Social Europe

Recommendation from the Scientific Expert Group on Occupational Exposure Limits for 2-butoxyethanol

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8 hour TWA	:	20 ppm (98 mg/m^3)
STEL (15 mins)	:	50 ppm (246 mg/m^3)
Additional classification	:	"skin"

Substance:

2-Butoxyethanol **$C_4H_9OCH_2CH_2OH$**

Synonyms : ethylene glycol monobutyl ether; butylglycol; Butyl Cellosolve®
EINECS N° : 203-905-0
EEC N° : 603-014-00-0
Classification : Xn; R20/21/22 Xi; R37
CAS N° : 111-76-2
MWt : 118.17

Conversion factor (20°C, 101 kPa) : 4.92 mg/m^3 = 1 ppm

1. Occurrence/use

2-Butoxyethanol is a colourless liquid with a mild ether-like odour. It has a MPt of -77 °C, a BPt of 170 °C and a vapour pressure of 0.1 kPa at 20°C. The vapour density is 4.1 times that of air and it is explosive in the range 1.1 - 12.7 % in air.

2-Butoxyethanol is widely used as a solvent in surface coatings, such as lacquers, enamels or latex paints. It is also used in metal cleaning formulas and household cleaners. The production rate in the EU is in excess of 1000 tonnes per annum.

2. Health Significance

2-Butoxyethanol is readily absorbed after inhalation, oral or dermal exposure in experimental animals and humans (Johanson, 1988; Corley *et al.*, 1994). The major metabolic route involves initial oxidation to 2-butoxyacetic acid, following both dermal and inhalation exposure (Johanson, 1988). Conjugates of 2-butoxyacetic acid are excreted predominantly in the urine.

On acute exposure, 2-butoxyethanol is moderately toxic to laboratory animals. Dermal LD50 values were in the region of 400 - 500 mg/kg in rabbits. The 4h LC50 in rats was about 450 ppm (2214 mg/m^3).

The critical effect of 2-butoxyethanol in several animal species is haematotoxicity. Carpenter *et al*. (1956) reported increased fragility of erythrocytes in rats after 6 weeks repeated inhalation of 2-butoxyethanol at 54 ppm (266 mg/m^3), which returned to normal overnight after exposure. More recently, in a 90d inhalation study in rats, (Dodd *et al.*, 1983) found a significant decrease in erythrocytes and haemoglobin values in females after 6 weeks of exposure to 77 ppm (379 mg/m^3), 6h/d, 5d/w. Effects were reduced towards the end of the study and no difference was seen in erythrocyte fragility. No effects were seen at 25 ppm (123 mg/m^3). *In vitro* studies have shown that the metabolite 2-butoxyacetic acid is much more potent than 2-butoxyethanol in inducing lysis of erythrocytes (Bartnik *et al*., 1987) and that human erythrocytes are an order of magnitude less sensitive than rat erythrocytes (Ghanayem, 1989; Udden, 1994; Udden and Patton, 1994). Rettenmeier *et al*. (1993) established that 2-butoxyacetic acid is extensively conjugated with glutamine in humans, but not in rats.

Data on chronic inhalation studies are not available.

2-Butoxyethanol has been shown not to induce sister chromatid exchanges or point mutations in mammalian cells (McGregor, 1984).

Several studies have indicated that 2-butoxyethanol does not exhibit relevant reproductive toxicity (e.g. NTP, 1985; Tyl *et al.*, 1984; Nelson *et al*., 1984; NTP, 1989).

Few data are available on the effect of 2-butoxyethanol in humans. Irritation of the mucous membranes and occasionally headaches were reported by volunteers after inhalation of approximately 100 ppm (492 mg/m^3) for 4 or 8 hours, and 200 ppm (984 mg/m^3) for 8 hours (Carpenter *et al.*, 1956). There was no evidence of haemolysis. The

reports of headaches are not considered to be indicative of significant potential for neurotoxicity, particularly as the lipid solubility of 2-butoxyethanol is not similar to that of solvents that are recognised to be neurotoxic.

Recommendation

The study of Dodd *et al*. (1983), indicating a NOAEL of 25 ppm (123 mg/m^3) for haematological effects in rats, was considered to be the best available basis for proposing occupational exposure limits. Because a number of *in vivo* and *in vitro* studies have demonstrated that humans are less sensitive than rats to the haemolytic effects of 2-butoxyethanol, there is no requirement for an uncertainty factor. Taking into account the preferred value approach, the recommended 8-hour TWA is 20 ppm (98 mg/m^3). On the basis of the volunteer study of Carpenter *et al.* (1956), a STEL (15 mins) of 50 ppm (246 mg/m^3) was proposed to limit peaks in exposure which could result in irritation.

A "skin" notation was also recommended as percutaneous absorption is likely to considerably increase the total body burden. In view of the potential for significant skin absorption, biological monitoring may be appropriate.

At the levels recommended, no measurement difficulties are foreseen.

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