



CHEMICAL UPDATE WORKSHEET

Chemical Name:	Chloromethane (Methyl chloride)
CAS #:	74-87-3
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)	50.49	50.49	EPI	EXP
Physical State at ambient temp	Liquid	Gas	MDEQ	
Melting Point (°C)	176	-97.70	EPI	EXP
Boiling Point (°C)	-24	-24.00	EPI	EXP
Solubility (ug/L)	6.34E+6	5.320E+06	EPI	EXP
Vapor Pressure (mmHg at 25°C)	4332	4.30E+03	EPI	EXP
HLC (atm-m³/mol at 25°C)	4.52E-2	8.82E-03	EPI	EXP
Log Kow (log P; octanol-water)	0.91	0.91	EPI	EXP
Koc (organic carbon; L/Kg)	6.30	13.22	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm²/s)	0.13	1.24E-01	W9	EST
Diffusivity in Water (Dw; cm²/s)	6.5E-6	1.3648E-05	W9	EST
Soil Water Partition Coefficient (Kd; inorganics)	NR	NR	NA	NA

	Part 201 Value	Updated Value	Reference Source	Comments
Flash Point (°C)	-60.8 F	NA	NA	NA
Lower Explosivity Level (LEL; unit less)	0.081	0.081	CRC	EXP
Critical Temperature (K)		416.25	EPA2004	EXP
Enthalpy of Vaporization (cal/mol)		5.11E+03	EPA2004	EXP
Density (g/mL, g/cm ³)		0.911	PC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm ²)	2.71E-05	2.81E-05	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm ²)	6.67E-05	6.89E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm ²)	3.87E-05	4.48E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm ²)	9.48E-05	1.09E-04	EMSOFT	EST

(B) Toxicity Values/Benchmarks

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
Reference Dose (RfD) (mg/kg/day)	--	NA	MDEQ, 2015	
RfD details	NA	<p>Tier 1 and 2 Sources: IRIS: Per IRIS (7/17/01), no value can be derived as methyl chloride exists primarily as a gas and adequate oral exposure studies are not available. PPRTV: Per PPRTV (12/4/2012), no value can be derived as chloromethane exists primarily as a gas, and no adequate oral exposure studies are available. MRL: Per ATSDR (12/2014), no oral MRL values at this time.</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD, no value at this time.</p>		Complete
Oral Cancer Slope Factor (CSF) (mg/kg-day) ⁻¹	3.3E-3	3.3E-3	MDEQ, 2000	
CSF details	24-month inhalation study in mice (CIIT, 1981) * Route-to-Route extrapolation. Male B6C3F1 mice, renal cortical adenomas and adenocarcinomas . Revised species scaling factor of (BWh/BWa) to the 0.25 power used for q* calculation.	<p>Tier 3 Source: MDEQ: Basis: The MDEQ CSF of 3.3E-3 (mg/kg-day)⁻¹ is based on a 2000 assessment. The HEAST value is an older assessment. Since, the DEQ CSF is based on an inhalation study that IRIS (2001), PPRTV (2012) and MDEQ-AQD (2013) considered inadequate for developing a meaningful conclusion, this CSF is an interim value and should be prioritized for update. See RfD deials below. Per AQD (2013), male mouse renal tumors are due to mouse kidney P450 CYP2E1 activation. Humans do not have P450 CYP2E1 in kidneys; therefore, no basis for human carcinogenicity. (See Updated Value - IURF section for details.)</p> <p>Carcinogen Weight-of-Evidence (WOE) Class: "Inadequate Information to Assess Carcinogenic Potential"</p> <p>WOE Basis: little pertinent information and/or conflicting evidence. In animals, only a single 2-year study (CIIT, 1981) was conducted, resulting in tumors in the kidneys of male mice but no tumors at any other site or in female mice or rats of either sex. Human studies were limited to an epidemiological study in which pancreatic cancer was not associated with chloromethane exposure (Kernan et</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
	Source: SWQD CCD/WRD date: 1/11/2000	<p>al., 1999), along with other studies either confounded by exposure to other chemicals (Dow Corning Corporation, 1992; Olsen et al., 1989), by demonstrating a “healthy worker” effect (Holmes et al., 1986), or by having wide variability (Rafnsson and Gudmundsson, 1997), thus precluding meaningful conclusions. Source and Date: PPRTV, 12/14/2012</p> <p>Tier 1 and 2 Sources: IRIS: Per IRIS (7/17/2001), no value at this time. An EPA screening-level review in 2003 did not identify any critical new studies pertinent to the cancer assessment for methyl chloride. PPRTV: Per PPRTV (12/14/2012), no value at this time. MRL: NA; MRLs are for non-cancer effects only.</p> <p>Tier 3 Sources: MDEQ: Per DEQ-CCD/WRD, CSF = 3.3E-3 (mg/kg-day)⁻¹: Derivation: Route-to-route extrapolation. Revised species scaling factor of (BWh/BWa) to the 0.25 power used for the Q* calculation. Critical Study: CIIT (Chemical Industry Institute of Toxicology). (1981) Final report on a chronic inhalation toxicology study in rats and mice exposed to methyl chloride. Report prepared by the Battelle Columbus Laboratories for the Chemical Industry Institute of Toxicology. EPA/OTS Doc #878212061, NTIS/OTS0205952. 541012. Method(s): 24-month inhalation study in mice; route-to-route extrapolation. 1) <i>Dose response data: Tumor Type</i> - renal cortical adenomas and adenocarcinomas; <i>Test Species</i> - male B6C3F1 mice; <i>Route</i> - 2) <i>Extrapolation method:</i> Linear; rrevised species scaling factor of (BWh/BWa) to the 0.25 power used for q* calculation Source and date: CCD/WRD, 1/11/2000</p> <p>HEAST: Per HEAST Summary 1997, CSF= 1.3E-2 (mg/kg-day)⁻¹ based on route to route extrapolation of Inhalation Unit Risk = 1.8E-6 (µg/m³)-1; 24 month mouse inhalation study; kidney tumors (Reference 005038)</p>		

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>Texas CEQ: CSF = 1.3E-02 (mg/kg-day)⁻¹ is the HEAST (1997) value.</p> <p>Other Tier 3: No value is available at this time from these Tier 3 sources/databases: NTP ROC, health and environmental agencies of California, Massachusetts, Minnesota, New Jersey, and New York, Canada, The Netherlands (RIVM), WHO (IARC), WHO (IPCS/INCHEM), ECHA (REACH) and OECD HPV.</p>		
Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (µg/m³)	9.0E+1	9.0E+1	IRIS, 2001	
RfC/ITSL details	<p>ITSL based on EPAs July 17, 2001 RfC of 90 ug/m3. The critical effect is cerebellar lesions in 11-day continuous mouse inhalation study, NOAEL = 50 ppm or 103 mmg/m3 and LOAEL is 100 ppm or 206 mg/m3. See IRIS printout for additional details. Source: IRIS CCD date: 7/17/2001</p>	<p>Tier 1 Source: IRIS: Basis: IRIS (7/17/2001) is a tier 1 source. RfC = 9.0E-2 mg/m³ (9.0E+1 µg/m³). Critical Studies: 1) Landry, TD; Quast, JF; Gushow, TS; et al. (1983) Methyl chloride: inhalation toxicity in female C57BL/6 mice continuously or intermittently exposed for 11 days. EPA/OTS Doc #878213687, NTIS/OTS0206357. (unpublished) 2) Landry, TD; Quast, JF; Gushow, TS; et al. (1985) Neurotoxicity of methyl chloride in continuously versus intermittently exposed female C57BL/6 mice. Fundam Appl Toxicol 5(1): 87-98. Method(s): Female C57BL/6 mice (12/group) were exposed continuously (22 hours/day for 11 days) to 15, 50, 100, 150 and 200 400, 800, 1,600, or 2,400 ppm methyl chloride. Mice were also exposed intermittently (5.5 hours/day) for 11 days to 0, 150, 400, 800, 1,600, or 2,400 ppm. Critical effect: cerebellar lesions End point or Point of Departure (POD): NOAEL = 50 ppm (103.2 mg/m³) NOAEL_{HEC} = 94.6 mg/m³ Uncertainty Factors: UF = 1,000 (10 each for interspecies variability, interspecies extrapolation, and 11 day to chronic exposure extrapolation) Source and date: IRIS, 7/17/2001</p>		COMPLETE



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		<p>Tier 2 Sources: PPRTV: PPRTV (12/4/2012) refers to the IRIS chronic RfC. A sub chronic p-RfC = 3.0 mg/m³ is available: Critical Study(ies): Landry et al. (1983, 1985) Method(s): female C57BL/6 mice (12/group) were “continuously” (22–22.5 hours/day) exposed to 0, 15, 50, 100, 150, 200, or 400 ppm (0, 28.4, 94.6, 189.3, 283.9, 378.6, or 757.2 mg/m³), or “intermittently” (5.5 hours/day) to 0, 150, 400, 800, 1600, or 2400 ppm (0, 71.0, 189.3, 378.6, 757.2, or 1135.8 mg/m³) of chloromethane (purity = 99.5%) for whole body during 11 days. Neurofunctional testing was conducted during the course of the study. Critical effect: cerebellar lesions in female C57BL/6 mice End point or Point of Departure (POD): NOAEL = 50 ppm; NOAEL_{ADJ} = 94.6 mg/m³; NOAEL_{HEC} = 94.6 mg/m³ Uncertainty Factors: UF = 30 (10 for interspecies variability and 3 for interspecies extrapolation).</p> <p>MRL: Per ATSDR (12/1998), inhalation chronic MRL = 0.05 ppm. Acute and intermediate MRLs are also available. The 2009 ATSDR Addendum for chloromethane reported that very little new information was found that is relevant to the Toxicological Profile.</p> <p>Critical Study: CIIT. 1981. Final report on a chronic inhalation toxicology study in rats and mice exposed to methyl chloride. Unpublished study prepared by Battelle-Columbus Laboratories, Columbus, OH. OTS Submission Document ID 40-8120717)</p> <p>Method(s): F344 rats and B6C3F1 mice (120/sex/species/concentration) were exposed to 0, 50, 225, or 1000 ppm (0, 18, 83, or 368 mg/m³) chloromethane 6 hours/day, 5 days/week, for up to 24 months. Interim sacrifices and toxicological evaluations were scheduled for 6, 12, and 18 months after initiation of the study. Due to high mortality in the 1000-ppm mice, this group was euthanized after 21 or 22 months of exposure. A 6-month interim report of this study was prepared by Mitchell et al. (1979b). The results of the chronic-duration study were presented in the unpublished final report by CIIT (1981).</p>		

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>Critical effect: neurological effects (swelling and degeneration of the axons of the spinal cord) in male and female mice</p> <p>End point or Point of Departure (POD): NOAEL = 50 ppm</p> <p>Uncertainty Factors: UF = 100 (10 each for interspecies variability and interspecies extrapolation)</p> <p>Source and date: ATSDR, 12/1998</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD-AQD (09/03/2013) adopted IRIS of 90 µg/m³.</p>		
Inhalation Unit Risk Factor (IURF) ((µg/m³)⁻¹)	6.39E-7	NA	MDEQ, 2015	
IURF details	<p>Potency is based on Pavkov 1982. A 2-yr inhalation study, where exposures were 6/24 hr. for 5/7 days, with male mice developing renal tumors. CCD/AQD date: 12/16/1985</p>	<p>Carcinogen Weight-of-Evidence (WOE) Class: “Inadequate Information to Assess Carcinogenic Potential”</p> <p>IRIS WOE Basis: little pertinent information and/or conflicting evidence. In animals, only a single 2-year study (CIIT, 1981) was conducted, resulting in tumors in the kidneys of male mice but no tumors at any other site or in female mice or rats of either sex. Human studies were limited to an epidemiological study in which pancreatic cancer was not associated with chloromethane exposure (Kernan et al., 1999), along with other studies either confounded by exposure to other chemicals (Dow Corning Corporation, 1992; Olsen et al., 1989), by demonstrating a “healthy worker” effect (Holmes et al., 1986), or by having wide variability (Rafnsson and Gudmundsson, 1997), thus precluding meaningful conclusions.</p> <p>Source and Date: PPRTV, 12/14/2012; IRIS, 2001</p> <p>Tier 1 and 2 Sources: IRIS: Per IRIS (7/17/2001), no value at this time. An EPA screening-level review in 2003 did not identify any critical new studies pertinent to the cancer assessment for methyl chloride. PPRTV: Per PPRTV (12/14/2012), no value at this time. MRL: NA; MRLs are for non-cancer effects only.</p>		Complete

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>Tier 3 Sources: MDEQ: Per DEQ/AQD 9/3/2013: Previous AQD potency of 6.39E-7 per µg/m³ is based on Pavkov 1982. A 2 yr. inhalation study, where exposures were 6/24 hr. for 5/7 days, with male mice developing renal tumors. Looked for updated information on 6/6/13, EPA says inadequate information for carcinogenicity determination. Male mouse renal tumors are due to mouse kidney P450 CYP2E1 activation. Humans do not have P450 CYP2E1 in kidneys; therefore, no basis for human carcinogenicity. <u>Value is rescinded until new information available.</u></p> <p>HEAST: Per Heast Summary 1997 (p.3-9), IUR = 1.8E-6 (µg/m³)⁻¹; 24 month mouse inhalation study; kidney tumors (Reference 005038).</p> <p>Other Tier 3: No value is available at this time from these Tier 3 sources/databases: NTP ROC, health and environmental agencies of California, Massachusetts, Minnesota, New Jersey, New York, and Texas, Canada, The Netherlands (RIVM), WHO (IARC), WHO (IPCS/INCHEM), ECHA (REACH) and OECD HPV.</p>		
Mutagenic Mode of Action (MMOA)? (Y/N)	--	NO	USEPA, 2015	
MMOA Details	--	NA Not listed as a carcinogen with mutagenic MOA in the EPA 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		



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
Secondary Maximum Contaminant Level (SMCL) (ug/L)	--	NO	SDWA, 1976 and USEPA SMCL List, 2015	
SMCL details	NA	SDWA, 1976 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		
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 (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)	ID
Updated GSI value (µg/L)	ID
Rule 57 Drinking Water Value (µg/L)	110

	Rule 57 Value (µg/L)	Verification Date
Human Non-cancer Values- Drinking water source (HNV-drink)	3,500	5/2010
Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)	240,000	5/2010
Wildlife Value (WV)	NA	NA
Human Cancer Values for Drinking Water Source (HCV-drink)	110	5/2010
Human Cancer values for non-drinking water source (HCV-Non-drink)	7,300	5/2010
Final Chronic Value (FCV)	ID	11/2010
Aquatic maximum value (AMV)	ID	11/2010
Final Acute Value (FAV)	ID	11/2010

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 ($\mu\text{g}/\text{kg}$)	250	MDEQ, 2015
Target Detection Limit – Water ($\mu\text{g}/\text{L}$)	5	MDEQ, 2015
Target Detection Limit – Air (ppbv)	2.00E+01	MDEQ, 2015
Target Detection Limit – Soil Gas (ppbv)	6.50E+02	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