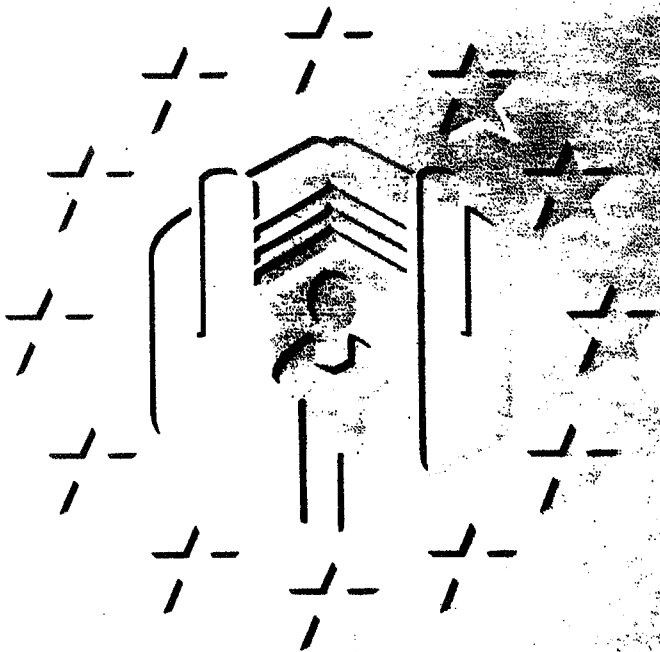




EUROPEAN COMMISSION

Occupational exposure limits

Recommendations
of the
Scientific Expert
Group
1991-92



Health and safety

Report
EUR 15091 EN

Dimethylamine

8-hour TWA: 2 ppm (3.8 mg/m³)
STEL (15 minutes): 5 ppm (9.4 mg/m³)
Additional classification: —

Substance identification

Dimethylamine (CH₃)₂NH
Synonyms: DMA, N-methyl methanamine
Einecs No: 204-697-4
EEC No: 612-001-00-9; Classification: F+; R12 Xi; R36/37
CAS No: 124-40-3
MWt: 45.08
Conversion factor (20°C, 101 kPa): 1.88 mg/m³ = 1 ppm

Occurrence/use

DMA is a strongly alkaline gas with a fishy odour. It has a melting-point of – 93°C, boiling-point of 7°C and a vapour pressure of 170 kPa at 20°C. The odour threshold in air is 0.001 to 0.05 ppm (0.0014 to 0.1 mg/m³). DMA can react with nitrite to form N-nitrosodimethylamine (NDMA) which is hepatotoxic and carcinogenic.

DMA occurs naturally in biological fluids as a result of endogenous metabolic processes. Large amounts are found in frozen fish due to the action of trimethylamine oxidase on trimethylamine. It is manufactured by the reaction of ammonia and alcohol and is used as an accelerator in vulcanizing rubber, in leather tanneries as a dehairing agent, in solvents, surfactants, insecticides, fungicides and many other products.

Occupational exposure levels of 0.6 to 17.6 ppm (1.1 to 33.1 mg/m³) have been measured. Other aliphatic amines were also present in the atmosphere, but only DMA was detected in increased amounts in the urine of workers, indicating that the other aliphatic amines, particularly trimethylamine, may be metabolized to DMA. Commonly used analytical methods detect other lower aliphatic amines.

Health significance

The SEG discussed the document on DMA prepared by the Dutch Expert Committee for Occupational Standards. DMA is rapidly absorbed following oral or inhalation exposure but exhibits low systemic toxicity. The critical effect is irritation of the upper respiratory tract, particularly the nasal passages. Eye irritation occurs at higher exposure levels. No data on human health effects were available.

A study conducted by Coon (1970) on continuous exposure of DMA at 5 ppm (9.4 mg/m³) for 90 days demonstrated interstitial inflammation of the lungs in five species, including rats, monkeys and dogs. It was considered that these changes were not treatment-related and consequently, in the absence of similar lung lesions in studies conducted at much higher exposure levels, this study should not be taken into account in recommending the exposure limits.

In rats and mice, inhalation of DMA at levels of 10 to 175 ppm (19 to 329 mg/m³), six hours a day, five days a week for two years, caused concentration-related lesions in the respiratory and olfactory mucosa (CIIT, 1990). In the 10 ppm (19 mg/m³) exposure group only a few animals were affected and lesions were confined to focal degeneration of the olfactory epithelium in the dorsal meatus. The specificity of the lesion for the nasal passages is consistent with the high water solubility of DMA, which results in the majority of DMA being absorbed by the nasal surface secretions and therefore not reaching the lower regions of the respiratory tract.

The respiratory and olfactory nasal mucosae of the rat are capable of metabolizing DMA to formaldehyde *in vitro*. However, the significance of *in vivo* nasal metabolism to formaldehyde is not known. A two-year inhalation study (175 ppm, 329 mg/m³, six hours a day, five days a week) gave no evidence of carcinogenicity (CIIT, 1990).

The significance of the potential nitrosation of DMA to the carcinogenic NDMA still requires clarification.

Recommendation

The CIIT study, establishing a lowest observed effect level of 10 ppm (19 mg/m³), was considered to be an adequate basis for setting exposure limits. An uncertainty factor of 5 was applied to allow for the absence of human data and a NOAEL. The recommended 8-hour TWA for DMA is 2 ppm (3.8 mg/m³). To prevent short-term exposure to irritant levels a STEL (15 minutes) of 5 ppm (9.4 mg/m³) is recommended. A 'skin' notation is not considered necessary as skin absorption would not contribute significantly to endogenous levels of DMA.

At the levels recommended no measurement difficulties are foreseen.

These recommendations should be supported by additional animal data on dermal exposure and reproduction toxicology. Information on human exposure should be obtained.

Key bibliography

ACGIH (1989) 'Threshold limit values and biological exposure indices for 1989-90', American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio.

Buckley, L. A., Morgan, K. T., Swenberg, J. A., James, R. A., Hamm jr., T. E. and Barrow, C. S. (1985) 'The toxicity of dimethylamine in F344 rats and B6C3F1 mice following a one-year inhalation exposure', *Fund. Appl. Toxicol.*, 5, pp. 341-352.

Chemical Industry Institute of Toxicology (CIIT) (1990) 'Twenty-four month final report on inhalation toxicity of dimethylamine in F344 rats and B6C3F1 mice', CIIT archives, Docket No 11957.

Coon, R. A., Jones, R. A., Jenkins jr., L. J. and Siegel, J. (1970) 'Animal inhalation studies on ammonia, ethylene glycol, formaldehyde, dimethylamine and ethanol', *Toxicol. Appl. Pharmacol.*, 16, pp. 646-655.

DFG (1989) 'Maximum concentrations at the workplace and biological tolerance values for working materials', 1989, Report XXV, Commission for the investigation of health hazards of chemical compounds in the work area, VCH, Weinheim, Germany.

Dutch Expert Committee for Occupational Standards (1990) 'Health-based recommended occupational exposure limit for dimethylamine'.

Gross, E. A., Patterson, D. L. and Morgan, K. T. (1987) 'Effects of acute and chronic dimethylamine exposure on the nasal mucociliary apparatus of F344 rats', *Toxicol. Appl. Pharmacol.*, 90, pp. 359-376.

NIOSH (1984) *Manual of analytical methods*, third edition, Vol. 1, US Department of Health and Human Services.