# sec-Butyl alcohol

| CAS number: | 78-92-2 |
| --- | --- |
| Synonyms: | Butan-2-ol, 2-butanol, sec-butanol, butylene hydrate, 2-hydroxybutane, methyl ethyl carbinol |
| Chemical formula: | C4H10O |
| Structural formula: |  |

Workplace exposure standard (interim)

| TWA: | **100 ppm (303 mg/m3)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **—** |
| IDLH: | **2,000 ppm** |
| 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 100 ppm (303 mg/m3) is recommended to protect for upper respiratory tract and eye irritation in exposed workers.

In the absence of substance-specific chronic exposure data, the current TWA should be retained in the interim until a detailed examination of additional data is carried out at the next scheduled review.

## Discussion and conclusions

sec-Butyl alcohol is used as an intermediate in methyl ethyl ketone (MEK) and perfume production, as a solvent and in hydraulic brake fluid.

Critical effects of exposure are nasal and respiratory irritation. Limited human and animal studies demonstrate a relatively low potential for irritation and systemic toxicity when compared to the structurally similar n-butyl alcohol (ACGIH, 2018).

One study suggests a TWA of 130 ppm based on 0.2 times the respiratory depression threshold (RD0) of 640 ppm seen in acutely exposed mice (ACGIH, 2018). No substance-specific chronic exposure studies are available, but the metabolite MEK has been used by analogy due to its rapid and quantitative formation following sec-butyl alcohol absorption. A 90-day inhalational study with MEK-exposed rats reported a NOAEL of 2,500 ppm for increased liver weights (ACGIH, 2018; DFG, 2003).

The current TWA of 100 ppm is considered protective for irritation endpoints. This level is also expected to protect for potential liver toxicity observed in MEK-exposed rats. Given the limited substance-specific exposure data available from the primary sources, it is recommended that a review of additional sources be conducted at the next scheduled review.

## Recommendation for notations

Not classified as a 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 not recommended based on the available evidence.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA Year TWA: 100 ppm (303 mg/m3) | |
|  |
| ACGIH 2002 TLV-TWA: 100 ppm (303 mg/m3) |
| TLV-TWA intended to protect for potential irritant and CNS effects.  TLV-TWA based on weight of evidence from animal and human studies, including acute respiratory depression threshold (RD0) in mice that suggest lower toxicity than n-butyl alcohol.  Insufficient data to recommend a TLV-STEL or notations for carcinogenicity, skin absorption or sensitisation.  Summary of data:  Methyl ethyl ketone (MEK), is the major (>97%) metabolite following absorption of sec‑butyl alcohol. Sub-chronic studies of MEK exposure were used to support TLV-TWA recommendation.  Human data:   * Odour and nasal irritation thresholds at 95 ppm and 5,711 ppm, respectively (1–3 s in each nostril):   + five-fold less irritating than n-butanol to anosmic volunteers * Sensitisation in individuals allergic to ethanol and other primary alcohols; no sensitisation observed in non-allergic individuals * Evidence for potentiation of MEK to n-hexane polyneuropathy in exposed individuals:   + considered an unlikely outcome from sec-butanol exposure at the workplace due to the high concentrations necessary to elicit such effects * Volunteers exposed to MEK at 200 or 270 ppm (4 h) did not present measurable psychological or behavioural effects.   Animal data:   * Oral LD50: 6,500 mg/kg (rat), 4,900 mg/kg (rabbit); ataxia at 452 mg/kg (rats) * Rats died (5/6) after 14 d following 4 h exposure at 16,000 ppm; more than twice the lethal concentration of n-butanol * Narcosis at 5,330 ppm in inhalation study (mice, total 117 h, no further details) * Classified as weak respiratory irritant * RD50: 11,800 ppm; RD0: 640 ppm (mice) * TLV estimated by 0.2 x RD0, which equates to 130 ppm and supports the recommended TLV-TWA of 100 ppm * Not irritating to skin and caused severe corneal injury (rabbits) * NOEL: 2,500 ppm for histological and physiological changes including increased liver weight in repeat inhalation study, treatment range: 0–5,000 ppm (rats, 6 h/d, 5 d/wk, 90 d); LOEL: 5,000 ppm * MEK potentiates neurotoxicity of methyl n-butyl ketone and n-hexane in animals and humans at high exposures (up to 2,000 ppm 6 h/d for 3 d), relevance to occupational exposure uncertain * Non-mutagenic in vitro, which is consistent with general lack of genotoxicity for MEK *in vivo* and *in vitro* * Depression in growth of weanling rats at 2% in drinking water in 2-generation feeding study, treatment range 0–2% * Low teratogenic activity noted in developmental study, treatment range 0–7,000 ppm (rats, 7 h/d, d 1–9 of gestation); foetal NOAEL of 3,500 ppm based on foetus weight, no maternal NOAEL established, body weight loss at all exposures. |
| DFG 2003 MAK: not established |
| Summary of additional data:  MAK of 100 ppm (set in 1969) withdrawn due to insufficient exposure data.  Insufficient data to recommend notations for skin, genotoxicity or sensitisation.  Human data:   * Positive patch test results in some studies dismissed as cross-reactions to ethanol, which was also tested in those studies or may have otherwise been present as a confounder * Nasal irritation threshold 9,440 ppm (≈2 s), study with anosmic volunteers * Dermal penetration rate: 1.68 mg/cm2/h (neat), 0.21 mg/cm2/h (saturated aqueous solution).   Animal data:   * Plasma half-life 2.5 h (rats) * No signs of narcosis at 3,500 ppm in single inhalational dose study (rats, n=5, 7 h); transient narcotic effects and restricted motor activity at 5,000 ppm, deep narcosis at 7,000 ppm, lethal at 10,000 ppm * Lethal at 10,670 ppm (3.7 h) or 16,000 ppm (2.7 h) in mice; no effect at 1,650 ppm (7 h), onset of central nervous depression at 3,300 ppm (50–100 min) * Non-mutagenic in vitro * In vivo study reporting increase in polyploid bone marrow cells dismissed due to insufficient evidence of dose-dependence (rats, n=8). |
| 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 |
| --- | --- | --- | --- |
| OECD |  | 2002 | * Produces reversible depression of central nervous system in animals at high exposure doses * Found to produce intoxication effects with a slower recovery to normal behaviour than ethanol. |
| US NIOSH |  | 1994 | * IDLH based on acute inhalation toxicity data in animals * Value also approximates 10% of the lower explosive limit (LEL) of 1.7%. |

### 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 | — |
| HCIS | — |
| NICNAS | NA |
| EU Annex | — |
| ECHA | NA |
| ACGIH | — |
| DFG | — |
| SCOEL | NA |
| HCOTN | NA |
| 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 |
| --- |
| Insufficient data to assign a skin notation |

### IDLH

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

## Additional information

| Molecular weight: | 74.1 |
| --- | --- |
| 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) sec-Butyl alcohol – 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).

Organisation for Economic Cooperation and Development (OECD) (2002) SIDS initial assessment profile – Butan-2-ol or sec-Butanol (sBA).

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