Recommendation of the Scientific Expert Group on Occupational Exposure Limits for Allyl alcohol

8 hour TWA	:	2 ppm (4.8 mg/m³)
STEL (15 mins)	:	5 ppm (12.1 mg/m³)
Additional classification	:	"skin"

Substance:

Allyl alcohol CH_2=CH-CH_2-OH

Synonyms : Propenol; propenyl alcohol; vinyl carbinol

EINECS N° : 203-470-7

EEC N° : 603-015-00-6 Classification: R10 T; R23/24/25 Xi; R36/37/38

CAS N° : 107-18-6

MWt : 58.08

Conversion factor (20°C, 101kPa) : 2.42 mg/m³ = 1 ppm

Occurrence/use:

Allyl alcohol is a flammable colourless liquid with a penetrating odour. It has a MPt of -129°C, a BPt of 97°C and a vapour pressure of 3.2 kPa at 25°C. It has a vapour density of 2.02 times that of air and is explosive in the range 2.5 - 18 % in air. The odour threshold is about 0.25 - 1.2 ppm (0.6 - 3.0 mg/m³).

Allyl alcohol is used in the preparation of pharmaceuticals, as a raw material for synthesis of allyl resin and plastics, as a flavouring agent and in the synthesis of glycerine. It is also used as a herbicide. The production rate in the EEC is in excess of 10,000 tonnes per annum.

Health Significance:

Allyl alcohol is readily absorbed by inhalation, ingestion or skin penetration.

Allyl alcohol has a high acute toxicity by all routes of exposure. Symptoms of acute exposure to allyl alcohol in man have been reported to be irritation of the eyes and nose, commencing at levels of 5 ppm (12 mg/m³) (Swensson, 1986). Systemic toxicity is considered to be caused by the primary metabolite, acrolein, which reacts with thiol groups (Ohno et al, 1984). Doses of 20 - 90 mg/kg allyl alcohol have been reported to result in the reduction of liver glutathione content and liver necrosis (Poulsen and Korsholm, 1984). Dunlap et al (1958) established a NOAEL for irritation and systemic effects in rats of 20 ppm (48 mg/m³) 7 hours/day, for 60 days.

Allyl alcohol has been shown to be mutagenic to Salmonella typhimurium (Eder et al, 1982), but not to Streptomyces or Aspergillus (Principe et al, 1981). Glycide aldehyde, which can be formed by epoxidation of acrolein, was found to cause papillomas and carcinomas when applied to the skin of mice 3 times a week for their entire lives (van Duuren et al, 1982).

Recommendation:

The study of Dunlap et al (1958), indicating a NOAEL of 20 ppm (48 mg/m³) for hepatotoxicity in rats, was considered to be the best available basis for proposing occupational exposure limits. An uncertainty factor of 10 was applied to allow for the absence of human data on systemic effects. The recommended 8-hour TWA is 2 ppm (4.8 mg/m³). Based upon the study of Swensson (1986), a STEL (15 mins) of 5 ppm (12.1 mg/m³) was proposed to limit peaks in exposure which could result in irritation.

A “skin” notation was recommended because percutaneous absorption could contribute significantly to the total body burden.

At the levels recommended, no measurement difficulties are foreseen.

Key Bibliography:

Swensson, Å. (1986). Allyl alcohol. In: Nordiska expertgruppen för gränsvärdes dokumentation Arnete och Hälsa 8, 1-40.

Dunlap, M.K., Kodama, J.K., Wellington, J.S., Anderson, H.H., Hine, C.H. (1958). The toxicity of allyl alcohol. Arch. Ind. Health 18, 303-311.

van Duuren, B.L., Orris, L., and Nelson, N. (1982). Carcinogenicity of epoxides, lactones and peroxy compounds. Part II. J. Natl. Cancer Inst. 35, 707-717.

Eder, E., Henschler, D., Neudecker, T. (1982). Mutagenic properties of allylic and α,ß-unsaturated compounds: consideration of alkylating mechanisms. Xenobiotica 12, 831-848.

Ohno, Y., Ormstad, K., Ross, D., and Orrenius, S. (1984). Mechanism of allyl alcohol toxicity and protective effects of low-molecular weight thiols, studied with isolated rat hepatocytes. Toxicol. Appl. Pharmacol. 78, 169-179.

Poulsen, H.E. and Korsholm, B. (1984). Quantitative liver functions after administration of allyl alcohol to rats. Acta Pharmacol Toxicol. 54, 120-123.

Principe, P., Dogliotti, E., Bignami, M., Cerbelli, R., Falcone, E., Fabrizi, M., Conti, G. and Comba, P. (1981). Mutagenicity of chemicals of industrial and agricultural relevance in Salmonella, Streptomyces and Aspergillus. J. Sci. Food Agric. 32, 826-832.