



CHEMICAL UPDATE WORKSHEET

Chemical Name:	2,4-Dichlorophenoxyacetic acid
CAS #:	94-75-7
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)	---	140.50	EPI	EXP
Boiling Point (°C)	---	NA	NA	
Solubility (ug/L)	6.80E+5	6.77E+05	EPI	EXP
Vapor Pressure (mmHg at 25°C)	NA	8.25E-05	EPI	EXP
HLC (atm-m³/mol at 25°C)	4.50E-6	9.75E-08	HSDB	EXP
Log Kow (log P; octanol-water)	2.7	2.81	EPI	EXP
Koc (organic carbon; L/Kg)	451	29.63	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm²/s)	0.059	2.79E-02	W9	EST
Diffusivity in Water (Dw; cm²/s)	6.5E-6	7.3445E-06	W9	EST

	Part 201 Value	Updated Value	Reference Source	Comments
Soil Water Partition Coefficient (Kd; inorganics)	NR	NR	NA	NA
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/cm³)		1.42	PC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm²)	2.00E-06	1.42E-06	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm²)	2.00E-06	1.42E-06	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm²)	2.40E-06	1.79E-06	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm²)	2.40E-06	1.79E-06	EMSOFT	EST

(B) Toxicity Values/Benchmarks

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
Reference Dose (RfD) (mg/kg/day)	1.0	5.0E-2	OPP, 2012	
RfD details	Rat subchronic and chronic dietary studies (Dow Chemical Co., 1983); NOAEL = 1mg/kg/day; UF = 100; Critical effect = hematologic, hepatic and renal toxicity. CCD date: 2/5/1986	<p>Tier 1 Source: EPA-OPP: Basis: OPP is a Tier 1 source. OPP (2012) is a more current assessment than IRIS. OPP chronic RfD/cPAD = 0.05 (5.0E-2) mg/kg-day. Critical Study: Jeffries, T.; Yano, B.; Ormand, J. et al. (1995) 2,4-Dichlorophenoxyacetic Acid: Chronic Toxicity/Oncogenicity Study in Fischer 344 Rats: Final Report: Lab Project Number: K/002372/064. Unpublished study prepared by The Dow Chemical Co., Health and Environmental Sciences. 2020 p. MRID 43612001; Yano, B. (1997) 2,4-Dichlorophenoxyacetic Acid: Chronic Toxicity/Oncogenicity Study in Fischer 344 Rats: Supplemental Histopathology--Brains from Low- and Mid-Dose Level Rats Sacrificed for the 2-Year Necropsy: Revised (Final Report): Lab Project Number: K-002372-064FR: K-002372-064. Unpublished study prepared by The Dow Chemical Co. 14 p. MRID 44284501. Methods: Combined chronic toxicity/carcinogenicity study; Fischer 344 rat received doses of 0, 5, 75, or 150 mg/kg/day acceptable/Guideline) Critical effect: decreased body-weight gain (females) and food consumption (females), alterations in hematology and clinical chemistry parameters, increased thyroid weights (both sexes at study termination), and decreased testes and ovarian weights. End point or Point of Departure (POD): NOAEL = 5 mg/kg-day Uncertainty Factors: UF = 100 (10 each for intraspecies variability and interspecies extrapolation) Source and date: EPA/OPP Memorandum: 2,4 D. Human Health Assessment Scoping Document in Support of Registration review, 12/2/2012</p> <p>Tier 1 and 2 Sources: IRIS: RfD = 1.0E-2 mg/kg/day</p>	Complete	



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>Critical Study: Dow Chemical Co. 1983. Acc. No. 251473. Available from EPA. Write to FOI, EPA, Washington, DC 20460</p> <p>Methods: Fischer 344 rats (20/sex/treatment) were exposed to 0, 1.0, 5.0, 15, or 45 mg/kg/day 2,4-dichlorophenoxyacetic acid (2,4-D) in diet for 91 days.</p> <p>Critical effect: hematologic, hepatic and renal toxicity</p> <p>End point or Point of Departure (POD): NOAEL = 1.0 mg/kg/day</p> <p>Uncertainty Factors: UF = 100 (10 each for intraspecies variability and interspecies extrapolation)</p> <p>Source and date: IRIS, Last revision date - 5/05/1988. An EPA screening-level review in November 2001 identified one or more significant new studies.</p> <p>PPRTV: No PPRTV record available at this time.</p> <p>MRL: No MRL record available at this time.</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD, RRD adopted IRIS RfD (2/5/1986). Per CCD/WRD (1998), RfD = 0.007 mg/kg-day based on a study in dogs dosed via capsules 5 days/week for 90 days (Drill, 1953). NOAEL = 10 mg/kg; UF=1,000 (10 each for interspecies extrapolation, intraspecies variability and use of subchronic study. CCD/WRD date - 5/1/1998.</p>		
Oral Cancer Slope Factor (CSF) (mg/kg-day)⁻¹	--	NA	MDEQ, 2015	
CSF details	NA	<p>Carcinogen Weight-of-Evidence (WOE) Class: Group D chemical [not classifiable as to human carcinogenicity].</p> <p>WOE Basis: Based on the overall pattern of responses observed in both in vitro and in vivo genotoxicity tests and a weight-of-evidence assessment, 2,4-D is not mutagenic, although some cytogenic effects were observed.</p> <p>Source and Date: EPA/OPP Memorandum: 2,4 D. Human Health Assessment Scoping Document in Support of Registration review, 12/2/2012</p> <p>Tier 1 and 2 Sources: IRIS: Per IRIS (5/05/1988), no value at this time. There is no IRIS evaluation and determination for evidence of human carcinogenic potential</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>EPA/OPP: Per OPP (12/2/2012), no value 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>		
Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) ($\mu\text{g}/\text{m}^3$)	--	1.75 E+2	OPP, 2012	
RfC/ITSL details	NA	<p>Tier 1 Source: EPA-OPP: Basis: OPP is a Tier 1 source. Inhalation long-term based RfC = $0.175 \text{ mg}/\text{m}^3$ ($1.75\text{E}+2 \text{ }\mu\text{g}/\text{m}^3$) is derived based on OPP (2012) oral RfD ($5.0\text{E}-2 \text{ mg}/\text{kg}\text{-day}$); assumed 70 kg body weight and $20 \text{ m}^3/\text{day}$ inhalation rate. OPP has derived an inhalation long-term level of concern (LOC) value for inhalation exposure based on the oral RfD value (Table A3.1). Critical Study: Jeffries, T.; Yano, B.; Ormand, J. et al. (1995) 2,4-Dichlorophenoxyacetic Acid: Chronic Toxicity/Oncogenicity Study in Fischer 344 Rats: Final Report: Lab Project Number: K/002372/064. Unpublished study prepared by The Dow Chemical Co., Health and Environmental Sciences. 2020 p. MRID 43612001 (1995); Yano, B. (1997) 2,4-Dichlorophenoxyacetic Acid: Chronic Toxicity/Oncogenicity Study in Fischer 344 Rats: Supplemental Histopathology--Brains from Low- and Mid-Dose Level Rats Sacrificed for the 2-Year Necropsy: Revised (Final Report): Lab Project Number: K-002372-064FR: K-002372-064. Unpublished study prepared by The Dow Chemical Co. 14 p. MRID 44284501 (19xx). Methods: Combined chronic toxicity/carcinogenicity study; Fischer 344 rat received doses of 0, 5, 75, or 150 mg/kg/day acceptable/Guideline) Critical effect: decreased body-weight gain (females) and food consumption (females), alterations in hematology and clinical chemistry parameters, increased</p>		Complete

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		thyroid weights (both sexes at study termination), and decreased testes and ovarian weights. End point or Point of Departure (POD): NOAEL = 5 mg/kg-day Uncertainty Factors: UF = 100 (10 each for intraspecies variability and interspecies extrapolation) Source and date: EPA/OPP Memorandum: 2,4 D. Human Health Assessment Scoping Document in Support of Registration review, 12/2/2012 Tier 1 and 2 Sources: IRIS: Per IRIS (5/05/1988), 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/AQD (1/13/2015) ITSL = 35 µg/m ³ , Averaging time = annual. 2,4-D annual ITSL of 35 ug/m3 is derived from EPA RfD of 1 x 10 ⁻² mg/kg/day based on a 90-day rat oral bioassay and 1-year interim report from a 2-year rat oral bioassay performed by the Dow Chemical Company in 1983 (NOAEL of 1.0 mg/kg/day). Critical effect of hematologic, hepatic, and renal toxicity. The 2,4-D 8-hr ITSL of 100 ug/m3 is based on an ACGIH TLV-TWA of 10 mg/m3		
Inhalation Unit Risk Factor (IURF) ((µg/m³)⁻¹)	--	NA	MDEQ, 2015	
IURF details	NA	Carcinogen Weight-of-Evidence (WOE) Class: Group D chemical [not classifiable as to human carcinogenicity]. WOE Basis: Based on the overall pattern of responses observed in both in vitro and in vivo genotoxicity tests and a weight-of-evidence assessment, 2,4-D is not mutagenic, although some cytogenic effects were observed. Source and Date: EPA/OPP Memorandum: 2,4 D. Human Health Assessment Scoping Document in Support of Registration review, 12/2/2012 Tier 1 and 2 Sources: IRIS: Per IRIS (5/05/1988), no value at this time. There is no IRIS evaluation and		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		determination for evidence of human carcinogenic potential EPA/OPP: Per OPP (12/2/2012), no value at this time. PPRTV: No PPRTV record available at this time. 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; this substance is not considered a developmental toxicant at this time although one of the critical effects is a reproductive effect (see below).	MDEQ, 2015	
Developmental or Reproductive Toxicity Details	NA	Critical effect: decreased body-weight gain (females) and food consumption (females), alterations in hematology and clinical chemistry parameters, increased thyroid weights (both sexes at study termination), and decreased testes and ovarian weights. Critical Study: MRID 43612001 (1995); MRID 44284501 (19xx). Guideline No. 870.4100a/870.4200 Methods: Combined chronic toxicity/carcinogenicity study; Fischer 344 rat received doses of 0, 5, 75, or 150 mg/kg/day acceptable/Guideline)		
State Drinking Water Standard (SDWS) (ug/L)	--	70	SDWA, 1976	
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	



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
SMCL details	NA	MI Safe Drinking Water Act (SDWA) 1976 PA 399 and USEPA SMCL List		
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	
ABS_{gi} details		RAGS E (EPA, 2004) Default Value		
Skin absorption efficiency value (AE_d)	---	0.05	USEPA RAGS-E	
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)	220
Updated GSI value (µg/L)	220
Rule 57 Drinking Water Value (µg/L)	240

	Rule 57 Value (µg/L)	Verification Date
Human Non-cancer Values- Drinking water source (HNV-drink)	240	4/1998
Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)	1,900	4/1998
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)	220	2/1998
Aquatic maximum value (AMV)	1,400	2/1998
Final Acute Value (FAV)	2,900	2/1998

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

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