
1,1-Dichloro-1-nitroethane

(CAS No: 594-72-9)

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/118, The Hague, June 8, 2004

Preferred citation:

Health Council of the Netherlands: Committee on Updating of Occupational Exposure Limits. 1,1-Dichloro-1-nitroethane; Health-based Reassessment of Administrative Occupational Exposure Limits. The Hague: Health Council of the Netherlands, 2004; 2000/15OSH/118.

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1 Introduction

The present document contains the assessment of the health hazard of 1,1-dichloro-1-nitroethane 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 A Wientjes, M.Sc. and H Stouten, M.Sc. (TNO Nutrition and Food Research, Zeist, the Netherlands)

The evaluation of the toxicity of 1,1-dichloro-1-nitroethane has been based on the review by the American Conference of Governmental Industrial Hygienists (ACGIH) (ACG91). Where relevant, the original publications were reviewed and evaluated as will be indicated in the text. In addition, in February 1998, literature was searched in the on-line databases Medline, Cancerlit, Toxline, and Chemical Abstracts, starting from 1966, 1963, 1965, and 1967, respectively, and using the following key words: dichloronitroethane, dichloronitroethane, ethide, and 594-72-9.

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	:	1,1-dichloro-1-nitroethane
synonyms	:	dichloronitroethane; ethide
molecular formula	:	$C_2H_3Cl_2NO_2$
structural formula	:	$H_3C-CCl_2NO_2$
CAS number	:	594-72-9

3 Physical and chemical properties

molecular weight	:	143.96
boiling point	:	124°C
melting point	:	not available
flash point	:	58°C (closed cup); 76°C (open cup)
vapour pressure	:	at 20°C: 2.0 kPa
solubility in water	:	poorly soluble (at 20°C: 0.35 g/100 mL)
log P _{octanol/water}	:	1.56 (estimated)
conversion factors	:	at 20°C, 101.3 kPa: 1 ppm = 6.0 mg/m ³ 1 mg/m ³ = 0.17 ppm

Data from ACG91, <http://esc.syrres.com>.

1,1-Dichloro-1-nitroethane is a colourless liquid with an unpleasant odour that causes tearing (ACG91).

4 Uses

1,1-Dichloro-1-nitroethane is used primarily in organic synthesis and as a fumigant for produce. It has also been used in the manufacture of highly accelerated rubber cements and insecticides (ACG91). According to the database of the Dutch Pesticide Authorisation Board (CTB)*, 1,1-dichloro-1-nitroethane is at present not permitted in the Netherlands for use as an active ingredient in pesticides.

5 Biotransformation and kinetics

The committee did not find data on the biotransformation and kinetics of 1,1-dichloro-1-nitroethane.

6 Effects and mechanism of action

Human data

The committee did not find data on the toxic effects of 1,1-dichloro-1-nitroethane in humans.

* At: <http://www.ctb-wageningen.nl>.

Animal data

When two 5 mL portions of 1,1-dichloro-1-nitroethane were applied (daily, for 2 consecutive days) to the clipped skin of the bellies of rabbits with 30-minute intervals elapsing between applications and left there for 4 hours before being removed, the skin became swollen and irritated (Mac40, Mac45).

In a series of acute and subacute experiments (n=24) in rabbits and guinea pigs (n=2/group/species) with concentrations ranging between 144 and 90,000 mg/m³ (25-15,600 ppm*) and exposure durations between 10 minutes and 204 hours (exposures > 6 hours divided into periods of 6 hours/day, 5 days/week), 1,1-dichloro-1-nitroethane appeared to be an eye- and airway-irritating compound. Exposure to concentrations below 580 mg/m³ (100 ppm) (duration probably 6 hours**) was stated to induce definite but not severe signs of irritation, while no such signs were seen at 144 mg/m³ (25 ppm) (exposure probably 6 hours/day, 5 days/week, for 34 days). The mortality data are summarised in Table 1. The lungs were the target organ. Exposure to concentrations higher than 1000 mg/m³ (170 ppm) for longer than 30 minutes caused oedema, congestion, haemorrhage, and bronchitis. In addition, effects on the heart, blood vessels, liver, and kidneys were found (Mac45). Although this study has some flaws such as a small number of animals, single concentrations and durations, sacrifices 6 to 12 weeks after ending exposure, and limited reporting, the committee concludes that exposure to 144 mg/m³ (25 ppm), 6 hours/day, 5 days/week, for 34 days, does not seem to cause irritation or gross or histological organ lesions.

Table 1 Mortality in rabbits and guinea pigs following exposure to 1,1-dichloro-1-nitroethane (adapted from Mac45).

concentration (mg/m ³)	duration (hours)	rabbit	guinea pig	concentration (mg/m ³)	duration (hours)	rabbit	guinea pig
90.000	1.25	2/2	2/2	3500	2.5	1/2	0/2
57.700	0.5	2/2	2/2	2000	0.5	0/2	0/2
57.700	0.16	2/2	2/2	1500	1	0/2	0/2
28.900	0.5	2/2	2/2	1000	2	1/2	1/2
28.900	0.16	2/2	0/2	1000	0.5	0/2	0/2
14.400	2.25	2/2	2/2	700	1	0/2	0/2
14.400	0.66	2/2	0/2	580	6	2/2	2/2
5800	3.25	2/2	1/2	350	2	0/2	0/2
5800	1	1/2	0/2	300	18.75	2/2	0/2
5800	0.5	1/2	1/2	200	4	0/2	0/2
5000	0.16	0/2	0/2	144	34 days	0/2	0/2
3500	5	2/2	2/2	144	18.75	0/2	0/2

* Conversions by Machle et al.

** This exposure was lethal to all animals.

Following oral administration (gavage) to rabbits, the lethal dose was reported to be between 150 and 200 mg/kg bw. A dose of 150 mg/kg bw caused a 10% weight loss within 10 days with a rather slow recovery. At lethal doses, effects were observed in the stomach, blood vessels, lungs, liver, and kidneys (Mac45).

1,1-Dichloro-1-nitroethane, tested at 5 dose levels of 10-666 µg/plate with and without metabolic activation, was positive in mutagenicity assays using *S. typhimurium* strains TA97, TA98, TA100, and TA1535 (Zei92).

7 Existing guidelines

The current administrative occupational exposure limit (MAC) for 1,1-dichloro-1-nitroethane in the Netherlands is 10 mg/m³ (2 ppm), 8-hour TWA.

Existing occupational exposure limits for 1,1-dichloro-1-nitroethane 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 toxic effects in humans following exposure to 1,1-dichloro-1-nitroethane.

In experimental animals, 1,1-dichloro-1-nitroethane is a skin-, eye-, and airway-irritating compound. In rabbits and guinea pigs, effects depend on the concentration and duration of exposure. Lung effects occurred after exposure to concentrations in excess of 1000 mg/m³ (170 ppm) for longer than 30 minutes. Exposure to 57,700 mg/m³ (10,000 ppm) for 10 minutes or to 580 mg/m³ (100 ppm) for 6 hours killed all animals (i.e., 2 rabbits and 2 guinea pigs). No effects were seen following exposure to 144 mg/m³ (25 ppm), 6 hours/day, 5 days/week, for 34 days. At lethal exposures, the lungs were the target organ, but the heart, blood vessels, liver, and kidneys were affected as well. Single oral doses of 150-200 mg/kg bw were lethal to rabbits.

1,1-Dichloro-1-nitroethane was mutagenic in *S. typhimurium*.

There is no information available from valid studies on the toxicity (including reproduction toxicity and carcinogenicity) following repeated exposure. In addition, there is no information from genotoxicity testing in *in vitro* mammalian systems or from *in vivo* genotoxicity tests.

The committee considers the toxicological database on 1,1-dichloro-1-nitroethane too poor to justify recommendation of a health-based occupational exposure limit.

The committee concludes that there is insufficient information to comment on the level of the present MAC-value.

References

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Annex

Occupational exposure limits for 1,1-dichloro-1-nitroethane 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	2	10	8 h	administrative		SZW04
Germany - AGS	10	60	8 h		S	TRG03
- DFG MAK-Kommission	- ^c	- ^c	8 h			DFG03
Great-Britain - HSE	-	-				HSE02
Sweden	-	-				Swe00
Denmark	2	12	ceiling			Arb02
USA - ACGIH	2	-	8 h	TLV		ACG04
- OSHA	10	60	ceiling	PEL		ACG03
- NIOSH	2	10	8 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.