# nitrogen trifluoride

| CAS number: | 7783-54-2 |
| --- | --- |
| Synonyms: | Nitrogen fluoride, trifluoroamine, trifluoroammonia, perfluoroammonia |
| Chemical formula: | NF3 |
| Structural formula: | — |

Workplace exposure standard (retained)

| TWA: | **10 ppm (29 mg/m3)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **—** |
| IDLH: | **1,000 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 10 ppm (29 mg/m3) is recommended to protect for methaemoglobinaemia and liver and kidney effects in exposed workers.

## Discussion and conclusions

Nitrogen trifluoride is an oxidiser for high-energy fuels and is also used in chemical syntheses.

Critical effects of exposure include methaemoglobinaemia, enlargement of the spleen and pathologic changes in the liver (ACGIH, 2018).

No human inhalation toxicity data are available, with the only one study reporting the detection of odour by one volunteer exposed at 500 ppm (no odour was detected when exposed at 100 ppm). A NOAEC of 5 ppm is identified in a 90-day inhalation study in rats based on haemolytic anaemia (ECHA, 2013). Mild to moderate pathologic changes in liver and inflammation of the kidneys are reported at 100 ppm in a 19-week inhalation study in rats. No changes to spleen or haematological parameters are reported in this study (ACGIH, 2018).

The TWA of 10 ppm is consistent across the primary sources available and is recommended to be retained. This TWA derived by ACGIH (2018) and HCOTN (2004) and based on evidence presented is considered protective of RBC effects.

## Recommendation for notations

Not classified as a carcinogen according to the Globally Harmonized Sysstem 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: 10 ppm (29 mg/m3) | |
|  |
| ACGIH 2001 TLV-TWA: 10 ppm (29 mg/m3) |
| TLV-TWA recommended to minimise the potential for elevated methaemoglobin in blood, anoxia and effects on liver and kidney histology.  Human data:   * 5 volunteers exposed for 2–3 min at 100 and 500 ppm did not detect odour at 100 ppm * one volunteer reported an odour at 500 ppm   Animal data:   * Single IP injections of the gas (8–15 mL/kg) in rats caused cyanosis and enlarged spleens, possibly due to methaemoglobinaemia * Anoxic deaths from methaemoglobinaemia reported from acute inhalation data in rats and slight histologic changes to liver and kidneys and enlargement and darkening of spleen in some rats * Inhalation at 1,000 ppm for 4 h in rats caused significant increase in methaemoglobin * inhalation at 3,000 ppm for 10 min did not exhibit increase * LC50: 6,700 ppm (rats, inhalation, 1 h); 7,500 ppm (mice, inhalation, 1 h) * Dogs more sensitive than rabbits and rodents to chemically induced methaemoglobinaemia * Some ocular irritation observed in animals during inhalation studies * Following 9 IP injections of 10 mL of the gas, rabbits showed enlarged spleens, pathologic changes in liver and myocardial degeneration * Rats inhaling 100 ppm (7 h/d, 5 d/wk, 19 wk duration) demonstrated mild to moderate pathologic changes in liver and interstitial and tubular nephritis in kidneys * significant effects on spleen or haematologic parameters not observed.   Insufficient data to recommend skin, SEN or carcinogenicity notations or TLV-STEL. |
| DFG NA NA |
| No report. |
| SCOEL NA NA |
| No report. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN 2004 TWA: 10 ppm (29 mg/m3) |
| Summary of additional data:   * No data found on effects on skin, eyes and mucous membranes * LC50: 2,000 ppm (5,920 mg/m3) (mice, inhalation, 4 h) * No data found on potential carcinogenicity, mutagenicity or genotoxicity * Toxicological database considered too poor to justify recommendation of health-based OEL, but committee considered TWA of 10 ppm too high based on effects observed in 19‑wk inhalation study with rats. |

### Secondary source reports relied upon

| **Source** |  | **Year** | **Additional information** |
| --- | --- | --- | --- |
| ECHA |  | 2013 | * Time adjusted 4-h LC50 of 3,350 ppm (from 1-h rat study with a LC50 of 6,700 ppm) * NOAEL of 5 ppm (rats, 90 d); based on haemolytic anaemia at 20 ppm and greater doses * Negative results in genotoxicity assays. |

### 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 | NA |
| HCIS | NA |
| NICNAS | NA |
| EU Annex | NA |
| ECHA | NA |
| ACGIH | NA |
| DFG | NA |
| 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? | Yes |
| --- | --- |

## Additional information

| Molecular weight: | 71 |
| --- | --- |
| 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.

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).

Health Council of the Netherlands (HCOTN) (2004) Nitrogen trifluoride. Health-based Reassessment of Administrative Occupational Exposure Limits. The Hague: Health Council of the Netherlands; publication no. 2000/15OSH/125.

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