# ETHYLAMINE

**CAS number:** 75-04-7

**Synonyms:** Aminoethane

**Chemical formula:** $C_2H_5NH_2$

**Structural formula:** —

## Workplace exposure standard (amended)

**TWA:** **5 ppm (9 mg/m$^3$)**

**STEL:** **15 ppm (28 mg/m$^3$)**

**Peak limitation:** **—**

**Notations:** **Sk.**

**IDLH:** **600 ppm**

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

## Recommendation and basis for workplace exposure standard

A TWA of 5 ppm (9 mg/m$^3$) is recommended to protect for upper respiratory tract irritation in exposed workers.

A STEL of 15 ppm (28 mg/m$^3$) is recommended to protect for irritation and potential eye and lung damage from acute exposures at higher concentrations.

## Discussion and conclusions

Ethylamine is used as a solvent, in chemical manufacture and petroleum refinement. Critical effects are upper respiratory tract irritation, and lung and kidney damage at higher concentrations (ACGIH, 2018).

Human exposure data are limited; however, occupational exposure has been associated with eye irritation and oedema (ACGIH, 2018). A LOAEC of 50 ppm for eye and lung damage is reported in rabbit inhalation study. This study also reported heart muscle degeneration at 50 ppm. However, 100 ppm dose caused kidney damage but not eye or heart damage (ACGIH, 2018).

In the absence of reliable human exposure data, the recommended TWA of 5 ppm is derived from the LOAEC of 50 ppm in animals consistent with the derivations presented in primary source reports (ACGIH, 2018; DFG, 1996; SCOEL; 1994). A factor of ten is applied to account for the absence of an experimentally determined NOAEL and lack of chronic exposure data (SCOEL 1994). Whilst DFG (1996) provides an explanation for the TWA, no derivation was included in ACGIH (2018). The LOAEL is within an order of magnitude of the recommended TWA; a STEL of 15 ppm is therefore expected to protect for irritation effects and damage of eyes and lung in acutely exposed workers, which is in accordance with the recommendation presented by the ACGIH (2018).

Substance-specific carcinogenicity data are limited. A recent toxicological evaluation has grouped ethylamine with other primary amines based on similarities in structure and toxic endpoints (OECD,

2011). On this basis, the genotoxic and carcinogenic potential of ethylamine is considered low. The reported dermal $LD_{50}$ is within 10% of the calculated inhalational $LD_{50}$.

## 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.

A skin notation is recommended based on evidence for dermal absorption and adverse systemic effects in animals.

# APPENDIX

## Primary sources with reports

| Source | Year set | Standard |
|---|---|---|
| ***SWA*** | ***1991*** | ***TWA: 2 ppm (3.8 mg/m$^3$); STEL: 6 ppm (11 mg/m$^3$)*** |
| | | |
| ***ACGIH*** | ***2013*** | ***TLV-TWA: 5 ppm (9 mg/m$^3$); TLV-STEL: 15 ppm (28 mg/m$^3$)*** |

TLV-TWA intended to protect for irritation produced by repeat low-level exposures. TLV-STEL intended to prevent transient irritation produced at higher concentrations. Reversibility of critical effects is not discussed.

Summary of data:

TLV-TWA based primarily on animal data that suggest adverse lung and kidney effects occur due to inhalation of 50 and 100 ppm, respectively. Limited substance-specific human toxicity data exist; assessment is supported with recommendations for structurally related diethylamine and triethylamine.

Human data:

- Odour threshold: 0.95 ppm
- Reports of occupational eye irritation and corneal oedema exist (no further information provided)
- Beneficial effect on heart arrhythmia in children (n=134); 10 yr follow-up (n=76) shows 83% recovery rate (no further information provided).

Animal data:

- Severely irritating to skin of guinea pigs as 0.1 mL of 70% solution; only mild irritation observed in rabbits; severe eye irritation as 0.5 mL of 1% solution (rabbits)
- $LD_{50}$: 400 mg/kg (rats, oral)
- $LD_{50}$: 390 (rabbits, dermal)
- $RD_{50}$: 151 ppm (mice)
- 2 of 6 rats survived inhalation of 8,000 ppm for 4 h
- Sub-chronic inhalation study with exposure groups of 50 and 100 ppm (rabbits, 7 h/d, 5 d/wk, 6 wk)
  - 50 ppm group showed lung lesions, corneal erosion, and heart muscle degeneration
  - 100 ppm showed no changes to heart and cornea, but slight to moderate kidney damage (no further information)
  - LOAEC: 50 ppm for lung irritation/damage
- Sub-chronic inhalation study with exposure groups of 10, 100, 500 ppm (rats, 6 h/d, 5 d/wk, 24 wk):
  - no adverse effects at 10 or 100 ppm
  - body weight gain reduction, inflammatory necrosis, and metaplasia observed in nasal tract of 500 ppm group
  - NOAEL: 100 ppm for damage to nasal tract and reduced bw gain
- No chronic or carcinogenicity data available for assessment; analogy to metabolism of methylamine to corresponding nitrosamines is however made, which suggests carcinogenic potential exists
- Available *in vitro* and *in vivo* mutagenicity studies support non-genotoxic activity except for slight increase in sister chromatid exchange with Chinese hamster V79 cells
- No reports of metabolism and distribution, but not expected to be rapidly or extensively converted in mammals.

| Source | Year set | Standard |
|---|---|---|
| A skin notation is recommended based on low dermal $LD_{50}$ in rabbits. Insufficient data to assign notations for carcinogenicity or sensitisation. | | |
| ***DFG*** | ***1997*** | ***MAK: 5 ppm (9.4 mg/m$^3$)*** |
| Summary of additional data:<br>MAK derived from a weight of evidence approach combining inhalational NOAEL of 100 ppm in rats and $RD_0$ values of structurally related diethylamine and the previous MAK for diethylamine (5 ppm) based on a LOAEC of 10 ppm for subjective irritation from a volunteer study. Despite the amendment of the current diethylamine MAK to 2 ppm to account for a chronic exposure study with mice and rats, the ethylamine MAK of 5 ppm is retained due to animal studies showing a lower local irritation potency for ethylamine than diethylamine.<br>No carcinogenicity studies available for assessment. Carcinogenic activity however not expected based on chemical structure, which is supported by an absence of carcinogenicity in mice and rats chronically exposure to diethylamine.<br>Dermal uptake calculated to be 39 mg from a 0.5% aqueous solution or 10 mg from a gas, which is less than 25% of the systemically tolerable level of 240 mg. Therefore, a skin notation is not considered necessary.<br>No data on sensitisation available.<br>Human data:<br>• No irritant studies in humans available for assessment, analogy made to effects of diethylamine in volunteer study (n=5) with LOAEC of 10 ppm for nose and eye irritation (no further details provided)<br>• 3 studies estimate dermal uptake fluxes from a 0.5% aqueous solution: 19.5,10.2, or 3.1 µg/cm$^2$/h; assuming 2,000 cm$^2$ skin surface and 1 h exposure ≡39, 20.4, or 6.2, respectively (<1% aqueous solution considered irritating due to corrosive effect)<br>o equivalent exposure to gaseous substance from such an aqueous solution calculated to be 10 mg in 8 h assuming whole-body exposure (18,000 cm$^2$)<br>• Oral dose of ethylamine hydrochloride (2 g) was “tolerated well”, 32% recovered in urine (no further information provided)<br>• Reports of workplace exposure causing formation of a thin, blue layer on the cornea (cited data dates from 1949, no further information provided).<br>Animal data:<br>• $LC_{50}$: 6,830 ppm (female rats, 4 h)<br>• $LD_{50}$: 265 mg/kg (rabbits, dermal); potentially higher uptake due to damaged skin<br>• Sub-chronic inhalation studies show that local irritational effects of ethylamine ≈triethylamine <diethylamine based on nasal inflammation (rats, 10 d):<br>o ethylamine: moderate at 1,000 ppm and slight at 250 ppm<br>o triethylamine: moderate at 1,000 ppm<br>o diethylamine: moderate to severe at 500 ppm<br>• Inhalation studies with structurally related diethylamine (rats, 13 wk or 2 yr) reported<br>o NOAEL: 16 ppm; LOAEL: 32 ppm for nasal effects (13 wk)<br>o LOAEL: 32 ppm for nasal effects (2 yr); no NOAEL determined<br>• Non-mutagenic in bacterial assays, slight increased sister chromatid exchange reported in Chinese hamster V79 cells. | | |
| ***SCOEL*** | ***1994*** | ***TWA: 5 ppm (9.4 mg/m$^3$)*** |
| Summary of additional data:<br>TWA based on sub-chronic inhalation study with rabbits, reported a LOAEL of 48 ppm for lung damage (also reported by ACGIH). An uncertainty factor of 10 is applied on the LOAEL to account for | | |

| Source | Year set | Standard |
|---|---|---|
| the absence of an experimentally determined NOAEL and lack of chronic exposure data. Insufficient data available to recommend a STEL, a skin notation is not considered necessary.<br>Animal data:<br>• Non-mutagenic to bacteria *in vitro* except in combination with nitrite. | | |
| ***OARS/AIHA*** | ***NA*** | ***NA*** |
| No report. | | |
| ***HCOTN*** | ***NA*** | ***NA*** |
| No report. | | |

## Secondary source reports relied upon

| Source | | Year | Additional information |
|---|---|---|---|
| HSE | ✓ | 2002 | TWA: 2 ppm (3.8 mg/m$^3$); STEL: 6 ppm (11 mg/m$^3$). |
| OECD | ✓ | 2011 | • Grouped with related primary alkyl amines (i.e. not di- and triethylamine) to close gaps in toxicological database<br>• Observed corrosivity/basicity in foreground of systemic toxicity<br>• Dermal absorption only considered likely if natural acidity of skin is neutralised, absorption of short-chain (<C6) considered negligible<br>• Dermal $LD_{50}$ values (24 h patch) in this group range from 200 mg/kg with long-chain congeners to 2,000 mg/kg for short-chain and substituted congeners (unspecified species)<br>• Lack of skin sensitisation potential for various primary amines, no data presented for ethylamine but expected to have similar properties<br>• Weight of evidence suggests members of the primary amine group assessment are not mutagenic<br>• No carcinogenicity data are available<br>• No adverse effect on male and female gonads at up to 500 ppm repeat inhalation study (rats, 24 wk),<br>• No substance-specific developmental studies for ethylamine; foetal toxicity reported in repeat oral doses with structurally related butylamine hydrochloride (400 mg/kg/d), but not by inhalation of the free amine (>243 ppm)<br>  ○ data for butylamine hydrochloride used precautionarily for developmental toxicity assessment of orally ingested primary amine hydrochloride salts. |
| US NIOSH | ✓ | 1994 | IDLH based on acute inhalation toxicity data in animals. |

### 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 | — |
| NICNAS | NA |
| EU Annex | — |
| ECHA | NA |
| ACGIH | Skin |
| DFG | — |
| SCOEL | — |
| HCOTN | NA |
| IARC | NA |
| 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: | yes |
| Dermal repeat-dose NOAEL ≤200 mg/kg: | |
| Dermal $LD_{50}$/Inhalation $LD_{50}$ <10: | yes |
| *In vivo* dermal absorption rate >10%: | |
| Estimated dermal exposure at WES >10%: | yes |
| | **consider assigning a skin notation** |

### IDLH

| | |
|---|---|
| Is there a suitable IDLH value available? | Yes |

## Additional information

| | |
|---|---|
| Molecular weight: | 45.08 |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = 1.84 mg/m$^3$; 1 mg/m$^3$ = 0.54 ppm |
| This chemical is used as a pesticide: | ☐ |
| This chemical is a biological product: | ☐ |

| | |
|---|---|
| Molecular weight: | 45.08 |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = 1.84 mg/m$^3$; 1 mg/m$^3$ = 0.54 ppm |
| This chemical is used as a pesticide: | ☐ |
| 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) (1996) Ethylamin – MAK value documentation, German language edition.

Deutsche Forschungsgemeinschaft (DFG) (2002) Ethylamin – MAK value documentation, German language edition.

Deutsche Forschungsgemeinschaft (DFG) (2019) Ethylamin – MAK value documentation, German language edition.

EU Scientific Committee on Occupational Exposure Limits (SCOEL) (1994) Recommendation from the Scientific Committee on Occupational Exposure Limits for Ethylamine. SCOEL/SUM/33.

Organisation for Economic Cooperation and Development (OECD) (2011) SIDS initial assessment profile – C1-13 Primary Amines.

UK Health and Safety Executive (HSE) (2002) EH40/2005 Workplace exposure limits.

US National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations – Ethylamine.