CARBON DISULFIDE

CAS number:	75-15-0
Synonyms:	Carbon disulphide, carbon bisulfide
Chemical formula:	CS_2
Structural formula:	

Workplace exposure standard (amended)

TWA:	**1 ppm (3.13 mg/m^3)**
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/m^3) 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/m^3 (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/m^3) (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.		

Source	Year set	Standard
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.		

Secondary source reports relied upon

Source		Year	Additional information
NICNAS	✓	2014	• Median animal inhalational data, LC_{50} ≈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	-

Source	Notations
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
Dermal LD_{50} ≤1000 mg/kg:	
Dermal repeat-dose NOAEL ≤200 mg/kg:	
Dermal LD_{50}/Inhalation LD_{50} <10:	
In vivo dermal absorption rate >10%:	
Estimated dermal exposure at WES >10%:	
	a skin notation is warranted

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/m^3; 1 mg/m^3 = 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* 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.