# 1,1,2,2-Tetrachloroethane

| CAS number: | 79-34-5 |
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| Synonyms: | Acetylene tetrachloride,  1,1-dichloro-2,2-dichloroethane,  1,1,2,2-TCA, tetrachloroethane, s-tetrachloroethane, sym-tetrachlorethane |
| Chemical formula: | C2H2Cl4 |

Workplace exposure standard (retained)

| TWA: | **1 ppm (7 mg/m3)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **Sk.** |
| IDLH: | **100 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 1 ppm (7 mg/m3) is recommended to protect for effects on liver and gastrointestinal tract and potential narcosis in exposed workers.

## Discussion and conclusions

1,1,2,2-Tetrachloroethane (1,1,2,2-TCA) was widely used as a solvent and chemical intermediate in the manufacture of trichloroethene and tetrachloroethene.

The critical effects of exposure include effects on liver and gastrointestinal tract (GIT) and narcosis.

Very limited data from human studies are available with most data relating to accidental exposures. Short term inhalational exposure at 13 ppm for 10 minutes is tolerated without adverse effect in volunteers. However, mucous membrane irritation, pressure in the head, vertigo and fatigue reported at 145 ppm for 30 minutes or 334 ppm for 10 minutes (ACGIH, 2018). Epidemiological surveys of workers found adverse effects on the central nervous system (CNS) and GIT at greater than 10 ppm (70 mg/m3) (ACGIH, 2018; DFG, 1958; HCOTN, 2002). No adverse effects reported in an 11‑month inhalation study in rats and rabbits at 0.3 or 1.46 ppm, but liver damage is reported in both species following inhalation at 14.6 ppm. Another study found very slight increase in liver lipid content in rats inhaling 2 ppm for 265 exposures of 4 hours/day (ACGIH, 2018). In a 14‑week dietary study in rats, 20 mg/kg/day is considered the LOAEL based on vacuolisation of hepatocytes (HCOTN, 2002).

Available human and animal data do not confidently identify a NOAEC but a LOAEL of 20 mg/kg/day was reported in rats. The TWA of 1 ppm (7 mg/m3) is recommended to be retained. It is consistent across primary sources and on the weight of evidence presented is expected to be protective of effects on the liver, CNS and GIT.

## 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 as evidence suggests potential dermal absorption and adverse systemic effects.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 1 ppm (6.9 mg/m3) | |
|  |
| ACGIH 2001 TLV-TWA: 1 ppm (6.9 mg/m3) |
| TLV-TWA recommended to minimise nervous system, GIT and hepatic effects. Toxic effects in animals and humans observed around 10 ppm, forming the basis for the TWA.  Summary of data:  Human data:   * Poisonings of aircraft industry workers at start of WWI: * deaths reported characterised by GIT, hepatic and nervous system effects * no quantitative exposure data but indicate effects on liver * symptoms of lesser exposures included headaches, drowsiness and nausea * from suicide cases with similar clinical findings reported estimates human fatal doses ranging from 265–6,000 mg/kg and estimated LOAEL of 100 mg/kg * No greater occurrence (in comparison to general population) of cardiovascular lesions in 75 workers from plant producing and using the chemical; exposure range 0.37–3.2 ppm, occasional peaks at 40 ppm * Study of 380 workers (192 in direct contact and 188 occasionally exposed): * poisoning primarily characterised by nervous system effects (tremors) * 3 ppm may be detected by odour: * 13 ppm may be tolerated without effect for 10 min * inhalation of 145 ppm for 30 min or 334 ppm for 10 min causes mucous membrane irritation, pressure in the head, vertigo and fatigue * No definitive conclusions from study of army workers exposed to fumes in clothing processing plant and cancer incidence: * other compounding factors influencing findings.   Animal data:   * LD50: 319 mg/kg (rats, oral) * LD50: 6,300 mg/kg (rabbits, dermal): * narcosis can be produced following topical application * Single 300 or 600 mg/kg doses in mice reported liver damage involving cytochrome P450 * 4 h LC50: 1,000 ppm (rats); 655 ppm (mice) * Decrease in spontaneous motor activity of rats inhaling 200 ppm (6 h): * no effects at 576 ppm (30 min) * No effects in rats inhaling 2 ppm, 4 h/d, 265 exposures: * very slight increase in liver lipid content * No effects in rats or rabbits inhaling 0.3 or 1.46 ppm, 3−4 h/d, 11 mo duration: * at 14.6 ppm liver damage in both species * Gavage daily doses of 62 and 108 mg/kg/d (male rats), 43 and 76 mg/kg/d (female rats), 142 mg/kg/d and 282 mg/kg/d (male and female mice, respectively), 5 d/wk, 78 wk duration: * no statistically significant increase in neoplastic lesions in rats; 2 hepatocellular carcinomas (rare in this strain of rat) observed in high-dose males * hepatocellular carcinomas detected in both sexes of mice, including 13% of control male mice * No increase in pulmonary tumours following IP administration of 400 mg/kg/d for 8 wk in mice * No histopathologic changes in reproductive system of rats inhaling 560 ppm for 15 wk * Embryotoxic and weakly teratogenic in mice following IP injections * Increased mutation rates in *Salmonella* and *E. coli*; DNA repair stimulated in *E. coli*: * negative results in all other mutagenic tests.   Insufficient data available to recommend a SEN notation or TLV-STEL.  Skin notation assigned due to systemic effects reported following dermal contact.  Confirmed Animal Carcinogen with Unknown Relevance to Humans assigned. |
| DFG 1958 MAK: 1 ppm (7.0 mg/m3) |
| MAK based on estimates (no further information) as no chronic animal studies or prolonged exposure with known concentrations in humans reported.  Summary of additional data:   * Depression of CNS main adverse effect * Study of 380 workers (cited in ACGIH, 2018): direct contact included both dermal and inhalation; concentrations reportedly between 9 and 98 ppm * Reports of illness in workers exposed <10 ppm; skin absorption must be considered; no further information. |
| SCOEL NA NA |
| No report. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN 2006 TWA: 1 ppm (7 mg/m3) |
| Summary of additional data:   * Skin notation assigned; absorption through skin may significantly contribute to body burden * From epidemiological surveys of workers (cited in ACGIH, 2018; DFG, 1958), adverse symptoms from CNS and GIT at >1,0­30 ppm (7,­210 mg/m3); skin exposure involved * No data from animal sensitisation studies * Inadequacies in repeated inhalation studies identified * 14 wk diet studies in rats and mice; continuous access to compound: * 20 mg/kg/d (lowest dose tested) in male rats induced vacuolisation of hepatocytes * 80 mg/kg/d (lowest dose tested) in female mice caused hepatic hypertrophy in 2/10 * Not considered by committee as a stochastic genotoxic compound * Insufficient evidence to suggest carcinogenic to humans; however classified as a suspect (non-genotoxic) carcinogen * 14 wk oral study of rats and mice used by committee as starting point for deriving HBROEL: * hepatocellular vacuolisation at 20 mg/kg/d considered LOAEL * with consideration of mildness of key effect, continuous access to compound and no exposure-free recovery period, UF of 2 applied in absence of NOAEL and 10 for intraspecies and interspecies variation; recommended TWA of 1 ppm (7 mg/m3). |

### Secondary source reports relied upon

NIL.

### 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 | Skin |
| HCIS | — |
| NICNAS | NA |
| EU Annex | NA |
| ECHA | — |
| ACGIH | Carcinogenicity – A3, Skin |
| DFG | Carcinogenicity – 3B, H (skin) |
| 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: | yes | 4.00 |  |
| 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 warranted** |

### IDLH

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

## Additional information

| Molecular weight: | 167.84 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = 6.87 mg/m3; 1 mg/m3 = 0.15 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) (2002) 1,1,2,2-Tetrachlorethan – MAK value documentation.

Health Council of the Netherlands (HCOTN) (2006) Tetrachloroethane. Health-based calculated occupational cancer risk values. The Hague: Health Council of the Netherlands; publication no. 2006/09OSH.

International Agency for Research on Cancer (IARC) 1,1,2,2-Tetrachloroethane. IARC Monographs – 106.

US National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations – 1,1,2,2-Tetrachloroethane.