TRIFLUOROBROMOMETHANE

CAS number: 75-63-8

Synonyms: Bromofluoroform, bromotrifluoromethane, freon 13B1, halon 1301, refrigerant 13B1, trifluoromonobromomethane

Chemical formula: $CBrF_3$

Workplace exposure standard (retained)

TWA: **1,000 ppm (6,090 mg/m^3)**

STEL: **—**

Peak limitation: **—**

Notations: **—**

IDLH: **40,000 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 1,000 ppm (6,090 mg/m^3) is recommended to protect for effects on cardiovascular system and central nervous system (CNS) in exposed workers.

Discussion and conclusions

Trifluorobromomethane has been used as a fire extinguisher and chemical intermediate.

Critical effects of exposure are effects on psychomotor function, narcosis and cardiac sensitisation.

Volunteers exposed at 10 to15 per cent (100,000–150,000 ppm) in air have decreased performance in five of six psychomotor tasks, with feelings of impending unconsciousness at 15 per cent. Twenty-minute exposures at 10 per cent in volunteers caused confusion, unsteadiness, and giddiness. Three of the 10 volunteers developed arrhythmia (ACGIH, 2018; DFG, 1993). Reduced performance in psychomotor function, logical reasoning, mental performance and increased reaction time reported in studies of volunteers exposed at 7 per cent (70,000 ppm) for three hours (DFG, 1993). At reduced atmospheric pressure, exposures at 4 and 7 per cent (three to five-minute durations) caused increased reaction times, fatigue and dizziness (ACGIH, 2018; DFG, 1993).

Acute effects in animals occur at extremely high concentrations, generally following exposures at greater than 50 per cent. Lethality reported in rats exposed to 834,000 ppm for 15 minute and ventricular fibrillations reported at exposures of 40 per cent (400,000 ppm) in dogs (duration not provided) (ACGIH, 2018).

Given the low acute toxicity, a TWA of 1,000 ppm (6,090 mg/m^3) is recommended to be retained as assigned by the primary sources and is considered protective of the effects on the cardiovascular system and CNS.

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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.

There are insufficient data to recommend a skin notation.

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APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 1,000 ppm (6,090 mg/m^3)***
ACGIH	***2001***	***TLV-TWA: 1,000 ppm (6,090 mg/m^3)***

TLV-TWA recommended to minimise the potential for cardiac sensitisation and arrhythmias.

Summary of data:

Derivation of TLV-TWA not provided but noted to be of low toxicity.

Human data:

- Exposure at 10–15% in air caused decrease in 5/6 psychomotor tasks in volunteers
- Feeling of impending unconsciousness at 15%
- 3-min exposures at 4% and 7% caused slight increased reaction time
- Exposures up to 10% caused light-headedness, paraesthesia, and diminished performance
- Auriculoventricular dissociation and premature ventricular contractions were recorded on ECG during exposures in volunteers at 16.9%

  No cardiac arrhythmias reported during exposures at 4%–7% for 3 min in hyperbaric chamber or at 5%–7% for 5 min at pressurised altitudes of 1,000–20,000 ft (305–6,096 m) in aircraft flight tests.

Animal data:

- Most important toxicological effects are on the CNS and cardiovascular systems
- Acute effects only occurred at extremely high concentrations
- LC_{50}: 840,000 ppm (rat); 880,000 ppm (guinea pig)
- Performance reduction occurred for trained monkeys exposed at 20%–25%
- Exposure at 40% in dogs caused ventricular fibrillation; stimulation of CNS activity also occurred; no further information
- No signs of intoxication and no pathologic change detected at necropsy during 18 wk study in dogs and rats exposed at 23,000 ppm (2.3%).

Insufficient data to recommend Skin, SEN or carcinogenicity notations.

DFG	***1993***	***MAK: 1,000 ppm (6,200 mg/m^3)***

Summary of additional data:

- No effects in ECG recordings reported in a study in 3 healthy males exposed at 0, 1, 3 ,5, 7 and 10% for 3–3.5 min (several hours up to 24 h between exposures):
  - at 7–10% narcotic effects noted (light headedness, difficulty concentrating during reaction tests and feeling of impending unconsciousness)
- Exposure at 5% and 10% for 20 min in 10 volunteers:
  - no ill effects in 4 volunteers exposed at 5%
  - all 6 volunteers described confusion, unsteadiness, and giddiness at 10%
  - CNS effects described as severe by one person and moderate by the remaining 5

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Source	Year set	Standard
		○ no changes in ECG for 7/10 volunteers ○ arrhythmia recorded in remaining 3 volunteers with one developing A-V dissociation and bigeminy • Reduced performance in psychomotor function, logical reasoning, mental performance and reaction time after inhalation at 7% for 3 h by 6 healthy volunteers: ○ no effects normal liver function, ECG, blood pressure, heart rate and sleeping pattern • Additional results from studies conducted at reduced atmospheric pressure cited in ACGIH (2018): ○ significantly increased reaction times during all exposures ○ 6/8 subjects felt dizzy, faint, or drowsy during exposure at 7% and 3 subjects during exposure at 4% ○ 2 subjects felt dizzy, faint, or drowsy at 506 hPa with no exposure. • Changes only noted in animals during acute toxicity tests following exposures >50% • No symptoms of toxicity or abnormal findings after necropsy of 20 rats and 20 guinea pigs exposed at 5% continuously for 10 d • General state of health, normal weight and food consumption in rats, guinea pigs and mice inhaling 50%, 2 h/d, 15 d • No effects on chemical parameters or blood counts 30 d study in male and female rats exposed at 5% (23 h/d) • No mutagenic effects with or without metabolic activation in Ames test in *S typhimurium* • No carcinogenicity studies available. MAK adopted in 1958 in keeping with TLV; however, DFG consider it justifiable to retain. No toxic effects at repeated exposures to concentrations higher than MAK reported in some early inhalation studies (not up to present day standards).
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
ECHA	✓	2019	• Whole body inhalation for 2 h in mice resulted in no mortality up to 800,000 ppm • Poisoning event in single male worker with estimated exposure at 15% for 10–15 min: ○ Occurred following sudden leak of greyish fumes from fire extinguishing system

Source		Year	Additional information
			○ Immediate eye irritation and shortness of breath, with chest tightness, dizziness, and light-headedness ○ In weeks following incident suffered fatigue, eye irritation, shortness of breath, decreased FEV and FVC, conjunctivitis ○ 3 yr after incident worker still experienced shortness of breath, cough and perennial non-infectious rhinoconjunctivitis ○ Respiratory problems responded to inhaled medication.
US NIOSH	✓	1994	• REL 1,000 ppm (6,100 mg/m^3) TWA • IDLH of 40,000 ppm based on narcotic effects in acute studies in humans.

Carcinogenicity — non-threshold based genotoxic carcinogens

Is the chemical mutagenic?	Insufficient data
Is the chemical carcinogenic with a mutagenic mechanism of action?	Insufficient data

Insufficient data are available to determine if the chemical is a non-threshold based genotoxic carcinogen.

Notations

Source	Notations
SWA	NA
HCIS	NA
NICNAS	NA
EU Annex	NA
ECHA	NA
ACGIH	NA
DFG	NA
SCOEL	NA
HCOTN	NA
IARC	NA
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

Insufficient data to assign a skin notation.

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IDLH

Is there a suitable IDLH value available?	Yes

Additional information

Molecular weight:	148.92
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 6.09 mg/m^3; 1 mg/m^3 = 0.164 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) (1993) Bromotrifluoromethane – MAK value documentation.

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).

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

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