

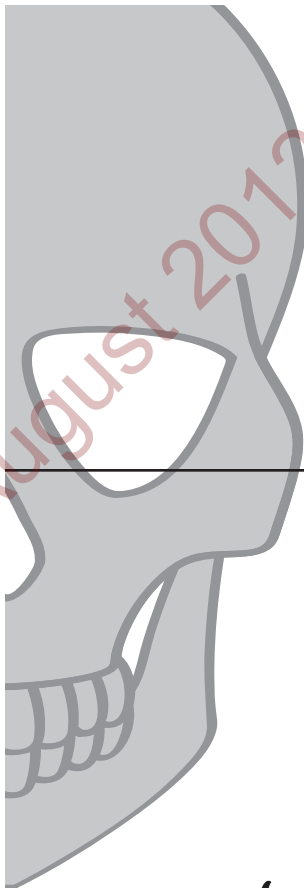


H₂S

The Killer

Alberta  Government








Current to August 2012



H₂S

The Killer

Seven-Step Initial Response Strategy

1. Evacuate	<ul style="list-style-type: none">• Get to a safe area immediately• Move upwind if release is downwind of you• Move crosswind if release is upwind of you• Move to higher ground if possible 
2. Alarm	<ul style="list-style-type: none">• Call for help (“Man down”), sound bell, horn, whistle or call by radio 
3. Assess	<ul style="list-style-type: none">• Do a head count• Consider other hazards 
4. Protect	<ul style="list-style-type: none">• Put on breathing apparatus before attempting rescue 
5. Rescue	<ul style="list-style-type: none">• Remove victim to a safe area 
6. Revive	<ul style="list-style-type: none">• Apply CPR if necessary 
7. Medical Aid	<ul style="list-style-type: none">• Arrange transport of victim to medical aid• Provide information to Emergency Medical Services (EMS) 

INTRODUCTION

The purpose of this booklet is to alert employers and workers to the dangers involved in working with H₂S and to provide guidance for controlling these dangers.

Hydrogen sulphide gas is one of the most deadly occupational hazards in Alberta. It goes by many names: H₂S, sour gas, sewer gas, stink damp, and sulfuretted hydrogen.

As the industry with the largest sources of H₂S, workers in the oil and gas industry must be aware of its deadly properties. However, sewer maintenance crews, blasters, miners and emergency responders must also learn to respect and work safely around this gas.

Employers must ensure that workers who may be exposed to H₂S gas are able to recognize its lethal effects. Procedures must be in place for activities where H₂S may be present as well as to ensure that victims who are overcome are rescued and given first aid.

BE ALERT! TAKE EVERY PRECAUTION

SOME PLACES WHERE H₂S IS FOUND



*Gas Plants, Refineries,
Petro-Chemical Plants,
Sulfur Recovery Plants*



Underground Mines



Tank Cars, Tank Trucks



*Oil & Gas Wells,
Battery Stations*



Commercial Laboratories



*Septic Tanks, Sewers,
Manure Handling Areas*



Pulp & Paper Mills



Pipelines

PROPERTIES OF H₂S

Colour	Colourless
Odour	Very offensive, commonly referred to as odour of rotten eggs at low concentrations, no odour at high concentrations, 1.188 at 25°C
Vapour density	1.189 (Air = 1.0) H ₂ S in its pure form is heavier than air
Explosive limits	4.3 to 46.0 percent by volume in air
Auto ignition temperature	260°C
Flammability	Forms explosive mixture with air or oxygen
Water Solubility	2.9 percent (2.9 g/100 mL water at 20°C)
Reactivity	Can react with iron to produce iron sulfide which will ignite in the presence of air unless it is kept wet (found as a brown/black deposit in vessels, tanks, pipes, fittings and exchange bundles).

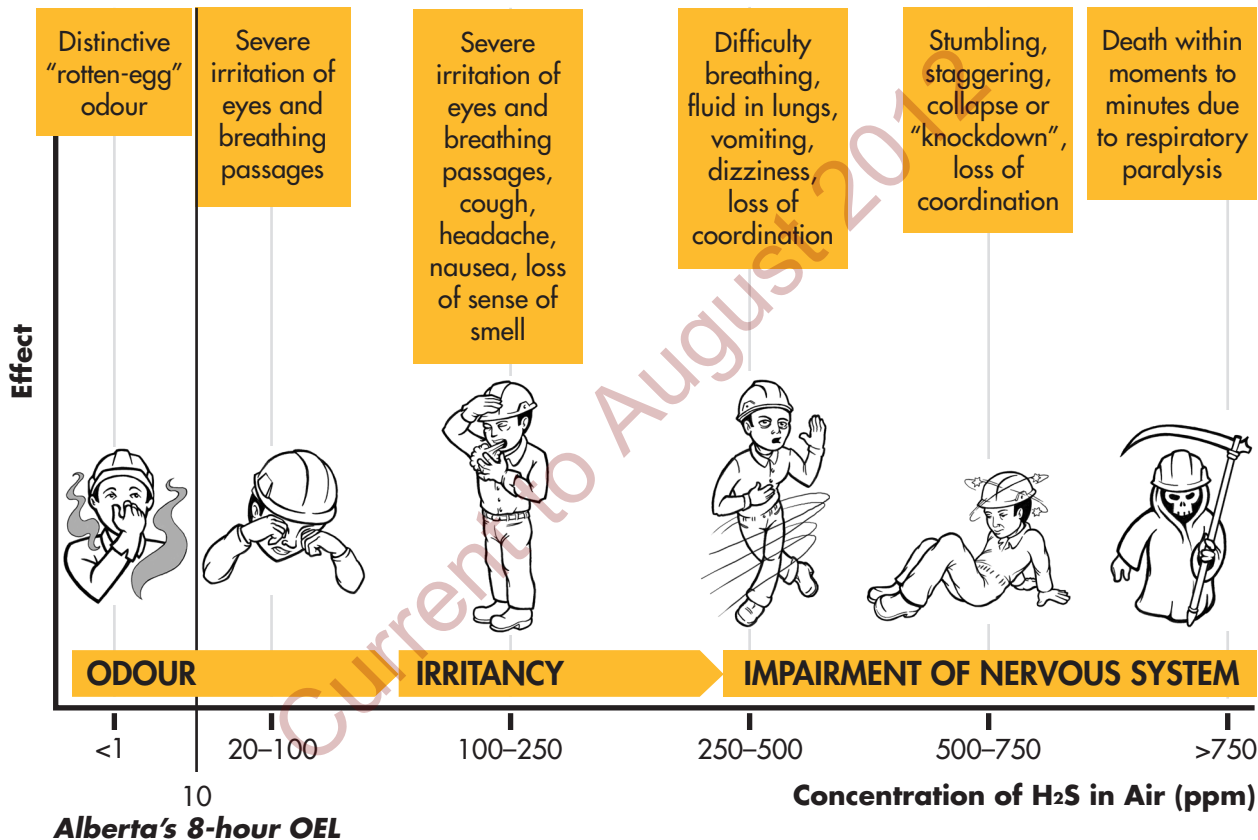
HEALTH EFFECTS OF H₂S

1 ppm	Can be smelled.
10 ppm	Alberta's Occupational Exposure Limit (OEL). Allowable for 8 hours of exposure
15 ppm	Alberta's Ceiling OEL. An unprotected worker may not be exposed above this concentration.
20-50 ppm	Severe eye irritation. Nose, throat and lung irritation. Loss of appetite.
100-200 ppm	Severe nose, throat and lung irritation. Ability to smell odour completely disappears (150 ppm)
500 ppm	Severe lung irritation. Headaches, dizziness, staggering, collapse.
500-1000 ppm	Respiratory paralysis. Irregular heart beat, collapse or death.

ppm = Parts of gas per million parts of air by volume.

1% = 10,000 ppm

EFFECTS OF H₂S EXPOSURE



DETECTION OF H₂S

Hydrogen Sulphide in low concentrations is easily recognizable by its characteristic foul odour similar to rotten eggs. **However**, continued exposure or exposure to concentrations over 100 ppm temporarily eliminates a person's ability to smell the gas. The effect usually misleads the worker into thinking the danger has passed; often with tragic results.

The acute effects of H₂S on the body are twofold. H₂S acts as an irritant to eyes, nose, throat and lungs, and it acts as an internal poison causing unconsciousness by paralysis of the respiratory system.

WARNING

***You cannot rely on your nose to tell you how much H₂S is present!
Wear your respiratory protection.***

To determine the presence of H₂S in your work area, one of the following means of detection should be used:

Continuous Monitors

In larger plants, a system is used where potentially hazardous areas are sampled by strategically located sensors. An alarm system is activated by

any sensor and gives a warning when the H₂S concentration rises above preset limits.

Personal Monitors

Battery powered H₂S monitors can be carried or worn by individual workers to indicate the concentration of H₂S to which they are being exposed.

Portable Monitors

Portable monitors are instruments that can be carried to the work site and moved with workers. It is important that you familiarize yourself with the detection equipment used at your work site. Learn its proper operation. Maintain and operate it according to the manufacturer's instructions. **YOUR LIFE MAY DEPEND ON IT.**

PERSONAL PROTECTION

When you are in an area where H₂S is a potential hazard, you must wear approved personal protective and respiratory protective equipment as required by Alberta's Occupational Health and Safety (OHS) Code.

The employer must:

- ensure that protective equipment does not itself create a hazard to workers
- select respiratory protective equipment in accordance with CSA Standard Z94.4-02, *Selection, Use and Care of Respirators*
- prepare a written code of practice regarding the selection, maintenance and use of respiratory protective equipment
- ensure that all respiratory equipment used is approved by NIOSH or another organization approved by a Director of Occupational Hygiene
- ensure that respiratory protective equipment is stored and maintained properly
- fit test equipment in accordance with CSA Standard Z94.4-02, *Selection, Use and Care of Respirators*

- ensure that workers are clean shaven where the facepiece of the respirator seals to the skin of the face
- if conditions at the work site may become immediately dangerous to life or health, workers must wear positive pressure self-contained breathing apparatus that meets the requirements in the OHS Code.
- provide other personal protective equipment appropriate to the hazards workers may be exposed to (such as safety eyewear or protective clothing)

TWO COMMON TYPES OF RESPIRATORY PROTECTION FOR H₂S

Self-Contained Breathing Apparatus (SCBA)

This type of apparatus supplies compressed air from a cylinder worn on the back to a full facepiece. This apparatus must be of the type that maintains positive pressure in the facepiece.



The cylinder must be rated to supply air for at least 30 minutes.

Heavy physical work will consume available air more quickly.

All self-contained breathing apparatus must be equipped with an alarm to warn when the air pressure is low.

Supplied Air Breathing Apparatus (SABA)

This apparatus supplies respirable air from cylinders, or a compressor in a remote location, via a hose to a full facepiece. This apparatus must be of a type that maintains positive pressure in the facepiece.

An emergency escape bottle must be worn with this type of equipment in case of an interruption of supplied air.

The emergency escape bottle is for escape purposes only and must never be used alone to carry out work in an H₂S environment.

NOTE: To prevent inward leaks of contaminated air, the worker must be clean shaven here the facepiece contacts the skin of the face.



SPECIAL HEALTH AND SAFETY REGULATORY REQUIREMENTS

The first concern in any area contaminated with H₂S is the protection of the life and health of the worker. There are certain jobs which cause H₂S to be released into the air. When working inside equipment such as vessels or tanks, workers must be protected by respiratory protective equipment and practice safe work procedures.

Additional health and safety requirements include:

- The employer must conduct a hazard assessment for their work site(s). Workers must be involved in this process.
- The employer must take steps to eliminate or control the hazard from H₂S.
- There are specific requirements for work that involves entry into a confined space or restricted space.
- Since H₂S is a flammable gas, requirements in part 10 of the OHS Code apply.
- If the work shift is longer than 8 hours, the OEL for H₂S must be adjusted, using the formula in Part 4 of the OHS Code.

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- A written code of practice is required for work sites where there is more than 10 kg of H₂S present as a pure substance, or there is a mixture in which there is more than 10 kg of H₂S and the concentration of H₂S is more than 0.1 percent by weight.
 - If a worker is working alone at a work site or assistance is not readily available should a worker be injured or ill, the employer must ensure that an effective communication system is in place.
 - Workers must be provided with Workplace Hazardous Material Information System (WHMIS) training where they use controlled products at their work site.

RESCUE AND FIRST AID

ALWAYS PUT ON RESPIRATORY PROTECTION BEFORE ATTEMPTING ANY RESCUE.

YOU COULD BECOME A VICTIM!

It is VITALLY IMPORTANT that everyone working around or near H₂S know the procedures to follow in case of an emergency:

- Workers must be provided with specific training on H₂S hazards where they may be exposed to H₂S at the work site.
- The OHS Code requires that personnel be trained in first aid. Training in C.P.R. (cardiopulmonary resuscitation) is an essential component of a worker's knowledge and skills in first aid.
- When workers use respiratory protective equipment for rescue, they must be aware of its limitations.
- Regular practice and training in rescue are necessary to provide appropriate rescue capability at the work site.
- The OHS Code specifies requirements for emergency preparedness and response. Workers who are responsible for emergency response and rescue will require additional training and equipment.

EMPLOYER RESPONSIBILITY

The employer has key responsibilities for injury and incident prevention:

- Know and inform workers about the company policy on H₂S.
- Include safe work procedures in instructions when teaching job methods.
- Identify unsafe conditions and actions.
- Take IMMEDIATE and appropriate action when H₂S is suspected or detected.
- Provide training for workers for work in environments where H₂S may be present. A worker must either be competent or directly supervised by a competent worker.
- Conduct sessions to inform workers of the “Code of Practice” and work procedures that are used on your work site prior to beginning work.

- Ensure that worker safety meetings are held. These should be used for instruction, review or discussion of unsafe conditions or actions which have been observed. Workers should be encouraged to take an active part in these meetings. Their constructive suggestions help keep safe work practices up to date.
- Ensure workers have appropriate first aid training.
- Ensure that specific procedures are in place to deal with emergency preparedness and response.
- Ensure that personal protective equipment used by workers is used properly, and does not endanger their health or safety.

WORKER RESPONSIBILITY

The worker, as well as the employer, has responsibilities under the *Occupational Health and Safety Act*.

- When workers must wear personal protective equipment, they must use the appropriate equipment. They must not use personal protective equipment that is not in a condition to perform the function for which it was designed.
- Workers with equipment under their control that does not comply with the OHS Code must remove that equipment from service.
- Workers must be aware of the “Code of Practice” developed for jobs involving confined space entry and must not enter or remain in a confined space if control measures are not in place.
- Workers must participate in training programs provided by the employer.

Getting copies of the OHS Act, Regulation & Code

Queen’s Printer



www.qp.gov.ab.ca



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Occupational Health and Safety



www.worksafe.alberta.ca

**Call any Government of Alberta office toll-free
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then the telephone number you want to reach**

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