CARBARYL

CAS number: 63-25-2

Synonyms: 1-naphthyl methylcarbamate,
α-Naphthyl N-methylcarbamate

Chemical formula: $C_{12}H_{11}NO_2$

Structural formula: —

Workplace exposure standard (amended)

TWA: **0.5 mg/m^3**

STEL: **—**

Peak limitation: **—**

Notations: **Carc. 2., Sk.**

IDLH: **100 mg/m^3**

Sampling and analysis:

Recommendation and basis for workplace exposure standard

A TWA of 0.5 mg/m^3 is recommended to protect for cholinesterase inhibition and reduce the risk of cancer in exposed workers.

Discussion and conclusions

Carbaryl is used primarily as an insecticide, acaricide and molluscicide. It is known to act as a cholinesterase inhibitor (ACGIH, 2018).

No adverse health effects were reported in a study of six men administered oral doses of 0.06 mg/kg (approximately 1 mg/m^3) over six weeks. Increasing the dose to 0.13 mg/kg (approximately 2 mg/m^3) resulted in signs of cholinesterase inhibition. An industrial study reported no adverse effects in workers exposed to 0.21 to 31 mg/m^3. Rats exposed to 10 mg/m^3 displayed no gross, visible signs of adverse effects. A NOAEL of 716 mg/kg/d is reported in mice for neoplastic (cancer) responses (ACGIH, 2018)

To derive the TWA, an uncertainty factor of two was applied to the oral NOAEL of 1 mg/m^3 in humans to arrive at a concentration of 0.5 mg/m^3. This concentration is the same as the ACGIH (2018) recommendation and is considered sufficiently low to minimise the potential for cholinesterase inhibition. Regarding carcinogenic effects, assuming a 70 kg worker inhales 10 m^3 per eight-hour shift, the NOAEL in mice of 716 mg/kg equates to >5,000 mg/m^3. This value supports the conclusions that the recommended TWA is also considered protective for cancer in exposed workers.

Recommendation for notations

Classified as a category 2 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 evidence of dermal absorption and systemic effects reported in workers.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 5 mg/m³***
ACGIH	***2008***	***TLV-TWA: 0.06 ppm (0.5 mg/m³) (Inhalable fraction and vapour)***
TLV-TWA recommended to minimise the risk of cholinesterase inhibition in exposed workers. Summary of data: Used primarily as an insecticide, acaricide and molluscicide. Human data: • No adverse effects in workers exposed to 0.21–31 mg/m³ • Cholinesterase inhibition was observed in volunteers administered a single oral dose of 2 mg/kg; no inhibition observed at 1 mg/kg • No adverse effects (cholinesterase inhibition) in 6 men administered oral doses of 0.06 mg/kg (≈1 mg/m³) over 6 wk ○ abdominal changes and sleeping difficulties reported when the dose was increased to 0.13 mg/kg (≈2 mg/m³); no profound changes to cholinesterase activity reported at this dose • Morphological defects in sperm reported in workers with airborne and dermal exposure; no further information • No evidence of skin sensitisation. Animal Data • LD_{50}: 4,000 mg/kg (rats, dermal) • Rats exposed to 10 mg/m³ of micronized dust 7 h/d for 90 d showed no signs of gross visible injury • Dogs exposed to 75 mg/m³ of micronised dust showed signs of cholinesterase inhibition within 5 h; assumed single exposure • NOEL: 5 mg/kg (dogs, oral), 10 mg/kg (rats, oral) • Dose-response for tumour growth not statistically significant in mice, oral dose 0–8,000 ppm over 2 y • NOEL of 716 mg/kg in dietary study over 180 d; no gross findings, no pre-neoplastic or neoplastic changes were associated with carbaryl • Negative results in mutagenicity assays. Assigned an A4, not classified as human carcinogen.		
DFG	***2002***	***MAK: 5 mg/m³***
MAK is recommended to minimise the risk of acetylcholinesterase inhibition in exposed workers. Summary of additional data: • Mucosal irritations in animals ≥390 mg/m³; no further information • MAK ID derived from worker exposure to 0.21–31 mg/m³ with no effect (same as ACGIH, 2018).		
SCOEL	***NA***	***NA***
No report.		

Source	Year set	Standard
OARS/AIHA	***NA***	***NA***
No report.		
HCOTN	***NA***	***NA***
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	Carc. 2
HCIS	Carcinogenicity – category 2
NICNAS	NA
EU Annex	Carcinogenicity – category 2
ECHA	NA
ACGIH	Carcinogenicity – A4, Skin
DFG	H (skin)
SCOEL	NA
HCOTN	NA
IARC	Carcinogenicity – Group 3
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:	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:	201.2
Conversion factors at 25°C and 101.3 kPa:	1 ppm = mg/m^3; 1 mg/m^3 = 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) (2012) Carbaryl – MAK value documentation.

International Agency for Research on Cancer (IARC) (1987) Overall evaluations of carcinogenicity: an updating of IARC monograph volumes 1 to 42, supplement 7. IARC Monographs on the evaluation of the carcinogenic risk to humans.

Tenth Adaptation to Technical Progress Commission Regulation (EU) No 2017/776 amending, for the purposes of its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the

European Parliament and of the Council on classification, labelling and packaging of substances and mixtures (the CLP Regulation).

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