SULFOTEP

CAS number: 3689-24-5

Synonyms: Dithion, dithiophos, sulfotepp, TEDP, tetraethyl dithionopyrophosphate, tetraethyl dithiopyrophosphate, thiotepp

Chemical formula: $C_8H_{20}O_5P_2S_2$

Workplace exposure standard (amended)

TWA: —

STEL: —

Peak limitation: —

Notations: Sk.

IDLH: 10 mg/m^3

Sampling and analysis: N/A

Recommendation and basis for workplace exposure standard

This chemical has been nominated for removal from the *Workplace exposure standards for airborne contaminants* due to a lack of evidence that it is used or generated in Australian workplaces or that it presents a potential for legacy exposure. Therefore, a TWA is not recommended.

Discussion and conclusions

Sulfotep is an organophosphorus insecticide used to control a range of acarine and hemipteran pests. It is used in greenhouses as fumigants. There is lack of evidence that this chemical is used or generated in Australian workplaces or that it presents a potential for legacy exposure.

The critical effects of exposure are inhibition of cholinesterase (ChE) activity.

Inhalational exposure data for humans are limited to accidental poisonings with symptoms of acute exposure including nausea, vomiting, burning eyes, blurred vision, breathing problems, headache, muscle twitching in arms and legs and weakness. No quantitative data are available (ACGIH, 2018). In animal studies, dogs appear more sensitive to adverse effects than rats. NOAEL of 0.01 mg/kg/day and 0.75 mg/kg/day for red blood cell (RBC) ChE inhibition are reported in a 13-week feeding study in dogs and rats, respectively. A NOAEL 0.5 mg/kg/day is reported in a two-year feeding study in rats. A NOAEC of 1.9 mg/m^3 is reported for increased lung weight in a 12-week inhalation study in rats (ACGIH, 2018; DFG, 2011; SCOEL, 1997).

ACGIH (2005) and SCOEL (1997) recommend occupational exposure limit of 0.1 mg/m^3. DFG (2011) recommend a MAK of 0.01 mg/m^3.

This chemical has been nominated for removal from the WES list. A TWA is not recommended.

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 dermal absorption and contribution to adverse systemic effects.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***0.007 ppm (0.1 mg/m³)***
ACGIH	***2005***	***TLV-TWA: 0.008 ppm (0.1 mg/m³) Inhalable fraction and vapour***

TLV-TWA recommended to minimise the risk of RBC ChE inhibition. TLV-TWA is derived from animal data.

Summary of data:

Human data:

- Symptoms of acute poisoning in 2 men conducting spraying:
  - nausea, vomiting, burning eyes, blurred vision, breathing problems, headache, muscle twitching in arms and legs, weakness
  - marked reduction in blood ChE activity; activity recovered after 20 and 28 d
- 67 reports across US from 1982–1995 of various poisonings or incidents; no further information
- Skin lesions reported during spraying; no further information
- Lack of suitable studies linking exposure to RBC ChE activity.

Animal data:

- Oral LD_{50}: 5 mg/kg (rats); 21.5 mg/kg (female mice); 25 mg/kg (male rabbits); 3 mg/kg (male cats); 5 mg/kg (male dogs):
  - exposure in all species caused depressed ChE activity of peripheral and CNS
  - oral doses at 3–12 m/kg in rats caused 5–64% depression of RBC AChE activity and 0–56% depression of plasma AChE activity (at 25 h)
  - surviving rats recovered 1–4 d post-dosing
- LD_{50}: 65 mg/kg (rats, dermal, 7 d), depression of ChE activity of peripheral and CNS; 20 mg/kg (rabbit, dermal)
- 4 h LC_{50}: 38 mg/m^3 (female rats); 59 mg/m^3 (male rats); 40 mg/m^3 (mice)
- Non-irritating to skin of rabbits (24 h duration):
  - slight redness when applied to rabbit eye returning to normal within 24 h
- Rats dosed at 0, 0.89, 1.94, or 2.83 mg/m^3, whole body, 6 h/d, 5 d/wk, 12 wk duration:
  - increased lung weight of females at 2.83 mg/m^3
  - no effects on RBC AChE activity
- 90 d feeding study in rats dosed at 5, 10, 20 or 50 ppm and dogs at 0.5, 3, 15 or 75 ppm:
  - decreased RBC ChE activity in rats at 20 and 50 ppm (≡1.3 and 3.3 mg/kg)
  - decreased RBC ChE activity in dogs at 15 and 75 ppm (≡0.5 and 3 mg/kg)
  - some vomiting and diarrhea in dogs at 15 ppm; more frequent at 75 ppm
- NOEL 10 ppm in 2 yr feeding study in rats, dosed at 0, 2, 10, or 50 ppm, for inhibition of RBC ChE activity
- No adverse effects observed in 2 yr feeding study in mice, same dose concentrations as rats
- Conflicting results for mutagenicity in *S. typhimurium* strain TA1535 with metabolic activation; genotoxicity not observed in all other *in vivo* studies

Source	Year set	Standard
• No evidence of maternal or foetal toxicity in rats or rabbits. A skin notation is assigned. Insufficient data to assign a SEN notation or recommend a TLV-STEL.		
DFG	***2011***	***MAK: 0.01 ppm (0.13 mg/m³)***
Summary of additional data: • NOAEL from 13 wk and 2 yr feeding studies in rat identified as 0.75 and 0.5 mg/kg/d respectively (ACGIH, 2018) • NOAEC of 1.9 mg/m³ identified in rats for increased lung weight, from 12 wk study cited in ACGIH (2018) • MAK derived from 13 wk feeding study in dogs (cited in ACGIH, 2018) as the most sensitive species, with NOAEL of 0.5 ppm (≡0.014 mg/kg/d) identified for AChE inhibition: ○ for derivation of concentration in air, value is converted to 5 d exposure, species-specific correction factor of 1:1.14 (dog) applied; assuming 100% oral absorption, 70 kg body weight and 10 m³ expired air volume arrives at concentration of 0.28 mg/m³ (0.021 ppm): ○ chemical can be present as vapour at this concentration, thus MAK of 0.01 ppm ○ no decrease in NOAEL in rats from subchronic to chronic study reported as justification for application of subchronic data.		
SCOEL	***1997***	***TWA: 0.1 mg/m³***
Summary of additional data: • No information on exposure in humans • No evidence of skin sensitisation in 12 male guinea pigs; at 100% then 50%: ○ 3 died following 1st or 2nd induction due to high doses • No increased incidences of tumours in rats and mice exposed up to 50 ppm in diet, 2y duration • As skin absorption is major route of uptake, biological monitoring may be more appropriate • TWA derived from NOAEL of 1.9 mg/m³ identified from 12 wk inhalation study in rats. UF of 20 is applied to extrapolate from subchronic study and noting rats relatively insensitive to effects. TWA of 0.1 mg/m³ is supported by 13 wk feeding study in dogs: ○ NOAEL 0.5 ppm (≡0.0125 mg/kg/d), SCOEL derive a value of 0.09 mg/m³.		
OARS/AIHA	***NA***	***NA***
No report.		
HCOTN	***NA***	***NA***
No report.		

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	Skin
HCIS	—
NICNAS	NA
EU Annex	NA
ECHA	NA
ACGIH	Carcinogenicity – A4, Skin
DFG	H (skin)
SCOEL	Skin
HCOTN	NA
IARC	NA
US NIOSH	SK:SYS

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:	yes
Dermal LD_{50}/Inhalation LD_{50} <10:	yes
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? Yes

Additional information

Molecular weight:	322.30
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 13.2 mg/m^3; 1 mg/m^3 = 0.076 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) (2012) Sulfotep – MAK value documentation.

EU Scientific Committee on Occupational Exposure Limits (SCOEL) (1997) Recommendation from the Scientific Committee on Occupational Exposure Limits for sulfotep. SCOEL/SUM/69.

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

US National Institute for Occupational Safety and Health (NIOSH) (2015 DHHS (NIOSH) Publication Number 2015-227) NIOSH Skin Notation Profiles: Tetraethyl dithionopyrophosphate (TEDP).