# methyl n-butyl ketone

| CAS number: | 591-78-6 |
| --- | --- |
| Synonyms: | Butyl methyl ketone, 2-hexanone, hexan-2-one, ketone,butyl methyl, MnBK, propylacetone |
| Chemical formula: | C6H12O |
| Structural formula: | — |

Workplace exposure standard (amended)

| TWA: | 5 ppm (20 mg/m3) |
| --- | --- |
| STEL: | 10 ppm (40 mg/m3) |
| Peak limitation: | — |
| Notations: | Sk. |
| IDLH: | 1,600 ppm |
| Sampling and analysis: The recommended value is quantifiable through available sampling and analysis techniques. | |

## Recommendation and basis for workplace exposure standard

A TWA of 5 ppm (20 mg/m3) is recommended to protect for neurotoxic effects in exposed workers.

A STEL of 10 ppm (40 mg/m3) is recommended to protect for acute adverse effects including testicular toxicity in exposed workers.

## Discussion and conclusions

Methyl n-butyl ketone (MnBK) is used in paints, lacquers, ink thinners, glues, resins, oils and waxes.

The critical effects of exposure include neurotoxicity in humans and testicular toxicity in animals.

Distal polyneuropathy is reported in exposed workers. However, reporting of accurate human exposure levels are limited. Testicular toxicity is reported in animals in short-term oral studies. In sub-chronic inhalation studies in monkeys and rats, exposures at 1,000 ppm for nine months or 100 ppm for four months resulted in abnormal neurophysiologic indicators. This is equivalent to an eight-hour TWA of 75 ppm. Decreased nerve conduction velocity occurred in rats exposed at 50 ppm for six months. Formation of the neurotoxic metabolite 2,5-hexanedione is detected in human serum following inhalation at 50 ppm over four hours and 100 ppm over seven and half hours (ACGIH, 2001). A NOAEL of 190 mg/kg/day was identified from a repeat oral dosing study in rats (DFG, 2001).

Based on the available evidence, the SWA TWA of 5 ppm (20 mg/m3) derived by ACGIH (2001) and DFG (2001) is recommended to be retained and considered protective for neurotoxic effects in exposed workers.

A STEL of 10 ppm (40 mg/m3) (ACHIH, 2001) is recommended to protect for acute adverse effects including testicular toxicity in exposed workers.

## 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 recommended based on evidence suggesting rapid dermal absorption and contribution to total body burden in humans.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1995 TWA: 5 ppm (20 mg/m3) | |
|  |
| ACGIH 2001 TLV-TWA: 5 ppm (20 mg/m3); TLV-STEL: 10 ppm (40 mg/m3) |
| TLV-TWA recommended to protect for neurotoxic effects in exposed workers. TLV-TWA is based on decreased nerve conduction in rodents and nonhuman primates at 50–75 ppm and identification of the neurotoxic metabolite 2,5-hexanedione in human serum at 50 ppm. STEL recommended to protect for brief excursions which may induce testicular toxicity.  Summary of data:  Human data:   * Strong odour, transient, moderate eye and nasal irritation reported in volunteers exposed at 1,000 ppm * Increased potential for neurotoxicity due to 60–90% pulmonary retention following inhalation * Absorption through skin reported, greatly increasing body burden: * absorption rates of 4.2–8.0 µg/min/cm2 * Distal polyneuropathy reported in workers manufacturing printed fabrics with MnBK, with mean concentrations in air 6–36 ppm and area atmospheric concentrations 1–156 ppm: * numerous variables affected concentrations reported and unclear if atmospheric concentrations were representative of workers’ exposure concentration * accuracy of exposure levels is not considered reliable * No neurologic effects reported in workers engaged for 3 yr in manufacture of MnBK; recorded air measurements 1–46 ppm * Neurotoxic metabolite 2,5-hexanedione identified in serum following inhalation for 4 h at 100 ppm and 7.5 h at 50 ppm.   Animal data:   * LD50: 2,590 mg/kg (male rat, oral) * Minimum oral lethal dose of 914 mg/kg in guinea pigs; symptoms included eye and upper respiratory irritation, then narcosis and death: * inhalation study for 810 min at 1,000 ppm reported no definite reaction * Exposure at 200–600 ppm in chickens, rats and cats for 24 h/d, 7 d/wk for 4–12 wk caused peripheral neuropathy * Rats and monkeys inhaling 1,000 ppm (6 h/d, 5 d/wk for 4 mo) or 100 ppm (6 h/d, 5 d/wk for 9 mo) developed abnormal neurophysiologic indicators (no further information); doses ≡TWA of 75 ppm * Recovery of neurologic effects noted in animal studies; exposures at  100–1,000 ppm * Potentiation of toxicity with concurrent exposure to methyl ethyl ketone or ethanol and toxicity of chlorinated solvents * Male rats developed atrophy of the testes following inhalation at 700 ppm for 11 wk * Testicular toxicity in rats confirmed following repeated sub-chronic dosing at  660–1,400 mg/kg/d: * metabolite 2,5-hexanedione formed during metabolism and known to cause testicular toxicity in rodents * testicular injury occurs at doses below those which bring about neurotoxicity * short, relatively high exposures to the metabolite associated with testicular toxicity, whereas chronic, lower exposure levels lead to defects in the axon.   Skin notation assigned due to reports of significant increases in body burden following absorption through skin of humans.  Insufficient data to recommend SEN or carcinogenicity notations. |
| DFG 2001 MAK: 5 ppm (21 mg/m3) |
| Summary of additional data:   * Metabolite 2,5-hexanedione caused testicular toxicity in rats without signs of peripheral neurotoxicity * Extent of testicular injury is dependent on rate of 2,5-hexanedione, not total dose: * NOAEL of 190 mg/kg/d established in rats (duration 69 d).   MAK has been deemed adequately protective assuming complete metabolism of MnBK to  2,5-hexanedione at MAK of 5 ppm (21 mg/m3), this is equivalent to total dose of 3 mg/kg (assuming 70 kg body weight and 10 m3 respiratory volume) and well below the NOAEL (NOAEC). |
| 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 |  | 2015 | * LD50: 4,800 mg/kg (rabbits, dermal). |

### Carcinogenicity — non-threshold based genotoxic carcinogens

| Is the chemical mutagenic? | Insufficient data |
| --- | --- |
| 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 | — |
| HCIS | NA |
| NICNAS | NA |
| EU Annex | NA |
| ECHA | NA |
| ACGIH | Skin |
| DFG | H (skin) |
| 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 |
| --- |

|  |  |  |  |
| --- | --- | --- | --- |
| Adverse effects in human case study: |  |  |  |
| Dermal LD50 ≤1000 mg/kg: | no |  |  |
| Dermal repeat-dose NOAEL ≤200 mg/kg: |  |  |  |
| Dermal LD50/Inhalation LD50 <10: |  |  |  |
| *In vivo* dermal absorption rate >10%: |  |  |  |
| Estimated dermal exposure at WES >10%: | yes |  |  |
|  |  |  | **Insufficient data to assign a skin notation** |

### IDLH

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

## Additional information

| Molecular weight: | 100.16 |
| --- | --- |
| 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) 2‐Hexanon – MAK value documentation.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2015) 2-Hexanone: Human health tier II assessment.

US National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations – 2-Hexanone.