



## CHEMICAL UPDATE WORKSHEET

<b>Chemical Name:</b>	<b>Sulfate</b>
<b>CAS #:</b>	<b>14808-79-8</b>
<b>Revised By:</b>	RRD Toxicology Unit
<b>Revision Date:</b>	August 19, 2015

### (A) Chemical-Physical Properties

	<b>Part 201 Value</b>	<b>Updated Value</b>	<b>Reference Source</b>	<b>Comments</b>
<b>Molecular Weight (g/mol)</b>	96.066	96.0626	Pub Chem	EXP
<b>Physical State at ambient temp</b>	Inorganic	Inorganic	MDEQ	
<b>Melting Point (°C)</b>	---	NA	NA	
<b>Boiling Point (°C)</b>	---	NA	NA	
<b>Solubility (ug/L)</b>	NA	NA	NA	NA
<b>Vapor Pressure (mmHg at 25°C)</b>	NA	NR	NA	NA
<b>HLC (atm-m<sup>3</sup>/mol at 25°C)</b>	NR	NR	NA	NA
<b>Log Kow (log P; octanol-water)</b>	NR	NR	NA	NA
<b>Koc (organic carbon; L/Kg)</b>	NR	NR	NA	NA
<b>Ionizing Koc (L/kg)</b>		NR	NA	NA
<b>Diffusivity in Air (Di; cm<sup>2</sup>/s)</b>	0.08	NR	NA	NA
<b>Diffusivity in Water (Dw; cm<sup>2</sup>/s)</b>	8.0E-6	NR	NA	NA
<b>Soil Water Partition Coefficient (Kd; inorganics)</b>	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)		NR	NA	NA
Enthalpy of Vaporization (cal/mol)		NR	NA	NA
Density (g/mL, g/cm <sup>3</sup> )		NR	NA	NA
EMSOFT Flux Residential 2 m (mg/day/cm <sup>2</sup> )	NA	NR	NR	NA
EMSOFT Flux Residential 5 m (mg/day/cm <sup>2</sup> )	NA	NR	NR	NA
EMSOFT Flux Nonresidential 2 m (mg/day/cm <sup>2</sup> )	NA	NR	NR	NA
EMSOFT Flux Nonresidential 5 m (mg/day/cm <sup>2</sup> )	NA	NR	NR	NA

**(B) Toxicity Values/Benchmarks**

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
<b>Reference Dose (RfD) (mg/kg/day)</b>	--	NA	MDEQ, 2015	
<b>RfD details</b>	<p>Available studies do not report an effect level, however, high dose of 5,000 mg/l from a developmental study by Andres and Cline (J. Anim. Sci.,1989) was used to generate RfD = 39 mg/kg. Resulting drinking water criterion demonstrates that aesthetic criterion of 250 ppm (mg/L) is also protective of health effects. Diarrhea occurring at high concentrations of sulfate in drinking water also should not occur at aesthetic criterion. CF (EPA in process of</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> No MRL record is available at this time.</p> <p><b>Tier 3 Source:</b>  <b>MDEQ:</b> Per DEQ-CCD, no value at this time. See Part 201 Value RfD details.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
	determining if sulfate should be regulated as NPDWR). CCD/RRD date: 2/15/2000.			
<b>Oral Cancer Slope Factor (CSF) (mg/kg-day)<sup>-1</sup></b>	--	NA	MDEQ, 2015	
<b>CSF details</b>	NA	<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.  <b>Tier 3 Source:</b> <b>MDEQ:</b> Per DEQ-CCD, no value at this time. See Part 201 Value RfD details.		Complete
<b>Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (µg/m<sup>3</sup>)</b>	--	NA	MDEQ, 2015	
<b>RfC/ITSL details</b>	NA	<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.  <b>Tier 3 Source:</b> <b>MDEQ:</b> Per DEQ-CCD, no value at this time. See Part 201 Value RfD details.		Complete
<b>Inhalation Unit Risk Factor (IURF) ((µg/m<sup>3</sup>)<sup>-1</sup>)</b>	--	NA	MDEQ, 2015	



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
<b>IURF details</b>	NA	<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.  <b>Tier 3 Source:</b> <b>MDEQ:</b> Per DEQ-CCD, no value at this time. See Part 201 Value RfD details.		Complete
<b>Mutagenic Mode of Action (MMOA)? (Y/N)</b>	--	NO	USEPA, 2015	
<b>MMOA Details</b>	--	Not listed as a carcinogen with mutagenic MOA in the USEPA OSWER List.		
<b>Developmental or Reproductive Effector? (Y/N)</b>	No	NA	MDEQ, 2015	
<b>Developmental or Reproductive Toxicity Details</b>	NA	NA		
<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>	2.5E+5	2.5E+5	USEPA SMCL list	
<b>SMCL details</b>	EPA SMCL list	USEPA SMCL list. The SMCL is based on taste.		
<b>Is there an aesthetic value for drinking water? (Y/N)</b>	NO	Not evaluated.	NA	
<b>Aesthetic value (ug/L)</b>	2.5E+5	2.5E+5	USEPA SMCL list	

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
<b>Aesthetic Value details</b>		USEPA SMCL list		
<b>Phytotoxicity Value? (Y/N)</b>	NO	Not evaluated.	NA	
<b>Phytotoxicity details</b>	NA	NA	NA	
<b>Others</b>				

**(C) Chemical-specific Absorption 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> )		0.5	MDEQ, 2015	
AE <sub>i</sub> Details				
Relative Source Contribution for Water (RSC <sub>w</sub> )		NA	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>	(EE)
<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) Target Detection Limits (TDL)**

	<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>	1,000	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

**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

