

DIETHANOLAMINE

CAS number: 111-42-2

Synonyms: 2,2'-Iminodiethanol, DEA, bis(hydroxyethyl)amine, ethanol, 2,2'-iminobis

Chemical formula: $C_4H_{11}NO_2$

Structural formula: —

Workplace exposure standard (amended)

TWA: 0.11 ppm (0.5 mg/m³)

STEL: —

Peak limitation: —

Notations: Sk.

IDLH: —

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

Recommendation and basis for workplace exposure standard

A TWA of 0.11 ppm (0.5 mg/m³) is recommended to protect for local irritation effects and effects in the liver and kidneys in exposed workers.

Discussion and conclusions

Diethanolamine (DEA) is used in various industrial, commercial and consumer products and processes such as a liquid detergent for emulsion paints, as a corrosion inhibitor and in cosmetic formulations.

Critical effects following inhalation in animal studies include local effects on the upper respiratory tract and effects in the liver and kidneys (ACGIH, 2018; DFG 2006). Limited human data are available. A NOAEC of 1.5 mg/m³ is reported in a sub-chronic study in rats. The LOAEC is reported at 3 mg/m³ with minor, reversible effects in the upper respiratory tract (DFG, 2006; HCOTN, 2005). A NOAEL of 2 mg/kg/day reported in a drinking water study in rats with effects at 4 mg/kg/day included liver damage and death. This value is equivalent to a human inhalation concentration of 14 mg/m³ over an eight hour period (ACGIH, 2018).

HCOTN (2005) derived a TWA of 0.11 ppm (0.5 mg/m³) by dividing the NOAEC of 1.5 mg/m³ by a factor of four to account for inter- and intra-species differences. Noting the steep response curve for systemic effects in the liver of rats, a TWA of 0.11 ppm is considered sufficiently protective for the critical effects identified.

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. However, noting that occupational asthma is reported in worker studies and positive reactions reported in worker patch studies, a review of the classification for skin and respiratory sensitisation is recommended.

A skin notation is recommended based on evidence of dermal uptake and systemic effects in animals.

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APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	1991	TWA: 3 ppm (13 mg/m³)
ACGIH	2009	TLV-TWA: 0.2 ppm (1 mg/m³)
<p>TLV-TWA recommended based on effects in the liver and kidneys.</p> <p>Summary of data:</p> <p>Human data:</p> <ul style="list-style-type: none"> • DEA elicited positive reactions in 3% of 251 workers who underwent 2 y patch testing • Slight increase of FEV at 0.5 mg/m³ in patient suspected to have DEA-induced occupational asthma. <p>Animal data:</p> <ul style="list-style-type: none"> • 0.5 ppm for 6 h/d for 45 d: no effects in rats, guinea pigs, or dogs • 0.26 ppm for 24 h/d for 90 d: liver damage in rats, guinea pigs and dogs • 25 ppm for 6 h/d for 10 d: increased liver weight in rats • 6 ppm for 6 h/d, 5 d/wk for 13 wk: increased liver and kidney weight, reduced rate of body weight gain and some mortalities in male rats • Evidence suggests lower exposure concentrations for extended time periods may produce greater adverse response • NOEL: 20 mg/kg/d (rats, oral diet); kidney and liver effects • NOEL: 2 mg/kg/d (rats, oral drinking water); deaths and liver damage at 4 mg/kg/d; suggests steep dose-response curve • NOEL of 2 mg/kg/d \equiv inhalation dose of 14 mg/m³ (3.2 ppm); 70 kg worker breathing 10 m³ per 8 h shift • Dermal application to rodents produced dose-related increase in liver tumours in female mice • LD₅₀: 12.7 mg/kg (rabbits, dermal). <p>No evidence of mutagenicity.</p> <p>No developmental effects identified.</p> <p>Insufficient data to recommend a STEL or SEN notation.</p>		
DFG	2006	MAK: 1 mg/m³
<p>Summary of additional data:</p> <ul style="list-style-type: none"> • Dermal carcinogenicity study in mice observed liver and kidney tumours at 40 mg/kg • No mutagenic effects identified • NOAEC of 1.5 mg/m³ in rats; 3 mo inhalation study; LOAEC 3 mg/m³ for reversible upper respiratory squamous metaplasia • MAK based on NOAEC of 1.5 mg/m³ and minimal effects at LOAEC of 3 mg/m³ • NOAEC of 50 mg/m³ for prenatal developmental effects. 		



Source	Year set	Standard
SCOEL	NA	NA
No report.		
OARS/AIHA	NA	NA
No report.		
HCOTN	2005	TWA: 0.5 mg/m³
Summary of additional data:		
<ul style="list-style-type: none"> TWA based NOAEC of 1.5 mg/m³ for reversible squamous metaplasia of the laryngeal epithelium; assessment factor of 4 applied to account for inter- and intraspecies variation, differences between experimental conditions and the exposure pattern of the worker, and the type, low incidence, and slightness of the critical effect Rounded to nearest number. 		

Secondary source reports relied upon

Source	Year	Additional information
NICNAS	✓ 2016	<ul style="list-style-type: none"> No further information.

Carcinogenicity — non-threshold based genotoxic carcinogens

Is the chemical mutagenic?

No

The chemical is not a non-threshold based genotoxic carcinogen.

Notations

Source	Notations
SWA	—
HCIS	NA
NICNAS	NA
EU Annex	NA
ECHA	—
ACGIH	Carcinogenicity – A3, Skin
DFG	H (skin), Sh (dermal sensitiser)
SCOEL	NA
HCOTN	—
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:

Dermal LD₅₀ ≤ 1000 mg/kg: **yes**

Dermal repeat-dose NOAEL ≤ 200 mg/kg:

Dermal LD₅₀/Inhalation LD₅₀ < 10:

In vivo dermal absorption rate > 10%:

Estimated dermal exposure at WES > 10%:

consider assigning a skin notation

IDLH

Is there a suitable IDLH value available? No

Additional information

Molecular weight: 105.14

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 ☐ 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) (2006) Diethanolamine – MAK value documentation.

Health Council of the Netherlands (HCOTN) (2005) 2,2'-Iminodiethanol. Health-based calculated occupational cancer risk values. The Hague: Health Council of the Netherlands; publication no. 2000/15OSH/152.

International Agency for Research on Cancer (IARC) (2013) Diethanolamine. IARC Monographs on the evaluation of the carcinogenic risk to humans.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2016) Ethanol, 2,2'-iminobis-: Human health tier III assessment – IMAP report.

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