



CHEMICAL UPDATE WORKSHEET

Chemical Name:	Cyanazine
CAS #:	21725-46-2
Revised By:	RRD Toxicology Unit
Revision Date:	November 19, 2105

(A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	241	240.70	EPI	EXP
Physical State at ambient temp	Solid	Solid	MDEQ	
Melting Point (°C)	---	168.00	EPI	EXP
Boiling Point (°C)	---	NA	NA	
Solubility (ug/L)	1.70E+5	1.70E+05	EPI	EXP
Vapor Pressure (mmHg at 25°C)	0.00000022	1.38E-07	EPI	EXP
HLC (atm-m ³ /mol at 25°C)	1.00E-10	2.57E-10	HSDB	EXP
Log Kow (log P; octanol-water)	2.2	2.22	EPI	EXP
Koc (organic carbon; L/Kg)	146	134.1	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm ² /s)	0.08	4.91E-02	W9	EST
Diffusivity in Water (Dw; cm ² /s)	8.0E-6	5.7372E-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)		NA	NA	NA
EMSOFT Flux Residential 2 m (mg/day/cm ²)	NA	1.09E-07	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm ²)	NA	1.09E-07	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm ²)	NA	1.15E-07	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm ²)	NA	1.15E-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-3	2.0E-4	WHO, 2011/MNMDH, 2007	
RfD details	<p>One-year oral beagle dog study (Dickie, 1986-unpublished) NOAEL=0.7 mg/kg/day; UF=100; Critical effects = decreased bw/bw gain, elevated platelet counts and reduced levels of total protein, albumin & calcium. CCD/SWQD date: 6/1/1994</p>	<p>Tier 3 Source: WHO and Minnesota MDH: Basis: The selected RfD = 2.0E-4 mg/kg-day is based on the WHO (2011) Tolerable Daily Intake and Minnesota MDH (2007) RfD values. They represent more updated information than that found in the 1996 IRIS file. See details below.</p> <p>Tier 1 and 2 Sources: IRIS: Per IRIS (3/01/1996), no value at this time. The oral RfD for cyanazine was withdrawn on 7/1/1992. An EPA screening-level review in 2002 identified one or more significant new studies. However, cyanazine is not presently on the IRIS Review List. PPRTV: No PPRTV record available at this time. MRL: No MRL record available at this time.</p> <p>Tier 3 Sources: MDEQ: Per DEQ-CCD-WRD, 5/18/1998, RfD = 7.0E-3. The RRD RfD of 3E-3 mg/kg-day is erroneous (should be 0.007). See Part 201 Value RfD details. Critical Study: Dickie, B.C. (May also be cited as DuPont or Hazleton Labs, 1986.) One-Year Oral Dosing Study in Dogs with the Triazine Herbicide Cyanazine. DuPont Report No. HLA 6160-104. Performed by Hazleton Laboratories for Shell Oil Co. (Unpublished) Method(s): One-year oral Beagle dogs (6/sex/group) received cyanazine in feed at 0, 10, 25, 100 or 200 ppm for one year. Actual exposure levels were 0, 0.27, 0.68, 3.2 or 6.1 mg/kg b.w./d for males and 0, 0.28, 0.72, 3.02 or 6.39 mg/kg b.s./d for females, respectively (EPA, 1988). Critical effect: Dose-related decrease in body weight and body weight gains were noted at 100 and 200 ppm; elevated platelet counts and reduced levels of total protein, albumin & calcium in both sexes.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		<p>End point or Point of Departure (POD): NOAEL = 0.7 mg/kg-day Uncertainty Factors: UF = 100 (10 each for interspecies variability and interspecies extrapolation) Source and date: MDEQ-CCD/WRD, 5/18/1998</p> <p>HEAST: RfD= 2E-3 mg/kg/day from HEAST Summary (7/1997): route – diet, species/duration: dog/1 year (Dickie, 1986), critical effect - decreased whole body weight, increased platelet count, altered blood clinical chemistry parameters, NOAEL – 0.625 mg/kg-day, UF – 300.</p> <p>Minnesota MDH: RfD= 2.6E-4 mg/kg/day: <u>Point of Departure:</u> 0.26 (NOAEL, Bogdanffy MS, JC O’Connor, JF Hansen, V Gaddamidi, CS Van Pelt, JW Green, JC Cook. Journal of Toxicology and Environmental Health Part A. 60:567-586. 2000. Chronic Toxicity and Oncogenicity Bioassay in rats with the Chloro-s-Triazine Herbicide Cyanazine.). Human Equivalent Dose Adjustment: None (inadequate information) <u>Total uncertainty factor:</u> 1,000 <u>UF allocation:</u> 10 for interspecies, 10 for interspecies, 10 for database uncertainty (neuroendocrine effects, shown to be sensitive effects for triazines, have not been adequately assessed) <u>Critical effect(s):</u> decreased adult BW/BW gain and decreased food consumption /efficiency. <u>Secondary effect(s):</u> increased incidence of extramedullary hematopoiesis of the spleen and granulocytic hyperplasia of the bone marrow, reduced serum protein, increased incidence of palpable masses, and reduced growth rate. <u>Source and date:</u> MDH, 2007</p> <p>Texas CEQ: RfD= 2.0E-03 mg/kg/day is based on HEAST (1997).</p> <p>WHO: Total Daily Intake: TDI - 0.198 µg/kg body weight/day NOAEL: 0.198 mg/kg body weight Critical effect: hyperactivity in male rats</p>		

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>Key study: a 2-year toxicity/carcinogenicity study; Bogdanffy MS. 1990. Combined chronic toxicity / oncogenicity study with cyanazine in rats. Unpublished report prepared by Haskell Laboratory and submitted to the US Environmental Protection Agency by E.I. duPont de Nemours Company (Study No. 23-90, 11 May 1990; MRID No. 415099-02.), using an uncertainty factor of 1000 (100 for interspecies and interspecies variation and 10 for limited evidence of carcinogenicity) (Ref.:WHO (2003) Cyanazine in drinking-water)</p> <p>Sources: WHO. Guidelines for Drinking Water Quality 4th edition, 2011, p. 342; Cyanazine in Drinking-water (Background document for development of WHO Guidelines for Drinking-water Quality), 1998</p> <p>Other Tier 3: No value is available at this time from these Tier 3 sources/databases: NTP ROC, health and environmental agencies of California, Massachusetts, New Jersey And New York, WHO (IARC), WHO (IPCS/INCHEM), Canada, The Netherlands (RIVM) and OECD HPV.</p>		
Oral Cancer Slope Factor (CSF) ((mg/kg-day)⁻¹)	3.7E-1	3.7E-1	MDEQ, 2000	
CSF details	<p>Two-year dietary study in Sprague-Dawley rats (Bogdanffy, 1990; unpublished); Malignant mammary gland tumors. HEAST (1994) presents SF of 8.4 (mg/kg/d) - 1 using a conversion factor of 0.05 to convert ppm in feed to mg/kg/day doses.</p>	<p>Tier 3 Source: MDEQ: Basis: The MDEQ (2000) CSF value is selected as the assessment is more current than the HEAST (1997). WHO derived a noncancerous endpoint. MN assessment indicated that mammary gland tumors observed in rats are not relevant to humans. See details below.</p> <p>Tier 1 and 2 Sources: IRIS: Per IRIS (6/1/1994), no value at this time. EPA has not evaluated the carcinogenicity potential of cyanazine. PPRTV: No PPRTV record available at this time. MRL: NA; MRLs are for non-cancer effects only.</p> <p>Tier 3 Sources: MDEQ: Per CCD/WRD (1/12/2000), CSF = 3.7E-1 (mg/kg-day)⁻¹.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
	<p>SWQD used assumed feeding rate of 0.08 kg food/kg BW/day. Revised species scaling factor of (BWh/BWa) to the 0.25 power used for q* calculation. RD calculation date: 1/12/2000.</p>	<p>Critical Study: Bogdanffy, 1990. Combined chronic toxicity/oncogenicity study with cyanazine in rats. Unpublished report prepared by Haskell Laboratory and submitted by E. I. DuPont de Nemours and Co. Study No. 23-90, Report dated May 11, 1990. MRID No. 415099-02. As cited in EPA, 1991.</p> <p>Method(s): Groups of 52 S-D rats/sex were fed cyanazine at 0, 1, 5, 25, or 50 ppm in the diet for 2 years. For the WRD assessment, a feeding rate of 0.08 kg food/kg BW/day was assumed. The resulting slope factor is 0.3733 per mg/kg/day using Global 82.</p> <p>Critical Effects: Increased incidence of mammary gland adenomas and carcinomas.</p> <p>Carcinogen Weight-of-Evidence (WOE) Class: 1993 HEAST places cyanazine into Group C: possible human carcinogen based on a 2 year rat dietary study which found an increased incidence of combined adenomas/carcinomas of the mammary gland (Bogdanffy, 1990).</p> <p>HEAST: CSF= 8.4E-1 (mg/kg-day)⁻¹ from HEAST Summary 1997: route – diet, species/duration: rat/2 years, target – mammary gland, cancer – adenoma, carcinoma and combines.</p> <p>Minnesota MDH (2009): CSF= 1.0 (mg/kg-day)⁻¹: <u>Cancer classification:</u> Group C (possible human carcinogen) <u>Slope factor:</u> 1.0 (mg/kg/d)-1 (laboratory animal) <u>Source of slope factor:</u> EPA 1993 – as cited by EPA 1994. Federal Register Environmental Documents. Atrazine, Simazine and Cyanazine; Notice of Initiation of Special Review. November 23, 1994. <u>Tumor site(s):</u> Mammary gland tumors in female Sprague Dawley rats are induced via a neuroendocrine-mediated mechanism of action. The tumors produced via this mechanism of action are not relevant in humans; however, the neuroendocrine disruption is a noncancerous endpoint of concern.</p> <p>Texas CEQ: CSF= 8.4E-01 (mg/kg-day)-1 is based on HEAST (1997).</p>		

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>WHO: Total Daily Intake: TDI - 0.198 µg/kg body weight/day. Based on a 2-year toxicity/carcinogenicity study in rats (Bogdanfy, 1990), a NOAEL of 0.198 mg/kg of body weight per day has been identified, based on hyperactivity in male rats. By applying an uncertainty factor of 1000 (100 for inter- and interspecies variation and 10 for limited evidence of carcinogenicity), a TDI of 0.198 µg/kg (2.0 E-4 mg/kg-day) of body weight can be calculated.</p> <p>Other Tier 3: No value is available at this time from these Tier 3 sources/databases: NTP ROC, health and environmental agencies of California, Massachusetts, New Jersey and New York, WHO (IARC), WHO (IPCS/INCHEM), Canada, The Netherlands (RIVM) and OECD HPV.</p>		
Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (µg/m³)	--	NA	MDEQ, 2015	
RfC/ITSL details	NA	<p>Tier 1 and 2 Sources: IRIS: Per IRIS (3/31/1987), 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: Per DEQ-CCD, no value at this time.</p>		Complete
Inhalation Unit Risk Factor (IURF) ((µg/m³)⁻¹)	--	NA	MDEQ, 2015	
IURF details	NA	<p>Tier 1 and 2 Sources: IRIS: Per IRIS (6/1/1994), no value at this time. EPA has not evaluated the carcinogenicity potential of cyanazine. PPRTV: No PPRTV record available at this time. MRL: NA; MRLs are for non-cancer effects only.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		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)	--	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 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	



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
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)	56 (X)
Updated GSI value (µg/L)	56 (X)
Rule 57 Drinking Water Value (µg/L)	2 (M); 0.93

	Rule 57 Value (µg/L)	Verification Date
Human Non-cancer Values- Drinking water source (HNV-drink)	190	5/1998
Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)	12,000	5/1998
Wildlife Value (WV)	NA	NA
Human Cancer Values for Drinking Water Source (HCV-drink)	0.93	5/1998
Human Cancer values for non-drinking water source (HCV-Non-drink)	56	5/1998
Final Chronic Value (FCV)	110	4/1998
Aquatic maximum value (AMV)	1,000	4/1998
Final Acute Value (FAV)	2,000	4/1998

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 ($\mu\text{g}/\text{L}$)	2	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