



CHEMICAL UPDATE WORKSHEET

Chemical Name:	2-Methylnaphthalene
CAS #:	91-57-6
Revised By:	RRD Toxicology Unit
Revision Date:	September 16, 2015

(A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	142.2	142.20	EPI	EXP
Physical State at ambient temp	Solid	Solid	MDEQ	
Melting Point (°C)	34.6	34.40	EPI	EXP
Boiling Point (°C)	241.1	241.10	EPI	EXP
Solubility (ug/L)	24600	24600	EPI	EXP
Vapor Pressure (mmHg at 25°C)	0.068	5.50E-02	EPI	EXP
HLC (atm-m ³ /mol at 25°C)	4.99E-4	5.18E-04	EPI	EXP
Log Kow (log P; octanol-water)	3.9	3.86	EPI	EXP
Koc (organic carbon; L/Kg)	6820	2478	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm ² /s)	0.08	5.24E-02	W9	EST
Diffusivity in Water (Dw; cm ² /s)	8.0E-6	7.78E-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	97	PC	EXP
Lower Explosivity Level (LEL; unit less)	NA	NA	NA	NA
Critical Temperature (K)		761.00	EPA2004	EXP
Enthalpy of Vaporization (cal/mol)		1.26E+04	EPA2004	EXP
Density (g/mL, g/cm ³)		1.0058	CRC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm ²)	6.33E-06	1.50E-05	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm ²)	6.33E-06	1.67E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm ²)	7.58E-06	2.02E-05	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm ²)	7.58E-06	2.12E-05	EMSOFT	EST

(B) Toxicity Values/Benchmarks

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
Reference Dose (RfD) (mg/kg/day)	3.6E-2	4.0E-3	IRIS 2003	
RfD details	EPA Office of Research and Development justification for proposed provisional RfD for 2-methylnaphthalene using "Naphthalenes" oral RfD as a surrogate (EPA/ORD 7/11/95). Critical effects = decreased erythrocytes.	<p>Tier 1 Source: IRIS: BASIS: The IRIS RfD was selected because it is a Tier 1 value and corroborated by PPRTV. IRIS and PPRTV RfDs are the same; ATSDR-MRL is based on the same study but value is slightly different. All used benchmark dose modeling. MDEQ-WRD used the same study but did not conduct benchmark dose modeling. IRIS (12/22/2003): RfD = 4.0E-3 mg/kg-day: Critical Study: Murata, Y; Denda, A; Maruyama, H; Nakae, D; Tsutsumi, M; Tsujiuchi, T; Konishi, Y (1997) Short communication. Chronic toxicity and carcinogenicity studies of 2-methylnaphthalene in B6C3F1 mice. Fundam Appl Toxicol. 36:90-93. Methods: Murata et al. (1997) fed B6C3F1 mice (50/sex/group) diets containing 0, 0.075, or 0.15% 2-methylnaphthalene for 81 weeks. The average intakes were reported as 0, 54.3 or 113.8 mg/kg-day for males and 0, 50.3, or 107.6 mg/kg-day for females. The RfD was derived by benchmark dose analysis of the incidence data for pulmonary alveolar proteinosis in B6C3F1 male and female mice exposed to 2-methylnaphthalene in the diet for 81 weeks (Murata et al., 1997). Critical effect: Pulmonary alveolar proteinosis. POD: BMDL05 = 3.5 mg/kg-day Uncertainty Factors: UF = 1000. (10 each for interspecies differences, intraspecies variation, and deficiencies in the database).</p> <p>Tier 2 Sources: PPRTV: Per PPRTV (09/18/2007), subchronic RfD = 4E-3 mg/kg-day based on Murata et al., 1997. A chronic RfD was not provided. <i>(Per PPRTV: In the derivation of the chronic RfD, IRIS (U.S. EPA, 2003) noted that, in addition to the uncertainties noted above, there was model</i></p>	IRIS 2003	Complete



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		<p><i>uncertainty owing to the lack of actual dose-response information or mode of action information near a dose where the point of departure was estimated. The responses in 2-MN exposed animals suggested a continuation of the plateau into the lower exposure region, so using a linear model might have provided a higher benchmark dose than was appropriate. In addition, while BMDS was used to generate a lower bound on the estimated benchmark dose, the lower bound probably described too narrow a confidence limit on the benchmark dose. This was because the uncertainty in the data set could not be adequately described without the high dose responses.)</i></p> <p>MRL: Final oral chronic RfD = 0.04 mg/kg/day Critical Study: Murata Y, Denda A, Maruyama H, et al. 1997. Chronic toxicity and carcinogenicity studies of 2-methylnaphthalene in B6C3F1 mice. <i>Fundam Appl Toxicol</i> 36(1):90-93. Method: Groups of 50 male and 50 female B6C3F1 mice were exposed to dietary levels of 0, 0.075, or 0.15% 2-MN for 81 weeks. Average intakes were reported as 0, 54.3, or 113.8 mg/kg/day for males and 0, 50.3, or 107.6 mg/kg/day for females. Critical effect: pulmonary alveolar proteinosis in female mice End point or Point of Departure (POD): BMDL₀₅ = 4.3 mg/kg.day Uncertainty factors: UF = 100; 10 for extrapolation from mice to humans and 10 for human variability Source and date: ATSDR 08/2005</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD-WRD, 11/05/2009. RfD = 5.2E-2. Male and female B6C3F1 mice (50/sex/group) were exposed to 0, 0.075, or 0.15% 2-methylnaphthalene in the diet for 81 weeks. Corresponding doses were 0, 54.3 or 113.8 mg/kg/d for males or 0, 50.3 or 107.6 mg/kg/d for females. Slight but significant decreases in final body weights occurred in both male and female mice; male mice receiving the treated diets had significant increases in absolute and relative brain and kidney weights; and pulmonary alveolar</p>		



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		proteinosis (chronic progressive lung disease) occurred in 42.9 and 46.9% of the male mice and 55.1% and 45.8% of the female mice in the low- and high-dose groups respectively. HNV based on average male and female LOAEL of 52.3 mg/kg/d. UF=1000 for intraspecies, interspecies, and LOAEL-to-NOAEL extrapolation (Murata et al 1997).		
Oral Cancer Slope Factor (CSF) (mg/kg-day)⁻¹	--	NA	MDEQ, 2015	
CSF details	--	<p>Under the Draft Revised Guidelines for Carcinogen Risk Assessment (U.S. EPA, 1999), the data base for 2-methylnaphthalene is inadequate to assess human carcinogenic potential. As such, the data are unsuitable to calculate quantitative cancer risk estimates for humans. Source: IRIS Tox Review, December 2003.</p> <p>Tier 1 and 2 Sources: IRIS: No value available. PPRTV 08/18/2007: Using the draft revised guidelines for carcinogen risk assessment (U.S. EPA, 1999), the IRIS assessment (U.S. EPA, 2003) concluded the data were inadequate for an assessment of human carcinogenic potential of 2-MN. This conclusion was based on the absence of data concerning the carcinogenic potential of 2-MN in humans, by any route of exposure, and limited, equivocal oral evidence in animals. Updated literature searches for this assessment identified no relevant data other than those already considered for the IRIS assessment. Based on the revised guidelines for carcinogen risk assessment (U.S. EPA, 2005), the equivalent carcinogenicity descriptor would be "Inadequate Information to Assess Carcinogenic Potential". MRL: NA; MRLs are for non-cancer effects only.</p> <p>Tier 3 Source: MDEQ: Per DEQ-CCD, no oral cancer slope factor presented by RRD or WRD.</p>		Complete
Reference Concentration	1.0E+1	1.0E+1	MDEQ, 2002	



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
(RfC) or Initial Threshold Screening Level (ITSL) ($\mu\text{g}/\text{m}^3$)				
RfC/ITSL details	Annual averaging time. Chronic RfC: Based on 4 hr. rat inhalation study where the highest dose was used as a LC50 surrogate. Rule 232(1) (f). Annual averaging time.	<p>Tier 3 Source: MDEQ: Basis: MDEQ value is preferred since route to route-to-route extrapolation from the oral RfD for 2-methylnaphthalene is not supported by pharmacokinetic data. No Tier and 2 values. See details below.</p> <p>Tier 1 and 2 Sources: IRIS (12/22/2003): An RfC cannot be calculated for 2-methylnaphthalene due to inadequate data. No epidemiology studies or case reports were located which examined the potential effects of human inhalation exposure to 2-methylnaphthalene. No chronic or subchronic toxicity studies were identified in which animals were exposed to 2-methylnaphthalene by inhalation. PPRTV 09/18/2007: A provisional inhalation RfC could not be derived for 2-methylnaphthalene because data on adverse health effects following inhalation exposure were lacking for humans and animals. Without sufficient pharmacokinetic data and information to rule out portal-of-entry effects, there was no basis to support a route-to-route extrapolation from the oral data, even if they otherwise were considered sufficient. MRL: Per ATSDR (08/2005), no inhalation value available at this time.</p> <p>Tier 3 Sources: MDEQ: Per DEQ-CCD-AQD, 12/27/2002: The ITSL of $10 \mu\text{g}/\text{m}^3$ is based on an acute inhalation study by Korsak et al. 1998. There were no deaths observed in the highest dose from a rat behavioral testing study following 4 hour inhalation of $527 \text{ mg}/\text{m}^3$. This dose was used as a surrogate LC50 in the R232 (1) (f) equation. Annual averaging time. California DTSC: RfC= $1.6\text{E}-01 \mu\text{g}/\text{m}^3$ based on route extrapolation from an</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>IRIS (2003) oral toxicity value (4.0E-3 mg/kg-day) to an inhalation toxicity value: RfC (µg/m³) = RfDo (mg/kg-day) × 80 kg × (1 day/20 m³) × 1000 µg/mg (DTSC MSL, 2015)</p> <p>Massachusetts DEP: TEL/AAL = 14.25 µg/m³. This value is for naphthalene including 2-methylnaphthalene (1990 update). The Threshold Effect Exposure Limit (TEL) and Allowable Ambient Limit (AAL) are health based ambient air guidelines/concentrations for evaluating exposures to ambient air.</p> <p>Other Tier 3: No value is available at this time from these Tier 3 sources/databases: HEAST, NTP ROC, health and environmental agencies of Minnesota, New Jersey, New York, and Texas, WHO (IARC), WHO (IPCS/INCHEM), Canada, The Netherlands (RIVM), ECHA (REACH) and OECD HPV.</p>		
Inhalation Unit Risk Factor (IURF) ((µg/m ³) ⁻¹)	--	NA	MDEQ, 2015	
IURF details	--	<p>Under the Draft Revised Guidelines for Carcinogen Risk Assessment (U.S. EPA, 1999), the data base for 2-methylnaphthalene is inadequate to assess human carcinogenic potential. As such, the data are unsuitable to calculate quantitative cancer risk estimates for humans.</p> <p>Source: IRIS Tox Review, December 2003.</p> <p>Tier 1 and 2 Sources: IRIS: No value available. PPRTV 08/18/2007: Using the draft revised guidelines for carcinogen risk assessment (U.S. EPA, 1999), the IRIS assessment (U.S. EPA, 2003) concluded the data were inadequate for an assessment of human carcinogenic potential of 2-MN. This conclusion was based on the absence of data concerning the carcinogenic potential of 2-MN in humans, by any route of exposure, and limited, equivocal oral evidence in animals. Updated literature searches for this assessment identified no relevant data other than those already considered for the IRIS assessment. Based on the revised guidelines for</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		carcinogen risk assessment (U.S. EPA, 2005), the equivalent carcinogenicity descriptor would be "Inadequate Information to Assess Carcinogenic Potential". MRL: NA; MRLs are for non-cancer effects only. Tier 3 Source: MDEQ: Per DEQ-CCD, no data presented.		
Mutagenic Mode of Action (MMOA)? (Y/N)	--	No	USEPA, 2014	
MMOA Details	--	Not listed as a carcinogen with mutagenic MOA in the USEPA OSWER List.		
Developmental or Reproductive Effector? (Y/N)	--	No, the RfD is not based on a reproductive-developmental effect.	MDEQ, 2015	
Developmental or Reproductive Toxicity Details	--			
State Drinking Water Standard (SDWS) (ug/L)	--	NO	SDWA, 1976	
SDWS details	--	MI Safe Drinking Water Act (SDWA) 1976 PA 399		
Secondary Maximum Contaminant Level (SMCL) (ug/L)	--	NO	SDWA, 1976 and USEPA SMCL List	
SMCL details		MI Safe Drinking Water Act (SDWA) 1976 PA 399 and USEPA SMCL List		
Is there an aesthetic value for drinking water? (Y/N)	NA	Not evaluated.	NA	
Aesthetic value (ug/L)	NA	NA	NA	

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
Aesthetic Value details	NA	NA		
Phytotoxicity Value? (Y/N)	NA	Not evaluated.	NA	
Phytotoxicity details	NA	NA	NA	
Others				

(C) Chemical-specific Exposure 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 (AEd)	---	0.1	MDEQ, 2015	
AEd 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)	19
Updated GSI value (µg/L)	19
Rule 57 Drinking Water Value (µg/L)	600

	Rule 57 Value (µg/L)	Verification Date
Human Non-cancer Values- Drinking water source (HNV-drink)	600	11/2009
Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)	1,000	11/2009
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)	19	9/2009
Aquatic maximum value (AMV)	170	9/2009
Final Acute Value (FAV)	340	9/2009

Sources:

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



(E) Analytical Information

	Value	Source
Target Detection Limit – Soil ($\mu\text{g}/\text{kg}$)	330	MDEQ, 2015
Target Detection Limit – Water ($\mu\text{g}/\text{L}$)	5	MDEQ, 2015
Target Detection Limit – Air (ppbv)	1.70E+01	MDEQ, 2015
Target Detection Limit – Soil Gas (ppbv)	5.70E+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 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