



CHEMICAL UPDATE WORKSHEET

Chemical Name:	Diuron
CAS #:	330-54-1
Revised By:	RRD Toxicology Unit
Revision Date:	September 1, 2015

(A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	233.1	233.10	EPI	EXP
Physical State at ambient temp	Solid	Solid	MDEQ	
Melting Point (°C)	158	158.00	EPI	EXP
Boiling Point (°C)	---	NA	NA	
Solubility (ug/L)	37300	4.2E+04	EPI	EXP
Vapor Pressure (mmHg at 25°C)	0.0000027	6.90E-08	EPI	EXP
HLC (atm-m ³ /mol at 25°C)	2.70E-6	5.04E-10	PP	EST
Log Kow (log P; octanol-water)	2.77	2.68	EPI	EXP
Koc (organic carbon; L/Kg)	187	109.1	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm ² /s)	0.08	2.77E-02	W9	EST
Diffusivity in Water (Dw; cm ² /s)	8.0E-6	7.293E-06	W9	EST
Soil Water Partition Coefficient (Kd; inorganics)	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)		NA	NA	NA
Enthalpy of Vaporization (cal/mol)		NA	NA	NA
Density (g/mL, g/cm ³)		1.48	PC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm ²)	NA	1.41E-07	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm ²)	NA	1.41E-07	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm ²)	NA	1.50E-07	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm ²)	NA	1.50E-07	EMSOFT	EST

(B) Toxicity Values/Benchmarks

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
Reference Dose (RfD) (mg/kg/day)	4.3E-3	3.0E-3	OPP, 2003	
RfD details	EPA IRIS RfD modified to represent DEQ policies concerning use of animal default biological values (dog food consumption) and uncertainty factors. 2-year dog feeding study (du Pont, 1964); 2 male and 3 female dogs per control and four dosage groups. Critical effect = abnormal pigments in blood. NOAEL = 25 ppm adjusted to 0.425 mg/kg using DEQ dog food consumption default of 0.017 kg/kg bw. UF = 100; Additional UF of 3 used in IRIS, to account for	<p>Tier 1 Source: EPA-OPP: Basis: The OPP endpoint was selected over the IRIS endpoint because it is based on a chronic study and a more recent assessment. EPA-OPP: Chronic RfD = 0.003 mg/kg/day. Critical Study: MRID: Primary study = 40886501 = Schmidt, W. (1985) Diuron: Study for Chronic Toxicity and Carcinogenicity with Wistar Rats (Administration in Diet for Up to Two Years: Project ID: T/8010647; Du Pont Report No. D/TOX 17. Unpublished study prepared by Bayer AG. 1473 p.). Also, 43871901, 43804501, 44302003. Methods: combined chronic toxicity/carcinogenicity study in rats. Diuron (98.7% a.i.; batch no. 232114080) was administered to groups of 60 male and 60 female Wistar rats at dietary concentrations of 0, 25, 250, or 2500 ppm (0, 1.0, 10, or 111 mg/kg/day, respectively, for males and 0, 1.7, 17, or 203 mg/kg/day for females, respectively) for up to 24 months. At 12 months, 10 animals/sex/group were sacrificed for interim evaluation. Critical Effects: Evidence of hemolytic anemia and compensatory hematopoiesis (significantly decreased erythrocyte counts, hemoglobin levels, and hematocrit, and increased MCV, MCH, abnormal erythrocyte forms, reticulocyte counts, and leukocyte count) POD: LOAEL = 1.0 mg/kg/day for both sexes of rats. A NOAEL was not established. Uncertainty Factors: UF = 300 (UF of 100 to account for both interspecies extrapolation and intra-species variability, an additional UF of 3 to account for the lack of a NOAEL) Source and Date: EPA-OPP Memorandum Diuron: The revised HED chapter of the reregistration eligibility decision document (RED). PC Code 035505. Case 0046. DP Code D291546, September 8, 2003; Reregistration Eligibility Decision (RED) for Diuron, September 30, 2003</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
	incomplete chronic toxicity data base, not applied here because is inconsistent with DEQ UF policy. CCD date: 10/2/95	<p>Tier 1 and 2 Sources: IRIS (8/22/1988): RfD = 2E-3 mg/kg/day. Critical Study: E.I. du Pont de Nemours and Company, Inc. 1964a. MRID No. 00017763, 00091192. EPA. (unpublished) Method(s): Two male and 3 female dogs were fed 0, 25, 125, 250, and 1250 ppm (0, 0.625, 3.125, 6.25, and 31.25 mg/kg/day) diuron in the diet for two years. Critical effect: abnormal pigments in blood End point or Point of Departure (POD): NOAEL = 25 ppm (0.625 mg/kg-day) Uncertainty Factors: UF = 300 (10 each for interspecies variability and interspecies extrapolation, and 3 for database deficiencies) Source and date: IRIS, Last revision date – 8/22/1988 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 (10/2/1995): RfD = 4.3E-3 mg/kg/day. EPA IRIS RfD modified to represent DEQ policies concerning use of animal default biological values (dog food consumption) and uncertainty factors. 2-year dog feeding study (du Pont, 1964); 2 male and 3 female dogs per control and four dosage groups. Critical effect = abnormal pigments in blood. NOAEL = 25 ppm adjusted to 0.425 mg/kg using DEQ dog food consumption default of 0.017 kg/kg bw. UF = 100; Additional UF of 3 used in IRIS, to account for incomplete chronic toxicity data base, not applied here because is inconsistent with DEQ UF policy.</p>		
Oral Cancer Slope Factor (CSF) (mg/kg-day)⁻¹	--	1.9E-2	OPP, 2003	
CSF details	NA	<p>Tier 1 Source: EPA-OPP: Basis: OPP is the only available information. See details below.</p> <p>Classification of Carcinogenic Potential: The HED Carcinogenicity Peer Review Committee (CPRC) classified diuron as “known/likely” human carcinogen.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		<p>Treatment of diuron resulted in a significant increase in the incidences of urinary bladder carcinoma in both sexes of the Wistar rat, kidney carcinomas in the male rat (a rare tumor), and mammary gland carcinomas in the female NMRI mouse. There are no acceptable modes of action on mechanism of carcinogenicity for diuron.</p> <p>Source and date: EPA-OPP Memorandum Diuron: The revised HED chapter of the reregistration eligibility decision document (RED). PC Code 035505. Case 0046. DP Code D291546, September 8, 2003</p> <p>Tier 1 Sources: EPA-OPP: Critical Study: Schmidt, W. (1985) Diuron: Study for Chronic Toxicity and Carcinogenicity with Wistar Rats (Administration in Diet for Up to Two Years: Project ID: T/8010647; Du Pont Report No. D/TOX 17. Unpublished study prepared by Bayer AG. 1473 p.A chronic toxicity/oncogenicity study (MRID 40886501; supplementary data provided in MRIDs 43871901, 43804501, and 44302003)</p> <p>Methods: Diuron (98.7% a.i.; batch no. 232114080) was administered to groups of 60 male and 60 female Wistar rats at dietary concentrations of 0, 25, 250, or 2500 ppm (0, 1.0, 10, or 111 mg/kg/day, respectively, for males and 0, 1.7, 17, or 203 mg/kg/day for females, respectively) for up to 24 months. At 12 months, 10 animals/sex/group was sacrificed for interim evaluation.</p> <p>Critical Effects: This study showed conclusive evidence for the carcinogenicity of Diuron in male and female rats.</p> <p>POD: The CPRC recommended a low dose linear extrapolation model with Q1* of $1.91 \times 10^{-2} \text{ (mg/kg/day)}^{-1}$ be applied to the animal data for the quantification of human risk, based on the urinary bladder carcinomas in the male rat.</p> <p>Source and date: Reregistration Eligibility Decision (RED) for Diuron, September 30, 2003</p> <p>IRIS: Per IRIS (8/20/1988), no value at this time. IRIS has not evaluated this chemical for evidence of human carcinogenic potential.</p>		

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>Tier 2 Sources: 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) ($\mu\text{g}/\text{m}^3$)	7.0E+0	3.3E+0	OPP, 2003	
RfC/ITSL details	<p>ITSL based on EPA RfD (IRIS, 1988), in turn based on a two year feeding study in dogs (du Pont, 1964) per R232 (1) (b). Critical effect: abnormal pigments in the blood of males at dose levels > 25 ppm (0.625 mg/kg-d); NOEL = 0.625 mg/kg-d; LEL = 3.125 mg/kg-d. FINAL. AQD calculation date: 5/13/1999</p>	<p>Tier 1 Source: EPA-OPP: Basis: OPP, 2003 is the newest assessment based on more recent studies. Long-term inhalation RfC= 3.3 $\mu\text{g}/\text{m}^3$. An oral endpoint was used for inhalation exposure: inhalation exposure assumed equivalent to oral exposure. Critical Studies: 1) Schmidt, W. (1985) Diuron: Study for Chronic Toxicity and Carcinogenicity with Wistar Rats (Administration in Diet for Up to Two Years: Project ID: T/8010647; Du Pont Report No. D/TOX 17. Unpublished study prepared by Bayer AG. 1473 p. 2) Rossberg, W.; Wurnitzer, U. (1995) Addendum 1 Supporting the Diuron 2-Year Feeding Study in Rats: Lab Project Number: 13962A: T8010647. Unpublished study prepared by Bayer AG Institute of Toxicology. 42 p. 3) Rossberg, W. (1995) Volume 1 of Supplementary Data Supporting the Diuron 2-Year Feeding Study in Rats: Lab Project Number: D/TOX 17: T8010647. Unpublished study prepared by Bayer Ag Institute of Toxicology. 46 p. 4) Malek, D. (1997) Volume 2 of Supplementary Data Supporting the Diuron Two-Year Feeding Study in Rats: Lab Project Number: D/TOX 17: T8010647: 13962 B. Unpublished study prepared by DuPont Agricultural Products. 25 p. Methods: (based on RfD studies) combined chronic toxicity/carcinogenicity study in rats. Diuron (98.7% a.i.; batch no. 232114080) was administered to groups of</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>60 male and 60 female Wistar rats at dietary concentrations of 0, 25, 250, or 2500 ppm (0, 1.0, 10, or 111 mg/kg/day, respectively, for males and 0, 1.7, 17, or 203 mg/kg/day for females, respectively) for up to 24 months. At 12 months, 10 animals/sex/group were sacrificed for interim evaluation.</p> <p>Critical effects: Evidence of hemolytic anemia and compensatory hematopoiesis</p> <p>End point or Point of Departure (POD): LOAEL = 1.0 mg/kg/day</p> <p>Uncertainty factors: UF = 300; 10 each for interspecies and intra-species variability and 3 for use of a LOAEL</p> <p>Source and Date: EPA-OPP Memorandum Diuron: The revised HED chapter of the reregistration eligibility decision document (RED). PC Code 035505. Case 0046. DP Code D291546, September 8, 2003; Reregistration Eligibility Decision (RED) for Diuron, September 30, 2003</p> <p>Tier 1 and 2 Sources: IRIS: Per IRIS (8/22/1988), no value at this time. PPRTV: No PPRTV record available at this time. MRL: No MRL record available at this time.</p> <p>Tier 3 Source: MDEQ-AQD (5/13/1999): AQD ITSL = 7 µg/m³ based on the EPA RfD (IRIS, 1988), in turn based on a two year feeding study in dogs (du Pont, 1964) per R232(1)(b). Critical effect is abnormal pigments in the blood of males at dose levels > 25 ppm (0.625 mg/kg-day) (NOEL = 0.625 mg/kg-d; LEL = 3.125 mg/kg-d). See more RfD details above.</p>		
Inhalation Unit Risk Factor (IURF) ((µg/m ³) ⁻¹)	--	NA	MDEQ, 2015	
IURF details	NA	<p>Classification of Carcinogenic Potential: The HED Carcinogenicity Peer Review Committee (CPRC) classified diuron as “known/likely” human carcinogen. Treatment of diuron resulted in a significant increase in the incidences of urinary bladder carcinoma in both sexes of the Wistar rat, kidney carcinomas in the male rat (a rare tumor), and mammary gland carcinomas in the female NMRI mouse. There are no acceptable modes of action on mechanism of carcinogenicity for</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		diuron. Tier 1 Sources: IRIS: Per IRIS (8/20/1988), no value at this time. IRIS has not evaluated this chemical for evidence of human carcinogenic potential. EPA-OPP, 9/30/2003: An IURF is not provided. 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, 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 and RfC/ITSL are 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		
Secondary Maximum Contaminant Level (SMCL) (ug/L)	--	NO	SDWA, 1976 and US-EPA SMCL List	
SMCL details	NA	MI Safe Drinking Water Act (SDWA) 1976 PA 399 and USEPA SMCL List, 2015		



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
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)	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 ($\mu\text{g}/\text{kg}$)	500	MDEQ, 2015
Target Detection Limit – Water ($\mu\text{g}/\text{L}$)	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