Minnesota Department of Health

Health Based Guidance for Water
Health Risk Assessment Unit, Environmental Health Division
651-201-4899

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Toxicological Summary for: 1,1-Dichloroethane

CAS**: 75-34-3**
Synonyms: 1,1-Ethylidene dichloride

Acute Non-Cancer Risk Assessment Advice ($nRAA_{Acute}$) = Not Derived (Insufficient Data)

Short-term Non-Cancer Risk Assessment Advice ($nRAA_{Short\text{-}term}$) = 400 µg/L

$$\frac{\text{(Reference Dose, mg/kg-d) x (Relative Source Contribution) x (Conversion Factor)}}{\text{(Short-term Intake Rate, L/kg-d)}}$$

$$= \frac{\text{(0.60 mg/kg-d) x (0.2)}^{*} \text{ x (1000 µg/mg)}}{\text{(0.285 L/kg-d)}^{**}}$$

= 421 rounded to **400 µg/L**

*Relative Source Contribution: MDH 2008, Section IV.E.1.
**Intake Rate: MDH 2008, Section IV.E.1. and US EPA 2011, Exposure Factors Handbook, Tables 3-1 and 3-81

Reference Dose/Concentration:	(714 x 0.25)/300 = 0.60 mg/kg-d (Sprague Dawley rat)
Source of toxicity value:	determined by MDH in 2015
Point of Departure (POD):	714 mg/kg-d (NOAEL, Muralidhara et al. 2001)
Human Equivalent Dose (MDH, 2011):	714 x 0.25 = 179 mg/kg-d
Total uncertainty factor (UF):	300
Uncertainty factor allocation:	3 for interspecies differences (for toxicodynamics), 10 for intraspecies variability, and 10 for database insufficiencies (lack of oral development and reproductive studies, lack of neurological function testing)
Critical effect(s):	Decreased body weight and central nervous system depression
Co-critical effect(s):	Increased mortality
Additivity endpoint(s):	Nervous system

Subchronic Non-Cancer Risk Assessment Advice ($nRAA_{Subchronic}$) = 400 µg/L

$$\frac{\text{(Reference Dose, mg/kg-d) x (Relative Source Contribution) x (Conversion Factor)}}{\text{(Subchronic Intake Rate, L/kg-d)}}$$

$$= \frac{\text{(0.60 mg/kg-d) x (0.2)}^{*} \text{ x (1000 µg/mg)}}{}$$

(0.070 L/kg-d)**

= 1714 rounded to 2000 µg/L

*Relative Source Contribution: MDH 2008, Section IV.E.1.
**Intake Rate: MDH 2008, Section IV.E.1. and US EPA 2011, Exposure Factors Handbook, Tables 3-1 and 3-81

Reference Dose/Concentration:	(714 x 0.25)/300 = 0.60 mg/kg-d (Sprague Dawley rat)
Source of toxicity value:	determined by MDH in 2015
Point of Departure (POD):	714 mg/kg-d (NOAEL, Muralidhara et al. 2001)
Human Equivalent Dose (MDH, 2011):	714 x 0.25 = 179 mg/kg-d
Total uncertainty factor (UF):	300
Uncertainty factor allocation:	3 for interspecies differences (for toxicodynamics), 10 for intraspecies variability, and 10 for database insufficiencies (lack of oral development and reproductive studies, lack of neurological function testing)
Critical effect(s):	Decreased body weight and central nervous system depression
Co-critical effect(s):	Increased mortality
Additivity endpoint(s):	Nervous system

The Subchronic nRAA must be protective of the acute, and short-term exposures that occur within the subchronic period and therefore, the Subchronic nRAA is set equal to the Short-term nRAA of 400 µg/L. Additivity endpoints: Nervous system

Chronic Non-Cancer Risk Assessment Advice ($nRAA_{Chronic}$) = 80 µg/L

$$\frac{\text{(Reference Dose, mg/kg-d) x (Relative Source Contribution) x (Conversion Factor)}}{\text{(Chronic Intake Rate, L/kg-d)}}$$

$$= \frac{\text{(0.18 mg/kg-d) x (0.2)* x (1000 µg/mg)}}{\text{(0.044 L/kg-d)**}}$$

= 818 rounded to 800 µg/L

1,1-Dichloroethane is a Group C carcinogen. Based on the available data, MDH has determined that application of a Group C adjustment factor of 10 to address concerns regarding carcinogenic potential is warranted (see Cancer section below).

=800 µg/L ÷ 10

=80 µg/L

*Relative Source Contribution: MDH 2008, Section IV.E.1.
**Intake Rate: MDH 2008, Section IV.E.1. and US EPA 2011, Exposure Factors Handbook, Tables 3-1 and 3-81

Reference Dose/Concentration:	(714 x 0.25)/1000 = 0.18mg/kg-d (Sprague Dawley rat)
Source of toxicity value:	determined by MDH in 2015

Point of Departure (POD):	714 mg/kg-d (NOAEL, Muralidhara et al. 2001, subchronic exposure duration)
Human Equivalent Dose (MDH, 2011):	714 x 0.25 = 179 XX mg/kg-d
Total uncertainty factor (UF):	1000
Uncertainty factor allocation:	3 for interspecies differences (for toxicodynamics), 10 for intraspecies variability, and 10 for database insufficiencies (lack of oral development and reproductive studies, lack of neurological function testing), 3 for use of a subchronic study
Critical effect(s):	Decreased body weight and central nervous system depression
Co-critical effect(s):	Increased mortality
Additivity endpoint(s):	Nervous system

Cancer Risk Assessment Advice (cRAA) = Not Derived

Cancer classification:	Group C (EPA IRIS 1996)
Slope factor (SF):	There is evidence of carcinogenicity in animals, evidence of genotoxicity and close structural relationships with carcinogenic compounds. However, no EPA cancer slope factor is available. The Chronic RAA value incorporates a Group C carcinogen adjustment factor of 10 to address the concern that 1,1-dichloroethane could potentially be carcinogenic to humans.
Source of cancer slope factor (SF):	Not applicable
Tumor site(s):	Not applicable

Volatile: Yes (high)

Summary of Guidance Value History:

A noncancer Chronic HRL of 70 µg/L was promulgated in 1993. Noncancer Short-term, Subchronic, and Chronic RAAs of 500, 500, and 100 µg/L were derived in 2009. Short-term, Subchronic, and Chronic noncancer RAAs of 400, 400, and 80 were derived in 2016. The 2016 Short-term, Subchronic, and Chronic values are lower than the previous RAAs as a result of: 1) use of MDH's most recent risk assessment methodology; and 2) correction of a transcription error.

Summary of toxicity testing for health effects identified in the Health Standards Statute (144.0751):

Even if testing for a specific health effect was not conducted for this chemical, information about that effect might be available from studies conducted for other purposes. MDH has considered the following information in developing health protective guidance.

	Endocrine	Immunotoxicity	Development	Reproductive	Neurotoxicity
Tested for specific effect?	No	No	Yes	No	No
Effects observed?	-	-	Yes[1]	-	-[2]

Comments on extent of testing or effects:

[1] An inhalation developmental study does exist. Delayed ossification was observed at levels estimated to be 1.5-fold higher than the NOAEL utilized to derive the short-term, subchronic, and chronic RfD.

[2] Not specifically studied, but neurological effects were observed at the LOAEL of the critical study (13-week gavage study by Muralidhara et al. 2001). The nervous system has been listed as a health endpoint. A database UF has also been incorporated into the derivation of the RfD due to the lack of neurological function testing.

Resources Consulted During Review:

Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for 1,1-Dichloroethane (August 2015) http://www.atsdr.cdc.gov/ToxProfiles/tp133.pdf (Accessed: 10/2/2015)

ATSDR (Agency for Toxic Substances and Disease Registry). Minimal Risk Levels. http://www.atsdr.cdc.gov/mrls.html

California Environmental Protection Agency, OEHHA Toxicity Criteria Database. http://www.oehha.ca.gov/risk/ChemicalDB/index.asp;http://www.oehha.ca.gov/risk/pdf/cancerpotalpha81005.pdf

California EPA. OEHHA. 2003. Public Health Goals for Chemicals in Drinking Water: 1,1-Dichloroethane in Drinking Water.

EPA. Environmental Protection Agency. Health Effects Assessment Summary Tables (HEAST). July 1997.

EPA. Integrated Risk Information System. 1,1-Dichloroethane. (12/1/96) http://www.epa.gov/iris/subst/0409.htm (Accessed: 7/15/02)

EPA. Region 3. Risk Based Concentration. (click on RBC Tables PDF link) http://www.epa.gov/reg3hwmd/risk/human/rbc/rbc1006.pdf

EPA. Region 9. Preliminary Remediation Goal. (click on Region 9 PRGs 2004 Table link) http://www.epa.gov/region09/waste/sfund/prg/files/04prgtable.pdf

EPA. Office of Drinking Water. Drinking Water Standards and Health Advisories (August, 2006) http://www.epa.gov/waterscience/criteria/drinking/dwstandards.pdf

EPA. 2006. Superfund Technical Support Center (STSC) Provisional Peer Reviewed Toxicity Values for 1,1-Dichloroethane (CASRN 75-34-3).

Hoffman HT, Birnstiel H. and Jobst P. (1971). On the inhalation toxicity or 1,1- and 1,2-dichloroethane. ARCH TOXIKOL. 27: 248-265.

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Klaunig, J et al. 1986. Carcinogenicity of Chlorinated Methane and Ethane Compounds Administered in Drinking Water to Mice. EHP 69:89-95, 1986.

McCall, SN, P Jurgens, KM Ivanetich. 1983. Hepatic Microsomal Metabolism of the Dichloroethanes. Biochem Pharmacology 3292):207-213.

Muralidhara et al., (2001) Acute, subacute, and subchronic oral toxicity studies of 1,1-dichloroethane in rats: application to risk evaluation. Toxicol Sci 64(1): 135-145.

NCI (National Cancer Institute) 1978. Bioassay of 1,1-Dichloroethane for Possible Carcinogenicity. CAS No. 75-34-3.

Patlolla BP, Patlolla AK, and Tchounwou PB. 2005. Cytogenetic effects of 1,1-dichloroethane in mice bone marrow cells. Int J Environ Res Public Health Apr: 2(1):101-106. (obtained abstract only)

Syracuse Research PhysProp Database. http://www.syrres.com/esc/physdemo.htm
Weisburger, E. 1977. Carcinogenicity Studies on Halogenated Hydrocarbons. EHP 21:7-16, 1977.

WHO Recommended Classification of Pesticides by Hazard. 2004.
http://www.who.int/ipcs/publications/pesticides_hazard_rev_3.pdf

World Health Organization. Guidelines for Drinking-Water Quality. Chapter 12 Chemical Fact Sheets. http://www.who.int/water_sanitation_health/dwq/gdwq0506_12.pdf