Propyne

(CAS No: 74-99-7)

Health-based Reassessment of Administrative Occupational Exposure Limits

Committee on Updating of Occupational Exposure Limits,
a committee of the Health Council of the Netherlands

No. 2000/15OSH/128, The Hague, June 8, 2004

Preferred citation:
Health Council of the Netherlands: Committee on Updating of Occupational Exposure Limits. Propyne; Health-based Reassessment of Administrative Occupational Exposure Limits. The Hague: Health Council of the Netherlands, 2004; 2000/15OSH/128.

1 Introduction

The present document contains the assessment of the health hazard of propyne by the Committee on Updating of Occupational Exposure Limits, a committee of the Health Council of the Netherlands. The first draft of this document was prepared by M Busschers, M.Sc. and H Stouten, M.Sc. (TNO Nutrition and Food Research, Zeist, the Netherlands).

The evaluation of the toxicity of propyne has been based on the review by the American Conference of Governmental Industrial Hygienists (ACGIH) (ACG98). Where relevant, the original publications were reviewed and evaluated as will be indicated in the text. In addition, in April 1999, literature was searched in the on-line databases Medline, Toxline, and Chemical Abstracts, starting from 1966, 1965, and 1967, respectively, and using the following key words: propyne, methylacetylene, methyl acetylene, and 74-99-7.

In July 2000, the President of the Health Council released a draft of the document for public review. No comments were received.

An additional search in Toxline and Medline in November 2003 did not result in information changing the committee's conclusions.

2 Identity

name	:	propyne
synonyms	:	1-propyne; methyl acetylene; allylene; propine
molecular formula	:	C_3H_4
structural formula	:	$H_3C\text{-}C{\equiv}CH$
CAS number	:	74-99-7

3 Physical and chemical properties

molecular weight	:	40.07
boiling point	:	-23°C
melting point	:	-103°C
flash point	:	-
vapour pressure	:	at 20°C: 507 kPa
solubility in water	:	poorly soluble (at 25°C: 0.4 g/100 mL)
log $P_{octanol/water}$	:	0.94 (experimental); 1.04 (estimated)
conversion factors	:	at 20°C, 101.3 kPa: 1 ppm = 1.67 mg/m^3 1 mg/m^3 = 0.60 ppm

Data from ACG98, NLM03, http:esc.syrres.com.

Propyne is a colourless gas with a sweet odour.

4 Uses

Propyne is used as a welding torch fuel, a chemical intermediate, and a propellant (ACG98, Hor57).

5 Biotransformation and kinetics

The committee did not find data on the biotransformation and kinetics of propyne.

6 Effects and mechanism of action

Human data

The committee did not find data on the effects of propyne in humans.

Animal data

Irritation and sensitisation

The committee did not find data on the potential irritating or sensitising properties of propyne.

Acute toxicity

At concentrations of 10-15% (100,000-150,000 ppm or 167,000-ca. 250,000 mg/m^3), propyne induced anaesthesia in rats and cats with cardiac irregularities and convulsive movements (Hen40). When 20 male rats were exposed to 42,000 ppm (71,400 mg/m^3) for 6 hours, they initially became hyperactive, but after 7 minutes, they showed lethargy and signs of ataxia. Up to 45 minutes after starting exposure, they showed an increasing severity in abnormal and unsteady gait and in uncoordinated head movements, resulting in lying prone on the floor. After 95 minutes, the animals appeared completely anaesthetised. There was no mortality at the end of the exposure period. Most animals behaved normally within 40 minutes after ending exposure. Only effects on the lung were found at post-mortem examinations. In animals (n=5) killed immediately, lungs were dark red on the external surface and on cut section while microscopic findings

included oedema, bronchial contraction, and alveolar haemorrhage. In the remaining rats sacrificed 9 days post-exposure, the lungs showed more severe colouration and oedema while bronchiolitis and pneumonitis were observed microscopically (Hor57).

Repeated-dose toxicity

A group of 20 male rats and 2 male and 2 female dogs were exposed to an average concentration of 28,700 ppm (47,930 mg/m^3), 6 hours/day, 5 days/week, for 6 months. Mortality was noted in 8/20 treated rats and in 2/20 control rats. The 4 dogs survived the treatment period. Symptoms included slight ataxia, salivation, excitement, mydriasis, and tremors. These symptoms disappeared rapidly after ending of each exposure. Body weights were slightly depressed in treated rats. Body weight loss was noted in exposed dogs during the first 6 weeks, but they returned to their initial weights by week 14, and then continued to gain weight slightly. In rats, only lungs were affected, being distended and showing a dark-red colouration, ranging from speckled red areas to a homogeneous, dark-red, haemorrhagic appearance. The cut section of the rat lungs was a homogeneous, dark-red colour, and either oedema fluid or blood could be expressed from them. Some rat lungs had cysts that contained a 'cheesy' material. Microscopically, definite pulmonary irritation was observed in exposed rats. No macroscopic or microscopic abnormalities were found in the dogs (Hor57).

The committee did not find data on the potential carcinogenicity or reproduction toxicity of propyne.

Mutagenicity and genotoxicity

Propyne was negative when tested under gas exposure conditions in *S. typhimurium* strains TA98, TA100, TA1535, and TA1537 both with and without metabolic activation. Under these conditions, the compound was found positive when tested in *E. coli* strain WP2 *uvrA* both in the presence and absence of a metabolic activation system (Ara94).

7 Existing guidelines

The current administrative occupational exposure limit (MAC) for propyne in the Netherlands is 1650 mg/m^3 (1000 ppm), 8-hour TWA.

Existing occupational exposure limits for propyne in some European countries and in the USA are summarised in the annex.

8 Assessment of health hazard

The committee did not find data on effects of propyne in humans or animal data on the potential irritating or sensitising properties.

In rats, no mortality was observed following a single 6-hour exposure to 71,400 mg/m^3 (42,000 ppm). Exposure caused transient effects on the nervous system and macroscopic and microscopic changes in the lungs.

Repeated exposure to propyne for 6 months at 48,790 mg/m^3 (28,700 ppm) resulted in mortality in 8/20 rats, but not in 4 dogs, in nervous system (transient) and body weight effects in both species, and in lung damage in rats.

Propyne was found to be mutagenic in *E. coli* strain WP2 *uvrA* both in the presence and absence of metabolic activation, but not in *S. typhimurium* strains.

The committee did not find data on the potential carcinogenicity or reproduction toxicity of propyne.

The committee considers the toxicological database on propyne too poor to justify recommendation of a health-based occupational exposure limit.

The committee concludes that, based on the mortality observed in the 6-month inhalation study, the present MAC value of 1650 mg/m^3 (1000 ppm), 8-hour TWA, may be too high.

References

ACG98 American Conference of Governmental Industrial Hygienists (ACGIH). Methyl acetylene. In:TLVs® and other occupational exposure values -1998. [CD-ROM]. Cincinnati OH, USA; ACGIH®, 1998.

ACG03 American Conference of Governmental Industrial Hygienists (ACGIH). Guide to occupational exposure values - 2003. Cincinnati OH, USA: ACGIH®, Inc, 2003: 83.

ACG04 American Conference of Governmental Industrial Hygienists (ACGIH). 2004 TLVs® and BEIs® based on the documentation of the Threshold Limit Values for chemical substances and physical agents & Biological Exposure Indices. Cincinnati OH, USA: ACGIH®, 2004: 37.

Arb02 Arbejdstilsynet. Grænseværdier for stoffer og materialer. Copenhagen, Denmark: Arbejdstilsynet, 2002: 30 (At-vejledning C.0.1).

Ara94 Araki A, Noguchi T, Kato F, et al. Improved method for mutagenicity testing of gaseous compounds by using a gas sampling bag. Mutat Res 1994; 307: 335-44.

DFG03 Deutsche Forschungsgemeinschaft (DFG): Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area. List of MAK and BAT values 2003. Maximum concentrations and Biological Tolerance Values at the workplace Weinheim, FRG: Wiley-VCH Verlag GmbH & Co. KGaA, 2003: 77 (rep no 39).

EC04 European Commission: Directorate General of Employment and Social Affairs. Occupational exposure limits (OELs); http://europe.eu.int/comm/employment_social/health_safety/areas/oels_en.htm.

Hen40 Henderson VE. Anesthetic characteristics of methylacetylene. J Pharmacol 1940; 69: 74-5

Hor57 Horn HJ, Weir RJ, Reese WH. Inhalation toxicology of methylacetylene. AMA Arch Ind Health 1957; 15: 20-6.

HSE02 Health and Safety Executive (HSE). EH40/2002. Occupational Exposure Limits 2002. Sudbury (Suffolk), England: HSE Books, 2002.

NLM03 US National Library of Medicine (NLM), ed. 1-Propyne. In: The Hazardous Substances Data Bank (HSDB) (last revision date propyne file: February 2003; last review date: September 1994); http://toxnet.nlm.nih.gov.

Swe00 Swedish National Board of Occupational Safety and Health. Occupational exposure limit values and measures against air contaminants. Solna, Sweden: National Board of Occupational Safety and Health, 2000; Ordinance AFS 2000:3.

SZW04 Ministerie van Sociale Zaken en Werkgelegenheid (SZW). Nationale MAC-lijst 2004. The Hague, the Netherlands: Sdu Uitgevers, 2004: 33.

TRG03 TRGS 900. Grenswerte in der Luft am Arbeitsplatz; Technische Regeln für Gefahrstoffe. BArbBl 2003; (9).

Annex

Occupational exposure limits for propyne in various countries.

country - organisation	occupational exposure limit		time-weighted average	type of exposure limit	note[a]	reference[b]
	ppm	mg/m^3				
the Netherlands						
- Ministry of Social Affairs and Employment	1000	1650	8 h	administrative		SZW04
Germany						
- AGS	1000	1700	8 h			TRG03
	4000	6800	15 min			
- DFG MAK-Kommission	-[c]	-[c]				DFG03
Great-Britain						
- HSE	-	-				HSE02
Sweden	-	-				Swe00
Denmark	1000	1650	8 h			Arb02
USA						
- ACGIH	1000	-	8 h	TLV		ACG04
- OSHA	1000	1650	8 h	PEL		ACG03
- NIOSH	1000	1650	10 h	REL		ACG03
European Union						
- SCOEL	-	-				EC04

[a] S = skin notation; which means that skin absorption may contribute considerably to body burden; sens = substance can cause sensitisation.

[b] Reference to the most recent official publication of occupational exposure limits.

[c] Listed among compounds for which studies of the effects in man or experimental animals have yielded insufficient information for the establishment of MAK values.