CHEMICAL UPDATE WORKSHEET

Chemical Name:	**Acenaphthene**
CAS #:	**83-32-9**
Revised By:	RRD Toxicology Unit
Revision Date:	September 24, 2015

(A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	154.2	154.21	EPI	EXP
Physical State at ambient temp	Solid	Solid	MDEQ	
Melting Point (˚C)	368	93.40	EPI	EXP
Boiling Point (˚C)	279	279.00	EPI	EXP
Solubility (ug/L)	4240	3.9E+03	EPI	EXP
Vapor Pressure (mmHg at 25˚C)	0.00228	2.15E-03	EPI	EXP
HLC (atm-m^3/mol at 25˚C)	1.55E-4	1.84E-04	EPI	EXP
Log Kow (log P; octanol-water)	3.92	3.92	EPI	EXP
Koc (organic carbon; L/Kg)	7140	5027	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm^2/s)	0.0421	5.06E-02	W9	EST
Diffusivity in Water (Dw; cm^2/s)	7.69E-6	8.33E-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	135	PC	EXP
Lower Explosivity Level (LEL; unit less)	NA	NA	NA	NA
Critical Temperature (K)		8.03E+02	EPA2004	EXP
Enthalpy of Vaporization (cal/mol)		1.22E+04	EPA2004	EXP
Density (g/mL, g/cm^3)		1.222	CRC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm^2)	2.51E-06	6.88E-06	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm^2)	2.51E-06	8.71E-06	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm^2)	3.01E-06	8.71E-06	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm^2)	3.01E-06	8.71E-06	EMSOFT	EST

(B) Toxicity Values/Benchmarks

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
Reference Dose (RfD) (mg/kg/day)	1.8E-1	6.0E-2	IRIS, 1994	
RfD details	Mouse oral subsonic study, NOAEL = 175 mg/kg-d UF = 1000**, Critical Effect = hepatotoxicity (U.S. EPA 1989) *Adjusted to 2 significant figures. **EPA applied an additional uncertainty factor of 3 to account for lack of data in a 2nd species, additional uncertainty factor not applied for criteria derivation per MDEQ policy. CCD/RRD date: 11/15/1989	**Tier 1 Source:** **IRIS:** **Basis:** This value is the only chronic reference dose available. **IRIS (1994) RfD** = 6.0E-2 mg/kg-day. **Critical Study**: U.S. EPA (Environmental Protection Agency). (1989) Subchronic toxicity study in mice with acenaphthene (unpublished draft final report). Prepared by Hazleton Laboratories America, Inc., Rockville, MD (HLA Study No. 2399-127). 627088. (USEPA, 1989) **Method(s)**: CD-1 mice (20/sex/group) were exposed to 0, 175, 350, or 700 mg/kg/day acenaphthene by gavage for 90 days. **Critical effect**: Liver weight changes with hepatocellular hypertrophy and increased cholesterol levels. **End point or Point of Departure (POD):** LOAEL = 350 mg/kg/day **Uncertainty Factors**: UF = 3,000 (10 each for intraspecies variability, interspecies extrapolation and use of a subchronic study, and 3 for database inadequacies) **Source and date:** IRIS, Last revision date - 4/01/1994 **Tier 2 Sources:** **PPRTV**: PPRTV (4/6/2011) refers to the IRIS chronic RfD. A subchronic-pRfD = 2.0E-1 was derived as follows: **Critical Study**: U.S. EPA, 1989 (See IRIS RfD section) **Critical effect**: increased relative liver weight in female mouse **End point or Point of Departure (POD):** $BMDL_{10}$ = 161 mg/kg/day **Uncertainty Factors**: UF = 1,000 (10 each for intraspecies variability, interspecies extrapolation and database inadequacies) **MRL**: Per ATSDR MRL List (12/2014), no oral chronic MRL value at this time. An oral intermediate MRL = 0.6 mg/kg-day based on hepatic effects and UF = 300 was derived on 8/1995. A Toxicological Profile is not available.		Complete

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		Tier 3 Source: **MDEQ**: Per CCD/RRD (11/15/1989), RfD = 1.8E-1 mg/kg-day. See Part 201 RfD details.		
Oral Cancer Slope Factor (CSF) (mg/kg-day)$^{-1}$)	--	NA	MDEQ, 2015	
CSF details	NA	**Carcinogen Weight-of-Evidence (WOE) Class**: "Inadequate Information to Assess Carcinogenic Potential." **IRIS WOE Basis**: No carcinogenicity studies in animals by oral or inhalation routes have been found. The carcinogenicity of acenaphthene after dermal exposure in mice has been investigated in two studies, but both studies were determined to be unsuitable for carcinogenicity risk determination due to a lack of control animals or poor survival. **Source and Date**: PPRTV, 4/06/2011. **Tier 1 and 2 Sources:** **IRIS:** Per IRIS (5/01/1993), no value at this time. **PPRTV:** Per PPRTV (4/6/2011), no value at this time. **MRL:** MRLs are for non-cancer effects only. **Tier 3 Source:** **MDEQ:** Per DEQ-CCD, no value at this time.		Complete
Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (ug/m^3)	2.1E+2	2.1E+2	MDEQ, 1993	
RfC/ITSL details	ITSL based on EPA's RfD of 0.06 mg/kg from an unpublished 90 day mouse gavage	**Tier 3 Source:** **MDEQ:** **Basis:** No Tier 1 or 2 values available. MDEQ selected because a justification is available. Although the justification is dated 1993, the RfC is similar to the 2015 CALEPA value which is also based on a route to route extrapolation. See details		Complete

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
	study. The NOAEL for hepatotoxicity was identified as 175 mg/kg (Wolfe 1989). CCD/AQD Date: 7/19/1993	below. **Tier 1 and 2 Sources:** **IRIS:** Per IRIS (4/1/1994), no value at this time. **PPRTV:** Per PPRTV (4/6/2011), no value at this time. **MRL:** Per ATSDR (12/2014), no inhalation MRL at this time. **Tier 3 Sources:** **MDEQ:** **Basis:** MDEQ-ITSL (1993) = 2.1E+2 ug/m³ is based on a route to route extrapolation of the IRIS RfD of 0.06 mg/kg-day with 24 hour time averaging. **Critical Study:** Wolfe, (1989) Subchronic toxicity study in mice with acenaphthene (unpublished draft final report). Prepared by Hazleton Laboratories America, Inc., Rockville, MD (HLA Study No. 2399-127). 627088. (USEPA, 1989) **Critical effect**: Liver weight changes with hepatocellular hypertrophy and increased cholesterol levels. **End point or Point of Departure (POD):** LOAEL = 350 mg/kg/day **Uncertainty Factors**: UF = 3,000; (10 each for intraspecies variability, interspecies and subchronic-to-chronic extrapolation, and 3 for database deficiency). **Source and date:** MDEQ-AQD; 7/19/1993 **California DTSC (05/2015):** RfC= 2.4E+2 µg/m³ based on route to route extrapolation from an RfD. The basis of the RfD is not immediately available for evaluation. **New Jersey DEP (08/2011):** Benchmark concentration = 9.1E-1 µg/m³. The basis of this value is not immediately available for evaluation. Additionally, it is unclear as is whether this “benchmark concentration” is equivalent to an RfC. **New York DEC (02/2005):** RfC = 210 µg/m³ Based on route to route extrapolation from the EPA IRIS RfD value of 0.06 mg/kg/d, assuming a 70 kg adult breathing 20 m^3 of air per day.		

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
		Other Tier 3: No value is available at this time from these Tier 3 sources/databases: HEAST, NTP ROC, health and environmental agencies of Massachusetts, Minnesota and Texas, WHO (IARC), WHO (IPCS/INCHEM), Canada, ECHA (REACH) and OECD HPV.		
Inhalation Unit Risk Factor (IURF) ((µg/m^3)$^{-1}$)	--	NA	MDEQ, 2015	
IURF details	NA	**Carcinogen Weight-of-Evidence (WOE) Class**: "Inadequate Information to Assess Carcinogenic Potential." **IRIS WOE Basis**: No carcinogenicity studies in animals by oral or inhalation routes have been found. The carcinogenicity of acenaphthene after dermal exposure in the mouse has been investigated in two studies, but both studies were determined to be unsuitable for carcinogenicity risk determination due to a lack of control animals or poor survival. **Source and Date**: PPRTV, 4/06/2011. **Tier 1 and 2 Sources:** **IRIS:** Per IRIS (5/01/1993), no value at this time. **PPRTV:** Per PPRTV (4/6/2011), no value at this time. **MRL:** MRLs are for non-cancer effects only.		Complete
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 or RfC/ITSL 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	

	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
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	
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 details	NA	NA		
Phytotoxicity Value? (Y/N)	NO	Not evaluated.	NA	
Phytotoxicity details	NA	NA		
Others				

(C) Chemical-specific Absorption Factors

	Part 201 Value	Update	Source/Reference/ Dates	Comments/Notes /Issues
Gastrointestinal absorption efficiency value (ABSgi)	---	8.33E-06	MDEQ, 2015/USEPA RAGS-E	
ABSgi details		RAGS E (EPA, 2004) Default Value		
Skin absorption efficiency value (AEd)	---	0.1	MDEQ, 2015	
AEd details				
Ingestion Absorption Efficiency (AEi)		1.0	MDEQ, 2015	
AEi 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)	38
Updated GSI value (µg/L)	38
Rule 57 Drinking Water Value (µg/L)	580

	Rule 57 Value (µg/L)	Verification Date
Human Non-cancer Values- Drinking water source (HNV-drink)	580	3/1999
Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)	890	3/1999
Wildlife Value (WV)	NA	
Human Cancer Values for Drinking Water Source (HCV-drink)	NA	
Human Cancer values for non-drinking water source (HCV-Non-drink)	NA	
Final Chronic Value (FCV)	38	6/2002
Aquatic maximum value (AMV)	100	6/2002
Final Acute Value (FAV)	200	6/2002

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 (μg/kg)	330	MDEQ, 2015
Target Detection Limit – Water (μg/L)	5	MDEQ, 2015
Target Detection Limit – Air (ppbv)	3.30E+01	MDEQ, 2015
Target Detection Limit – Soil Gas (ppbv)	1.10E+03	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