METHYL SILICATE

CAS number: 681-84-5

Synonyms: Tetramethoxy silane; tetramethyl orthosilicate, tetramethyl silicate

Chemical formula: $C_4H_{12}O_4Si$

Structural formula: —

Workplace exposure standard (retained)

TWA: **1 ppm (6 mg/m^3)**

STEL: **—**

Peak limitation: **—**

Notations: **—**

IDLH: **—**

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

Recommendation and basis for workplace exposure standard

A TWA of 1 ppm (6 mg/m^3) is recommended to protect for damage to the eye and respiratory tract in exposed workers.

Discussion and conclusions

Methyl silicate is used to coat screens of television picture tubes and is used in binders, corrosion-resistant coatings and catalyst preparation and as a silicone intermediate.

Critical effects of exposure include eye pain, blindness and severe corneal injury, with respiratory, bronchiolar and inflammatory lesions reported at higher concentrations (ACGIH, 2018).

Very limited human toxicological data are available with reports of minimal ocular lesions with exposure at 200 to 300 ppm in industrial setting. A NOAEC of 10 ppm (63 mg/m^3) was identified in a sub-chronic inhalation study in rats (ACGIH, 2018; HCOTN, 2004).

ACGIH (2018) recommendation of 1 ppm is based on the NOAEC of 10 ppm from sub-chronic study in rats. HCOTN (2004) used this same study to recommend health-based OEL of 0.3 ppm by applying different uncertainty factors.

Based on the available human and animal data, the TWA of 1 ppm (6 mg/m^3) is recommended to be retained and is same as TLV-TWA by ACGIH (2018). This value is considered sufficiently low to minimise potential for ocular injury in exposed workers. A STEL is not recommended as the revised TWA is considered adequately protective of acute exposures.

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.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 1 ppm (6 mg/m^3)***
ACGIH	***2001***	***TLV-TWA: 1 ppm (6 mg/m^3)***
TLV-TWA recommended to minimise eye damage and reported respiratory tract and lung damage in animals. Derivation of the TLV-TWA not provided. Summary of data: Human data: • In industrial setting, reports of eye pain, blindness and severe injury to the cornea; at moderate concentrations effects may be reversible if promptly treated with cortisone and penicillin • Exposure at 200–300 ppm for 15 min can produce minimal lesions; 1,000 ppm can produce corneal injury requiring hospitalisation. Animal data: • Marked oedema and necrosis of eye lid in rabbit following instillation into eye • No mortality in rats exposed at 125 ppm for 4 h; 100% mortality at 250 ppm • Exposure at 1,000 ppm saturated vapour for 5 min caused eye burn in rabbits, but no effect after 4 min • In guinea pig study, brief exposure to high concentrations caused more eye injury than exposure to low concentrations for longer periods; all corneal damage reported to be reversible • LC_{50}: 300 ppm (1 h), 95 ppm (4 h) and 26 ppm (8 h) (guinea pig) • NOAEC: 10 ppm (rats, inhalation, 6 h/d, 5 d/wk for 28 d): o no adverse effects at 10 ppm o corneal lesions and significant decreases in blood proteins and enzymes at 15 ppm o respiratory and bronchiolar lesions at 30 ppm o mortality or moribund at 45 ppm. Insufficient data to recommend skin, SEN or carcinogenicity notations or TLV-STEL.		
DFG	***NA***	***NA***
No report.		
SCOEL	***NA***	***NA***
No report.		
OARS/AIHA	***NA***	***NA***
No report.		
HCOTN	***2004***	***TWA: 1 ppm (6 mg/m^3)***
Administrative OEL. Summary of additional data:		

Source	Year set	Standard
• LC_{50}: 335 mg/m^3 (53 ppm) (rats, 4 h) • LD_{50}: 17.4 mg/kg (rabbits, 14 d) • No mutagenicity, genotoxicity or carcinogenicity information • Committee recommended lowering the administrative TWA of 1 ppm to health-based OEL of 0.3 ppm (2 mg/m^3): ○ the calculated limit of 2 mg/m^3 (0.3 ppm) based on the NOAEL of 63 mg/m^3 (10 ppm) (also cited by ACGIH) and application of an assessment factor of 18 to account for intra- and interspecies variation and study duration and rounding according to HCOTN methodology.		

Secondary source reports relied upon

Source		Year	Additional information
ECHA	✓	2013	• NOAEC: 15 ppm (93 mg/m^3) (rat, 28-d); same study quoted by ACGIH and HCOTN, however, different NOAEC based on local effects on respiratory tract and minimal effects observed at 15 ppm.

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	NA
NICNAS	NA
EU Annex	NA
ECHA	NA
ACGIH	—
DFG	NA
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
Insufficient data to assign a skin notation

IDLH

Is there a suitable IDLH value available?	No

Additional information

Molecular weight:	152.22
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 6.22 mg/m^3; 1 mg/m^3 = 0.161 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.

European Chemicals Agency Regulation (ECHA) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

Health Council of the Netherlands (HCOTN) (2004) Tetramethyl orthosilicate. Health-based Reassessment of Administrative Occupational Exposure Limits. The Hague: Health Council of the Netherlands; publication no. 2000/15OSH/132.