METHYLACRYLONITRILE

CAS number: 126-98-7

Synonyms: Methacrylonitrile, 2-methyl-2-propenenitrile, 2-cyanopropene, isopropene cyanide, isopropenylnitrile, 2-methylpropenenitrile

Chemical formula: C_4H_5N

Structural formula: —

Workplace exposure standard (retained)

TWA: **1 ppm (2.7 mg/m^3)**

STEL: **—**

Peak limitation: **—**

Notations: **Sk., DSEN**

IDLH: **4 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 1 ppm (2.7 mg/m^3) is recommended to protect for ocular and dermal irritation and central nervous system (CNS) effects in exposed workers.

Discussion and conclusions

Methylacrylonitrile is used in the production of plastic elastomers and coatings, including microcapsules, and as an intermediate in preparation of bulk chemicals. Critical effects include eye and skin irritation and CNS impairment.

Human toxicological data is limited to one acute inhalation study with volunteers exposed to varying concentrations of 2 to 24 ppm. This study reported irritation of ear, nose and throat at 24 ppm (one-minute duration) and transient irritant effects (ear, nose and throat) at 2 to 14 ppm for ten-minute duration (ECHA, 2019).

Critical effects were generally concentration related in acute toxicity studies in animals and followed a pattern of loss of consciousness, tonic-clonic convulsions and then death across all the tested species. Acute toxicity is caused by metabolic conversion to cyanide. NOAEC of 19.3 to 52.6 ppm and 3.2 to 8.8 ppm were reported in rats and dogs, respectively in sub-chronic inhalation studies based on liver effects (ACGIH, 2018).

Based on the NOAEC in dogs, the current TWA of 1 ppm (2.7 mg/m^3) is recommended to be retained consistent with ACGIH (2018). This TWA is considered to protect for irritation to the eye and skin, and CNS impairment in exposed workers.

Recommendation for notations

Not classified as a carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Classified as a skin sensitiser but not a respiratory sensitiser according to the GHS. A review of skin sensitisation classification is recommended as there is a lack of supportive evidence (ECHA, 2019).

A skin notation is recommended based on evidence suggesting rapid dermal absorption and adverse systemic effects in animals.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 1 ppm (2.7 mg/m^3)***
ACGIH	***2011***	***TLV-TWA: 1 ppm (2.7 mg/m^3)***
TLV-TWA recommended to minimise potential for ocular and dermal irritation and possible CNS effects in exposed workers. Summary of data: No human data available. Animal data: • LC_{50}: 36 ppm (mice); 37 ppm (rabbits); 88 ppm (guinea pig); 328–700 ppm (male and female rat respectively); 4 h exposure. Effect in all species was concentration related, generally loss of consciousness, tonic-clonic convulsions, then death • Acute toxicity predominantly caused by metabolically formed cyanide • LD_{50}: 250–280 mg/kg (rabbit, dermal); rapidly absorbed through intact skin; however, skin irritation at application site negligible • LD_{50}: 20–25 mg/kg (mice, oral); 25–50 mg/kg (rats, oral) • NOEL: 19.3–52.6 ppm (rats, inhalation, 91 d); 3.2–8.8 ppm (dogs, inhalation, 90 d) • NOAEL: 30 mg/kg/d (rats, oral gavage, 13 wk) • No neoplasms or non-neoplastic lesions observed in studies of male and female rats (0, 3, 10 or 30 mg/kg/d) and mice (0, 1.5, 3 or 6 mg/kg/d) for 105 wk by oral gavage • Negative results in genotoxicity tests. Skin notation warranted based on rapid dermal absorption and subsequent toxic effects. Insufficient data to recommend a SEN notation or TLV-STEL.		
DFG	***NA***	***NA***
No report.		
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
NTP	✓	2001	• No additional information.

Source		Year	Additional information
US EPA	✓	1988	• No additional information.
ECHA	✓	2019	• Acute inhalation study with volunteers (1-10 min exposures): ○ inhalation at 2–24 ppm for 1 min; further study of 9 volunteers exposed at 2 ppm for 10 min and 7 volunteers exposed at 14 ppm for 10 min ○ nose, throat and eye irritation in workers exposed at 24 ppm for 1 min; no irritation noted at other concentrations ○ transitory eye, nose or throat irritant effects observed in workers at 2 or 14 ppm for 10 min exposure, ○ at dangerous concentrations, likely that odour of methylacrylonitrile not detected • Recommended 8 h TWA of 3 ppm based on NOEL of 3.2 ppm in dogs.
US NIOSH	✓	2017	• IDLH based on mice and rabbit study, with no clinical signs or deaths at 19.7 ppm exposure (4 h). This NOAEC was extrapolated to 39 ppm for a 30 min duration. An IDLH of 4ppm in humans was derived by dividing the 30 min exposure by an uncertainty factor of 10 to account for interspecies differences.

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	Skin:Sen
HCIS	Skin sensitisation – category 1
NICNAS	NA
EU Annex	NA
ECHA	Skin Sens. 1
ACGIH	Carcinogenicity – A4, Skin
DFG	NA
SCOEL	NA
HCOTN	NA
IARC	NA

Source	Notations
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	
Conclusion:	
Adverse effects in human case study:	
Dermal LD_{50} ≤1000 mg/kg:	yes
Dermal repeat-dose NOAEL ≤200 mg/kg/d:	
Dermal LD_{50}/Inhalation LD_{50} <10:	
In vivo dermal absorption rate >10%:	
Estimated dermal exposure at WES >10%:	
	consider assigning a skin notation

IDLH

Is there a suitable IDLH value available?	Yes

Additional information

Molecular weight:	67.09
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 2.74 mg/m^3; 1 mg/m^3 = 0.365 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.

European Chemicals Agency Regulation (ECHA) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

National Toxicology Program (NTP) (2001) NTP-RoC: Methylacrylonitrile.

US Environmental Protection Authority (US EPA) (1998) Integrated Risk Information System (IRIS) Chemical Assessment Summary – Methylacrylonitrile.

US National Institute for Occupational Safety and Health (NIOSH) (2017-204) Immediately dangerous to life or health concentrations – Methacrylonitrile.