

DISULFOTON

CAS number: 298-04-4

Synonyms: Disyston, O,O-Diethyl-S-ethylmercaptoethyl dithiophosphate, Di-Syston, dithiosystox, phosphorodithioc acid O,O-Diethyl-S-(ethylthio)ethyl ester, thiodementon

Chemical formula: $C_8H_{19}O_2PS_3$

Structural formula: —

Workplace exposure standard (amended)

TWA: 0.02 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 0.02 mg/m³ is recommended to protect for cholinesterase inhibition in exposed workers.

Discussion and conclusions

Disulfoton is an organophosphate insecticide used on cotton, tobacco, sugar beet, corn, peanuts, wheat, potatoes and cereal grains. In humans disulfoton is absorbed through the skin and dermal exposure can cause systemic inhibition of cholinesterase. Combined inhalation and dermal exposure of workers at 0.6 mg/m³ resulted in minimal inhibition of RBC cholinesterase (ACGIH, 2018). A NOAEC of 0.16 mg/m³ was reported in a 13-week inhalation study in rats. A NOAEL of 0.025 mg/kg/d was reported a two-year feeding bioassay in dogs (ACGIH, 2018; HCOTN, 2003) which is equivalent to an inhalational exposure of 0.2 mg/m³ (ACGIH, 2018).

The recommended TWA of 0.02 mg/m³ is adopted from the HCOTN (2003) based on the NOAEC of 0.16 mg/m³ and divided by an uncertainty factor of 9 to account for inter- and intra-species variation and rounding up. The recommended TWA is supported by the NOAEL in dogs and considered protective for cholinesterase inhibition 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 suggesting dermal absorption and adverse systemic effects in humans.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	1991	TWA: 0.1 mg/m³
ACGIH	2002	TLV-TWA: 0.05 mg/m³
<p>TLV-TWA recommended to minimise the potential for effects on cholinesterase in exposed workers.</p> <p>Summary of data:</p> <p>Human data:</p> <ul style="list-style-type: none"> Human exposure observations; combined inhalation and dermal; minimal inhibition of RBC cholinesterase (23%) seen when airborne level was 0.6 mg/m³; 90 wk exposure No measurable decreases in plasma or RBC cholinesterase activity in 5 volunteers dosed orally with 0.75 mg/kg for 30 consecutive days; only dose tested A farmer who had worn contaminated gloves for several days developed weakness, fatigue and cyanosis Case studies of poisoning by ingestion, one fatal. <p>Animal data:</p> <ul style="list-style-type: none"> LC₅₀: 15–60 mg/m³, (4 h, rats) LD₅₀: 6–20 mg/kg (rats, dermal) Significant RBC cholinesterase inhibition at concentrations 0.1–1.4 mg/m³; 2 x 21 d inhalation studies in rats Repeat-dose feeding studies; brain and RBC cholinesterase activity unaffected at following dose: <ul style="list-style-type: none"> 0.5 mg/kg/d mice 0.04 mg/kg/d rat 0.025 mg/kg/d dog Did not produce tumours in lifetime feeding studies in rats and mice. <p>The lowest NOAEL in animals (dogs) of 0.025 mg/kg in was extrapolated to an equivalent inhalational NOAEC of ≈0.2 mg/m³ by assuming 100% absorption, 70 kg worker inhaling 10 m³ air in 8 h shift; inhalation. Therefore a TLV-TWA of 0.05 mg/m³ should be sufficiently protective.</p> <p>Insufficient data to recommend a sensitiser notation or STEL.</p>		
DFG	NA	NA
No report.		
SCOEL	NA	NA
No report.		
OARS/AIHA	NA	NA
No report.		
HCOTN	2003	TWA: 0.02 mg/m³
Summary of additional data:		

Source	Year set	Standard
<ul style="list-style-type: none"> • Previous TWA 0.1 mg/m³ • Considered very toxic after respiratory, dermal and oral exposure • NOAEL: <ul style="list-style-type: none"> ○ 0.025 mg/kg bw for dogs; 2 yr oral study ○ 0.4 mg/kg bw for rabbits; 3 wk dermal ○ 0.16 mg/m³ for rats; 13 wk inhalation ○ <0.04 mg/kg bw for rats; 2 yr oral • Derives TWA from NOAEL of 0.16 mg/m³ and application of an assessment factor of 9 to account for intra- and interspecies variation; rounded to preferred numeral. 		

Secondary source reports relied upon

Source	Year	Additional information
US EPA	✓ 1987	<ul style="list-style-type: none"> • LEL 0.04 mg/kg/d; 2 yr, rat, oral • 2 yr feeding, dog; NOEL 0.025 mg/kg/d; LEL 0.05 mg/kg/d

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	NA
ECHA	NA
ACGIH	Carcinogenicity – A4, Skin
DFG	NA
SCOEL	NA
HCOTN	Skin
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 LD₅₀ ≤1000 mg/kg: yes
Dermal repeat-dose NOAEL ≤200 mg/kg:
Dermal LD₅₀/Inhalation LD₅₀ <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: 274.38
Conversion factors at 25°C and 101.3 kPa: 1 ppm = 11.22 mg/m³; 1 mg/m³ = 0.089 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
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[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) Disulfoton. Health-based calculated occupational cancer risk values. The Hague: Health Council of the Netherlands; publication no. 2000/15OSH/071.

US Environmental Protection Authority (US EPA) (1987) Integrated Risk Information System (IRIS) Chemical Assessment Summary – Disulfoton.