# Camphor, synthetic

| CAS number: | 76-22-2 |
| --- | --- |
| Synonyms: | Bornan-2-one, 2-bornanone, 2-camphanone, 2-keto-1, 7, 7 7-trimethylnorcamphane,  1,7,7, -trimethylnorcamphor, |
| Chemical formula: | C10H16O |
| Structural formula: | — |

Workplace exposure standard (amended)

| TWA: | **2 ppm (12 mg/m3)** |
| --- | --- |
| STEL: | — |
| Peak limitation: | — |
| Notations: | **DSEN** |
| IDLH: | **1,200 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 2 ppm (12 mg/m3) is recommended to protect for irritation of the nose and eyes in exposed workers.

There is insufficient data about immediate and severe effects to support a STEL. Therefore, it is recommended that the STEL be withdrawn.

## Discussion and conclusions

Synthetic camphor is primarily used as a plasticiser for cellulose esters and ethers which are in turn used in a range of industrial applications and processes.

The data available relating to irritation as the critical effect is conflicting. It is an irritant to the eyes and nose and exposure to high concentrations can result in adverse effects on the central nervous system (ACGIH, 2018). No irritation or sensory effects are reported in a study of workers exposed to less than 2 ppm for five days a week for up to 10 months. Exposures ranging from 15 to 21 ppm were reported to cause mild eye irritation and drowsiness (DFG, 2013).

The recommended TWA is considered sufficiently low to minimise irritation of the nose and eyes and effects on the central nervous system. Only mild effects are noted at exposures up to 21 ppm and a STEL is not recommended as the TWA is considered sufficient to protect for these effects.

## Recommendation for notations

Not classified as a carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Classified as a skin sensitiser and not a 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: 2 ppm (12 mg/m3); STEL: 3 ppm (19 mg/m3) | |
|  |
| ACGIH 2001 TLV-TWA: 2 ppm (12 mg/m3); TLV-STEL: 3 ppm (19 mg/m3) |
| TLV-TWA and TLV-STEL recommended to minimise the potential for irritation of the nose and eyes and loss of the sense of smell (anosmia).  Summary of data:  Human data:   * Minor inflammation reported in workers exposed at <2 ppm, 5 d /wk, for up to 10 mo * Fatal exposure reported from inhalation of heated vapour; no concentration noted * Nausea, anxiety, dizziness, confusion, headache, twitching, spasticity, convulsions and coma reported following heavy exposure; no concentration noted.   Animal data:   * Prolonged inhalation at 6 mg/m3 (1 ppm) may cause severe injury to animals (no further information) * LD50: 3,000 mg/kg (rats, intraperitoneal) * Subcutaneous injection 1/mo over 18 mo produced no elicited tumours in mice.   Assigned an A4, not classified as human carcinogen.  Insufficient data to assign a sensitiser or skin notation. |
| DFG 2013 NA |
| No MAK recommended due to lack of NOAEL in human and animal inhalation studies.  Summary of additional data:  Previous MAK of 13 mg/m3 (withdrawn 2013).  Human data:   * Factory workers exposed to 24–192 mg/m3 reported very slight eye irritation and drowsiness, follow-up examinations of 6 workers detected no lymphadenopathy. * a follow-up study (after improving working conditions) reported the same symptoms at 2.5–3.5 mg/m3.   Animal data:   * LCLo: 300 mg/m3 (rats,3 h) * LD50: 5,000 mg/kg (rabbits, dermal) * NOAEL for systemic effects 200 mg/kg/d (mice, dermal) * NOAEL: 16 mg/kg nephropathy (female rats, dermal) * increased incidences of nephropathy sine in male rats at this concentration.   Insufficient data available to assign a sensitiser or skin notation. |
| SCOEL NA NA |
| No report. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN 2001 TWA: 2 ppm (12 mg/m3) |
| TWA considered an administrative OEL.  Toxicological data insufficient to justify recommendation of a health based OEL.  Summary of additional data:   * Oral doses of 50–500 mg/kg reported to be lethal to human adults. |

### Secondary source reports relied upon

NIL.

### 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 | Carcinogenicity – A4 |
| 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 |
| --- |
| |  |  |  |  | | --- | --- | --- | --- | | 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 |
| --- | --- |

## Additional information

| Molecular weight: | 152.23 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = Number mg/m3; 1 mg/m3 = Click or tap here to enter text. 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) (2013) Kampfer – MAK value documentation.

Health Council of the Netherlands (HCOTN) (2001) Bornan-2-one (camphor, synthetic). Health-based calculated occupational cancer risk values. The Hague: Health Council of the Netherlands; publication no. 2000/15OSH/018.

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