1-BROMOPROPANE

CAS number: 106-94-5

Synonyms: n-Propylbromide, propylbromide

Chemical formula: C_3H_7Br

Workplace exposure standard (new)

TWA: **0.1 ppm (0.5 mg/m^3)**

STEL: **—**

Peak limitation: **—**

Notations: **Carc. 2**

IDLH: **—**

Sampling and analysis: There is uncertainty regarding quantification of the recommended value with available sampling and/or analysis techniques.

Recommendation and basis for workplace exposure standard

A TWA of 0.1 ppm (0.5 mg/m^3) is recommended to protect for neurotoxic and hepatotoxic effects in exposed workers.

Discussion and conclusions

1-Bromopropane is used as a solvent to clean metals and electronics.

The critical effects of 1-bromopropane are neurotoxicity and hepatoxicity. Long-term studies in mice and rats also report carcinogenic effects. However, the mechanism of carcinogenicity and relevance of these results for humans is unclear. Several case studies report symptoms of polyneuropathy and neurotoxicity in exposed workers. Reported symptoms included headache, nausea, incontinence and subacute spastic paraparesis with distal sensory loss.

In a study of female workers, a LOAEL of 1.28 ppm was reported for loss of vibration sensation in toes and reduced red blood cell count. A NOAEL was not identified. In another study, workers exposed to time weighted average exposures of 0.34 to 49.19 ppm showed diminished sensation for vibration and lower scores in memory and mode tests. In rats, a NOAEL of 200 ppm for hepatoxicity was reported in a 13 week inhalation study (ACGIH, 2018).

A TWA of 0.1 ppm is recommended using the LOAEL of 1.28 ppm and applying an uncertainty factor of 10 to account for the absence of a NOAEL in humans. The recommended TWA is considered to provide an appropriate margin of safety to account for the uncertainty surrounding carcinogenicity effects reported in animal studies.

Recommendation for notations

Classified as a carcinogen category 2 according to the Globally Harmonized System of Classification and Labelling on Chemicals (GHS).

Not classified as a skin sensitiser or respiratory sensitiser according to the GHS.

A skin notation is not recommended as animal studies report low systemic toxicity after dermal application.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***NA***	***NA***
ACGIH	***2014***	***TLV-TWA: 0.1 ppm (0.5 mg/m^3)***

TLV-TWA recommended to protect for the potential for neurotoxicity, hepatotoxicity, and reproductive and developmental toxicity.

Summary of data:

Human data:

- Several case studies of exposed workers reported polyneuropathy and neurotoxicity symptoms including headache, nausea, incontinence and subacute spastic paraparesis with distal sensory loss
- A study of workers exposed to TWA of 0.34–49.19 ppm reported diminished vibration sensation and lower scores in memory and mode tests
    - concluded that exposure could adversely affect peripheral sensory and motor nerves, and CNS in humans
    - no exposure duration of frequency provided
- Dose-dependent neurological and haematologic effects demonstrated in a study of 60 female workers
    - LOAEL of 1.28 ppm for loss of vibration sensation in toes and lowered red blood cell count
    - NOAEL not identified.
- TLV-TWA of 0.1 ppm derived using LOAEL of 1.28 ppm and applying an uncertainty factor of 10 to account for absence of NOAEL in humans.

Animal data:

- NOAEL of 200 ppm for hepatoxicity (rat, 13 wk, inhalation)
- Rats exposed to 125, 250 or 500 ppm 6 h/d, 5 d/wk for 2 yr developed cancer of the large intestine
    - concluded some evidence of carcinogenicity in males and clear evidence in females
- Mice exposed to 62.5, 125, or 250 ppm 6 h/d, 5 d/wk for 2 yr, reported females with lung tumours
    - concluded clear evidence of carcinogenicity in females, but none in males
- LC_{50}: 7,000 ppm (rats, 4 h)
    - mortality due to respiratory inflammation and pulmonary oedema
- LD_{50}: >2,000 mg/kg (rats, dermal).

No basis for sensitisation notation.

No data to support a STEL.

Source	Year set	Standard
DFG	***2011***	***Not assigned***
No MAK assigned due to unexplained carcinogenic effect seen in animal studies and its relevance to humans. Summary of additional data: Human data: • Two publications using dermal penetration rates of 22 µg/cm²/h and 24 µg/cm²/h (for saturated aqueous solution) were used to determine absorption in model calculations o calculations showed that 1 h exposure of 2,000 cm² skin surface (hands and forearms) leads to estimated absorption of 44 mg (for 22 µg/cm²/h) and 48 mg (24 µg/cm²/h). Animal data: • NOAEC of 100 mg/m³ for maternal pre- and postnatal reduced body weight in rats o NOAEC is also considered applicable for developmental toxicity (reduced bw in offspring) in rats • Carcinogenicity results (as ACGIH, 2014) may be species specific or sex specific and no clear explanation for tumour occurrence or mechanism for rare colonic adenomas in rats • Contradictory results in *in vitro* genotoxicity studies: o inconsistent results reported in gene mutation studies with *S. typhimurium* strains o mouse lymphoma test reported positive results at high concentrations o no significant differences in high and no exposure groups in comet assay o negative results in most *in vivo* assays.		
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
NICNAS	✓	2013	• Negative results reported for all *in vivo* genotoxicity studies • All Ames tests except one showed negative results • One *in vitro* mouse lymphoma assay reported mutagenic activity • Not considered mutagenic considering all available data.

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	—
HCIS	Carcinogenicity – category 2
NICNAS	Carc. Cat 3
EU Annex	NA
ECHA	Carcinogenicity – category 1B
ACGIH	Carcinogenicity – A3
DFG	Carcinogenicity – 2
SCOEL	NA
HCOTN	NA
IARC	Carcinogenicity – Group 2B
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:	
Dermal LD_{50} ≤1000 mg/kg:	no
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 not warranted

IDLH

Is there a suitable IDLH value available?	No

Additional information

Molecular weight:	122.99
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:	☐

Molecular weight:	122.99		
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) (2011) 1-Bromopropane – MAK value documentation, German language.

International Agency for Research on Cancer (IARC) (2018) Some industrial chemicals volume 115. IARC Monographs on the evaluation of the carcinogenic risk to humans.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2013) Propane, 1-bromo: Human health tier II assessment – IMAP report.

Regulation (EC) 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), establishing a European Chemicals Agency, amending Directive 1999/45/EC.