Recommendation from Scientific Expert Group on Occupational Exposure Limits for Ethanolamine

8 hour TWA	:	1 ppm (2.5 mg/m^3)
STEL (15 mins)	:	3 ppm (7.6 mg/m^3)
Additional classification	:	"skin"

Substance:

Ethanolamine $NH_2CH_2CH_2OH$

Synonyms	:	2-aminoethanol, monoethanolamine		
EINECS N°	:	205-483-3		
EEC N°	:	603-030-00-8	Classification :	Xn; R20 Xi; R36/37/38
CAS N°	:	141-43-5		
MWt	:	61.08		

Conversion factor (20°C, 101kPa) : 2.54 mg/m^3 = 1 ppm

Occurrence/use:

Ethanolamine is a colourless liquid, with an ammoniacal odour. It has a MPt of 10.5°C, a BPt of 170°C and a vapour pressure of 0.05 kPa at 20°C. It has a vapour density of 2.1 times that of air and is explosive in the range of 2.5-17% in air. The odour threshold is 2-3 ppm (5-8 mg/m^3).

Ethanolamine is widely used in industry, including production of detergents and soaps, synthesis of dyestuffs, rubber vulcanization and the removal of acidic gases from atmospheres, such as carbon dioxide from submarines. The production rate in the EEC is in excess of 1,000 tonnes per annum. Typical occupational exposures are less than 1 ppm (2.5 mg/m^3).

Health Significance:

Ethanolamine is absorbed through the skin, lungs and gastrointestinal tract (Klain *et al*, 1985; Weeks *et al*, 1960; Weissbach and Sprinson, 1953). It is a normal constituent of the body, and following condensation to phosphatidyl ethanolamine or transformation into phosphatidyl choline can be incorporated into cellular membranes. It can be converted into amino acids or deaminated and used as an energy source.

The acute toxicity of ethanolamine is relatively low. Repeated oral administration to rats has indicated a NOAEL of 320 mg/kg/day (Smyth *et al*, 1951). Repeated inhalation exposure at concentrations above 66 ppm (168 mg/m^3) caused behavioural changes and pathological lesions

to the lung, liver, kidneys, spleen and testes in a number of species (Weeks *et al*, 1960). A NOAEL was not found in this study.

Exposure of rats, dogs and guinea pigs to ethanolamine vapour was reported to produce skin irritation at levels as low as 5 ppm (13 mg/m^3), although this may have been potentiated by direct skin contact with ethanolamine liquid that had condensed on the surface of the inhalation chamber (Weeks *et al*, 1960). Rats exposed to 5 ppm (13 mg/m^3) ethanolamine also exhibited lethargy after 2-3 weeks exposure. Behavioural changes are therefore concluded to be the critical effect of ethanolamine.

Ethanolamine has not been found to be mutagenic in bacteria (Dean *et al*, 1985; Hedenstedt and Frascati, 1978; Mortelmans *et al*, 1986) and did not induce cell transformation (Inuoe *et al*, 1982). There is evidence for reproductive toxicity at exposure levels much higher than those inducing skin irritation and behavioural effects (Mankes, 1986; Weeks *et al*, 1960). Ethanolamine has not been tested for immunotoxicity in animals or for carcinogenicity.

Very little information is available on the effects of exposure to ethanolamine vapour in humans, although the liquid has been reported to be a skin irritant and sensitizer (Cosmetic Ingredient Review Expert Panel, 1983; Tsyrkunov, 1975). Some studies, which are mostly poorly documented, suggest that ethanolamine may give rise to occupational asthma (Gelfand, 1963).

Recommendation:

The study of Weeks *et al* (1960), establishing a LOAEL of 5 ppm (13 mg/m^3) for behavioural effects in rats, was considered to be the best available basis for proposing occupational exposure limits. An uncertainty factor of 5 was applied because of the extrapolation from animal studies. The lack of a NOAEL did not justify a higher factor in this instance because the effects seen were minimal. The recommended 8-hour TWA is 1 ppm (2.5 mg/m^3). A STEL (15 mins) of 3 ppm (7.6 mg/m^3) was recommended to prevent exposure to irritating levels. A "skin" notation was recommended as dermal absorption could contribute substantially to the total body burden.

The levels are quite near to the present limit of detection and other amines may interfere with the analysis.

Key bibliography:

Criteria document for an occupational exposure limit for ethanolamine. Prepared by Industrial Toxicology Unit, Institute of Occupational Health, Birmingham. (EUR 14240)

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