# methyl isobutyl ketone

| CAS number: | 108-10-1 |
| --- | --- |
| Synonyms: | 4-Methyl-2-pentanone, MIBK, hexone, isopropylacetone |
| Chemical formula: | C6H12O |
| Structural formula: | — |

Workplace exposure standard (amended)

| TWA: | **20 ppm (82 mg/m3)** |
| --- | --- |
| STEL: | **75 ppm (307 mg/m3)** |
| Peak limitation: | **—** |
| Notations: | **Carc. 2** |
| IDLH: | **500 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 20 ppm (82 mg/m3) is recommended to protect for effects on the central nervous system (CNS) and irritation of the eyes and respiratory tract in exposed workers.

A STEL of 75 ppm (307 mg/m3) is recommended to protect for acute effects on the CNS and irritation of the eyes and respiratory tract in exposed workers.

## Discussion and conclusions

Methyl isobutyl ketone (MIBK) is used as a component of cellulose and polyurethane lacquers and paint solvents, as an extraction solvent and in the manufacture of methyl amyl alcohol. The critical effects of inhalational exposure are on the CNS such as dizziness, headache, and eye and upper respiratory tract irritation.

Effects on the CNS including discomfort, tiredness and breathing difficulty, are reported in volunteers exposed at 49 ppm (200 mg/m3) for ninety minutes to two hours. Volunteers reported eye irritation following exposure for fifteen minutes at 200 ppm or greater (ACGIH, 2018). Slowed reaction times are reported in baboons exposed continuously for seven days at 50 ppm (DFG, 1999). Elevation in the incidence and extent of hyaline droplets is reported in the kidneys of male rats at 250 ppm and 1000 ppm but these effects are not considered relevant for humans (ACGIH, 2018).

A TWA of 20 ppm is recommended as assigned by ACGIH (2018), DFG (1999) and SCOEL (1991). This TWA is cited to be protective of effects on the CNS and irritation effects. Based on the evidence of short-term irritant effects, a STEL of 75 ppm (307 mg/m3) is also recommended.

## Recommendation for notations

Classified as a carcinogen category 2 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.

There are insufficient data to recommend a skin notation.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 50 ppm (205 mg/m3); STEL: 75 ppm (307 mg/m3) | |
|  |
| ACGIH 2010 TLV-TWA: 20 ppm (82 mg/m3); STEL: 75 ppm (307 mg/m3) |
| TLV-TWA and TLV-STEL recommended to protect for effects on the CNS and irritation of the eyes and respiratory tract.  Summary of data:  Human data:   * Statistically significant elevation in intensity of CNS symptoms including discomfort, tiredness and breathing difficulty reported in volunteers exposed at 49 ppm (200 mg/m3) for 90–120 min: * of the 12 volunteers, most reported irritation to the eyes at ≥200 ppm for 15 min * reported 100 ppm was high concentration tolerable for 8 h * No human cancer data available.   Animal data:   * In mice, NOAEC of 662 ppm; LOAEC of 757 ppm; 4 h exposure; decrease in immobility time as an indicator of behavioural toxicity * NOAEC of 50 ppm in rats exposed 6 h/d for 14 wk; based on elevation in the incidence and extent of hyaline droplets in the kidneys of male rats (not relevant for humans); significant elevation in serum cholesterol * Increased renal tubule adenoma and mononuclear cell leukaemia in male rats exposed at 1,800 ppm for 6 h/d, 5 d/wk, 104 wk * Significantly increased rates of hepatocellular adenoma in mice exposed at 1,800 ppm for 6 h/d, 5 d/wk, 104 wk.   Insufficient data to recommend a skin or sensitiser notation. |
| DFG 1999 MAK: 20 ppm (82 mg/m3) |
| MAK recommended to protect for irritation effects on the mucous membranes and effects on the CNS.  Summary of additional data:   * Odour threshold of 0.4 ppm; subjecting reporting of symptoms may be related * Critical effects in humans documented ≥100 ppm; no further exposure information * NOAEC of 50 ppm in rats and mice; sex-specific kidney damage occurred in rats and liver weights were marginally increased only in 1 sex in mice; same as ACGIH (2018) * Reaction times of baboons effected at 50 ppm, 7 d continuous exposure: * MAK based on above evidence * Guinea pig dermal penetration of 6.6 mg/cm2/h; will contribute to systemic toxicity, skin notation. |
| SCOEL 1991 TWA: 20 ppm (83 mg/m3); STEL: 50 ppm (208 mg/m3) |
| Summary of additional data:   * TWA and STEL based on study in workers that reported complaints of nausea, vomiting, diarrhoea, irritation of the eyes and airways at concentrations ~100 ppm * No further information provided. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN NA NA |
| No report. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| NICNAS |  | 2013 | * Study in volunteers: neurological effects (vertigo) occurred in 1/8 volunteers at 10 mg/m³; headache and vertigo in 2/8 reported with exposure to 100 or 200 mg/m³ * LD50: 2,000 mg/kg (rats) * NOAEC of 50 ppm for hyaline droplets not considered relevant to humans * Not considered genotoxic. |
| US EPA |  | 2003 | * Inhalation RfC of 3 mg/m3 based on a human equivalent NOAEC of 1,026 mg/m3 for development effects in rats and mice (reduced foetal body weight, skeletal variations and increased foetal death in mice, and skeletal variations in rats). |

### 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 | NA |
| HCIS | Carcinogenicity – category 2 |
| NICNAS | Carc. Cat. 3 |
| EU Annex | NA |
| ECHA | NA |
| ACGIH | Carcinogenicity – A3 |
| DFG | H (skin) |
| SCOEL | NA |
| HCOTN | NA |
| IARC | Carcinogenicity – Group 2B |
| 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: | no |  |  | | 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 | 2.00 |  | |  |  | 2  **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) (1999) Hexone – MAK value documentation.

EU Scientific Committee on Occupational Exposure Limits (SCOEL) (1991) Recommendation from the Scientific Committee on Occupational Exposure Limits for 4-Methylpentane-2-one. SEG/SUM/6.

International Agency for Research on Cancer (IARC) Some chemicals present in industrial and consumer products, food and drinking-water. IARC Monographs – 101.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2013) 2-Pentanone, 4-methyl: Human health tier II assessment – IMAP report.

US Environmental Protection Authority (US EPA) (2003) Integrated Risk Information System (IRIS) Chemical Assessment Summary – Methyl isobutyl ketone.

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