



CHEMICAL UPDATE WORKSHEET

Chemical Name:	Toxaphene
CAS #:	8001-35-2
Revised By:	RRD Toxicology Unit
Revision Date:	August 19, 2015

(A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	414	414	HSDB	EST
Physical State at ambient temp	Solid	Solid	MDEQ	
Melting Point (°C)	351	77.00	PP	EXP
Boiling Point (°C)	---	NA	NA	
Solubility (ug/L)	740	550	PP	EXP
Vapor Pressure (mmHg at 25°C)	0.00000418	6.69E-06	PP	EXP
HLC (atm-m³/mol at 25°C)	6.00E-6	6.00E-06	PP	EXP
Log Kow (log P; octanol-water)	5.5	5.90	PP	EXP
Koc (organic carbon; L/Kg)	2.55E+5	2.57E+05	SSG	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm²/s)	0.0116	3.42E-02	W9	EST
Diffusivity in Water (Dw; cm²/s)	4.34E-6	4.00E-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)		873.31	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)	1.28E-07	1.33E-07	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm ²)	1.28E-07	1.33E-07	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm ²)	1.51E-07	1.65E-07	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm ²)	1.51E-07	1.65E-07	EMSOFT	EST

(B) Toxicity Values/Benchmarks

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
Reference Dose (RfD) (mg/kg/day)	--	2.0E-4	ATSDR, 2014/ MDEQ 2015	
RfD details	NA	<p>Tier 2 Source: ATSDR: Basis: ATSDR is a Tier 2 source. No Tier 1 is available. MDEQ applied an additional UF = 10 to the intermediate MRL to extrapolate to a chronic value. ATSDR MRL/RfD= 2.0E-4 mg/kg-day. MRL: Intermediate and acute MRLs are available (final 10/2014) per April 2015 MRL list. The Intermediate RfD = 0.002 mg/kg/day. MDEQ applied an additional UF = 10 to the intermediate MRL to extrapolate to a chronic value. The acute MRL is 0.05 mg/kg/day based on neurological effects. Critical Study: Tryphonas H, Arnold DL, Bryce F et al. (2001) Affects of toxaphene on the immune system of cynomolgus (<i>Macaca fascicularis</i>) monkeys. <i>Food Chem Toxicol.</i> 39: 947-958 Methods: groups of 10 female cynomolgus monkeys/dose group (approximately 7 years of age on average) received toxaphene via oral capsules at 0, 0.1, 0.4, or 0.8 mg toxaphene/kg/day for up to 75 weeks. Groups of five males dosed at 0 or 0.8 mg/kg/day (approximately 12.5 and 6 years of age on average, respectively) were included in the study. Critical effect: depressed humoral immunity indicated by decreased anti-SRBC (IgM) titers End point of Point of Departure (POD): BMDL1SD = 0.22 mg/kg/day Uncertainty Factors: ATSDR UF = 100; 10 for interspecies extrapolation and 10 for human variability. MDEQ applied an additional UF = 10 for subchronic to chronic. <u>Total UF = 1000.</u> Source and Date: ATSDR; final 10/2014</p> <p>Tier 1 and 2 Sources: IRIS: Per IRIS (1/01/1991), no value at this time. PPRTV: No PPRTV record is available at this time.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>Tier 3 Source: MDEQ-WRD: RfD = 3.5E-3 mg/kg/day Critical Study: Chu I et al. (1988) Reproduction study of toxaphene in the rat. <i>Journal of Environmental Science and Health, Part B: Pesticides, Food Contaminants, and Agricultural Wastes.</i> 23:101-126 Method(s): A 1 generation 2 litter reproduction study: 15 male and 30 female weanling Sprague-Dawley rats were exposed to 0, 4, 20, 100 or 500 ppm toxaphene in diet for 26 weeks. Critical effect: Treatment-related histological changes in the liver, thyroid and kidney of adult rats End point or Point of Departure (POD): NOAEL = 4 ppm (0.35 mg/kg-day) Uncertainty Factors: UF = 100 (10 each for intraspecies variability and interspecies extrapolation) Source and date: MDEQ-CCD/WRD, 10/14/1997</p>		
Oral Cancer Slope Factor (CSF) (mg/kg-day)⁻¹	4.4E-1	1.1E+0	IRIS, 1991	
CSF details	<p>Probable human carcinogen. Hepatocellular carcinogenic and neoplastic nodules in male mice (Litten Bionetics, 1978). Revised species scaling factor of (BWh/BWa) to the 0.25 power used for q* calculation. CCD/RRD date: 1/28/2000.</p>	<p>Tier 1 Source: IRIS: Basis: IRIS a Tier 1 source. IRIS CSF= 1.1E+0 mg/kg-day)⁻¹. Critical Study: Litton Bionetics. 1978. Carcinogenic evaluation in mice: Toxaphene. Final report. Prepared by Litton Bionetics, Inc., Kensington, MD for Hercules, Inc., Wilmington, DE. LBI Project No. 20602. Method(s): 54 B6C3F1 mice (54/sex/group) were exposed to 0, 7, 20 and 50 ppm toxaphene for 18 months at doses. Animals were observed 6 months post-treatment.</p> <ol style="list-style-type: none"> 1) <i>Dose response data:</i> Tumor Type - hepatocellular carcinomas and neoplastic nodules; <i>Test Species</i> - mouse/B6C3F1, males; <i>Route</i> – oral (diet) 2) <i>Extrapolation method:</i> linearized multistage procedure, extra risk <p>Carcinogen Weight-of-Evidence (WOE) Class: B2; probable human carcinogen IRIS WOE Basis: based on increased incidence of hepatocellular tumors in mice</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>and thyroid tumors in rats and is supported by mutagenicity in Salmonella. Source and Date: IRIS, Last revision date – 1/01/1991</p> <p>Tier 2 Sources: PPRTV: No PPRTV record is available at this time. MRL: NA; MRLs are for non-cancer effects only.</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD/RRD (1/08/2000), CSF = 4.4E-1 (mg/kg-day)⁻¹. See Part 201 Value CSF details.</p>		
Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (µg/m³)	--	NA	MDEQ, 2015	
RfC/ITSL details	NA	<p>Tier 1 and 2 Sources: IRIS: Per IRIS (1/01/1991), no value at this time. PPRTV: No PPRTV record is available at this time. MRL: No MRL record is available at this time.</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD, no value at this time.</p>		Complete
Inhalation Unit Risk Factor (IURF) ((µg/m³)⁻¹)	3.2E-4	3.2E-4	IRIS, 1991	
IURF details	Potency based on IRIS SF, results of diet study conducted at Litton Bionetics (1978) where male mice had	<p>Tier 1 Source: IRIS: Basis: IRIS is a Tier 1 source. Tthe IURF was based on the oral data used to derive the CSF. Critical Study: Litton Bionetics. 1978. Carcinogenic evaluation in mice: Toxaphene. Final report. Prepared by Litton Bionetics, Inc., Kensington, MD for Hercules, Inc., Wilmington, DE. LBI Project No. 20602.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
	increased incidence of hepatocellular carcinomas and neoplastic nodules. The oral slope factor of 1.1 (mg/kg)-1 was converted to the air value. CCD/AQD date: 3/5/87	<p>Method(s): 54 B6C3F1 mice (54/sex/group) were exposed to 0, 7, 20 and 50 ppm toxaphene for 18 months at doses. Animals were observed 6 months post-treatment.</p> <p>3) <i>Dose response data: Tumor Type</i> - hepatocellular carcinomas and neoplastic nodules; <i>Test Species</i> - mouse/B6C3F1, males; <i>Route</i> – oral (diet)</p> <p>4) <i>Extrapolation method:</i> linearized multistage procedure, extra risk</p> <p>Carcinogen Weight-of-Evidence (WOE) Class: B2; probable human carcinogen</p> <p>IRIS WOE Basis: based on increased incidence of hepatocellular tumors in mice and thyroid tumors in rats and is supported by mutagenicity in Salmonella.</p> <p>Source and Date: IRIS, Last revision date – 1/01/1991</p> <p>Tier 2 Sources: PPRTV: No PPRTV record is available at this time. MRL: NA; MRLs are for non-cancer effects only.</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD (3/05/1987), AQD adopted IRIS IURF. See Part 201 Value IURF details.</p>		
Mutagenic Mode of Action (MMOA)? (Y/N)	--	NO	USEPA, 2015	
MMOA Details	--	<p>NA</p> <p>Not listed as a carcinogen with mutagenic MOA in the US EPA OSWER List. Per IRIS (last revision data 1/1/1991; Toxaphene is mutagenic to Salmonella (Hill, 1977). It was negative in a modified dominant lethal assay of male ICR/Ha Swiss mice (Epstein, 1972). No significant differences were found between rates of chromosomal aberrations in leukocytes of workers occupationally exposed to toxaphene and of unexposed workers (U.S. EPA, 1978).</p>		
Developmental or Reproductive Effector? (Y/N)	No	No. The RfD or RfC/ITSL is not based on a reproductive-developmental effect.	MDEQ, 2015	



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
Developmental or Reproductive Toxicity Details	NA	NA		
State Drinking Water Standard (SDWS) (ug/L)	3.0	3.0	SDWA, 1976	
SDWS details	SDWA, 1976	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, 2015		
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 Exposure 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 (EPA, 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)	1.0 (M); 0.000068
Updated GSI value (µg/L)	1 (M); 0.000068
Rule 57 Drinking Water Value (µg/L)	1 (M); 0.000068

	Rule 57 Value (µg/L)	Verification Date
Human Non-cancer Values- Drinking water source (HNV-drink)	0.021	10/1997
Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)	0.021	10/1997
Wildlife Value (WV)	0.00014	10/1997
Human Cancer Values for Drinking Water Source (HCV-drink)	0.000068	7/1997
Human Cancer values for non-drinking water source (HCV-Non-drink)	0.000068	7/1997
Final Chronic Value (FCV)	0.005	6/1997
Aquatic maximum value (AMV)	0.15	6/1997
Final Acute Value (FAV)	0.3	6/1997

Sources:

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

(E) Analytical Information

	Value	Source
Target Detection Limit – Soil ($\mu\text{g}/\text{kg}$)	170	MDEQ, 2015
Target Detection Limit – Water ($\mu\text{g}/\text{L}$)	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