



## CHEMICAL UPDATE WORKSHEET

<b>Chemical Name:</b>	<b>Pyridine</b>
<b>CAS #:</b>	<b>110-86-1</b>
<b>Revised By:</b>	RRD Toxicology Unit
<b>Revision Date:</b>	September 21, 2015

### (A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	79.11	79.10	EPI	EXP
Physical State at ambient temp	Liquid	Liquid	MDEQ	
Melting Point (°C)	231	-41.60	EPI	EXP
Boiling Point (°C)	115.2	115.20	EPI	EXP
Solubility (ug/L)	3.00E+5	1000000000	EPI	EXP
Vapor Pressure (mmHg at 25°C)	19.76	2.08E+01	EPI	EXP
HLC (atm-m <sup>3</sup> /mol at 25°C)	7.00E-3	1.10E-05	EPI	EXP
Log Kow (log P; octanol-water)	0.67	0.65	EPI	EXP
Koc (organic carbon; L/Kg)	4.56	71.72	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm <sup>2</sup> /s)	0.091	9.31E-02	W9	EST
Diffusivity in Water (Dw; cm <sup>2</sup> /s)	7.6E-6	1.09E-05	W9	EST
Soil Water Partition Coefficient (Kd; inorganics)	NR	NR	NA	NA

	Part 201 Value	Updated Value	Reference Source	Comments
Flash Point (°C)	68 F	20	CRC	EXP
Lower Explosivity Level (LEL; unitless)	0.018	0.018	CRC	EXP
Critical Temperature (K)		619	CRC	EXP
Enthalpy of Vaporization (cal/mol)		8.39E+03	CRC	EXP
Density (g/mL, g/cm <sup>3</sup> )		0.9819	CRC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm <sup>2</sup> )	2.69E-05	1.54E-05	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm <sup>2</sup> )	6.52E-05	1.73E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm <sup>2</sup> )	3.82E-05	2.08E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm <sup>2</sup> )	9.23E-05	2.19E-05	EMSOFT	EST

**(B) Toxicity Values/Benchmarks**

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
<b>Reference Dose (RfD) (mg/kg/day)</b>	1.0E-3	1.0E-3	IRIS, 1989	
<b>RfD details</b>	<p>The RfD is based on a subchronic oral rat study (USEPA, 1986). Sprague-Dawley rats (10/dose/sex) were gavaged daily with 0, 0.25, 1.0, 10, 25, and 50 mg/kg/day pyridine for 90 days. CRITICAL EFFECT = A significant dose-related increase in the female liver-to-body weight ratios was observed in the 10, 25 and 50 mg/kg/day dose groups. NOAEL = 1.0 mg/kg-d. Total UF = 1,000 (10 each for intraspecies variability and interspecies and subchronic to</p>	<p><b>Tier 1 Source:</b>  <b>IRIS:</b>  <b>Basis:</b> IRIS is a Tier 1 Source. Per IRIS (1989); RfD = 1.0E-3 mg/kg/day  <b>Critical Study:</b> U.S. EPA. 1986. Pyridine. 90-Day subchronic oral toxicity in rats. Sponsored by Office of Solid Waste, Washington, DC.  <b>Method:</b> In the U.S. EPA (1986) study Sprague-Dawley rats (10/dose/sex) were gavaged daily with 0, 0.25, 1.0, 10, 25, and 50 mg/kg/day pyridine for 90-days. Data generated included body and organ weights, food consumption, hematologic and clinical chemistry parameters, ophthalmologic evaluations and histopathologic examinations of target organs. A September 2002 EPA screening level review did not identify any significant new studies.  <b>Critical effect:</b> Increased Liver Weight  <b>End point or Point of Departure (POD):</b> NOAEL = 1 mg/kg/day  <b>Uncertainty Factors:</b> UF = 1000; 10 for interspecies and 10 for intra- species variability in the toxicity of this chemical in lieu of specific data. An additional factor of 10 was applied to extrapolate from a subchronic to chronic effect level  <b>Source and date:</b> IRIS; 6/1/1989</p> <p><b>Tier 2 Sources:</b>  <b>PPRTV:</b> No PPRTV record available at this time.  <b>MRL:</b> No MRL record available at this time.</p> <p><b>Tier 3 Source:</b>  <b>MDEQ:</b> Per DEQ-CCD/WRD (5/6/1992), RfD = 1.0E-3 mg/kg/day. (Oral, SWQD): NOAEL of 1 mg/kg/d in male and female Sprague-Dawley rats dosed by gavage for 90 days (UF=1000) (EPA, 1986). Based on IRIS value.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
	chronic extrapolation). The IRIS RfD was last revised on: 6/1/89. A September 2002 EPA screening level review did not identify any significant new studies. No PPRTV (12/22/11, 12/13/12).			
<b>Oral Cancer Slope Factor (CSF) (mg/kg-day)<sup>-1</sup></b>	--	NA	MDEQ, 2015	
<b>CSF details</b>	No RD entry in EPB-CCD (9/16/11). Per IRIS: a quantitative estimate of the carcinogenic risk from oral exposure is not available at this time (9/16/11). No PPRTV (12/22/11).	<p><b>IRIS WOE Basis:</b> This substance/agent has not undergone a complete evaluation and determination under US EPA's IRIS program for evidence of human carcinogenic potential.</p> <p><b>Source and Date:</b> IRIS; (only RfD revision date available 6/1/1989)</p> <p><b>Tier 1 and 2 Sources:</b></p> <p><b>IRIS:</b> Per IRIS (RfD revision date only 6/1/1989), has not undergone a complete evaluation and determination - no value at this time.</p> <p><b>PPRTV:</b> No PPRTV record available at this time.</p> <p><b>MRL:</b> NA; MRLs are for non-cancer effects only.</p> <p><b>Tier 3 Source:</b></p> <p><b>MDEQ:</b> Per DEQ-CCD, no value at this time.</p>		Complete
<b>Reference Concentration (RfC) or Initial Threshold</b>	3.5E+0	3.5E+0	MDEQ, 1996	



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
<b>Screening Level (ITSL) (<math>\mu\text{g}/\text{m}^3</math>)</b>				
<b>RfC/ITSL details</b>	<p>Per AQD: The ITSL was based on the RfD of 0.001 mg/kg/day. The ACGIH TLV (5 ppm) was deemed inappropriate because CNS effects were reported in humans at 6 ppm. Neurological effects and nasal effects from inhalation studies were not observed in the oral studies; however, the hepatic effects observed in a short term animal inhalation study by Hotchkiss et al. (1993) show that pyridine affects the liver via both routes of exposure. Since the toxic effects of pyridine form</p>	<p><b>Tier 3 Source:</b>  <b>MDEQ:</b>  <b>Basis:</b> The MDEQ (1996) ITSL of 3.5E+0 <math>\mu\text{g}/\text{m}^3</math> is selected. This value is extrapolated from an IRIS (1989) oral RfD that is based on a 1986 key study. ECHA (REACH) derived an inhalation value by extrapolating from an oral dose, the same approach as MDEQ; however, the key oral study (1990 NTP 2 year carcinogenicity/toxicity) and the overall assessment factor or UF (450) are different from that used by IRIS. RIVM indicated that their value is of low reliability. See details below.</p> <p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> Per IRIS (RfD revision date only 6/1/1989), no value at this time.  <b>PPRTV:</b> No PPRTV record available at this time.  <b>MRL:</b> No MRL record available at this time.</p> <p><b>Tier 3 Sources:</b>  <b>MDEQ:</b> Per DEQ-CCD/AQD (12/13/1996), RfC = 3.5 <math>\mu\text{g}/\text{m}^3</math>. Averaging time = 24 hours. The ITSL was based on RfD of 0.001 mg/kg/day. The ACGIH TLV (5 ppm) was deemed inappropriate because CNS effects were reported in humans at 6 ppm. Neurological effects and nasal effects from inhalation studies were not observed in the oral studies; however, the hepatic effects observed in a short term animal inhalation study by Hotchkiss et al. (1993) show that pyridine affects the liver via both routes of exposure. Since the toxic effects of pyridine form both oral and inhalation exposures are systemic in nature it was deemed appropriate to use the RfD to develop the ITSL. Furthermore, the ITSL based on the RfD, would protect against the effects seen in the inhalation studies.  <b>Source and date:</b> DEQ-CCD/AQD; 12/13/1996</p> <p><b>RIVM:</b> Tolerable concentration in air (TCA) = 1.2E+2 <math>\mu\text{g}/\text{m}^3</math>; low reliability. The previous value as derived by Vermiere et al. (1991) was maintained due to lack of new significant information.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
	<p>both oral and inhalation exposure is systemic in nature it was deemed appropriate to use the RfD to develop the ITSL. Furthermore, the ITSL based on the RfD, would protect against the effects seen in the inhalation studies. FINAL. AQD calculation date: 12/13/96. No PPRTV (12/22/11).</p>	<p>Source: RIVM Table 1 Human-toxicological Maximum Permissible Risk Levels – Evaluations 1999/2000 (p19):</p> <p><b>ECHA (REACH):</b> Derived No Effect Level (DNEL) = 0.6 mg/m<sup>3</sup> (6.0E+2 µg/m<sup>3</sup>); Most sensitive endpoint - repeated dose toxicity; Overall assessment factor (AF) - 450 (details on the UF is not available); Dose descriptor starting point (after route to route extrapolation) - NOAEC.</p> <p><u>DNEL Basis:</u> Study: NTP (2000). 2 year carcinogenicity/toxicity Method: Groups of 50 male and 50 female Wistar rats were given drinking water containing 0, 100, 200 or 400 ppm pyridine for 2 years. Effects: increase in the incidence of testicular adenoma in males at the 400 ppm level. Hepatic centrilobular toxicity occurred at the 200 and 400 ppm dose levels in males Endpoint: NOAEL - 8 mg/kg bw/day (100 ppm; actual dose received); LOAEL – 17 mg/kg-day (200 ppm) Note: In an outside study analyzing neoplasm rates in 1,370 control Wistar rats, a control rate of 3.9% (range, 0% - 22%) was reported for interstitial cell neoplasms of the testis (Walsh and Poteracki, 1994). The rate for interstitial cell adenomas in the NTP study of Wistar rats exposed to 400 ppm pyridine was only marginally outside this historical range, and incidences of this neoplasm were not increased relative to controls in the 100 or 200 ppm groups. This was considered to be equivocal evidence for a carcinogenic effect.</p> <p><b>Other Tier 3:</b> No value is available at this time from these Tier 3 sources/databases: HEAST, NTP ROC, health and environmental agencies of California, Massachusetts, Minnesota, New Jersey, New York, and Texas, WHO (IARC), WHO (IPCS/INCHEM), Canada and OECD HPV.</p>		
<b>Inhalation Unit Risk Factor (IURF) ((µg/m<sup>3</sup>)<sup>-1</sup>)</b>	--	NA	MDEQ, 2105	
<b>IURF details</b>	No AQD entry in EPB-CCD	<b>IRIS WOE Basis:</b> This substance/agent has not undergone a complete evaluation and determination under US EPA's IRIS program for evidence of human		Complete



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
	(9/16/11). No PPRTV (12/22/11).	carcinogenic potential. <b>Source and Date:</b> IRIS; (only RfD revision date available 6/1/1989)  <b>Tier 1 and 2 Sources:</b> <b>IRIS:</b> Per IRIS (only RfD revision date available 6/1/1989), no value at this time. <b>PPRTV:</b> No PPRTV record available at this time. <b>MRL:</b> NA; MRLs are for non-cancer effects only.  <b>Tier 3 Source:</b> <b>MDEQ:</b> Per DEQ-CCD no value at this time.		
<b>Mutagenic Mode of Action (MMOA)? (Y/N)</b>	--	NO	USEPA, 2015	
<b>MMOA Details</b>	--	Not listed as a carcinogen with mutagenic MOA in the USEPA OSWER List.		
<b>Developmental or Reproductive Effector? (Y/N)</b>	NO	No, the RfD and RfC are not based on a reproductive-developmental effect.	MDEQ, 2015	
<b>Developmental or Reproductive Toxicity Details</b>	NA	NA		
<b>State Drinking Water Standard (SDWS) (µg/L)</b>	NO	NO	SDWA, 1976	
<b>SDWS details</b>	NA	MI Safe Drinking Water Act (SDWA) 1976 PA 399		
<b>Secondary Maximum Contaminant Level (SMCL) (µg/L)</b>	NO	NO	SDWA, 1976 and USEPA SMCL List	
<b>SMCL details</b>	NA	MI Safe Drinking Water Act (SDWA) 1976 PA 399 and USEPA SMCL List, 2015		
<b>Is there an Aesthetic Value? (Y/N)</b>	NO	Not evaluated.	NA	

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
<b>Aesthetic value details</b>	NA	NA		
<b>Is there a Phytotoxicity Value? (Y/N)</b>	NO	Not evaluated.	NA	
<b>Phytotoxicity details</b>	NA	NA		
<b>Others:</b>				

**(C) Chemical-specific Absorption Factors**

	Part 201 Value	Update	Source/Reference/ Dates	Comments/Notes /Issues
Gastrointestinal absorption efficiency value (ABS <sub>gi</sub> )	---	1.0	MDEQ, 2015/USEPA RAGS-E, 2004	
ABS <sub>gi</sub> details		RAGS E (USEPA, 2004) Default Value		
Skin absorption efficiency value (AE <sub>d</sub> )	---	0.1	MDEQ, 2015	
AE <sub>d</sub> details				
Ingestion Absorption Efficiency (AE <sub>i</sub> )		1.0	MDEQ, 2015	
AE <sub>i</sub> Details				
Relative Source Contribution for Water (RSC <sub>w</sub> )		0.2	MDEQ, 2015	
Relative Source Contribution for Soil (RSC <sub>s</sub> )		1.0	MDEQ, 2015	
Relative Source Contribution for Air (RSC <sub>A</sub> )		1.0	MDEQ, 2015	
Others				

**(D) Rule 57 Water Quality Values and GSI Criteria**

<b>Current GSI value (µg/L)</b>	NA
<b>Updated GSI value (µg/L)</b>	NA
<b>Rule 57 Drinking Water Value (µg/L)</b>	NA

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

Sources:

1. MDEQ Surface Water Assessment Section Rule 57 [website](#)
2. MDEQ Rule 57 [table](#)



**(E) Target Detection Limits (TDL)**

	<b>Value</b>	<b>Source</b>
<b>Target Detection Limit – Soil (<math>\mu\text{g}/\text{kg}</math>)</b>	330	MDEQ, 2015
<b>Target Detection Limit – Water (<math>\mu\text{g}/\text{L}</math>)</b>	20	MDEQ, 2015
<b>Target Detection Limit – Air (ppbv)</b>	1.10E+00	MDEQ, 2015
<b>Target Detection Limit – Soil Gas (ppbv)</b>	3.60E+01	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 OEHHHA	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

