# Cyclopentadiene

| CAS number: | 542-92-7 |
| --- | --- |
| Synonyms: | 1,3-Cyclopentadiene, p-pentine, pentole |
| Chemical formula: | C5H6 |

Workplace exposure standard (interim)

| TWA: | **75 ppm (203 mg/m3)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **—** |
| IDLH: | **750 ppm** |
| **Sampling and analysis:** The recommended value is quantifiable through available sampling and analysis techniques. | |

## Recommendation and basis for workplace exposure standard

An interim TWA of 75 ppm (203 mg/m3) is recommended to protect for eye and respiratory tract irritation in exposed workers.

Given the limited data available from the primary sources, it is recommended that a review of additional sources be conducted at the next scheduled review.

## Discussion and conclusions

Cyclopentadiene is used in organic syntheses and the chemical manufacture of resins. It is monomeric as a vapour or when freshly distilled and dimerises rapidly to solid dicyclopentadiene upon standing, in which it is commonly handled (ACGIH, 2018).

This polymerisation behaviour leads to contradictory or confounding reports in the available toxicological data (ACGIH, 2018; DFG, 2000). The critical effects of exposure to the monomer are objectionable odour and irritation of the eyes and upper respiratory tract. Animal experiments indicate that irritation observed near acutely lethal doses are reversible within two weeks (DFG, 2000).

Limited human and animal exposure data exist. ACGIH (2018) noted a LOAEL of 250 ppm for objectionable and irritating odour in volunteers and adverse kidney and liver effects in animals following exposures above 500 ppm.

An interim TWA of 75 ppm is recommended based on the LOAEL in volunteers. The recommended TWA is also expected to protect for kidney and liver effects seen in animals. Given the limited data, a detailed evaluation of the available toxicological data should be conducted in subsequent reviews. Experimental design and potentially confounding information regarding exposure to the dimer, dicyclopentadiene, should be considered during these reviews.

## 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: 75 ppm (203 mg/m3) | |
|  |
| ACGIH 2001 TLV-TWA: 75 ppm (203 mg/m3) |
| TLV-TWA intended to minimise potential for irritation to eyes and respiratory tract and offensive odour. Insufficient data to recommend a STEL or notations for carcinogenicity, sensitisation or skin absorption.  Summary of data:  TLV-TWA derived from a LOAEL of 250 ppm for an irritating objectionable odour in human subjects; no objective irritational effects are discussed in the cited report at 250 or 500 ppm.  Limited human and animal exposure data exist, but the recommended TLV-TWA is expected to protect for both objectionable odour and potential objective irritational effects.  Unless freshly distilled, the compound readily dimerises to crystalline dicyclopentadiene, in which form it is commonly handled or transported. Thus, it is unclear if available toxicology data derived from exposures to the liquid represent exposure to the monomer or the dimer.  Human data:   * Odour threshold: 1.9 ppm * Irritating, objectionable odour noted in subjects exposed to 250 or 500 ppm (no further information provided).   Animal data:   * Narcotising and lethal at 3 mL (633 mg/kg) as subcutaneous injection in rabbits:   + injections of 0.5–1.0 mL (106–211 mg/kg) non-narcotising   + liquid caused local irritation, inflammation in pleural and peritoneal cavities and kidney hyperaemia * LD50 of dimer: 820 mg/kg (rats, oral) * LD50 of dimer: 5,380 mg/kg (rabbits, dermal) * No adverse effects at 400 ppm (6 h) followed by 800 ppm (16 h) based on bodyweight and haematological parameters in inhalation study (dogs, n=39) * NOAEC: 250 ppm for liver and kidney toxicity and haematological parameters in repeat inhalation study, treatment range: 250–500 ppm (rabbits, rats, guinea pigs, dogs, 7 h/d, 135 times, exposure period unclear):   + kidney and liver toxicity observed at 500 ppm (rats, 7 h/d, 35 times in 53 d period). |
| DFG 2000 MAK: not established |
| Summary of data:  Previous MAK of 75 ppm withdrawn because no experimental basis for a derivation can be made from available toxicological data. Contradictory toxicology data for exposure to liquid and saturated vapours is attributed to dimeric impurities in the tested substance.  Human data:   * Irritation to the upper respiratory tract at 250 ppm * Critical effect of occupational exposure likely to be irritation of upper respiratory tract.   Animal data:   * LC50: 1,778 ppm (male mice, 6 h); 3,908 ppm (female mice, 6 h) * Agency attributes contradictory outcomes of three acute inhalation studies to substance impurity, i.e. contamination with dimer; (mice, rats, guinea pigs, 6 h):   + lethal to mice at 1,040 ppm in one study, but non-lethal at 4,919 ppm in other study   + eye irritation observed in all species   + irritational effects reversible within 2 wk in rats   + dose-dependent lung damage in mice exposed to 1,427–5,465 ppm * Oral doses of 1,000–1,470 mg/kg lethal to rats; composition of the tested substance unclear because acute intoxication, but no mortality, observed at 10,000 mg/kg (rats) in second study from same research group:   + necropsies revealed changes to lungs, heart and GIT * No mortality at 3,160 mg/kg in recent single dermal application studies (rabbits); significant erythema, increased respiration rate, ataxia and irritability observed, behavioural effects were reversible within 14 d * Iritis and weak conjunctival effects when 0.1 mL applied directly to eyes (rabbits) * Sub-chronic repeat inhalation study with exposure groups of 244, 714 and 2,558 ppm (male and female mice, n=10/sex, 6 h/d, 5 d/wk, 2 wk) found:   + all males died after 1 exposure to 2,558 ppm and survived until 3 exposures in the 714 ppm group; all females died after 3 exposures in both groups   + all animals survived 244 ppm without signs of intoxication   + no abnormal findings in examination of animals; increased liver weights of females in 244 ppm group, but no macroscopic changes to liver observed * Weak exposure-related irritation of lung parenchyma in repeat inhalation exposure at 993 ppm (rats, guinea pigs, dogs, 6 h/d, 5 d/wk, 4 wk) * No reports on sensitisation, genotoxicity or carcinogenicity available * No reports on skin permeability, but low dermal toxicity indicates low potential for skin penetration. |
| 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 |
| --- | --- | --- | --- |
| US NIOSH |  | 1994 | * IDLH based on acute inhalation toxicity data in animals * LC50: 14,182 ppm (rats, 2 h); 5,091 (mice, 2 h) |

### 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 | NA |
| 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? | Yes |
| --- | --- |

## Additional information

| Molecular weight: | 66.1 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = 2.70 mg/m3; 1 mg/m3 = 0.370 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) (2000) 1,3-Cyclopentadien – MAK value documentation, German language edition.

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