

Petroleum and Petrochemical Bulletin

Upper limit for Hydrogen Sulphide (H₂S)	Bulletin 17-02 Rev. 1 - 0
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Introduction

TIC Council member companies have identified the need to set an upper limit for H₂S in the breathing zone for personnel or when using SCBA.

As per OSHA Respiratory Protection standard (available from following link: <https://www.osha.gov/sites/default/files/publications/3384small-entity-for-respiratory-protection-standard-rev.pdf>), the maximum level of exposure is calculated from the exposure limits and assigned protection factor (APF) of the personal protective equipment used.

The exposure limit for hydrogen sulphide used is the threshold limit value for short term exposure (TLV-STEL) of 5ppm as given by American Conference of Governmental Industrial Hygienists (ACGIH) available from the following link: <https://www.acgih.org/hydrogen-sulfide/>.

Using the negative-pressure SCBA (where respirators draw air into the face piece via the negative pressure created by user inhalation) APF given by OSHA Respiratory Protection standard of 50, the maximum level of exposure concentration equates to 250ppm.

TIC Council members will not expose their inspectors to levels at or above 100ppm by working in locations where H₂S concentration in the breathing zone is at or above this level. This is to ensure escape and survival should any mechanical equipment fail for any reason.

Should the levels of H₂S vapor in a tank headspace be declared or measured to be of 500ppm or more, TIC Council Member Companies recommend that no manual sampling takes place with either open or closed equipment to ensure the safety of personnel. Gauging may be performed but only with closed UTI devices, however if the personal H₂S alarms are activated, then all work should stop. The limit of 500ppm is recommended as H₂S concentrations at or under this level dissipate quicker in the event of a leak or equipment failure, lowering the possibility on the H₂S concentration reaching dangerous levels in the breathing zone.

It must also be noted that SCBA should not be used or be necessary for regular or routine activities and that, apart from emergency use, situations where SCBA may be needed should be subject to a risk assessment and the work carried out under permit to work arrangements. Further, it is the responsibility of the terminal or vessel concerned to ensure that H₂S levels are adequately monitored and remain within the limits specified.

If SCBA is required to be worn for a specific activity, personnel should be trained and familiar with the SCBA equipment to be used and undergo regular refresher training on the use and maintenance.

H₂S contamination risk is to be assessed for all petroleum derived products. Therefore all parties involved are to remain vigilant and take appropriate precautions where needed. H₂S may be present in bitumen and asphalt to levels of approximately 4,000ppm in the tank headspace.

<u>Revisions/Reaffirmations</u>	
Rev. 0	February 2018
Rev. 1	June 2023

Toxic Effects of Hydrogen Sulphide

Hydrogen sulphide is a very dangerous and deadly gas, it is colourless and heavier than air. It can accumulate in low places and is hazardous in small concentrations. Exposure to H₂S can cause serious injury or death.

The US Occupational Safety and Health Administration (OSHA) publish the following table which summarises the health effects of H₂S exposure.

Concentration (ppm)	Symptoms/Effects
0.01-1.5	Odour threshold (when rotten egg smell is first noticeable to some). Odour becomes more offensive at 3-5 ppm. Above 30 ppm, odour described as sweet or sickeningly sweet.
2-5	Prolonged exposure may cause nausea, tearing of the eyes, headaches or loss of sleep. Airway problems (bronchial constriction) in some asthma patients.
20	Possible fatigue, loss of appetite, headache, irritability, poor memory, dizziness.
50-100	Slight conjunctivitis ("gas eye") and respiratory tract irritation after 1 hour. May cause digestive upset and loss of appetite.
100	Coughing, eye irritation, loss of smell after 2-15 minutes (olfactory fatigue). Altered breathing, drowsiness after 15-30 minutes. Throat irritation after 1 hour. Gradual increase in severity of symptoms over several hours. Death may occur after 48 hours.
100-150	Loss of smell (olfactory fatigue or paralysis).
200-300	Marked conjunctivitis and respiratory tract irritation after 1 hour. Pulmonary edema may occur from prolonged exposure.
500-700	Staggering, collapse in 5 minutes. Serious damage to the eyes in 30 minutes. Death after 30-60 minutes.
700-1000	Rapid unconsciousness, "knockdown" or immediate collapse within 1 to 2 breaths, breathing stops, death within minutes.
1000-2000	Nearly instant death

Effects of single exposure

The current IDHL (Immediately Dangerous to Life or Health) limit for H₂S exposure is 100 ppm ^[1] and clinical data has shown that short term single exposures to concentrations of 500 ppm and above may be fatal.

References

- TIC Council Bulletins:
- 12-02 - Bunker Sampling for H₂S
 - 16-05 - H₂S Monitoring and Measurement
 - 16-01 - Stop Work Authority (SWA)

TIC Council Petroleum and Petrochemicals Committee Safety Code – Part 1: Field Inspection.

TIC Council Code of Practice Petroleum and Petrochemicals Committee Section 3 - Health Safety and the Environment.

SOLAS (Safety of Life at Sea).

ISM (International safety management).

ISGOTT (International Safety Guide for Oil Tankers and Terminals).

OSHA (Occupational Safety and Health Administration) Respiratory Protection standard Regulations.

(ACGIH) American Conference of Governmental Industrial Hygienists H₂S exposure limit.

Reference should also be made to any local or national regulations which may apply in the region concerned and has precedence on this bulletin.

[1] US National Institute for Health and Safety (NIOSH)

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