



CHEMICAL UPDATE WORKSHEET

Chemical Name:	Methanol (DD)
CAS #:	67-56-1
Revised By:	RRD Toxicology Unit
Revision Date:	August 21, 2015

(A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	32.05	32.04	EPI	EXP
Physical State at ambient temp	Liquid	Liquid	MDEQ	
Melting Point (°C)	175	-97.60	EPI	EXP
Boiling Point (°C)	64.6	64.70	EPI	EXP
Solubility (ug/L)	2.90E+7	1000000000	EPI	EXP
Vapor Pressure (mmHg at 25°C)	121.6	1.27E+02	EPI	EXP
HLC (atm-m³/mol at 25°C)	1.70E-4	4.55E-06	EPI	EXP
Log Kow (log P; octanol-water)	-0.72	-0.77	EPI	EXP
Koc (organic carbon; L/Kg)	0.196	1	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm²/s)	0.15	1.58E-01	W9	EST
Diffusivity in Water (Dw; cm²/s)	1.3E-5	1.65E-05	W9	EST
Soil Water Partition Coefficient (Kd; inorganics)	NR	NR	NA	NA

	Part 201 Value	Updated Value	Reference Source	Comments
Flash Point (°C)	52 F	11	CRC	EXP
Lower Explosivity Level (LEL; unitless)	0.06	0.06	CRC	EXP
Critical Temperature (K)		512.7	CRC	EXP
Enthalpy of Vaporization (cal/mol)		8.42E+03	CRC	EXP
Density (g/mL, g/cm ³)		0.7914	CRC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm ²)	2.52E-05	1.97E-05	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm ²)	5.51E-05	2.75E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm ²)	3.54E-05	2.84E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm ²)	7.51E-05	3.54E-05	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	2.0E+0	IRIS, 2013	
RfD details	No conversion. Rat oral subchronic study. LOAEL = 2,500 mg/kg. Critical effects = increase in ed SAP, SGPT & brain weight. NOAEL = 500 mg/kg (US EPA, 1986). UF = 1000.	<p>Tier 1 Source: IRIS: Basis: IRIS is a Tier 1 source and a recent assessment. Critical Study: Rogers, JM; Mole, ML; Chernoff, N; Barbee, BD; Turner, CI; Logsdon, TR; Kavlock, RJ. (1993b). The developmental toxicity of inhaled methanol in the CD-1 mouse, with quantitative dose-response modeling for estimation of benchmark doses. <i>Teratology</i> 47: 175-188. Methods: EPA derived an RfD by using exposure response data from candidate principal inhalation studies of mice and rats (NEDO, 1987) and route-to-route extrapolation with the aid of the EPA physiologically based pharmacokinetic (PBPK) model. The decision to use inhalation rather than oral study data is due to limitations in the database of oral studies, including the limited reporting of noncancer findings in the subchronic and chronic oral studies of rats, the determination that developmental effects are the most sensitive effects of methanol exposure, and the high-dose levels used in the rodent oral developmental studies. --Rogers et al. (1993b) evaluated development toxicity in pregnant female CD-1 mice exposed to air or 1,000, 2,000, 5,000, 7,500, 10,000, or 15,000 ppm (0, 1,310, 2,620, 6,552, 9,894, 13,104, and 19,656 mg/m³) methanol vapors (≥99.9% purity) in a chamber for 7 hours/day on GD6-GD15. There were no methanol-related reductions in maternal body weight gain or overt signs of toxicity. Dams were sacrificed on GD17 for a comparison of developmental toxicity in methanol-treated groups versus the chamber air-exposed control group. Fetuses in all exposure groups were weighed, assessed for viability, and examined for external malformations. Fetuses in the control, 1,000, 2,000, 5,000, and 15,000 ppm groups were also examined for skeletal and visceral defects. Critical Effect: cervical rib anomalies in fetal CD-1 mice (extra ribs) and decreased brain weight in male Sprague-Dawley rats from exposure throughout gestation and lactation</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>End Point or Point of Departure (POD): BMDL₀₅(internal) = 43.1 mg/L. The RfD is the oral dose predicted to yield a methanol blood concentration equal to an RfD_{internal} of 0.43 mg/L, which is derived from the Point of Departure adjusted by the 100-fold uncertainty factor</p> <p>Uncertainty Factors: UF = 100; 10 for variation in sensitivity within the human population; 3 for extrapolation from animals to humans; 3 to account for deficiencies in the toxicity database. 10 X 3 X 3 = 100 (rounded).</p> <p>Source and date: IRIS, 09/30/2013.</p> <p>Tier 2 Sources: PPRTV: No PPRTV record available at this time. MRL: No MRL record available at this time.</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD/WRD, RfD = 0.5 mg/kg/day 10/23/1998. DEQ-CCD/RRD RfD is also 0.5 mg/kg/day (01/20/1988).</p>		
Oral Cancer Slope Factor (CSF) (mg/kg-day) ⁻¹	--	NA	MDEQ, 2015	
CSF details	--	<p>Tier 1 and 2 Sources: IRIS: Per IRIS (9/30/2013) no value available at this time. PPRTV: No PPRTV record available at this time. MRL: NA; MRLs are for non-cancer effects only.</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD, no value at this time.</p>		Complete
Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (µg/m ³)	3.25E+3	2.0E+4	IRIS, 2013	
RfC/ITSL details	The ITSL is based	Tier 1 Source:		



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
	<p>on short term TLV/REL of 250 ppm. It is inappropriate to use oral data or animal data (due to differences in metabolism) for calc of ITSL. 1 hr. averaging time. FINAL. AQD calculation date: 8/3/92. 11/21/2011 (CF)</p>	<p>IRIS: Basis: IRIS is a Tier 1 source. Critical Study: NEDO (New Energy Development Organization). (1987). Toxicological research of methanol as a fuel for power station: summary report on tests with monkeys, rats and mice. Tokyo, Japan. Method: NEDO (1987) evaluated the effects of pre- and postnatal methanol (reagent grade) exposure (20 hours/day) on reproductive and other organ systems of Sprague-Dawley rats. In a two-generation study, F0 generation rats (30 males and 30 females per exposure group) were exposed to 0, 10, 100, and 1,000 ppm (0, 13.1, 131, and 1,310 mg/m³) from 8 weeks old to the end of mating (males) or to the end of lactation period (females). The F1 generation was exposed to the same concentrations from birth to the end of mating (males) or to weaning of F2 pups 21 days after delivery (females). Males and females of the F2 generation were exposed from birth to 21 days old (one animal/sex/litter was exposed to 8 weeks of age). NEDO (1987) noted reduced brain, pituitary, and thymus weights, and early testicular descent in the offspring of F0 and F1 rats exposed to 1,000 ppm methanol. To confirm the possible compound-related effect of methanol on the brain, NEDO (1987) performed an additional study in which Sprague-Dawley rats were exposed to 0, 500, 1,000, and 2,000 ppm (0, 655, 1,310, and 2,620 mg/m³) methanol from the first day of gestation through the F1 generation. The number of F0 parental animals included per group in this supplemental experiment was not reported. However, the number of pups per dose group per "period after birth" was reported as 11-14/sex/dose/postnatal period, and it is reasonable to assume that, consistent with the standard culling protocol used for both the F1 and F2 generations of the two-generation study (NEDO, 1987 pages 185 and 189), the pups for each gender, dose and exposure time combination came from a different litter (to avoid problems associated with litter correlation). Dose-related decreases in brain weights were observed in the male and female offspring at 3, 6, and 8 weeks of age. Critical effect: Reduced brain weight in rat pups at 6 weeks of age. End point or Point of Departure (POD): $POD_{\text{internal}} = BMDL_{1SD}(\text{internal}) = 858 \text{ mg-hr./L}$</p>		Complete

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		<p>Uncertainty Factors: UF = 100: 10 (to account for human variation) X 3 (to account for extrapolation from rats to humans) X 3 (database deficiencies). Source: IRIS, 9/30/2013</p> <p>Tier 2 Sources: PPRTV: No PPRTV record available at this time. MRL: No MRL record available at this time.</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD-AQD (11/26/2013): The 24 hour AT ITSL is based upon the US EPA inhalation RfC of 20 mg/m³. The 1 hour ITSL is based on the California acute REL of 28,000 ug/m³. The acute REL was derived from a human NOAEL of 250 mg/m³ in which volunteers were exposed to methanol vapor for 75 minutes (Cook., et al. 1991).</p>		
Inhalation Unit Risk Factor (IURF) ((µg/m ³) ⁻¹)	--	NA	MDEQ, 2015	
IURF details	--	<p>Tier 1 and 2 Sources: IRIS: Per IRIS (9/30/2013) no value available at this time. PPRTV: No PPRTV record available at this time. MRL: NA; MRLs are for non-cancer effects only.</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD-AQD, no value at this time.</p>		Complete
Mutagenic Mode of Action (MMOA)? (Y/N)	--	NO	USEPA, 2015	
MMOA Details	--	Not listed as a carcinogen with mutagenic MOA in the USEPA OSWER List		
Developmental or Reproductive Effector? (Y/N)	No	<p>Yes- for both oral and inhalation, the RfD and RfC are based on developmental effects. Oral Exposure Pathways- Single Exposure Inhalation Exposure Pathways- Single Exposure</p>	MDEQ, 2015	



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
Developmental or Reproductive Toxicity Details		See RfD and RfC details above.		
State Drinking Water Standard (SDWS) (µg/L)	NA	NO	SDWA, 1976	
SDWS details	--	MI Safe Drinking Water Act (SDWA) 1976 PA 399		
Secondary Maximum Contaminant Level (SMCL) (µg/L)	NA	NO	SDWA, 1976 and USEPA SMCL List	
SMCL details		MI Safe Drinking Water Act (SDWA) 1976 PA 399 and USEPA SMCL List, 2015		
Is there an Aesthetic Value? (Y/N)	No	Not evaluated.	NA	
Aesthetic value details	NA	NA		
Is there a Phytotoxicity Value? (Y/N)	No	Not evaluated.	NA	
Phytotoxicity details	NA	NA		
Others:				

(C) Chemical-specific Absorption 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 (AE _d)	---	0.1	MDEQ, 2015	
AE _d details				
Ingestion Absorption Efficiency (AE _i)		1.0	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)	590,000 (X)
Updated GSI value (µg/L)	590,000 (X)
Rule 57 Drinking Water Value (µg/L)	14,000

	Rule 57 Value (µg/L)	Verification Date
Human Non-cancer Values- Drinking water source (HNV-drink)	14,000	10/1998
Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)	1,100,000	10/1998
Wildlife Value (WV)	NA	NA
Human Cancer Values for Drinking Water Source (HCV-drink)	NA	NA
Human Cancer values for non-drinking water source (HCV-Non-drink)	NA	NA
Final Chronic Value (FCV)	590,000	7/2003
Aquatic maximum value (AMV)	1,300,000	7/2003
Final Acute Value (FAV)	2,700,000	7/2003

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 ($\mu\text{g}/\text{kg}$)	4,400	MDEQ, 2015
Target Detection Limit – Water ($\mu\text{g}/\text{L}$)	400	MDEQ, 2015
Target Detection Limit – Air (ppbv)	2.46E+03	MDEQ, 2015
Target Detection Limit – Soil Gas (ppbv)	8.19E+04	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