TEMEPHOS

CAS number: 3383-96-8

Synonyms: O,O,O',O'-Tetramethyl O,O'-thiodi-p-phenylene phosphorothioate, Abat®, Abate®, Abathion®, Biothion®, Nimitex®, Swebate®

Chemical formula: $C_{16}H_{20}O_6P_2S_3$

Workplace exposure standard (amended)

TWA: **0.1 ppm (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 0.1 ppm (2 mg/m^3) is recommended to protect for cholinergic effects in exposed workers.

Discussion and conclusions

Temephos is an organophosphate pesticide (larvicide).

The critical effect of exposure is cholinesterase (ChE) inhibition, which may lead to cholinergic effects.

Human and animal inhalational data are limited. Significant dermal absorption is reported in occupationally exposed pesticide sprayers, but consequent adverse effects are not discussed in the available source material (ACGIH, 2018; HCOTN, 2003). Red blood cell (RBC) ChE inhibition in humans is not observed in repeat oral doses between 0.91 and 3.7 mg/kg/day (ACGIH, 2018). NOAEL of 0.3 to 0.46 mg/kg/day for ChE inhibition are reported in chronic and sub-chronic feeding studies with animals (ACGIH, 2018).

Both the recommendation of ACGIH (2018) and proposed health-based recommended OEL (HBROEL) of HCOTN (2003) rely on conversion of reported oral dose NOAEL to inhalational equivalents and derive a TWA recommendation between 1 to 2 mg/m^3. The proposed health-based occupational limit (HBROEL) TWA of 2 mg/m^3 by HCOTN (2003) is based on the oral NOAEL of 0.91 mg/kg/day for RBC ChE inhibition in volunteers and is recommended be adopted.

Volatile losses may be expected during sampling. Therefore, combined inhalable fraction and vapour phase should be considered during measurement.

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 due to evidence of appreciable dermal absorption in exposed workers and adverse effects in animals.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 10 mg/m^3***
ACGIH	***2005***	***TLV-TWA: 50 ppb (1 mg/m^3)***

TLV-TWA intended to protect for cholinergic effects.

Skin notation recommended due to reports of adverse effects following dermal absorption in humans and animals.

Not classifiable as a carcinogen in humans based on absence of carcinogenicity in chronic feeding studies with animals.

Summary of information:

TLV-TWA based on NOAEL reported for RBC ChE inhibition in repeat oral dose studies in humans, and sub-chronic and chronic feeding studies in animals. Oral NOAEL converted to inhalational equivalents assuming a respiratory volume of 10 m^3 in a 70 kg individual during an 8 h shift. Accordingly, a NOAEL of 3.7 mg/kg/d ≡26 mg/m^3 in humans and NOAEL of 0.46 and 0.3 mg/kg/d ≡3.5 and 2.1 mg/m^3 in dogs and rats, respectively.

TLV-TWA intended to be measured as combined inhalable fraction and vapour phase to account for volatile losses during sampling.

A BEI for ChE inhibiting organophosphates is available.

Human data:

- No adverse effects in individuals exposed to drinking water and walls of residences treated with substance
- Topical treatment for lice with 486–814 mg/kg doses with a 2% powder considered safe and effective in cited article
- No changes to RBC or plasma ChE activity at 1 mg/kg in volunteer repeat oral dose study
- No changes in RBC or plasma ChE activity or other adverse effects noted at 0.03–3.7 mg/kg in repeat dose study where doses were incrementally doubled during the study period (n=28, 4 wk):
  - substance detectable in urine for up to 3 wk post-exposure.

Animal data:

- Oral LD_{50}: 8,000–13,000 mg/kg (rats); 4,700 mg/kg (mice); cholinergic symptoms observed
- Dermal LD_{50}: >4,000 mg/kg (rats); 970–1,850 mg/kg (rabbits):
  - ChE inhibition at dermal dose of 1,200 mg/kg (rats)
- LC_{50}: >1,300 mg/m^3 (rats, 4 h)
- Significant RBC ChE inhibition at 0.9 and 17.5 mg/kg/d in repeat feeding study (rats, 90 d):
  - decreased body weight (females) and liver weight (males) at 17.5 mg/kg/d
  - NOAEL: 0.3 mg/kg/d (lowest dose)
- No evidence of carcinogenicity or clinical toxicity (ChE activity not measured) at 0.5, 5 and 15 mg/kg/d in chronic feeding study (rats, 2 yr)
- Significant RBC and plasma ChE inhibition at 12.5 mg/kg/d in chronic feeding study (dogs, 2 yr):
  - NOAEL: 0.46 mg/kg/d

Source	Year set	Standard
• Non-genotoxic in several *in vitro* assays with bacteria, or *in vivo* with rabbits (no further details provided) • No effects on reproduction or development at 0–6.2 mg/kg/d in 3-generation feeding study (rats) • No foetal or maternal toxicity at 0–30 mg/kg/d (oral dose) or 0–35 mg/kg/d (dermal dose) in 2 developmental studies (rabbits, GD 6–18): ○ reduced maternal weight gain at dermal dose of 50 mg/kg/d. Insufficient data to recommend a TLV-STEL or sensitiser notation.		
DFG	***NA***	***NA***
No report.		
SCOEL	***NA***	***NA***
No report.		
OARS/AIHA	***NA***	***NA***
No report.		
HCOTN	***2003***	***TWA: 10 mg/m^3***
Summary of additional information: Existing administrative OEL considered too high; HBROEL derived from NOAEL of 0.91 mg/kg/d reported in volunteer 4 wk oral dose study (also cited by ACGIH, 2018). A UF of 3 is applied to account for intraindividual variation and the oral dose is converted to an inhalational equivalent assuming a respiratory volume of 10 m^3 in a 70 kg individual during an 8 h shift to derive the proposed HBROEL of 2 mg/m^3. Skin notation not recommended or proposed based on low estimated skin absorption in humans and low acute lethal dermal toxicity in animals. Human data: • Agency concludes NOAEL of 0.91 mg/kg from 2 volunteer oral dose studies (also cited by ACGIH, 2018). Animal data: • Diarrhoea and reduced ChE activity at 178 mg/kg/d in repeat dermal dose study (rabbits, 5 d, no further details provided) • No data on mutagenic or genotoxic potential available.		

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	—
HCIS	NA
NICNAS	NA
EU Annex	NA
ECHA	NA
ACGIH	Carcinogenicity – A4, Skin
DFG	NA
SCOEL	NA
HCOTN	—
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:	yes	
In vivo dermal absorption rate >10%:		
Estimated dermal exposure at WES >10%:	no	
		a skin notation is warranted

IDLH

Is there a suitable IDLH value available?	No

Additional information

Molecular weight:	466.5
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 19.0 mg/m^3; 1 mg/m^3 = 0.05 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.

Health Council of the Netherlands (HCOTN) (2003) Temephos. Health-based calculated occupational cancer risk values. The Hague: Health Council of the Netherlands; publication no. 2000/15OSH/076.