# Benzoyl chloride

| CAS number: | 98-88-4 |
| --- | --- |
| Synonyms: | α-chlorobenzaldehyde, benzenecarbonyl chloride, benzoic acid chloride |
| Chemical formula: | C7H5OCI |

Workplace exposure standard (new)

| TWA: | **—** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **0.5 ppm (2.8 mg/m3)** |
| Notations: | **DSEN** |
| IDLH: | **—** |
| Sampling and analysis: | The recommended value is readily quantifiable through currently available sampling and analysis techniques. |

## Recommendation and basis for workplace exposure standard

A peak limitation of 0.5 ppm (2.8 mg/m3) is recommended to protect for severe irritation of the eyes and mucous membranes from acute exposure; and systemic toxicity, including possibly cancer, from chronic exposure.

Insufficient data available to recommend a TWA, STEL or IDLH value. The recommended peak limitation is expected to protect for the effects of acute exposure. An examination of additional data sources is recommended at the next scheduled review.

## Discussion and conclusions

Benzoyl chloride is a by-product in the manufacture of α-chlorinated toluene derivatives and available occupational hygiene data is limited to cases of mixed exposure with other chlorinated toluenes. Critical effects of acute exposure relate to its high reactivity and include severe eye and upper respiratory tract irritation (ACGIH, 2017). Effects of chronic exposure are unclear. However, lung cancer and chronic upper respiratory tract diseases are indicated by three small cohort studies of mixed α-chlorotoluene exposures (ACGIH, 2017; DFG 1992; IARC; 1999). Evidence from animal studies indicate the substance is a dermal sensitiser.

Due to the intolerability of acute exposures at low concentrations (2 ppm for one minute) (ACGIH, 2017) combined with a lack of exposure data, a TWA is not recommended. The compound may be carcinogenic based on tumour formation in a repeat dermal dose study with mice, but carcinogenic evaluation in humans is not possible with the available data (ACGIH, 2017).

## 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 Year — | |
| Not previously assigned. |
| ACGIH 2017 TLV-Ceiling: 0.5 ppm (2.8 mg/m3) |
| TLV-Ceiling intended to prevent irritation to eyes and mucous membranes and potential systemic toxicity, including risk of cancer.  Insufficient data to recommend skin or sensitiser notations.  Some benzoyl chloride producers have set internal exposure limits of 0.17 ppm (1 mg/m3).  Previous AIHA 15 min TWA was 1 ppm to prevent severe eye and mucous membrane irritation.  Summary of data:  Human data:   * Strong lachrymator and causes irritation of eyes and mucous membranes * Exposure at 2 ppm for 1 min is intolerable; difficult to define irritant dose threshold * Cancer of lymph nodes (1/6) and in lungs (5/6) fatal cases of exposed factory workers producing chlorotoluenes, in which benzoyl chloride is a by-product; benzotrichloride was suggested to be responsible for the cancer deaths * workers exposed to multiple chemicals used in chlorotoluene production presented chronic pharyngitis and sinusitis, impaired smell, and skin disorders * industrial hygiene practices at the factory were reportedly poor * Increased incidence of respiratory and digestive tract cancers reported in SMR study of exposed workers in a different chlorotoluene factory (n=163 exposed, n=790 unexposed); based on toxicological studies, benzotrichloride was concluded to be likely cause of cancer * follow-up study reported that SMR were also elevated for lung cancer (SMR=180) and Hodgkin’s disease (SMR=714).   Animal data:   * LD50: 1140–2618 mg/kg (rats, oral) * LC50: 247 to >377 ppm (rats, 4 h) * LD50: 790 to >2,000 mg/kg (rabbits, dermal) * Half-life in blood is 1.5 h (rats) * Extreme irritation in skin and eyes of rabbits (no further information provided) * Skin and lung tumours reported at both 6.1 and 12.1 mg in skin-painting study (mice, 3 times/wk for 4 wk, then 2 times/wk for 43 wk, 533 mg total dose/animal) * marked irritation of eyes, skin, and respiratory tract also noted * similar results reported for 2.8 mg in additional study (mice, 2 times/wk for 50 wk, 278 mg total dose/animal) * although cancer incidences were not statistically significant, concluded a weak carcinogen * MTD intraperitoneal: 158 mg/kg (mice) * Repeat doses at this concentration did not cause lung cancers in mice (3 times/wk, 8 wk) * Non-mutagenic as indicated by majority of bacterial studies; one study described positive mutagenicity, but was dismissed due to inconsistency in the report * Hydrolysed to benzoic acid when ingested in rats, but not when applied through skin incision. |
| DFG 1992 not yet established |
| Summary of additional data:   * Available human and animal data are very limited * Insufficient data on acute and chronic exposure to establish MAK * Further studies to assess carcinogenic potential are necessary * Establishment of a MAK for technical mixtures of chlorotoluene derivatives, including benzoyl chloride, is speculated.   Animal data:   * LD50: 1900 mg/kg (female rats, oral); 3619 mg/kg (male rats, oral) * Skin carcinoma and lung adenomas reported at 2.3 µL (mice, diluted with benzene, 2 times/wk, 50 wk). * results were not statistically significant; study concluded weak carcinogenicity * Negative results in bacterial mutagenicity possibly due to rapid hydrolysis of the substance in the test medium. |
| 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 |  | 2014 | * LC50: 252–344 ppm (1450–1980 mg/m3) (rats, 4 h) * Irritation effects may be caused by local generation of hydrogen chloride upon hydrolysis of the substance in moisture * Positive dermal sensitisation result in guinea pig maximisation study. |
| IARC |  | 1999 | * Limited evidence in humans and inadequate evidence in animals for carcinogenicity * Studies of exposures to mixtures of α-chlorinated toluenes and benzoyl chloride (same as those cited in ACGIH, 2017 and DFG, 1992) noted a significant excess of lung cancer (approx. 3-fold). |

### Carcinogenicity — non-threshold based genotoxic carcinogens

| Is the chemical mutagenic? | Insufficient data |
| --- | --- |
| Is the chemical carcinogenic with a mutagenic mechanism of action? | No |
| **Insufficient data are available to determine if the chemical is a non-threshold based genotoxic carcinogen.** | |

## Notations

| Source | Notations |
| --- | --- |
| SWA | NA |
| HCIS | Skin sensitisation – category 1 |
| NICNAS | Skin sensitisation – category 1 |
| EU Annex | NA |
| ECHA | NA |
| ACGIH | Carcinogenicity – A4 |
| DFG | Carcinogenicity – category 3B |
| 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? | No |
| --- | --- |

## Additional information

| Molecular weight: | 140.57 |
| --- | --- |
| 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) Benzoyl chloride: 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.