Social Europe

Recommendation from the Scientific Committee on Occupational Exposure Limits for triethylamine

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Table of Contents

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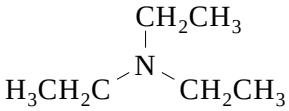
8 hour TWA	:	1 ppm (4.2 mg/m^3)
STEL (15 mins)	:	3 ppm (12.6 mg/m^3)
Additional classification	:	"skin"

Substance:

Triethylamine



Synonyms : N,N-diethyl ethanamine, (diethylamino)ethane
EINECS N° : 204-469-4
EEC N° : 612-004-00-5 Classification : F; R11 Xi; R36/37
CAS N° : 121-44-8
MWt : 101.19
Conversion factor (20°C, 101 kPa) : 4.21 mg/m^3 = 1 ppm

1 Occurrence/use

Triethylamine is a colourless liquid with a strong ammoniacal odour. It has a MPt of -115°C, a BPt of 90°C and a vapour pressure of 7.2 kPa at 20°C. The vapour density is 3.5 times that of air and it is explosive in the range 1.2 - 8.0% in air. The highest odour threshold quoted is 0.6 ppm (2.7 mg/m^3).

The major use of triethylamine is in production of pharmaceutical agents and pesticides. It is also used as a catalyst for resins and in the manufacture of polyurethane foam. Occupational exposure levels of 0.2 to 32.4 ppm (0.8 to 136 mg/m^3) have been measured. Production in the EC is estimated to be under 10,000 tonnes per annum.

2 Health Significance

Triethylamine is well absorbed percutaneously (Carpenter, 1949) and via the lungs. The major metabolic route is N-oxidation to triethylamine N-oxide. Triethylamine is well distributed throughout the body and eliminated mainly in the urine (Åkesson *et al.,* 1988). Elimination in exhaled air is minimal.

Exposure of rabbits to 50 ppm (210 mg/m^3) triethylamine for 7h/d, 5d/week for 6 weeks, caused erosions and oedema of the cornea, pulmonary irritation, peribronchial infiltration, thickening of vascular walls of lungs and slight degeneration of the liver (Brieger and Hodes, 1951).

Triethylamine showed no genotoxic activity in the Ames test (Zeiger *et al,*, 1987) or in a sister chromatid exchange assay (Sorsa *et al.*, 1988).

Data from the effects on chicken embryos and on developmental stages of a wasp indicate that the teratogenicity of triethylamine should be investigated in a mammalian species.

Åkesson et al. (1985) examined the effects of single exposures of triethylamine in human volunteers. The main effects seen were visual disturbances, with a LOAEL of 4.3 ppm (18 mg/m^3) after 4-6h exposure. No effect was observed after 8h at 2.4 ppm (10 mg/m^3). Investigations of workers in a polyurethane foam production plant indicated that repeated exposure to a TWA of 2.4-3.6 ppm (10-15 mg/m^3) for 4-8h caused a "blue haze" visual disturbance, although this may have been due to brief excursions above the TWA (Åkesson *et al.*, 1986). Three out of four workers reported a "blue haze" on a day when the TWA was 2.6 ppm (11 mg/m^3) and the peak concentration was 5.7 ppm (24 mg/m^3). The workers did not show any sign of permanent eye damage. In a briefly reported study, exposure to an 8h TWA of up to 5 ppm (21 mg/m^3) triethylamine had no effect on the vision of workers in foundries (Warren and Selchan, 1988). Slight hazy and blurred vision was reported at concentrations over 5 ppm (21 mg/m^3) and halo vision, with eye, nose and throat irritation occurred above 10 ppm (42 mg/m^3). Further evidence of visual disturbances was obtained in a recent study in which 4 volunteers were exposed to triethylamine for 4 hours at concentrations of 0.7, 1.5 and 9.6 ppm (3.0, 6.5 and 40.6 mg/m^3) (Järvinen *et al*., 1999). The highest concentration resulted in marked oedema and microcysts in the corneal epithelium. No effects were observed at 0.7 ppm (3.0 mg/m^3), whereas at 1.5 ppm (6.5 mg/m^3), two of the subjects perceived minimal to moderate

blurring of their vision and decreased contrast sensitivity and minimal to mild corneal changes were observed in three of the subjects (Järvinen *et al*., 1999).

3 Recommendation

The study of Järvinen *et al*. (1999) indicating a NOAEL of 0.7 ppm (3.0 mg/m^3) and LOAEL of 1.5 ppm (6.5 mg/m^3) for slight visual disturbances in volunteers, was considered to be the best available basis for setting exposure limits. As the NOAEL is based on well-investigated human exposure data, no uncertainty factor was considered necessary. The recommended 8-hour TWA for triethylamine is 1 ppm (4.2 mg/m^3). Based upon the observation of Åkesson *et al.* (1986), that occupational exposure to a TWA of 2.6 ppm (11 mg/m^3) with a peak concentration of 5.7 ppm (24 mg/m^3) resulted in visual disturbance to 3 out of 4 workers, a STEL (15 mins) of 3 ppm (12.6 mg/m^3) is proposed. No long term human data are available, but the proposed limits are not contradicted by the results of longer term studies in experimental animals.

A "skin" notation was also recommended as dermal absorption could significantly contribute to the total body burden.

At the levels recommended, no measurement difficulties are foreseen.

4 Key Bibliography

Åkesson, B., Florén, I and Skerfving, S. (1985). Visual disturbances after experimental human exposure to triethylamine. Br. J. Ind. Med. 42, 848-850.

Åkesson, B., Bengtsson, M. and Florén, I (1986). Visual disturbances after industrial triethylamine exposure. Int. Arch. Occup. Environ. Hlth. 57, 297-302.

Åkesson, B., Skerfving, S. and Mattiasson, L. (1988). Experimental study on the metabolism of triethylamine in man. Br. J. Ind. Med. 45, 262-268.

Brieger, H. and Hodes, W.A., (1951). Toxic effects of exposure to vapors of aliphatic amines. Am. Med. Assoc. Arch. Ind. Hyg. Occup. Med. 3, 287-291.

Carpenter, C.P. (1949). Range finding tests on triethylamine. EPA-OTS 86-870001409 Mellon Institute of Industrial Research, University of Pittsburgh, USA.

Järvinen, P., Engström, Riihimäki, V., Ruusuvaara, P. and Setälä, K. (1999). Effects of experimental exposure to triethylamine on vision and the eye. Occup. Environ. Med. 56, 1-5.

Smillie, M.V., Glass, D.C., Cross, H.J., Levy, L.S., Chipman, J.K. and Fletcher, A.C. (1991). Occupational Exposure Limits: Criteria document for triethylamine.

Sorsa, M., Pyy, L., Salomaa, S., Nylund, L. and Yager, J.W., (1988). Biological and environmental monitoring of occupational exposure to cyclophosphamide in industry and hospitals. Mutat. Res. 204, 465-479.

Warren, D.W. and Selchan, D.F. (1988). An industrial hygiene appraisal of triethylamine and dimethylamine exposure limits in the foundry industry. Am. Ind. Hyg. Assoc. J. 49, 630-634.

Zeiger, E., Anderson, B., Haworth, S., Lawlor, T., Mortelmans, K. and Speck, W., (1987). Salmonella mutagenicity tests: III Results from the testing of 255 chemicals. Environ. Mutagen. 9, Suppl. 9 1-109.