

H2S PROPERTIES AND INITIAL RESPONSE STRATEGY TO SAFE WORKING AT OFFSHORE

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ABSTRACT

Hydrogen sulphide or H₂S is a naturally occurring gas found in a variety of geological formation. It is also formed by the natural decomposition of organic material in the absence of oxygen. It is encountered in a variety of industrial processes, including sewage and waste water treatment facilities and the production also refining of petroleum, pulp and paper, metals, acid gas, stink dump, vessels, etc. H₂S gas is colorless, heavier than air and extremely toxic in small concentrations, it has a rotten egg smell, causes eye and throat irritation. H₂S can deaden your sense of smell; at higher concentrations can cause death. For these reasons training in how to protect you is crucial in any industry and places where H₂S might be encountered. You will know more about the toxic effect and dangers of H₂S, but first take a look at the following fatality incidents, which occurred in the petroleum industry. All of this incident could have been prevented. The data were collected by using study of literature and observation. The suggestions to overcome the problem are cautions when dealing with any confined space and if near oil and gas facilities check wind direction.

Key Words: H₂S properties, Response strategy and Location

ABSTRAK

Hydrogen sulfida H₂S adalah gas alami yang ditemukan dalam berbagai formasi geologi. Ini juga dibentuk oleh penguraian alami bahan organik tanpa adanya oksigen. Hal ini ditemui dalam berbagai proses industri, termasuk fasilitas pengolahan air limbah dan limbah dan produksi juga pemurnian minyak bumi, pulp dan kertas, logam, gas asam, tempat pembuangan bau, kapal, dll. Gas H₂S tidak berwarna, lebih berat dari udara dan sangat beracun dalam konsentrasi kecil, memiliki bau telur busuk, menyebabkan iritasi mata dan tenggorokan. H₂S dapat mematikan indra penciuman Anda; pada konsentrasi yang lebih tinggi dapat menyebabkan kematian. Untuk alasan ini, pelatihan tentang cara melindungi Anda sangat penting di industri dan tempat mana pun di mana H₂S mungkin ditemukan. Anda akan mengetahui lebih banyak tentang efek toksik dan bahaya H₂S, tetapi pertama-tama perhatikan insiden kematian berikut, yang terjadi di industri perminyakan. Semua kejadian ini sebenarnya bisa dicegah. Pengumpulan data dilakukan dengan studi literatur dan observasi. Saran untuk mengatasi masalah tersebut adalah berhati-hati saat berhadapan dengan ruang terbatas dan jika dekat fasilitas minyak dan gas memeriksa arah angin.

Kata Kunci: Properti H₂S, Strategi Respon dan Lokasi

Introduction

Toxic gases represent a very serious hazard especially to those working in the oil and gas industry. The purpose of giving this information is to ensure that all company employees in the field are aware of the danger of hydrogen sulphide gas and the precaution recommended working safely in an H₂S environment.

H₂S is usually mixed with other hydrocarbons, gases or liquids. We must be prepared to deal with the health effects and others hazards of these substances as well.

Highly poisonous gas content at H₂S. This means we must be extremely cautious when working in an area where the gas may be present, but what will exposure to this gas do to you, what are its effects, will it harm or kill, with your understanding these, we cannot tell which exposure level are harmful or fatal.

H₂S enters the body through the lungs. It dissolves readily in blood and is carried by the bloodstream throughout the body. It affects breathing by causing the respiratory control center in the brain to shut down. Without message from the brain, respiration stops. Death occurs because the oxygen in the blood is quickly used up, causing the heart to stop which leads to death.

Discussion

After loading his tank with sour produced water, an oiler climbed on the tank to gauge his load. His body was found the next hours and condition was death on top of the tank near the open hatch.

A boiler foreman was exposed with hydrogen sulphide while removing a blind on top of a vessel. After the exposure, he fell 10 m than his death.

A rig worker collapsed while operating a blow out preventer valve. The foreman brought breathing apparatus to rescue him but was overcome. A third worker came to their rescue and was also overcome the problem. The crew finally removed them from the area. The third worker was revived but the first worker and both of the foreman death.

These incidents at up side are not here to scare you, but to point out dangers associated with H₂S. We can control these hazards through receiving adequate training, pre job planning and emergency response planning, control hazards, following safe work procedures and using breathing apparatus. All of these activities are designed to ensure your safety when working in an area where H₂S may be present.

To protect yourself from the dangers of H₂S exposure, there are a number of things you must know:

1. PROPERTIES OF H₂S
2. LOCATION OF H₂S
3. TOXICITY OF H₂S

1. PROPERTIES OF H₂S

If we are going to understand what H₂S and how it behaves, we need to know its properties. With proper knowledge, we will be better able to protect yourself from this hazardous gas. In this section we will learn about the properties of H₂S, including Physical State, Color, Odor, Vapor Density, Flammability and Solubility.

TABLE 1 PROPERTY OF H₂S

PROPERTIES	DESCRIPTION
<i>Physical state</i>	Normally encountered as a gas
<i>Color</i>	Colorless. No visible sign of H ₂ S to warn you of its presence
<i>Odor</i>	Smells like rotten eggs Impairs your sense of smell at low concentrations Do not rely on your sense of smell to detect H ₂ S

<i>Vapor Density</i>	Heavier than air. It may flow or settle in low lying area like pits, trenches and Natural depressions
<i>Flammability</i>	Flammable. Burns with a blue flame and gives off Sulphur dioxide gas,SO ₂ SO ₂ is hazardous,irritates the eyes and the respiratory system Explosive when mixed with air
<i>Solubility</i>	Dissolves in water, oil, sludge, emulsions, well fluids and moltenSulphur. H ₂ S is released when liquids are agitated, depressurized or heated

H₂S will be released from a liquid if the liquid is agitated or disturbed. This can happen in a number of ways. Pumping a liquid from a holding tank to a tank on the vessel will cause H₂S in the liquid to be released. Walking through a liquid at the bottom of a vessel will be cause release of the gas. We must take care when transferring or working around liquid that may contain dissolved H₂S.

Be careful when we depressurize any system, vessel, tank, etc that may contain a liquid with H₂S in it. Depressurizing the system releases the dissolved H₂S and it may become hazard. Raising the temperature of a liquid containing H₂S may cause the gas to be released. We must be cautions around vessels, holding tanks, etc. on hot day.

2. LOCATION OF H₂S

H₂S is a naturally occurring substance. Sources of the gas include geological formation, organic material and chemically produced H₂S.

It can be found in pulp mills, mines, sewers, ships holds and swamps, etc. The oil and gas industry is the single largest source of H₂S. Knowing where this toxic gas is usually found will be help you to develop strategy to reduce your likelihood of exposure. In this section you will know about common location of H₂S and general locations linked to H₂S occurrence include:

1. Drilling operations
2. Well stimulation operations
3. Well service operations
4. Production operations
5. Plant operations
6. Transportation operations

COMMON LOCATIONS

We can expect to find H₂S anywhere in the oil and gas industry. This mean we could find H₂S in wellheads or wellbores, piping system, vessels, pipelines, tanks, production facilities, pits and low spots, confined or enclosed spaces, shacks, sour spills.

The common areas where H₂S leaks occur are seals, fittings, flanges, drains, samples valves, relief valves and vent lines.

1. DRILLING OPERATIONS

When drilling for oil or gas, it is possible that a formation containing H₂S may be encountered. If that happen, the gas could be released from or accumulate in the following areas at blow out preventer, flow nipple, drilling fluids at the wellbore, drilling fluid piping system, shale shaker and mud tanks, flare pit, under the sub structure, degasser and choke manifold.

2. WELL STIMULATION OPERATION,

Specific locations of H₂S in well stimulation operations include at wellhead, circulating tanks, production tanks, circulating pump and piping system, production fluids, vents, sample valves, coil tubing, flare pit, tanks, dismantling and repairing at maintenance facilities.

3. WELL SERVICE OPERATION,

Specific locations of H₂S in this operation include at circulating tanks, production tanks, circulating pumps and piping systems, open tanks, gauge hatches, wellhead, wellbore and other fluids, dismantling and repairing facilities.

4. PRODUCTION OPERATIONS,

There are several specific locations in field operation where H₂S will probably occur, these include at water, oil or emulsion storage tanks and associated man ways. Treat and separators processing oil, water, gas and emulsion. Dehydrators for removing water from gas streams. Pig senders and traps for cleaning pipelines also field gathering system. Flare pits and stack used for burning off gas. Enhanced oil recovery sites, these activities may cause a formation to become sour.

5. PLANT OPERATIONS,

In plants, H₂S may found around the following at inlet separators, the sweetening process, process vessels, compressor buildings, Sulphur extraction, storage and transfer facilities and storage tanks.

6. TRANSPORTATION OPERATIONS

Specific transportation facilities and areas where H₂S may be found include at terminals for transferring product between truck, railcars and vessels. Hatch, vents spills associated with trucks, railcars and vessels. When working around pipelines and pipelines facilities, you may find H₂S in the following area at meter stations due to operational adjustments and maintenance. Pig launching and receiving stations. Compressor and building where the pressure of the gas is raised before entering the pipeline system.

3. TOXICITY LEVELS OF H₂S

How many H₂S does it take to make me sick or kill me?

At what level can I smell it?

When do I lose my sense of smell?

At what PPM will I pass out?

The following table will guide you answer the questions.

Table 2. H₂S toxicity levels.

H ₂ S EXPOSURE (PPM)	POSSIBLE HEALTH EFFECTS
Less than 1 PPM	You can smell it
10 PPM (8 hour OEL)	No known adverse health effect. Occupational Exposure Limits (OEL)
20 to 200 PPM	Eye and respiratory tract irritation and loss of smell. Will also cause headache and nausea
300 PPM	Immediately Dangerous to Life and Health (IDLH)
500 to 700 PPM	Affects the central nervous system. After a couple of minutes, it causes loss of reasoning, loss of balance, unconsciousness and breathing to stop
700 to 1000 PPM	Immediately loss of consciousness. Permanent brain damage and death will occur if you are not rescued immediately

At lower levels of exposure, H₂S caused irritation to your eyes and throat. At higher level, it has major effect on your nervous and respiratory system. Individual sensitivity to H₂S exposure may vary from person to person. Pulmonary edema (fluid in the lungs) can develop after H₂S exposure. Anyone knocked down by H₂S must be examined as soon as possible.

RESEARCH FINDINGS

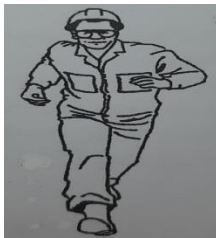
Up to this point we have been known about the properties of H₂S, where it is found, exposure limits a toxicity levels. But what do we do when we encounter an H₂S release, without that knowledge we would be in very serious danger. In this section we will learn the step initial response strategy and then we will apply it to a case study.

SEVEN STEPS INITIAL RESPONSE STRATEGY

There are seven steps you should take if you encounter an H₂S release,

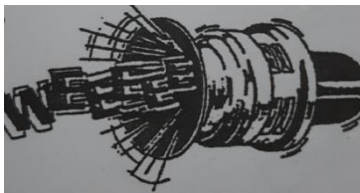
1. EVACUATE

Get to safe area immediately. Move upwind if release is downwind of you. Move crosswind if release if upwind of you. Move to higher ground if possible.



2. ALARM

Call for help (mandown) sound bell, horn, whistle or call by radio.



3. ASSESS

Do a head count and consider other hazard.



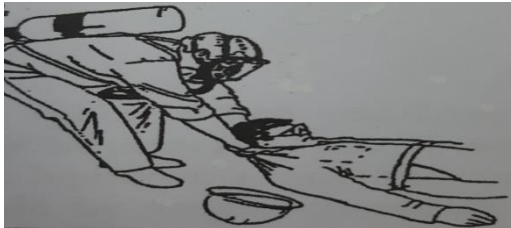
4. PROTECT

Put on breathing apparatus before attempting rescue.



5. RESCUE

Remove victim to a safe area.



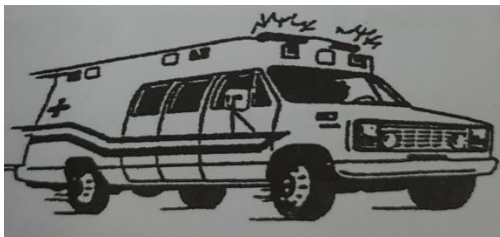
6. REVIVE

Apply artificial respiration if necessary



7. MEDICAL AID

Arrange transport of victim to medical aid and provide information to Emergency Medical Service(EMS).



CONCLUSION AND SUGGESTION

A. CONCLUSIONS

1. H₂S is heavier than air. This means the gas may collect in low lying area or be trapped by buildings, natural barriers or other confined spaces. In the event of a leak, go to high ground upwind from the source of the H₂S. If downwind head in direction that takes you crosswind.
2. H₂S may be dissolved in liquids and then be released if agitated, depressurized or heated. This mean that gas in the liquids is released when they are circulated, pumped, flowed or swabbed in to tanks. This also applies to H₂S in wellbore fluids that are agitated by these activities. That is another reason why you would expect to find H₂S at the top of open tanks gauge hatches and vent lines. In short any place where fluids are being moved depressurized or heated, you can expect H₂S gas to be released. The Alberta Energy and Utilities Board (AEUB) require signs to be placed at locations where the concentration of H₂S is 10 PPM (Parts per Million) or more.



3. The Data were collected by using study of literature and observation.

B. SUGGESTIONS

1. I must have cautions when dealing with any confined space. When you enter a confined space, there is always possibility that H₂S may be present. The two main things to watch for are scale and liquids. If you agitate liquids in a tank, they may release any H₂S that they contain. The removal of scale by steam, chemical or grinding may also cause the release of any H₂S in the scale. Blisters on the inside or outside of tanks may also contain H₂S.
2. If you are near oil and gas facilities, check wind direction by looking at windsocks, weather vanes, tape, trees etc. these are all good indicators of wind direction. If H₂S is present, it will move downwind. Staying upwind of a facility in the event of a leak should help keep you out of danger.
3. Raising the temperature of a liquid containing H₂S may cause the gas to be released. You must be cautions around vessels, holding tanks, etc on hot day.

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