Social Europe

Recommendation from the Scientific Expert Group on Occupational Exposure Limits for acetone

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8 hour TWA	:	500 ppm (1210 mg/m^3)
STEL (15 mins)	:	1000 ppm (2420 mg/m^3)
Notation	:	-

Substance:

Acetone **CH_3-CO-CH_3**

Synonyms : 2-Propanone; dimethyl ketone; methyl ketone
EINECS N° : 200-662-2
EEC N° : 606-001-00-8
Classification : F; R11
CAS N° : 67-64-1
MWt : 58.08

Conversion factor (20°C, 101 kPa) : 2.42 mg/m^3 = 1 ppm

1. Occurrence/use

Acetone is a clear colourless liquid with a sweetish aromatic odour. It has a MPt of -95.4 °C, a BPt of 56.2°C and a vapour pressure of 24.7 kPa at 20°C. The vapour density is 2.0 times that of air and it is explosive in the range 2.2 - 13.0 % in air. The odour threshold is about 13 ppm (31 mg/m^3).

Acetone is a normal body metabolite and may occur in small quantities in exhaled air of all mammals. It also may be formed by various types of degradation or combustion of organic materials from agricultural and industrial activities. It is widely used in industry as a solvent for cellulose acetate and nitrocellulose, and for acrylic paints, varnishes, lacquers, adhesives, printing inks and other resin solutions. It is also used as a degreasing agent and a raw material for chemical syntheses. The production rate in the EEC is about 10^6 tonnes per annum.

2. Health Significance

An average of 45% of inhaled acetone will be absorbed (Wigaeus *et al.*, 1981), but percutaneous absorption is likely to be comparatively low. Most of the absorbed acetone is metabolised, becoming incorporated into normal intermediary metabolism, but an increasing proportion is exhaled at higher blood concentrations (Owen *et al.*, 1982).

The critical effects of acetone are considered to be irritation of mucous membranes and neurobehavioural effects.

Exposure of volunteers to acetone for 6 hours per day for 1 or 6 days resulted in mucous membrane irritation at 500 and 1000 ppm (1210 and 2420 mg/m3), with minimal effects at 250 ppm (605 mg/m3)and none at 100 ppm (242 mg/m3) (Matsushita et al., 1969a and b). No symptoms were reported in any of the groups towards the end of the exposure sessions, indicating sensory adaptation. Exposure at higher levels will often be tolerable to workers, with complaints of irritation generally commencing at 8 hour time weighted exposures above 1000 ppm (2420 mg/m3) (Raleigh and McGee, 1972). More recently, irritation of the eyes, mouth and throat in volunteers exposed to 1000 ppm (2420 mg/m3) acetone for 4 or 8 hours was confirmed by Seeber et al. (1992a).

The neurotoxicity of acetone has been documented in a number of experimental studies. In juvenile baboons exposed continuously to 500 ppm (1210 mg/m^3) acetone for 7 days, an increase in response time was seen for a complex operant discrimination task (Geller, *et al.*, 1979). When mice were exposed to a continuous series of 30 min acetone exposure sessions at six levels increasing from 100 to 56,000 ppm (242 to 135,520 mg/m^3), a schedule-controlled type of operant behaviour showed decreased response rates at 1000 ppm (2420 mg/m^3) and above (Glowa and Dews, 1987).

Increases in simple visual reaction time were seen in six subjects exposed to 250 or 500 ppm (605 or 1210 mg/m^3) for 6 hours per day in an exposure chamber for six consecutive days (Matsushita *et al.*, 1969b). In a more extensive study, 22 volunteers exposed to 250 ppm (605 mg/m^3) acetone for 4 hours in an exposure chamber, small but statistically significant decreases were found in two measures of a dual task test (Dick *et al.*, 1989). Choice reaction time, visual vigilance, memory scanning and postural sway

showed no changes, whilst minimal differences were seen in the profile of moods test. However, this study is not considered suitable to use as a basis in proposing occupational exposure limits. Exposure of 16 volunteers to about 1000 ppm (2420 mg/m^3) acetone for 4 or 8 hours, simple and choice reaction time, memory scanning by the Sternberg paradigm and spontaneous motor activity failed to show any clear relationship to exposure (Seeber *et al*., 1992b; 1994)

Eight workers exposed to acetone in cellulose acetate manufacturing were assessed on 9 separate days during a three week period. The average exposure was 980 ppm (2372 mg/m^3) acetone. There were no exposure-related effects on simple reaction time or a modified Stroop's colour vigilance test, but ratings of tension, tiredness, complaints and annoyance were significantly affected (Seeber *et al*., 1994).

Information on the chronic effects of acetone is not available.

Acetone has generally been shown to be negative in mutagenicity assays (Maron *et al*., 1981). Data on carcinogenicity are lacking.

A developmental study conducted with rats and mice exposed to acetone intermittently during gestation produced evidence of embryotoxicity but no significant increase in malformations. A NOAEL of 2200 ppm (5324 mg/m^3) was reported (NTP, 1988). Administration of acetone to rats in the drinking water for 13 weeks at approximately 3400 mg/kg/day resulted in decreased motility and increased abnormalities of the sperm, but no histopathological lesions (NTP, 1991). No effects were seen in male mice treated similarly at doses up to 4858 mg/k/day (NTP, 1991) or in male rats given acetone in the drinking water at a dose of 1071 mg/kg/day for 6 weeks (Larsen *et al*., 1991).

Acetone exposure to rats causes induction of cytochrome P450 enzymes particularly P450 2E1, which is also found in humans (Patten *et al*., 1986). Experimental studies suggest that some induction and resultant potentiation of toxicity due to other solvents may occur at acute oral doses of 0.05 ml/kg (Charbonneau *et al*., 1988), corresponding to a blood-acetone concentration of 100 mg/l and above (Charbonneau *et al.*, 1986). Blood concentrations at that magnitude can be achieved in volunteers after an 8 hour exposure to acetone at 1000 ppm (2420 mg/m^3) (Blaszkewicz *et al*., 1992). However, no potentiation could be detected in rats exposed to 1000 ppm (2420 mg/m^3) acetone (Charbonneau *et al*., 1986).

Recommendation

Taking into account the reports noted above of irritation and neurobehavioural effects in volunteers and workers, it is considered that symptoms may occur at acetone exposures of 1000 ppm (2420 mg/m^3) or greater. In view of the mild nature of the symptoms, and because tolerance develops in workers, an uncertainty factor of 2 was considered adequate. The recommended 8-hour TWA is 500 ppm (1210 mg/m^3). The compound is a mild irritant, therefore a STEL (15 mins) of 1000 ppm (2420 mg/m^3) is proposed to limit peaks in exposure which could result in irritation or discomfort.

No "skin" notation was considered to be necessary.

At the levels recommended, no measurement difficulties are foreseen.

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