CHEMICAL UPDATE WORKSHEET

Chemical Name:	**Dicamba (DD)**
CAS #:	**1918-00-9**
Revised By:	RRD Toxicology Unit
Revision Date:	August 17, 2015

(A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	221.04	221.04	EPI	EXP
Physical State at ambient temp	Solid	Solid	MDEQ	
Melting Point (˚C)	115	115.00	EPI	EXP
Boiling Point (˚C)	NA	NA	NA	
Solubility (ug/L)	4.5E+6	8.310E+06	EPI	EXP
Vapor Pressure (mmHg at 25˚C)	9.7E-5	1.25E-05	EPI	EXP
HLC (atm-m^3/mol at 25˚C)	7.90E-9	4.38E-10	PP	EST
Log Kow (log P; octanol-water)	2.4	2.21	EPI	EXP
Koc (organic carbon; L/Kg)	95.3	29.01	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm^2/s)	0.08	2.92E-02	W9	EST
Diffusivity in Water (Dw; cm^2/s)	8.0E-6	7.80E-06	W9	EST
Soil Water Partition Coefficient (Kd; inorganics)	NR	NR	NA	NA

	Part 201 Value	Updated Value	Reference Source	Comments
Flash Point (˚F)	NA	NA	NA	NA
Lower Explosivity Level (LEL; unit less)	NA	NA	NA	NA
Critical Temperature (K)		NA	NA	NA
Enthalpy of Vaporization (cal/mol)		NA	NA	NA
Density (g/mL, g/cm^3)		1.57	CRC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm^2)	NA	3.15E-07	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm^2)	NA	3.15E-07	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm^2)	NA	3.42E-07	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm^2)	NA	3.42E-07	EMSOFT	EST

(B) Toxicity Values/Benchmarks

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
Reference Dose (RfD) (mg/kg/day)	3.0E-2	4.5E-1	OPP, 2008	
RfD details	Five groups of female rabbits were dosed with 0.5% methyl cellulose at 1 mg/kg/day containing doses of 0, 1.0, 3.0, or 10.0 mg/kg/day of dicamba. Dicamba was administered on days 6-18 of gestation. Rabbits receiving 10 mg/kg/day had a slightly lower net weight gain. There were slightly reduced fetal body weights and increased post implantation loss in the 10 mg/kg/day group. NOEL for maternal and fetotoxicity of 3 mg/kg/day. RfD of 3E-2 (UF of 100	**Tier 1 Source:** **EPA-OPP:** **Basis:** EPA-OPP is a Tier 1 source that is more current than IRIS. OPP chronic cRfD = 0.45 mg/kg-day. **Critical Study**: Masters, R. (1993) Technical Dicamba: A Study of the Effect on Reproductive Function of Two Generations in the Rat: Lab Project Number: SNC 140/921437. Unpublished study prepared by Huntingdon Research Centre Ltd. 392 p. (MRID no: 43137101) **Method(s)**: Multi-generation Reproduction Study in Rats **Critical effect**: Decreased pup weight **End point or Point of Departure (POD):** NOAEL = 45 mg/kg-day **Uncertainty Factors**: UF = 100 (10 each for interspecies variability and interspecies extrapolation) **Source and date:** EPA/Office of Chemical Safety and Pollution Prevention (OPP), Reregistration Eligibility Decision (RED) for Dicamba and Associated Salts (6/2006), Amendments to the Dicamba Reregistration Eligibility Decision (RED), 10/31/2008 (EPA-HQ-OPP-2005-0479-0024) **Tier 1 Sources:** **IRIS:** Per IRIS (7/01/1992), RfD = 3.0E-2 mg/kg-day. **Critical Study**: Velsicol Chemical Corporation. 1978. MRID No. 00028236. Available from EPA. Write to FOI, EPA, Washington, DC 20460. (unpublished) **Method(s)**: Five groups of female rabbits (31 to 35/group) were given 0, 1.0, 3.0, or 10.0 mg/kg/day of dicamba in 0.5% methyl cellulose on gestation days 6-18. Additional rabbits were added to each group at a later starting time. A positive control group was treated with 3 mg/kg/day of 6-aminonicotinamide on day 9 of gestation only. **Critical effect**: maternal and fetal toxicity **End point or Point of Departure (POD):** NOAEL = 3.0 mg/kg/day		Complete

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
	(10x each for inter and intra species variability)). CCD date:	**Uncertainty Factors**: UF = 100 (10 each for interspecies variability and interspecies extrapolation) **Source and date:** IRIS, Last revision date - 7/01/1992. EPA screening-level review in 2002 reported one or more significant new studies. **EPA-OPP:** Per OPP (10/31/2008), acute RfD = 1.0 mg/kg-day based on neurotoxicity signs such as impaired gaits and righting reflex in male and females rats. LOAEL = 300 mg/kg/day in the rat acute neurotoxicity study (MRID no: 42774104) and UF = 300 (10 each for interspecies extrapolation and interspecies variation, and 3 for using a LOAEL). **Tier 2 Sources**: **PPRTV:** No PPRTV record available at this time. **MRL:** No MRL record available at this time **Tier 3 Source:** **MDEQ:** Per DEQ-CCD, RRD (7/1/1992) adopted IRIS value RfD = 3.0E-2 mg/kg/day. See Part 201 Value RfD details.		
Oral Cancer Slope Factor (CSF) (mg/kg-day)$^{-1}$)	--	NA	MDEQ, /2015	
CSF details	NA	**Carcinogen Weight-of-Evidence (WOE) Class**: Not likely to be carcinogenic to humans **IRIS WOE Basis**: Information from 2 studies: 1) Goldenthal, E. (1985) Lifetime Dietary Toxicity and Oncogenicity Study in Rats: Technical Dicamba: 163-694. Unpublished study prepared by International Research and Development Corp. 2101 p (MRID no: 00146150). 2) Crome, S.; Stuart, V.; Anderson, A.; et al. (1987) Dicamba: Potential Tumorigenic Effects in Prolonged Dietary Administration to Mice: Report No. VCL 72/871205. Unpublished study prepared by Huntingdon Research Centre Ltd. 966 p. (MRID no: 40872401) **Source and Date**: EPA-OPP Amendments to the Dicamba Reregistration Eligibility Decision (RED), 10/31/2008		Complete

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		Tier 1 and 2 Sources: **IRIS:** Per IRIS (11/01/1993), no carcinogenicity assessment at this time. **PPRTV:** No PPRTV record available at this time. **MRL:** NA; MRLs are for non-cancer effects only. **EPA-OPP**: Per OPP (10/31/2008), no value at this time. **Tier 3 source:** **MDEQ:** Per DEQ-CCD, no value at this time.		
Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (µg/m³)	--	NA	MDEQ, 2015	
RfC/ITSL details	NA	**Tier 1 and 2 Sources**: **IRIS:** Per IRIS (7/01/1992), no RfC 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) ((µg/m^3)$^{-1}$)	--	NA	MDEQ, 2015	
IURF details	NA	**Carcinogen Weight-of-Evidence (WOE) Class**: Not likely to be carcinogenic to humans **IRIS WOE Basis**: Information from 2 studies: 1) Goldenthal, E. (1985) Lifetime Dietary Toxicity and Oncogenicity Study in Rats: Technical Dicamba: 163-694. Unpublished study prepared by International Research and Development Corp. 2101 p (MRID no: 00146150). 2) Crome, S.; Stuart, V.; Anderson, A.; et al. (1987) Dicamba: Potential Tumorigenic Effects in Prolonged Dietary Administration to Mice: Report No.		Complete

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		VCL 72/871205. Unpublished study prepared by Huntingdon Research Centre Ltd. 966 p. (MRID no: 40872401) **Source and Date**: EPA-OPP Amendments to the Dicamba Reregistration Eligibility Decision (RED), 10/31/2008 **Tier 1 and 2 Sources**: **IRIS:** Per IRIS (11/01/1993), no carcinogenicity assessment at this time. **PPRTV:** No PPRTV record available at this time. **MRL:** NA; MRLs are for non-cancer effects only. **EPA-OPP**: Per OPP (10/31/2008), no value at this time. **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	YES-oral, the RfD is based on a reproductive-developmental effect. Oral Exposure Pathways- Full Term Exposure No – for inhalation exposure. The RfC/ITSL is not based on a reproductive-developmental effect.	MDEQ, 2015	
Developmental or Reproductive Toxicity Details	NA	**Critical Study (ies)**: Masters, R. (1993) Technical Dicamba: A Study of the Effect on Reproductive Function of Two Generations in the Rat: Lab Project Number: SNC 140/921437. Unpublished study prepared by Huntingdon Research Centre Ltd. 392 p. (MRID no: 43137101 (1993)) **Method(s)**: Multi-generation Reproduction Study in Rats **Critical effect**: Decreased pup weight.		
State Drinking Water Standard (SDWS) (ug/L)	--	NO	SDWA, 1976	

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
SDWS details	NA	MI Safe Drinking Water Act (SDWA) 1976 PA 399		
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 (ABSgi)	---	1.0	MDEQ, 2015/ USEPA RAGS-E, 2004	
ABSgi details		RAGS E (USEPA, 2004) Default Value		
Skin absorption efficiency value (AEd)	---	0.1	MDEQ, 2015	
AEd details				
Ingestion Absorption Efficiency (AEi)		0.5	MDEQ, 2015	
AEi 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)	NA
Updated GSI value (µg/L)	NA
Rule 57 Drinking Water Value (µg/L)	NA

	Rule 57 Value (µg/L)	Verification Date
Human Non-cancer Values- Drinking water source (HNV-drink)		
Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)		
Wildlife Value (WV)		
Human Cancer Values for Drinking Water Source (HCV-drink)		
Human Cancer values for non-drinking water source (HCV-Non-drink)		
Final Chronic Value (FCV)		
Aquatic maximum value (AMV)		
Final Acute Value (FAV)		

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 (μg/kg)	50	MDEQ, 2015
Target Detection Limit – Water (μg/L)	1	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

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