# Cyclohexane

| CAS number: | 110-82-7 |
| --- | --- |
| Synonyms: | Hexahydrobenzene, hexamethylene, hexanaphthalene |
| Chemical formula: | C6H12 |
| Structural formula: | — |

Workplace exposure standard (amended)

| TWA: | **100 ppm (350 mg/m3)** |
| --- | --- |
| STEL: | — |
| Peak limitation: | — |
| Notations: | — |
| IDLH: | **1,300 ppm (LEL)** |
| **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 (350 mg/m3) is recommended to protect for depression of the central nervous system (CNS), headache, dizziness, and narcosis in exposed workers.

It is recommended that the previous STEL of 300 ppm (1,050 mg/m3) is withdrawn as there is no evidence of acute adverse effects evident within ten times of the recommended TWA.

## Discussion and conclusions

Cyclohexane is used as a solvent, in perfume manufacture, surface coating and removal, in extraction of essential oils, in molecular weight determination and in the manufacturing of various chemicals. The critical effects are sedation, neurobehavioural effects and systemic toxicity.

A combination of occupational and experimental studies on human exposure to 95–274 ppm produced no subjective, behavioural or systematic symptoms. In chronic inhalation animal studies NOAEC and NOAELs of 434 ppm or above was reported, including a reproductive study (ACGIH, 2018).

Based on the evidence presented in humans and animals, the current TWA of 100 ppm (rounded from 95 ppm) is retained and considered to be protective of depression of the CNS, headache dizziness, and narcosis.

As there is insufficient data to suggest an immediately acute effect at concentrations within ten times the recommended TWA, it is recommended that the STEL be withdrawn.

## 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 not recommended based on the available evidence.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 100 ppm (350 mg/m3); STEL: 300 ppm (1,050 mg/m3) | |
|  |
| ACGIH 2002 TWA: 100 ppm (350 mg/m3) |
| TLV-TWA recommended to minimise the potential for depression of the central nervous system, headache, dizziness, narcosis and death.  Summary of data:  Human data:   * Physiologically based pharmacokinetic model based on a rat and human study predicted a NOEC at 1,200 ppm (inhalation) with sedation at 3,900 ppm * 12 subjects exposed at 25 ppm and 250 ppm for 4 h; no change was recorded in any of the neurobehavioral parameters measured * 33 women exposed up to 274 ppm whilst applying glue solvent over a measured work shift produced no symptoms. Parameter included haematological, serum biochemical, liver function, kidney function, sister chromatid exchange rates and other subjective symptoms * 18 women exposed up to 95 ppm whilst using adhesive in a luggage factory produced no symptoms. Parameter included peripheral nerve condition and other subjective symptoms.   Animal data:   * LD50: 6,200–30,400 mg/kg (rats, 14 d, oral), age dependant * NOEC: 2,000 ppm (rats, 6 h, inhalation), based on behavioural effects * Inhalation exposure to 434, 786 and 3,355 ppm over 10 wk (rabbits, 6 h/d) * no clinical signs of toxicity at any level * microscopic changes in liver and kidney at 786 ppm * histopathological effects NOEC of 434 ppm * Inhalation exposure to 0, 500, 2,000 and 7,000 ppm over 14 wk (mice, 6 h/d, 5 d/wk) * 7,000 ppm: increased liver weight, reversible after 1 mo, increase in erythrocyte mass and plasma protein concentration * 2,000 ppm and 7,000 ppm: stimulus response and behavioural changes * NOEC for reversible behavioural changes and sedation was 500 ppm * Based on several reproductive studies, systematic toxicity: NOEC: 500 ppm, reproductive toxicity NOEL: 7,000 ppm.   Negative results in mutagenicity assays  Insufficient data available to assign a carcinogen notation. |
| DFG 1999 MAK: 200 ppm (700 mg/m3) |
| A provisional MAK value established. Further studies are required to confirm this MAK value.  Summary of additional data:   * 25 mg/kg/d cyclohexanol resulted in inhibition of spermatogenesis in the spermatocyte and spermatid stage (rabbits, 40 d, gavage) * The spermatotoxic effect seen in the rabbit is not to be expected in humans exposed to a cyclohexane concentration of 200 mL/m3. |
| SCOEL 2001 TWA: 200 ppm (700 mg/m3) |
| Summary of additional data:   * Cyclohexane was not found to be a skin sensitiser when tested by the modified Buhler method. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN NA NA |
| No report. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| ECHA |  | 2011 | * LD50: 2,000 mg/kg (rats, dermal) * LC50: 9,500 ppm (rats, 4 h). |
| US EPA |  | 2003 | * No additional information. |

### 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 | NA |
| HCIS | NA |
| NICNAS | NA |
| EU Annex | NA |
| ECHA | — |
| ACGIH | NA |
| DFG | NA |
| 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: | 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%: |  |  |  | |  |  |  | **a skin notation is not warranted** | |

### IDLH

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

## Additional information

| Molecular weight: | 84.16 |
| --- | --- |
| 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) (1999) Cyclohexane – MAK value documentation.

EU Scientific Committee on Occupational Exposure Limits (SCOEL) (2001) Recommendation from the Scientific Committee on Occupational Exposure Limits for cyclohexane. SCOEL/SUM/13.

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).

US Environmental Protection Agency (US EPA) (2003) Toxicological Review of Cyclohexane.

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