# Cyclohexanol

| CAS number: | 108-93-0 |
| --- | --- |
| Synonyms: | Cyclohexyl alcohol, hexahydrophenol, hydralin, hydroxycyclohexane |
| Chemical formula: | C6H12O |

Workplace exposure standard (retained)

| TWA: | **50 ppm (206 mg/m3)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **Sk.** |
| IDLH: | **400 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 50 ppm (206 mg/m3) is recommended to protect for eye irritation and potential central nervous system (CNS) effects in exposed workers.

## Discussion and conclusions

Cyclohexanol is manufactured from either cyclohexane or phenol, which may form cyclohexanone as a by-product. It is used in the production of nylon, paints, plastics, degreasers, detergents and insecticides.

Critical effects of exposure are eye irritation and depression of the CNS at higher concentrations. Chronic exposure data for both humans and animals are very limited. Based on the available data, irritation effects in humans may be prevented at concentrations below 100 ppm (ACGIH, 2018) and bioaccumulation of the substance is unlikely at concentrations below 50 ppm based on toxicokinetic findings in rabbits (DFG, 2010). Narcotic effects in humans have not been investigated in the available studies. A sub-chronic inhalation study reported that concentrations of 997 ppm caused narcotic effects in rabbits (ACGIH, 2018).

Based on available human and animal studies, a TLV-TWA of 50 ppm is recommended by the ACGIH. Given the limited chronic exposure data, the current TWA of 50 ppm by ACGIH (2018) is retained and is considered to protect for eye irritation and potential narcosis.

## 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: 50 ppm (206 mg/m3) | |
|  |
| ACGIH 2001 TLV-TWA: 50 ppm (206 mg/m3) |
| TLV-TWA intended to protect for eye irritation and potential narcosis and incoordination.  A skin notation is recommended based on dermal application studies with rabbits, which reported systemic effects such as narcosis, tremors, hypothermia and death. Insufficient data to recommend a TLV-STEL or notations for carcinogenicity or sensitisation.  Summary of data:  TLV-TWA is based on limited acute human and sub-chronic animal studies that cite eye irritation and systemic effects as the critical effects of exposure.  Human data:   * Odour threshold: 0.15 ppm * Acceptable concentration for 8 h exposure estimated at <100 from volunteer inhalation study (n=10, 3–5 min exposures, test concentrations not specified) * Non-specific autonomic nervous system disturbances in 114 individuals (n=174 women and 279 men) exposed above a “permitted” concentration (not specified) in a study of individuals exposed over a 2 yr period (frequency not specified); compared with 8 of 100 individuals in an unexposed control group * Evidence of erythema or oedema in 48 h patch with 4% in petrolatum.   Animal data:   * LD50: 2,060 mg/kg (rat, oral) * LD50: 270 mg/kg (mouse, intravenous) * LD50: 1,000 mg/kg (mouse, intramuscular) * Moderate to severe reversible eye irritation in rabbits; slight irritation on skin * Acute dermal application with rabbits results in narcosis, tremors, hypothermia and death at toxic concentrations (not specified, no further information provided) * Temporary erythema and sloughing of skin in sub-chronic repeat/prolonged dermal application study with 15% ointment (rabbits, amount and solvent not specified, 10 d)   + death reported after 11 d, preceded by narcosis, tremors, and hypothermia * Eye irritation, salivation, narcosis and mild convulsions in sub-chronic inhalational studies at 1,229 ppm for 150 h or at 997 ppm for 300 h (rabbits, 6 h/d, 5–11 wk):   + death occurred in 50% of animals and degeneration of the heart, brain, liver and kidneys observed at these concentrations   + slight liver and kidney degeneration at 145 ppm in related study * Higher mortality and inhibited growth in developmental study at 1% in diet; treatment range 0.1–1% (mice, multiple generations and up to 21 d following birth):   + mortality rate increased with successive generations   + normal growth resumes when exposure is ceased * Non-mutagenic *in vitro* and *in vivo*. |
| DFG 2010 MAK: not established |
| Summary of additional data:  Previous MAK of 50 ppm withdrawn due to insufficient chronic exposure data in humans. Several studies presented in the assessment are dismissed due to inadequate experimental documentation.  Human data:   * Half-life of 1.5 h in subjects exposed to 57 ppm for 8 h by inhalation; diol metabolites were eliminated with half-life of 14–18 h * Odour threshold of 0.5 ppm and stimulation threshold of 430 ppm from recent volunteer study (n=72) using intranasal instillation (1–2 sec).   Animal data:   * LC50: 6,500 ppm (rat, duration not specified); no fatalities in rats exposed to 3,515 ppm for 1 h or 878 ppm for 3 h * Dermal LD50: 501–794 mg/kg (rabbits) reported in recent studies; older studies report range of 12,400–22,700 mg/kg * Non-sensitising to guinea pig skin in standardised maximisation test * NOAEL <145 ppm from sub-chronic inhalation study, treatment range: 145–227 ppm (rabbits, 10 wk) (also cited in ACGIH, 2018)   + no substance accumulation observed in rabbits at 145 ppm after 10 wk * Degenerative changes in testes in daily oral intake study at 25 mg/kg (rabbits, 40 d)   + bw unchanged over the test period, but adverse blood and serum indicators observed   + adverse effects of exposure, except blood and serum indicators, reversible in 70 d * Spermatotoxic effects observed in repeat subcutaneous injection study at 15 mg/kg (rats/gerbils, 21/37 d) * No tumour initiating or promoting effects shown for cyclohexanol alone. Only co-application with known tumour promoter caused increase of tumorigenic lesions in liver. |
| SCOEL NA NA |
| No report. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN NA NA |
| No report. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| HSE |  | 2002 | * 8 h TWA: 50 ppm (208 mg/m3). |
| US NIOSH |  | 1994 | * IDLH based on acute oral toxicity data in animals. |

### 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 | NA |
| EU Annex | — |
| ECHA | NA |
| ACGIH | Skin |
| DFG | H (skin) |
| SCOEL | NA |
| HCOTN | NA |
| 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: | no |  |  | | Dermal LD50 ≤1000 mg/kg: | yes | 3.00 |  | | Dermal repeat-dose NOAEL ≤200 mg/kg: |  |  |  | | Dermal LD50/Inhalation LD50 <10: |  |  |  | | *In vivo* dermal absorption rate >10%: |  |  |  | | Estimated dermal exposure at WES >10%: |  |  |  | |  |  | 3 | **consider assigning a skin notation** | |

### IDLH

| Is there a suitable IDLH value available? | Yes |
| --- | --- |

## Additional information

| Molecular weight: | 100.16 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = Number mg/m3; 1 mg/m3 = Number 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) (2010) Cyclohexanol – MAK value documentation, German language edition.

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 – cyclohexanol.