# Chlorinated camphene

| CAS number: | 8001-35-2 |
| --- | --- |
| Synonyms: | Campheclor, polychlorcamphene, toxaphene |
| Chemical formula: | C10H10Cl8 (average) |
| Structural formula: | — |

Workplace exposure standard (retained)

| TWA: | **0.5 mg/m3** |
| --- | --- |
| STEL: | **1 mg/m3** |
| Peak limitation: | **—** |
| Notations: | **Carc. 2., Sk.** |
| IDLH: | **200 mg/m3** |
| Sampling and analysis: | The recommended value is quantifiable through available sampling and analysis techniques. |

## Recommendation and basis for workplace exposure standard

The current TWA of 0.5 mg/m3 is recommended to protect for acute central nervous system (CNS) effects including excess salivation, nausea, vomiting, muscle spasms, convulsions and potential liver damage in exposed workers.

A STEL of 1 mg/m3 is recommended to prevent systemic toxicity due to bioaccumulation.

## Discussion and conclusions

Technical grade mixtures (toxaphene) are used as a contact insecticide and comprise up to 670 chlorinated derivatives.

While there are no quantitative estimates, available studies indicate the potential for systemic toxicity from skin absorption (NIOSH 2019). Acute adverse CNS effects are reported in humans following ingestion of 10 mg/kg. In rats, dietary exposures of 50 mg/kg are associated with liver damage (ACGIH, 2018). In animals, chronic ingestion also leads to temporary bioaccumulation in adipose and other tissues. The compounds are mutagenic in bacterial systems and carcinogenic in animals, causing liver cancers in chronic feeding studies (ACGIH, 2018; DFG, 2003). However, no mechanistic studies or evidence for carcinogenicity in human case studies are available.

The recommended TWA is expected to protect for adverse CNS effects and is consistent with the TWA for the toxicologically similar congener chlordane. A STEL is recommended to prevent bioaccumulation and accompanying systemic effects.

## Recommendation for notations

Classified as carcinogen category 2 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 of systemic effects following dermal exposure in humans and animals.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1993 TWA: 0.5 mg/m3; STEL: 1 mg/m3 | |
|  |
| ACGIH 2001 TLV-TWA: 0.5 mg/m3; TLV-STEL: 1 mg/m3 |
| TLV-TWA based on that of chlordane by analogy and intended to minimise potential for acute adverse effects to central nervous system including salivation, nausea, vomiting, muscle spasms/convulsions and potential liver damage.  TLV-STEL intended to prevent bioaccumulation and consequential systemic effects. Skin notation is recommended due to reported toxicity in dermal absorption studies with rabbits. Classified as a carcinogen in animals with unknown relevance to humans.  Summary of additional data:  Chronic ingestion leads to accumulation (including chlorinated metabolites) in fatty tissues. These are eliminated rapidly when ingestion ceases.  Human data:   * Lethal dose in humans estimated 2–7 g * Similar acute toxicity to the structurally related chlordane * Acute toxicity usually results from accidental ingestion and causes CNS stimulation including confusion, nausea, vomiting and muscle spasms in the extremities and convulsions within 4 h * In fatal cases, death occurs within 4–24 h of exposure * Non-fatal poisoning causes adverse central nervous effects at 10 mg/kg in some exposed individuals, but not in others (no further information provided) * No reports on chronic intoxication available.   Animal data:   * Oral LD50: 60–120 mg/kg (rats), 290–365 mg/kg (guinea pigs), 200 mg/kg (hamsters) * LC50: 20 mg/m3 (mice, 2 h, technical grade) * tonic-clonic convulsions, vomiting and hyperreflexia observed * deaths resulted from respiratory failure * Not toxic to dogs at high concentrations (50% dust) in dermal absorption studies * lethal to rabbits at lower concentrations (no further information) * Liver damage at 50–200 mg toxaphene/kg of diet in repeat feeding study (rats, 2–9 mo) * no such effects in diet at 189 mg/kg after 12 wk * Thyroid and adrenal hypertrophy at 5–500 mg toxaphene/kg of diet (quails, 4 mo) * Positive dose-related dependence of liver cell carcinoma incidence in range of 99–198 mg toxaphene/kg of diet (mice) and thyroid tumour incidence in range of 540–1,112 mg/kg of diet (rats, durations both unspecified) * Mutagenic in bacterial assays and non-clastogenic in mice. |
|  |
| DFG 2003 not established |
| Summary of additional data:  Previous MAK value withdrawn due to carcinogenicity in animals and unknown carcinogenic potential in humans. Usage banned in Germany, but exposure may occur during remediation or waste disposal.  Human data:   * No abnormal findings in volunteer inhalational study at up to 500 mg/m3 toxaphene (n=25, 30 min, 10 d) * follow-up exposure 3 wk later under same conditions for 3 d, low information content of study questioned by agency * SCE reported in lymphocytes of 8 women accidentally intoxicated by crop sprayer at an unknown concentration for >4 h * Increased lung cancer incidence reported in epidemiological study of pesticide-exposed workers * no conclusions on carcinogenicity of toxaphene due to mixed exposures.   Animal data:   * Dermal application of 16 mg/kg leads to substance accumulation in adipose tissue, adrenal cortex, bone marrow, liver and kidneys (rats) * detectable up to 24 h post-exposure * Thyroid tumours reported in rats reported in repeat 13 wk feeding study * not relevant to humans due to species-specific metabolism * No mechanistic studies available, but may act as tumour promoter by analogy to other polychlorinated compounds * Some pure isolated substances from technical grade mixtures are significantly more toxic than toxaphene * LD50: 3.1 and 6.6 mg/kg, respectively for an octachloro derivative and heptachlorobornane (mice, IP) * No chronic inhalational or allergenic data available * NOAEL: 0.29–0.38 mg/kg for haematological and histopathological changes in 2 repeat feeding studies (rats, 13–27 wk) * LOAEL ≈2 mg/kg for histopathological changes to liver, kidney and thyroid described in one study * NOAEL: 0.2 mg/kg for histopathological effects on liver, kidney, and thyroid in repeat feeding study (dogs, 13 wk) * dosage reduced to 5 mg/kg in 10 mg/kg group due to seizures and vomiting * all animals survived * dose dependent increase in serum phosphatase levels reported. |
| 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 |
| --- | --- | --- | --- |
| IARC |  | 2001 | * 2 parallel case–control studies (1,245 controls) of NHL (n=622) and leukaemia (n=578) in the same populations showed no significant increase in risk associated with exposure to toxaphene * Sufficient evidence for carcinogenicity in animals with inadequate evidence in humans. |
| US NIOSH |  | 2019 | * No quantitative estimates of absorption * Available studies indicate potential for systemic toxicity from dermal absorption * Dermal LD50: 780–1,075 mg/kg (rats), 1,025 mg/kg (rabbits) * non-standard acute toxicity test that involved submersion of animal in aqueous solution of the substance for 2 min. |
| US NIOSH |  | 1994 | * IDLH based on acute inhalation toxicity data in humans. |

### Carcinogenicity — non-threshold based genotoxic carcinogens

| Is the chemical mutagenic? | Yes |
| --- | --- |
| Is the chemical carcinogenic with a mutagenic mechanism of action? | Insufficient data |
| **Insufficient data are available to determine if the chemical is a non-threshold based genotoxic carcinogen.** | |

## Notations

| Source | Notations |
| --- | --- |
| SWA | Carc. 2, Skin |
| HCIS | Carcinogenicity – category 2 |
| NICNAS | NA |
| EU Annex | Carcinogenicity – category 2 |
| ECHA | NA |
| ACGIH | Carcinogenicity – A2, Skin |
| DFG | Carcinogenicity – 2, H (skin) |
| SCOEL | NA |
| HCOTN | NA |
| IARC | Carcinogenicity – Group 2B |
| US NIOSH | SK:SYS |

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: | 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 | **a skin notation is warranted** | |

### IDLH

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

## Additional information

| Molecular weight: | 414 (average) |
| --- | --- |
| 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) (2003) Toxaphene – MAK value documentation.

Tenth Adaptation to Technical Progress Commission Regulation (EU Annex) No 2017/776 amending, for the purposes of its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures (the CLP Regulation).

International Agency for Research on Cancer (IARC) (2001) Some Thyrotropic Agents. IARC Monographs on the evaluation of the carcinogenic risk to humans, volume 79.

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

US National Institute for Occupational Safety and Health (NIOSH) (2019) NIOSH Skin Notation Profiles: chlorinated camphene.