



## CHEMICAL UPDATE WORKSHEET

<b>Chemical Name:</b>	<b>Dibromomethane (methylene bromide)</b>
<b>CAS #:</b>	<b>74-95-3</b>
<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
<b>Molecular Weight (g/mol)</b>	173.85	173.84	EPI	EXP
<b>Physical State at ambient temp</b>	Liquid	Liquid	MDEQ	
<b>Melting Point (°C)</b>	221	-52.50	EPI	EXP
<b>Boiling Point (°C)</b>	97	97.00	EPI	EXP
<b>Solubility (ug/L)</b>	1.10E+7	1.19E+07	EPI	EXP
<b>Vapor Pressure (mmHg at 25°C)</b>	45.6	4.44E+01	EPI	EXP
<b>HLC (atm-m<sup>3</sup>/mol at 25°C)</b>	9.00E-4	8.22E-04	EPI	EXP
<b>Log Kow (log P; octanol-water)</b>	1.62	1.70	EPI	EXP
<b>Koc (organic carbon; L/Kg)</b>	39.2	21.73	EPI	EST
<b>Ionizing Koc (L/kg)</b>		NR	NA	NA
<b>Diffusivity in Air (Di; cm<sup>2</sup>/s)</b>	0.08	5.51E-02	W9	EST
<b>Diffusivity in Water (Dw; cm<sup>2</sup>/s)</b>	8.0E-6	1.1902E-05	W9	EST
<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; unit less)	NA	NA	NA	NA
Critical Temperature (K)		583.00	EPA2004	EXP
Enthalpy of Vaporization (cal/mol)		7.87E+03	EPA2004	EXP
Density (g/mL, g/cm <sup>3</sup> )		2.4969	CRC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm <sup>2</sup> )	NA	2.69E-05	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm <sup>2</sup> )	NA	6.18E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm <sup>2</sup> )	NA	4.25E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm <sup>2</sup> )	NA	9.50E-05	EMSOFT	EST

**(B) Toxicity Values/Benchmarks**

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
Reference Dose (RfD) (mg/kg/day)	1.1E-2	3.0E-3	PPRTV, 2009 /MDEQ, 2015	
RfD details	<p>Rat 63 day 6 hour/day inhalation study (Keyes et al., 1982; USEPA 1987). Critical effects = increased carboxyhemoglobin. Based on route-to-route extrapolation, including an absorption factor of 0.5. No pharmacokinetic data were provided to justify route to route extrapolation. CCD/RRD date: 3/1/1991</p>	<p><b>Tier 2 Source:</b>  <b>PPRTV:</b>  <b>Basis:</b> PPRTV is a Tier 2 value, no tier 1 available. PPRTV (9/3/0/2009) subchronic p-RfD = 9.0E-3 mg/kg-day. MDEQ applied an additional uncertainty factor of 3 to account for subchronic to chronic exposure extrapolation to derive a RfD = 3.0E-3 mg/kg-day. No chronic p-RfD is available.  <b>Critical Study (ies):</b> Komsta, E., I. Chi, V.E. Valli et al. 1988. Results of a short-term toxicity study for three organic chemicals found in Niagara river drinking water. Bull. Environ. Contam. Toxicol. 41:515–522.  <b>Method(s):</b> Young-adult Sprague-Dawley rats (10/sex/group) were exposed to methylene bromide (dibromomethane) in drinking water at concentrations of 1.0, 10.0, 100.0, or 1000.0 mg/L for 4 weeks. Methylene bromide was initially solubilized with 0.5% by weight (w/v) Emulphor followed by dilution with tap water to appropriate concentrations. Control groups (10 per sex) were exposed to water alone or vehicle. Reported approximate chemical intakes were 0.1, 1.2, 11.9, and 124 mg/kg-day in males and 0.1, 0.9, 8.6, and 90 mg/kg-day in females.  <b>Critical effect:</b> kidney effects in male and female rats and liver and <b>thyroid</b> effects in males  <b>End point or Point of Departure (POD):</b> NOAEL = 8.6 mg/kg-day  <b>Uncertainty Factors:</b> UF = 1,000 (10 each for intraspecies variability, interspecies extrapolation, and database deficiencies)  <b>Source and date:</b> PPRTV, 9/30/2009</p> <p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> No IRIS file available at this time.  <b>MRL:</b> No MRL record available at this time.</p> <p><b>Tier 3 Source:</b>  <b>MDEQ:</b> Per DEQ-CCD/RRD (3/1/1991), RfD = 1.1E-2 mg/kg-day. See Part 201 RfD</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		details.		
<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:</b> "Inadequate Information to Assess the Carcinogenic Potential"</p> <p><b>IRIS WOE Basis:</b> The only study providing information on the carcinogenicity of methylene bromide (Keyes et al., 1982) is not an adequate evaluation of the carcinogenic potential of methylene bromide due to the short (90-day) exposure duration and insufficient histopathological follow-up. Methylene chloride, a structural analog of methylene bromide, is carcinogenic and there are metabolic similarities between methylene chloride and methylene bromide.</p> <p><b>Source and Date:</b> PPRTV, 9/3/0/2009</p> <p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> No IRIS file available at this time.  <b>PPRTV:</b> Per PPRTV (9/30/2009), no value 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
<b>Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (µg/m³)</b>	--	4.0E+0	PPRTV, 2009	
<b>RfC/ITSL details</b>	NA	<p><b>Tier 3 Source:</b>  <b>PPRTV Screening Value:</b>  <b>Basis:</b> PPRTV Tier 3 screening value is used. California and Texas have adopted the PPRTV value.  <b>PPRTV (9/30/2009):</b> Tier 3 screening chronic p-RfC = 4.0E-3 mg/m³. PPRTV screening value is considered a Tier 3 value.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		<p><b>Critical Study:</b> Keyes, D.G., J.W. Henck, G.C. Jersey et al. 1982. Methylene bromide: A ninety-day repeated inhalation toxicity study in rats and dogs with a subsequent two-year holding period for rats. Toxicology Research Laboratory, Health and Environmental Sciences, Dow Chemical Company, Midland, MI. U.S. EPA/OPTS Public Files. Fiche No. OTS0516108. Doc. No. 86-870001205. Section 8D. Unpublished.</p> <p><b>Method(s):</b> Groups of 115 male and 15 female Sprague-Dawley rats and three male Beagle dogs were exposed to 0, 25, 75, or 150 ppm (0, 178, 533, or 1066 mg/m<sup>3</sup>) of methylene bromide for 6 hours/day, 5 days/week, for a total of 62 or 63 exposures (rats) or 70 exposures (dogs) in approximately 90 days.</p> <p><b>Critical effect:</b> increased blood carboxyhemoglobin (COHb)</p> <p><b>End point or Point of Departure (POD):</b> NOAEL = 8.6 mg/kg-day</p> <p><b>Uncertainty Factors:</b> UF = 3,000 (10 each for intraspecies variability, database deficiencies, and subchronic to chronic extrapolation, and 3 for interspecies extrapolation for pharmacodynamic differences)</p> <p><b>Source and date:</b> PPRTV, 9/30/2009</p> <p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> No IRIS file available at this time.  <b>PPRTV:</b> Per PPRTV (9/30/2009), no subchronic or chronic p-RfC value at this time.  <b>MRL:</b> No MRL record available at this time.</p> <p><b>Tier 3 Sources:</b>  <b>MDEQ:</b> Per DEQ-CCD, no value at this time.</p> <p><b>Texas CEQ:</b> TCEQ (2014) adopted the PPRTV screening pRfC of 4.0E-3 mg/m<sup>3</sup>. Summary of Updates to the Tables Accompanying the Texas Risk Reduction Program (TRRP) Rule, 2014, Table 11.</p> <p><b>California DTSC:</b> DTSC (5/2015) adopted the PPRTV screening pRfC of 4.0E-3 mg/m<sup>3</sup>.</p>		

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<b>Other Tier 3:</b> No value is available at this time from these Tier 3 sources/databases: HEAST, NTP ROC, health and environmental agencies of Massachusetts, Minnesota, New Jersey and New York, WHO (IARC), WHO (IPCS/INCHEM), Canada, The Netherlands (RIVM), ECHA (REACH) and OECD HPV.		
<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:</b> "Inadequate Information to Assess the Carcinogenic Potential"</p> <p><b>IRIS WOE Basis:</b> The only study providing information on the carcinogenicity of methylene bromide (Keyes et al., 1982) is not an adequate evaluation of the carcinogenic potential of methylene bromide due to the short (90-day) exposure duration and insufficient histopathological follow-up. Methylene chloride, a structural analog of methylene bromide, is carcinogenic and there are metabolic similarities between methylene chloride and methylene bromide.</p> <p><b>Source and Date:</b> PPRTV, 9/30/2009</p> <p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> No IRIS file available at this time.  <b>PPRTV:</b> Per PPRTV (9/30/2009), no value 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
<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>	No	No, the RfD or RfC/ITSL is not based on a reproductive-developmental effect.	MDEQ, 2015	



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
<b>Developmental or Reproductive Toxicity Details</b>	NA	Note that RfD is based on critical effects that include a thyroid effect, which may be a developmental effect.		
<b>State Drinking Water Standard (SDWS) (ug/L)</b>	--	NO	SDWA, 1976; US EPA MCL and SMCL Lists	
<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, 2015	
<b>SMCL details</b>	NA	SDWA, 1976 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	
<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> )		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) Target Detection Limits (TDL)**

	<b>Value</b>	<b>Source</b>
<b>Target Detection Limit – Soil (<math>\mu\text{g}/\text{kg}</math>)</b>	250	MDEQ, 2015
<b>Target Detection Limit – Water (<math>\mu\text{g}/\text{L}</math>)</b>	5	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