

Protecting against Hydrogen Sulphide (H₂S)¹ Exposure in the Petroleum Industry

Potential Hazard

Hydrogen sulphide (also known as H₂S or sour gas) is a chemical that occurs naturally in petroleum and natural gas. It is a by-product of natural gas purification and crude oil refinement. H₂S is colourless and flammable, and smaller amounts of the gas smell like rotten eggs.

H₂S is a killer. You can become very sick or die if you come into contact with this extremely toxic gas:

- low concentrations of H₂S can cause headaches; nausea; confusion; skin complications; irritation of the eyes, nose, throat and lungs; memory loss; disorientation; and slower reaction times.
- high concentrations of H₂S can cause unconsciousness, which is known as "knockdown," or death. Those who survive large amounts of H₂S exposure could have permanent damage to their nervous system, and impaired learning and memory.

The table below shows the health effects of H₂S at various exposure levels:

EXPOSURE VIA INHALATION		
Hydrogen sulfide concentration		Signs and symptoms
ppm	mg m ⁻³	
0.001 - 0.3	0.0014 - 0.42	Odour threshold (highly variable from person to person)
1	1.39	This is Manitoba's legislated exposure limit. It is the American Conference of Governmental Industrial Hygienists (ACGIH)'s Threshold Limit Value - Time Weighted Average (TLV - TWA)
10 - 20	15 - 30	Threshold for eye irritation
50 - 100	70 - 140	Serious eye damage
150 - 250	210 - 350	Loss of olfactory sense
320 - 530	450 - 750	Pulmonary oedema with risk of death
530 - 1000	750 - 1400	Strong central nervous system stimulation, hyperpnoea followed by respiratory arrest
1000 - 2000	1400 - 2800	Immediate collapse with paralysis of respiration

Adapted from Air Quality Guidelines for Europe, Second Edition, World Health Organization Regional Office for Europe Copenhagen, Inorganic Pollutants, p.147, 2000. Accessed Oct. 20, 2016: http://www.euro.who.int/_data/assets/pdf_file/0005/74732/E71922.pdf.

Remember: repeated contact with H₂S can lead to more serious health issues, even if you do not have any negative symptoms at first.

(see over)

SAFE Work Manitoba contact information:

Winnipeg: 204-957-SAFE (7233)
Toll-Free: 1-855-957-SAFE (7233)

Publications and resources available at: safemanitoba.com



How to control the hazard

Exposure to H₂S can be prevented by:

- removing or reducing the hazard at its source through the use of **engineering controls**
- using approved **personal protective equipment (PPE)**
- developing and implementing **safe work procedures**.

Each of these control methods may not be enough on their own. You may need to combine them to provide maximum protection.

Engineering Controls

Engineering controls to remove H₂S could include ventilation systems to reduce the amount of gas in the air, chemical treatments to remove H₂S from gas and gas streams, or other measures. H₂S levels must be monitored wherever the gas may be present. H₂S detectors should be installed in or near areas where the chemical is being used or stored. It is a recommended practice to install automatic monitoring equipment to detect the level of oxygen and the presence of potentially explosive air-gas mixtures.

Personal Protective Equipment (PPE)

You must wear appropriate respiratory equipment when engineering controls may not completely prevent exposure to H₂S. The respiratory equipment must be suitable for the type of work being done and the H₂S concentration levels: please see the National Institute of Occupational Health and Safety (NIOSH) for their [equipment recommendations](#).

You should also wear chemical safety goggles, protective gloves, coveralls, boots and/or other chemical protective clothing if your job tasks may expose you to H₂S.

Safe Work Procedures

As for all work hazards, you must develop safe work procedures (SWPs) for work environments in which H₂S is present. SWPs should include:

- educating workers about the dangers and symptoms of H₂S exposure, as well as what to do if exposure occurs. All workers who are likely to come into contact with H₂S must undergo an approved "H₂S Alive" training course.
- using monitoring systems to measure H₂S concentrations in the air. Systems should alert workers when concentrations are approaching dangerous levels.
- training workers on how to use the required PPE, and when PPE must be used.
- any other measures necessary to prevent exposure to H₂S.

Additional information

Employers are responsible for providing all necessary equipment, systems, tools, information, instruction and training to ensure the safety and health of their workers on the job.

Remember, H₂S is a killer. Please review your company's safe work procedures if you may come into contact with H₂S, whether through drilling activity, production activity or a spill. Be aware of your work environment — **if you don't know, FIND OUT!**

(see over)

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In Manitoba, oil production from the Lodgepole and Mission Canyon formations is sour. The Petroleum Branch of Manitoba's Department of Growth, Enterprise and Trade has gas analysis and H₂S concentration data available for most oil pools in the province.

The Petroleum Branch has developed a policy on H₂S-related safety equipment and programs. The policy increases overall oilfield safety and provides regulation regarding H₂S safety training for all oilfield personnel.

Do not take unnecessary risks! Assume an H₂S hazard is present at all locations unless proper investigation and testing indicates that no hazard exists.

For further information, please contact the following offices or visit the Petroleum Branch website at <http://www.gov.mb.ca/stem/petroleum/index.html>

Winnipeg

1395 Ellice Avenue
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Tel 204-945-6577
Fax 204-945-0586
Toll-free 1-800-223-5215
petroleum@gov.mb.ca

Virden

227 King Street West
Box 1359
Virden MB R0M 2C0
Tel 204-748-4260
Fax 204-748-2208
Toll-free 1-800-223-5215

Waskada

23 Railway Avenue
Box 220
Waskada MB R0M 2E0
Tel 204-673-2472
Fax 204-673-2767
Toll-free 1-800-223-5215

Reference to legal requirements under workplace safety and health legislation:

- Duties of Employers: *Manitoba Workplace Safety and Health Act* – Part 4
- Oil and Gas: *Manitoba Regulation 217/2006* – Part 41
- Occupational Exposure Limits for Airborne Hazardous Substances: *Manitoba Workplace Safety and Health Regulation*, Part 36 (Chemical and Biological Substances Application), Sec. 36.5(1)

Additional workplace safety and health information available at safemanitoba.com, The National Institute for Occupational Health and Safety (NIOSH) (Hydrogen sulfide – <https://www.cdc.gov/niosh/npg/npgd0337.html>), and the American Conference of Governmental Industrial Hygienists (ACGIH).

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