# Carbon Disulfide

| CAS number: | 75-15-0 |
| --- | --- |
| Synonyms: | Carbon disulphide, carbon bisulfide |
| Chemical formula: | CS2 |
| Structural formula: |  |

 Workplace exposure standard (amended)

| TWA: | **1 ppm (3.13 mg/m3)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
|  Notations: | **Sk.** |
| IDLH: | **500 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 1 ppm (3.13 mg/m3) is recommended to protect for the onset of adverse nervous system effects in exposed workers and is considered protective of other adverse health endpoints including cardiotoxicity.

## Discussion and conclusions

The critical effects in humans that are associated with exposure to carbon disulfide are neurotoxicity and cardiotoxicity. This has been demonstrated in a large range of observational studies, supported by evidence from experimental animal studies for neurotoxicity outcomes (ACGIH, 2018; DFG, 2004; HCOTN, 2011).

A LOAEL of 15 mg/m3 (5 ppm) for incidence of ischaemic findings was reported in a prospective cohort study in Japanese workers (HCOTN, 2011). Motor nerve induction deficits and other adverse nervous system effects were reported to appear following exposures slightly above 1 ppm (ACGIH, 2018); which forms the basis of the TWA recommendation. A TWA of 1 ppm is considered protective of neurotoxic effects that may begin to develop at 3 ppm (9 mg/m3)(HCOTN, 2011).

Evidence was provided reporting human observations of absorption via dermal route leading to peripheral nerve damage and systemic toxicity (ACGIH, 2018; HCOTN, 2011).

## 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 sufficient evidence in humans demonstrating systemic effects following dermal exposure.

# Appendix

### Primary sources with reports

| Source Year set Standard  |
| --- |
| SWA Year TWA: 10 ppm (31 mg/m3) |
|  |
| ACGIH 2006 TLV-TWA: 1 ppm (3.13 mg/m³) |
| TLV-TWA recommended to protect for neurological endpoints and other adverse effects in all organ systems in exposed workers exposed.Summary of data:Human data:* Four worker exposure studies provide evidence of reduced motor conduction velocities (range of exposures 0.2–65.7 ppm)
* Odour threshold reported at 0.1–0.2 ppm
* Acute exposures at 500–1,000 ppm resulted in psychiatric disturbances (no further information provided)
* Acute exposure at 5,000 ppm resulted in CNS depression, coma, respiratory paralysis and death (no further information provided)
* Not all literature reviewed provided defined exposure-dose information for CNS symptoms
* Physiological responses (adverse nervous system effects) resulting from exposure appear to occur at slightly above 1 ppm.

Animal data:* No dermal LD50 reported
* LC50: 220 ppm (mice; 1 h) and 3,200 and 8,000 ppm (rats and mice; 2 h)
* No animal data available for eye and skin irritation and sensitisation.

Results from *in vitro* studies provide little evidence of genotoxicity.Absorption via dermal route reported peripheral nerve damage and systemic toxicity in workers. |
| DFG 2004 MAK: 5 ppm (16 mg/m³) |
| Provisional MAK assigned to be protective of neurotoxicity and cardiotoxicity that can occur at concentrations <10 ppm. This MAK is accompanied by a recommendation for further research.Summary of additional data:* NOEL: 4 ppm (humans); based on 40 yr exposure; uncertainty in exposure concentrations noted
* Endocrine effects reported in chronic human exposure studies; LH and FSH reduction with increasing exposure time; at 4.6±1.5 ppm (14.4±4.62 mg/m3)
* Neurological effects on the eye and ototoxic effects reported (enhanced hearing loss a low frequencies) in humans
* No carcinogenicity or genotoxicity data reported or reviewed
* No reports available regarding skin or respiratory tract sensitisation; no notations assigned.
 |
| SCOEL 2008 TWA: 5 ppm (16 mg/m3) |
| TWA is assigned to protect for neurotoxicity and cardiotoxicity and is considered to be protective for other reported health effects.* Considered a threshold of 10 ppm (30 mg/m3) for earliest non-clinical changes in human studies and applied an uncertainty factor of 2 to account for seriousness of effects
* Cardiotoxicity reported in humans at ≈63 mg/m3 (20 ppm)
* Local effects on skin and mucous membranes on dermal contact; blistering, ulceration, degradation of sweat glands and local nerve endings reported in animal studies
* No investigations into dermal contact in humans.
 |
| OARS/AIHA NA NA |
| No report  |
| HCOTN 2011 TWA: 2 ppm (5 mg/m3) |
| The TWA is assigned to protect for neurotoxicity and cardiotoxicity in exposed workers.Summary of additional data:* TWA of 5 mg/m3 (2 ppm) derived by application of a factor of 3 to a reported LOAEL of 15 mg/m3 (5 ppm) (prospective cohort study, incidence of ischaemic findings)
* TWA is below the reported concentration at which neurotoxic effect may develop (9 mg/m3; 3 ppm)
* A skin notation assigned based on evidence from an experimental study reporting absorption of liquid carbon disulfide.
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### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| NICNAS |  | 2014 | * Median animal inhalational data, LC50 ≈10.35 mg/L
* NOAEC: 155.8 mg/m3 (S-D rats; 6h/d. 5d/wk for at least 89 d)
* Reproductive effects reported in animal and human studies.
 |

### Carcinogenicity — non-threshold based genotoxic carcinogens

| Is the chemical mutagenic? | No |
| --- | --- |

## Notations

| Source | Notations  |
| --- | --- |
| SWA | Skin |
| HCIS | - |
| NICNAS | - |
| EU Annex | - |
| ECHA | - |
| ACGIH | Carcinogenicity Category A4; Skin |
| DFG | H (skin)  |
| SCOEL | Skin |
| HCOTN | Skin |

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: | yes | 4.00 |   |   |   |
| Dermal LD50 ≤1000 mg/kg: |   |   |   |   |   |
| Dermal repeat-dose NOAEL ≤200 mg/kg: |   |   |   |   |   |
| Dermal LD50/Inhalation LD50 <10: |   |   |   |   |   |
| *In vivo* dermal absorption rate >10%: |   |   |   |   |   |
| Estimated dermal exposure at WES >10%: |   |   |   |   |   |
|   |   |   | **a skin notation is warranted** |

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### IDLH

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

## Additional information

| Molecular weight: | 76.13 |
| --- | --- |
| 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: |[x]
| 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: | [x]  ACGIH [x]  DFG [x]  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) (2005) Carbon disulfide – MAK value documentation.

EU Scientific Committee on Occupational Exposure Limits (SCOEL) (2008) Recommendation from the Scientific Committee on Occupational Exposure Limits for carbon disulfide. SCOEL/SUM/82.

Health Council of the Netherlands (HCOTN) (2011). Carbon disulfide. Health-based calculated occupational cancer risk values. The Hague: Health Council of the Netherlands; publication no. 2011/26.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2014) Carbon disulfide: Human health tier II assessment.

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