



CHEMICAL UPDATE WORKSHEET

Chemical Name:	Bromate
CAS #:	15541-45-4
Revised By:	RRD Toxicology Unit
Revision Date:	August 14, 2015

(A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	79.9	127.9022	PC	EXP
Physical State at ambient temp	Solid	Inorganic	MDEQ	
Melting Point (°C)	178.64	NA	NA	
Boiling Point (°C)	889.52	NA	NA	
Solubility (ug/L)	38000	NA	NA	NA
Vapor Pressure (mmHg at 25°C)	7.94E-9	NR	NA	NA
HLC (atm-m³/mol at 25°C)	1.0	NR	NA	NA
Log Kow (log P; octanol-water)	0.63	NR	NA	NA
Koc (organic carbon; L/Kg)	NR	NR	NA	NA
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm²/s)	NR	NR	NA	NA
Diffusivity in Water (Dw; cm²/s)	NR	NR	NA	NA
Soil Water Partition Coefficient (Kd; inorganics)	NA	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)		NR	NA	NA
Enthalpy of Vaporization (cal/mol)		NR	NA	NA
Density (g/mL, g/cm ³)		NR	NA	NA
EMSOFT Flux Residential 2 m (mg/day/cm ²)	NA	NR	EMSOFT	NA
EMSOFT Flux Residential 5 m (mg/day/cm ²)	NA	NR	EMSOFT	NA
EMSOFT Flux Nonresidential 2 m (mg/day/cm ²)	NA	NR	EMSOFT	NA
EMSOFT Flux Nonresidential 5 m (mg/day/cm ²)	NA	NR	EMSOFT	NA

(B) Toxicity Values/Benchmarks

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
Reference Dose (RfD) (mg/kg/day)	3.7E-3	4.0E-3	IRIS, 2001	
RfD details	<p>Potassium bromate was administered orally in drinking water at 0, .02, .10, .20 and .40 g/L and 0, .08, .4 and .8 g/L to male F344 rats and male B6C3F1 mice (78/group), respectively, for 100 weeks. Survival and body weight was decreased. Water consumption and organ weight (spleen, liver, kidney and thyroid) increased. Urothelial hyperplasia identified as critical effect. On the basis of kidney effects in male rats, a</p>	<p>Tier 1 Source: IRIS: Basis: IRIS is the only available data. Critical Study: DeAngelo, AB; George, MH; Kilburn, SR; et al. (1998) Carcinogenicity of potassium bromate administered in the drinking water to male B6C3F1 mice and F344/N rats. Toxicol Pathol 26(5):587-594. Method(s): Male F344 rats and B6C3F1 mice (78/group) received 0, 0.02, 0.1, 0.2, and 0.4 g/L and of 0, 0.08, 0.4, and 0.8 g/L potassium bromate in drinking water, respectively, for 100 weeks. Calculated mean daily doses bromate doses for the rats were 0, 1.1, 6.1, 12.9, and 28.7 mg BrO₃⁻/kg-day. Critical effect: increased incidence of urothelial hyperplasia in male rats End point or Point of Departure (POD): NOAEL = 1.1 mgBrO₃⁻/kg-day. Uncertainty Factors: UF = 300 (10 each for intraspecies variability and interspecies extrapolation and 3 for database insufficiency. Source and date: IRIS, Last revision date - 6/06/2001. A review of studies in 2006 did not identify any new critical study.</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, RRD adopted the IRIS RfD value expressing it in 2 significant figures. See Part 201 Value RfD details.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
	NOAEL of 1.1 mg bromate/kg-day was identified. The total UF is 300. Mice may be less sensitive than rats to the effects of bromate exposure through drinking water. A NOAEL of 59.6 mg bromate/kg-day was identified in male mice (DeAngelo 1998). Source: RRD; 6/06/2001			
Oral Cancer Slope Factor (CSF) (mg/kg-day)⁻¹	0.7	7.0E-1	IRIS, 2001	
CSF details	See "RfD " section for DeAngelo (1998) study details; tumor type - testicular mesothelioma, renal tubular adenoma and carcinoma, and thyroid follicular cell adenoma and carcinoma; test species - male	<p>Tier 1 Source: IRIS: Basis: IRIS is the only available data. Critical Study(ies): DeAngelo, AB; George, MH; Kilburn, SR; et al. (1998) Carcinogenicity of potassium bromate administered in the drinking water to male B6C3F1 mice and F344/N rats. Toxicol Pathol 26(5):587-594 Method(s):</p> <ol style="list-style-type: none"> 1) <i>Dose response data:</i> Tumor Type - testicular mesothelioma, renal tubular adenoma and carcinoma, and thyroid follicular cell adenoma and carcinoma; <i>Test Species</i> - F344 rats, male; <i>Route</i> - ingestion, drinking water 2) <i>Extrapolation method:</i> Time-to-tumor, Weibull 3) The human equivalent dose was estimated using body weight to the 3/4 		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
	F344 rats; route - oral through drinking water Source: IRIS; Entry date: 6/6/2001	(0.75) power scaling factor, resulting in a 10% increase in cancer risk. Carcinogen Weight-of-Evidence (WOE) Class: B2 - likely human carcinogen by the oral route of exposure IRIS WOE Basis: carcinogenic to male and female rats following exposure in drinking water Source and Date: IRIS, Last revision date - 6/06/2001. A review of studies in 2006 did not identify any new critical study pertinent to cancer assessment. Tier 2 Sources: PPRTV: No PPRTV record available at this time. MRL: NA; MRLs are for non-cancer effects only. Tier 3 Source: MDEQ: Per DEQ-CCD, MDEQ adopted IRIS value.		
Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) ($\mu\text{g}/\text{m}^3$)	--	NA	MDEQ, 2015	
RfC/ITSL details	NA	Tier 1 and 2 Sources: IRIS: Per IRIS (6/06/2001), no value at this time. PPRTV: No PPRTV record available at this time. MRL: No MRL record available at this time. Tier 3 Source: MDEQ: Per DEQ-CCD, no value at this time.		Complete
Inhalation Unit Risk Factor (IURF) ($(\mu\text{g}/\text{m}^3)^{-1}$)	--	NA	MDEQ, 2015	
IURF details	NA	Tier 1 and 2 Sources: IRIS: Per IRIS (6/06/2001), no value at this time. PPRTV: No PPRTV record available at this time.		Complete.



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		MRL: NA; MRLs are for non-cancer effects only. Tier 3 Source: MDEQ: Per DEQ-CCD, no value at this time.		
Mutagenic Mode of Action (MMOA)? (Y/N)	--	NO	USEPA, 2015	
MMOA Details	--	NA Not listed as a carcinogen with mutagenic MOA in the USEPA OSWER List.		
Developmental or Reproductive Effector? (Y/N)	No	No, the RfD is not based on a reproductive-developmental effect.	MDEQ, 2015	
Developmental or Reproductive Toxicity Details	NA	NA		
State Drinking Water Standard (SDWS) (ug/L)	1.0E+1	10	SDWA, 1976	
SDWS details	MI Safe Drinking Water Act (SDWA) 1976 PA 399	MI Safe Drinking Water Act (SDWA) 1976 PA 399		
Secondary Maximum Contaminant Level (SMCL) (ug/L)	--	NO	SDWA, 1976 and USEPA SMCL List	
SMCL details	NA	MI Safe Drinking Water Act (SDWA) 1976 PA 399 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		



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
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)	---	0.01	MDEQ, 2015	
AE _d details				
Ingestion Absorption Efficiency (AE _i)		0.5	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)	40 (X)
Updated GSI value (µg/L)	40 (X)
Rule 57 Drinking Water Value (µg/L)	10 (M); 0.5

	Rule 57 Value (µg/L)	Verification Date
Human Non-cancer Values- Drinking water source (HNV-drink)	100	5/2005
Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)	8,200	5/2005
Wildlife Value (WV)	NA	NA
Human Cancer Values for Drinking Water Source (HCV-drink)	0.5	5/2005
Human Cancer values for non-drinking water source (HCV-Non-drink)	40	5/2005
Final Chronic Value (FCV)	760	5/2005
Aquatic maximum value (AMV)	6,900	5/2005
Final Acute Value (FAV)	14,000	5/2005

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 ($\mu\text{g}/\text{kg}$)	200	MDEQ, 2015
Target Detection Limit – Water ($\mu\text{g}/\text{L}$)	10	MDEQ, 2015
Target Detection Limit – Air (ppbv)	NA	MDEQ, 2015
Target Detection Limit – Soil Gas (ppbv)	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 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