FENSULFOTHION

CAS number: 115-90-2

Synonyms: Dasanit, O,O-diethyl-O-(4-methylsulfinyl) phenyl)-phosphorothioate, Terracur R

Chemical formula: $C_{11}H_{17}O_4PS_2$

Structural formula: —

Workplace exposure standard (amended)

TWA: **0.01 mg/m^3 (inhalable fraction and vapour)**

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 0.01 mg/m^3 is recommended to protect for cholinergic effects in exposed workers.

Discussion and conclusions

Fensulfothion is an organophosphate insecticide that was registered for use in the USA until 1990. The critical effect of exposure is cholinesterase inhibition based on animal studies. Acute exposure in humans is lethal and has been associated with nausea, vomiting and abdominal pain (ACGIH, 2018).

Quantitative human exposure data are limited, the recommended TWA is therefore based on chronic feeding studies in animals (ACGIH, 2018). Of two chronic feeding studies, the most conservative NOAEL is 0.025 mg/k/day for cholinesterase inhibition in dogs and is used for deriving the TWA. An equivalent air concentration at this NOAEL approximates to 0.2 mg/m^3 following toxicokinetic conversion. An overall factor of 20 is applied to this value of 0.2 mg/m^3 to afford the recommended TWA of 0.01 mg/m^3.

The TWA is intended to be measured as the combined inhalable particulate fraction and vapour to account for potential evaporative losses during sampling (ACGIH, 2018).

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 for dermal absorption and adverse systemic effects in animals and humans.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 0.1 mg/m^3***
ACGIH	***2005***	***TLV-TWA: 0.0008 ppm (0.01 mg/m^3) inhalable fraction and vapour***

TLV-TWA intended to protect for cholinergic effects.

Summary of data:

No quantitative toxicological data available for exposure in humans; case studies of poisonings are however indicative of the cholinergic effects observed in animal studies. TLV-TWA derived from a NOAEL of 0.025 mg/kg/d for cholinesterase inhibition in a chronic feeding study with dogs. Conversion to an inhalational dose assuming 100% absorption in a 70-kg person with a respiratory volume of 10 m^3 per 8-h shift results in a NOAEC of 0.2 mg/m^3. The TLV-TWA of 0.01 mg/m^3 is derived by dividing the NOAEC by a factor of 20 to account for uncertainty in the database. Evaporative losses may occur during exposure sampling; TLV-TWA includes inhalable particulate fraction and vapour.

Human data:

- Accidental fatal poisoning >24 h when applied to potato crops; autopsy showed pulmonary oedema and blood cholinesterase inhibition
- Combined dermal and oral poisoning led to vomiting, nausea, disorientation, diarrhoea and abdominal pain.

Animal data:

- Oral LD_{50}: 1.8 mg/kg (female rats), 4.1 mg/kg (male rats):
  - symptoms appear within 15 min, lethal within 2 h
  - cholinergic inhibition of sub-lethal doses peaks at 1–2 h, occurs equally in central and peripheral nervous systems, and persists for 3–5 d
- Dermal LD_{50}: 3.5–4.1 mg/kg (female rats), 19–30 mg/kg (male rats)
- Facile oral absorption; metabolic oxidation produces active cholinesterase inhibiting agent
- LC_{50}: 113 mg/m^3 (male rats, 1 h), 29.5 mg/m^3 (male rats, 4 h)
- Repeat feeding carcinogenicity study with treatment groups of 1, 5 and 20 ppm of diet (rats, 17 mo) reported:
  - LOAEL: 1 ppm ≡0.05 mg/kg/d for plasma, RBC, and brain cholinesterase inhibition, no histopathological effects noted
- No evidence for carcinogenicity in chronic feeding study with treatment groups of 1, 2 and 5 ppm of diet (dogs, 2 yr):
  - NOAEL: 1 ppm ≡0.025 mg/kg/d
  - LOAEL: 2 ppm ≡0.05 mg/kg/d for cholinergic effects; severe weight loss, and cholinergic poisoning at 5 ppm ≡0.125 mg/kg/d
- Non-mutagenic *in vitro*
- Slight reduction in lactation index of 3rd generation pups at maternally toxic doses in 3-generation reproductive study (rats); some females died before mating, no developmental effects at 1 ppm of diet ≡0.05 mg/kg/d.

A skin notation is recommended due to low dermal LD_{50} values in animals and reports of systemic poisoning in humans following skin contact.

Classified as non-carcinogenic in humans based on negative results of chronic animal feeding studies.

Source	Year set	Standard
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	***NA***	***NA***
No report.		

Secondary source reports relied upon

Source		Year	Additional information
NICNAS	✓	2018	• Tier I: agricultural and therapeutic uses are excluded from assessment.

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	—
NICNAS	NA
EU Annex	—
ECHA	—
ACGIH	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:	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%:		
		a skin notation is warranted

IDLH

Is there a suitable IDLH value available?	No

Additional information

Molecular weight:	308.40
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 12.6 mg/m^3; 1 mg/m^3 = 0.08 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.

European Chemicals Agency (ECHA) (2019) Fensulfothion – REACH assessment.

Tenth Adaptation to Technical Progress Commission Regulation (EU Annex) No 2017/776 amending, for the purposes of its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures (the CLP Regulation).

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