# Methyl alcohol

| CAS number: | 67-56-1 |
| --- | --- |
| Synonyms: | Methanol, carbinol, methyl hydroxide, wood alcohol, wood spirits |
| Chemical formula: | CH4O |
| Structural formula: | — |

Workplace exposure standard (amended)

| TWA: | **100 ppm (130 mg/m3)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **Sk.** |
| IDLH: | **6,000 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 100 ppm (130 mg/m3) is recommended to protect for neurotoxic and central nervous system (CNS) effects in exposed workers.

## Discussion and conclusions

Methyl alcohol is used as a solvent for various natural and synthetic resins, as antifreeze, and as denaturant for ethanol.

Critical effects of exposure include visual disturbances, blindness, headaches and nausea. In contrast, differing symptoms have been noted in animals (due to metabolic differences), with metabolic acidosis and degeneration of retina ganglion cells not seen in rodents.

Limited human data are available. An acute NOAEC of 200 ppm for acute neurotoxic effects and mucus membrane irritation is reported in a four-hour inhalation study of volunteers at rest with a corresponding blood level of 6.5 mg/L. Another study calculated a concentration of 6 mg methyl alcohol per litre in blood following exposure of workers at 100 ppm with physical activity over eight hours. This corresponds to the concentration in blood where no effects were observed, forming the justification for the DFG (2019) recommendations. No adverse effects are reported in a study in dogs exposed at 450 to 500 ppm for 379 days (ACGIH, 2018). A NOAEC of 1,000 ppm is reported in rodents for systemic effects from an 18 to 24-month inhalation study (HCOTN, 2010).

A TWA of 100 ppm (130 mg/m3) is recommended as assigned by DFG (2019) and recommended by the HCOTN (2010). This TWA is cited to be protective of CNS effects, adverse effects and potential irritation. The evidence does not warrant the recommendation of a STEL due to the recommended reduction in the TWA.

## 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 adverse systemic effects in humans and animals following dermal application.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 200 ppm (262 mg/m3); STEL: 250 ppm (328 mg/m3) | |
|  |
| ACGIH 2009 TLV-TWA: 200 ppm (262 mg/m3); TLV-STEL: 250 ppm (328 mg/m3) |
| TLV-TWA recommended to minimise effects of headaches, visual disturbances and nausea. Derivation of TLV-TWA not provided.  Summary of data:  Human data:   * Slowly eliminated from body, thus repeated exposure results in increasing concentration in blood and tissue * Occupational poisoning frequently caused death or blindness, with several cases occurring in confined spaces * Report of fatality *via* inhalation over 12 h in female worker with reported vapour concentrations ranging from 4,000–13,000 ppm * Several studies reported no evidence of effects in workers exposed to 160–1,000 ppm, another study indicated severe, recurrent headaches following exposure to 200–375 ppm * Ocular disturbances and blindness reported in 2 studies following repeated rubbing of skin; however, inhalation may also be route of exposure in these cases.   Animal data:   * Differing symptoms in animals compared with humans, with metabolic acidosis and degeneration of retina ganglion cells not seen in rodents: * attributed to metabolic differences * Reduction in respiratory rate by 50% occurred at 25,000–41,000 ppm in mice * No symptoms observed in dogs exposed via inhalation at 450–500 ppm for 379 d and exposure limit of 200 ppm recommended based on this study * Negative results for carcinogenicity: * mutagenic in RK mutagen test * not mutagenic in other microbial and mammalian cell assays.   A skin notation is recommended due to absorption through the skin causing blindness and other visual disturbances.  Insufficient data to recommend SEN or carcinogenicity notation. |
| DFG 2019 MAK: 100 ppm (130 mg/m3) |
| MAK recommended to protect for irritation and CNS effects.  Summary of additional data:   * NOAEC= 200 ppm (4 h exposure at rest) for acute neurotoxic effects and mucus membrane irritation: * 4 h exposure at 200 ppm corresponds to 6.5 mg/L in blood * no neurobehavioural effects * Reports worker exposure (with physical activity) at 100 ppm for 8 h results in ~6 mg/L in blood: * corresponds to concentration in blood where no effects observed * half-life in the blood is 1.4 h; based on this information no accumulation expected over working week * Exposure at 100 ppm not expected to result in acidosis. |
| SCOEL NA NA |
| No report. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN 2010 TWA: 200 ppm (260 mg/m3); STEL 400 ppm (520 mg/m3) |
| TWA recommended to protect workers from acute neurotoxic and CNS effects and was based on extrapolation from animal studies.  Committee recommended lowering of administrative value to TWA of 100 ppm (133 mg/m3) based on cited NOAEL of 1,000 ppm in animals and applying an uncertainty factor of 10 for interspecies and intraspecies variation.  Summary of additional data:   * No human studies to derive OEL * Animal studies indicate liquid may cause moderate skin irritation but no skin sensitisation * NOAEL: 1,330 mg/m3 (1,000 ppm) in rats and mice exposed for 19–20 h/d for 18–24 mo; no neoplastic or non-neoplastic effects * Repeat-dose inhalational toxicity studies over 4 wk showed no systemic effects in monkeys or rats exposed up to 6,650 mg/m3 (5,000 ppm) (6 h/d, 5 d/wk).   Not likely to be genotoxic or have carcinogenic potential. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| ECHA |  | 2019 | * DNEL: 130 mg/m3. |
| US NIOSH |  | 1994 | * REL: 200 ppm (260 mg/m3) TWA, 250 ppm (325 mg/m3) STEL. |

### 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 | Skin |
| EU Annex | NA |
| ECHA | — |
| ACGIH | Skin |
| DFG | H (skin) |
| SCOEL | NA |
| HCOTN | Skin |
| 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: | yes | 4.00 |  | | Dermal LD50 ≤1000 mg/kg: |  |  |  | | Dermal repeat-dose NOAEL ≤200 mg/kg: |  |  |  | | Dermal LD50/Inhalation LD50 <10: |  |  |  | | *In vivo* dermal absorption rate >10%: |  |  |  | | Estimated dermal exposure at WES >10%: |  |  |  | |  |  |  | **a skin notation is warranted** | |

### IDLH

| Is there a suitable IDLH value available? | Yes, based on LEL |
| --- | --- |

## Additional information

| Molecular weight: | 32.04 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = 1.31 mg/m3; 1 mg/m3 = 0.764 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*](http://www.acgih.org/tlv-bei-guidelines/policies-procedures-presentations) on the ACGIH website.

Deutsche Forschungsgemeinschaft (DFG) (2019) Methanol – MAK value documentation.

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) (2010) Methanol. Health-based recommended occupational exposure limit. The Hague: Health Council of the Netherlands; publication no. 2010/01OSH.

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