



ETHYL MERCAPTAN

CAS number: 75-08-1

Synonyms: Ethanethiol

Chemical formula: C_2H_6S

Structural formula: —

Workplace exposure standard (retained)

TWA: 0.5 ppm (1.3 mg/m³)

STEL: —

Peak limitation: —

Notations: —

IDLH: 500 ppm

Sampling and analysis: The recommended value is quantifiable through available sampling and analysis techniques.

Recommendation and basis for workplace exposure standard

A TWA of 0.5 ppm (1.3 mg/m³) is recommended to protect for irritation to the mucous membranes and effects to the central nervous system (CNS) in exposed workers.

Discussion and conclusions

Ethyl mercaptan is used in the production of plastics, insecticides, antioxidants and as an odourant in natural gas supplies. Adverse effects include irritation of mucous membranes and, at higher concentrations, fatigue, nausea and headaches.

A NOAEC of 0.5 ppm and LOAEC of 4 ppm for irritation and central nervous effects is reported from a volunteer repeat inhalation study. A LOAEC of 40 ppm for changes in cardiovascular regulation and organ weights was reported in repeat exposure, inhalation study in animals (ACGIH, 2018).

The current TWA of 0.5 ppm which was adopted from ACGIH is recommended to be retained based on the NOAEL of 0.5 ppm in volunteers. This TWA is considered sufficiently low to protect for adverse effects. However, as the substance has an extremely objectionable odour and prolonged exposure at the TWA would likely cause nuisance, it is recommended that efforts be made to reduce exposure as much as possible. The current dataset is insufficient to evaluate mutagenic or carcinogenic activity (HCTON, 2004; DFG, 2000; OECD, 2010).

Recommendation for notations

Not classified as a carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Not classified as a skin sensitiser or respiratory sensitiser according to the GHS.

There are insufficient data to recommend a skin notation. The requirement for a skin notation should be evaluated in subsequent reviews due to inconsistencies in the current dataset (DFG, 2000).

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	1991	TWA: 0.5 ppm (1.3 mg/m³)
ACGIH	2004	TLV-TWA: 0.5 ppm (1 mg/m³)
TLV-TWA intended to minimise potential for irritation to the mucous membranes and central nervous effects. Summary of data: TLV-TWA derived from a NOAEL of 0.5 ppm for irritation and central nervous effects in a volunteer repeat inhalation study; the same study reported a LOAEL of 4 ppm. The substance has an extremely objectionable odour and prolonged exposure at the TLV-TWA would likely cause nuisance; it is recommended to reduce exposure below the TLV-TWA as far as possible. Human data: • Reported odour threshold: 0.76 ppb • Periodic nausea, irritation of mucous membranes, fatigue, altered taste perception, and rise in olfactory threshold at 4 ppm in volunteer inhalation study (3 h/d, 5–10 d): ◦ NOAEL: 0.5 ppm • Accidental exposure (n=28) at 4 ppm caused nausea and headaches, which resolved in 24 h; 1 person showed reversible liver effects evidenced by excretion of epithelial cells, protein and RBS and was considered normal within 6 wk. Animal data: • LC₅₀: 2,770 ppm (rats, 4 h), 4,420 ppm (mice, 4 h) • LD₅₀: 450 mg/kg (rats, ip) ◦ maximal sub-lethal doses caused deep sedation for >1 h ◦ higher doses caused muscular incoordination, paralysis, cyanosis, respiratory depression, coma, and death ◦ lymphocytes accumulated hepatic portal space following ip administration but not when administered by inhalation • Slightly irritating when liquid applied directly to eyes (rabbits), but signs of greater irritation in animals exposed to high vapour concentrations for 15 min (no further details provided) • LOAEL of 40 ppm for changes in cardiovascular regulation and organ weights in repeat inhalation study (rabbits, rats, mice, 5 mo, duration and frequency not specified) • Rapidly absorbed and excreted when inhaled at 30 ppm (rabbits, 25 min); only trace amounts present in blood following exposure, comparable metabolism observed at 10,000 ppm for 1 h. Insufficient data to recommend a TLV-STEL or notations for carcinogenicity, sensitisation, or skin absorption.		



Source	Year set	Standard
DFG	2000	MAK: 0.5 ppm (1.3 mg/m³)
Summary of additional data: Provisionally recommended MAK (2005) confirmed in current re-evaluation and derivation maintained. MAK based on structurally related methyl mercaptan and supported by human volunteer data that reported a NOAEL of 0.39 ppm and a LOAEL of 3.9 ppm. MAK for methyl mercaptan of 0.5 ppm is based on a sub-chronic inhalational study that reported a LOAEL of 2 ppm for slight behavioural changes in rats, higher concentrations caused reduced body weight gain. Human data: • Odour threshold 0.002 ppm • Decreased respiration rate, increased respiratory volume at 50 (n=2) or 112 ppm (n=3) for 20 min; no other symptoms reported when exposure was increased to 35 or 60 min • Unclear at which concentration odour becomes intolerable • <i>In silico</i> dermal absorption rate calculated at 1.07, 0.13, or 0.08 mg/cm²/h in 3 separate studies $\approx$ 2,140 mg; 260 mg; or 160 mg, respectively (assuming 2,000 cm² skin for 1 h) Animal data: • Acute exposure to 10, 100, or 1,000 ppm causes decreased respiratory frequency and expiratory volume only in 1,000 ppm group (rabbits, 20 min) • LD₅₀: 2,000 mg/kg (rats, dermal) • Moderate reversible erythema in patch test with 0.5 ml (rabbits); reversible in 24 h • No upper respiratory tract irritation in mice exposed to 750 ppm twice per min (duration not specified, no further information provided) • No data for carcinogenic, allergenic or reproductive toxicity presented • Only <i>in vitro</i> mutagenicity data is presented, these studies generally reported negative results except at high concentrations; substance considered non-genotoxic. Skin notation warranted based on results of 3 <i>in silico</i> studies. Insufficient data to assign sensitisation notation.		
SCOEL	NA	NA
No report.		
OARS/AIHA	NA	NA
No report.		
HCOTN	2004	TWA 8 hours: 0.5 ppm (1 mg/m³)
Summary of additional data: Insufficient data available to recommend a health-based occupational exposure limit (OEL). Human data: • Endogenous human metabolite excreted in breath and urine (higher in cirrhotic patients) • 60–80% of inhaled substance absorbed from lungs into blood. Animal data: • LD₅₀: >2,000 (rabbits, dermal) • Repeat inhalation study reported LOAEL of 40 ppm for changes in cardiovascular regulation and organ weights in (cited in ACGIH, 2018) considered inadequate for derivation of a health-based OEL due to insufficient documentation • Mutagenicity data is equivocal: negative in <i>Salmonella typhimurium</i>, equivocal results in a mouse lymphoma forward mutation assay, and positive in Chinese hamster ovary sister chromatid exchange assay.		

Secondary source reports relied upon

Source	Year	Additional information
HSE	✓ 2002	TWA: 0.5 ppm (1.3 mg/m³); STEL: 2 ppm (5.2 mg/m³).
OECD	✓ 2010	- Grouped with other aliphatic thiols based on similar structure and toxic endpoints - Ethyl mercaptan returned equivocal evidence for mutagenicity in mammalian cells <i>in vitro</i> and positive results for sister chromatid exchange at cytotoxic levels - Weight of evidence suggests that aliphatic thiols of this group, including ethyl mercaptan, do not induce gene mutations in bacteria or chromosomal aberrations <i>in vivo</i> or <i>in vitro</i> - No carcinogenicity studies were identified for any of the 4 compounds in the group.
US NIOSH	✓ 1994	IDLH based on acute inhalation toxicity data in animals; may be conservative due to lack of relevant acute toxicity data for workers.

Carcinogenicity — non-threshold based genotoxic carcinogens

Is the chemical mutagenic?

Insufficient data

Is the chemical carcinogenic with a mutagenic mechanism of action?

Insufficient data

Insufficient data are available to determine if the chemical is a non-threshold based genotoxic carcinogen.



Notations

Source	Notations
SWA	—
HCIS	—
NICNAS	NA
EU Annex	—
ECHA	—
ACGIH	—
DFG	H (skin)
SCOEL	NA
HCOTN	—
IARC	NA
US NIOSH	NA

NA = not applicable (a recommendation has not been made by this Agency); — = the Agency has assessed available data for this chemical but has not recommended any notations

Skin notation assessment

Calculation

Adverse effects in human case study:
 Dermal LD₅₀ ≤ 1000 mg/kg: no
 Dermal repeat-dose NOAEL ≤ 200 mg/kg:
 Dermal LD₅₀/Inhalation LD₅₀ < 10:
In vivo dermal absorption rate > 10%:
 Estimated dermal exposure at WES > 10%: yes

insufficient data to assign a skin notation

IDLH

Is there a suitable IDLH value available? Yes

Additional information

Molecular weight:	62.13
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 2.54 mg/m ³ ; 1 mg/m ³ = 0.394 ppm
This chemical is used as a pesticide:	☐
This chemical is a biological product:	☒
This chemical is a by-product of a process:	☐



Molecular weight:	62.13
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 2.54 mg/m ³ ; 1 mg/m ³ = 0.394 ppm
This chemical is used as a pesticide:	☐
A biological exposure index has been recommended by these agencies:	☐ ACGIH ☐ DFG ☐ SCOEL

Workplace exposure standard history

Year	Standard
Click here to enter year	

References

American Conference of Industrial Hygienists (ACGIH®) (2018) TLVs® and BEIs® with 7th Edition Documentation, CD-ROM, Single User Version. Copyright 2018. Reprinted with permission. See the [TLVs® and BEIs® Guidelines section](#) on the ACGIH website.

Deutsche Forschungsgemeinschaft (DFG) (2005) Ethanethiol – MAK value documentation.

European Chemicals Agency (ECHA) (2019) Ethyl mercaptan – REACH assessment.

Health Council of the Netherlands (HCOTN) (2004) Ethanethiol. Health-based calculated occupational cancer risk values. The Hague: Health Council of the Netherlands; publication no. 2000/15OSH/120.

Organisation for Economic Cooperation and Development (OECD) (2010) SIDS initial assessment profile – C2-C4 Aliphatic Thiols Category.

UK Health and Safety Executive (HSE) (2002) EH40/2005 Workplace exposure limits.

US National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations – Ethyl mercaptan.