CHEMICAL UPDATE WORKSHEET

Chemical Name:	**p-Toluidine**
CAS #:	**106-49-0**
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)	107.17	107.16	EPI	EXP
Physical State at ambient temp	Liquid	Solid	MDEQ	
Melting Point (˚C)	---	43.60	EPI	EXP
Boiling Point (˚C)	200.4	200.40	EPI	EXP
Solubility (ug/L)	7.60E+6	6500000	EPI	EXP
Vapor Pressure (mmHg at 25˚C)	NA	2.86E-01	EPI	EXP
HLC (atm-m^3/mol at 25˚C)	6.10E-6	2.02E-06	EPI	EXP
Log Kow (log P; octanol-water)	1.39	1.39	EPI	EXP
Koc (organic carbon; L/Kg)	23.3	112.7	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm^2/s)	0.08	7.12E-02	W9	EST
Diffusivity in Water (Dw; cm^2/s)	8.0E-6	8.98E-06	W9	EST
Soil Water Partition Coefficient (Kd; inorganics)	NR	NR	NA	NA

	Part 201 Value	Updated Value	Reference Source	Comments
Flash Point (˚C)	188 F	87	CRC	EXP
Lower Explosivity Level (LEL; unitless)	NA	0.011	PC	EXP
Critical Temperature (K)		667	CRC	EXP
Enthalpy of Vaporization (cal/mol)		1.06E+04	CRC	EXP
Density (g/mL, g/cm^3)		0.9619	CRC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm^2)	9.83E-06	5.37E-06	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm^2)	9.96E-06	5.37E-06	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm^2)	1.19E-05	6.79E-06	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm^2)	1.19E-05	6.79E-06	EMSOFT	EST

(B) Toxicity Values/Benchmarks

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
Reference Dose (RfD) (mg/kg/day)	--	4.0E-3	PPRTV, 2012	
RfD details		**Tier 2 Source:** **PPRTV:** **Basis:** No Tier 1 available. Per PPRTV, no chronic or subchronic p-RfD can be derived because the total composite UF for the derivation is greater than 3000. . Screening chronic provisional RfD (screening chronic p-RfD) = 4E-3 mg/kg-day. Critical Studies: • Malik-Bryś, M; Seńczuk, W. (1995a) Toxicodynamic properties of toluidines in chronic poisoning. Part I. Experiments on animals maintained on protein-rich diet. Bromatol Chem Toksykol, 28(3):67–72. (Translated by Maritza Rivas, ScienceDocs Inc.) 597310. • Malik-Bryś, M; Seńczuk, W. (1995b) Toxicodynamic properties of toluidines in chronic poisoning. Part II. Experiments on animals maintained on protein-rich diet. Bromatol Chem Toksykol, 28(3):175–178. (Translated by Maritza Rivas, Science Docs Inc.) 684245 • Malik-Bryś, M; Seńczuk, W. (1995c) Toxicodynamic properties of toluidines in chronic poisoning. Part III. The effects of the diet on the course of poisoning. Bromatol Chem Toksykol, 28(3):275–281. (Translated by Winnie Tsui, RIC International, Inc.) 673405. **Critical Effects:** Increased methemoglobin content in female rats. **POD:** LOAEL = 40 mg/kg-day **UF =** 10,000 (10 intraspecies variability; 10 for interspecies differences; 10 for lack of a two generation reproduction study or developmental study; 10 for the use of a LOAEL. **Source:** PPRTV, 11/14/2012 **Tier 1 and 2 Sources**: **IRIS:** No IRIS file available at this time.		Complete

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		MRL: No MRL record available at this time. **Tier 3 Source:** **MDEQ:** Per DEQ-CCD (date), no value at this time.		
Oral Cancer Slope Factor (CSF) (mg/kg-day)$^{-1}$)	5.6E-2	3.0E-2	PPRTV, 2012	
CSF details	In feed mouse study; 18 months duration (Weisburger et al., 1978) Journal of Environmental Pathology and Toxicology 2: 325-256. Human Health and Environmental Effects Profile for toluidines. Revised species scaling factor of (BWh/BWa) to the 0.25 power used for q* calculation. CCD/RRD date: 9/28/1999	**Tier 2 Source:** **PPRTV:** **Basis:** No Tier 1 available. PPRTV is a newer assessment than MDEQ. **PPRTV** p-CSF = 3.0E-2 (mg/kg-day) $^{-1}$. **Cancer Weight of Evidence:** Suggestive evidence of carcinogenic potential based on positive results in one animal species in one study. **Critical study:** Weisburger et al. 1978b. Testing of twenty-one environmental aromatic amines or derivatives for long-term toxicity or carcinogenicity. J Environ Pathol Toxicol 2(2):325−356. 064640. **Methods:** In a peer-reviewed study, Weisburger et al. (1978b) administered p-toluidine (≥97% purity) in the diet to 25 CD-1 mice/sex/dose group at nominal doses of 1000 or 2000 mg/kg dietary concentration for 6 months. The mice were treated an additional 12 months with lowered doses of 500- or 1000-mg/kg dietary concentration. Animals were maintained on control diets for an additional 3 months prior to study termination. The nominal time-weighted-average human equivalent doses are 15 and 30 mg/kg-day. p-OSF = BMR ÷ $BMDL_{10HED}$ = 0.1 ÷ 3.0 mg/kg-day = 3E-2 $(mg/kg\text{-}day)_{-1}$ **Critical Effects:** increased incidences of liver tumors. The incidence of liver tumors in male mice was considered the most sensitive tumor response because the modeled data produced a slightly lower BMD_{10} and $BMDL_{10}$ of 5.3 and 3.0 mg/kg-day, respectively, compared to those from female mice. **Source:** PPRTV, 11/14/2012 **Tier 1 and 2 Sources:** **IRIS:** No IRIS file available at this time.		Complete

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		MRL: NA; MRLs are for non-cancer effects only. **Tier 3 Source:** **MDEQ per CCD-RRD, 9/28/1999:** CSF = 5.6E-2 (mg/kg-day)-1 **Critical Study(ies)**: Weisburger et al., 1978) Journal of Environmental Pathology and Toxicology 2: 325-256. **Methods**: In feed mouse study; duration 18 months. **Carcinogen Weight-of-Evidence (WOE) Class**: **IRIS WOE Basis**: **Source and Date**: MDEQ-CCD/RRD, 9/28/1999**.**		
Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (µg/m³)	--	2.0E+0	MDEQ, 1988	
RfC/ITSL details		**Tier 3 Source:** **MDEQ:** **Basis:** MDEQ was the only value returned from Tier 3 search. See details below. **Tier 1 and 2 Sources:** **IRIS:** No IRIS file available at this time. **PPRTV:** Per PPRTV dated 11/14/2012, no inhalation studies were found on the subchronic, chronic, developmental, or reproductive toxicity or carcinogenicity of p-toluidine in animals. **MRL:** No MRL record available at this time. **Tier 3 Source:** **MDEQ:** Per DEQ-CCD-AQD, the ITSL of 2.0 (annual averaging) is based on an oral rat LD50 of 655 mg/kg as reported by Apostolou and Peoples (1971). AQD calculation date of 3/2/1988. **Other Tier 3:** No value is available at this time from these Tier 3 sources/databases: HEAST, NTP ROC, health and environmental agencies of		Complete

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		California, Massachusetts, Minnesota, New Jersey, New York, and Texas, WHO (IARC), WHO (IPCS/INCHEM), Canada, The Netherlands (RIVM), OECD HPV, and ECHA (REACH).		
Inhalation Unit Risk Factor (IURF) ((µg/m^3)$^{-1}$)	3.1E-5	3.1E-5	MDEQ, 1988	
IURF details	Potency based on Weisburger et al (1978). A feeding study with TWA dose of 0, 666 or 1333 ppm causing increased male mice hepatomas. CCD/AQD date: 3/2/1988.	**Tier 3 Source:** **MDEQ:** **Basis:** MDEQ was the only value returned from Tier 3 search. See details below. **Tier 1 and 2 Sources:** **IRIS:** No IRIS file available at this time. **PPRTV:** Per PPRTV dated 11/14/2012, no inhalation studies were found on the subchronic, chronic, developmental, or reproductive toxicity or carcinogenicity of p-toluidine in animals. **MRL:** NA; MRLs are for noncancerous effects only. **Tier 3 Sources:** **MDEQ-AQD:** IUR of 3.1E-5 (mg/kg-day)$^{-1}$. 3/2/1988 AQD calculation date. **Critical Study**: Weisburger et al., 1978. Journal of Environmental Pathology and Toxicology 2: 325-256. **Methods**: A feeding study with TWA dose of 0, 666, or 1333 ppm causing increased hepatomas in male mice. **Cancer Weight of Evidence:** Suggestive evidence of carcinogenic potential based on positive results in one animal species in one study. **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, New York, and Texas, WHO (IARC), WHO (IPCS/INCHEM), Canada, The Netherlands (RIVM), OECD HPV, and ECHA (REACH).		Complete
Mutagenic Mode of Action	--	NO	USEPA, 2015	

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
(MMOA)? (Y/N)				
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 RfD or RfC/ITSL is not based on a reproductive-developmental effect.	MDEQ, 2015	
Developmental or Reproductive Toxicity Details	NA	NA		
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, 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	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, 2004	
ABSgi details		RAGS E (USEPA, 2004) Default Value		
Skin absorption efficiency value (AEd)	---	0.1	MDEQ, 2015	
AEd details				
Ingestion Absorption Efficiency (AEi)		1.0	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)	660	MDEQ, 2015
Target Detection Limit – Water (μg/L)	10	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