2-ETHOXYETHANOL

CAS number: 110-80-5

Synonyms: Cellosolve, EGEE, ethylene glycol monoethyl ether, ethyl glycol, glycol, monoethyl ether

Chemical formula: $C_4H_{10}O_2$

Structural formula: —

Workplace exposure standard (amended)

TWA: **2 ppm (7.6 mg/m^3)**

STEL: —

Peak limitation: —

Notations: **Sk.**

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 2 ppm (7.6 mg/m^3) recommended to protect for reproductive and developmental effects in exposed workers.

Discussion and conclusions

2-Ethoxyethanol is used as a solvent for nitrocellulose, natural and synthetic resins and as a mutual solvent for the formulation of soluble oils.

Limited data are available in humans. Critical effects include embryo mortality and growth retardation. Effects on sperm parameters could not be excluded in the group of workers who excreted approximately 100 mg/L of the metabolite 2-ethoxyacetic acid in urine.

DFG (2007) used physiologically based pharmacokinetic (PBPK) modelling to determine that exposure to 2 ppm over an eight-hour work shift would result in the excretion of 50 mg/L of the metabolite in urine. Noting that reproductive effects could not be excluded at 100 mg/L of the metabolite in a worker study, 2 ppm is expected to provide sufficient protection for reproductive and developmental effects in exposed workers. It is recommended that the TWA (MAK) of 2 ppm is adopted.

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.

A skin notation is recommended based on evidence suggesting potential dermal absorption and adverse systemic effects in animals.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 5 ppm (18 mg/m^3)***
ACGIH	***2001***	***TLV-TWA: 5 ppm (18 mg/m^3)***

TLV-TWA recommended to minimise the potential for reproductive and developmental effects.

Summary of data:

TLV-TWA based on analogy to 2-methoxyethanol and the fact that 2-ethoxyethanol is less toxic in animals.

Human data:

- Limited information in humans
- Workers exposed to ≤88 mg/m^3 had significantly lower average sperm counts than controls
  - both exposed and control groups had lower sperm counts than those found in other occupational groups.

Animal data:

- Irritating and disagreeable in acutely toxic concentrations but not at concentrations considered safe for prolonged and repeated daily exposure
- Individuals of several species died after repeated exposure to 1,400 ppm for up to 12 h
  - kidney injury reported
- LD_{50}: 3.6 mL/kg (rabbits; dermal)
- Mice given oral doses of 1,000 and 2,000 mg/kg/d 5 d/wk for 5 wk presented depression of testicular weight and leukopenia
- Study in rats and rabbits to evaluate developmental toxicity:
  - rats exposed for 7 h/d, 5 d/wk for 3 wk; mated and exposed daily through to GD; sacrificed and examined at GD 21
  - rabbits artificially inseminated; exposed for 7 h/d through to GD18; sacrificed and examined at GD 30
  - 617 ppm (rabbits) or 767 ppm (rats) induced significantly increased incidences of embryo mortality at maternally toxic concentrations
  - exposure of pregnant rabbits or rats at 160 or 202 ppm, respectively, induced significantly increased incidence of terata, growth retardation and embryo mortality.

Insufficient data to recommend sensitisation or carcinogenicity notations or a TLV-STEL.

DFG	***2007***	***MAK: 2 ppm (7.6 mg/m^3)***

Summary of additional data:

- PBPK model shows 2 ppm ≡50 mg/L 2-ethoxyacetic acid in urine; basis for MAK.
- Dermal absorption and accumulation of toxic metabolite ethoxyacetic acid over course of work week; internal exposure is crucial for toxicity; used as starting point for MAK
- Effects on sperm parameters could not be excluded in the group of workers who excreted 85 ± 31.3 mg/g (2-ethoxyacetic acid /creatinine); ≈100 mg/L urine.

Source	Year set	Standard
SCOEL	***NA***	***NA***
No report.		
OARS/AIHA	***NA***	***NA***
No report.		
HCOTN	***2011***	***TWA: 0.16 ppm (0.5 mg/m^3)***

Summary of additional data:

- Induce testicular atrophy in rats after oral dosing, IP injection, inhalation exposure and dermal application
  - NOAEL of 12.5 mg/kg/d in rabbits (affected spermatogenesis, oral dose)
- Uses a study in which pregnant rabbits were exposed to EGME (0, 3, 10, 50 ppm) by inhalation as a starting point for bench mark dose (BMD) analysis
- $BMDL_{10}$ is 1.3 ppm (4.1 mg/m^3) increase in number of foetuses with delayed ossifications; interspecies factor of 3 and intraspecies factor of 3 to derive MAK.

Secondary source reports relied upon

Source		Year	Additional information
NICNAS	✓	2014	• Critical health effects include systemic long-term effects (reproductive toxicity and developmental toxicity) and systemic acute effects (acute toxicity from oral/dermal/inhalation exposure) • PBPK modelling indicates that an OEL of 2 ppm should protect workers from the most sensitive adverse effects.
US EPA	✓	1991	• NOAEL 103 ppm; decreased testis weight, seminiferous tubule degeneration and decreased haemoglobin; rabbits, sub chronic inhalation study.

Carcinogenicity — non-threshold based genotoxic carcinogens

Is the chemical mutagenic? No

The chemical is not a non-threshold based genotoxic carcinogen.

Notations

Source	Notations
SWA	Skin
HCIS	—
NICNAS	—
EU Annex	NA
ECHA	NA
ACGIH	Skin

Source	Notations
DFG	H (skin)
SCOEL	NA
HCOTN	Skin
IARC	NA
US NIOSH	SK:SYS

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 LD_{50} ≤1000 mg/kg:	yes	
Dermal repeat-dose NOAEL ≤200 mg/kg:		
Dermal LD_{50}/Inhalation LD_{50} <10:		
In vivo dermal absorption rate >10%:		
Estimated dermal exposure at WES >10%:		
		consider assigning a skin notation

IDLH

Is there a suitable IDLH value available? Yes

Additional information

Molecular weight:	90.12
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 3.68 mg/m^3; 1 mg/m^3 = 0.272 ppm
This chemical is used as a pesticide:	☐
This chemical is a biological product:	☐
This chemical is a by-product of a process:	☐
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) (2008) 2-Ethoxyethanol – MAK value documentation.

Health Council of the Netherlands (HCOTN) (2011) Ethyleneglycol monomethyl ether (EGME) and ethyleneglycol monomethyl ether acetate (EGMEA). Health-based calculated occupational cancer risk values. The Hague: Health Council of the Netherlands; publication no. 2011/10.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2014) Alkoxyethanols (C1-C2) and their acetates: Human health tier II assessment – IMAP report.

US Environmental Protection Authority (US EPA) (1991) Integrated Risk Information System (IRIS) Chemical Assessment Summary – 2-Ethoxyethanol .

US National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations – 2-Ethoxyethanol.

US National Institute for Occupational Safety and Health (NIOSH) (2011) NIOSH Skin Notation Profiles: 2-Ethoxyethanol (EE).