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

Adopted as Rule: August 2018

Toxicological Summary for: Cis 1,2-Dichloroethylene

CAS: **156-59-2**
Synonyms: Cis 1,2-Dichloroethene, 1,2-DCE

Acute Non-Cancer Health Risk Limit ($nHRL_{Acute}$) = Not Derived (Insufficient Data)

Short-term Non-Cancer Health Risk Limit ($nHRL_{Short\text{-}term}$) = 20 µg/L

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

$$= \frac{\text{(0.033 mg/kg-d) x (0.2)}^{*} \text{ x (1000 µg/mg)}}{\text{(0.285 L/kg-d)}^{**}}$$

= 23.2 rounded to **20 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:	HED/Total UF = 9.9/300 = 0.033 mg/kg-d (Sprague Dawley rats)
Source of toxicity value:	Determined by MDH in 2014
Point of Departure (POD):	43.3 mg/kg-d ($BMDL_{10}$, McCauley et al. 1995)
Dose Adjustment Factor (DAF):	0.23 Body weight scaling, default (US EPA 2011 and MDH 2011)
Human Equivalent Dose (HED):	POD x DAF = 43.3 mg/kg-d x 0.23 = 9.9 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 uncertainties related to a lack of reproductive, developmental, neurological, or immune testing, as well as a lack of testing in species other than the rat.
Critical effect(s):	Increased liver weights in females
Co-critical effect(s):	Not applicable
Additivity endpoint(s):	Hepatic (liver) system

Subchronic Non-Cancer Health Risk Limit ($nHRL_{Subchronic}$) = 10 µg/L

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

$$= \frac{\text{(0.0043 mg/kg-d) x (0.2)}^{*} \text{ x (1000 µg/mg)}}{\text{(0.070 L/kg-d)}^{**}}$$

= 12.3 rounded to **10 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:	HED/Total UF = 1.28/300 = 0.0043 mg/kg-d (Sprague Dawley rats)
Source of toxicity value:	Determined by MDH in 2014
Point of Departure (POD):	5.1 mg/kg-d $BMDL_{10}$ (EPA, 2010, McCauley et al. 1995)
Dose Adjustment Factor (DAF):	0.25 Body weight scaling, default (US EPA 2011 and MDH 2011)
Human Equivalent Dose (HED):	POD x DAF = 5.1 mg/kg-d x 0.25 = 1.28 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 uncertainties related to a lack of reproductive, developmental, neurological, or immune testing, as well as a lack of testing in species other than the rat.
Critical effect(s):	Increased kidney weights in males
Co-critical effect(s):	Not applicable
Additivity endpoint(s):	Renal (kidney) system

Chronic Non-Cancer Health Risk Limit ($nHRL_{Chronic}$) = 6 µg/L

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

$$= \frac{\text{(0.0013 mg/kg-d) x (0.2)}^{*} \text{ x (1000 µg/mg)}}{\text{(0.044 L/kg-d)}^{**}}$$

= 5.9 rounded to **6 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:	HED/Total UF = 1.28/1000 = 0.0013 mg/kg-d (Sprague Dawley rats)
Source of toxicity value:	Determined by MDH in 2014
Point of Departure (POD):	5.1 mg/kg-d ($BMDL_{10}$, EPA 2010, McCauley et al. 1995; subchronic)
Dose Adjustment Factor (DAF):	0.25 Body weight scaling, default (US EPA 2011 and MDH 2011)
Human Equivalent Dose (HED):	POD x DAF = 5.1 mg/kg-d x 0.25 = 1.28 mg/kg-
Total uncertainty factor (UF):	1000
Uncertainty factor allocation:	3 for interspecies differences (for toxicodynamics), 10 for intraspecies variability, 3 for extrapolation from a subchronic study to a chronic study, and 10 for database uncertainties related to a lack of reproductive, developmental, neurological, or immune testing, as well as a lack of testing in species other than the rat.
Critical effect(s):	Increased kidney weights in males
Co-critical effect(s):	Not applicable
Additivity endpoint(s):	Renal (kidney) system

Cancer Health Risk Limit (cHRL) = Not Applicable

Cancer classification:	Inadequate information to assess the carcinogenic potential (U.S. Environmental Protection Agency, 2010a)
Slope factor (SF):	Not Applicable
Source of cancer slope factor (SF):	Not Applicable
Tumor site(s):	Not Applicable

Volatile: Yes (High)

Summary of Guidance Value History:
In 1993/94 MDH promulgated a HRL value of 70 µg/L. In 2009 this value was repealed and replaced with revised HRL values. The 2009 HRL values were 70 µg/L for short term and subchronic durations, and 50 µg/L for the chronic duration. The 2014 values are lower than the 2009 values as a result of 1) selection of different, more sensitive critical effects; and 2) rounding to one significant digit. In 2016 MDH updated the intake rate values used to derive guidance values. This did not result in any change to the nHBV values derived in 2014. The 2016 guidance was adopted as HRLs in 2018.

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	No	No	No
Effects observed?	No	--[1]	No	No	--[2]

Comments on extent of testing or effects:

[1] Immune effects were not directly tested. An increase in absolute and relative thymus weights was observed in female rats exposed to a dose more than 650,000 times the chronic RfD for 90 days.

[2] Neurotoxicity was not directed tested. At lethal doses, symptoms such as decreased activity, ataxia, suppressed or total loss of righting reflex, and depressed respiration were observed. The short term, subchronic, and chronic RfDs are protective of these effects.

Resources Consulted During Review:

Agency for Toxic Substances and Disease Registry (ATSDR). (1996). Toxicological Profile for 1,2-Dichloroethene. from http://www.atsdr.cdc.gov/toxprofiles/tp87.pdf

Agency for Toxic Substances and Disease Registry (ATSDR). (2013). Minimal Risk Levels (MRLs) List. from http://www.atsdr.cdc.gov/mrls/mrllist.asp

California Environmental Protection Agency. (2006). Public Health Goal for CIS- and TRANS- 1,2-DICHLOROETHYLENE in drinking water. from https://oehha.ca.gov/media/downloads/water/chemicals/phg/phgcistrans030306.pdf

California Environmental Protection Agency. (2014). Water Quality Goals. from http://www.waterboards.ca.gov/water_issues/programs/water_quality_goals/search.shtml

Jenkins, L. J., Jr., Trabulus, M. J., & Murphy, S. D. (1972). Biochemical effects of 1,1-dichloroethylene in rats: comparison with carbon tetrachloride and 1,2-dichloroethylene. *Toxicol Appl Pharmacol, 23*(3), 501-510.

McCauley, P. T., Robinson, M., Daniel, F. B., & Olson, G. R. (1995). The effects of subacute and subchronic oral exposure to cis-1,2-dichloroethylene in Sprague-Dawley rats. *Drug Chem Toxicol, 18*(2-3), 171-184. doi: 10.3109/01480549509014319

Minnesota Department of Health (MDH). (2008). Statement of Need and Reasonableness (SONAR), July 11, 2008. Support document relating to Health Risk Limits for Groundwater Rules. Retrieved from http://www.health.state.mn.us/divs/eh/risk/rules/water/hrlsonar08.pdf

Minnesota Department of Health (MDH). (2011). MDH Health Risk Assessment Methods to Incorporate Human Equivalent Dose Calculations into Derivation of Oral Reference Doses (May 2011, revised 2017) from http://www.health.state.mn.us/divs/eh/risk/guidance/hedrefguide.pdf

Tiesjema, B., and Baars, A.J. (2009). Re-evaluation of some human-toxicological Maximum Permissible Risk levels earlier evaluated in the period 1991-2001. Bilthoven, the Netherlands: National Institute for Public Health and the Environment, RIVM.

U. S. Environmental Protection Agency. (2012). Benchmark Dose Technical Guidance. http://www.epa.gov/raf/publications/pdfs/benchmark_dose_guidance.pdf

U.S. Environmental Protection Agency - Office of Research and Development. (1988). Recommendations for and Documentation of Biological Values for Use in Risk Assessment. from http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=34855

U.S. Environmental Protection Agency (EPA) - Office of Research and Development. (2011). Exposure Factors Handbook: 2011 Edition. Retrieved from https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236252

U.S. Environmental Protection Agency - Office of the Science Advisor. (2011). Recommended Use of Body Weight¾ as the Default Method in Derivation of the Oral Reference Dose. from http://www.epa.gov/raf/publications/pdfs/recommended-use-of-bw34.pdf

U.S. Environmental Protection Agency. (2010a). cis-1,2-Dichloroethylene Quickview (CASRN 156-59-2). from http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showQuickView&substance_nmbr=0418

U.S. Environmental Protection Agency. (2010b). Toxicological Review of cis-1,2-Dichloroethylene and trans-1,2-Dichloroethylene. from http://www.epa.gov/iris/toxreviews/0418tr.pdf

U.S. Environmental Protection Agency. (2011). Provisional Peer-Reviewed Toxicity Values for cis-1,2-Dichloroethylene (CASRN 156-59-2). from http://hhpprtv.ornl.gov/issue_papers/Dichloroethylenecis12.pdf

U.S. Environmental Protection Agency. (2012). 2012 Edition of the Drinking Water Standards and Health Advisories. from http://water.epa.gov/action/advisories/drinking/upload/dwstandards2012.pdf

World Health Organization. (2008). Guidelines for Drinking-water Quality. http://www.who.int/water_sanitation_health/dwq/fulltext.pdf?ua=1