

Def

261-3a SEG/SUM/61C
January 1996

Recommendation from Scientific Expert Group
on Occupational Exposure Limits
for Nitric acid

8 hour TWA	:	-
STEL (15 mins)	:	0.5 ppm (1.3 mg/m ³)
Additional classification	:	-

Substance:

Nitric acid	HNO₃	
Synonyms	:	Hydrogen nitrate; nitrous fumes; nitryl hydroxide; aqua fortis
EINECS N°	:	231-714-2
EEC N°	:	007-004-00-1
CAS N°	:	7697-37-2
MWt	:	63.01
Conversion factor (20°C, 101 kPa)	:	2.62 mg/m ³ = 1 ppm
		Classification : O; R8 C; R35

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% NO₂, and when heated or in the presence of light it readily decomposes to red fuming nitric acid, containing 8 - 17% NO₂.

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 to nitric oxide in the aqueous environment of the upper respiratory tract. The production rate in the EU is in excess of 10,000 tonnes per annum.

Health Significance:

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

Nitric acid is a strong mineral acid with corrosive properties. It causes skin and eye burns, and stains tissue yellow due to formation of xanthoproteic acid. Exposure to a low concentration of nitric acid results

in mild irritation of the eyes and throat, a dry cough and tightness of the chest. Diem (1907) concluded that vapours from heated nitric acid in concentrations of 11.5 - 12.2 ppm (30 - 32 mg/m³) 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/m³) nitric acid vapour for 10 mins had no effect on pulmonary function in healthy volunteers (Sackner and Ford, 1981).

Exposure of rats to 0.73 ppm (1.9 mg/m³) nitric acid vapour for 3 hours resulted in a significant increase in the number of focal lung lesions in rats (Mautz *et al.*, 1988). There are no reports of adequately controlled chronic studies of nitric acid in experimental animals.

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 (Demerec *et al.*, 1951; Henschler, 1990).

Data on reproductive toxicology and immunotoxicity are not available.

Recommendation:

There was no available basis for proposing an 8-hour TWA. The study of Sackner and Ford (1981), indicating a NOAEL of 1.6 ppm (4.2 mg/m³) for effects on pulmonary function in volunteers over a 10 min period, was considered to provide a basis for proposing a STEL (15 mins). Based upon the study of Mautz *et al.* (1988), reporting that lung lesions were observed in rats exposed to nitric acid at 0.73 ppm (1.9 mg/m³) for 3 hours, it was considered possible that repeated short term exposure to workers at the NOAEL could result in health effects and therefore an uncertainty factor of 2 was proposed. Taking into account the preferred value approach the recommended STEL is 0.5 ppm (1.3 mg/m³). The SEG considered that this value would protect against irritation in the respiratory tract, although specific detailed information is lacking. No "skin" notation was considered to be necessary.

At the levels recommended, no measurement difficulties are foreseen.

Key Bibliography:

Beaumont, J. J., Leveton, J., Knox, K., Bloom, T., McQuiston, T., Young, M., Goldsmith, R., Steenland, N. K., Brown, D. P. and Halperin, W. E. (1987). Lung cancer mortality in ovrkers exposed to sulfuric acid mist and other acid mists. J. Natl. Cancer Inst. 79, 911-921.

Demerec, M., Bertani, G. and Flint, J. (1951). A survey of chemicals for mutagenic action on E. coli. The American Naturalist. 85, 119-136.

Diem, L. (1907). Experimentelle Untersuchungen über die Einatmung von Salpetersäuredämpfen. Inaugural-Dissertation. Kgl. Bayer. Julius-Maximilians-Universität Würzburg.

Henschler, D. (ed). Criteria document of occupational exposure limits : nitric acid (21.06.1990). VCH Weinheim.

Nielsen, P.J. (1993). Occupational Exposure Limits: Criteria Document for Nitric Acid. EUR 16668 EN

IARC (1992). IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Vol 54, Occupational Exposures to Mists and Vapours from Strong Inorganic Acids: and other Industrial Chemicals. International Agency for Research on Cancer, Lyon.

Mautz, W.J., Kleinman, M.T., Phalen, R.F. and Crocker, T.T. (1988). Effects of exercise exposure on toxic interactions between inhaled oxidant and aldehyde air pollutants. *J. Toxicol. Environ. Health*, 25, 165-178.

Sackner, M.A. and Ford, D. (1981). Effects of breathing nitrate aerosols in high concentrations for 10 minutes on pulmonary function of normal and asthmatic adults, and preliminary results in normals exposed to nitric acid fumes. *Am. Rev. Respir. Dis.* 123, 51 (abstract).

Soskolne, C.L., Zeighami, E.A., Hanis, N.M., Kupper, L.L., Hermann, N., Amsel, J., Mausner, J.S. and Stellman, J.M. (1984). Laryngeal cancer and occupational exposure to sulfuric acid. *Am. J. Epidemiol.* 120, 358-369.

Steenland, K., Schnorr, T., Beaumont, J., Halperin, W. and Bloom, T. (1988). Incidence of laryngeal cancer and exposure to acid mists. *Br. J. Ind. Med.* 45, 766-776.