# 1,1,1,2-Tetrafluoroethane

| CAS number: | 811-97-2 |
| --- | --- |
| Synonyms: | HFC 134a |
| Chemical formula: | C2H2F4 |
| Structural formula: | — |

Workplace exposure standard (retained)

| TWA: | **1,000 ppm (4,240 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 1,000 ppm (4,240 mg/m3) is recommended to protect for possible narcosis and central nervous system (CNS) effects in exposed workers.

## Discussion and conclusions

1,1,1,2-Tetrafluoroethane is the most common hydrofluorocarbon (HFC) refrigerant gas used in Australia and is also used as a propellant in medical aerosols, as a foam in fire suppression applications and aerosols (NICNAS, 2014).

The critical effects of exposure to relatively high concentrations are narcosis and CNS effects (DFG, 1996; US EPA, 1995). Acute toxicity of 1,1,1,2-Tetrafluoroethane is low. Oral absorption in humans is limited and it is rapidly excreted by the lungs. No adverse effects on pulse, blood pressure, electrocardiogram or lung function reported in a limited study of eight volunteers exposed up to 8,000 ppm for eight weeks (ECHA, 2019). US EPA (1995) and DFG (1996) reported a NOEAC of 10,000 ppm from a two‑year inhalation study in rats based on increased relative testes weight. The same study cited by ECHA (2019) considered 50,000 ppm (the highest dose) as the NOAEC. A NOAEC of 50,000 ppm reported in a shorter 90‑day inhalation study in rats (ECHA, 2019).

The TWA of 1,000 ppm (4,240 mg/m3) as assigned by DFG (1996) is recommended based on the weight of evidence presented and is protective for narcotic and CNS effects.

## 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 TWA: 1,000 ppm (4,240 mg/m3) | |
|  |
| ACGIH NA NA |
| No report. |
| DFG 1996 MAK: 1,000 ppm (4,200 mg/m3) |
| Summary of data:   * Low acute toxicity, but narcotic in high concentrations * 20 volunteers tolerated with no effect on vital functions or ECG, exposures for 8 weeks at concentrations up to 800 µL (8,000 ppm; 100 µL volumes sprayed into MDI at 30 sec intervals) * LC50: >500,000 ppm (rat, 4 h) * NOEL: 10,000 ppm (rat, inhalation) * Dorsal skin of rabbits slightly red following administration of liquid, which is likely due to freezing effect of liquefied gas: * slight irritation to eyes of rabbits, sprayed with gas for 5 or 15 sec * Not sensitising in animals * Not found to be allergenic in guinea pigs * Genotoxicity not observed in *in vitro* and *in vivo* studies * Equivocal results in carcinogenicity studies: * increase in Leydig cell hyperplasia and benign Leydig cell adenomas in rats (also in control animals) * threshold concentration for occurrence of tumours 10,000–50,000 ppm * tumour likely due to hormonal mechanism of action.   MAK determined based on NOEL of 10,000 ppm from inhalation study in rats. |
| SCOEL NA NA |
| No report. |
| OARS/AIHA 2003 TWA: 1.000 ppm |
| No additional information. |
| HCOTN NA NA |
| No report. |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| NICNAS |  | 2014 | * No additional data. |
| US EPA |  | 1995 | * NOAEL 10,000 ppm and LOAEL 50,000 ppm based on increased relative testes weight (cited in ECHA, 2019) * 90 d inhalation study in male and female rats exposed at 0, 2,000 10,000 or 50,000 ppm for 6 h/d, 5 d/wk, identified NOAEC of 50,000 ppm * Single or repeated short-term exposures to relatively high concentrations in rats caused reversible CNS depression. |
| ECHA |  | 2019 | * Limited absorption in humans; rapidly excreted via lungs * 2 y chronic toxicity/carcinogenicity study in male and female rats exposed at 0, 2,500, 10,000 or 50,000 ppm (whole body) for 6 h/d, 5d/wk: NOAEC 50,000 ppm * Not considered a carcinogenic risk to humans * 8 volunteers exposed at 1,000, 2,000, 4,000 or 8,000 ppm (whole body) for 1 h/wk for 8 wk: no adverse effects on pulse, blood pressure, electrocardiogram or lung function. |

### 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 | NA |
| 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

| Insufficient data to assign a skin notation. |
| --- |

### IDLH

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

## Additional information

| Molecular weight: | 102.03 |
| --- | --- |
| 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) (2008) 1,1,1,2-Tetrafluorethan – MAK value documentation.

European Chemicals Agency Regulation (ECHA) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).

National Industrial Chemicals Notification and Assessment Scheme (2014) Ethane, 1,1,1,2-tetrafluoro-: Environment tier II assessment – IMAP report.

Occupational Alliance for Risk Science (OARS) (2003) Workplace environmental exposure level – Tetrafluoroethane, 1,1,1,2- (HFC-134a).

US Environmental Protection Authority (US EPA) (1995) Integrated Risk Information System (IRIS) Chemical Assessment Summary – 1,1,1,2-Tetrafluoroethane.