ACETALDEHYDE

CAS number:	75-07-0
Synonyms:	Ethanal, ethyl aldehyde
Chemical formula:	C_2H_4O
Structural formula:	

Workplace exposure standard (interim)

TWA:	**—**
STEL:	**—**
Peak limitation:	**20 ppm (36 mg/m^3)**
Notations:	**Carc. Cat 2**
IDLH:	**2,000 ppm**
Sampling and analysis:	The recommended value is readily quantifiable through currently available sampling and analysis techniques.

Recommendation and basis for workplace exposure standard

A peak limitation of 20 ppm (36 mg/m^3) is recommended to protect for eye and respiratory tract irritation and the consequent risk of cancer in workers exposed to acetaldehyde at the workplace.

It is recommended that further assessment of the genotoxicity and mutagenicity data be undertaken at the next scheduled review of the workplace exposure standards.

Discussion and conclusions

Data in humans from observational studies indicate that acute exposures above 25 ppm result in irritation of the eyes, and exposures above 135 ppm result in upper respiratory tract irritation. An experimental study in humans demonstrated no significant effects below 50 ppm (ACGIH, 2018; DFG, 2008).

There is no evidence of mutagenic effects in identified bacterial reverse mutation assays. Data sources indicate that acetaldehyde is carcinogenic in animals. However, evidence is limited in humans. Tumour formation at the site of exposure (respiratory tract) suggests a threshold and therefore a non-genotoxic mechanism of carcinogenicity is assumed. Inflammation caused by repeated irritation and subsequent regenerative growth of the epithelia in organs of the olfactory/respiratory tract has been noted as a mechanism of action for nasal and laryngeal cancers. The recommended peak limitation is expected to prevent the possibility of excess cancers in workers.

Recommendation for notations

Classified as a category 2 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 not warranted as there is no indication that acetaldehyde is absorbed through skin.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***2001***	***TWA: 20 ppm (36 mg/m^3); STEL: 36 ppm (91 mg/m^3)***
ACGIH	***2014***	***TLV - Ceiling: 25 ppm (45 mg/m^3)***

TLV-Ceiling recommended to prevent irritation of the eye and upper respiratory tract and is expected to prevent the possibility of excess cancers.

Summary of data:

Human data:

- Study of 12 workers: eye irritation in several individuals at 25 ppm (15 min) and in most subjects at 50 ppm. 200 ppm resulted in eye irritation for all subjects and respiratory irritation for most subjects.
- A controlled exposure study of 14 workers reported mild upper respiratory tract irritation in all subjects (135 ppm, 30 min)
- An exposure chamber study of 20 males showed no significant effects on nasal mucosa (50 ppm; 4 h):
- Epidemiological study (150 workers): excess risk of respiratory tract (N=5) and oral cavity (N=2) cancers in workers at an aldehydes chemical plant. However, evidence of carcinogenicity is not considered robust due to multiple chemical exposures
- Odour threshold in humans reported at 0.21 ppm.

Animal data:

- LC_{50}: 20,000 ppm (rats, 30 min); 13,300 ppm (rats, 4 h)
- Evidence of carcinogenicity in animals (nasal, laryngeal); limited evidence in humans (oral cavity)
- No evidence of mutagenic effects in bacterial reverse mutation assays
- Positive *in vitro* results for genotoxicity in *Drosophila;* mechanisms of mutagenicity not firmly established.

No studies reported on dermal absorption.

Insufficient data available to assign a dermal or respiratory sensitiser notation.

Insufficient data available to assign a Skin notation.

Source	Year set	Standard
DFG	***2008***	***MAK: 50 ppm (91 mg/m³)***
MAK value recommended to reduce the potential for irritant effects in the nasal mucosa and is also expected to be protective against cancer in exposed workers. Summary of data: • NOAEC: 150 ppm and LOAEC: 500 ppm (rats, 4 wk) • Tumour formation attributed to genotoxic effects • Lethal mutations observed in *Drosophila melanogaster* • No studies of dermal absorption identified • Based on a systemic NOAEC of 1,365 mg/m^3 and physicochemical data, the contribution of dermal exposure to systemic toxicity is low • No data available for respiratory sensitisation • Limited data available for contact (skin) sensitisation.		
SCOEL	***NA***	***NA***
OARS/AIHA	***NA***	***NA***
HCOTN	***NA***	***NA***

Secondary source reports relied upon

Source		Year	Additional information
NICNAS	✓	2017	• Based on the weight of evidence, considered to be genotoxic • Tumour formation at the site of exposure suggests a threshold (non-genotoxic) mechanism of carcinogenicity • Does not exhibit mutagenic activity in *Salmonella typhimurium.*

Carcinogenicity — non-threshold based genotoxic carcinogens

Is the chemical mutagenic?	No

Notations

Source	Notations
SWA	Carc. 2
HCIS	—
NICNAS	Carc. Cat. 3
EU Annex	NA
ECHA	Carcinogenicity – category 2
ACGIH	Carcinogenicity – A2
DFG	Carcinogenicity – category 5

Source	Notations
SCOEL	NA
HCOTN	Carcinogenicity – category 1B
IARC	Carcinogenicity – Group 2B
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:	no
Dermal LD_{50} ≤1000 mg/kg:	no
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 not warranted

IDLH

Is there a suitable IDLH value available? Yes

Additional information

Molecular weight:	44.05
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) (2008) Acetaldehyde – MAK value documentation.

European Chemicals Agency (ECHA) (2008) Acetaldehyde – IFRA Response to the ECHA Public Consultation on the CLH report "Proposal for Harmonized Classification and Labelling of acetaldehyde" based on regulation (EC) 1272/2008 (CLP Regulation), Annex VI, Part 2.

Health Council of the Netherlands (HCOTN) (2014) Subcommittee on the Classification of Carcinogenic Substances of the Dutch Expert Committee on Occupational Safety. Acetaldehyde: Re-evaluation of the carcinogenicity and genotoxicity. The Hague: Health Council of the Netherlands, 2014/28.

International Agency for Research on Cancer (IARC) (1999) Acetaldehyde. IARC Monographs on the evaluation of the carcinogenic risk to humans.

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

US National institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life and health concentrations – acetaldehyde.