Social Europe

Recommendation from the Scientific Committee for Occupational Exposure Limits for nitric acid

SCOEL/SUM/61

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European Commission

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8 hour TWA	: no recommendation made
STEL(15mins)	: 1 ppm (2.6 mg/m^3)
Additional classification:	---

Substance:

Nitric acid	: **HNO_3**
Synonyms	: Hydrogen nitrate; nitrous fumes; nitryl hydroxide
EINECS N0	: 231-714-2
EEC N0	: 007-004-00-1
Classification	: 0; R8 C; R35
CAS N0	: 7697-37-2
MWt	: 63.01
Conversion factor (20°C, 101 kPa) :	2.62 mg/m3 = l ppm

1. Occurrence/use

Nitric acid is a clear colourless or yellowish liquid with a characteristic choking odour. It has a MPt of -41.6°C, a BPt of 83°C and a vapour pressure of 6.2 kPa at 20°C. The vapour density is 2.2 times that of air. The odour threshold is in the region of 0.3 - 1 ppm (0.75 - 2.5 mg/m3). In moist air it forms a white fume, containing 0.1 - 0.4% NO_2, and when heated or in the presence of light it readily decomposes to red fuming nitric acid, containing 8 - 17% NO_2.

Nitric acid is formed as a reaction product of water and nitrogen dioxide from various natural sources and ambient air. Nitric acid is a major industrial acid. It is used in manufacture of fertilisers and in etching, dipping, plating and engraving processes. Exposure to nitric acid also occurs indirectly by exposure to nitrogen dioxide, a major air pollutant, which is converted slowly to nitric acid in the aqueous environment of the upper respiratory tract. The production rate in the EU is in excess of 10,000 tonnes per annum.

2. Health Significance

No data are available on the absorption, distribution, biotransformation or elimination of nitric acid.

Nitric acid is a strong mineral acid with powerful oxidising properties. It causes skin and eye burns, and stains tissue yellow as a result of a xanthogenic reaction. Exposure to relatively low concentrations of nitric acid results in mild irritation of the eyes and throat, a dry cough and tightness of the chest. From an early experiment in humans Diem (1907) concluded that vapours from heated nitric acid in concentrations of 11.5 - 12.2 ppm (30 - 32 mg/m^3) could not be inhaled for longer than 1 hour without causing health effects in humans.

In a study reported in abstract only, exposure to 1.6 ppm (4.2 mg/m^3) nitric acid vapour for 10 mins had no effect on pulmonary function in healthy volunteers (Sackner and Ford, 1981). Unfortunately only one concentration was tested, in a small number (5) of individuals. Therefore this study offers only a limited basis for deriving health-based limit values. The exposure period of 10 minutes is relevant for the derivation of a 15-minute STEL value.

According to Fairhall (1957), as cited by ACGIH, continued exposure to the vapour and mist of nitric acid may result in a chronic bronchitis, and more severe exposure results in a chemical pneumonitis (which appears likely to result from the nitrous fumes). The vapour and mist of nitric acid may erode the teeth, particularly affecting the canines and incisors. It has been suggested that nitric acid was less potent than sulfuric or hydrochloric acid in eroding the teeth.

An association between incidences of laryngeal cancer and exposure to acid mists containing sulphuric acid has been reported (IARC, 1992). This is possibly due to respirable acid mist particles, which are deposited primarily in the upper airways, causing an irritating effect. The irritation may damage the epithelium and thereby potentiate the carcinogenic effects of other substances (Steenland *et al,,* 1988; Beaumont *et al.,* 1987; Soskolne *et al.,* 1984). Information on carcinogenic properties of nitric acid is lacking. No evidence of mutagenicity was found in bacterial studies of nitric acid (Demeric *et al.,* 1951; Henschler, 1990). Hence, it is likely that the carcinogenicity of acid mists is an epigenetic effect.

Data on reproductive toxicology and immunotoxicity are not available.

Recommendation

There are no data from which to derive an 8-h TWA limit value.

The study of Sackner and Ford (1981) indicates a NOAEL of 1.6 ppm (4.2 mg/m^3) for effects of nitric acid on pulmonary function in volunteers over a 10 min period. Only one concentration was tested in a small number (5) of individuals and therefore this study offers only a limited basis for deriving health-based limit values. However, it is considered to provide a basis for proposing a STEL (15 mins). Based on the NOAEL of 1.6 ppm for local short-term (10 min) effects of nitric acid on the airways a STEL of 1.0 ppm (2.6 mg/m^3) is recommended. Although SCOEL could not recommend a specific 8-h TWA limit, the committee felt that 8-h TWA exposures should be appreciably below the STEL. No "skin" notation was considered to be necessary.

At the levels recommended, no measurement difficulties are foreseen.

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Key Documentations used: ACHIH (1996); Nielsen (1996)