occupational Safety and Health Administration and the National Institute for Occupational Safety and Health have set limits on the amount of sulfuric acid in workplace air.

Where can I get more information about sulfuric acid?

The Agency for Toxic Substances and Disease Registry (ATSDR) has a fact sheet with answers to frequently asked health questions about sulfuric acid. It is available through the ATSDR Information Center at 888.422.8737 or on the Internet at <http://www.atsdr.cdc.gov/tfacts117.pdf>.

Contact Information

For more information, contact the EPRI Customer Assistance Center at 800.313.3774 (askepri@epri.com).

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