# Ethylidene norbornene

| CAS number: | 16219-75-3 |
| --- | --- |
| Synonyms: | ENB, ethylidenebicyclo(2,2,1)hept-2-ene, 5-ethyldine-2-norbornene |
| Chemical formula: | C9H12 |
| Structural formula: | — |

Workplace exposure standard (amended)

| TWA: | **2 ppm (10 mg/m3)** |
| --- | --- |
| STEL: | **4 ppm (20 mg/m3)** |
| Peak limitation: | **—** |
| Notations: | **—** |
| 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 2 ppm (10 mg/m3) is recommended to protect for upper respiratory tract and eye irritation in exposed workers.

A STEL of 4 ppm (20 mg/m3) is recommended to protect for acute irritant effects in exposed workers. There are insufficient data available to recommend a peak limitation.

## Discussion and conclusions

Ethylidene norbornene (ENB) is used in the formation of polymer precursors during polymer production (ACGIH, 2018).

Critical effects are transient eye and upper respiratory tract irritation. At higher concentrations, haematological changes, hepatic lesions, anaemia and testicular atrophy are reported in rodents (ACGIH, 2018). Nephropathy and thyroid effects observed in rodents are not considered relevant to humans.

Human exposure data are limited to a single study that reported a LOAEC of 5.6 ppm for transient eye and upper respiratory tract irritation. Transient periocular swelling was reported at a LOAEC of 5 ppm in a sub-chronic inhalation study in rats (ACGIH, 2018). Based on these studies, ACGIH assigned a TLV-TWA of 2 ppm and a TLV-STEL of 4 ppm (ACGIH, 2018).

A TWA of 2 ppm is recommended as assigned by ACGIH. Applying a factor of two to these LOAEC to account for the absence of a NOAEC in both studies and rounding down results in a value of 2 ppm and supports the recommended TWA. The recommended TWA is considered sufficiently protective of transient signs of irritation described at the LOAELs in both humans and animals.

A STEL of 4 ppm (20 mg/m3) is recommended in place of the previous peak limitation to protect for upper respiratory tract and eye irritation from acute exposures; a peak limitation is not considered necessary as the critical effects are transient and mild. This combination of WES parameters agrees with the recommendations of the ACGIH (2018), and is considered more protective than those published by the ECHA (2019).

## 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.

There are insufficient data to recommend a skin notation.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 Peak limitation: 5 ppm (25 mg/m3) | |
|  |
| ACGIH 2014 TLV-TWA: 2 ppm (10 mg/m3); TLV-STEL: 4 ppm (20 mg/m3) |
| TLV-TWA and TLV-STEL recommended to minimise the potential for upper respiratory tract and eye irritation in exposed workers based on a LOAEC of 5.6 ppm from a controlled exposure study (no further explanation on the derivation of TLV-TWA).  Summary of data:  Human data:   * Reported transitory upper respiratory tract and/or eye irritation in exposed volunteers  (5.6–11.2 ppm, 30 min).   Animal data:   * Death of 5/6 rats at 4,000 ppm (4 h) * LC50: 732–3,104 ppm; mice and rabbits, 4 h, single exposure * Effect on blood cells count observed in a subacute inhalation study at 350 ppm (rats, 10 animals/sex; 5/2/4 d (exposure/rest/exposure) * Thyroid follicle defects observed in a 9-day subacute inhalation study at 50–350 ppm (rats, 10 animals/sex; 5/2/4 d (exposure/rest/exposure) * No death or gross lesions observed ≤150 ppm in 14-wk sub-chronic study (rats; 15 animals/sex; 6 h/d, 5 d/wk): * transient periocular swelling observed from 5 ppm in female animals * decreased body weight gain, haematological effects, hypertrophic response in thyroid follicular cells and/or mild anaemia in males at concentrations of 25–150 ppm. * all effects resolved after 4 wk recovery * NOAEL: 61 ppm for female rats (12 animals/sex/dose, 7h/d, 5 d/w; 89 d) * LC50: 150–237 ppm based on two sub-chronic studies (rats, 89–98 d): * hepatic and renal lesions evident observed at autopsy * testicular atrophy observed in males at 237 ppm * NOAEL: 22 ppm in dogs (3 animals/dose, 7h/d, 89 d): * hepatic lesions, blood changes observed * testicular atrophy observed at 93 ppm * NOAEC: 25 ppm for pregnant rats (0–354 ppm, 10 d): * hypertrophic response in thyroid follicular cells * No reproductive, gestational or lethal effects observed suggesting no testicular toxicity (rats; 20 animals/dose; 0–254 ppm; 6 h/d, 5 d) * LD50: 5,660–9,170 mg/kg (rabbits, dermal) * LD50: 2.54–5.66 mL/kg (rats, oral) * Nephropathy and thyroid effects observed in rodents not considered relevant to humans in several studies * No clastogenic activity observed in hamster ovary cells.   No mutagenic activity observed in *in vitro* Ames test without metabolic activation (S*almonella typhimurium*). Insufficient data available to recommend Skin, RSEN, DSEN or carcinogenicity notations. |
| DFG NA NA |
| No report. |
| SCOEL NA NA |
| No report. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN NA NA |
| No report. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| NTP |  | 2018 | * Ames test negative in *S. typhimurium* strains TA100, TA1535, TA1537, TA98. |
| ECHA |  | 2019 | * Long term derived no effect level (DNEL) for workers: 4 ppm based on a NOAEC of 25 ppm in rats. * Acute DNEL for workers: 10 ppm extrapolated from long term DNEL * Classified as a Skin Sensitiser 1B based on a positive mouse local lymph node assay. |
| OECD |  | 2002 | * Mild irritant to skin. No data on skin sensitisation. |

### 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 | NA |
| ACGIH | — |
| DFG | NA |
| SCOEL | NA |
| 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 |
| --- |
| Insufficient data to assign a skin notation |

### IDLH

| Is there a suitable IDLH value available? | No |
| --- | --- |

## Additional information

| Molecular weight: | 120.20 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = 4.91 mg/m3; 1 mg/m3 = 0.204 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*](http://www.acgih.org/tlv-bei-guidelines/policies-procedures-presentations) on the ACGIH website.

European Chemicals Agency (ECHA) (2019) Ethylidene norbornene – REACH assessment.

National Toxicology Program (NTP) (1999) NTP-RoC: Ethylidene norborene.

Organisation for Economic Co-operation and Development (OECD) (2002) OECD Cooperative Chemicals Assessment Program SIDS Initial Assessment Profile - 5-Ethylidene-2-norbornene.