



## CHEMICAL UPDATE WORKSHEET

<b>Chemical Name:</b>	Lindane (gamma-Hexachlorocyclohexane)
<b>CAS #:</b>	58-89-9
<b>Revised By:</b>	RRD Toxicology Unit
<b>Revision Date:</b>	September 24, 2015

### (A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	290.9	290.83	EPI	EXP
Physical State at ambient temp	Solid	Solid	MDEQ	
Melting Point (°C)	386	112.50	EPI	EXP
Boiling Point (°C)	3234	323.40	EPI	EXP
Solubility (ug/L)	6800	7300	EPI	EXP
Vapor Pressure (mmHg at 25°C)	0.00003724	4.20E-05	EPI	EXP
HLC (atm-m <sup>3</sup> /mol at 25°C)	1.40E-5	5.14E-006	EPI	EXP
Log Kow (log P; octanol-water)	3.73	3.72	EPI	EXP
Koc (organic carbon; L/Kg)	1080	2807	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm <sup>2</sup> /s)	0.0176	2.75E-02	W9	EST
Diffusivity in Water (Dw; cm <sup>2</sup> /s)	7.34E-6	7.35E-06	W9	EST

	Part 201 Value	Updated Value	Reference Source	Comments
Soil Water Partition Coefficient (Kd; inorganics)	NR	NR	NA	NA
Flash Point (°C)	NA	65.6	PC	EXP
Lower Explosivity Level (LEL; unitless)	NA	NA	NA	NA
Critical Temperature (K)		839.36	EPA2001	EXP
Enthalpy of Vaporization (cal/mol)		1.50E+04	EPA2001	EST
Density (g/mL, g/cm <sup>3</sup> )		1.87	PC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm <sup>2</sup> )	NA	1.13E-06	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm <sup>2</sup> )	NA	1.13E-06	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm <sup>2</sup> )	NA	1.42E-06	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm <sup>2</sup> )	NA	1.42E-06	EMSOFT	EST

**(B) Toxicity Values/Benchmarks**

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
Reference Dose (RfD) (mg/kg/day)	3.3E-4	4.7E-3	OPP, 2002	
RfD details	Rat subchronic oral study; Critical effect = liver & kidney toxicity. NOAEL = 0.33 mg/kg (Zoecon Corp. 1983). *RfD presented in two significant figures. RD calculation date: 1/22/86.	<p><b>Tier 1 Source:</b>  <b>EPA-OPP:</b>  <b>Basis:</b> OPP is a Tier 1 source and is a more recent assessment than IRIS. The RfD is based on the information published under the Registration Eligibility Decision (RED) by the Health Effects Division (HED) Risk Assessment for Lindane, dated July 31, 2002.  <b>USEPA RfD</b> = 0.0047 = 4.7E-3 mg/kg/day.  <b>Critical Study:</b> Aymes, S.J. (1989) Combined oncogenicity and toxicity study by dietary administration to Wistar rats for 104 weeks. Life Sciences Research, England. Study No. 90/CIL002/0839. November 7, 1989. Unpublished. (MRID 41853701).  <b>Methods:</b> Lindane was administered in the diet to groups of 115 male and 115 female Wistar rats at concentrations of 0, 1, 10, 100, or 400 ppm for 2 years. Corresponding delivered doses were 0, 0.05, 0.47, 4.81, and 19.66 mg/kg/day, respectively, for males and 0, 0.06, 0.59, 6.00, and 24.34 mg/kg/day, respectively, for females.  <b>Critical Effects:</b> Periacinar hepatocyte hypertrophy, increased liver and spleen weights, and decreased platelets.  <b>End point or Point of Departure (POD):</b> The systemic toxicity LOAEL for male and female rats is 100 ppm (4.81 and 6.0 mg/kg/day, respectively). The systemic toxicity NOAEL is 10 ppm (0.47 and 0.59 mg/kg/day for males and females, respectively).  <b>Uncertainty Factors:</b> = 100 (10 each for interspecies extrapolation and interspecies variability).  <b>Source: USEPA RED Documents, 7/31/2002.</b> Revised HED risk assessment for Lindane. Memorandum dated July 31, 2002 from Becky Daiss, Health Effects Division, OPPTS.</p> <p><b>Tier 1 and 2 Sources:</b>  <b>IRIS (03/01/1988):</b> RfD = 3E-4 mg/kg/d.  <b>Critical Study:</b> Zoecon Corporation. 1983. MRID No. 00128356. Available from EPA.  <b>Method:</b> Twenty male and 20 female Wistar KFM-Han (outbred) SPF rats/treatment group were administered 0, 0.2, 0.8, 4, 20, or 100 ppm lindane (99.85%) in the diet. After 12 weeks, 15 animals/sex/group were sacrificed. The remaining rats were fed the</p>	Complete	



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>control diet for an additional 6 weeks before sacrifice.</p> <p><b>End point or Point of Departure (POD):</b> Rats receiving 20 and 100 ppm lindane were observed to have greater-than-control incidence of the following: liver hypertrophy, kidney tubular degeneration, hyaline droplets, tubular distension, interstitial nephritis, and basophilic tubules. Since these effects were mild or rare in animals receiving 4 ppm, this represents a NOAEL. The reviewers of the study calculated the dose to be 0.29 mg/kg/day for males and 0.33 mg/kg/day for females, based on measured food intake.</p> <p><b>Uncertainty Factors:</b> = 1,000 (10 each for sub chronic-to-chronic extrapolation, interspecies extrapolation and interspecies variability).</p> <p><b>Source and date:</b> IRIS, 03/01/1988</p> <p><b>PPRTV:</b> No PPRTV record available for lindane at this time.</p> <p><b>MRL (08/2005):</b> Final oral intermediate MRL = 1E-5 mg/kg/d.</p> <p><b>Critical Study:</b> Meera P, et al. (1992) Immunomodulatory effects of <math>\gamma</math>-HCH (lindane) in mice. Immunopharmacol Immunotoxicol 14:261-282.</p> <p><b>Methods:</b> Groups of six female Swiss mice were exposed to lindane in measured dietary doses of 0, 0.012, 0.12, or 1.2 mg/kg/d for up to 24 weeks.</p> <p><b>Critical Effects:</b> Immunological/lymphoreticular effects in mice.</p> <p><b>End Point or Point of Departure (POD):</b> Adverse immunological effects were observed at all doses. The LOAEL = 0.012 mg/kg/d, the lowest dose.</p> <p><b>Uncertainty Factors:</b> ATSDR applied uncertainty factors = 1,000 (10 each for LOAEL-to-NOAEL extrapolation, interspecies extrapolation, and interspecies variability). Final Oral acute MRL = 3E-3 mg/kg/day; UF = 300; Effect = developmental;</p> <p><b>Tier 3 Source:</b> <b>MDEQ:</b> Per DEQ-CCD, WRD (5/1/1995) and RRD (1/22/1986) have the same RfD of 3.3E-4 mg/kg/d based on the same critical study as in IRIS and presented above.</p>		
<p><b>Oral Cancer Slope Factor (CSF) (mg/kg-day)<sup>-1</sup></b></p>	<p>7.1E-1</p>	<p>1.1E+0</p>	<p>CALEPA, 2009</p>	



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
<p><b>CSF details</b></p>	<p>(Per RRD: SWQD): Liver tumor induction in male mice exposed to 400 ppm (52 mg/kg/d) lindane in diet for 110 weeks (Thorpe and Walker, 1973). Revised species scaling factor of (BWh/BWa) to the 0.25 power used for q* calculation. RRD calculation date: 1/18/00.</p>	<p><b>Tier 3 Source:</b>  <b>CALEPA:</b>  <b>Basis:</b> CAL is a more recent toxicity assessment than HEAST and MDEQ. MN and NY are based on CAL and TX and NJ are based on HEAST. See details below.</p> <p><b>Tier 1 Sources:</b>  <b>IRIS (10/01/1993):</b> An oral cancer slope factor is not available at this time.  <b>EPA RED Documents:</b> Memorandum dated July 31, 2002; Revised HED Risk Assessment for Lindane; from Becky Daiss, Health Effects Division (OPPTS). The HED Cancer Assessment Review Committee (CARC) met on 09/13/2001 and reevaluated all the available information/data. Based on the most recent review of the data including the newly submitted carcinogenicity study in CD-1 mice and in accordance with the EPA Draft Guidelines for Carcinogen Risk Assessment (July, 1999), the CARC has classified lindane into the category “Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential” based on an increased incidence of benign lung tumors in female mice only. The Committee, therefore, recommended that the quantification of human cancer risk is not required.</p> <p><b>Tier 2 Sources:</b>  <b>PPRTV:</b> No PPRTV record for lindane is available at this time.  <b>MRL:</b> NA; MRLs are for non-cancer effects only.</p> <p><b>Tier 3 Sources:</b>  <b>MDEQ:</b> MDEQ/WRD (09/16/1998). Oral CSF = 7.1E-1 per (mg/kg/d)  <b>Critical Study:</b> Thorpe, E. and A. I. Walker. (1973) The toxicology of dieldrin (HEOD). II. Comparative long - term oral toxicity studies in mice with dieldrin, DDT, phenobarbitone, β-BHC and γ-BHC. Food and Cosmetics Toxicology 11:433-442.  <b>Methods:</b> Groups of 30 male and 30 female mice were fed 400 ppm Lindane for 110 weeks. The control group consisted of 45 animals of each sex.  <b>Study results:</b> Benign and malignant liver tumors were found at the following numbers: males at 0 ppm: 11/45 (24%) and 400 ppm: 27/28 (96%). Females at 0 ppm: 10/44 (23%) and 400 ppm: 20/29 (69%). No increases in other tumor types were seen.</p>		<p>Complete</p>



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes/ Issues
		<p><b>HEAST 1997:</b> CSF= 1.3E+0 (mg/kg-day)<sup>-1</sup> based on Heast Summary 1997 for gamma-Hexachlorocyclohexane. Further derivation details are not available.</p> <p><b>Critical Studies:</b></p> <p>1) Thorpe E and AIT Walker. 1973, The toxicology of dieldrin (HEOD). II. Comparative long-term oral toxicity studies in mice with dieldrin, DDT, phenobarbitone, beta-BHC and gamma-BHC. <i>Food Cosmet Toxicol.</i> 11: 433-442.</p> <p>2) US EPA. 1987. Health and environmental effects profile for hexachlorocyclohexanes. Prepared by the Office of Health and Environmental Assessment. Environmental Criteria and Assessment Office, Cincinnati OH for the Office of Solid Waste and Emergency Response, Washington DC.</p> <p>3) US EPA 1984. Health effects assessment for lindane. Prepared by the Office of Health and Environmental Assessment. Environmental Criteria and Assessment Office, Cincinnati OH, for the Office of Emergency and Remedial Response, Washington DC.</p> <p><b>California EPA 2009:</b> CSF= 1.1 (mg/kg-day)<sup>-1</sup>.</p> <p><b>Critical Studies:</b></p> <p>1) Thorpe E and AIT Walker. 1973, The toxicology of dieldrin (HEOD). II. Comparative long-term oral toxicity studies in mice with dieldrin, DDT, phenobarbitone, beta-BHC and gamma-BHC. <i>Food Cosmet Toxicol.</i> 11: 433-442.</p> <p>2) USEPA. 1988. Drinking Water Criteria Document for Lindane. Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, U.S. Environmental Protection Agency, Cincinnati, OH.</p> <p><b>Methods:</b> The USEPA (1988) selected the study by Thorpe and Walker (1973) as the basis for the cancer potency for lindane. This was considered to be the best study for development of a cancer potency factor for lindane because of the large sample size of mice surviving for a full lifespan, and the large numbers of tumors in the treatment group. Thorpe and Walker (1973) showed an increase in liver tumors in male CF1 mice fed 400 ppm lindane in the diet for 110 weeks, compared with controls. A linearized multistage procedure was used to estimate the cancer potency of lindane from the Thorpe and Walker (1973) data in male CF1 mice (Crump et al., 1982). The concentrations of lindane given in the feed were 0 or 160 ppm. The 95% upper confidence bound on the dose response slope was used to derive the human cancer</p>		

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>potency value for lindane. Using these relationships, a human cancer potency (qhuman) of 1.1 [mg/kg-day]<sup>-1</sup> was reported (USEPA, 1987). An airborne unit risk factor of 3.1E-4 (µg/m<sup>3</sup>)<sup>-1</sup> was calculated from the q human value by OEHHA/ATES using the default parameters of 70 kg human body weight and 20 m<sup>3</sup>/day breathing rate.</p> <p><b>Source and date:</b> OEHHA. Technical Support Document for Describing Available Cancer Potency Factors, 2009, p. B-376</p> <p><b>Minnesota 2014:</b> CSF= 1.10E+00 (mg/kg-day)<sup>-1</sup> based on CalEPA, 2009.</p> <p><b>New Jersey DEP 2008:</b> CSF= 1.3 (mg/kg-day)<sup>-1</sup> based on HEAST.</p> <p><b>New York DEC 2006:</b> CSF= 0.71 (mg/kg-day)<sup>-1</sup> based on CalEPA (All the cancer potency factors derived by authoritative bodies use male and female mouse data sets showing an increased incidence of liver tumors. The CA EPA and NYS DEC values are derived from the same lifetime mouse feeding study and differ only in the scaling factor used to relate the rodent dose to an equivalent human dose. The US EPA HEAST value is poorly documented, and its precise basis is unclear. The NYS DEC derivation includes using the interspecies scaling factor that is more consistent with currently accepted risk assessment practice. Therefore, the NYS DEC cancer potency factor (0.71 per mg/kg/day) is the toxicity value recommended for use in the derivation of an oral cancer-based soil cleanup objective for gamma-HCH. The gamma-HCH risk specific dose calculated from this toxicity value is 1.4 x 10<sup>-6</sup> mg/kg/day.)</p> <p><b>Texas CEQ 2014:</b> CSF= 1.3E+00 (mg/kg-day)<sup>-1</sup> based on HEAST.</p> <p><b>Other Tier 3:</b> No value is available at this time from these Tier 3 sources/databases: NTP ROC, health and environmental agency of Massachusetts, WHO (IARC), WHO (IPCS/INCHEM), The Netherlands (RIVM) and OECD HPV.</p>		
Reference Concentration (RfC) or Initial Threshold Screening Level	NA	NA	MDEQ, 2015	



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes/ Issues
(ITSL) ( $\mu\text{g}/\text{m}^3$ )				
RfC/ITSL details		<p><b>Tier 1 Sources:</b>  <b>IRIS (07/01/1992):</b> RfC not available at this time.</p> <p><b>EPA RED:</b> Memorandum dated July 31, 2002; Revised HED Risk Assessment for Lindane; from Becky Daiss, Health Effects Division (OPPTS).</p> <p><b>Critical Study:</b> MRID No. 255003. Anonymous. 1983. 90-day inhalation study in rats with Lindane. Fraunhofer Institut fur Toxikologies und Aerosolforschung, D-5948 Schmollenberg, Germany. Project No. 104264. February 28, 1983. Unpublished. (Translated from German)</p> <p><b>Methods:</b> Lindane was administered by inhalation to groups of 12 male and 12 female Wistar rats at nominal concentrations of 0, 0.02, 0.10, 0.50, or 5.0 <math>\text{mg}/\text{m}^3</math>, 6 h/day for 90 days.</p> <p><b>Critical Effects:</b> Increased kidney weights and bone marrow effects.</p> <p><b>End Point or Point of Departure (POD):</b> For intermediate inhalation exposures, the NOAEL was identified as 0.5 <math>\text{mg}/\text{m}^3</math> (0.13 <math>\text{mg}/\text{kg}</math>). For inhalation risk assessments for occupational exposure, the target MOE is 100 (10 each for interspecies variability and interspecies extrapolation). Long-term inhalation exposure is "not expected".</p> <p><b>Tier 2 Sources:</b>  <b>PPRTV:</b> No PPRTV record available for lindane at this time.  <b>MRL: (08/2005):</b> Per ATSDR, an inhalation MRL for lindane could not be developed due to insufficient data.</p> <p><b>Tier 3 Source:</b>  <b>MDEQ/AQD:</b> EPB-CCD: no ITSL value available.</p>		Complete
Inhalation Unit Risk Factor (IURF) ( $(\mu\text{g}/\text{m}^3)^{-1}$ )	NA	NA	MDEQ, 2015	
IURF details		<p><b>Tier 1 Sources:</b>  <b>IRIS 10/01/1993:</b> No cancer data available.</p>		Complete

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes/ Issues
		<p><b>RED Memo dated July 31, 2002</b> (Revised HED Risk Assessment for Lindane; from Becky Daiss, Health Effects Division, OPPTS).</p> <p>The HED Cancer Assessment Review Committee (CARC) met on 09/13/2001 and reevaluated all the available information/data. Based on the most recent review of the data including the newly submitted carcinogenicity study in CD-1 mice and in accordance with the EPA Draft Guidelines for Carcinogen Risk Assessment (July, 1999), the CARC has classified lindane into the category "Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential" based on an increased incidence of benign lung tumors in female mice only. The Committee, therefore, recommended that the quantification of human cancer risk is not required.</p> <p><b>Tier 2 Sources:</b>  <b>PPRTV:</b> No PPRTV record for lindane is 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, no IURF value at this time.</p>		
Mutagenic Mode of Action (MMOA)? (Y/N)	--	No	USEPA, 2015	
MMOA Details	--	Not listed as a carcinogen with mutagenic MOA in the USEPA OSWER List		
Developmental or Reproductive Effector? (Y/N)	No	NO	MDEQ, 2015	
Developmental or Reproductive Toxicity Details	NA	No, the RfD is not based on a reproductive-developmental effect.		
State Drinking Water Standard (SDWS) (µg/L)	0.2	0.2	SDWA, 1976	
SDWS details		MI Safe Drinking Water Act (SDWA) 1976 PA 399		
Secondary	NA	NO	SDWA, 1976 and	

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes/ Issues
Maximum Contaminant Level (SMCL) (µg/L)			USEPA SMCL List	
SMCL details		MI Safe Drinking Water Act (SDWA) 1976 PA 399 and USEPA SMCL List, 2015		
Is there an Aesthetic Value? (Y/N)	No	Not evaluated.	NA	
Aesthetic value (ug/L)	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> )	---	0.04	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**

<b>Current GSI value (µg/L)</b>	0.03 (M); 0.026
<b>Updated GSI value (µg/L)</b>	0.03 (M); 0.026
<b>Rule 57 Drinking Water Value (µg/L)</b>	0.03 (M); 0.025

	<b>Rule 57 Value (µg/L)</b>	<b>Verification Date</b>
<b>Human Non-cancer Values- Drinking water source (HNV-drink)</b>	0.47	7/1997
<b>Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)</b>	0.5	7/1997
<b>Wildlife Value (WV)</b>	0.026	9/1998
<b>Human Cancer Values for Drinking Water Source (HCV-drink)</b>	0.025	9/1998
<b>Human Cancer values for non-drinking water source (HCV-Non-drink)</b>	0.027	9/1998
<b>Final Chronic Value (FCV)</b>	0.07	6/1997
<b>Aquatic maximum value (AMV)</b>	0.95	7/1997
<b>Final Acute Value (FAV)</b>	1.9	7/1997

## 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>	20	MDEQ, 2015
<b>Target Detection Limit – Water (<math>\mu\text{g}/\text{L}</math>)</b>	0.03	MDEQ, 2015
<b>Target Detection Limit – Air (ppbv)</b>	NA	MDEQ, 2015
<b>Target Detection Limit – Soil Gas (ppbv)</b>	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

