



CHEMICAL UPDATE WORKSHEET

Chemical Name:	Mirex
CAS #:	2385-85-5
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)	545.54	545.55	EPI	EXP
Physical State at ambient temp	Solid	Solid	MDEQ	
Melting Point (°C)	485	NA	NA	
Boiling Point (°C)	NA	NA	NA	
Solubility (ug/L)	6.8E-6	85	EPI	EXP
Vapor Pressure (mmHg at 25°C)	3.0E-7	8.00E-07	EPI	EXP
HLC (atm-m³/mol at 25°C)	5.16E-4	8.11E-04	EPI	EXP
Log Kow (log P; octanol-water)	6.70	6.89	EPI	EXP
Koc (organic carbon; L/Kg)	3.86E+6	3.566E+05	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm²/s)	0.08	2.85E-02	W9	EST
Diffusivity in Water (Dw; cm²/s)	8.0E-6	3.33E-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)		NA	NA	NA
Enthalpy of Vaporization (cal/mol)		NA	NA	NA
Density (g/mL, g/cm ³)		NA	NA	NA
EMSOFT Flux Residential 2 m (mg/day/cm ²)	NA	1.28E-06	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm ²)	NA	1.28E-06	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm ²)	NA	1.62E-06	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm ²)	NA	1.62E-06	EMSOFT	EST

(B) Toxicity Values/Benchmarks

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
Reference Dose (RfD) (mg/kg/day)	2.3E-4	2.0E-4	IRIS, 1992	
RfD details	(Oral, IRIS). Rat chronic dietary feeding study. Critical effect: liver cytomegaly, fatty metamorphosis, angiectasis, thyroid cystic follicles (NTP 1990).9.3E-1	<p>Tier 1 Source: IRIS: Basis: IRIS is a Tier 1 source. Critical Study: NTP (National Toxicology Program). 1990. Toxicology and Carcinogenesis Studies of MIREX (CAS No. 2385-85-5) in F344/N Rats (Feed Studies). NTP TR 313. Methods: Groups of 52 male and 52 female F344/N rats (initial body weight 120 and 100 g, respectively) were fed mirex (reported purity >96%) for 104 weeks. Reported mirex doses were in ppm and when converted to mg/kg-day were 0, 0.007, 0.07, 0.7, 1.8 and 3.8 mg/kg-day for males and 0, 0.007, 0.08, 0.7, 2.0 and 3.9 mg/kg-day for females. In a second study, 52 female F344/N rats were fed diets containing mirex at doses of 3.9 and 7.7 mg/kg-day. Critical effect: Liver cytomegaly, fatty metamorphosis, angiectasis, and thyroid cystic follicles. End point or Point of Departure (POD): NOAEL = 1 ppm = 0.07 mg/kg/day. Uncertainty Factors: UF = 300; 10 each for intraspecies and interspecies variability and 3 for lack of a complete database, specifically multigenerational data on reproductive effects and cardiovascular toxicity data. Source: IRIS, 10/01/1992</p> <p>Tier 2 Sources: PPRTV: No PPRTV record available at this time. MRL: Per ATSDR 08/1995 the oral chronic final MRL = 8E-4 mg/kg/day Critical Study: NTP. 1990. National Toxicology Program. Toxicology and carcinogenesis studies of mirex (CAS No. 2385-85-5) in F344/N rats (feed studies). Research Triangle Park, NC: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Toxicology Program. NTP TR 3 13. Methods: 2-year dietary study with F344/N rats (52/sex) of both sexes at a dose</p>	IRIS, 1992	Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>of 0.7 mg/kg/day following a 2-year oral exposure to mirex doses of 0-7.7 mg/kg/day (males: 0, 0.007, 0.075, 0.7, 1.8, 3.8; females: 0, 3.9, 7.7). Critical effect: hepatic changes including increased fatty metamorphosis (cytoplasmic vacuoles consistent with intracellular fat accumulation) and necrosis of hepatocytes (focal and/or centrilobular) End point or Point of Departure (POD): NOAEL = 0.075 mg/kg/day Uncertainty Factors: UF = 100;</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD/RRD (10/01/1992): rat chronic dietary feeding study. Critical effect is liver cytomegaly, fatty metamorphosis, angiectasis, and thyroid cystic follicles (NTP 1990).</p>		
Oral Cancer Slope Factor (CSF) (mg/kg-day)⁻¹	9.3E-1	9.3E-1	MDEQ, 1999	
CSF details	(Oral, SWQD); Increase in liver tumors in male F344/N rats exposed via the diet for 2 years. Tumor incidence rates were adjusted for early mortality (NTP 1990).	<p>Tier 3 Source: MDEQ: Basis: MDEQ (1999) CSF value based on a 2 year cancer study (NTP, 1990). The California (1992) estimate, derived using a 104-week study (Innes et al., 1968 and 1969), was not used as the assessment did not account for the more current NTP cancer study. See details below.</p> <p>Tier 1 and 2 Sources: IRIS: Per IRIS (7/01/1993), not available at this time. PPRTV: No PPRTV record available at this time. MRL: NA; MRLs are for non-cancer effects only.</p> <p>Tier 3 Sources: MDEQ: Per DEQ-CCD-RRD 04/01/1999. Increase in liver tumors in male F344/N rats exposed via the diet for 2 years. Tumor incidence rates were adjusted for early mortality. (NTP 1990). Cancer oral slope factor = 0.93 per mg/kg/d. Critical Study: NTP (National Toxicology Program). 1990. Toxicology and</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		<p>Carcinogenesis Studies of MIREX (CAS No. 2385-85-5) in F344/N Rats (Feed Studies). NTP TR 313.</p> <p>Methods: Groups of 52 male and 52 female F344/N rats (initial body weight 120 and 100 g, respectively) were fed mirex (reported purity >96%) for 104 weeks. Reported mirex doses were in ppm and when converted to mg/kg-day were 0, 0.007, 0.07, 0.7, 1.8 and 3.8 mg/kg-day for males and 0, 0.007, 0.08, 0.7, 2.0 and 3.9 mg/kg-day for females. In a second study, 52 female F344/N rats were fed diets containing mirex at doses of 3.9 and 7.7 mg/kg-day.</p> <p>California DTSC: CSF= 18 mg/kg-day)⁻¹:</p> <p>Tumor type: Liver tumors Species: (M) Mouse Study Length: 104 weeks Calculation method: Gold et al. list the results of the studies by Innes (1968) and Innes et al. (1969) in both sexes of B6C3F1 and B6AKF 1 mice, and in an insensitive study in rats (low doses and smaller numbers of animals). Elevated incidences of liver tumors are seen in both sexes of both strains studied by Innes (1968) and Innes et al. (1969). Potency values for these 4 data sets are consistent with one another. The cancer potency is the geometric mean of values derived from these 4 sets of data (male and female B6C3F1 and B6AKF1 mice).</p> <p>Data sources:</p> <p>1) Innes JRM (1968). Evaluation of carcinogenic, teratogenic, and mutagenic activities of selected pesticides and industrial chemicals. Volume 1: Carcinogenic study. Bionetics Research Laboratories, Inc. Distributed by National Technical Information Service, Springfield, VA.</p> <p>2) Innes JRM, Ulland BM, Valerio MG, Petrucelli L, Fishbein L, HartER, Pallota AJ, Bates: RR, Falk HL, Gart JJ, Klein M, Mitchell I and Peters J (1969). Bioassay of pesticides and industrial chemicals for tumorigenicity in mice: a preliminary note. J. Nat. Cancer Inst. 42: 1101-1114.</p> <p>3) Gold IS, Sawyer CB, Magaw R, Backman GM, de Veciana M, Levinson R, Hooper NK, Havender WR, Bernstein L, PeteR, Pike MK, Ames BN (1984). A carcinogenic potency database of the standardized results of animal bioassays. Environmental</p>		



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		Health Perspectives 58:9-319. Source: OEHHA 1992. Expedited Cancer Potency 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, Minnesota, New Jersey, New York, and Texas, WHO (IARC), WHO (IPCS/INCHEM), Canada, The Netherlands (RIVM), ECHA (REACH) and OECD HPV.		
Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) ($\mu\text{g}/\text{m}^3$)	--	NA	MDEQ, 2015	
RfC/ITSL details	--	Tier 1 and Sources: IRIS: Per IRIS (10/01/1992), no value at this time. PPRTV: No PPRTV record available at this time. MRL: Per ATSDR (08/1995), no inhalation value at this time. Tier 3 Source: MDEQ: Per DEQ-CCD-AQD, no value at this time.		Complete
Inhalation Unit Risk Factor (IURF) ($(\mu\text{g}/\text{m}^3)^{-1}$)	NA	NA	MDEQ, 2015	
IURF details	--	Tier 1 and 2 Sources: IRIS: Per IRIS (7/1/1993) no value at this time. PPRTV: No PPRTV record available at this time. MRL: NA; MRLs are for non-cancer effects only. Tier 3 Source: MDEQ: Per DEQ-CCD-AQD, no value at this time.		Complete
Mutagenic Mode of Action (MMAOA)? (Y/N)	--	NO	USEPA, 2015	



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
MMOA Details	--	NA Not listed as a carcinogen with mutagenic MOA in the USEPA OSWER List.		
Developmental or Reproductive Effector? (Y/N)	--	No, the RfD is not based on a reproductive-developmental effect.	MDEQ, 2015	
Developmental or Reproductive Toxicity Details	--	NA		
State Drinking Water Standard (SDWS) (µg/L)	--	NO	SDWA, 1976	
SDWS details	--	MI Safe Drinking Water Act (SDWA) 1976 PA 399		
Secondary Maximum Contaminant Level (SMCL) (µg/L)	--	NO	SDWA, 1976 and 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 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 _{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)		0.5	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 (µg/L)	0.02 (M); 0.000016
Updated GSI value (µg/L)	0.02 (M); 0.000016
Rule 57 Drinking Water Value (µg/L)	0.02 (M); 0.000016

	Rule 57 Value (µg/L)	Verification Date
Human Non-cancer Values- Drinking water source (HNV-drink)	ID* (0.000016)	4/1999
Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)	ID* (0.000016)	4/1999
Wildlife Value (WV)	0.000016	4/1999
Human Cancer Values for Drinking Water Source (HCV-drink)	0.000042	4/1999
Human Cancer values for non-drinking water source (HCV-Non-drink)	0.000042	4/1999
Final Chronic Value (FCV)	ID* (0.000016)	5/1999
Aquatic maximum value (AMV)	ID	5/1999
Final Acute Value (FAV)	ID	5/1999

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 ($\mu\text{g}/\text{kg}$)	50	MDEQ, 2015
Target Detection Limit – Water ($\mu\text{g}/\text{L}$)	0.02	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 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

