# Dicyclopentadiene

| CAS number: | 77-73-6 |
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| Synonyms: | Bicyclopentadiene, 1,3-cyclopentadiene dimer, DCPD |
| Chemical formula: | C10H12 |

Workplace exposure standard (amended)

| TWA: | **0.5 ppm (2.7 mg/m3)** |
| --- | --- |
| STEL: | **—** |
| 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 0.5 ppm (2.7 mg/m3) is recommended to protect for eye and throat irritation, and potential liver and kidney toxicity in exposed workers.

## Discussion and conclusions

Dicyclopentadiene is used as an intermediate in chemical manufacture of insecticides, elastomers, metallocenes, paints and plastics. It is produced during the carbonisation of coal, and as a by-product when steam-cracking gas oil and naphtha (NTP, 1990).

Critical effects of exposure are irritation of the mucous membranes of the eyes and upper respiratory tract (ACGIH, 2018). Human and animal exposure data are limited. Acute inhalation studies in volunteers reported irritation at concentrations between 1 and 5.5 ppm (ACGIH, 2018; DFG, 2000). Despite evidence for potential acclimation in some exposed individuals, concentrations of 2.9 to 5.5 ppm were described as nauseating (DFG, 2000). Chronic animal exposure studies (ACGIH, 2018; DFG, 2000) show that higher concentrations cause liver and kidney damage (above 35 ppm) and haemorrhaging of the lungs and gastrointestinal tract (above 332 ppm).

A TWA of 0.5 ppm is based on eye and throat irritation observed in acutely exposed volunteers at 1 ppm (DFG, 2000). This value is also expected to protect for potential liver and kidney toxicity reported for animals exposed to higher concentrations.

## 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 not recommended based on the available evidence.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 5 ppm (27 mg/m3) | |
|  |
| ACGIH 2001 TWA: 5 ppm (27 mg/m3) |
| TLV-TWA intended to minimise potential for irritation to eyes and throat, and potential adverse lung and CNS effects.  Insufficient data to recommend a STEL or notations for carcinogenicity, sensitisation, or skin absorption.  Summary of data:  Toxicological data for human exposure are limited to reports of accidental overexposure and a very small acute volunteer study. No chronic human or animal exposure studies available for assessment.  TLV-TWA derivation is not discussed, but value is based on available animal exposure data and expected to minimise the potential for eye irritation, lung effects and CNS responses in workers.  Human data:   * Odour threshold: 0.003 ppm, irritation threshold: 10 ppm * Volunteer acute inhalation study with exposures of 1 and 5.5 ppm (30 min)   + mild eye and throat irritation in 1 subject at 1 ppm (>7 min); olfactory fatigue >24 min in another subject   + no olfactory fatigue at 5.5 ppm * Potential acclimation indicated in study of accidentally exposed workers (concentrations and exposure periods not specified) who experienced headaches for 2 mo, but none during following 3 mo.   Animal data:   * LC50: 660 ppm (rats, 4 h); 2,500 ppm lethal in 1 h   + 3/4 rats survived at 250 ppm (6 h/d, 10 d); all survived at 100 ppm (6 h/d. 15 d) * Sequence of critical effects in multiple test species (rats, mice, rabbits, guinea pigs, dogs) progressed from eye irritation, to loss of coordination, to lethal convulsions * LD50: 342 mg/kg (rat, oral) * LD50: 303 mg/kg (rat, intraperitoneal) * Relatively low irritation from eye and skin exposure (species unspecified) * Haemorrhage of lungs and intestines in repeat inhalation study at 332 ppm (rats, 10 d, exposure duration not specified); all animals died at 332 ppm and not at 72 or 146 ppm for which no haemorrhages were reported * Sub-chronic inhalational study, treatment range: 19.7–74 ppm (rats, 7 h/d, 89 d)   + NOAEL <19.7 ppm   + kidney damage and adverse lung effects, e.g. pneumonia, in 35 and 74 ppm groups   + dogs exposed under similar conditions, treatment range: 9–32 ppm, showed minimal changes in biochemical parameters and no dose-related changes to organs upon examination. |
| DFG 1991 MAK: 0.5 ppm (2.7 mg/m3) |
| MAK value derived from limited acute volunteer studies, in which brief eye and throat irritation was reported at 1 ppm. MAK of 0.5 ppm is expected to protect for these irritation effects and objectionable odour experienced at 5.5 ppm. Agency notes that the occupational threshold of 5 ppm used in other countries is insufficiently protective.  Summary of additional data:  Human data:   * Several acute volunteer inhalation studies summarised as:   + odour threshold: 0.006–0.072 ppm; objectionable odour threshold: 0.18–1.35 ppm; mild eye and throat irritation at 1 ppm in 1 subject   + nauseating and unpleasant mouth sensation at 2.9–5.5 ppm, but with indication of acclimation.   Animal data:   * 4 h LC50: 145 ppm (mice); 359–385 ppm (rats); 770 ppm (guinea pigs); 771 ppm (rabbits) * LD50: 5,065 mg/kg (rabbits, dermal); mild erythema, but no signs of systemic toxicity after 24 h occlusive patch applied at 2 mg/kg (rabbits) * Accumulation in body fat, bile, gall bladder, and adrenals after oral absorption and excreted in urine in 24–96 h * Negative result for guinea pig sensitisation test * No adverse reproductive or teratogenic effects in daily feeding and reproductive study, treatment range: 24–85 mg/kg for males, 42–170 mg/kg for females (mink, 12 mo); significant bw reduction in neonates from exposed females * Non-mutagenic in standardised bacterial mutagenicity assays, no *in vivo* studies presented * Administration *via* intramuscular injection yielded negative results in carcinogenicity study with rats (no further information provided). |
| 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 |
| --- | --- | --- | --- |
| HSE |  | 2002 | * TWA: 5 ppm (27 mg/m3). |
| NTP |  | 1990 | * Structurally related dicyclopentadiene dioxide non-tumorigenic in skin painting study with mice * Workplace exposure studies estimate 1,122 workers (incl. 85 females) potentially exposed between 1981–1983 (no further information provided) * Wildlife officers accidentally exposed to unknown concentration experienced eye and throat irritation, and headaches * Sub-chronic inhalation study with exposure groups 20, 47, and 72 ppm (dogs, n=1/group, 89 d) reported:   + diarrhoea at 20 ppm; diarrhoea and salivation at 47 ppm   + inactivity at 72-ppm * NOAEL of 8.9–23.5 ppm for altered blood biochemical markers in sub-chronic inhalation study with dogs also cited in ACGIH (2018). |
| OECD |  | 1998 | * Slight to moderate eye irritation estimated at exposure (500 mg, 24 h, humans; no further information provided) * Average atmospheric concentrations at two production plants was 2.3 ppm (12.9 mg/m3); workers estimated to be potentially exposed to 0.94 mg/kg/d intermittently over ≈1.5 h/d, which was considered acceptable * Combined repeat dose reproductive study with exposure groups of 4, 20, 100 mg/kg/d (rats, duration not specified); exposure caused histopathological changes to livers and kidneys   + NOEL: 4 mg/kg/d (males), 20 mg/kg/d (females)   + LOEL: 20 mg/kg/d (males), 100 mg/kg/d (females) * Similar toxic endpoints was reported in an inhalational study (rats, 6 h/d, 13 wk); kidney toxicity results from rat-specific metabolism   + NOAEL: 50 ppm. |

### Carcinogenicity — non-threshold based genotoxic carcinogens

| Is the chemical mutagenic? | Insufficient data |
| --- | --- |
| Is the chemical carcinogenic with a mutagenic mechanism of action? | Insufficient data |
| **Insufficient data are available to determine if the chemical is a non-threshold based genotoxic carcinogen.** | |

## Notations

| Source | Notations |
| --- | --- |
| SWA | — |
| HCIS | — |
| NICNAS | NA |
| EU Annex | NA |
| ECHA | NA |
| ACGIH | — |
| DFG | — |
| 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 |
| --- |
| |  |  |  |  | | --- | --- | --- | --- | | Adverse effects in human case study: | no |  |  | | Dermal LD50 ≤1000 mg/kg: | no |  |  | | Dermal repeat-dose NOAEL ≤200 mg/kg: |  |  |  | | Dermal LD50/Inhalation LD50 <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? | No |
| --- | --- |

## Additional information

| Molecular weight: | 132.20 |
| --- | --- |
| 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*](http://www.acgih.org/tlv-bei-guidelines/policies-procedures-presentations) on the ACGIH website.

Deutsche Forschungsgemeinschaft (DFG) (1991) Dicyclopentadien – MAK value documentation, German language edition.

Deutsche Forschungsgemeinschaft (DFG) (2000) Dicyclopentadien – MAK value documentation, German language edition.

National Toxicology Program (NTP) (1990) Toxicity Studies of Chitosan (CASRN 77-73-6) Executive Summary of Safety and Toxicity Information Dicyclopentadiene.

Organisation for Economic Cooperation and Development (OECD) (1998) SIDS initial assessment profile – Dicyclopentadiene.

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