# Hexane (n-hexane)

| CAS number: | 110-54-3 |
| --- | --- |
| Synonyms: | Hexane |
| Chemical formula: | C6H14 |
| Structural formula: | — |

Workplace exposure standard (amended)

| TWA: | **50 ppm (176 mg/m3)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **Sk.** |
| IDLH: | **1,100 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 (176 mg/m3) is recommended to protect for neurotoxic effects in exposed workers.

## Discussion and conclusions

Commercial grades of *n*-hexane are used as solvents for vegetable oils, coatings, paints, or adhesives and are employed as denaturants for ethanol. Analytical grade *n*-hexane is a commonly used solvent in laboratories.

The critical effects of exposure are neurotoxicity including polyneuropathy and narcosis. Numerous case reports exist reporting polyneuropathy in workers following exposure to solvents containing *n*‑hexane. There is one report of severe intoxication following dermal exposure and absorption (ACGIH, 2018). A LOAEL of approximately 70 ppm associated with electroneuromyographic abnormalities is reported in a study of post-shift metabolite concentrations in workers (SCOEL, 1995). Two groups of workers exposed at an average of 58 ppm showed no significant toxic effects on the peripheral nervous system. A NOEC of 100 ppm is identified for electrophysiological measurements of the tail nerve of rats in a 24 week study. This NOEC formed the basis of the recommended DFG MAK of 50 ppm (DFG, 2000). The previous TLV-TWA of 25 ppm recommended by ACGIH was based on the studies involving exposures to solvent assumed to contain 30% n-hexane. A detailed review of that data identified n-hexane content at 50 to 70%. This provided justification to amend the TLV-TWA to 50 ppm (ACGIH, 2018).

Based on the evidence presented, a TWA of 50 ppm is recommended as derived by ACGIH (2018) and DFG (2016). This TWA is cited to be protective of neurotoxic effects, narcosis and eye and mucous membrane irritation.

## 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 case report evidence in humans.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 2001 TWA: 20 ppm (72 mg/m3) | |
|  |
| ACGIH 2001 TLV-TWA: 50 ppm (176 mg/m3) |
| TLV-TWA recommended to minimise the potential for neurotoxic effects, narcosis and eye and mucous membrane irritation.  Summary of data:   * Previous TLV-TWA of 25 ppm based on studies with exposures to commercial hexane with a n-hexane content as low as 30%; recent more detailed review concluded that n-hexane content of 50–70%; TLV-TWA amended to 50 ppm * Literature references to hexane possible refer to a mean normal hexane isomer or a specific isomer blend * Neurotoxicity of *n*-hexane is not seen in other isomers * Metabolises to 2,5-hexanedione and 2,5-hexanediol *in vivo* producing neuropathy.   Human data:   * Report of severe intoxication following dermal absorption * 2,000 ppm for 10 min caused no effects; 5,000 ppm caused dizziness and giddiness * Polyneuropathy reported in worker study at 500 ppm; duration described as 48 h or longer work weeks * Minimal concentration required for neurotoxic effects not identified * Numerous case reports of polyneuropathy in workers from solvent exposure; a review indicated most solvents were believed to contain 50–70% *n*-hexane.   Animal data:   * Mice exposed at 250 ppm, 24 h/d, 6 d/wk for 1 yr showed signs of neurotoxicity * No evidence of peripheral polyneuropathy in mice inhaling 100 ppm for 7 mo; no further information on isomers mix * Progressive testicular toxicity from 2,5-hexanedione in rats in feeding study at doses less than those producing neurotoxicity.   Insufficient data available to recommend sensitiser or carcinogenicity notation or TLV-STEL. |
| DFG 2000 MAK: 50 ppm (180 mg/m3) |
| Summary of additional data:   * Observations in workers confirms occurrence of neurotoxic symptoms after long-term exposure to hexane; most studies limited in terms of concentration data * 2 groups of workers exposed at an average of 58 ppm for an average of 5.2 or 6.2 yr; no clinically manifest polyneuropathy or significant toxic effects on the peripheral nervous system * NOEC of 100 ppm identified in rats; daily exposure for 12 h for up to 24 wk; no significant deviations from the control values in terms of electrophysiological measurements of the tail nerve; regarded the most sensitive end-point of chronic intoxication * Evidence presented justifies retention of MAK. |
| SCOEL 1995 TWA: 20 ppm (72 mg/m3) |
| Summary of additional data:   * Worker post-shift concentration of metabolite 2,5-hexanedione in urine >7.5 mg/L associated with electroneuromyographic abnormalities; ≡8 h TWA of ≈70 ppm (250 mg/m3); considered a LOAEL * TWA derived by application of UF of 2 to LOAEL and rounding to arrive at 20 ppm * STEL or skin notation not considered necessary. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN NA NA |
| No report. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| NICNAS |  | 2016 | * NOAEC of 500 ppm in rats for nasal legions; 13 wk 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 | NA |
| HCIS | NA |
| NICNAS | NA |
| EU Annex | NA |
| ECHA | NA |
| ACGIH | Skin |
| DFG | H |
| 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: | yes | 4.00 |  | | 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 warranted** | |

### IDLH

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

## Additional information

| Molecular weight: | 86.10 |
| --- | --- |
| 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) (2000) n-Hexane – MAK value documentation.

EU Scientific Committee on Occupational Exposure Limits (SCOEL) (1995) Recommendation from the Scientific Committee on Occupational Exposure Limits for n-hexane. SEG/SUM/52.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2016) Hexane: Human health tier II assessment – IMAP report.