The ToxGuide™ is developed to be used as a pocket guide.

Sources of Exposure

General Populations

- Contaminated air is the most important source of exposure to exogenous hydrogen sulfide
- Hydrogen sulfide is endogenously produced by bacteria in the mouth and large intestine.
- Hydrogen sulfide may occur naturally in well water and can be formed in hot water heaters.
- Populations living in areas of geothermal activity, near waste sites or industries that release hydrogen sulfide may be more likely to be exposed to higher levels than the general population.
- Natural sources of hydrogen sulfide are significantly greater than anthropogenic emissions.

Occupational Populations

- Workers may be exposed to higher levels of hydrogen sulfide at facilities where fermentation of manure occurs, in the vicinity of stagnant wells, or at waste-water treatment facilities, extruded rubber plants, landfills, textile industries, petroleum refineries, and other industrial facilities where hydrogen sulfide is released.

Toxicokinetics and Normal Human Levels

Toxicokinetics

- Hydrogen sulfide gas is primarily absorbed through the lungs; it can also be absorbed through the gastrointestinal tract and intact skin.
- Hydrogen sulfide appears to be widely distributed throughout the body via the blood.
- The major metabolic pathway for hydrogen sulfide is oxidation to thiosulfate which is converted to sulfate.
- Sulfate formed from the oxidation of hydrogen sulfide is mainly excreted in the urine.

Normal Human Levels

- No information was located regarding normal levels of hydrogen sulfide in humans.

Biomarkers/Environmental Levels

Biomarkers

- Hydrogen sulfide and its breakdown products can be measured in blood and urine; urinary thiosulfate is the most frequently used biomarker of exposure to hydrogen sulfate.

Environmental Levels

Air

- Estimated hydrogen sulfide air levels in the United States are 0.11-0.33 ppb, but may be much higher in some areas.

Water

- Hydrogen sulfide readily evaporates from surface water and is not likely to be found in significant concentrations.

Soil

- Hydrogen sulfide in soil is mostly from geothermal sources and may vary widely depending on proximity to the source.

Other media

- Hydrogen sulfide is produced in the large intestine of mammals.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2016. Toxicological Profile for Hydrogen Sulfide and Carbonyl Sulfide. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

H_2S

ToxGuide™ for Hydrogen Sulfide H_2S

CAS# 7783-06-4

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U.S. Department of Health and Human Services
Public Health Service
Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov

Contact Information:
Division of Toxicology
and Human Health Sciences
Environmental Toxicology Branch

1600 Clifton Road NE, F-57
Atlanta, GA 30329-4027
1-800-CDC-INFO
1-800-232-4636

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Chemical and Physical Information

Hydrogen Sulfide is a Gas

- Hydrogen sulfide is a heavier-than-air colorless gas with a rotten egg smell. The odor threshold ranges from 0.0005 to 0.3 ppm.
- Hydrogen sulfide gas is released from volcanoes, sulfur springs, undersea vents, swamps, stagnant bodies of water, crude petroleum and natural gas, and manure or coal pits. It is also released by bacteria, fungi, and actinomycetes during the decomposition of sulfur-containing proteins and direct reduction of sulfate.
- Hydrogen sulfide is produced during desulfurization of gas-oil and coke distillate fractions in the presence of hydrogen.
- Hydrogen sulfide can be produced in the mouth and intestinal tract by bacterial metabolism of sulfhydryl-containing amino acids; endogenous hydrogen sulfide may be involved in regulation of vascular smooth muscle, some neurological processes, and other physiological processes.
- Hydrogen sulfide is used in the production of elemental sulfur and sulfuric acid, to prepare inorganic sulfides that are used in the manufacture of numerous products, in the purification of selected elements and compounds, as an agricultural disinfectant, and as a source of hydrogen.
- Hydrogen sulfide is used in metallurgy, production of heavy water for the nuclear industry, and as an analytical reagent.

Routes of Exposure

- Inhalation - Most likely route of exposure for general population because hydrogen sulfide is ubiquitous in air; most likely route of occupational exposure at facilities where hydrogen sulfide is produced, used, or generated.
- Oral – Not a likely source of exposure because hydrogen sulfide is a gas.
- Dermal - Potential route of exposure particularly among workers who handle hydrogen sulfide-containing substances.

Hydrogen Sulfide in the Environment

- Most hydrogen sulfide enters the air; however, it is readily soluble in water and can attach to some types of soils.
- Hydrogen sulfide in the air can be degraded to sulfur dioxide and sulfate compounds.
- Hydrogen sulfide in soil and water can be broken down to sulfide by some bacteria.
- Hydrogen sulfide is not likely to accumulate in the food chain.

Relevance to Public Health (Health Effects)

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

Minimal Risk Levels (MRLs)

Inhalation

- An MRL of 0.07 ppm has been derived for acute-duration (≤14 days) inhalation exposure to hydrogen sulfide.
- An MRL of 0.02 ppm has been derived for intermediate-duration (15-364 days) inhalation exposure to hydrogen sulfide.
- No chronic-duration (≥365 days) inhalation MRL was derived for hydrogen sulfide.

Oral

- No acute-, intermediate-, or chronic-duration oral MRLs were derived for hydrogen sulfide.

Health Effects

- Main targets of hydrogen sulfide toxicity include the nervous system and respiratory tract.
- High-level exposure to hydrogen sulfide may cause unconsciousness and death; recovery from unconsciousness may be followed by persistent headaches, poor concentration ability and attention span, impaired short-term memory, and impaired motor function.
- Respiratory distress, arrest, and pulmonary edema are associated with high-level exposure to hydrogen sulfide, and may be secondary to central nervous system depression or lack of oxygen in tissues.
- Cardiovascular effects have been observed following high-level exposure to hydrogen sulfide.
- Lower-level exposure results in less severe nervous system and respiratory effects.
- Insufficient human data are available to assess the carcinogenicity of hydrogen sulfide; no animal studies are available.

Children's Health

- Children exposed to hydrogen sulfide would likely experience effects similar to those seen in poisoned adults.
- No data were located regarding hydrogen sulfide-related developmental effects in humans; low concentrations of hydrogen sulfide during pregnancy did not cause birth defects in animals.