



CHEMICAL UPDATE WORKSHEET

Chemical Name:	Triethanolamine
CAS #:	102-71-6
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)	149.19	149.19	EPI	EXP
Physical State at ambient temp	Liquid	Liquid	MDEQ	
Melting Point (°C)	---	20.50	EPI	EXP
Boiling Point (°C)	335.4	335.40	EPI	EXP
Solubility (ug/L)	1.0E+9	1000000000	EPI	EXP
Vapor Pressure (mmHg at 25°C)	0.00000359	3.59E-06	EPI	EXP
HLC (atm-m ³ /mol at 25°C)	3.38E-19	7.05E-13	PP	EST
Log Kow (log P; octanol-water)	-1.38	-1.00	EPI	EXP
Koc (organic carbon; L/Kg)	0.044	10	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm ² /s)	0.08	5.14E-02	W9	EST
Diffusivity in Water (Dw; cm ² /s)	8.0E-6	8.08E-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	179	CRC	EXP
Lower Explosivity Level (LEL; unitless)	NA	0.01	CRC	EXP
Critical Temperature (K)		787.45	HSDB	EXP
Enthalpy of Vaporization (cal/mol)		1.61E+04	HSDB	EXP
Density (g/mL, g/cm ³)		1.1242	CRC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm ²)	NA	1.66E-08	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm ²)	NA	1.66E-08	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm ²)	NA	1.67E-08	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm ²)	NA	1.67E-08	EMSOFT	EST

(B) Toxicity Values/Benchmarks

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
Reference Dose (RfD) (mg/kg/day)	5.0E-1	5.0E-1	MDEQ, 1994	
RfD details	RfD based on 104-week drinking water study in F344 rats; LOAEL = 10,000 ppm, UF = 1000; Critical effects = nephropathy & increased kidney weight (Maekawa et al., 1986). CCD/RRD date: 5/03/1994.	<p>Tier 3 Source: MDEQ: Basis: MDEQ value based on a 104-week exposure via drinking water study and a UF of 1,000. Texas used a secondary source and UF of 3,000. The ECHA (REACH) did not provide adequate details on the source of the subchronic study and used minimal UF. See details below.</p> <p>Tier 1 and 2 Sources: IRIS: No IRIS file available at this time PPRTV: No PPRTV record available at this time. MRL: No MRL record available at this time.</p> <p>Tier 3 Sources: Critical Study (ies): Maekawa A et al. (1986) Lack of carcinogenicity of triethanolamine of F344 rats. J Toxicol Environ Health. 19: 345-357. Method(s): 104-week drinking water study in F344 rats; Concentrations at 0, 1% and 2%. Critical effect: nephropathy & increased kidney weight End point or Point of Departure (POD): LOAEL = 10,000 ppm Uncertainty Factors: UF = 1,000 (10 each for interspecies variability, interspecies extrapolation and use of a LOAEL) Source and date: MDQ-CCD/RRD, 5/03/1994.</p> <p>Texas CEQ: RfD= 2.0E-01 mg/kg/day: Key studies: Knaak JB, Leung HW, Stott WT, Busch J, and Bilsky J. 1997. Toxicology of mono-, di-, and triethanolamine. Rev Environ Contam Toxicol149:1-86. Basis: Chronic administration (2 yr.) of TEA in drinking water (0, 1%, or 2% w/v; 525 and 1100 mg kg-1 d-1 in males and 910 and 1970 mg kg-1 d-1 in females) depressed body and kidney weights in F-344 rats. Histopathological findings</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>consisted of an "acceleration of so-called chronic nephropathy" commonly found in the kidneys of aging F-344 rats.</p> <p>In B6C3F1 mice, chronic administration of TEA in drinking water (0, 1%, or 2%) produced no significant change in terminal body weights between treated and control animals or gross pathological changes</p> <p>LOAEL: 525 mg/kg-day</p> <p>Uncertainty Factors: 10 - Use of a LOAEL 10 - Interspecies Extrapolation 10 - Interspecies Extrapolation 3 - Database Uncertainties</p> <p>Source: TCEQ Assessment dated 1/16/2001 (In TCEQ Communication, 2015)</p> <p>ECHA (REACH): Derived No Effect Level (DNEL) = 13 mg/kg bw/day: Key study: "Other company data", 1989 Methods: Cox CD rats (20/sex/dose) were exposed to 0; 250; 500; 1000 mg/kg bw triethanolamine orally (in diet) for 91 days. Dose descriptor starting point (after route to route extrapolation): NOAEL – 1,000 mg/kg Critical effect: No significant effect at highest dose tested Overall assessment factor (AF): 80 (justifications are not specified) Source: ECHA REACH Dossier for Triethanolamine (accessed on 9/15/15)</p> <p>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 and New York, WHO (IARC), WHO (IPCS/INCHEM), Canada, The Netherlands (RIVM) and OECD HPV.</p>		
Oral Cancer Slope Factor (CSF) (mg/kg-day)⁻¹	--	NA	MDEQ, 2015	
CSF details	NA	<p>Tier 1 and 2 Sources:</p> <p>IRIS: No IRIS file available at this time</p> <p>PPRTV: No PPRTV record available at this time.</p> <p>MRL: NA; MRLs are for non-cancer effects only.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		Tier 3 Source: MDEQ: Per DEQ-CCD, no value at this time.		
Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) ($\mu\text{g}/\text{m}^3$)	5.0E+1	4.7E+0	ECHA, 2008 /MDEQ, 2015	
RfC/ITSL details	This compound was originally an interim chemical with an ITSL of 50 $\mu\text{g}/\text{m}^3$ (8 hr. averg). It has been finalized with the same value and averaging time. This value was derived from an ACGIH TLV of 5 mg/m^3 based on minimizing the potential for skin and eye irritation. Although there is some evidence this compound is weakly carcinogenic from oral exposures, there has been no	<p>Tier 3 Source: ECHA (REACH): Basis: ECHA derived a value using a NOAEC from a 28-day inhalation study (Gamer et al, 2008). MDEQ used the Gamer study to derive an RfC. According to the study authors, the NOAEC for a 90-day no adverse effect concentration" (NOAEC) for changes due to TEA exposure in the respiratory tract is $4.7\text{mg}/\text{m}^3$. Uncertainty factor of 1000 (10 for interspecies extrapolation, 10 for interspecies variability and 10 for use of a sub chronic study) is applied to the NOAEC to derive a RfC = $4.7\text{E}-3 \text{ mg}/\text{m}^3$ or $4.7\text{E}+0 \mu\text{g}/\text{m}^3$. MDEQ AQD (1997) derived a value based on a ACGIH TLV value. See details below.</p> <p>Tier 1 and 2 Sources: IRIS: No IRIS file available at this time PPRTV: No PPRTV record available at this time. MRL: No MRL record available at this time.</p> <p>Tier 3 Sources: MDEQ: AQD Basis: Per AQD, the ACGIH recommends a Threshold Limit Value TL V of 5 mg/m^3 for triethanolamine to minimize the potential for skin and eye irritation, and acute and chronic effects. This value was originally used to set an interim ITSL of 50 $\mu\text{g}/\text{m}^3$. Because none of the reviewed literature supported the derivation of an RfC(D), the interim value will be used again and become the final ITSL. The ITSL value was derived from an ACGIH TLV of 5.0 mg/m^3 based on minimizing the</p>	Complete	



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
	<p>evidence of carcinogenicity from inhalation exposure. CCD/AQD date: 8/11/1997</p>	<p>potential for skin and eye irritation. Averaging time = 8h. Calculation: 5 mg/m³ / 100 = 0.05 mg/m³ or 50 µg/m³ The ITSL for triethanolamine =50 J.lg/m3 based on 8-hour averaging. Source and date: MDEQ-CCD/AQD, 8/11/1997</p> <p>ECHA (REACH): Derived No Effect Level (DNEL) = 1.25 mg/m³ or 1.2E+3 µg/m³: <u>Key study:</u> Gamer AO1, Rossbacher R, Kaufmann W, van Ravenzwaay B. 2008. The inhalation toxicity of di- and triethanolamine upon repeated exposure. Food and Chemical Toxicology, 46(6), 2173-2183. <u>Methods and Findings:</u> Systemic and respiratory tract (RT) toxicity of triethanolamine (TEA) was assessed in a 28-day nose-only inhalation study in Wistar rats (10animals/sex, concentrations: 0, 20, 100, 500mg/m³; 5 days/week, 6h/day). In two nose-only 90-day inhalation studies, with similar exposure design, Wistar rats were exposed to 0, 15, 150, 400mg/m³ diethanolamine (DEA) (DEA Study 1: 13animals/sex, general sub chronic study) and to 0, 1.5, 3, 8mg/m³ (DEA Study 2: 10animals/sex) to specifically investigate respiratory tract toxicity. <u>Critical effect:</u> irritation of the upper respiratory tract, minimal to moderate focal inflammatory change in the submucosa of the larynx TEA appears to be less potent with respect to systemic toxicity and RT irritancy than DEA. <u>Point of Departure (POD):</u> The 90-day no adverse effect concentration" (NOAEC) for changes due to TEA exposure in the respiratory tract was 4.7mg/m³ derived by extrapolation from the NOAEC of the 28 day study. The dose descriptor starting point (after route to route extrapolation): NOAEC – 0.2 mg/L air Assessment Factors or UFs: None Source: ECHA REACH Dossier for Triethanolamine (accessed on 9/15/15)</p> <p>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) and OECD HPV.</p>		

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
Inhalation Unit Risk Factor (IURF) (($\mu\text{g}/\text{m}^3$) ⁻¹)	--	NA	MDEQ, 2015	
IURF details	NA	Tier 1 and 2 Sources: IRIS: No IRIS file available 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, no value at this time.		Complete
Mutagenic Mode of Action (MMOA)? (Y/N)	--	NO	USEPA, 2015	
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 is not based on a reproductive-developmental effect.	MDEQ, 2014	
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	

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
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 (USEPA, 2004) Default Value		
Skin absorption efficiency value (A _{Ed})	---	0.1	MDEQ, 2015	
A _{Ed} details				
Ingestion Absorption Efficiency (A _{Ei})		1.0	MDEQ, 2015	
A _{Ei} 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) Analytical Information

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

