

Preventing harm from hydrogen sulphide

July 2021

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ACKNOWLEDGEMENTS

WorkSafe would like to acknowledge and thank the stakeholders who have contributed to the development of this guidance.

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1.0 Introduction

What this guide is about

This quick guide is for any persons conducting a business or undertaking (PCBUs) whose work may expose workers and other people to hydrogen sulphide. PCBUs must ensure, so far as is reasonably practicable, the health and safety of workers and other people are not put at risk by their work.

In this quick guide, 'you' means the PCBU.

Train your workers

You must ensure, so far as is reasonably practicable, the provision of any information, training, instruction, or supervision that is necessary to protect all persons from risks to their health and safety arising from work.¹ For more information, see our guidance: [Information, instruction, supervision and training when handling hazardous substances](#)

Engage with your workers

Strong worker engagement, participation and representation leads to healthier and safer work. They are also good for business performance and productivity – because they help inform better decisions. Workers who help shape safer work systems can suggest practical, cost-effective solutions. They are more likely to make them happen in practice.

The Health and Safety at Work Act 2015 (HSWA) requires that a PCBU engage with and enable the participation and representation of workers. A PCBU should regularly discuss health and safety issues at their work with their workers.

Have an emergency plan

You must prepare, implement and maintain an emergency plan for your work.² Your plan must include what to do if there is an emergency involving hazardous substances (for example, hydrogen sulphide). You must make sure workers are trained in, and familiar with, the emergency plan. For more information, see our guidance: [Managing your hazardous substances - Emergency plans](#)

¹ Health and Safety at Work Act 2015, section 36(3)(f).

² Health and Safety at Work (General Risk and Workplace Management) Regulations 2016, regulation 14.

2.0 Exposure to hydrogen sulphide

What is hydrogen sulphide?

Hydrogen sulphide (H₂S) is a highly toxic, colourless (transparent) gas which is heavier than air. The gas is corrosive and flammable.

Hydrogen sulphide can paralyse a person's breathing system and kill in minutes. Even in small amounts, it is dangerous to health.

Hydrogen sulphide is naturally occurring in geothermal areas and is emitted from volcanoes, undersea vents, swamps and stagnant bodies of water.

It is often a by-product of some industrial processes (see Table 1 below).

Process	Industry
Manure and offal pits	Agriculture
Removal of hair from hides	Fellmongery/leather tanning
Extraction bores, thermal springs and pools	Drilling and civil works in geothermal areas
Treatment of toxic waste	Hazardous waste
Production and refining	Oil and gas
Manufacturing processes	Pulp and paper
Sewers, tanks and sewage treatment plants	Water and wastewater

Table 1: Industries and processes where hydrogen sulphide is often a by-product

Hydrogen sulphide may also be found:

- in or near confined spaces such as tanks, pits, cellars and sumps
- in or near semi-enclosed, poorly ventilated areas
- wherever there is rotting organic material, particularly where there is not much oxygen.

For more information about working safely in a confined space, see our website: [worksafe.govt.nz](https://www.worksafe.govt.nz)

Hydrogen sulphide has been found in high concentrations in environments such as construction and plumbing sites, and worksites where contractors were engaged to clear rotting vegetation underwater.

What are the effects of exposure to hydrogen sulphide?

When inhaled, hydrogen sulphide is absorbed through the lungs and into the blood. Exposure to low levels of the gas may cause irritation to the eyes, nose and throat. Exposure to high levels may cause shortness of breath, lung damage, or cardiac arrest.

Inhaling very high levels of hydrogen sulphide may cause immediate collapse and death.³

The level of harm to workers caused by exposure to hydrogen sulphide depends on:

- duration: the length of time they are exposed to the gas
- frequency: how often they are exposed
- intensity: how much (concentration) gas they are exposed to
- individual susceptibility: including the worker's general wellbeing, health and fitness.⁴

Do not rely on your sense of smell to detect hydrogen sulphide

Small amounts (low concentrations) of hydrogen sulphide smell like rotten eggs, or the gas may smell sickly sweet.

Hydrogen sulphide rapidly deadens the sense of smell. This means when there is a large amount of the gas (high concentrations), you will not be able to smell it. This makes hydrogen sulphide very dangerous. You may think the gas is no longer there when in actual fact, its levels may have increased.

Having a cold or other 'flu-like' symptoms will also affect a person's ability to smell the gas.

Common factors in cases of exposure to hydrogen sulphide

Several work fatalities and injuries in New Zealand have been caused by exposure to hydrogen sulphide. The common factors in these incidents include:

- PCBUs and workers:
 - did not understand the risks or likelihood of exposure to hydrogen sulphide
 - relied on respiratory protective equipment (RPE) as the only control measure
 - did not realise hydrogen sulphide levels had increased after a liquid containing organic material had been stirred up or otherwise disturbed
- workers were not adequately trained in the control measures for hydrogen sulphide
- new processes were introduced, or processes were changed, but these were not explained adequately to workers
- work tasks involving hydrogen sulphide were poorly planned
- workers did not wear personal exposure monitoring devices
- personal exposure monitoring devices were worn but they did not work properly
- other people rushed in to help and became victims themselves.

³ Levels above 500ppm may cause immediate collapse.

⁴ There may be other factors present such as humidity, and air movement.

3.0 Levels of hydrogen sulphide and health effects

The following table describes the effects that may occur at specific hydrogen sulphide levels.⁵

Concentration in parts per million (ppm)*	Observations and health effects
Less than 1	Most people smell something similar to rotten eggs.
3 to 5	Odour is strong.
20 to 150	Nose and throat feel dry and irritated. Eyes sting, itch or water, and 'gas eye' ⁶ symptoms may occur. Prolonged exposure may cause coughing, hoarseness, shortness of breath, and runny nose.
150 to 200	Sense of smell is blocked (olfactory fatigue).
200 to 250	Major irritation of the nose, throat and lungs occurs, along with headaches, nausea, vomiting, and dizziness. Prolonged exposure can cause fluid build-up in the lungs (pulmonary oedema), which can be fatal.
300 to 500	Symptoms are the same as above but more severe. Death can occur within 1 to 4 hours of exposure.
Above 500	Immediate loss of consciousness. Death is rapid, sometimes immediate.

*1ppm = 1 part of gas per million parts of air by volume.

Table 2: Potential health effects at specific hydrogen sulphide levels

Hydrogen sulphide levels of 100ppm and higher are considered immediately dangerous to life and health (IDLH).

⁵ WorkSafe New Zealand would like to thank WorkSafe British Columbia for the use of their table.

⁶ Similar to mild conjunctivitis.

4.0 Managing the risks of hydrogen sulphide

As a PCBU you must ensure, so far as is reasonably practicable, that the health and safety of workers and other people is not put at risk from your work. You must eliminate risks that arise from your work, so far as is reasonably practicable. If it is not possible to eliminate risks, you must minimise them, so far as is reasonably practicable.

Eliminate the risks

Consider how to eliminate the risks of hydrogen sulphide. For example, remove the conditions (such as rotting organic material) that may lead to the production of hydrogen sulphide.

Minimise the risks

If the risks cannot be eliminated, you must minimise them so far as is reasonably practicable.

You must make sure:

- containers of hazardous substances and wastes are clearly and accurately labelled. For more information, see our guidance: [Labelling, decanting and repackaging hazardous substances](#)
- hazardous substances and wastes are safely handled, stored and disposed of
- workers have been trained in the health effects of hydrogen sulphide and how to minimise their exposure
- workers that are working in areas where hydrogen sulphide is present are adequately supervised by a person who is trained in and familiar with the emergency plan. In some instances, this may require a fully trained standby worker.

You must engage with your workers when considering how to minimise risks. With your workers:

- identify when workers or other people may be exposed to hydrogen sulphide. For example, certain work tasks may increase the risks of exposure
- use the hierarchy of control measures to select the appropriate level of control measures to minimise exposure to hydrogen sulphide. For example, where possible isolate workers from areas where hydrogen sulphide is generated. Or put in place engineering control measures such as local exhaust ventilation to remove hydrogen sulphide gas from the work area
- give preference to control measures that protect many workers at the same time. Personal protective equipment (PPE) is the least effective control measure. It only protects the person wearing it. PPE should not be the first or only control measure you consider.

You should also provide workers with well-maintained and calibrated personal exposure monitoring devices, and make sure workers are trained to use them correctly.

Respiratory protective equipment (RPE)

The type of respirator you choose will depend on the results of your risk assessment, control measures, and the level of hydrogen sulphide. Always choose a respirator that fully protects the worker, conforms with AS/NZS 1716 and is selected in accordance with AS/NZS 1715.

Supplied air respiratory protection should be used where the concentrations of hydrogen sulphide may reach a level of immediate danger to life and health (IDLH). Consider having sufficient supplied air systems available for use as part of your emergency plan (for example, a supplied air emergency escape device or self-contained breathing apparatus (SCBA)).

Carry out fit testing for each worker who will wear a respirator that requires a seal against the face.

Provide information, training and instruction so workers can correctly use, wear, store and maintain their RPE. For more information, see our guidance: [RPE guidance for businesses and workers](#)

Exposure and health monitoring

You must manage the health risks to workers and others that arise from being exposed to the work carried out by your business. In some circumstances, this could mean monitoring worker exposure (exposure monitoring) and monitoring the health of workers (health monitoring).

Exposure monitoring measures and evaluates what your workers are being exposed to while they are at work. Exposure monitoring will tell you the concentrations of hydrogen sulphide your workers are exposed to during all or part of their work shift and if your control measures are working properly. It should be carried out by suitably qualified, trained and experienced people (such as occupational hygienists).

Health monitoring looks at whether a worker's health is being harmed because of what they are being exposed to while they are at work. Health monitoring can tell you if workers are experiencing health effects from potential exposure to hydrogen sulphide. It should be carried out by suitably qualified, trained and experienced health practitioners (such as an occupational health nurse). You must have worker's consent before you monitor their health.

Monitoring is not a control measure. It does not replace the need for control measures to minimise worker exposure to harm.

You must engage with your workers when making decisions about monitoring. For more information about health and exposure monitoring, see our website: [worksafe.govt.nz](https://www.worksafe.govt.nz)

What to do if you suspect there is hydrogen sulphide at your work

If you suspect there is hydrogen sulphide at your work:

- before starting work, you must complete a risk assessment and review your control measures
- ensure everyone in the area stays clear and upwind of the suspected source while the risk assessment is carried out
- **if the risk assessment indicates that a significant risk to the health of workers and other people remains, evacuate the area or building and activate your emergency plan.**

If the risk assessment indicates that the risk is being managed effectively, continue to monitor the effectiveness of controls and:

- put up signs in the area warning of the risk
- **DO NOT** allow anyone to approach or move downwind of the suspected source, or to enter confined or low-lying areas (for example, basements)
- vent the gas if it can be done remotely. For example, by activating extraction systems from a safe location
- further control should only be attempted following specialist advice, or by emergency services such as Fire and Emergency New Zealand
- notify WorkSafe New Zealand. An uncontrolled release of hydrogen sulphide is a notifiable incident. Call 0800 030 040 or see: [WorkSafe](#). For more information, see our guidance: [Notifying WorkSafe – what events need to be notified?](#)

Confirming there is hydrogen sulphide at your work

A gas detector fitted with a hydrogen sulphide sensor can confirm whether or not the gas is present and at what level. The detector sounds an alarm to warn workers in the immediate environment if gas levels reach a pre-set value. The detector can be carried by a person or it can be kept in a fixed location.

You should have a written gas detection program that covers the selection, use, storage and maintenance of the system. You should consider what type of gas detection is suitable (fixed or personal monitors) for the exposure risk. You may need to seek specialist advice from a competent and qualified person such as an occupational hygienist. For more information about where to get specialist help, see Section 5.

Only use gas detectors in accordance with the manufacturer's directions, including when checking that the sensors are working prior to use (bump testing) and regular calibration.

Workers and supervisors should be trained in the correct use, storage and maintenance of the gas detector, and in the correct procedures for safely operating in and withdrawing from an area where hydrogen sulphide may be present.

If hydrogen sulphide is regularly detected at your work, you should revisit the risk assessment for the task and review your control measures.

Using a gas detector is not a substitute for exposure monitoring.

If someone has been overcome by hydrogen sulphide gas, call 111 immediately.

5.0 More information

Specialist help

Occupational hygienists

[New Zealand Occupational Hygiene Society](#)

Occupational nurses

[Australian and New Zealand Society of Occupational Medicine](#)

[New Zealand Occupational Health Nurses' Association](#)

Registered health and safety professionals

[Health and Safety Association of New Zealand \(HASANZ\)](#)

WorkSafe Special guide

[Workplace exposure standards](#)