# Benzyl chloride

| CAS number: | 100-44-7 |
| --- | --- |
| Synonyms: | alpha-Chlorotoluene, α-chlorotoluene, *ω*‑chlorotoluene, chlorophenylmethane, tolyl chloride |
| Chemical formula: | C7H7Cl |

Workplace exposure standard (retained)

| TWA: | **1 ppm (5.2 mg/m3)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **Carc. 1B, DSEN** |
| IDLH: | **10 ppm (52 mg/m3)** |
| Sampling and analysis: | The recommended value is readily quantifiable through currently available sampling and analysis techniques. |

## Recommendation and basis for workplace exposure standard

A TWA of 1 ppm (5.2 mg/m3) for benzyl chloride is recommended to protect for irritation of the eyes, nose and throat in exposed workers.

## Discussion and conclusions

Benzyl chloride is a reactive by-product of chemical manufacture and frequently presents as a mixture with dichlorotoluene and trichlorotoluene in technical-grade preparations.

Benzyl chloride is carcinogenic in animals and mutagenic in bacterial and isolated mammalian cell assays (DFG, 1992). Available human carcinogenicity studies, while suggestive of causality, are inadequate for an assessment due to small cohort sizes and mixed exposures with other related compounds. Animal studies indicate the chemical is a dermal sensitiser (NICNAS, 2013). The IDLH value of 10 ppm (52 mg/m3) is based human data that suggests a concentration of 20 ppm (104 mg/m3) produces an intolerable and irrespirable atmosphere.

Critical effects of exposure are acute eye and upper respiratory tract irritation that may lead to lung oedema, weakness, anorexia and insomnia upon chronic exposure (DFG, 1992). The TWA is derived from human sensory data indicating exposures below 1 ppm do not cause lung injury (ACGIH, 2018).

## Recommendation for notations

Classified as a category 1B carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Classified as a dermal 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 Year TWA: 1 ppm (5.2 mg/m3) | |
|  |
| ACGIH 2001 TLV-TWA: 1 ppm (5.2 mg/m3) |
| TLV-TWA intended to minimise potential for acute irritation to eyes, nose and throat and development of lung oedema following prolonged exposures. TLV-TWA derived from 1 ppm threshold limit based on human sensory data, which prevented lung injury.  Insufficient data available to recommend notations for skin and sensitisation or a TLV-STEL.  Confirmed animal carcinogen with unknown relevance to humans.  Summary of data:  Human data:   * Potent lachrymator and can cause corneal injury * Lung injury prevented below 1 ppm according to human sensory data (no further information provided) * Slight conjunctivitis at 1.5 ppm after 5 min exposure (no further information provided) * Threshold for eye irritation of 8 ppm (10 s exposure, no further information provided) * Single breath containing 35 ppm caused nasal irritation (no further information provided) * Intolerable at 16 ppm for 1 min (no further information provided).   Animal data:   * LC50: 80 ppm (mice, 2 h) * LC50: 150 ppm (rats, 2 h) * Both rats and mice survive at 400 ppm (1 h) * Eye and respiratory tract irritation at 95 ppm (rabbits, cats, 8 h/d, 6 d) * Skin sensitisation reported in guinea pigs (no further information provided) * Sarcomas at injection site and lung metastases formed following weekly administration of 80 mg/kg in repeat subcutaneous dose study (rats, 51 wk, mean induction time 500 d) * at 40 mg/kg, only some sarcomas formed * Papillomas and carcinomas of stomach at 50–100 mg/kg (mice) and 15–30 mg/kg (rats) in repeat feeding study (3/wk, 2 yr) * Mutagenic and clastogenic in rodent cells (species not specified). |
| DFG 1992 Not assigned |
| No MAK established due to good evidence of mutagenic and carcinogenic activity both *in vitro* and in animals.  Summary of additional data:  Frequently present as mixtures with both di- and trichlorotoluene in commercially available products. Toxicology of all three congeners and their mixtures are considered separately in the assessment.  Human data:   * Odour threshold of 0.047 ppm * Weakness, anorexia, and insomnia in workers regularly exposed to 2 ppm * workers also presented liver function disorders, tremor, and low white blood cell count (no further information provided) * Multiple small cohort studies and case reports indicate association between development of respiratory tract cancer and exposure (as a mixture with dichlorotoluene and trichlorotoluene).   Animal data:   * LD50: 313 ppm (mice, oral) * LD50: 238 ppm (rats, oral) * LD50: 193 ppm (rats, subcutaneous) * In vitro bacterial and mammalian cell studies demonstrate mutagenic activity; can act by base-pair substitution * Mutagenic in mice by DNA alkylation * Carcinogenic following epicutaneous application to mice and rats (no further information provided) * Repeat feeding study with male and female rats reported hyperkeratosis and hyperplasia in stomach and necrosis of heart muscle at doses > 15 mg/kg (3 d/wk, 27 wk for females; 37 wk for males) * female rats died after single dose at 250 mg/kg or 4 doses at 125 mg/kg * male rats died after 5 doses of 250 mg/kg or 6–9 doses at 125 mg/kg * Immediate irritation at 400 ppm (cats, 7.5 h, inhalation); paralysis at 1,000 ppm (cats, 2 h) * coughing, sneezing, corneal clouding observed 1 d after exposure * death from pulmonary oedema 2–3 d after exposure * Progressive inflammation of airways at 93 ppm in repeat inhalation study (cats, 8 h/d, 6 d), symptoms were lethal in some animals (no further information provided). |
| 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 |
| --- | --- | --- | --- |
| NICNAS |  | 2013 | * No acute dermal toxicity data available * Lowest toxic concentration in humans 31 ppm (160 mg/m3) (no further information provided) * Positive skin sensitisation in guinea pigs (0.01 mg/animal, 2/wk for 12 wk during induction phase); challenge test 2 wk after induction phase with one drop of substance (concentration/amount unspecified). |
| IARC |  | 1999 | * Limited evidence in humans for the carcinogenicity of α‑chlorinated toluene derivatives * Sufficient evidence in experimental animals for carcinogenicity. |
| US EPA |  | 1989 | * Probable human carcinogen based on inadequate human carcinogenicity data and sufficient evidence for carcinogenic activity in mice and rats and mutagenic activity in various tests * No data available to quantify cancer risk from inhalational exposure * Human studies deemed inadequate to determine carcinogenicity of benzyl chloride alone due to co-exposure to other structurally related by-products. |
| US NIOSH |  | 1994 | * 20 ppm renders air unbreathable in 1 min * IDLH of 10 ppm to allow escape in the event of respirator failure. |

### Carcinogenicity — non-threshold based genotoxic carcinogens

| Is the chemical mutagenic? | Yes |
| --- | --- |
| Is the chemical carcinogenic with a mutagenic mechanism of action? | Yes |
| **Insufficient data are available to determine if the chemical is a non-threshold based genotoxic carcinogen.** | |
| Is a cancer slope factor or inhalation unit risk value available? | No |

## Notations

| Source | Notations |
| --- | --- |
| SWA | — |
| HCIS | Carcinogenicity – category 1B, Skin sensitisation – category 1 |
| NICNAS | Carc. Cat. 1B, Sensitisation – category 1 |
| EU Annex | Carcinogenicity – category 1B |
| ECHA | NA |
| ACGIH | Carcinogenicity – A3 |
| DFG | Carcinogenicity – 2, H (Skin) |
| SCOEL | NA |
| HCOTN | NA |
| IARC | Carcinogenicity – Group 2A |
| 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 |
| --- |
| Insufficient data to assign a skin notation |

### IDLH

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

## Additional information

| Molecular weight: | 126.58 |
| --- | --- |
| 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) (1992) α-Chlorinated Toluenes – MAK value documentation.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2013) Benzene, (chloromethyl)-: Human health tier II assessment – IMAP report.

International Agency for Research on Cancer (IARC) (1999) alpha-chlorinated toluenes and benzoyl chloride. IARC Monographs on the evaluation of the carcinogenic risk to humans volume 71.

Tenth Adaptation to Technical Progress Commission Regulation (EU) 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).

US Environmental Protection Agency (US EPA) (1989) IRIS chemical assessment summary – Benzyl chloride; CASRN 100-44-7.

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