ETHION

CAS number: 563-12-2

Synonyms: Nialate, diethion, bis[S-(Diethoxyphosphinothioyl)mercapto]methane, ethyl methylene phosphorodithioate, phosphorodithioic acid, S,S'-methylene O,O,O'O'-tetraethyl ester, O,O,O,O-tetraethyl-S,S'-methylene di(phosphorodithioate)

Chemical formula: $C_9H_{22}O_4P_2S_4$

Workplace exposure standard (amended)

TWA: **0.05 mg/m³**

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 0.05 mg/m³ is recommended to protect for cholinergic symptoms and other central nervous system (CNS) effects in exposed workers.

Discussion and conclusions

Ethion is an organophosphate insecticide used on citrus fruits, deciduous fruits, nuts and cotton.

Critical effects of exposure include decreased activity of cholinergic enzymes and CNS effects. Ethion has been cited in numerous poisoning incidents. Oral doses in humans of 0.05 mg/kg/day for 21 days did not report noticeable effects on plasma cholinesterase (ChE) activity and doses of 0.075 mg/kg/day for 21 days reported significant reductions of plasma ChE activity. A NOAEL 0.05 mg/kg/day for inhibition of red blood cell (RBC) ChE inhibition was reported in a one year oral study in dogs (ACGIH, 2018).

The recommended TWA of 0.05 mg/m³ is adopted directly from ACGIH (2018). This TWA is expected to be protective of cholinergic symptoms and other CNS effects in exposed workers.

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 dermal uptake and systemic effects in animals.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 0.4 mg/m^3***
ACGIH	***2003***	***TLV-TWA: 0.05 mg/m^3***

TLV-TWA recommended to prevent the occurrence of cholinergic symptoms and other adverse biologic effects in workers.
Summary of data:
Human data:
• Cited in numerous poisoning incidents
• Oral doses of 0.05 mg/kg/d for 21 d did not produce consistent effects on plasma ChE activity
  ○ significant reductions in plasma ChE activity reported at 0.075 mg/kg/d for 21 d
• TLV-TWA explanation: assuming 100% absorption, a dose of 0.1 mg/kg/d in a 70-kg worker inhaling 10 m^3 per 8 h shift ≡0.7 mg/m^3.
Animal data:
• NOAEL 0.05 mg/kg/h for RBC ChE inhibition in dogs; 1 yr, oral diet study
  ○ equivalent to a daily inhalation exposure of 0.35 mg/m^3
• Dermally treated rabbits exhibited inhibited ChE activity in plasma, RBC and brain at doses ranging from 1.0–250 mg/kg/d for 21 d
• Dermal LD_{50}: 245 (rats, males); 62 mg/kg (rats, female)
• Maternal toxicity (hyperactivity) and developmental toxicity (delayed ossification of pubis) at 2.5 mg/kg/d in rabbits; gavage at GD 6–15.
 	
TLV–TWA is sufficiently low to be protective of short-term exposure peaks.
Inadequate data to assign a sensitisation notation.		

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
US EPA	✓	1989	• NOEL of 0.05 mg/kg/d in humans; plasma ChE inhibition; same study as ACGIH (2018).

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	NA
ACGIH	Carcinogenicity – A4, Skin
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

Calculation	
Adverse effects in human case study:	
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%:	
	consider assigning a skin notation

IDLH

Is there a suitable IDLH value available?	No

Additional information

Molecular weight:	384.48
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 15.73 mg/m^3; 1 mg/m^3 = 0.06 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.

US Environmental Protection Authority (US EPA) (1989) Integrated Risk Information System (IRIS) Chemical Assessment Summary – Ethion.