



CHEMICAL UPDATE WORKSHEET

Chemical Name:	Trichloroethylene (DD)
CAS #:	79-01-6
Revised by:	RRD Toxicology Unit
Revision Date:	October 12, 2015

(A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	131.39	131.39	EPI	EXP
Physical State at ambient temp	Liquid	Liquid	MDEQ	
Melting Point (°C)	188	-84.70	EPI	EXP
Boiling Point (°C)	87.2	87.20	EPI	EXP
Solubility (ug/L)	1.10E+6	1280000	EPI	EXP
Vapor Pressure (mmHg at 25°C)	72.2	6.90E+01	EPI	EXP
HLC (atm-m³/mol at 25°C)	1.03E-2	9.85E-03	EPI	EXP
Log Kow (log P; octanol-water)	2.71	2.42	EPI	EXP
Koc (organic carbon; L/Kg)	168	60.7	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm²/s)	0.079	6.87E-02	W9	EST
Diffusivity in Water (Dw; cm²/s)	9.1E-6	1.02E-05	W9	EST

	Part 201 Value	Updated Value	Reference Source	Comments
Soil Water Partition Coefficient (Kd; inorganics)	NR	NR	NA	NA
Flash Point (°C)	NA	90	PC	EXP
Lower Explosivity Level (LEL; unitless)	0.08	0.08	CRC	EXP
Critical Temperature (K)		5.44E+02	EPA2004	EXP
Enthalpy of Vaporization (cal/mol)		7.51E+03	EPA2004	EXP
Density (g/mL, g/cm ³)		1.4642	CRC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm ²)	2.60E-05	2.78E-05	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm ²)	6.00E-05	6.73E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 2m (mg/day/cm ²)	3.68E-05	4.43E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 5m (mg/day/cm ²)	8.34E-05	1.06E-04	EMSOFT	EST

(B) Toxicity Values/Benchmarks

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
Reference Dose (RfD) (mg/kg/day)	1.7E-3	5.0E-4	IRIS, 2011	
RfD details	<p>Dawson et al. (1993) found developmental effects (cardiac abnormalities) in fetuses of Sprague Dawley rats exposed via maternal drinking water from pre-pregnancy and through gestation. NOAEL for developmental effects was 0.17 mg/kg/d. This RfD (1.7E-03) was used to develop developmental DCC but not noncarcinogen DCC. Noncancerous RfD = 1.8E-2. IRIS RfD last revised - 8/1/1992. CCD date -</p>	<p>Tier 1 Source: IRIS: Basis: IRIS is a Tier 1 source. IRIS RfD = 0.0005 mg/kg/day based on the critical effects of heart malformations (rats), adult immunological effects (mice), and developmental immunotoxicity (mice) from 3 oral studies:</p> <p>1) Study: Johnson, P; Goldberg, S; Mays, M; Dawson, B. (2003). Threshold of trichloroethylene contamination in maternal drinking waters affecting fetal heart development in the rat. Environ Health Perspect 111: 289-292. Methods: Sprague-Dawley rats exposed on GDs 1–22 by drinking water Critical effect: Fetal heart malformations End point or Point of Departure (POD): HED_{99, BMDL01} = 0.0051 mg/kg/day Uncertainty Factors: UF = 10 (1 was applied because the POD is a BMDL01; 3 to account for toxicodynamic uncertainty was applied because the use of the PBPK models to extrapolate internal doses from rats to humans reduces toxicokinetic uncertainty but does not account for the possibility that humans may be more sensitive than rats to TCE due to toxicodynamic differences; 3 to account for possible toxicodynamics differences in sensitive humans was applied because the probabilistic human PBPK model used in this assessment incorporates the best available information about variability in toxicokinetic disposition of TCE in humans but does not account for humans who may be sensitive due to toxicodynamic factors; 1 was applied because the exposure is considered to adequately cover the window of exposure that is relevant for eliciting the effect) Primary candidate: RfD = 0.00051 mg/kg-day.</p> <p>2) Study: Peden-Adams, M; Eudaly, J; Heesemann, L; Smythe, J; Miller, J; Gilkeson, G; Keil, D. (2006). Developmental immunotoxicity of trichloroethylene (TCE): Studies in B6C3F1 mice. J Environ Sci Health A Tox Hazard Subst Environ Eng 41: 249-271. Methods: Pups exposed from GD 0 until 3 or 8 weeks of age through drinking water (placental and lactational transfer, and pup ingestion)</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes/ Issues
		<p>Critical effect: Decreased PFC response (3 and 8 weeks), and increased delayed-type hypersensitivity (8 weeks) in pups</p> <p>End point or Point of Departure (POD): LOAEL = 0.37 mg/kg/day</p> <p>Uncertainty Factors: UF = 1,000 (10 was applied because the POD is a LOAEL for multiple adverse effects; 10 was applied to account for toxicokinetic and toxicodynamics differences between mice and humans on the basis of applied dose; 10 was applied to account for human variability in toxicokinetics and toxicodynamics)</p> <p>Primary candidate: RfD = 0.00037 mg/kg-day.</p> <p>3) Study: Keil, D; Peden-Adams, M; Wallace, S; Ruiz, P; Gilkeson, G. (2009). Assessment of trichloroethylene (TCE) exposure in murine strains genetically-prone and non-prone to develop autoimmune disease. J Environ Sci Health A Tox Hazard Subst Environ Eng 44: 443-453.</p> <p>Methods: female B6C3F1 mice exposed for 30 weeks by drinking water</p> <p>Critical effect: Decreased thymus weight</p> <p>End point or Point of Departure (POD): HED_{99, LOAEL} = 0.048 mg/kg/day</p> <p>Uncertainty Factors: UF = 100 (10 was applied because the POD is a LOAEL for an adverse effect; 3 to account for toxicodynamic uncertainty was applied because the use of the PBPK models to extrapolate internal doses from mice to humans reduces toxicokinetic uncertainty but does not account for the possibility that humans may be more sensitive than mice to TCE due to toxicodynamic differences; 3 to account for possible toxicodynamics differences in sensitive humans was applied because the probabilistic human PBPK model used in this assessment incorporates the best available information about variability in toxicokinetic disposition of TCE in humans but does not account for humans who may be sensitive due to toxicodynamic factors)</p> <p>Primary candidate: RfD = 0.00048 mg/kg-day.</p> <p>Source and date: IRIS, Last revision date - 9/28/2011. An IRIS Toxicological Review is available.</p> <p>Tier 2 Sources:</p> <p>PPRTV: No PPRTV record available at this time.</p> <p>MRL: Per ATSDR Draft Toxicological Profile (2015), oral chronic or intermediate MRL =</p>		



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>5.0E-4 mg/kg-day based on developmental and immunological effects. ATSDR has adopted the preferred chronic RfD of 0.0005 mg/kg/day for trichloroethylene that was derived by EPA (2011e) as the chronic- and intermediate-duration oral MRL for trichloroethylene.</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD, RfD = 1.7E-3 mg/kg-day based on a 1992 IRIS value. See Part 201 Value RfD details.</p>		
Oral Cancer Slope Factor (CSF) (mg/kg-day⁻¹)	1.0E-2	4.6E-2	IRIS, 2011	
CSF details	<p>Same studies as previous SF (two gavage studies in male and female mice (NCI, 1976; NTP, 1990)); however, rather than use the geometric mean, the highest estimate was used. Estimates ranged from 0.0030 to 0.10 (mg/kg-day)⁻¹. The two highest estimates are from male mice and are equivalent (0.010; one estimate was for male mice from the NCI study, and the other for male</p>	<p>Tier 1 Source: IRIS: Basis: IRIS is a Tier 1 source. IRIS CSF = 4.6E-2 (mg/kg-day)⁻¹ for adult-based CSF; CSF = 3.7E-2 for liver and NHL; and CSF = 9.3E-3 for kidney (mutagenic). <u>Note:</u> TCE is carcinogenic at multiple sites. For kidney tumors, TCE acts via a mutagenic mode of action (MOA). For liver and other TCE-induced tumors, the MOA is not clear. Increased early-life susceptibility is assumed for kidney cancer and therefore, the age-dependent adjustment factors (ADAFs) should be applied to the kidney cancer component of the total cancer risk. For liver and non-Hodgkin lymphoma (NHL), the cancer risk is calculated without ADAF. The EPA (2015) Regional Screening Level (RSL) generated adjustment factors for cancer and cancer-mutagenic effects: CAF = 0.804 and MAF = 0.202, respectively to facilitate calculating exposure risk. The CAF and MAF are based on the ratio of the NHL and liver-based CSF or kidney-based CSF, respectively, to the adult-based CSF. These factors should be applied in calculating the risk-based health values for TCE exposure via ingestion and dermal routes. Critical Studies: 1) Charbotel, B; Fevotte, J; Hours, M; Martin, J-L; Bergeret, A. (2006). Case-control study on renal cell cancer and occupational exposure to trichloroethylene. Part II: Epidemiological aspects. Ann Occup Hyg 50: 777-787. 2) U.S. EPA. (U.S. Environmental Protection Agency). (2011b). Supplementary data for</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
	<p>mice from the NTP study). SF adjusted with revised species scaling factor (BWh/BWa) to the 0.25 power. Per IRIS: a quantitative estimate of the carcinogenic risk from oral exposure is not available at this time (9/20/11). IRIS SF last revised 7/1/1989.</p>	<p>TCE assessment: Human posteriors by subject. 3) Raaschou-Nielsen, O; Hansen, J; McLaughlin, J; Kolstad, H; Christensen, J; Tarone, R; Olsen, J. (2003). Cancer risk among workers at Danish companies using trichloroethylene: A cohort study. Am J Epidemiol 158: 1182-1192. Methods: 1) <i>Dose response data: Tumor Type</i> - Renal cell carcinoma, non-Hodgkin's lymphoma, and liver tumors; <i>Test Species</i> - Human (epidemiological studies); <i>Route</i> - Inhalation, (route-to-route extrapolation to Oral) 2) <i>Extrapolation method:</i> PBPK model-based route-to-route extrapolation of the inhalation unit risk estimate for kidney cancer with a factor of 5 applied to include non-Hodgkin's lymphoma (NHL) and liver cancer risks Carcinogen Weight-of-Evidence (WOE) Class: "carcinogenic to humans" by all routes of exposure; carcinogenic by a mutagenic mode of action for induction of kidney tumors. Increased early-life susceptibility is assumed for kidney cancer and the age-dependent adjustment factors (ADAFs) should be used for the kidney cancer component of the total cancer risk. IRIS WOE Basis: convincing evidence of a causal association between TCE exposure in humans and kidney cancer, but there is also human evidence of TCE carcinogenicity in the liver and lymphoid tissues. Source and Date: IRIS, 9/28/2011. An IRIS Toxicological Review is available. Tier 2 Sources: PPRTV: No PPRTV record available at this time. MRL: NA; MRLs are for non-cancer effects only. Tier 3 Source: MDEQ: Per DEQ-CCD, RfD = 1.0E-2 based on a 1989 IRIS value. See Part 201 Value CSF details.</p>		
<p>Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (µg/m³)</p>	<p>NA</p>	<p>2.0E+0</p>	<p>IRIS, 2011</p>	



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
RfC/ITSL details	NA	<p>Tier 1 Source: IRIS: Basis: IRIS is a Tier 1 source. IRIS RfC = 2.0E-3 mg/m³. Critical Studies and Methods: 1) 30-week drinking water study, Keil et al., 2009 (immunotoxicity); 2) drinking water exposure from GD 1 to 22, Johnson et al., 2003 (heart malformations) Multiple Critical effects, Point of Departure (POD), Uncertainty Factors (UF), and candidates RfCs: 1) Female B6C3F1 Mice: IMMUNOTOXICITY. Point of Departure: LOAEL (HEC99) = 0.19 mg/m³ with UF of 100 yields candidate RfC of 0.0019 mg/m³. 2) Fetal Sprague-Dawley Rats: INCREASED FETAL CARDIAC MALFORMATIONS. Point of Departure: BMDL01 (HEC99) = 0.021 mg/m³ with UF of 10 yields candidate RfC of 0.0021 mg/m³ Final RfC Basis: The average of these two candidate RfCs yields a final RfC of 0.002 mg/m³ or 2 µg/m³. Source and date: IRIS, 9/28/2011. An IRIS Toxicological Review is available.</p> <p>Tier 2 Sources: PPRTV: No PPRTV record available at this time. MRL: Per ATSDR Draft Toxicological Profile (2015), inhalation chronic or intermediate MRL = 4.0E-4 ppm. ATSDR adopted the EPA (2011e) preferred chronic RfC of 0.0004 ppm for trichloroethylene as the chronic-duration inhalation MRL for trichloroethylene. The preferred chronic RfC of EPA is based on results of two critical studies for which individual candidate chronic RfCs were derived: A candidate chronic RfC of 0.00033 ppm for decreased thymus weight in female mice (Keil et al. 2009), and a candidate chronic RfC of 0.00037 ppm for fetal heart malformations in rats (Johnson et al. 2003).</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD/AQD (1/27/2015), AQD adopted the IRIS value: "US EPA finalized RfC = 9/28/2011. Multiple Critical Effects. Female B6C3F1 Mice: IMMUNOTOXICITY.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		Point of Departure: LOAEL (HEC99) = 0.19 mg/m ³ with UF of 100 yields candidate RfC of 0.0019 mg/m ³ . Fetal Sprague-Dawley Rats: INCREASED FETAL CARDIAC MALFORMATIONS. Point of Departure: BMDL01 (HEC99) = 0.021 mg/m ³ with UF of 10 yields candidate RfC of 0.0021 mg/m ³ . The average of these two candidate RfCs yields a final RfC of 0.002 mg/m ³ or 2 µg/m ³ . Confidence: High”		
Inhalation Unit Risk Factor (IURF) ((µg/m³)⁻¹)	1.7E-6	4.1E-6	IRIS, 2011	
IURF details	<p>Potency of 1.7 E-2 (mg/kg)-1 was derived by EPA in 1987 in EPA/600/8-82/OOFA based on the geometric mean of three animal studies. Conversion of oral potency (mg/kg)-1 to air potency based on EPA 1985 HAD metabolized dose conversion. CCD/AQD date: 3/21/1989.</p>	<p>Tier 1 Source: IRIS: Basis: IRIS is a Tier 1 Source. IRIS IURF = 4.1E-6 (adult-based IURF); IURF = 3.1E-6 for liver and NHL tumors; and IURF = 1.0E-6 for kidney (mutagenic MOA). Note: TCE is carcinogenic at multiple sites. For kidney tumors, TCE acts via a mutagenic mode of action (MOA). For liver and other TCE-induced tumors, the MOA is not clear. Increased early-life susceptibility is assumed for kidney cancer and therefore, the age-dependent adjustment factors (ADAFs) should be applied to the kidney cancer component of the total cancer risk. For liver and non-Hodgkin lymphoma (NHL), the cancer risk is calculated without ADAF. The EPA (2015) Regional Screening Level (RSL) generated adjustment factors for cancer and cancer with mutagenic effects: CAF = 0.756 and MAF = 0.244, respectively to facilitate calculating inhalation exposure risk. These factors are based on the ratio of the NHL and liver-based IURF or kidney-based IURF to the adult-based IURF estimate. These factors should be applied in calculating the risk-based health values for TCE exposure via inhalation. Critical Studies: Charbotel et al. (2006); EPA (2011); and Raaschou-Nielsen et al. (2003). Methods:</p> <ol style="list-style-type: none"> 3) <i>Dose response data: Tumor Type</i> - Renal cell carcinoma, non-Hodgkin's lymphoma, and liver tumors; <i>Test Species</i> - Human (epidemiological studies); <i>Route</i> - Inhalation 4) <i>Extrapolation method:</i> Low-dose linear extrapolation from the point of departure (LEC01) with a factor of 4 applied to include non-Hodgkin's 		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>lymphoma (NHL) and liver cancer risks, combined risk, Carcinogen Weight-of-Evidence (WOE) Class: “carcinogenic to humans” by all routes of exposure; carcinogenic by a mutagenic mode of action for induction of kidney tumors; Increased early-life susceptibility is assumed therefore, age-dependent adjustment factors (ADAFs) should be used for the kidney cancer component of the total cancer risk. IRIS WOE Basis: convincing evidence of a causal association between TCE exposure in humans and kidney cancer, but there is also human evidence of TCE carcinogenicity in the liver and lymphoid tissues. Source and Date: IRIS, 9/28/2011. An IRIS Toxicological Review is available.</p> <p>Tier 2 Sources: PPRTV: No PPRTV record available at this time. MRL: NA; MRLs are for non-cancer effects only.</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD (11/15/2011), AQD adopted the IRIS value: “US EPA finalized inhalation unit risk (IUR) = 9/28/2011. Human epid. studies with multiple cancers. EPA used weighted linear regression model for exposure-response on kidney cancer (renal cell carcinoma) incidence to obtain slope estimate for cumulative exposure from LEC01. The slope adjusted upward by 4 to account for increased risk of non-Hodgkin’s lymphoma and liver cancer. Age dependent adjustment factor (ADAF) was used for kidney cancer only (not NHL or liver cancer). EPA calculated the IUR with ADAF to be 4.8E-6 (the adult only IUR = 4.1E-6).”</p>		
Mutagenic Mode of Action (MMOA)? (Y/N)	--	YES	USEPA, 2015; IRIS, 2015	
MMOA Details	--	Listed as a carcinogen with mutagenic MOA in the USEPA OSWER List.		
Developmental or Reproductive Effector? (Y/N)	No	YES- for both oral and inhalation, the RfD and ITSL are based on reproductive-developmental effects. Oral Exposure Pathways- Single Exposure Inhalation Exposure Pathways- Single Exposure	MDEQ, 2015	



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes/ Issues
Developmental or Reproductive Toxicity Details	NA	<p>Repro-developmental effects: The RfD is based on 3 critical effects two of which are developmental: heart malformations (rats) and developmental immunotoxicity (mice)</p> <p>1) Study: Johnson, P; Goldberg, S; Mays, M; Dawson, B. (2003). Threshold of trichloroethylene contamination in maternal drinking waters affecting fetal heart development in the rat. Environ Health Perspect 111: 289-292.</p> <p>Critical effect: Fetal heart malformations</p> <p>2) Study: Peden-Adams, M; Eudaly, J; Heesemann, L; Smythe, J; Miller, J; Gilkeson, G; Keil, D. (2006). Developmental immunotoxicity of trichloroethylene (TCE): Studies in B6C3F1 mice. J Environ Sci Health A Tox Hazard Subst Environ Eng 41: 249-271.</p> <p>Critical effect: Decreased PFC response (3 and 8 weeks), and increased delayed-type hypersensitivity (8 weeks) in pups.</p>		
State Drinking Water Standard (SDWS) (ug/L)	5	5	SDWA, 1976	
SDWS details	SDWA, 1976	MI Safe Drinking Water Act (SDWA) 1976 PA 399		
Secondary Maximum Contaminant Level (SMCL) (ug/L)	--	NO	SDWA, 1976 and USEPA SMCL List	
SMCL details	NA	MI Safe Drinking Water Act (SDWA) 1976 PA 399 and USEPA SMCL List, 2015		
Is there an aesthetic value for drinking water? (Y/N)	NO	Not evaluated.	NA	
Aesthetic value (ug/L)	--	--	NA	
Aesthetic Value details		NA		
Phytotoxicity Value? (Y/N)	NO	Not evaluated.	NA	
Phytotoxicity details	NA	NA	NA	
Others	--	--		

(C) Chemical-specific Exposure Factors

	Part 201 Value	Update	Source/Reference/ Dates	Comments/Notes/ Issues
Gastrointestinal absorption efficiency value (ABS _{gi})		1.0	MDEQ, 2015/USEPA RAGS-E, 2004	
ABS _{gi} details		RAGS E (USEPA, 2004) Default Value		
Skin absorption efficiency value (AE _d)		0.1	MDEQ, 2015	
AE _d details				
Ingestion Absorption Efficiency (AE _i)		1.0	MDEQ, 2015	
AE _i Details				
Relative Source Contribution for Water (RSC _w)		0.2	MDEQ, 2015	
Relative Source Contribution for Soil (RSC _s)		1.0	MDEQ, 2015	
Relative Source Contribution for Air (RSC _a)		1.0	MDEQ, 2015	
Others				

(D) Rule 57 Water Quality Values and GSI Criteria

Current GSI value ($\mu\text{g/L}$)	200 (X)
Updated GSI value ($\mu\text{g/L}$)	200 (X)
Rule 57 Drinking Water Value ($\mu\text{g/L}$)	29

	Rule 57 Value ($\mu\text{g/L}$)	Verification Date
Human Non-cancer Values- Drinking water source (HNV-drink)	44	09/1997
Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)	550	09/1997
Wildlife Value (WV)	NA	NA
Human Cancer Values for Drinking Water Source (HCV-drink)	29	07/1997
Human Cancer values for non-drinking water source (HCV-Non-drink)	370	07/1997
Final Chronic Value (FCV)	200	07/2012
Aquatic maximum value (AMV)	1,800	07/2012
Final Acute Value (FAV)	3,500	07/2012

Sources:

1. MDEQ Surface Water Assessment Section Rule 57 [website](#)
2. MDEQ Rule 57 [table](#)

(E) Analytical Information

	Value	Source
Target Detection Limit – Soil ($\mu\text{g}/\text{kg}$)	50	MDEQ, 2015
Target Detection Limit – Water ($\mu\text{g}/\text{L}$)	1	MDEQ, 2015
Target Detection Limit – Air (ppbv)	3.70E-01	MDEQ, 2015
Target Detection Limit – Soil Gas (ppbv)	1.20E+01	MDEQ, 2015

CHEMICAL UPDATE WORKSHEET ABBREVIATIONS:

CAS # - Chemical Abstract Service Number.

Section (A) Chemical-Physical Properties**Reference Sources:**

CRC	Chemical Rubber Company Handbook of Chemistry and Physics, 95th edition, 2014-2015
EMSOFT	USEPA Exposure Model for Soil-Organic Fate and Transport (EMSOFT) (EPA, 2002)
EPA2001	USEPA (2001) Fact Sheet, Correcting the Henry's Law Constant for Soil Temperature. Office of Solid Waste and Emergency Response, Washington, D.C.
EPA4	USEPA (2004) User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings. February 22, 2004.
EPI	USEPA's Estimation Programs Interface SUITE 4.1, Copyright 2000-2012
HSDB	Hazardous Substances Data Bank
MDEQ	Michigan Department of Environmental Quality
NPG	National Institute for Occupational Safety and Health Pocket Guide to Chemical Hazards
PC	National Center for Biotechnology Information's PubChem database
PP	Syracuse Research Corporation's PhysProp database
SCDM	USEPA's Superfund Chemical Data Matrix
SSG	USEPA's Soil Screening Guidance: Technical Background Document, Second Edition, 1996
USEPA/EPA	United States environmental protection agency's Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). July, 2004.

W9 USEPA's User Guide for Water9 Software, Version 2.0.0, 2001

Basis/Comments:

EST	estimated
EXP	experimental
EXT	extrapolated
NA	not available or not applicable
NR	not relevant

Section (B) Toxicity Values/Benchmarks**Sources/References:**

ATSDR	Agency for Toxic Substances and Disease Registry
CALEPA	California Environmental Protection Agency
CAL DTSC	California Department of Toxic Substances Control
CAL OEHHA	CAEPA Office of Environmental Health Hazard Assessment
CCD	MDEQ Chemical Criteria Database
ECHA	European Chemicals Agency (REACH)
OECD HPV	Organization for Economic Cooperation and Development HPV Database
HEAST	USEPA's Health Effects Assessment Summary Tables
IRIS	USEPA's Integrated Risk Information System
MADEP	Massachusetts Department of Environmental Protection
MDEQ/DEQ	Michigan Department of Environmental Quality
DEQ-CCD/AQD	MDEQ Air Quality Division
DEQ-CCD/RRD	MDEQ Remediation and Redevelopment Division
DEQ-CCD/WRD	MDEQ Water Resources Division
MNDOH	Minnesota Department of Health
NJDEP	New Jersey Department of Environmental Protection



NYDEC	New York State Department of Environmental Conservation
OPP/OPPT	USEPA's Office of Pesticide Programs
PPRTV	USEPA's Provisional Peer Reviewed Toxicity Values
RIVM	The Netherlands National Institute of Public Health and the Environment
TCEQ	Texas Commission on Environmental Quality
USEPA	United States Environmental Protection Agency
USEPA OSWER	USEPA Office of Solid Waste and Emergency Response
USEPA MCL	USEPA Maximum Contaminant Level
WHO	World Health Organization
WHO IPCS	International Programme on Chemical Safety (IPCS/INCHEM)
WHO IARC	International Agency for Research on Cancers
NA	Not Available.
NR	Not Relevant.

Toxicity terms:

BMC	Benchmark concentration
BMCL	Lower bound confidence limit on the BMC
BMD	benchmark dose
BMDL	Lower bound confidence limit on the BMD
CSF	Cancer slope Factor
CNS	Central nervous system
IURF or IUR	Inhalation unit risk factor
LOAEL	Lowest observed adverse effect level
LOEL	Lowest observed effect level
MRL	Minimal risk level (ATSDR)
NOAEL	No observed adverse effect level
NOEL	No observed effect level
RfC	Reference concentration

RfD	Reference dose
p-RfD	Provisional RfD
aRfD	Acute RfD
UF	Uncertainty factor
WOE	Weight of evidence

Section (C) Chemical-specific Absorption Factors

MDEQ	Michigan Department of Environmental Quality
USEPA RAGS-E	United States Environmental Protection Agency's Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment). July, 2004.

Section (D) Rule 57 Water Quality Values and GSI Criteria

GSI	Groundwater-surface water interface
NA	A value is not available or not applicable.
ID	Insufficient data to derive value
NLS	No literature search has been conducted