# Acrylamide

| CAS number: | 79-06-1 |
| --- | --- |
| Synonyms: | Prop-2-enamide |
| Chemical formula: | C3H5NO |
| Structural formula: |  |

 Workplace exposure standard (amended)

| TWA: | **0.8 µg/m3 (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/m3 (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 m3/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/m3 |
|  |
| ACGIH 2005 TLV-TWA 0.03 mg/m3 (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/m3 (no duration provided)
* Vibration thresholds of fingers and toes were compared between exposed workers

(0.2–1.58 mg/m3) 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
* LD50: 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.
 |
| SCOEL 2011 NA |
| Not assigned due to carcinogenicitySummary of additional data:* A NOAEL of 0.035 ppm (0.1 mg/m3) 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/m3 |
| 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 m3/d.
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### 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 x 10-04 |
| Calculated TWA value (µg/m3) | 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 | 4.00 |   |
| Dermal LD50 ≤1000 mg/kg: |   |   |   |
| 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** |

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### 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/m3; 1 mg/m3 = 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 [x]  DFG [x]  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*](http://www.acgih.org/tlv-bei-guidelines/policies-procedures-presentations) on the ACGIH website.

Deutsche Forschungsgemeinschaft (DFG) (2009) Acrylamide – MAK value documentation.

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US Environmental Protection Agency (US EPA) (2010) Toxicological Review of Acrylamide. EPA/635/R-07/009F

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