# Beta-chloroprene

| CAS number: | 126-99-8 |
| --- | --- |
| Synonyms: | 2-Chloro-1,3-butadiene, 2-Chlorobutadiene, Chloroprene, 2-chlorobuta-1,3-diene, chlorobutadiene |
| Chemical formula: | C4H5Cl |
| Structural formula: | — |

Workplace exposure standard (amended)

| TWA: | **0.00007 ppm (0.27 µg/m3)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **Carc. 1B, Sk.** |
| IDLH: | **—** |
| Sampling and analysis: | The recommended value is below the current limit of detection for available sampling and analysis techniques. |

## Recommendation and basis for workplace exposure standard

A TWA of 0.00007 ppm (0.27 µg/m3) is recommended to reduce the risk of cancer in exposed workers.

## Discussion and conclusions

Beta-chloroprene is predominantly used for the manufacture of neoprene and polychloroprene latex.

Based on evidence in animals and humans, beta-chloroprene is characterised a non-threshold based genotoxic carcinogen (ACGIH, 2018; DFG, 2001; US EPA, 2010). Its carcinogenicity is demonstrated to act *via* a mutagenic mode of action, for which an exposure concentration that eliminates the risk of cancer cannot be derived.

The recommended TWA of 0.00007 ppm is derived at a minimal cancer risk level applying inhalation unit risk value. This value is based on data from a study reporting the incidence of tumours in multiple organ systems in rodents and derivation of human equivalent dose (US EPA, 2010).

## Recommendation for notations

Classified as a category 1B 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 evidence in animals and severity of effects.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 10 ppm (36 mg/m3) | |
|  |
| ACGIH 2017 TLV-TWA: 1 ppm (3.6 mg/m3) |
| TLV-TWA recommended to minimise the risk of lung cancer and the potential for skin, eye and respiratory tract irritation.  Summary of data:  Human data:   * Adverse effects from acute exposures to high concentrations include headache, irritability, cardiac palpitations, dizziness, insomnia, fatigue, respiratory irritation, chest pains, GIT disorders, dermatitis, temporary hair loss, conjunctivitis and corneal necrosis * 2 fatalities reported * Acute high exposure reported effects in the liver, circulatory system, hematopoietic system, central and peripheral nervous systems, immune system, reproductive system and the periodontium * Multi-stage BMD of an estimated 98 ppm for 8 h/d, 5 d/wk related to additional 10% risk of lung tumours in humans * Methodically weak studies reported occupational-related cancers * Cohort of 5,000 workers exposed to a median concentration of 5.2 ppm for 18 y found no significant associations with cancer * No significant increase in cancer-related mortality in cohorts of chloroprene workers exposed to median concentrations <0.2 ppm.   Animal data:   * 8 h inhalation at 167 ppm was fatal in mice * LD50: 0.62 mL/kg (dermal, no further detail) * Reported evidence of absorption through skin to elicit acute toxic effects * 40 ppm for 6 h/d, 5 d/wk for 4 wk caused irritation of the eyes and skin in rats and mice; rats also had retarded growth * 2 y inhalation exposure studies in rodents reported lung, mammary, kidney, vascular and skin cancers at concentrations as low as 12.8 ppm * Chemical stability is relevant to the biological and health effects, with oxidized chloroprene reported to be 4 times as acutely toxic as the non-oxidized form, by subcutaneous exposure in rats.   Genotoxicity   * Reported to induce mutations in *S. typhimurium*; induce dominant lethal mutations and chromosomal aberrations in bone marrow cells of rats; dominant lethal mutations in mice; recessive lethal mutations induced in *D. melanogaster* * Metabolites of chloroprene are mutagenic in *S. typhimurium* and alkylate deoxyguanosine and deoxycytosine in double-stranded calf thymus DNA * In contrast, negative results were also reported in *S. typhimurium* strains, *D. melanogaster*, murine bone marrow and erythrocyte-based cytogenetic assays * Mode of action studies suggest epoxide intermediates, that are produced 20–50 times greater in mice than in humans, are genotoxic.   Insufficient evidence to recommend sensitiser notations or STEL. |
| DFG 2001 Not assigned |
| Due to potential carcinogenicity, no MAK assigned. Recommended to reduce all exposure.  Summary of additional data:   * Unstable in its pure form * Oligomers are likely the cause of the unusual inconsistency relating to toxicity, mutagenicity and carcinogenicity * Epidemiological studies suggest liver carcinogenicity in humans. |
| SCOEL NA NA |
| No report. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN 2003 Not assigned |
| No additional information. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| NICNAS |  | 2018 | * No Australian use, import, or manufacture were reported under previous NICNAS mandatory calls for information. |
| US EPA |  | 2010 | * Statistically significant and dose-related information from chronic inhalation bioassay demonstrating the development of malignant tumours and the occurrence of multiple tumours indifferent animal species * Evidence of an association between liver cancer risk and occupational exposure to chloroprene * Suggestive evidence of an association between lung cancer risk and occupational exposure * Compelling evidence for a mutagenic mode of action: * metabolized to epoxide intermediates like butadiene * forms DNA adducts via its epoxide metabolite * point mutagen *in vitro* (in some but not all bacterial assays) and *in vivo* * similarities in tumour sites and sensitive species between chloroprene and butadiene in chronic rodent bioassay * Structural similarities between chloroprene and known human carcinogens, butadiene and vinyl chloride. |

### Carcinogenicity — non-threshold based genotoxic carcinogens

| Is the chemical mutagenic? | Yes |
| --- | --- |
| Is the chemical carcinogenic with a mutagenic mechanism of action? | Yes |
| **The chemical is a non-threshold based genotoxic carcinogen.** |  |
| Is a cancer slope factor or inhalation unit risk value available? | Yes |
| Inhalation unit risk value (1/(µg/m³)) | 3.0 x 10-4 |
| Calculated TWA value (µg/m3) | 0.27 |

## Notations

| Source | Notations |
| --- | --- |
| SWA | NA |
| HCIS | Carcinogenicity – category 1B |
| NICNAS | NA |
| EU Annex | Carcinogenicity – category 1B |
| ECHA | Carcinogenicity – category 1B |
| ACGIH | Carcinogenicity – A2, Skin |
| DFG | Carcinogenicity – 2, H (skin) |
| SCOEL | NA |
| HCOTN | — |
| IARC | Carcinogenicity – Group 2B |
| US NIOSH | — |

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: |  |  |  |  | | 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 | **consider assigning a skin notation** | | |

### IDLH

| Is there a suitable IDLH value available? | No, the chemical is a genotoxic carcinogen |
| --- | --- |

## Additional information

| Molecular weight: | 88.54 |
| --- | --- |
| 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) (2001) Chloropren – MAK value documentation.

European Chemicals Agency Regulation (ECHA) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

Health Council of the Netherlands (HCOTN) (2003) b-Chloroprene. Evaluation of the effects on reproduction, recommendation for classification. The Hague: Health Council of the Netherlands; publication no. 2003/06OSH.

International Agency for Research on Cancer (IARC) (1999) Volume 71 re-evaluation of some organic chemicals, hydrazine and hydrogen peroxide. IARC Monographs on the evaluation of the carcinogenic risk to humans.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2018) 1,3-Butadiene, 2-chloro-: Human health tier I assessment – IMAP report.

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 Authority (US EPA) (2018) Integrated Risk Information System (IRIS) Chemical Assessment Summary – Chloroprene.

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