Hydrogen Sulfide—
a matter of life and death

Invisible! Explosive! Flammable! Deadly!

These words all describe hydrogen sulfide, one of the leading causes of workplace death. Hydrogen sulfide is a by-product when organic matter decays. Therefore, workers who may have to work around hydrogen sulfide, or H2S, include those in oil and gas operations, mining and sewage, landfills, laboratories, and public utilities.

Because hydrogen sulfide is so dangerous, your employer is required to follow certain safety standards, such as monitoring the air in your workspace and providing engineering controls. But, most importantly, you must know how to protect yourself from H2S. If you recognize the hazards and follow specific procedures, you can work around this material safely.

Properties and characteristics

Hydrogen sulfide is invisible, but there are several ways to recognize conditions when it is important to be on the lookout for H2S.

- H2S smells like rotten eggs at low concentrations; however, do not trust your sense of smell to warn you because:
  - Other chemicals odors can hide or mask the smell.
  - With continued exposure, your ability to smell will become paralyzed; Then you could make the mistake of thinking that no more rotten egg smell means no more hydrogen sulfide - and more critical symptoms could develop.
- H2S is heavier than air, it collects in low-lying areas.

H2S is highly flammable. If there is enough hydrogen sulfide in the air between 43,000 and 460,000 ppm and the temperature is right, it will explode.

- Remember that burning H2S emits another dangerous chemical, sulfur dioxide, or SO2. This chemical can severely irritate your eyes, nose, throat, and respiratory system.
- H2S is soluble in water, oils, and most organic liquids, but when it is agitated or when temperatures increase, solubility decreases and higher concentrations of H2S are released. Also, acidic solutions containing H2S can severely irritate your skin and eyes.
- Hydrogen sulfide reacts violently to strong oxidizers, metals, oxides, peroxides, strong alkalis, active metals, and some plastics and rubbers. It is corrosive, forming the spontaneously ignitable by-product "iron sulfide scale". This by-product is often found in vessels and pipes containing H2S. So, if you clean such equipment, keep all surfaces wet to avoid ignition.

Effects of Exposure

Breathing hydrogen sulfide is the most dangerous route of exposure. But, how you are affected depends on the concentration you are exposed to and the length of exposure. For example, you can lose your sense of smell within minutes if exposed to more than 100 ppm. But, you could also lose your ability to smell if you breathe only 50 ppm over one hour's time.

Hydrogen Sulfide

has poor warning properties.

You may not realize that you are breathing hazardous levels of H2S until more serious symptoms develop. Although you should not rely on them to tell you if you have been exposed, these general guidelines may help you understand what can happen to you physically, when you are exposed.

At up to 100 ppm, you will experience:
- Rotten-egg smell
- Burning eyes
- Respiratory tract irritation

If prolonged, exposure up to 100 ppm will also cause:
- Loss of smell
- Headache
- Dizziness
- Coughing

From 100 ppm to 300 ppm, in addition to the above, side-effects will include:
- Drowsiness
- Severe eye and throat irritation
- Possibly pulmonary edema (respiratory difficulty due to fluid in the lungs)

Exposure up to 600 ppm will cause:
- Loss of reasoning and balance
- Eventual unconsciousness
- Death
Hydrogen Sulfide

Remember

These are just guidelines. Reactions to H₂S vary from person to person and depend on the concentration and the length of exposure. But, one thing is for certain, expo- sure to more than 600 ppm will kill you almost immediately!

Also be aware that even through breathing H₂S is the most dangerous kind of exposure, other kinds of expo- sure can also be harmful. For example, contact with liquids containing H₂S can severely irritate your skin and eyes.

Exposure Limits

To help you avoid these severe effects, OSHA has established exposure limits:

- **PEL**—Permissible Exposure Limit—the PEL for hydrogen sulfide is 10 ppm. This is an amount you can safely breathe, based on an eight-hour day over a five-day work week.

- **STEL**—Short-Term Exposure Limit—the STEL for H₂S is 15 ppm. This is how much you can safely be exposed to averaged over a 15-minute period. The STEL should be checked four times a day, when your risk is likely to be the greatest.

Air Monitoring

OSHA requires your employer to monitor the air in your work area. A variety of equipment can be used to do this.

- Fixed monitors located where widespread H₂S contamination is possible
- Alarms that can be seen and heard when H₂S levels exceed the PEL or STEL
- Portable monitors that you either hold in your hand or attach to yourself

No matter what devices you and your employer use to monitor the air in your work area, know how to use, respond to, and maintain them. Most critical of all **DO NOT** place all of your trust in air monitors. If you suspect H₂S, immediately move upwind, out of the area!

Controls

Engineering controls are another measure OSHA requires your employer to take in ensuring your safety. The most widely used engineering control is ventilation—either natural or mechanical.

**Normal airflow**—If you are relying on natural ventilation, remain alert for the safest way to escape by noticing which way wind socks, streamers, and flags are blowing. This is called being “wind conscious”.

**Mechanical ventilation**—is common in confined spaces where only fans and blowers can move the air. But, do not become too comfortable knowing fans and blowers are ventilating your work space. If you suspect H₂S, evacuate the area immediately.

PPE

Three types of personal protective equipment are used by workers at risk of exposure to hydrogen sulfide:

**Escape Units**

- Are completely self-contained,
- Equipped with an air cylinder rated for five minutes, and
- Used only to escape from (not enter) a hazardous area.

**Air-Line Units**

- Have an airline or hose that supplies air during normal use and
- Are equipped with a self-contained emergency-escape air cylinder in case the airline supply fails.

**SCBAs**

- Have an air cylinder rated for 15 or more minutes,
- Are used to enter a hazardous environment,
- The most flexible because they allow you to move from area to area (even if you have to disconnect from the air-line supply), and
- Are equipped with devices that warn you when approximately five minutes of air remain.

**REMEMBER:** Your respirator should always be positive-pressure type to prevent H₂S from entering. Never use air-purifying or cartridge type breathing apparatus when working around hydrogen sulfide.