# Sodium fluoroacetate

| CAS number: | 62-74-8 |
| --- | --- |
| Synonyms: | 1018, Fluoroacetic acid sodium salt, fratol, furatol, compound 1080, ratbane 1080,  sodium fluoroacetic acid, 1080 |
| Chemical formula: | CH2FCOONa |

Workplace exposure standard (amended)

| TWA: | **0.05 mg/m3** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **Sk.** |
| IDLH: | **2.5 mg/m3** |
| **Sampling and analysis**: The recommended value is quantifiable through available sampling and analysis techniques. | |

## Recommendation and basis for workplace exposure standard

A TWA of 0.05 mg/m3 is recommended to protect for adverse central nervous system (CNS) and cardiovascular effects in exposed workers.

## Discussion and conclusions

Sodium fluoroacetate is used as a pesticide for rodent and predator control.

Critical effects of exposure are progressive CNS and cardiovascular disturbances caused by the inhibition of cellular respiration.

Quantitative exposure data are limited to acute and repeat oral dose studies in animals. Cases of poisonings in humans described as progressive cardiac failure and CNS depression causing nausea, convulsions and increased blood pressure and heart rate (ACGIH, 2018; DFG, 2007). Adverse and reversible morphological changes to the testes occur consistently as the most sensitive endpoint in sub-chronic oral dose studies, with NOAEL between 0.05 and 0.075 mg/kg/day and corresponding LOAEL above 0.2 mg/kg/day in rats (DFG, 2007; US EPA 1991). However, a LOAEL of 0.07 mg/kg/day (lowest dose used) for reversible changes in testes is also reported in a drinking water study of seven days duration in rats (DFG, 2007).

The TWA of 0.05 mg/m3 is recommended to be retained. This TWA is the same as the occupational exposure level derived by ACGIH (2018) and DFG (2007), although the latter was based on a seven- day study in rats. The recommended TWA is considered sufficiently low to protect for CNS and cardiovascular effects in exposed workers.

There is insufficient data to recommend a STEL. The previous STEL of 0.15 mg/m3 is recommended to be withdrawn.

## 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 due to evidence of dermal absorption and contribution to adverse systemic effects.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 0.05 mg/m3; STEL: 0.15 mg/m3 | |
|  |
| ACGIH 2001 TLV-TWA: 0.05 mg/m3 |
| TLV-TWA intended to minimise potential for progressive adverse CNS and cardiovascular effects.  Skin notation warranted based on rapid absorption and systemic effects in humans; these data are not presented.  Summary of information:  Based on cases of poisonings in humans and LOAEL of 1 mg/kg/d for growth retardation and 0.66 mg/kg/d for fertility (males) in rats, 0.05 mg/m3 expected to be protective of critical effects (further derivation not presented or discussed).  Human data:   * LD50: ~2–5 mg/kg (oral) * Aqueous solution absorbed readily through intact or broken skin * Based on several cases of poisonings, clinical course described as initial phase of nausea, auditory hallucinations and nystagmus and epigastric pain, followed by facial muscle twitching, convulsive seizures, profuse sweating, blood pressure and heart rate increase with onset of coma.   Animal data:   * Oral LD50: 0.06 mg/kg (dogs); 0.173 mg/kg (prairie dogs) * Critical effects are species-specific:   + only convulsions in dogs and guinea pigs   + cardiac arrest in rabbits   + CNS and cardiac arrest in cats and rhesus monkeys   + primates and birds least susceptible to toxic effects   + wild rodents most susceptible to toxic effects * Impairs cellular respiration by inhibiting citric acid cycle * Transient growth rate fluctuation at 1 mg/kg/d in repeat feeding study (rats, up to 4 wk); severe growth inhibition at 2 mg/kg/d within 1st wk, effect reversed within 3–4 wk:   + rats conditioned to 2 mg/kg/d subsequently tolerated 4 mg/kg/d * Morphological changes to spermatids and testes at 0.66–2 mg/kg/d in drinking water study (rats, no further details):   + testes appear to be most vulnerable organ to toxic effects due to citrate accumulation * Weak evidence for mutagenic activity *in vitro* in mouse lymphosarcoma LS/BL cells, but only at cytotoxic concentrations * No carcinogenicity studies presented.   Insufficient data to recommend a TLV-STEL or notations for carcinogenicity and sensitisation. |
| DFG 2007, 2012 MAK: 0.05 mg/m3 |
| Summary of additional information:  Previous MAK established in 2006. In absence of suitable human exposure data, MAK derived from NOAEL of 0.075 mg/kg/d for decreased sperm motility in a sub-chronic gavage study with rats and LOAEL of 0.07 mg/kg/d for reversible tubular degeneration in testes in 7-d drinking water study with rats. An allometric scaling factor of 1:4 (for rats) is applied to estimate exposure in humans and the oral doses are converted to equivalent air concentration (assuming a 70 kg individual with a respiratory rate of 10 m3 during an 8 h shift) to obtain a NOAEC of 0.13 mg/m3 in humans. Therefore, previous MAK of 0.05 mg/m3 considered sufficiently protective and retained.  Skin notation recommended due to high dermal absorption rate in animals relative to MAK value.  Human data:   * Following poisoning, respiratory disorders occur first, followed by CNS impairment, gastrointestinal distress and electrolyte imbalance.   Animal data:   * LD50: 277 mg/kg (rabbits, dermal) * Reversible tubular degeneration and citrate accumulation in testes at 0.07 mg/kg/d (lowest tested dose) in a 7‑d, drinking water study with dose groups 0, 0.07, 0.18 and 0.71 mg/kg/d (rats, also cited in ACGIH, 2018): * LOAEL: 0.07 mg/kg/d, * no NOAEL determined * Decreased sperm motility at 0.25 mg/kg/d in sub-chronic gavage study with dose group 0, 0.075, 0.25 mg/kg/d (rats, 90 d): * NOAEL: 0.075 mg/kg/d * DFG speculates differences in LOAEL for 7-d and sub-chronic studies due to administration route; continuous exposure during 7-d study and bolus dose in sub-chronic * Non-mutagenic *in vitro* in bacteria, doses were cytotoxic * Negative results in micronucleus assay with oral doses of 1.7, 3.4, 6.9, and 8.6 mg/kg (mice, observed up to 48 h): * agency notes study is unreliable due to mortality at 6.9 and 8.6 mg/kg.   Insufficient data to recommend notations for carcinogenicity and sensitisation. |
| 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 EPA |  | 1991 | * Increased heart weight (females) and microscopic lesions in testes (males) at 0.2 mg/kg/d in sub-chronic gavage study with dose groups 0, 0.05, 0.2, 0.5 mg/kg/d (rats, 13 wk):   + transient convulsions in females at 0.5 mg/kg/d during wk 12   + transient fluctuation of haematological parameters in males of 0.05 and 0.5 mg/kg/d dose groups   + NOAEL: 0.05 mg/kg/d * Sub-chronic gavage study used principally to derive oral RfD * Inhalation RfD and carcinogenic potential not assessed. |
| US NIOSH |  | 2019 | * No *in vivo* or *in vitro* studies available to estimate degree of absorption through human/animal skin of humans or animals * No signs of dermal erythema or oedema when worn as protective collar, but ingestion of the collar was lethal (lambs, 7 d) * Insufficient data (IDSK) to assess hazards of skin exposure. |

### 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 | — |
| ECHA | — |
| ACGIH | Skin |
| DFG | H (skin) |
| SCOEL | NA |
| HCOTN | NA |
| IARC | NA |
| US NIOSH | — |

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: | yes | 3.00 |  | | Dermal repeat-dose NOAEL ≤200 mg/kg: |  |  |  | | Dermal LD50/Inhalation LD50 <10: |  |  |  | | *In vivo* dermal absorption rate >10%: |  |  |  | | Estimated dermal exposure at WES >10%: |  |  |  | |  |  | 3 | **a skin notation is warranted** | |

### IDLH

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

## Additional information

| Molecular weight: | 100.02 |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = 4.09 mg/m3; 1 mg/m3 = 0.24 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) (2007) Natriumfluoracetat – MAK value documentation, German language editon.

Deutsche Forschungsgemeinschaft (DFG) (2012) Natriumfluoracetat – MAK value documentation, German language edition.

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

US National Institute for Occupational Safety and Health (NIOSH) (2019) NIOSH Skin Notation Profiles: Sodium Fluoroacetate.

US Environmental Protection Authority (US EPA) (1991) Integrated Risk Information System (IRIS) Chemical Assessment Summary – Sodium fluoroacetate.