



## CHEMICAL UPDATE WORKSHEET

<b>Chemical Name:</b>	<b>Vinyl chloride</b>
<b>CAS #:</b>	<b>75-01-4</b>
<b>Revised By:</b>	RRD Toxicology Unit
<b>Revision Date:</b>	August 19, 2015

### (A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	62.5	62.50	EPI	EXP
Physical State at ambient temp	Liquid	Gas	MDEQ	
Melting Point (°C)	---	-153.70	EPI	EXP
Boiling Point (°C)	-13.3	-13.30	EPI	EXP
Solubility (ug/L)	2.76E+6	8800000	EPI	EXP
Vapor Pressure (mmHg at 25°C)	NA	2.98E+03	EPI	EXP
HLC (atm-m <sup>3</sup> /mol at 25°C)	2.70E-2	2.78E-02	EPI	EXP
Log Kow (log P; octanol-water)	1.5	1.27	SSG	EXP
Koc (organic carbon; L/Kg)	18.5	21.73	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm <sup>2</sup> /s)	0.106	1.07E-01	W9	EST
Diffusivity in Water (Dw; cm <sup>2</sup> /s)	1.23E-5	1.20E-05	W9	EST
Soil Water Partition Coefficient (Kd; inorganics)	NR	NR	NA	NA

	Part 201 Value	Updated Value	Reference Source	Comments
Flash Point (°C)	NA	-78	CRC	EXP
Lower Explosivity Level (LEL; unitless)	0.036	0.036	CRC	EXP
Critical Temperature (K)		432	EPA2004	EXP
Enthalpy of Vaporization (cal/mol)		5.25E+03	EPA2004	EXP
Density (g/mL, g/cm <sup>3</sup> )		0.9106	CRC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm <sup>2</sup> )	2.70E-05	2.81E-05	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm <sup>2</sup> )	6.61E-05	6.93E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm <sup>2</sup> )	3.85E-05	4.49E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm <sup>2</sup> )	9.38E-05	1.10E-04	EMSOFT	EST

**(B) Toxicity Values/Benchmarks**

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
<b>Reference Dose (RfD) (mg/kg/day)</b>	3.0E-3	3.0E-3	ATSDR, 2006	
<b>RfD details</b>	An administered NOAEL = 0.13 mg/Kg-d was converted using the PBPK model of Clewell et al. (1995) to a human equivalent dose (HED). At the HED, the time-integrated liver concentrations of reactive metabolites calculated by the model are predicted to be equal to or less than that achieved for the animal dose. 10/27/00.	<p><b>Tier 2 Source:</b>  <b>ATSDR:</b>  <b>Basis:</b> ATSDRL is the best available value because it is the most current.  <b>ATSDRL chronic oral MRL = 3.0E-3 mg/kg-day:</b>  <b>Critical Studies:</b> Til HP, Immel HR, Feron VJ. 1983. Lifespan oral carcinogenicity study of vinyl chloride in rats. Final report. Civo Institutes, TNO. Report No. V 93.285/291099.  Til HP, Feron VJ, Immel HR. 1991. Lifetime (149-week) oral carcinogenicity study of vinyl chloride in rats. Food Chem Toxicol 29:713-718.  <b>Methods:</b> Groups of Wistar rats (100/sex/group in controls and the two lowest exposure groups; 50/sex at the highest exposure level) were administered vinyl chloride in the daily diet at intended initial dietary concentrations of 0, 0.46, 4.6, or 46 ppm for 149 weeks. The authors reported the “actual oral exposure levels” of 0, 0.014, 0.13, and 1.3 mg/kg/day, respectively  <b>Critical effect:</b> liver cell polymorphisms  <b>End point or Point of Departure (POD):</b> NOAEL = 0.17 mg/kg-day; PBPK modeled NOAEL<sub>HED</sub> = 0.09 mg/kg-day  <b>Uncertainty Factors:</b> UF = 30 (10 for intraspecies variability and 3 for interspecies dosimetric adjustment)  <b>Source and date:</b> ATSDR, 7/2006. A Toxicological Profile is available.</p> <p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> Per IRIS (8/7/2000), RfD = 3.0E-3 mg/kg-day.  <b>Critical Studies:</b>  1) Til, HP; Immel, HR; Feron, VJ. (1983) Lifespan oral carcinogenicity study of vinyl chloride in rats. Final report. CIVO Institutes. TNO Report No. V 83.285/291099, TSCATS Document FYI-AX-0184-0353, Fiche No. 0353.  2) Til, HP; Feron, VJ; Immel, HR. (1991) Lifetime (149-week) oral carcinogenicity study of vinyl chloride in rats. Food Chem Toxicol 29:713-718.</p>		Complete

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p><b>Methods:</b> Wistar rats (n=100 or 50/sex/dose) were fed a diet containing vinyl chloride for 4 hrs. /day at reported bioavailable doses of 0, 0.014, 0.13, or 1.3 mg/kg/day. Evaporative loss averaged 20% over 4 hours.</p> <p><b>Critical effect:</b> liver cell polymorphism.</p> <p><b>End point or Point of Departure (POD):</b> NOAEL = 0.13 mg/kg-day; NOAEL<sub>HED</sub> = 0.09 mg/kg-day</p> <p><b>Uncertainty Factors:</b> UF = 30 (10 for intraspecies variability and 3 for interspecies extrapolation)</p> <p><b>Source and date:</b> IRIS, Last revision date – 8/7/2000</p> <p><b>PPRTV:</b> No PPRTV record available at this time.</p> <p><b>Tier 3 Source:</b></p> <p><b>MDEQ:</b> Per DEQ-CCD, RRD adopted the IRIS RfD. See Part 201 Value RfD details.</p>		
<b>Oral Cancer Slope Factor (CSF) (mg/kg-day)<sup>-1</sup></b>	<p>1.4E+0 (residential)</p> <p>7.2E-1 (nonresidential)</p>	<p>1.4E+0 (residential)</p> <p>7.2E-1 (nonresidential)</p>	IRIS, 2000	
<b>CSF details</b>	<p>Based on data by Feron et al., 1981 &amp; Til et al., 1983; Increased incidence of neoplastic nodules, hepatocellular carcinomas, and liver angiosarcomas in female rats. See IRIS printout for additional details.</p>	<p><b>Tier 1 Source:</b></p> <p><b>IRIS: IRIS</b></p> <p><b>Basis:</b> IRIS derived two CSF values: 7.2E-1 per mg/kg-day for continuous lifetime exposure during adulthood, and 1.4 per mg/kg-day for continuous lifetime exposure from birth. For exposures beginning at birth an additional twofold safety factor (age-dependent adjustment factor) is recommended. Per IRIS, animal evidence indicates age-dependent sensitivity and therefore, concern for young children potentially exposed to vinyl chloride (VC).</p> <p><b>Critical Study (ies):</b> Feron, V; Hendrikson, CFM; Speek, AJ; et al. (1981) Lifespan oral toxicity study of vinyl chloride in rats. Food Cosmet Toxicol 19:317-333.</p> <p><b>Method(s):</b> Bioavailable doses of 0, 1.7, 5.0, or 14.1 mg VC/kg-day were fed to Wistar rats (n = 80, 60, 60, and 80, respectively) for a lifetime.</p> <p>1) <i>Dose response data: Tumor Type</i> - Total of liver angiosarcoma, hepatocellular carcinoma, and neoplastic nodules; <i>Test Species</i> - Female Wistar rats; <i>Route</i> -</p>		Complete

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
	<p>The slope factor of 1.4 for exposure from birth is used for residential scenarios. A slope factor of 7.2E-1 for exposure during adulthood is used for industrial and commercial exposures. Source: MDEQ-CCD</p>	<p>Oral, diet 2) <i>Extrapolation method</i>: a) Linearized multistage (b) LED 10/linear method <b>Carcinogen Weight-of-Evidence (WOE) Class</b>: known human carcinogen by the inhalation route of exposure and the oral route by analogy because of positive animal bioassay data <b>IRIS WOE Basis</b>: (1) consistent epidemiologic evidence of a causal association between occupational exposure via inhalation and the development of angiosarcoma, an extremely rare tumor; (2) consistent evidence of carcinogenicity in rats, mice, and hamsters by both the oral and inhalation routes; (3) mutagenicity and DNA adduct formation by VC and its metabolites in numerous in vivo and in vitro test systems; and (4) efficient VC absorption via all routes of exposure tested, followed by rapid distribution throughout the body. <b>Note</b>: The recommended slope factors should not be used if the water concentration exceeds 10+05 µg/L, because above this concentration the slope factor may differ. <b>Source and Date</b>: IRIS, Last revision date - 8/7/2000. A Toxicological Review is available. An IRIS screening-level review in 2003 did not identify any critical new studies.</p> <p><b>Tier 2 Sources</b>: <b>PPRTV</b>: No PPRTV record available at this time. <b>MRL</b>: NA; MRLs are for non-cancer effects only.</p> <p><b>Tier 3 Source</b>: <b>MDEQ</b>: Per DEQ-CCD, RRD adopted the IRIS CSF. See Part 201 Value CSF details.</p>		
<b>Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (µg/m³)</b>	1.0E+2	8.0E+1	ATSDR, 2006	
<b>RfC/ITSL details</b>	ITSL based on EPA RfC, chronic rat	<b>Tier 2 Source</b> : <b>ATSDR</b> :		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
	<p>diet NOAEL of 0.13 mg/kg reported by Til et al 1983, 1991. Higher dose (1.3 mg/kg) caused liver cell polymorphism. CCD/AQD date: 8/7/2000</p>	<p><b>Basis:</b> This is the most current value and therefore the best available.  <b>ATSDR</b> intermediate-duration inhalation MRL = 0.03 ppm (7.67 E-2 mg/m<sup>3</sup>. rounded off to 8.0E-2 mg/m<sup>3</sup>). Per ATSDR, no chronic inhalation MRL at this time  <b>Critical Study:</b> Thornton SR, Schroeder RE, Robison RL, et al. 2002. Embryo-fetal developmental and reproductive toxicology of vinyl chloride in rats. Toxicol Sci 68:207-219.  <b>Method(s):</b> Sprague-Dawley rats (30/sex/group) were exposed to vinyl chloride vapor concentrations of 0, 10, 100, or 1,100 ppm, 6 hours/day for 10 weeks prior to mating and during a 3-week mating period. F0 males were exposed during the gestational period and sacrificed following the completion of parturition. F0 females were exposed during gestation and lactation (with the exception of a break in exposure from gestation day 21 through postnatal days 4 to allow for delivery of litters).  <b>Critical effect:</b> hepatic centrilobular hypertrophy  <b>End point or Point of Departure (POD):</b> LEC<sub>10</sub> = 5 ppm; LEC<sub>10HEC</sub> = 1 ppm  <b>Uncertainty Factors:</b> UF = 30 (10 for intraspecies variability and 3 for interspecies extrapolation)  <b>Source and Date:</b> ATSDR, 7/2006</p> <p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> IRIS (2000) RfC = 1.0E+2 µg/m<sup>3</sup>:  <b>Critical Study(ies):</b>                      1) Til, HP; Immel, HR; Feron, VJ. (1983) Lifespan oral carcinogenicity study of vinyl chloride in rats. Final report. CIVO Institutes. TNO Report No. V 83.285/291099, TSCATS Document FYI-AX-0184-0353, Fiche No. 0353.                      2) Til, HP; Feron, VJ; Immel, HR. (1991) Lifetime (149-week) oral carcinogenicity study of vinyl chloride in rats. Food Chem Toxicol 29:713-718.  <b>Method(s):</b> Wistar rats (n=100 or 50/sex/dose) were fed a diet containing vinyl chloride for 4 hrs./day at reported bioavailable doses of 0, 0.014, 0.13, or 1.3 mg/kg/day. Evaporative loss averaged 20% over 4 hours.  <b>Critical effect:</b> liver cell polymorphism.  <b>End point or Point of Departure (POD):</b> NOAEL = 0.13 mg/kg-day; NOAEL<sub>HEC</sub> = 2.5</p>		

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		mg/m <sup>3</sup> <b>Uncertainty Factors:</b> UF = 30 (10 for intraspecies variability and 3 for interspecies extrapolation) <b>Source and date:</b> IRIS, Last revision date – 8/7/2000 <b>PPRTV:</b> No PPRTV record available at this time. <b>MRL:</b> An acute inhalation MRL = 0.5 ppm is available based on a NOAEL of 50 ppm for delayed ossification (developmental effect) from the John et al. (1977,1981) studies and UF = 30 (ATSDR, 7/2006)  <b>Tier 3 Source:</b> <b>MDEQ:</b> Per DEQ-CCD, AQD adopted IRIS value for RfC. See Part 201 Value RfC details.		
<b>Inhalation Unit Risk Factor (IURF) ((µg/m<sup>3</sup>)<sup>-1</sup>)</b>	8.8E-6 (residential); 4.4E-6 (nonresidential)	8.8E-6 (residential); 4.4E-6 (nonresidential)	IRIS, 2000	
<b>IURF details</b>	EPA IRIS based on liver tumors in female S-D rats reported by Maltoni et al 1981 and 1984. LMS method and LED10 result in similar numbers. See IRIS printout for additional details. CCD/AQD date: 8/7/2000.	<b>Tier 1 Source:</b> <b>IRIS:</b> <b>Basis:</b> IRIS is the only available IURF and a Tier 1 source. MDEQ-AQD adopted the IRIS value. <b>IRIS</b> derived two IURF values: 8.8E-6 per mg/kg-day for continuous lifetime exposure from birth, and 4.4E-6 per mg/kg-day for continuous lifetime exposure during adulthood. IRIS recommends a twofold adjustment to account for greater responsiveness to VC exposure during early life. Per IRIS, animal evidence indicates age-dependent sensitivity and therefore, concern for young children potentially exposed to VC. <b>Critical Studies:</b> 1) Maltoni, C; Lefemine, G; Ciliberti, A; et al. (1981) Carcinogenicity bioassays of vinyl chloride monomer, a model of risk assessment on an experimental basis. Environ Health Perspect 41:3-29. 2) Maltoni, C; Lefemine, G; Ciliberti, A; et al. (1984) Experimental research on vinyl chloride carcinogenesis, Vol. 1 and 2. In: Archives of research on industrial		Complete



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		<p>carcinogenesis. Princeton, NJ: Princeton Scientific Publishers, Inc.  <b>Method(s):</b> Sprague-Dawley rats (30/sex/group) were exposed to 0, 1, 5, 10, 25, 50, 100, 150, 200, 250, 500, 2500, 6000, or 10,000 ppm VC by inhalation for 4 hours/day, 5 days/week for 52 weeks (Maltoni et al., 1981, 1984).                      1) <i>Dose response data: Tumor Type</i> - liver angiosarcoma, hepatocellular carcinoma, and neoplastic nodules; <i>Test Species</i> – Female Sprague-Dawley rats; <i>Route</i> - Inhalation                      2) <i>Extrapolation method:</i> a) Linearized multistage (b) LED 10/linear method  <b>Carcinogen Weight-of-Evidence (WOE) Class:</b> known human carcinogen by the inhalation route of exposure and the oral route by analogy because of positive animal bioassay data  <b>IRIS WOE Basis:</b> (1) consistent epidemiologic evidence of a causal association between occupational exposure via inhalation and the development of angiosarcoma, an extremely rare tumor; (2) consistent evidence of carcinogenicity in rats, mice, and hamsters by both the oral and inhalation routes; (3) mutagenicity and DNA adduct formation by VC and its metabolites in numerous in vivo and in vitro test systems; and (4) efficient VC absorption via all routes of exposure tested, followed by rapid distribution throughout the body.  <b>Note:</b> The recommended slope factors should not be used if the water concentration exceeds 10+05 µg/L, because above this concentration the slope factor may differ.  <b>Source and Date:</b> IRIS, Last revision date - 8/7/2000. A Toxicological Review is available. An IRIS screening-level review in 2003 did not identify any critical new studies.   <b>Other Sources:</b>  <b>MDEQ:</b> Per DEQ-CCD (8/7/2000), AQD adopted the IRIS value for IURF.  <b>PPRTV:</b> No PPRTV record available at this time.  <b>MRL:</b> NA; MRLs are for non-cancer effects only.</p>		
<b>Mutagenic Mode of Action (MMOA)? (Y/N)</b>	--	YES	USEPA, 2015	



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
<b>MMOA Details</b>	--	Vinyl chloride is listed as a carcinogen with mutagenic MOA in the USEPA OSWER List. USEPA recommends an additional twofold safety factor (age-dependent adjustment factor) for exposures beginning at birth. Animal evidence indicates age-dependent sensitivity and therefore, concern for young children potentially exposed to vinyl chloride.		
<b>Developmental or Reproductive Effector? (Y/N)</b>	No	No, the RfD or RfC is not based on a reproductive-developmental effect. However, ATSDR derived an acute inhalation MRL based on developmental effects.	MDEQ, 2015	
<b>Developmental or Reproductive Toxicity Details</b>	NA	An acute inhalation MRL = 0.5 ppm is available based on a NOAEL of 50 ppm for delayed ossification (developmental effect) from the John et al. (1977,1981) studies and UF = 30 (ATSDR, 7/2006)		
<b>State Drinking Water Standard (SDWS) (ug/L)</b>	2.0	2.0	SDWA, 1976	
<b>SDWS details</b>	SDWA, 1976	MI Safe Drinking Water Act (SDWA) 1976 PA 399		
<b>Secondary Maximum Contaminant Level (SMCL) (ug/L)</b>	--	NO	SDWA, 1976 and USEPA SMCL List	
<b>SMCL details</b>	NA	MI Safe Drinking Water Act (SDWA) 1976 PA 399 and USEPA SMCL List, 2015		
<b>Is there an aesthetic value for drinking water? (Y/N)</b>	NO	Not evaluated.	NA	
<b>Aesthetic value (ug/L)</b>	--	NA	NA	
<b>Aesthetic Value details</b>		NA		
<b>Phytotoxicity Value? (Y/N)</b>	NO	Not evaluated.	NA	
<b>Phytotoxicity details</b>	NA	NA		
<b>Others</b>	--	--	NA	

**(C) Chemical-specific Exposure Factors**

	Part 201 Value	Update	Source/Reference/ Dates	Comments/Notes /Issues
Gastrointestinal absorption efficiency value (ABS <sub>gi</sub> )	---	1.0	MDEQ, 2015/USEPA RAGS-E, 2004	
ABS <sub>gi</sub> details		MDEQ, 2015/USEPA RAGS-E, 2004		
Skin absorption efficiency value (AE <sub>d</sub> )	---	0.1	MDEQ, 2015	
AE <sub>d</sub> details				
Ingestion Absorption Efficiency (AE <sub>i</sub> )		1.0	MDEQ, 2015	
AE <sub>i</sub> Details				
Relative Source Contribution for Water (RSC <sub>w</sub> )		0.2	MDEQ, 2015	
Relative Source Contribution for Soil (RSC <sub>s</sub> )		1.0	MDEQ, 2015	
Relative Source Contribution for Air (RSC <sub>A</sub> )		1.0	MDEQ, 2015	
Others				

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

Current GSI value (µg/L)	13 (X)
Updated GSI value (µg/L)	13 (X)
Rule 57 Drinking Water Value (µg/L)	1 (M,X); 0.25

	Rule 57 Value (µg/L)	Verification Date
Human Non-cancer Values- Drinking water source (HNV-drink)	83	11/2011
Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)	4,400	11/2011
Wildlife Value (WV)	NA	NA
Human Cancer Values for Drinking Water Source (HCV-drink)	0.25	11/2011
Human Cancer values for non-drinking water source (HCV-Non-drink)	13	11/2011
Final Chronic Value (FCV)	930	11/2011
Aquatic maximum value (AMV)	8,400	11/2011
Final Acute Value (FAV)	17,000	11/2011

Sources:

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

**(E) Analytical Information**

	<b>Value</b>	<b>Source</b>
<b>Target Detection Limit – Soil (<math>\mu\text{g}/\text{kg}</math>)</b>	40	MDEQ, 2015
<b>Target Detection Limit – Water (<math>\mu\text{g}/\text{L}</math>)</b>	1	MDEQ, 2015
<b>Target Detection Limit – Air (ppbv)</b>	6.20E-01	MDEQ, 2015
<b>Target Detection Limit – Soil Gas (ppbv)</b>	2.10E+01	MDEQ, 2015

**CHEMICAL UPDATE WORKSHEET ABBREVIATIONS:**

CAS # - Chemical Abstract Service Number.

**Section (A) Chemical-Physical Properties****Reference Source(s):**

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