ACRYLAMIDE

CAS number:	79-06-1
Synonyms:	Prop-2-enamide
Chemical formula:	C_3H_5NO
Structural formula:	

Workplace exposure standard (amended)

TWA:	**0.8 µg/m^3 (2.8x10^{-4} ppm)**
STEL:	**—**
Peak limitation:	**—**
Notations:	**Carc. 1B, Sk., DSEN**
IDLH:	**—**
Sampling and analysis:	The recommended value is below the current limit of detection for available sampling and analysis techniques.

Recommendation and basis for workplace exposure standard

A TWA of 0.8 µg/m^3 (2.8x10^{-4} ppm) is recommended to protect for excess cancers in exposed workers and is considered protective of other adverse health effects.

Discussion and conclusions

Based on evidence in animals and humans, acrylamide is considered to be a non-threshold based genotoxic carcinogen (ACGIH, 2001; DFG 1984; SCOEL 2012).

The recommended TWA has been derived at a minimal cancer risk level applying an inhalation slope factor. This factor was derived from a route-to-route extrapolation of the dose-response relationship (oral-to-inhalation exposure) by assuming a continuous 24 hour inhalation exposure, an average adult weight of 70 kg and breathing volume of 20 m^3/d (US EPA, 2010).

Recommendation for notations

Classified as a category 1 carcinogen according to the Globally Harmonized System of Classification and Labelling on Chemicals (GHS).

Classified as a skin sensitiser and not a respiratory sensitiser according to the GHS.

A skin notation is recommended based on sufficient evidence in humans demonstrating systemic effects following dermal exposure.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	**Year**	***TWA 0.3 mg/m^3***
ACGIH	***2005***	***TLV-TWA 0.03 mg/m^3 (0.01 ppm)***

TLV-TWA recommended to protect for symptoms related to the central nervous system and contact dermatitis.

Summary of data:

Human data:

- Occupational poisoning with exposure over weeks (no concentration provided) reported symptoms of contact dermatitis (peeling at site of contact) and polyneuropathy
- A worker exposure study and follow up investigating peripheral neuropathy outcomes (abnormal sensation, decreased motor strength, abnormal gait and skin abnormalities) reported an absence of clinical symptoms below 0.3 mg/m^3 (no duration provided)
- Vibration thresholds of fingers and toes were compared between exposed workers (0.2–1.58 mg/m^3) and healthy adults; with 58.8% of exposed workers demonstrating decreased vibration sensitivity
- Readily absorbed by skin demonstrated in poisonings in occupational setting.

Animal data:

- Tumour initiator in mouse skin via dermal, gavage and intraperitoneal routes
- LD_{50}: 150–180 mg/kg (rats, rabbits and guinea pigs, oral)
- Produced excess cancers in mice and rats at chronic oral doses of 2.0 mg/kg/d but not at 0.5 mg/kg/d
- Reported to be a germ cell mutagen.

TLV-TWA was derived based on uncertainties in cancer potency in occupational settings and germ cell mutagenicity.

DFG	***2009***	***NA***

MAK value not established due to carcinogenicity.

Summary of additional data:

- Dermal absorption of acrylamide in humans resulted in local skin peeling, followed by peripheral neuropathies
- Occupational allergic contact dermatitis reported, supported by positive results in animal studies; assigned a dermal sensitiser notation
- Carcinogenic potential demonstrated in long-term studies in rats
- All evidence suggests a genotoxic mode of action; also stimulates hormone-sensitive tissues such as mammary gland, testes and thyroid
- Negative mutagenicity seen in *Salmonella typhimurium, Escherichia coli* and *Neurospora crassa*
- Chromosomal damage in mice observed after dermal application
- Dermal absorption of 14–30% in applied doses in rats.

Source	Year set	Standard
SCOEL	***2011***	***NA***
Not assigned due to carcinogenicity Summary of additional data: • A NOAEL of 0.035 ppm (0.1 mg/ m^3) derived from 0.5 nmol adduct/g globin for neurotoxicity outcomes; based on a study in workers mainly exposed via dermal contact • Assigned a Carcinogenicity Category B notation as evidence indicates it is a genotoxic carcinogen, and the existence of a threshold cannot be sufficiently supported.		
OARS/AIHA	***NA***	***NA***
No report		
HCOTN	***2006***	***0.16 mg/m^3***
Summary of additional data: • Concluded it is a (weak) genotoxic carcinogen with a non-threshold/stochastic mode of action • TWA derived from recalculating oral exposure (drinking), corresponding with an excess risk of dying from cancer of 4 per 100,000.		

Secondary source reports relied upon

Source		Year	Additional information
NICNAS	✓	2002	• Genotoxic based on evidence from *in vitro* and *in vivo* studies in both somatic and germ cells • Meets the approved criteria for classification as a Category 2 carcinogen.
US EPA	✓	2010	• Carcinogenic by a mutagenic mode of action • Inhalation slope factor extrapolated (oral-to-inhalation exposure); assuming continuous 24 h inhalation exposure, 70 kg body weight and breathing volume of 20 m^3/d.

Carcinogenicity — non-threshold based genotoxic carcinogens

Is the chemical mutagenic?	Yes
Is the chemical carcinogenic with a mutagenic mechanism of action?	Yes
The chemical is a non-threshold based genotoxic carcinogen.	
Is a cancer slope factor or inhalation unit risk value available?	Yes
Cancer slope factor (1/(mg/kg/day))	1.0×10^{-04}
Calculated TWA value (µg/m^3)	0.8

Notations

Source	Notations
SWA	Carc. 1B, Skin
HCIS	Carcinogenicity – category 1B
NICNAS	Carcinogenicity – category 2
EU Annex	Carcinogenicity – category 1B, Skin sensitisation – category 1
ECHA	Carcinogenicity – category 1B
ACGIH	Carcinogenicity – A3, Skin
DFG	Sh (dermal sensitiser)
SCOEL	Carcinogenicity – Sensitisation (dermal), Skin
HCOTN	Carcinogenicity – category 1B, Skin sensitiser, Skin
IARC	Carcinogenicity – Group 2A
US NIOSH	SK:SYS, SK:SEN

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:	
Dermal repeat-dose NOAEL ≤200 mg/kg:	
Dermal LD_{50}/Inhalation LD_{50} <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, the chemical is a genotoxic carcinogen

Additional information

Molecular weight:	71.08
Conversion factors at 25°C and 101.3 kPa:	1 ppm = Number mg/m^3; 1 mg/m^3 = Number 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.

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