



## CHEMICAL UPDATE WORKSHEET

<b>Chemical Name:</b>	Triethylene glycol (DD)
<b>CAS #:</b>	112-27-6
<b>Revised By:</b>	RRD Toxicology Unit
<b>Revision Date:</b>	September 16, 2015

### (A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	150.17	150.18	EPI	EXP
Physical State at ambient temp	Liquid	Liquid	MDEQ	
Melting Point (°C)	-7	-7.00	EPI	EXP
Boiling Point (°C)	545	285.00	EPI	EXP
Solubility (ug/L)	1.00E+6	1000000000	EPI	EXP
Vapor Pressure (mmHg at 25°C)	1.32E-3	1.32E-03	EPI	EXP
HLC (atm-m <sup>3</sup> /mol at 25°C)	2.61E-10	3.16E-11	PP	EST
Log Kow (log P; octanol-water)	-1.69	-1.75	EPI	EXP
Koc (organic carbon; L/Kg)	0.0218	10	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm <sup>2</sup> /s)	0.0427	5.09E-02	W9	EST
Diffusivity in Water (Dw; cm <sup>2</sup> /s)	8.06E-6	8.06E-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	177	CRC	EXP
Lower Explosivity Level (LEL; unitless)	NA	0.009	CRC	EXP
Critical Temperature (K)		775	CRC	EXP
Enthalpy of Vaporization (cal/mol)		1.71E+04	CRC	EXP
Density (g/mL, g/cm <sup>3</sup> )		1.1274	CRC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm <sup>2</sup> )	NA	9.90E-08	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm <sup>2</sup> )	NA	9.90E-08	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm <sup>2</sup> )	NA	1.01E-07	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm <sup>2</sup> )	NA	1.01E-07	EMSOFT	EST

**(B) Toxicity Values/Benchmarks**

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
<b>Reference Dose (RfD) (mg/kg/day)</b>	5.9E-1	5.9E+0	MDEQ, 2016	
<b>RfD details</b>	RfD based on 98-day continuous breeding reproductive study using Swiss CD-1 mice (NTP 1984). Mice were administered 0, 0.3, 1.5, or 3% TEG in drinking water. NOAEL of 0.3% triethylene glycol (0.59 g/kg/d). CRITICAL EFFECT: decrease in mean live pup weight at birth with exposure to 1.5 or 3% TEG (3.30 and 6.78 g/kg/d respectively). UF = 1000 (10 each for inter and intra-species and an additional 10 for a less than chronic study). CCD/RRD date: 7/29/1999.	<p><b>Tier 3 Source:</b>  <b>MDEQ:</b>  <b>Basis:</b> MDEQ (1999) value based on NTP (1984) reproductive study. Original DEQ RfD = 5.9E-1 mg/kg. 10-fold UF for the use of a subchronic study was removed resulting in a new RfD of 5.9E+0. Texas (2002) RfD is based on a secondary source. See details below.</p> <p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> No IRIS file is available at this time.  <b>EPA-OPP:</b> OPP (12/2013) concluded that based on the RED documents (Propylene Glycol and Dipropylene Glycol RED (9/2006) and Triethylene Glycol RED (9/2003)), propylene glycol, dipropylene glycol, and triethylene glycol poses no toxicological concerns due to their low toxicity; therefore, no toxicological endpoints of concern were developed. OPP also concluded that for registration review these chemicals pose no toxicological concerns when used according to pesticide labeled uses as no significant toxicity was observed in any of the animal toxicity studies in the existing toxicological database for registration review.  <b>Appendix A Toxicity Profile:</b> In this appendix, OPP reported that the effect of triethylene glycol on reproduction in Swiss CD-1 mice was examined. Doses of 0, 0.3, 1.5, and 3% were administered in drinking water using a continuous breeding protocol. No effects on reproductive function were observed at any dose level tested (up to the high dose of 6.78 g/kg) including sperm concentration, morphology, and motility. Reduced pup weight was observed at the 1.5 and 3% doses of triethylene glycol (Bossert, 1992; Lamb, 1997).  <b>Source and date:</b> EPA-HQ-OPP-2013-0218 and 0219. Propylene Glycol, Dipropylene Glycol and Triethylene Glycol Final Work Plan. Registration Review: Initial Docket, 12/2013; TRIETHYLENE GLYCOL: Revised Toxicology Chapter in Support of Issuance of the Reregistration Eligibility Decision (RED) Document. PC Code: 083501 Reregistration Case Number: 3145. CAS Registry Number: 112-27-6.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		<p>DP#: 325786, 10/11/2005</p> <p><b>PPRTV:</b> No PPRTV record is available at this time.  <b>MRL:</b> No MRL record is available at this time.</p> <p><b>Tier 3 Sources:</b>  <b>MDEQ:</b> CCD/RRD (1999) RfD = 5.9E-1 mg/kg-day.  <b>Critical Study:</b> NTP. 1984. Triethylene Glycol: Reproduction and fertility assessment in CD-1 mice when administered in the drinking water.  <b>Methods:</b> 98-day continuous breeding reproductive study using Swiss CD-1 mice exposed to 0, 0.3, 1.5, or 3% triethylene glycol in drinking water.  <b>Critical effect:</b> decreased mean live pup weight at birth  <b>End point or Point of Departure (POD):</b> NOAEL = 0.3% triethylene glycol (0.59 g/kg-day)  <b>Uncertainty Factors:</b> UF = 1000 (10 each for intraspecies variability, interspecies extrapolation and use of a less than chronic study). UF reduced to 100 by removing the 10-fold factor for use of a sub chronic study. Additional UF of 10 for use of a sub chronic study not necessary since the effect is developmental and full-term pregnant female and a child are the receptors.  <b>Additional info:</b> OPP (2005) reported that published literature (Bossert, N.L., et al. (1992) Reproductive Toxicity of Triethylene Glycol and its Diacetate and Dimethyl ether Derivatives in a Continuous Breeding Protocol in Swiss CD-1 mice. Fund. Appl. Pharmacol. 18: 602-608; and Lamb, I.V. et al. (1997) Triethylene Glycol. Environ. Health Perspectives, 105(Suppl 1): 235-236; also available as an NTP Report No. PB85-137073) examined the effect of triethylene glycol on reproduction in Swiss CD-1 mice. Doses of 0, 0.3, 1.5, and 3% were administered in drinking water using a continuous breeding protocol. No effects on reproductive function were observed at any dose level tested (up to the high dose of 6.78 g/kg) including sperm concentration, morphology, and motility. Reduced pup weight was observed at the 1.5 and 3% doses of triethylene glycol. OPP indicated that the available developmental and reproductive studies conducted with triethylene glycol are from published sources or from studies</p>		

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>submitted to the Office of Toxic Substances and do not report all the data that are normally reported under the OPPTS 870 toxicity test guidelines. Per OPP, it is apparent that the toxicities observed in these studies are consistently manifested only at doses of triethylene glycol that exceed the established limit doses for animal studies and are of a non-specific nature. OPP concluded that there is no concern for the developmental or reproductive toxicity of triethylene glycol.  <b>Source and date:</b> MDEQ-CCD/RRD, 7/29/1999</p> <p><b>Texas CEQ:</b> RfD= 3.0E+00 mg/kg/day.                      Justification:                      Key Study: In HSDB "... conc of 1.0, 2.0, &amp; 4.0% in diet of rats for 2 yr. without producing adverse effects. These dosage levels are equiv to as much as 3-4 g/kg/day without effect. ... rats could tolerate 3% in their drinking water for 30 days without effect, but 5% caused ill effects. ... equiv to about 5 &amp; 8 g/kg/day. Clayton, G. D. and F. E. Clayton (eds.). Patty's Industrial Hygiene and Toxicology: Volume 2A, 2B, 2C: Toxicology. 3rd ed. New York: John Wiley Sons, 1981-1982. 3840                      NOAEL: 3000 mg/kg-day                      Uncertainty Factors: 1000 (Inter- and intra-species extrapolation, and database uncertainties)                      Source: TCEQ, 11/14/2002 (in TCEQ Communication, 2015)</p> <p><b>OTHERS:</b> 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, Canada, The Netherlands (RIVM), WHO (IARC), WHO (IPCS/INCHEM), OECD HPV, and ECHA (REACH).</p>		
<b>Oral Cancer Slope Factor (CSF) (mg/kg-day)<sup>-1</sup></b>	--	NA	MDEQ, 2015	
<b>CSF details</b>	NA	<p><b>Carcinogen Weight-of-Evidence (WOE) Class and Basis:</b>                      Published literature sources examining the chronic toxicity and carcinogenic potential of triethylene glycol have shown the chemical to be non-toxic/negative in rodent species. Triethylene glycol administered in feed at levels of 0, 1, 2 or 4%</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>to Osborn-Mendel rats for 2 years showed that the body weight gains, hematological parameters and clinical chemistries were not affected by treatment. Under the conditions of this study, triethylene glycol was not carcinogenic in rats.</p> <p>Triethylene glycol was found to be negative for mutagenic or genotoxic potential in a battery of studies: a bacterial gene mutation assay using Salmonella typhimurium, an in vitro Chinese hamster ovary (CHO) mutation assay, an in vitro Chinese hamster ovary (CHO) chromosomal aberration assay and an in vitro sister chromatid exchange assay.</p> <p><b>Source and Date:</b> EPA-HQ-OPP-2013-0218 and 0219. Propylene Glycol, Dipropylene Glycol and Triethylene Glycol Final Work Plan. Registration Review: Initial Docket, 12/2013; TRIETHYLENE GLYCOL: Revised Toxicology Chapter in Support of Issuance of the Reregistration Eligibility Decision (RED) Document. PC Code: 083501 Reregistration Case Number: 3145. CAS Registry Number: 112-27-6. DP#: 325786, 10/11/2005</p> <p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> No IRIS file is available at this time.  <b>PPRTV:</b> No PPRTV record 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 value at this time.</p>		
Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (µg/m³)	--	NA	MDEQ, 2015	
RfC/ITSL details	NA	<p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> No IRIS file is available at this time.  <b>PPRTV:</b> No PPRTV record is available at this time.  <b>MRL:</b> No MRL record is available at this time.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<b>Tier 3 Source:</b> <b>MDEQ:</b> Per DEQ-CCD, no value at this time.		
<b>Inhalation Unit Risk Factor (IURF) ((<math>\mu\text{g}/\text{m}^3</math>)<sup>-1</sup>)</b>	--	NA	MDEQ, 2015	
<b>IURF details</b>	NA	<p><b>Carcinogen Weight-of-Evidence (WOE) Class and Basis:</b>                      Published literature sources examining the chronic toxicity and carcinogenic potential of triethylene glycol have shown the chemical to be non-toxic/negative in rodent species. Triethylene glycol administered in feed at levels of 0, 1, 2 or 4% to Osborn-Mendel rats for 2 years showed that the body weight gains, hematological parameters and clinical chemistries were not affected by treatment. Under the conditions of this study, triethylene glycol was not carcinogenic in rats.</p> <p>Triethylene glycol was found to be negative for mutagenic or genotoxic potential in a battery of studies: a bacterial gene mutation assay using Salmonella typhimurium, an in vitro Chinese hamster ovary (CHO) mutation assay, an in vitro Chinese hamster ovary (CHO) chromosomal aberration assay and an in vitro sister chromatid exchange assay.</p> <p><b>Source and Date:</b> EPA-HQ-OPP-2013-0218 and 0219. Propylene Glycol, Dipropylene Glycol and Triethylene Glycol Final Work Plan. Registration Review: Initial Docket, 12/2013; TRIETHYLENE GLYCOL: Revised Toxicology Chapter in Support of Issuance of the Reregistration Eligibility Decision (RED) Document. PC Code: 083501 Reregistration Case Number: 3145. CAS Registry Number: 112-27-6. DP#: 325786, 10/11/2005</p> <p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> No IRIS file is available at this time.  <b>PPRTV:</b> No PPRTV record 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 value at this time.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
<b>Mutagenic Mode of Action (MMOA)? (Y/N)</b>	--	NO	USEPA, 2015	
<b>MMOA Details</b>	--	NA Not listed as a carcinogen with mutagenic MOA in the USEPA OSWER List.		
<b>Developmental or Reproductive Effector? (Y/N)</b>	Yes	YES-oral, the RfD is based on a reproductive-developmental effect. Oral Exposure Pathways- Full Term Exposure	MDEQ, 2015	
<b>Developmental or Reproductive Toxicity Details</b>	--	<b>Reproductive effect:</b> decrease in mean live pup weight at birth <b>Critical Study:</b> NTP 1984 <b>Methods:</b> 98-day continuous breeding reproductive study using Swiss CD-1 mice exposed to 0, 0.3, 1.5, or 3% triethylene glycol in drinking water.		
<b>State Drinking Water Standard (SDWS) (ug/L)</b>	--	NO	SDWA, 1976	
<b>SDWS details</b>	NA	MI Safe Drinking Water Act (SDWA) 1976 PA 399		
<b>Secondary Maximum Contaminant Level (SMCL) (ug/L)</b>	--	NO	SDWA, 1976 and USEPA SMCL List	
<b>SMCL details</b>	NA	MI Safe Drinking Water Act (SDWA) 1976 PA 399 and USEPA SMCL List, 2015		
<b>Is there an aesthetic value for drinking water? (Y/N)</b>	NO	Not evaluated.	NA	
<b>Aesthetic value (ug/L)</b>	NA	NA	NA	
<b>Aesthetic Value details</b>	NA	NA		
<b>Phytotoxicity Value? (Y/N)</b>	NO	Not evaluated.	NA	
<b>Phytotoxicity details</b>	NA	NA	NA	

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
Others				

**(C) Chemical-specific Exposure 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> )	---	0.1	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>	NA
<b>Updated GSI value (µg/L)</b>	NA
<b>Rule 57 Drinking Water Value (µg/L)</b>	NA

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

Sources:

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



**(E) Analytical Information**

	<b>Value</b>	<b>Source</b>
<b>Target Detection Limit – Soil (<math>\mu\text{g}/\text{kg}</math>)</b>	50,000	MDEQ, 2015
<b>Target Detection Limit – Water (<math>\mu\text{g}/\text{L}</math>)</b>	4,000	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
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**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