

# CARBON DIOXIDE

**CAS number:** 124-38-9

**Synonyms:** Carbonic anhydride

**Chemical formula:** CO<sub>2</sub>

**Structural formula:**

## Workplace exposure standard (amended)

**TWA:** 5,000 ppm (9,000 mg/m<sup>3</sup>)

**STEL:** 30,000 ppm (54,000 mg/m<sup>3</sup>)

**Peak limitation:** —

**Notations:** —

**IDLH:** 40,000 ppm

**Sampling and analysis:** The recommended value is readily quantifiable through currently available sampling and analysis techniques.

## Recommendation and basis for workplace exposure standard

The TWA of 5,000 ppm and a STEL of 30,000 ppm are recommended to protect for physiological changes, metabolic stress and asphyxiation in exposed workers.

A separate TWA is not recommended for coal mines as there is no available health information to support an independent TWA.

## Discussion and conclusions

Carbon dioxide is produced in the body and has important physiological functions. It is also used as dry ice, a propellant in aerosols, carbonisation of beverages and in fire extinguishers.

Exposure to 50,000 ppm for 30 minutes results in signs of intoxication and exposure between 70,000 and 100,000 ppm for a few minutes results in unconsciousness. A slight effect in rhythm of respiration is reported in submarine personnel continuously exposed to 30,000 ppm with oxygen maintained at normal concentrations. Complaints of ill effects were recorded when oxygen levels decreased. Heart rate increases are also reported in monkeys and apes exposed to concentrations between 7,500 and 40,000 ppm for one hour (ACGIH, 2018; DFG, 1983).

Based on the human and animals data, the recommended TWA of 5,000 ppm and STEL of 30,000 ppm are considered protective for physiological changes, metabolic stress and asphyxiation 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 skin sensitiser or respiratory sensitiser according to the GHS.

There are insufficient data available to recommend a skin notation. However, carbon dioxide is not expected to be absorbed through human skin to result in a systemic effect.

DRAFT

## APPENDIX

### Primary sources with reports

Source	Year set	Standard
<b>SWA</b>	<b>1991</b>	<b><i>TWA: 5,000 ppm (9,000 mg/m<sup>3</sup>); STEL: 30,000 ppm (54,000 mg/m<sup>3</sup>) Carbon dioxide</i></b> <b><i>TWA: 12,500 ppm (22,500 mg/m<sup>3</sup>); STEL: 30,000 ppm (54,000 mg/m<sup>3</sup>) Carbon dioxide in coal mines</i></b>
<b>ACGIH</b>	<b>2001</b>	<b><i>TLV-TWA: 5,000 ppm (9,000 mg/m<sup>3</sup>); TLV-STEL: 30,000 ppm (54,000 mg/m<sup>3</sup>)</i></b>
<p>The TWA is recommended to minimise the potential for asphyxiation and metabolic stress.</p> <p>Summary of data:</p> <p>Human data:</p> <ul style="list-style-type: none"> <li>Depending on the duration and concentration, exposure to high concentrations can produce mild narcotic effects, stimulation of the respiratory centre and asphyxiation</li> <li>Stimulation of the respiratory centre occurs at 50,000 ppm or 5%</li> <li>Slight effect reported in submarine personnel exposed continuously to 30,000 ppm with oxygen content maintained at normal concentrations (minimum 18%); complaints of ill effect when oxygen at 15–17%</li> <li>Exposure to 50,000 ppm for 30 min results in signs of intoxication</li> <li>Unconsciousness within a few min at 7–10% (70,000–100,000 ppm)</li> <li>No noticeable symptoms reported from exposure to 5,500 ppm for 6 h</li> <li>Exposure of 23 men to 15,000 ppm for 42 d resulted in physiological adaption and mild evidence of stress reaction; 15,000 ppm interpreted as the upper limit of tolerance to extended periods of exposure</li> <li>Exposure to 27,600–39,500 ppm produced increased pulmonary ventilation rates in short-term exposure, physical exercise studies.</li> </ul>		
<b>DFG</b>	<b>1983</b>	<b><i>MAK: 5,000 ppm (9,100 mg/m<sup>3</sup>)</i></b>
<p>The MAK is recommended to prevent physiological effects in exposed workers.</p> <p>Summary of additional data:</p> <ul style="list-style-type: none"> <li>Exposure to 8,000–9,000 ppm for 24 h associated with alveolar dead space increases in humans</li> <li>Exposure to 8,000–12,000 ppm for ≤27 d leads to an increase in alveolar partial pressure CO<sub>2</sub> and pulmonary ventilation in humans</li> <li>Heart rate increase reported in studies with monkeys and apes exposed to concentrations between 7,500–40,000 ppm at 20–21% oxygen content for 1 h.</li> </ul>		
<b>SCOEL</b>	<b>NA</b>	<b>NA</b>
No report.		

Source	Year set	Standard
<b>OARS/AIHA</b>	<b>NA</b>	<b>NA</b>
No report.		
<b>HCOTN</b>	<b>NA</b>	<b>NA</b>
No report.		

## Secondary source reports relied upon

NIL.

## 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	NA
NICNAS	NA
EU Annex	NA
ECHA	NA
ACGIH	NA
DFG	NA
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:	44.01
Conversion factors at 25°C and 101.3 kPa:	1 ppm = Number mg/m <sup>3</sup> ; 1 mg/m <sup>3</sup> = Number ppm
This chemical is used as a pesticide:	<input type="checkbox"/>
This chemical is a biological product:	<input type="checkbox"/>
This chemical is a by-product of a process:	<input checked="" type="checkbox"/>
A biological exposure index has been recommended by these agencies:	<input type="checkbox"/> ACGIH <input type="checkbox"/> DFG <input type="checkbox"/> SCOEL

## Workplace exposure standard history

Year	Standard
<a href="#">Click here to enter year</a>	

## References

American Conference of Industrial Hygienists (ACGIH®) (2018) TLVs® and BEIs® with 7<sup>th</sup> Edition Documentation, CD-ROM, Single User Version. Copyright 2018. Reprinted with permission. See the [TLVs® and BEIs® Guidelines section](#) on the ACGIH website.

Deutsche Forschungsgemeinschaft (DFG) (2002) Carbon dioxide – MAK value documentation in German language.

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