FENTHION

CAS number:	55-38-9
Synonyms:	Baytex, DMTP, Entex, phosphorothioic acid O,O-dimethyl O-(3-methyl-4-(methylthio)phenyl)ester, lebaycid
Chemical formula:	$C_{10}H_{15}O_3PS_2$
Structural formula:	—

Workplace exposure standard (retained)

TWA:	**0.2 mg/m^3**
STEL:	—
Peak limitation:	—
Notations:	**Sk.**
IDLH:	—

Sampling and analysis: The recommended value is quantifiable through available sampling and analysis techniques.

Recommendation and basis for workplace exposure standard

A TWA of 0.2 mg/m^3 is recommended to protect for cholinergic effects in red blood cells (RBC) and the brain in exposed workers.

Discussion and conclusions

Fenthion is an organophosphate insecticide used for mosquito control in residential areas by aerial and ground application and for livestock dermal treatments.

Human volunteers exhibited no RBC cholinesterase inhibition following a daily oral dose of 0.02 to 0.07 mg/kg/day for four weeks; equivalent to a NOAEC in humans of 0.5 mg/m^3 (ACGIH, 2018). A NOAEC of 1 mg/m^3 was reported in rats from a six-week inhalation study sourced by DFG to derive a TWA of 0.2 mg/m^3 by dividing the NOAEC by an uncertainty factor of five (DFG, 2002). A NOAEL of 0.02 mg/kg/day with a LOAEL of 0.07 mg/kg/day for cholinergic effects is reported from a two-year oral study in monkeys. The NOAEL and LOAEL are equivalent to NOAEC and LOAEC of 0.14 mg/m^3 and 0.5 mg/m^3, respectively, assuming inhalation rate of 10 m^3 per eight-hour shift and 70 kg worker body weight.

A TWA of 0.2 mg/m^3 is recommended to be retained as, based on the weight of evidence presented, it is considered protective for cholinergic effects in RBC and the brain reported in humans and animals.

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 evidence of adverse systemic effects following dermal exposure in humans and animals.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 0.2 mg/m^3***
ACGIH	***2006***	***TLV-TWA: 0.004 ppm (0.05 mg/m^3)***

TLV-TWA of the total inhalable fraction and vapour is recommended to protect against cholinergic effects in red blood cells and the brain.

Summary of data:

Human data:

- Volunteers; oral dose 0.02–0.07 mg/kg/d for 4 wk; no physical signs or symptoms; no RBC cholinesterase inhibition, no change in clinical chemistry, haematology or urinalysis:
  - no signs of a cholinergic response at 0.07 mg/kg; dose equivalent to inhalation of 0.5 mg/m^3
- Poisoning produces tingling and numbness in the hands and feet, shooting pains, back pain, numbness and muscle weakness. Several reports of adverse visual effects associated with agricultural use
- Case report of accidental poisoning following dermal contact.

Animal data:

- Evidence of cumulative toxicity with lower lethal doses reported when administered on successive days compared with a single dose
- Toxicity via inhalation exposure occurs at a lower dose compared with oral route
- NOAEL: 1 mg/m^3 in rats; 6 h/d, 5 d/wk, 6 wk; RBC and brain cholinesterase activities inhibition
- LD_{50}: 500 mg/kg undiluted (rats, dermal)
- NOEL: 0.02 mg/kg/d for cholinergic effects (monkeys, oral gavage, 2 yr); LOEL 0.07 mg/kg/d (inhibition of RBC acetylcholinesterase) equivalent inhalation concentration of 0.5 mg/m^3 assuming inhalation rate of 10 m^3/d and 70 kg body weight
- No RBC or brain acetylcholinesterase inhibition at 0.13 mg/kg/d from repeated oral doses in rats; no further information; equivalent inhalation concentration of 0.9 mg/m^3 assuming inhalation rate of 10 m^3/d and 70 kg body weight
- Quickly absorbed through skin, lung and digestive tract and hydrolysed unchanged or after enzymatic oxidation
- Toxic effect after administration is acute ocular toxicity and evidence it is retina specific.

TLV-TWA based on evidence of association of significant inhibition of RBC and brain acetylcholinesterase with airborne aerosols.

Insufficient data in humans and animals to recommend SEN notation or TLV-STEL.

Source	Year set	Standard
DFG	***2002***	***MAK: 0.2 mg/m³***
Summary of additional data: • NOAEL: 0.02 mg/kg/day (humans, oral) • MAK derived using NOAEL of 1 mg/m³ in rats (ACGIH, 2006) and application of a safety factor of 5.		
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	✓	2018	• Tier 1 Human Health Assessment.
APVMA	✓	2015	• No additional information.
ECHA	✓	2016	• No additional information.

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
HCIS	—
NICNAS	NA
EU Annex	NA
ECHA	—
ACGIH	Carcinogenicity – A4, Skin
DFG	H (skin)
SCOEL	NA
HCOTN	NA

Source	Notations
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

Calculation	
Adverse effects in human case study:	yes
Dermal LD_{50} ≤1000 mg/kg:	yes
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?	No

Additional information

Molecular weight:	278.33
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 11.4 mg/m^3; 1 mg/m^3 = 0.09 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.

Australian Pesticides and Veterinary Medicines Authority (APVMA) (2015) Fenthion Chemical Review

Deutsche Forschungsgemeinschaft (DFG) (2002) Fenthion – MAK value documentation.

European Chemicals Agency (ECHA) (2016) Fenthion – REACH assessment.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2018) Phosphorothioic acid, O,O-dimethyl O-[3-methyl-4-(methylthio)phenyl] ester: Human health tier I assessment – IMAP report.