Hydrogen Sulfide, or H₂S is a compound of hydrogen and sulfur, and occurs naturally as a contaminant in crude oil and other fuels.

It is formed by a chemical reaction and can occur in either a liquid or gaseous form.
As a worker in the petroleum industry, chances are you have smelled the "rotten eggs" odor that characterizes hydrogen sulfide gas. Because of its odor, H₂S is also known as "sour gas".

Hydrogen Sulfide is extremely dangerous. The potential for exposure stretches across most operations in the oil industry, including: Production, Transportation, and Refining.

Hydrogen Sulfide exposure is one of the leading causes of work-related deaths in the petroleum industry.
Hydrogen Sulfide concentrations can vary from trace amounts to high concentrations that can cause severe health effects and even death. This Table illustrates the health effects for various H₂S levels. (PPM = Parts per million)

<table>
<thead>
<tr>
<th>Concentration (PPM)</th>
<th>Health Effect</th>
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<tr>
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<td>Eye irritation</td>
</tr>
<tr>
<td>20 - 100</td>
<td>Loss of sense of smell, headache &amp; nausea</td>
</tr>
<tr>
<td>100 - 300</td>
<td>Respiratory difficulty, pulmonary edema</td>
</tr>
<tr>
<td>300 - 600</td>
<td>Dizziness, cessation of breathing, unconsciousness</td>
</tr>
<tr>
<td>600+</td>
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Under atmospheric conditions, H₂S is a colorless gas.

Never rely on your sense of smell to detect H₂S!

Or ….. You may end up lying here!

Do you know WHY?
Physical Characteristics

High concentrations of H₂S cannot be detected by the sense of smell, since paralysis of the olfactory nerve (which detects odors) can occur at low levels.

Once the nerve is paralyzed, the sense of smell is lost.

Physical Characteristics

Hydrogen Sulfide has a density 1.2 times that of air. Since it is heavier, it tends to settle in low lying areas.

The gas can easily be dispersed by wind.

Physical Characteristics

Hydrogen Sulfide gas is 3 times more flammable than natural gas, so the potential for fire or explosion is always a danger.

H₂S will ignite at approximately 500 degrees Fahrenheit.
Hydrogen Sulfide burns with a blue flame and forms Sulfur Dioxide which is also a toxic gas. Sulfur Dioxide is heavier than H₂S and has a very distinct odor.

Because it is water soluble, hydrogen sulfide is often present in wastewater areas.

Always be aware of its possible presence in drainage ditches or when working around drains.
Hydrogen sulfide vapors can also collect inside confined spaces. Storage tanks, tank dikes or poorly ventilated areas can harbor H₂S. Natural air circulation or fans will disperse the gas.

H₂S is very corrosive and can cause severe stress cracking in steel and other metals.

Routine maintenance should include checking pipe seals and fittings for corrosion.
Hydrogen sulfide enters the body through the air you breathe. The amount of H₂S in the air is measured in parts-per-million or ppm.

Since H₂S is so toxic, exposure to it must be at a minimum. The company has established 10 ppm as the Permissible Exposure Limit Time Weighted Average (PEL-TWA) to H₂S in the workplace. The Short Term Exposure Limit (STEL) is 15 ppm.

How exposure to hydrogen sulfide affects you depends on:

the concentration of the gas
How exposure to hydrogen sulfide affects you depends on:

- The duration of the exposure
- Your own susceptibility to the gas

Let's review the health effects at various concentrations of H₂S.

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Let’s review again, the health effects at various concentrations of H₂S...

**20 PPM**

Below 20 PPM your eyes burn and water

**100 PPM**

20 PPM to 100 PPM; as concentrations approach 100 PPM you lose your sense of smell.

(This deadly side effect means high concentrations of H₂S, especially those capable of causing physical damage or DEATH, cannot be detected!)

Develop headaches, and have blurred vision with irritated eyes. You may also begin to cough and become nauseated.

**300 PPM**

100 PPM to 300 PPM; you experience difficulty in breathing with the onset of pulmonary edema - fluid in the lungs.

Time to get out or suffer serious physical harm!!
300 PPM to 600 PPM; Dizziness to the point of passing out and you stop breathing. You MUST be on your way out!

600+ PPM; You are DEAD! In fact at concentrations of 1000 PPM, one breath of H₂S is enough to paralyze your sense of smell and suppress your ability to breathe. An exposure at this level would be fatal within minutes.

Avoiding Exposure
Warning signs are posted to warn you of the presence of Hydrogen Sulfide. CAUTION IF ALARM SOUNDS, VACATE AREA IMMEDIATELY.

DANGER
HYDROGEN SULFIDE MAY BE PRESENT
Always work upwind of a possible emission source. Wind socks, streamers or vanes are an indication of wind direction.

Some facilities are equipped with H₂S sensors that are designed to detect high H₂S concentrations and provide a warning to personnel.

Warning can be audible, flashing lights, or a combination of both. At some locations, equipment can shut-in if high levels of H₂S are sensed.
Various types of personal monitors are provided for your on-site protection. These monitors are designed to alarm when the monitor senses a concentration of H₂S above the Permissible Exposure Limit (PEL).

Why might you wear a monitor on your ankle and your belt?

If a personal monitor has been assigned to you, take care of it and ensure it is properly calibrated and in proper working order.

Your life depends on it!

When working in areas having high concentrations of hydrogen sulfide, you will be required to wear an air supplied respirator. You are also required to be trained in respirator selection and use.
Air supplied respirators can be one of two types. Some facilities are equipped with fixed systems, others facilities may have Self-Contained Breathing Apparatus. (SCBA)

Avoiding Exposure

Use the buddy system whenever possible where H₂S concentrations have the potential of exceeding the Permissible Exposure Limit (PEL). This ensures that one person will be able to assist a co-worker if needed.

What does PEL stand for and what is the PEL limit?

Emergency Rescue

If you discover or are notified an individual has been overcome by H₂S...

NEVER rush in to attempt rescue without first protecting yourself with the proper respiratory equipment.

Often times the first rescuer becomes the second victim.
The victim should be immediately moved to fresh air. The sooner the victim is moved the better, as it greatly improves his or her chance for survival.

If the victim has ceased breathing, immediately begin artificial resuscitation. It is vital to get fresh air to the victim’s lungs. Keep the victim warm and treat for shock.

Depending on the length of exposure and concentration of H₂S, cardiac arrest may occur within 4-6 minutes. If the victim’s heart stops, begin cardiopulmonary resuscitation (CPR) immediately.
As one person initiates artificial resuscitation, another should call emergency personnel so that the victim can be transported to a hospital immediately for further treatment.

Recovery from over-exposure to H₂S is usually complete if first aid is administered promptly.

All victims, regardless of apparent condition, should receive appropriate medical aid as soon as possible.
Be aware of your facility's contingency plan for emergency medical care and transportation of victims.

We strive to offer you a safe work environment.
Although Hydrogen Sulfide has the potential to present serious risk, carefully following proper procedures and guidelines can make your work safe.

Exposure Examples
Examples of H₂S Poisoning...
• A truck driver was overcome with H₂S when a small amount of crude oil was spilled while loading at a battery site.
• A service rig floor hand was knocked down by the H₂S encountered while working around the wellhead in preparation for an acid frac job.
Exposure Examples

- A tank battery operator was overcome by H₂S while attending to a salt water spill at an oilfield facility.
- A production engineer was found dead at the hatch of a tank he was gauging. Levels approaching 150,000 ppm of H₂S were measured at the hatch.

Exposure Examples

- A worker was disconnecting a truck suction line from a valve when he became disoriented from the H₂S.
- A worker was bleeding down a pig trap inside a header building. He was overcome by H₂S, rendered unconscious and had to be rescued.

CONGRATULATIONS

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