ACROLEIN

CAS number:	107-02-8
Synonyms:	Acrylaldehyde, prop-2-enal
Chemical formula:	C_3H_4O
Structural formula:	

Workplace exposure standard (amended)

TWA:	**0.02 ppm (0.05 mg/m^3)**
STEL:	**0.05 ppm (0.12 mg/m^3)**
Peak limitation:	**—**
Notations:	**Sk.**
IDLH:	**2 ppm**
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 0.02 ppm (0.05 mg/m^3) and a STEL of 0.05 ppm (0.12 mg/m^3) is recommended for acrolein to protect for irritation of the eyes, the mucous membrane and skin of exposed workers.

Discussion and conclusions

The recommended TWA is based on the lowest reported LOAEL of 0.2 ppm (0.47 mg/m^3) for a critical health endpoint of damage to the bronchial mucosa in rats in all reported studies. An uncertainty factor of 10 is applied to account for the absence of a NOAEL and limited human data on chronic exposure.

An acute adverse effect of eye irritation, not associated with severe chronic outcomes, was reported at 0.06 ppm (0.14 mg/m^3). Based on this information a STEL has been recommended.

Recommendation for notations

Not classified as a carcinogen according to the Globally Harmonized System of Classification and Labelling on Chemicals (GHS).

Not classified as a skin sensitiser or respiratory sensitiser according to the GHS.

A skin notation is recommended based on a dermal absorption study in rabbits.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 0.1 ppm (0.23 mg/m^3); STEL: 0.3 ppm (0.69 mg/m^3)***
ACGIH	***2001***	***TLV-Ceiling: 0.1 ppm (0.23 mg/m^3);***

TLV-Ceiling recommended to reduce the potential for intense irritation of the eyes, mucous membranes, respiratory tract and the development of pulmonary oedema.

Summary of data:

The recommended TLV-Ceiling was based on:
Human data:

- Reported to cause human fatalities at 10 ppm (no duration provided)
- Mucous membrane irritation threshold for humans reported at 0.25 ppm (5 min exposure).

Animal Data:

- LOAEC: 0.22 ppm (90 d; monkeys, dogs and guinea pigs; emphysema and inflammation of the lung, liver, kidney and heart)
- RD_{50}: 0.88 ppm (mouse)
- Mutagenic in *Salmonella* reverse mutation assays and produced bacterial DNA adducts
- Carcinogenicity not adequately evaluated; metabolite (glycidaldehyde) considered carcinogenic
- Reported as a potent teratogen in cultured rodent embryos.

A skin notation recommended based on a single dermal absorption study that reported an LD_{50} of 560 mg/kg (rabbit; duration not provided)
Insufficient data available to recommend a sensitiser notation.

DFG	***2001***	***Not assigned***

MAK withdrawn in 2001 based on evidence indicating genotoxicity. Therefore a concentration that is protective of carcinogenic effects in humans cannot be confidently identified.

Summary of additional data:

- NOAEL: 0.4 ppm (hamsters and rabbits; 6 h/d, 5 d/wk for 13 wk)
- LOAEL: 0.4 ppm (rats; 6 h/d, 5 d/wk for 13 wk)
- LC_{50}: 21 ppm (rats; 4 h)
- Mutagenic in adequately conducted mutagenicity tests
- Genotoxic in *in vitro* tests and in *Drosophila melanogaster*
- No carcinogenic studies in humans identified
- Metabolism of cyclophosphamide produces acrolein in humans. Cyclophosphamide identified as carcinogen based on the formation of bladder tumours
- Studies in hamsters, rats and mice (dermal, inhalation and oral exposure) yielded no evidence of carcinogenic effects.

Source	Year set	Standard
SCOEL	***2007***	***TWA: 0.02 ppm (0.05 mg/m^3); STEL: 0.05 ppm (0.12 mg/m^3)***
TWA and STEL recommended to protect for irritation of the eyes, the mucosae and skin in exposed workers. Summary of additional data: • TWA was based on LOAEL of 0.2 ppm (0.47 mg/m^3); damage to the bronchial mucosa of rats. An uncertainty factor of 10 was applied to account for the absence of a NOAEL and of human data on prolonged exposure • STEL based on an OAEL of 0.06 ppm (0.14 mg/m^3) for eye irritation in human volunteers, exposure >5 min.		
OARS/AIHA	***NA***	***NA***
No report		
HCOTN	***NA***	***NA***
No report		

Secondary source reports relied upon

Source		Year	Additional information
HSE	✓	1993	• TWA of 0.02 ppm and STEL of 0.05 ppm • No additional information
NICNAS	✓	2017	• The critical health effects are systemic acute effects (acute toxicity from oral, dermal and inhalation exposure); and local effects (corrosivity and respiratory irritation) • Based on the weight of evidence, classification for mutagenicity is not warranted • Not considered carcinogenic based on available animal data and the results for genotoxicity indicating lack of systemic mutagenic potential, • Sensory irritation in humans following acute exposure is reported at airborne concentrations of 0.34 mg/m^3 and above, below the current STEL • A review of the current exposure standard may be beneficial to mitigate the risk of adverse effects
IARC	✓	1995	• Inadequate evidence in humans and animals to determine carcinogenicity
US EPA	✓	2003	• LOAEL: 0.4 ppm (0.9 mg/m^3) from sub chronic rat inhalation study (based on evidence of nasal histopathology) • Reported HEC LOAEL: 0.01 ppm (0.02 mg/m^3); derived by adjusting the dosing regimen of 0.4 ppm (0.9 mg/m^3) by 6 h/d, 5 d/wk and applying a RGDR for rat to human (0.14).

Carcinogenicity — non-threshold based genotoxic carcinogens

Is the chemical mutagenic?	No

Notations

Source	Notations
SWA	—
HCIS	—
NICNAS	—
EU Annex	NA
ECHA	—
ACGIH	Carcinogenicity – A4, Skin
DFG	Carcinogenicity – 3B
SCOEL	—
HCOTN	NA
IARC	—
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:	
Dermal LD_{50} ≤1000 mg/kg:	yes
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?	Yes

Additional information

Molecular weight:	56.06
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.

Deutsche Forschungsgemeinschaft (DFG) (2001) Acrolein – MAK value documentation.

European Chemicals Agency (ECHA) (2012) – Background document to the Opinion proposing harmonised classification and labelling at EU level of Acrolein. 107-02-8 ECHA/RAC/CLH-O-0000001792-72-03/A1

EU Scientific Committee on Occupational Exposure Limits (SCOEL) (2007) Recommendation from the Scientific Committee on Occupational Exposure Limits for Acrolein. SCOEL//SUM/32.

International Agency for Research on Cancer (IARC) (1995) Acrolein. IARC Monographs on the evaluation of the carcinogenic risk to humans. VOL: 63.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2017) Acrolein. Human health tier II assessment – IMAP report.

UK Health and Safety Executive (HSE) (1993) Acrolein – EH64: Summary criteria for occupational exposure limits.

US Environmental Protection Agency (US EPA) (2003) Toxicology Review of Acrolein. In Support of Summary Information on the Integrated Risk Information System (IRIS).