CHEMICAL UPDATE WORKSHEET

Chemical Name:	**4,4'-DDE (*p,p'*-dichlorodiphenyldichloroethylene)**
CAS #:	**72-55-9**
Revised By:	RRD Toxicology Unit
Revision Date:	September 16, 2015

(A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	518.03	318.03	EPI	EXP
Physical State at ambient temp	Solid	Solid	MDEQ	
Melting Point (˚C)	362	89.00	EPI	EXP
Boiling Point (˚C)	336	336.00	EPI	EXP
Solubility (ug/L)	120	4E+01	EPI	EXP
Vapor Pressure (mmHg at 25˚C)	0.0000057	6.00E-06	EPI	EXT
HLC (atm-m³/mol at 25˚C)	2.10E-5	4.16E-05	EPI	EXP
Log Kow (log P; octanol-water)	6.76	6.51	EPI	EXP
Koc (organic carbon; L/Kg)	2.70E+5	1.175E+05	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm^2/s)	0.0144	4.08E-02	W9	EST
Diffusivity in Water (Dw; cm^2/s)	5.87E-6	4.7648E-06	W9	EST
Soil Water Partition Coefficient (Kd; inorganics)	NR	NR	NA	NA

	Part 201 Value	Updated Value	Reference Source	Comments
Flash Point (˚C)	NA	NA	NA	NA
Lower Explosivity Level (LEL; unit less)	NA	NA	NA	NA
Critical Temperature (K)		860.38	EPA2001	EXP
Enthalpy of Vaporization (cal/mol)		1.50E+04	EPA2001	EST
Density (g/mL, g/cm^3)		NA	NA	NA
EMSOFT Flux Residential 2 m (mg/day/cm^2)	NA	5.98E-07	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm^2)	NA	5.98E-07	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm^2)	NA	7.54E-07	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm^2)	NA	7.54E-07	EMSOFT	EST

(B) Toxicity Values/Benchmarks

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
Reference Dose (RfD) (mg/kg/day)	7.0E-4	7.0E-4	MDEQ, 2000	
RfD details	Sub chronic reproductive study in rats (Kornbrust et al., 1986). No reproductive effects noted, mild hepatic effects at an LOAEL of 10 mg/Kg-day, UF = 10,000. CCD/RRD date: 3/21/2000.	**Tier 3 Source:** **MDEQ:** **Basis:** MDEQ RfD using a study of rats exposed to dietary DDE during gestation and lactation (Kornbrust, 1986). This value is based on a more current study that identified developmental effects; therefore, it is preferred. The NYSDEC RfD (1.2E-2 mg/kg-day) is based on a 1978 NTP carcinogenicity study with hepatic toxicity as the most sensitive effect. The RIVM (2001) tolerable daily intake (TDI) for DDE is based on DDT (surrogate chemical) value that is based on liver effects (centrilobular necrosis) from a 1950 study (Kraug et al., 1950). See details below. **Tier 1 and 2 Sources**: **IRIS:** Per IRIS (8/22/1988), no value at this time. **PPRTV:** Per PPRTV (7/6/2007), no value at this time. Chronic animal toxicity studies (NCI, 1978; Rossi et al., 1983; Tomatis et al., 1974) are available; however, these studies failed to define a LOAEL or NOAEL on which an RfD could be based Per PPRTV, developmental studies showed male reproductive effects. The lowest LOAEL of those studies was 10 mg/kg-day for male reproductive effects in rats (You et al., 1998). That LOAEL was matched for maternal toxicity (hepatic lesions) in another rat developmental study (Kornbrust et al., 1986). Another study that may be suitable as the basis for an RfD is an immunotoxicity study (Banerjee et al. 1996), in which a LOAEL of 20 mg/kg-day was reported following a 6-week exposure to p,p'-DDE in food. **MRL:** Per ATSDR, no MRL at this time. ATSDR (2002) Toxicological Profile for dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethane (DDD) and DDE is available. 2008 Addendum for DDT/DDD/DDE supplements the Tox Profile. **Tier 3 Sources:** **MDEQ:** Per DEQ-CCD/RRD (3/21/2000), RfD = 7.0E-4 mg/kg-day.		Complete

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		RfD derivation: **Critical Study**: Kornbrust, D., B. Gillis, B. Collins et al. 1986. Effects of 1,1-dichloro-2,2-bis[p-chlorophenyl]ethylene (p,p'-DDE) on lactation in rats. J. Toxicol. Environ. Health. 17: 23-36. **Methods**: Groups of 54 and 51 female Sprague-Dawley rats were exposed to 0 and 10 mg/kg p,p'-DDE in corn oil by gavage 5 days/week, for 5 weeks prior to mating (with untreated males), during gestation and during lactation through either postnatal day (PND) 8 or 19. **Critical effect**: mild hepatic effects in the rat dams **End point or Point of Departure (POD):** LOAEL = 10 mg/kg-day **Uncertainty Factors**: UF = 10,000 (10 each for intraspecies variability, interspecies extrapolation, LOAEL to NOAEL extrapolation and use of a sub chronic study) **Source and Date**: DEQ-CCD/RRD, 3/21/2000 **New York DEC:** RfD = 1.2E-2 mg/kg-day. Per NYSDEC (4/2005), the RfD for p,p'-DDE is based on liver toxicity in a chronic rat feeding study. Key study: NCI (National Cancer Institute). 1978. Bioassays of DDT, TDE and p,p'-DDE for possible carcinogenicity. US Department of Health Education and Welfare, Public Health Service, National Institutes of Health. NCI-CG-TR-131. Method: 78-week dietary study in rats POD: LOEL – 12 mg/kg-day Critical effect: liver effects (centrilobular necrosis) UF: 1,000 (for interspecies extrapolation, intraspecies variability and LOEL to NOEL extrapolation) Source: New York State Brownfield Cleanup Program, Development of Soil Cleanup Objectives: Technical Support Document, 2006, Appendix A. **RIVM (The Netherlands):** Per RIVM (2001), the ttolerable daily intake (TDI) of 5.0E-4 mg/kg-day for DDE is based on DDT as data indicate a similar pattern of toxicity with DDT. The DDT TDI		

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		is derived as follows: Key study: Laug EP, Nelson AA, Fitzhugh OG & Kunze FM (1950): Liver cell alteration and DDT storage in the fat of the rat induced by dietary levels of 1-50 ppm DDT. J Pharmacol Exptl Therap 98, 268-273. Critical effect: hepatotixic effects POD: NOAEL – 0.05 mg/kg-day UF: 100 (for intra- and interspecies extrapolation) Additional note: The TDI value is close to the value that can be derived using Laws et al. (1967, 1973) and UF = 100. Source: RIVM report #711701025, 2001 **Other Tier 3:** No value is available at this time from these Tier 3 sources/databases: HEAST, NTP ROC, health and environmental agencies of California, Massachusetts, Minnesota, New Jersey and Texas, WHO (IARC), WHO (IPCS/INCHEM), Canada, ECHA (REACH) and OECD HPV.		
Oral Cancer Slope Factor (CSF) (mg/kg-day)$^{-1}$)	2.0E-1	3.4E-1	IRIS, 1988	
CSF details	Increased incidence of liver tumors in female B6C3F1 mice exposed via the diet for 78 weeks followed by a 30 week observation period (NCI, 1978). Revised species scaling factor of (BWh/BWa) to the 0.25 power used for q* calculation.	**Tier 1 Source:** **IRIS:** **Basis:** IRIS is a Tier 1 source. **IRIS CSF** = 3.4E-1 (mg/kg-day)$^{-1}$. **Critical Studies**: 1) NCI (National Cancer Institute). 1978. Bioassays of DDT, TDE, and p,p'-p,p'-DDE for possible carcinogenicity. National Cancer Institute, National Institutes of Health, Bethesda, MD. NCI-CG-TR131. Technical Report No. 131. 2) Rossi, L., O. Barbieri, M. Sanguineti et al. 1983. Carcinogenicity study with technical-grade dichlorodiphenyltrichloroethane and 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene in hamsters. Cancer Res. 43:776-781. 3) Tomatis, L., V. Turusov, R.T. Charles, and M. Boicchi. 1974. Effect of long-term exposure to 1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene, to 1,1-dichloro-2,2-bis(p-chlorophenyl)ethane, and to the two chemicals combined in CF-1 mice. J. Natl. Canc. Inst. 52:883-891.		Complete

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
	Source: MDEQ/ CCD date: 2/04/2000	**Method(s)**: 1) NCI (1978) exposed B6C3F1 mice to DDE in feed at TWA doses of 148 and 261 ppm for 78 weeks. After an additional 15 weeks, increase in incidence of hepatocellular carcinomas was observed in both sexes while increased weight loss and mortality was observed in females only. 2) Tomatis et al. (1974) exposed CF-1 mice to 250 ppm DDE in feed for lifetime (130 weeks). Increased incidence of hepatomas in both sexes was observed. In females, 98% of exposed animals developed hepatomas. 3) Rossi et al. (1983) exposed Syrian Golden hamsters to 500 and 1000 ppm DDE in feed for 128 weeks. After 76 weeks, increased incidences of neoplastic nodules of the liver were observed in both sexes. 1) *Dose response data*: *Tumor Type* - hepatocellular carcinomas and hepatomas; *Test Species* - B6C3F1mouse, CF-1mouse, and Syrian Golden hamsters; *Route* - diet 2) *Extrapolation method*: Linearized multistage procedure, extra risk **Carcinogen Weight-of-Evidence (WOE) Class**: B2, probable human carcinogen **IRIS WOE Basis**: based on tumor types in mice, hamsters and rats **Source and Date**: IRIS, Last revision date - 8/022/1988. An EPA screening-level review in 2003 did not identify critical new critical studies. **Tier 2 Sources**: **PPRTV:** PPRTV (7/26/2007) refers to the IRIS value. **MRL:** NA; MRLs are for non-cancer effects only. **Tier 3 Sources:** **MDEQ:** Per DEQ-CCD/RRD (2/04/2000), CSF = 2.0E-1 $(mg/kg\text{-}day)^{-1}$. MDEQ modified the IRIS value. See Part 201 Value CSF details. **MDEQ:** Per DEQ-CCD/WRD (9/1/1988), CSF = 4.36E-1 $(mg/kg\text{-}day)^{-1}$ based on increased incidence of liver tumors in female B6C3F1 mice exposed via the diet for 78 weeks followed by a 30 week observation period (NCI, 1978).		
Reference Concentration	--	NA	MDEQ, 2015	

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
(RfC) or Initial Threshold Screening Level (ITSL) (µg/m³)				
RfC/ITSL details	NA	**Tier 1 and 2 Sources**: **IRIS:** Per IRIS (8/22/1988), no value at this time. **PPRTV:** Per PPRTV (7/26/2007), no value at this time. **MRL:** Per ATSDR (12/2014), no MRL at this time. ATSDR (2002) toxicological profile for dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethane (DDD) and DDE is available. **Tier 3 Source:** **MDEQ:** Per DEQ-CCD, no value at this time.		Complete
Inhalation Unit Risk Factor (IURF) ((µg/m^3)$^{-1}$)	9.7E-5	9.7E-5	MDEQ, 1999	
IURF details	Based on EPA IRIS oral slope factor for DDE of 3.4E-1 per (mg/kg). The oral slope factor is based on geometric mean of three studies NCI 1978, Tomatis et al 1974 and Rossi et al 1983 which found liver tumors in mice and hamsters. See EPA IRIS write up dated 8/22/99 for additional details.	**Tier 3 Source:** **MDEQ:** **Basis:** MDEQ IURF based on extrapolated IRIS oral CSF value is selected. California derived a similar value, which Minnesota and New Jersey adopted. New York's route extrapolation approach used a NYDEC RfD of 0.185 per mg/kg/day. See details below. **Tier 1 and 2 Sources**: **IRIS:** Per IRIS (8/22/1988), no value at this time. **PPRTV:** Per PPRTV (8/13/2007), no value at this time. **MRL:** NA; MRLs are for non-cancer effects only. **Tier 3 Sources:** **MDEQ:** DEQ/AQD (1999) IURF = 9.7E-5 (µg/m^3)$^{-1}$ based on route extrapolation of the EPA IRIS oral CSF (3.4E-1 per (mg/kg)). See Updated Value CSF details. **Source and Date**: MDEQ-CCD/AQD, 8/31/1999.		Complete

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
	CCD/AQD date: 8/31/1999	**California DTSC:** IURF= 0.000097 or 9.7E-5 $(\mu g/m^3)^{-1}$ based on IRIS IUR for DDT. CALEPA-OEHHA used DDT as surrogate for DDE as DDE is structurally similar to DDT and a metabolite. **New York DEC:** IURF= 0.012 or 1.2E-2 $(\mu g/m^3)^{-1}$. Per NYSDEC (2/2005), DDE is a systemic toxicant that is expected to be absorbed into the body following both oral and inhalation exposure. A default oral-to-inhalation extrapolation of the oral cancer potency factor for p,p'-DDE (0.185 per mg/kg/day) is used. The oral potency factor is based on liver effects (centrilobular necrosis) in rats from a 78-week dietary study (NTP, 1978). **Minnesota :** IURF= 9.70E-5 $(g/m^3)^{-1}$ based on CALEPA IUR. **New Jersey DEP:** IURF= 9.7E-05 $((\mu g/m^3)^{-1})$ based on CALEPA IUR. **Other Tier 3:** No value is available at this time from these Tier 3 sources/databases: HEAST, NTP ROC, health and environmental agencies of Massachusetts and Texas, WHO (IARC), WHO (IPCS/INCHEM), Canada, The Netherlands (RIVM), ECHA (REACH) and OECD HPV.		
Mutagenic Mode of Action (MMOA)? (Y/N)	--	NO	USEPA, 2015	
MMOA Details	--	NA Not listed as a carcinogen with mutagenic MOA in the USEPA OSWER List.		
Developmental or Reproductive Effector? (Y/N)	No	**NO**, the critical effect is not considered a reproductive-developmental effect although the RfD is based on a developmental study. (Based on the study by Kornbrust et al. See RfD section.)	MDEQ, 2015	
Developmental or Reproductive Toxicity Details	NA	**Additional Developmental Studies**: 1) You, L., M. Casanova, S. Archibeque-Engle et al. 1998. Impaired male sexual development in perinatal Sprague-Dawley and Long-Evans hooded rats exposed in utero and lactationally to p,p'-DDE. Toxicol. Sci. 45: 162-173. **Critical effect**: impaired sexual development (demasculinization represented by		

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		retention of thoracic nipples) in male SD pups **Method(s)**: Groups of 8 to 11 pregnant Long-Evans (LE) hooded and Sprague-Dawley (SD) rats were given p,p'-DDE (administered in corn oil) via gavage in doses of 0, 10 or 100 mg/kg on GD 14-18. A separate group of rats was given flutamide as a positive control. Three pregnant rats from each of the treated groups were sacrificed on GD 20. Remaining dams were allowed to give birth. **Critical effect**: impaired sexual development (demasculinization represented by retention of thoracic nipples) in male SD pups 2) You, L., K.A. Brenneman, and H. d'A. Heck. 1999. In utero exposure to antiandrogens alters the responsiveness of the prostate to p,p'-p,p'-DDE in adult rats and may induce prostatic inflammation. Toxicol. Appl. Pharmacol. 161: 258-266. You et al. (1999) evaluated the effect of in utero and lactational exposure to p,p'-DDE on the postnatal expression of specific hepatic cytochromes that are involved in testosterone metabolism. Pregnant Sprague-Dawley rats were gavaged with 0, 10 or 100 mg/kg-day of p,p'-DDE in corn oil from GD 14 to 18. Exposure to the high dose significantly increased the hepatic expression of CYP2A1 enzyme at PND 10 and CYP3A1 enzyme at PND 10 and 21 in male and female offspring; both doses induced the expression of CYP2B1 at PND 10 and 21 in both genders. These changes were associated with significant increases in testosterone hydrolase (an enzyme that inactivates testosterone) activity in high-dose males and females; increases in low-dose rats were not statistically significant. 3) Loeffler, I.K. and R.E. Peterson. 1999. Interactive effects of TCDD and p,p'-p,p'-DDE on male reproductive tract development in in utero and lactationally exposed rats. Toxicol. Appl. Pharmacol. 154: 28-39. **Loeffler and Peterson (1999)** exposed groups of 6 pregnant Holtzman rats to 0, 1, 10, 50, 100 or 200 mg/kg p,p'-DDE (in corn oil/acetone vehicle) by daily gavage between GD 14 and 18. A developmental LOAEL of 50 mg/kg-day for male reproductive effects (NOAEL = 10 mg/kg-day) is established. The LOAEL is based on the transitory 20% reduction in ventral prostate weight and nipple retention,		

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		although there is also a reduction in dorsolateral prostate relative weight at 50 mg/kg-day at PND 63. **End point or Point of Departure (POD):** LOAEL = 10 mg/kg-day **Uncertainty Factors**: UF = 3,000 (10 each for intraspecies variability, interspecies extrapolation, LOAEL to NOAEL extrapolation and 3 for database deficiencies)		
State Drinking Water Standard (SDWS) (ug/L)	--	NO	SDWA, 1976	
SDWS details	NA	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		
Is there an aesthetic value for drinking water? (Y/N)	NO	Not evaluated.	NA	
Aesthetic value (ug/L)	NA	NA	NA	
Aesthetic Value details	NA	NA		
Phytotoxicity Value? (Y/N)	NO	Not evaluated.	NA	
Phytotoxicity details	NA	NA	NA	
Others				

(C) Chemical-specific Absorption Factors

	Part 201 Value	Update	Source/Reference/ Dates	Comments/Notes /Issues
Gastrointestinal absorption efficiency value (ABSgi)	---	1.0	MDEQ, 2015/USEPA RAGS-E	
ABSgi details		RAGS E (EPA, 2004) Default Value		
Skin absorption efficiency value (AEd)	---	0.1	MDEQ, 2015E	
AEd details				
Ingestion Absorption Efficiency (AEi)		0.5	MDEQ, 2015	
AEi 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 (µg/L)	NA
Updated GSI value (µg/L)	NA
Rule 57 Drinking Water Value (µg/L)	NA

	Rule 57 Value (µg/L)	Verification Date
Human Non-cancer Values- Drinking water source (HNV-drink)		
Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)		
Wildlife Value (WV)		
Human Cancer Values for Drinking Water Source (HCV-drink)		
Human Cancer values for non-drinking water source (HCV-Non-drink)		
Final Chronic Value (FCV)		
Aquatic maximum value (AMV)		
Final Acute Value (FAV)		

Sources:

1. MDEQ Surface Water Assessment Section Rule 57 website
2. MDEQ Rule 57 table

(E) Target Detection Limits (TDL)

	Value	Source
Target Detection Limit – Soil (μg/kg)	20	MDEQ, 2015
Target Detection Limit – Water (μg/L)	0.1	MDEQ, 2015
Target Detection Limit – Air (ppbv)	NA	MDEQ, 2015
Target Detection Limit – Soil Gas (ppbv)	NA	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