Recommendation of the Scientific Expert Group on Occupational Exposure Limits for Chlorodifluoromethane

8 hour TWA	:	1000 ppm (3600 mg/m³)
STEL (15 mins)	:	-
Additional classification	:	-

Substance:

Chlorodifluoromethane $CHClF_2$

Synonyms	:	Difluorochloromethane; CFC22; Freon 22; R22; F22
EINECS N°	:	200-871-9
EEC N°	:	- Classification: -
CAS N°	:	75-45-6
MWt	:	86.47

Conversion factor (20°C, 101 kPa) : 3.60 mg/m³ = 1 ppm

Occurrence/use:

CFC22 is a gas with a faint, sweetish odour. It has a MPt of -160°C, a BPt of -40.8°C and a vapour pressure of 885 kPa at 20°C.

CFC22 is manufactured by reaction of chloroform with hydrogen fluoride. The major usage is as a refrigerant in air-conditioning systems and in commercial and domestic refrigerators and freezers. It is the raw material in the production of polytetrafluoroethane (PTFE) and bromochlorofluorocarbon (BCF) fire extinguishant, and is used for plastic foam blowing. The production rate in the EEC is in excess of 10,000 tonnes per annum.

Health Significance:

Few data are available on rates of uptake of CFC22. CFC22 has a low acute toxicity in animals with deaths occurring at concentrations of 28% (1 kg/m³) and above. No information is available regarding irritation or sensitisation in animals.

In repeated exposure studies, no signs of toxicity were reported in rats or mice exposed to 10,000 ppm (36 g/m³) CFC22 for 5 - 6 h/d for 90 days or more (Tinston et al, 1981a and b). Several effects (reduced body weight gain, hyperactive behaviour, clinical biochemistry changes and altered organ weights) were reported at 50,000 ppm (180 g/m³).

The genotoxic potential of CFC22 has been adequately investigated in a number of *in vitro* and *in vivo* systems, but was only shown to be mutagenic in the Ames test, with and without metabolic activation (Longstaff *et al*, 1984). Results of *in vivo* tests for clastogenicity have been inconclusive (Anderson and Richardson, 1979). The relevance of the positive results in the Ames test to human health is uncertain.

Carcinogenicity studies in rats and mice showed increased incidences of tumours (mainly fibrosarcomas of the salivary gland and Zymbals gland) only in male rats exposed to 50,000 ppm (180 g/m³) CFC22 (Tinston et al, 1981a). It was later revealed that the test substance used had been contaminated with a number of other chlorofluorocarbons, particularly chlorofluoromethane (FC31), which is known to be an exceedingly strong carcinogen. In view of this, and the absence of tumour-inducing effect in a gavage carcinogenicity study in rats (Longstaff et al, 1984), CFC22 is not considered to represent a carcinogenic risk to humans. There is also evidence for teratogenicity in rats but not rabbits exposed to 50,000 ppm (180 g/m³), but not 10,000 ppm (36 g/m³) CFC22 (Palmer et al, 1978a and b).

Few investigations of humans exposed to CFC22 are available. Exposure is poorly documented and simultaneous exposure to other CFCs and other substances occurred. CFC22, inhaled in controlled studies in humans and animals, has not been shown to be metabolised to any significant extent and is mainly eliminated by exhalation.

Recommendation:

The studies of Tinston et al (1981a and b) and Palmer et al (1978a and b), indicating a NOAEL of 10,000 ppm (36 g/m³) for chronic toxicity and teratogenicity in rats, was considered to be the best available basis for proposing an 8-hour TWA. An uncertainty factor of 10 was applied to allow for the absence of human data. The recommended 8-hour TWA is 1000 ppm (3600 mg/m³). This value refers to pure CFC22 only. No STEL or “skin” notation was considered to be necessary.

At the levels recommended, no measurement difficulties are foreseen.

Key Bibliography:

WATCH (1992). Criteria document for an occupational exposure limit: Chlorodifluoromethane. UK Health and Safety Commission.

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Palmer, A.K., Cozens, D.D., Clark, R. and Clark, G.C. (1978a). Effect of Actron 22 on pregnant rats: relationship to anophthalmia and microphthalmia. ICI Central Toxicology Laboratory Report no. CTL/C/548.

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Tinston, D.J., Chart, I.S., Godley, M.J., Gore, C.W. and Litchfield, M.H. (1981a). Chlorodifluoromethane (CFC22): Long term inhalation study in the rat. ICI Central Toxicology Laboratory Report no. CTL/P/548.

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