



# STRYCHNINE

**CAS number:** 100-42-5

**Synonyms:** Strychnidin-10-one, strychnos

**Chemical formula:**  $C_{21}H_{22}N_2O_2$

## Workplace exposure standard (retained)

**TWA:** 0.15 mg/m<sup>3</sup>

**STEL:** —

**Peak limitation:** —

**Notations:** —

**IDLH:** 3 mg/m<sup>3</sup>

**Sampling and analysis:** The recommended value is quantifiable through available sampling and analysis techniques.

## Recommendation and basis for workplace exposure standard

A TWA of 0.15 mg/m<sup>3</sup> is recommended to protect for neurotoxic and central nervous system (CNS) effects in exposed workers.

## Discussion and conclusions

Salts of strychnine (nitrate, sulphate, phosphate) have been used as rodenticides, in poisoned baits for larger animals and in medicine.

The critical effects of exposure are neurotoxicity and effects on the CNS, with exposure leading to hyperpyrexia, photophobia, muscular rigidity, joint stiffness, hysteria, myalgia lassitude and death (ACGIH, 2018; DFG, 1999).

No inhalational data are available. Numerous deaths have occurred following ingestion with a mean lethal dose in humans reported at 1.5 to 2.0 mg/kg; however, there is a wide individual variability in the response to poisoning with single doses of 0.07 mg/kg reported as lethal (ACGIH, 2018; DFG, 1999). There is no evidence of cumulative toxicity. A 28-day study in rats dosed at 5 or 10 mg/kg/day (males) and 2.5 mg/kg/day (females) caused transient slight trembling but no other substance-related changes. Mortality occurred at lowest dose. Subcutaneous injection at 0.25 to 0.35 mg/kg in dogs and guinea pigs generally caused increased reflexes or tonic-clonic convulsions (DFG, 1999). A TWA of 0.15 mg/m<sup>3</sup> corresponds to a total dose of 0.02 mg/kg/day (ACGIH, 2018; HCOTN, 2004).

A TWA of 0.15 mg/m<sup>3</sup> by SWA and ACGIH (2018) is recommended to be retained and is cited to adequately protect for neurotoxic and CNS effects and death in 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.



There are insufficient data to recommend a skin notation.

DRAFT

## APPENDIX

### Primary sources with reports

Source	Year set	Standard
<b>SWA</b>	<b>1991</b>	<b>TWA: 0.15 mg/m<sup>3</sup></b>
<b>ACGIH</b>	<b>2001</b>	<b>TLV-TWA: 0.15 mg/m<sup>3</sup></b>
<p>TLV-TWA recommended to minimise neurotoxic and CNS effects in exposed workers. TWA recommended based on reported fatal doses of 5 mg. TWA corresponds to dose of 0.02 mg/kg/d and deemed protective of adverse health effects.</p> <p>Summary of data:</p> <p>Human data:</p> <ul style="list-style-type: none"> <li>• Mean human lethal dose 1.5–2.0 mg/kg</li> <li>• Exposure symptoms: hyperpyrexia, photophobia, muscular rigidity, joint stiffness, hysteria, myalgia, lassitude and headache</li> <li>• Mode of toxic action is alteration of nerve impulses in spinal cord</li> <li>• No evidence of cumulative toxicity</li> <li>• Numerous deaths in 1960s and 1970s in US from pharmaceutical and pesticide use, generally due to accidental ingestion: <ul style="list-style-type: none"> <li>◦ generalised convulsions may occur 15–30 min after ingestion</li> </ul> </li> <li>• Patients administered 5–7 mg reported muscle tightness, especially of neck and jaws; individual muscles may twitch; doses of 5 mg reported fatal (no further information)</li> <li>• Large variability in individual response to poisoning; children more sensitive than adults</li> <li>• Primarily absorbed from intestine and concentrated in liver</li> <li>• Rapidly eliminated in urine.</li> </ul> <p>Animal data:</p> <ul style="list-style-type: none"> <li>• Rat LD<sub>50</sub>: ≈16 mg/kg (oral); 0.9–2.8 mg/kg (IP injection); 0.57 mg/kg (IV injection); 1.81 and 4.01 mg/kg (female and male, subcutaneous)</li> <li>• Subcutaneous injection at 0.25–0.35 mg/kg every 3–7 d in dogs and guinea pigs; occasionally no increase in reflexes but generally produced increased reflexes or tonic-clonic convulsions.</li> </ul> <p>Insufficient data to recommend skin, SEN or carcinogenicity notations or TLV-STEL.</p>		
<b>DFG</b>	<b>1999</b>	<b>Not assigned</b>
<p>Summary of additional data:</p> <ul style="list-style-type: none"> <li>• Deaths occurred in humans following doses &lt;7 mg; however, therapeutic doses of strychnine sulfate up to 7 mg were tolerated by humans without adverse effects on health (no further information)</li> <li>• After lethal intoxications of persons and dogs, highest concentrations were in blood, liver, bile and kidneys</li> <li>• No data available for irritation, sensitisation, reproductive toxicity, genotoxicity or carcinogenicity in humans</li> <li>• Median human lethal dose given as 1.5–2.0 mg/kg (as reported by ACGIH, 2018). other reports of lethality at:</li> </ul>		

Source	Year set	Standard
<ul style="list-style-type: none"> <li>15–30 mg (0.22–0.42 mg/kg) and</li> <li>5–10 mg (0.07–0.14 mg/kg)</li> <li>one patient survived dose of 3,750 mg (53.57 mg/kg)</li> <li>Survivors of poisoning suffered severe loss of visual acuity and left-sided paresis due to severe acidosis and prolonged hypoxia</li> <li>More toxic to female than male rats, attributed to higher rate of metabolism</li> <li>28-d study in rats (males, females, oral): <ul style="list-style-type: none"> <li>groups of 12 male rats dosed at 5 or 10 mg/kg/d</li> <li>groups of 12 female rats dosed at 2.5 mg/kg/d</li> <li>slight trembling developed in the animals 10–20 min after each dose and gradually regressed within the subsequent hour</li> <li>1 male rat died following 5 doses of 5 mg/kg; 5 male rats died in the 10 mg/kg dose group</li> <li>1 female rat in the study died (2.5 mg/kg)</li> <li>no other substance-related changes detected in surviving animals</li> <li>a NOAEL could not be derived due to death in the lowest dose group</li> <li>no further information provided</li> </ul> </li> <li>Not mutagenic in reversion test with <i>D. melanogaster</i>; result with <i>S. typhimurium</i> suggestive of effect on genetic recombination but is not mutagenic.</li> </ul> <p>MAK (up to 1999) was based on therapeutic doses up to 7 mg tolerated by humans without adverse health effects; withdrawn following reports of deaths following doses in this range (study details not included).</p>		
<b>SCOEL</b>	<b>NA</b>	<b>NA</b>
No report.		
<b>OARS/AIHA</b>	<b>NA</b>	<b>NA</b>
No report.		
<b>HCOTN</b>	<b>2004</b>	<b>TWA: 0.15 mg/m<sup>3</sup></b>
<p>Summary of additional data:</p> <ul style="list-style-type: none"> <li>ED<sub>50</sub> for convulsions very close to LD<sub>50</sub></li> <li>Studies suggest it may be specifically recombinogenic but not mutagenic</li> <li>No human inhalation data or acute toxicity data following dermal exposure</li> <li>Committee consider insufficient data to recommend HBROEL and that value may be too high given reported deaths in humans at doses of 5 mg.</li> </ul>		

## Secondary source reports relied upon

Source	Year	Additional information
US NIOSH	✓ 1994	<ul style="list-style-type: none"> <li>REL 0.15 mg/m<sup>3</sup></li> <li>IDLH of 3 mg/m<sup>3</sup> based on reported lethal oral dose of 1.5–2 mg/kg.</li> </ul>

## Carcinogenicity — non-threshold based genotoxic carcinogens

Is the chemical mutagenic? Insufficient data

Is the chemical carcinogenic with a mutagenic mechanism of action? Insufficient data

**Insufficient data are available to determine if the chemical is a non-threshold based genotoxic carcinogen.**

## Notations

Source	Notations
SWA	—
HCIS	—
NICNAS	Carc. Cat 3
EU Annex	NA
ECHA	—
ACGIH	—
DFG	—
SCOEL	NA
HCOTN	—
IARC	Carcinogenicity – Group 2A
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

Insufficient data to assign a skin notation.

## IDLH

Is there a suitable IDLH value available? Yes

## Additional information

Molecular weight:	334.4
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 13.68 mg/m <sup>3</sup> ; 1 mg/m <sup>3</sup> = 0.07 ppm
This chemical is used as a pesticide:	<input checked="" type="checkbox"/>
This chemical is a biological product:	<input type="checkbox"/>
This chemical is a by-product of a process:	<input type="checkbox"/>



Molecular weight:	334.4
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 13.68 mg/m <sup>3</sup> ; 1 mg/m <sup>3</sup> = 0.07 ppm
This chemical is used as a pesticide:	✓
A biological exposure index has been recommended by these agencies:	<input type="checkbox"/> ACGIH <input type="checkbox"/> DFG <input type="checkbox"/> SCOEL

## Workplace exposure standard history

Year	Standard
Click here to enter year	

## References

American Conference of Industrial Hygienists (ACGIH®) (2018) TLVs® and BEIs® with 7<sup>th</sup> 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) (1999) Strychnine – MAK value documentation.

Health Council of the Netherlands (HCOTN) (2004) Strychnine. Health-based reassessment of administrative occupational exposure limits. The Hague: Health Council of the Netherlands; publication no. 2000/15OSH/111.

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