



PUBLIC HEALTH STATEMENT

Hydrogen Sulfide

Division of Toxicology and Human Health Sciences

October 2014

This Public Health Statement is the summary chapter from the Toxicological Profile for Hydrogen Sulfide. It is one in a series of Public Health Statements about hazardous substances and their health effects. A shorter version, the ToxFAQs™, is also available. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present. For more information, call the ATSDR Information Center at 1-800-232-4636.

Overview

We define a public health statement and show how it can help you learn about hydrogen sulfide.

Introduction

A public health statement summarizes information about a hazardous substance. The information is taken from a toxicological profile developed by the Agency for Toxic Substances and Disease Registry's (ATSDR's) Division of Toxicology and Human Health Sciences (DTHHS). A toxicological profile is a thorough review of a hazardous substance.

This toxicological profile examines hydrogen sulfide and carbonyl sulfide. This section of the public health statement summarizes the DTHHS's findings on hydrogen sulfide, describes the effects of exposure to it, and describes what you can do to limit that exposure.

Hydrogen sulfide at hazardous waste sites

The U.S. Environmental Protection Agency (U.S. EPA) identifies the most serious hazardous waste sites in the nation. U.S. EPA then includes these sites on the National Priorities List (NPL) and targets them for federal clean-up activities. U.S. EPA has found hydrogen sulfide in at least 35 of the 1,689 current or former NPL sites.

The total number of NPL sites evaluated for hydrogen sulfide is not known. However, the possibility remains that as more sites are evaluated, the number of sites at which hydrogen sulfide is found may increase. This information is important; these future sites may be sources of exposure, and exposure to hydrogen sulfide may be harmful.

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A hydrogen sulfide release may be harmful

When a contaminant is released from a large area such as an industrial plant or from a container such as a drum or bottle, it enters the environment. However, such a release doesn't always lead to exposure. You can only be exposed to a contaminant when you come in contact with it. That contact—and therefore that exposure—can occur when you breathe, eat, or drink the contaminant, or when it touches your skin.

Even if you're exposed to hydrogen sulfide, you might not be harmed. Whether you are harmed will depend on such factors as the dose (how much), the duration (how long), and how you are exposed. Harm might also depend on whether you've been exposed to any other chemicals, as well as your age, sex, diet, family traits, lifestyle, and state of health.

A Closer Look at Hydrogen Sulfide

Overview

This section describes hydrogen sulfide in detail and how you can be exposed to it.

What is hydrogen sulfide

Hydrogen sulfide (H_2S) is a flammable, colorless gas that smells like rotten eggs. People usually can smell hydrogen sulfide at low concentrations in air, ranging from 0.0005 to 0.3 parts per million (ppm) (0.0005–0.3 parts of hydrogen sulfide in 1 million parts of air). At high concentrations, a person might lose their ability to smell it. This is important because a person might falsely think that hydrogen sulfide is no longer present; this may increase their exposure risk to air levels that may cause serious health effects.

Hydrogen sulfide occurs both naturally and from human-made processes. It is in the gases from volcanoes, sulfur springs, undersea vents, swamps, and stagnant bodies of water and in crude petroleum and natural gas. Hydrogen sulfide also is associated with municipal sewers and sewage treatment plants, swine containment and manure-handling operations, and pulp and paper operations. Industrial sources of hydrogen sulfide include petroleum refineries, natural gas plants, petrochemical plants, coke oven plants, food processing plants, and tanneries. Bacteria found in your mouth and gastrointestinal tract produce hydrogen sulfide during the digestion of food containing vegetable or animal proteins.

How is hydrogen sulfide used

Hydrogen sulfide is used primarily in the production of sulfur and sulfuric acid. It can also be used to make other chemicals such as sodium sulfide and sodium hydrosulfide, which are used to make a variety of products including dyes,

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pesticides, and pharmaceuticals. Hydrogen sulfide is utilized in the purification of nickel and manganese as well as hydrochloric and sulfuric acids. It is used in metallurgy, the nuclear industry, and in laboratory experiments. It is also an agricultural disinfectant.

Where is hydrogen sulfide found

Hydrogen sulfide can be released into the air, water, and soil at places where it is produced or used.

Possible Sources	Outcome
<p>Air: Most of the hydrogen sulfide released to air comes from natural sources such as swamps, bogs, and volcanoes.</p> <p>Hydrogen sulfide can also be released from industrial sources such as petroleum refineries, natural gas plants, kraft paper mills, manure treatment facilities, waste water treatment facilities, and tanneries.</p> <p>Hydrogen sulfide air concentrations from natural sources range between 0.00011 and 0.00033 ppm. In urban areas, the air concentrations are generally less than 0.001 ppm.</p>	Hydrogen sulfide remains in the atmosphere for approximately 1–42 days, depending on the season. It can change into sulfur dioxide and sulfates in the air.
<p>Water: Hydrogen sulfide might be released to water in liquid waste of an industrial facility or as the result of a natural event. It can be naturally present in well water.</p>	Hydrogen sulfide concentrations in surface water are usually very low because it readily evaporates from water. It can also be present in groundwater.
<p>Soil: Hydrogen sulfide can enter soil through atmospheric deposition or from spills.</p>	In soil, hydrogen sulfide is consumed by bacteria, which change it to sulfur.

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How Hydrogen Sulfide Can Affect Your Health

Overview

This section looks at how hydrogen sulfide enters your body and potential hydrogen sulfide health effects found in human and animal studies.

How hydrogen sulfide enters your body

Hydrogen sulfide enters your body primarily through the air you breathe. Much smaller amounts can enter your body through the skin. Hydrogen sulfide is a gas, so you would not likely be exposed to it by ingestion. When you breathe air containing hydrogen sulfide or when hydrogen sulfide comes into contact with skin, it is absorbed into the blood stream and distributed throughout the body.

How hydrogen sulfide leaves your body

In the body, hydrogen sulfide is primarily converted to sulfate and is excreted in the urine. Hydrogen sulfide is rapidly removed from the body.

Hydrogen sulfide health effects

The health effects of hydrogen sulfide depend on several factors such as how much hydrogen sulfide you are exposed to and the length of that exposure. Studies in workers, communities living near industrial sources of hydrogen sulfide, and volunteers suggest that the respiratory tract and nervous system are the most sensitive targets of hydrogen sulfide toxicity. No health effects have been found in humans exposed to typical environmental concentrations of hydrogen sulfide (0.00011–0.00033 parts per million [ppm]).

Respiratory effects

Exposure to low concentrations of hydrogen sulfide may cause irritation to the eyes, nose, or throat. It may also cause difficulty in breathing for some asthmatics.

Respiratory distress or arrest has been found in people exposed to very high concentrations of hydrogen sulfide.

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Nervous system effects Exposure to low concentrations of hydrogen sulfide may cause headaches, poor memory, tiredness, and balance problems.

Brief exposures to high concentrations of hydrogen sulfide (greater than 500 ppm) can cause a loss of consciousness. In most cases, the person appears to regain consciousness without any other effects. However, in some individuals, there may be permanent or long-term effects such as headaches, poor attention span, poor memory, and poor motor function.

Hydrogen sulfide and cancer Hydrogen sulfide has not been shown to cause cancer in humans, and its possible ability to cause cancer in animals has not been studied thoroughly.

DHHS and the International Agency for Research on Cancer (IARC) have not classified hydrogen sulfide as to its carcinogenicity.

EPA has determined that data for hydrogen sulfide are inadequate for carcinogenic assessment.

Children and Hydrogen Sulfide

Overview

This section discusses potential health effects of hydrogen sulfide exposure in humans from when they're first conceived to 18 years of age, and how you might protect against such effects.

Exposure effects for children There is very little information on possible health problems in children who have been exposed to hydrogen sulfide. Exposed children probably will experience effects similar to those experienced by exposed adults. Whether children are more sensitive to hydrogen sulfide exposure than adults is not known.

What about birth defects It is not known whether exposure to hydrogen sulfide causes birth defects in humans. The results of studies in animals suggest that exposure to low concentrations of hydrogen sulfide during pregnancy does not cause birth defects.

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How Can Families Reduce the Risk of Exposure to Hydrogen Sulfide?

If your doctor finds that you have been exposed to significant amounts of hydrogen sulfide, ask whether your children or unborn baby might also be exposed. Your doctor might need to ask your state health department to investigate.

Air

Hydrogen sulfide is part of the natural environment; the general population will have some exposure to hydrogen sulfide. Families can be exposed to more hydrogen sulfide than the general population if they live near natural or industrial sources of hydrogen sulfide, such as hot springs, manure holding tanks, or pulp and paper mills. However, their exposure levels are unlikely to approach those that sicken people exposed at work.

Reducing your exposure to hydrogen sulfide

Families can reduce their exposure to hydrogen sulfide by avoiding areas that are sources of hydrogen sulfide. For example, individuals of families that live on farms can avoid manure storage areas where high concentrations of hydrogen sulfide may be found.

Medical Tests to Determine Hydrogen Sulfide Exposure

Overview

We identify medical tests that can detect whether hydrogen sulfide is in your body.

Hydrogen sulfide can be measured in blood and urine

Hydrogen sulfide and its breakdown products such as thiosulfate can be measured in blood and urine. However, the detection of hydrogen sulfide or its metabolites cannot predict the kind of health effects that might develop from that exposure. Because hydrogen sulfide and its metabolites leave the body fairly rapidly, the tests need to be conducted soon after exposure.

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Federal Government Recommendations to Protect Human Health

Overview

One way the federal government promotes public health is by regulating toxic substances or recommending ways to handle or to avoid toxic substances.

The federal government regulates toxic substances

Regulations are enforceable by law. The U.S. EPA, the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA) are some federal agencies that have adopted toxic substances regulations.

Toxic substance recommendations

The Agency for Toxic Substances and Disease Registry (ATSDR) and the National Institute for Occupational Safety and Health (NIOSH) have made recommendations about toxic substances. Unlike enforceable regulations, these recommendations are advisory only.

Not-to-exceed levels

Regulations and recommendations can be expressed as “not-to-exceed” levels; that is, levels of a toxic substance in air, water, soil, or food that do not exceed a critical value usually based on levels that affect animals; levels are then adjusted to help protect humans. Sometimes these not-to-exceed levels differ among federal organizations. Different organizations use different exposure times (for example, an 8-hour workday or a 24-hour day), different animal studies, or emphasize some factors over others, depending on their mission.

Recommendations and regulations are also updated periodically as more information becomes available. For the most current information, check with the federal agency or organization that issued the regulation or recommendation.

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Some regulations and recommendations for hydrogen sulfide exposure in workers include:

Federal Organization	Regulation or Recommendation
Occupational Safety and Health Administration (OSHA)	OSHA set an acceptable ceiling limit of 20 ppm for hydrogen sulfide in workplace air; the ceiling limit is a 15-minute time-weighted average that cannot be exceeded at any time during the working day.
National Institute for Occupational Safety and Health (NIOSH)	NIOSH recommends a 10-minute ceiling level of 10 ppm for workers. NIOSH also determined that 100 ppm is immediately dangerous to life or health to workers.

Additional Information

Overview

Where to find more information about hydrogen sulfide.

Whom to contact first

If you have any more questions or concerns, please contact your community or state health or environmental quality department, or contact ATSDR at the address and phone number below.

Additional information from ATSDR

ATSDR can also tell you the location of occupational and environmental health clinics. These clinics specialize in recognizing, evaluating, and treating illnesses that result from exposure to hazardous substances.

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**Where to
obtain
toxicological
profile copies**

Toxicological profiles are also available online at www.atsdr.cdc.gov. For more information:

Call the toll-free information and technical assistance number at
1-800-CDCINFO (1-800-232-4636), or

Write to:

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Human Health Sciences
1600 Clifton Road NE
Mailstop F-57
Atlanta, GA 30333
Fax: 1-770-488-4178

For-profit organizations should request final toxicological profile copies from:

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
Phone: 1-800-553-6847 or 1-703-605-6000
Web site: <http://www.ntis.gov/>

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