



## CHEMICAL UPDATE WORKSHEET

<b>Chemical Name:</b>	Hexachlorocyclopentadiene (C-56)
<b>CAS #:</b>	77-47-4
<b>Revised By:</b>	RRD Toxicology Unit
<b>Revision Date:</b>	November 24, 2015

### (A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	272.77	272.77	EPI	EXP
Physical State at ambient temp	Liquid	Liquid	MDEQ	
Melting Point (°C)	283	-9.00	EPI	EXP
Boiling Point (°C)	239	239.00	EPI	EXP
Solubility (ug/L)	1800	1800	EPI	EXP
Vapor Pressure (mmHg at 25°C)	0.07296	6.00E-02	EPI	EXP
HLC (atm-m <sup>3</sup> /mol at 25°C)	2.70E-2	2.70E-02	EPI	EXP
Log Kow (log P; octanol-water)	5.39	5.40	EPI	EXP
Koc (organic carbon; L/Kg)	1.99E+5	1404	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm <sup>2</sup> /s)	0.0161	2.72E-02	W9	EST
Diffusivity in Water (Dw; cm <sup>2</sup> /s)	7.21E-6	7.22E-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; unitless)	NA	NA	NA	NA
Critical Temperature (K)		7.46E+02	EPA2004	EXP
Enthalpy of Vaporization (cal/mol)		1.09E+04	EPA2004	EXP
Density (g/mL, g/cm <sup>3</sup> )		1.7019	CRC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm <sup>2</sup> )	3.88E-06	2.63E-05	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm <sup>2</sup> )	3.88E-06	5.79E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm <sup>2</sup> )	4.63E-06	4.12E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm <sup>2</sup> )	4.63E-06	8.75E-05	EMSOFT	EST

**(B) Toxicity Values/Benchmarks**

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
Reference Dose (RfD) (mg/kg/day)	6.0E-3	6.0E-3	IRIS, 2001	
RfD details	Rat sub chronic oral study (Abdo et al., 1984). Critical effects = chronic irritation (forestomach lesions). UF = 1000; BMDL10 = 6 mg/kg/day. RD calculation date: 7/5/01.	<p><b>Tier 1 Source:</b></p> <p><b>IRIS:</b></p> <p><b>Basis:</b> IRIS is a Tier 1 source.</p> <p><b>Critical Study:</b> Abdo, KM; Montgomery, CA; Kluwe, WM; et al. (1984) Toxicity of hexachlorocyclopenta-diene: sub chronic (13-week) administration by gavage to F344 rats and B6C3F1 mice. J Appl Toxicol 4:75-81.</p> <p><b>Methods:</b> Young adult F344 rats (10/sex/dose) were administered 0, 10, 19, 38, 75, or 150 mg HCCPD/kg via corn oil gavage 5 days/week for 13 weeks. Young adult B6C3F1 mice were treated on the same regimen, but at doses of 0, 19, 38, 75, 150, or 300 mg/kg.</p> <p><b>End point or Point of Departure (POD):</b> Chronic irritation, manifested by forestomach lesions, was chosen as the critical effect because it occurred at lower doses than the toxic nephrosis. Female rats were more susceptible to the forestomach irritation than male rats or either sex of mice. The incidence of forestomach histopathology in female rats was 0/10, 0/10, 2/10, 5/10, 9/10, and 9/10 for the 0, 10, 19, 38, 75, or 150 mg/kg doses, respectively. Benchmark dose modeling was applied to these data because there was a clear increase in response with dose and there were at least two doses that produced more than minimal but less than maximal effects. The BMDL<sub>10</sub> = 6 mg/kg/day. (This is the 95% lower confidence limit on the maximum likelihood estimate of the dose corresponding to 10% risk.) The BMD10 is 11 mg/kg/day (this is the maximum likelihood estimate of the dose corresponding to 10% risk.)</p> <p><b>Uncertainty Factors:</b> UF = 1,000. Per IRIS: Chronic studies are preferred for RfD development. To account for the uncertainty in using a sub chronic study for RfD derivation, a UF of 10<sup>1/2</sup> is applied. Rather than using the default of 10, this UF was derived by comparing the data from the sub chronic and chronic inhalation studies (NTP, 1994). This approach is justified by the fact that HCCPD produces local effects by both oral and inhalation routes of exposure. The sub chronic NOAEL to chronic NOAEL ratio from NTP (1994) was 0.8 for respiratory effects in</p>	Complete	



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		<p>rats while the ratio for mice was 3 (see Section I.B.2 for a more thorough discussion of NTP, 1994). Because it is more typical for the sub chronic NOAEL to be larger than the chronic NOAEL, 3, or <math>10^{1/2}</math> was chosen as the sub chronic-to-chronic UF for the RfD. In the absence of data on which to base a pharmacokinetic or pharmacodynamic comparison of rodents to humans, the default UF of 10 is used for interspecies extrapolation. There are no data documenting the nature and extent of variability in human susceptibilities to HCCPD, so the default UF of 10 is used to protect sensitive human subpopulations. The database for HCCPD includes studies of genotoxicity, developmental toxicity, systemic toxicity, and cancer, but no reproductive studies are available. An additional UF of <math>10^{1/2}</math> is added for this database deficiency. Thus, the total UF is 1,000.</p> <p><b>Source and date:</b> IRIS, 7/05/2001</p> <p><b>Tier 2 Sources:</b>  <b>PPRTV:</b> No PPRTV record available at this time.  <b>MRL:</b> Oral Intermediate MRL = 0.1 mg/kg/day; MDEQ adjusted oral chronic MRL = 0.05 mg/kg/d.  <b>Critical study:</b> Abdo, KM; Montgomery, CA; Kluwe, WM; et al. (1984) Toxicity of hexachlorocyclopenta-diene: sub chronic (13-week) administration by gavage to F344 rats and B6C3F1 mice. J Appl Toxicol 4:75-81.  <b>Method(s):</b> Young adult F344 rats (10/sex/dose) were administered 0, 10, 19, 38, 75, or 150 mg HCCPD/kg via corn oil gavage 5 days/week for 13 weeks. Young adult B6C3F1 mice were treated on the same regimen, but at doses of 0, 19, 38, 75, 150, or 300 mg/kg.  <b>Critical effect</b> = renal lesions  <b>End Point or Point of Departure (POD):</b> The MRL was calculated using a NOAEL of 19 mg/kg/day based on the absence of renal lesions. Doses were normalized to account for a 5 days a week exposure schedule.  <b>Uncertainty Factors:</b> UF = 100 (10 for interspecies extrapolation and 10 for interspecies variability). Consistent with the justification provided by IRIS for its chronic RfD, MDEQ has applied an additional uncertainty factor of 3 (<math>10^{0.5}</math>) to account for the use of a sub chronic study, which yields a total uncertainty factor</p>		



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		of 300. <b>Source:</b> ATSDR Final, 07/1999.  <b>Tier 3 Source:</b> <b>MDEQ-RRD (07/05/2001):</b> Per DEQ-CCD the IRIS RfD was adopted. Oral RfD = 6E-3 mg/kg/d.		
<b>Oral Cancer Slope Factor (CSF) (mg/kg-day)<sup>-1</sup></b>	NA	NA	MDEQ, 2015	
<b>CSF details</b>		<b>Tier 1 and 2 Sources:</b> <b>IRIS:</b> Per IRIS, most of the information available is for the inhalation route of exposure. There is inadequate oral cancer data to perform a quantitative assessment. IRIS, 07/05/2011. <b>PPRTV:</b> No PPRTV record available at this time. <b>MRL:</b> NA; MRLs are only developed for non-cancer effects.  <b>Tier 3 Source:</b> <b>MDEQ:</b> No RRD or WRD oral cancer slope factor entry in DEQ-CCD.		Complete
<b>Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (µg/m<sup>3</sup>)</b>	2.0E-1	2.0E-1	IRIS, 2001	
<b>RfC/ITSL details</b>		<b>Tier 1 Source:</b> <b>IRIS:</b> <b>Basis:</b> IRIS is a Tier 1 source. <b>IRIS (07/05/2001):</b> RfC = 2E-1 µg/m <sup>3</sup> . <b>Critical Study:</b> NTP. (1994) Toxicology and carcinogenesis studies of hexachlorocyclopentadiene in F344/N rats and B6C3F1 mice (inhalation studies). National Toxicology Program Technical Report Series 437:318. <b>Method(s):</b> Sixty rats or mice per sex were exposed to atmospheres containing 0, 0.11, 0.56, or 2.23 mg/m <sup>3</sup> HCCPD for 5 days/week for 2 years. Ten male and 10		Complete



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		<p>female rats and mice from each exposure group were evaluated at 15 months. The stability of the compound was monitored throughout the study, and it was found that no degradation took place for up to 2 years. Standard bioassay data including body weights, organ weights, urinalysis, and histopathology were collected.</p> <p><b>Critical effect:</b> Suppurative inflammation of the nose in both male and female mice.</p> <p><b>End point or Point of Departure (POD):</b> Increases in suppurative inflammation of the nose were noted at 2.23 mg/m<sup>3</sup> HCCPD in both male and female mice during the interim evaluation at 15 months and at study termination. Suppurative inflammation of the nose in mice was chosen as the critical effect since it was the only respiratory tract effect that occurred in both rats and mice. Neither sex of mice was clearly more sensitive to the effect than the other, so both sexes were used for the dose-response analysis. The incidence of this effect was 4/99, 0/100, 4/100, and 76/98 in the 0, 0.11, 0.56, and 2.23 mg/m<sup>3</sup> groups, respectively. Thus, the NOAEL in mice for suppurative inflammation of the nose was 0.56 mg/m<sup>3</sup> HCCPD and the LOAEL was 2.23 mg/m<sup>3</sup>. The available data did not meet the suggested criteria for applying a benchmark concentration analysis (U.S. EPA, 1995) of at least three dose levels with two doses eliciting a greater than minimum and less than maximum response. Conversion from intermittent exposure to continuous exposure: 0.56 mg/m<sup>3</sup> × 6/24 hrs. × 5/7 days = 0.1 mg/m<sup>3</sup>. Thus, the duration-adjusted NOAEL of 0.10 mg/m<sup>3</sup> is used to derive the RfC. Conversion to human equivalent concentration (HEC) for interspecies dosimetric adjustment: NOAEL<sub>HEC</sub> was calculated for an effect in the extrathoracic (ET) region. MV<sub>A</sub> = 0.049 L/min, MV<sub>H</sub> = 13.8 L/min, [SA<sub>ET</sub>]<sub>A</sub> = 3 cm<sup>2</sup>, SA<sub>(ET)</sub><sub>H</sub> = 200 cm<sup>2</sup>. Regional Gas Dose Ratio (RGDR<sub>ET</sub>) = (MV<sub>A</sub>/[SA<sub>ET</sub>]<sub>A</sub>) / (MV<sub>H</sub>/SA<sub>(ET)</sub><sub>H</sub>) = 0.237. NOAEL<sub>HEC</sub> = NOAEL<sub>ADJ</sub> × RGDR<sub>ET</sub> = 0.1 mg/m<sup>3</sup> × 0.237 = 0.024 mg/m<sup>3</sup>.</p> <p><b>Uncertainty Factors:</b> UF = 100. Per IRIS, the default uncertainty factor for interspecies extrapolation is 10. Half of that factor, 10<sup>1/2</sup>, reflects the pharmacokinetic component of interspecies uncertainty and half represents the pharmacodynamic component of interspecies uncertainty. The pharmacokinetic component of interspecies uncertainty is accounted for by the dosimetric</p>		



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		<p>adjustment, which converts animal exposure concentrations of HCCPD to HEC. Thus, an uncertainty factor of <math>10^{1/2}</math> is employed for interspecies extrapolation to reflect the pharmacodynamic component of interspecies uncertainty. There are no data documenting the nature and extent of variability in human susceptibilities to HCCPD, so the default UF of 10 is used to protect sensitive human subpopulations. A factor of <math>10^{1/2}</math> is applied for an incomplete database because the inhalation database lacks developmental and reproductive toxicity. The total UF is 100.</p> <p><b>Source and date:</b> IRIS, 07/05/2001.</p> <p><b>Tier 2 Sources:</b>  <b>PPRTV:</b> No PPRTV record available at this time.  <b>MRL (07/1999):</b> chronic inhalation MRL = <math>2E-4</math> ppm = <math>2.5 \mu\text{g}/\text{m}^3</math>.  <b>Critical study:</b> NTP. (1994) Toxicology and carcinogenesis studies of hexachlorocyclopentadiene in F344/N rats and B6C3F1 mice (inhalation studies). National Toxicology Program Technical Report Series 437:318.  <b>Method(s):</b> Groups of 50 male and 50 female rats were exposed to concentrations of 0, 0.01, 0.05, or 0.2 ppm HCCPD for 6 hours/day, 5 days/week for 2 years. At sacrifice, the tissues were examined for the occurrence of tumors and histological abnormalities.  <b>Critical effect:</b> yellow-brown granular pigmentation of the nasal epithelium, trachea, and/or bronchioles.  <b>End point or Point of Departure (POD):</b> The 0.01 ppm LOAEL was selected as the basis of the MRL derivation. A <math>\text{LOAEL}_{\text{HEC}}</math> of 0.02 ppm was calculated.  <b>Uncertainty Factors:</b> = 90 (3 for minimally adverse cellular changes, 3 for extrapolation from humans to animals using a <math>\text{LOAEL}_{\text{HEC}}</math>, and 10 for interspecies variability).                      Inhalation intermediate MRL = 0.01 ppm; UF = 30; endpoint = resp.  <b>Source:</b> ATSDR, Final 7/1999.</p> <p><b>Tier 3 Source:</b>  <b>MDEQ-AQD:</b> Per DEQ-CCD, AQD ITSL = <math>0.2 \mu\text{g}/\text{m}^3</math> (24 hour averaging time). Based</p>		



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		on EPA. Calc. date = 7/17/2001.		
Inhalation Unit Risk Factor (IURF) (( $\mu\text{g}/\text{m}^3$ ) <sup>-1</sup> )	NA	NA	MDEQ, 2015	
IURF details		<p><b>Critical Study:</b> NTP. (1994) Toxicology and carcinogenesis studies of hexachlorocyclopentadiene in F344/N rats and B6C3F1 mice (inhalation studies). National Toxicology Program Technical Report Series 437:318.</p> <p><b>Carcinogen Weight-of-Evidence (WOE) Class:</b> Group E, evidence of noncarcinogenicity to humans via inhalation exposure.</p> <p><b>IRIS WOE Basis:</b> The apparent inability of HCCPD to cause genotoxic effects, and the lack of evidence for both human and animal carcinogenicity by the inhalation route, justify the conclusion that HCCPD is not likely to present a human cancer risk via inhalation exposure. In accordance with U.S. EPA's Proposed Guidelines for Carcinogen Risk Assessment (U.S. EPA, 1996), HCCPD is not likely to be a human carcinogen by the inhalation route based on current data indicating no evidence of cancer in well-conducted bioassays in two species of rodents; the absence of increased deaths from cancer in the limited human occupational studies available; and lack of mutagenicity in a variety of test systems. In a well conducted 2-year inhalation bioassay, no increased incidence of tumors was reported in male or female rats and mice up to 2.2 mg/m<sup>3</sup> (NTP, 1994). Several occupational epidemiological studies reported no increase in cancer mortality associated with HCCPD exposure, in the presence of other chlorinated production compounds. Mutagenicity studies were negative in five strains of <i>S. typhimurium</i>; negative in mouse micronucleus assays; showed no evidence of transformation of BALB/3T3 cells or forward mutations in mouse lymphoma cells; did not induce DNA repair when incubated with rat hepatocytes; and failed to induce lethal mutations in the offspring of male <i>Drosophila</i>. The only positive result for mutagenicity was an isolated statistically significant increase in sister chromatid exchanges and chromosomal aberrations in Chinese hamster ovary cells, but chromosome damage did not occur in metaphase stage rat liver cells. Because the existing chronic health effect data in both humans and animals do not include the oral route of exposure, the potential for carcinogenicity by the oral route is</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		<p>unknown. Additionally, there are no data on the carcinogenic potential of HCCPD in developing organisms.  <b>Source and Date:</b> IRIS 07/05/2001.</p> <p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> Per IRIS (7/5/2011), not likely to present a human cancer risk via inhalation exposure.  <b>PPRTV:</b> No 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-AQD:</b> Per DEQ-CCD, no value at this time.</p>		
<b>Mutagenic Mode of Action (MMOA)? (Y/N)</b>	--	NO	USEPA, 2015	
<b>MMOA Details</b>	--	Not listed as a carcinogen with mutagenic MOA in the USEPA OSWER List.		
<b>Developmental or Reproductive Effector? (Y/N)</b>	No	No, the RfD or RfC is not based on a reproductive-developmental effect.	MDEQ, 2015	
<b>Developmental or Reproductive Toxicity Details</b>	NA	NA		
<b>State Drinking Water Standard (SDWS) (µg/L)</b>	NA	50	SDWA, 1976	
<b>SDWS details</b>		MI Safe Drinking Water Act (SDWA) 1976 PA 399		
<b>Secondary Maximum Contaminant Level (SMCL) (µg/L)</b>	NA	NO	SDWA, 1976 and USEPA SMCL List	
<b>SMCL details</b>		MI Safe Drinking Water Act (SDWA) 1976 PA 399 and USEPA SMCL List, 2015		

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
Is there an Aesthetic Value? (Y/N)	No	Not evaluated.	NA	
Aesthetic value details	NA	NA		
Is there a Phytotoxicity Value? (Y/N)	No	Not evaluated.	NA	
Phytotoxicity details	NA	NA		
Others:				

**(C) Chemical-specific Absorption 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		RAGS E (USEPA, 2004) Default Value		
Skin absorption efficiency value (AE <sub>d</sub> )	---	0.1	MDEQ, 2015	
AE <sub>d</sub> details				
Ingestion Absorption Efficiency (AE <sub>i</sub> )		0.5	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**

<b>Current GSI value (µg/L)</b>	ID
<b>Updated GSI value (µg/L)</b>	ID
<b>Rule 57 Drinking Water Value (µg/L)</b>	140

	<b>Rule 57 Value (µg/L)</b>	<b>Verification Date</b>
<b>Human Non-cancer Values- Drinking water source (HNV-drink)</b>	140	4/1999
<b>Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)</b>	450	4/1999
<b>Wildlife Value (WV)</b>	NA	NA
<b>Human Cancer Values for Drinking Water Source (HCV-drink)</b>	NA	NA
<b>Human Cancer values for non-drinking water source (HCV-Non-drink)</b>	NA	NA
<b>Final Chronic Value (FCV)</b>	ID	4/1999
<b>Aquatic maximum value (AMV)</b>	ID	4/1999
<b>Final Acute Value (FAV)</b>	ID	4/1999

Sources:

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



**(E) Target Detection Limits (TDL)**

	<b>Value</b>	<b>Source</b>
<b>Target Detection Limit – Soil (<math>\mu\text{g}/\text{kg}</math>)</b>	1000	MDEQ, 2015
<b>Target Detection Limit – Water (<math>\mu\text{g}/\text{L}</math>)</b>	25	MDEQ, 2015
<b>Target Detection Limit – Air (ppbv)</b>	1.80E-02	MDEQ, 2015
<b>Target Detection Limit – Soil Gas (ppbv)</b>	5.90E-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 OEHHHA	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