



## CHEMICAL UPDATE WORKSHEET

<b>Chemical Name:</b>	<b>Phenanthrene</b>
<b>CAS #:</b>	<b>85-01-8</b>
<b>Revised By:</b>	RRD Toxicology Unit
<b>Revision Date:</b>	November 24, 2015

### (A) Chemical-Physical Properties

	Part 201 Value	Updated Value	Reference Source	Comments
Molecular Weight (g/mol)	178.24	178.24	EPI	EXP
Physical State at ambient temp	Solid	Solid	MDEQ	
Melting Point (°C)	---	99.24	EPI	EXP
Boiling Point (°C)	340	340.00	EPI	EXP
Solubility (ug/L)	1000	1150	EPI	EXP
Vapor Pressure (mmHg at 25°C)	0.00011	1.21E-04	EPI	EXP
HLC (atm-m <sup>3</sup> /mol at 25°C)	2.3E-5	4.23E-05	EPI	EXP
Log Kow (log P; octanol-water)	4.6	4.46	EPI	EXP
Koc (organic carbon; L/Kg)	33300	1.669E+04	EPI	EST
Ionizing Koc (L/kg)		NR	NA	NA
Diffusivity in Air (Di; cm <sup>2</sup> /s)	0.08	3.75E-02	W9	EST
Diffusivity in Water (Dw; cm <sup>2</sup> /s)	8.0E-6	7.47E-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	171	CRC	EXP
Lower Explosivity Level (LEL; unitless)	NA	NA	NA	NA
Critical Temperature (K)		869	HSDB	EXP
Enthalpy of Vaporization (cal/mol)		NA	NA	NA
Density (g/mL, g/cm <sup>3</sup> )		1.179	PC	EXP
EMSOFT Flux Residential 2 m (mg/day/cm <sup>2</sup> )	9.41E-07	1.55E-06	EMSOFT	EST
EMSOFT Flux Residential 5 m (mg/day/cm <sup>2</sup> )	9.41E-07	1.55E-06	EMSOFT	EST
EMSOFT Flux Nonresidential 2 m (mg/day/cm <sup>2</sup> )	1.23E-06	1.96E-06	EMSOFT	EST
EMSOFT Flux Nonresidential 5 m (mg/day/cm <sup>2</sup> )	1.23E-06	1.96E-06	EMSOFT	EST

**(B) Toxicity Values/Benchmarks**

	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
Reference Dose (RfD) (mg/kg/day)	7.1E-3	3.0E-2	TCEQ, 1993	
RfD details	Per RD: IRIS RfD file empty; Data for naphthalene used with additional 10-fold UF. See attached justification on file.	<p><b>Tier 3 Source:</b>  <b>Texas CEQ:</b>  <b>Basis:</b> No Tier 1 and 2 values are available for phenanthrene. New York (2004) is based on RIVM, 2000 which identifies a TDI of 4E-2 for the noncarcinogenic PAHs with certain # of carbons and is based on the TDIs that are available for several noncarcinogenic PAHs. Texas (2001) RfD is based on pyrene as a chemical surrogate; pyrene RfD = 3.0E-2 mg/kg-day (IRIS, 1990). The IRIS RfD for pyrene is selected because pyrene is structurally similar to phenanthrene (more so than naphthalene) and the IRIS RfD for pyrene is a Tier 1. See details below.</p> <p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> Per IRIS (no RfD assessment date given on IRIS), no value at this time.  <b>PPRTV:</b> Per PPRTV (3/25/2009), no value at this time.  <b>MRL:</b> No MRL record available at this time</p> <p><b>Tier 3 Sources:</b>  <b>Per MDEQ; RfD = 7.1E-3 mg/kg/day</b>  <b>Critical Study:</b> Per DEQ-CCD (calculated 2/9/1993); IRIS RfD file empty; Data for naphthalene used with additional 10-fold UF. Justification available in RRD files.  <b>Method:</b> not listed  <b>Critical effect:</b> not listed  <b>End point or Point of Departure (POD):</b> RD used NOAEL for naphthalene = 7.1E1 mg/kg-day from IRIS; 9/17/1998  <b>Uncertainty Factors:</b> UF for naphthalene is 1000 with an additional 10 fold factor applied for the inadequate toxicological database and for the possibility that phenanthrene is more toxic than naphthalene. .  <b>Source and date:</b> DEQ-RRD-CCD, 2/9/1993</p> <p><b>New York DOH:</b> RfD=0.04 (4.0E-2) mg/kg/day is based on a surrogate derivation</p>		complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<p>applying a RfD of 0.04 mg/kg/day for aromatic compounds to all aromatic petroleum hydrocarbons with effective carbon number 9-16. Based on RIVM (2001).</p> <p><b>Source:</b> New York State Brownfield Cleanup Program, Development of Soil Cleanup Objectives: Technical Support Document, 2006, Appendix A p2, p A624; NYSDOH Toxicity value recommendation:9/2004</p> <p><b>Texas CEQ:</b> RfD = 3.0E-02 mg/kg/day, a TCEQ derived value, is based on a chemical surrogate, pyrene, IRIS RfD of 0.03 mg/kg/day. July 12, 2001. (No further information is available.)</p> <p><b>RIVM:</b> TDI = 40 µg/mg/day (4.0E-1 mg/kg-day). The Tolerable Daily Intake is a risk estimate. Per RIVM report 711701025, the TDI for PAHs considered to be noncarcinogens should be set at 40 and 30 µg/mg/day for aromatic petroleum hydrocarbons with effective carbon number 9 to 16 and &gt;16-35 (e.g. benzo[g,h,i]perylene), respectively. Phenanthrene is considered carcinogenic but its carcinogenic potential is low (&lt;0.001); therefore RIVM applied a 40 µg/mg/day TDI. 2000.</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 and New Jersey, WHO (IARC), WHO (IPCS/INCHEM), Canada, ECHA (REACH) and OECD HPV.</p>		
<b>Oral Cancer Slope Factor (CSF) (mg/kg-day)<sup>-1</sup></b>	--	NA	MDEQ, 2015	
<b>CSF details</b>	<p>No RD entry in EPB-CCD (9/12/11).</p> <p>Per IRIS: quantitative estimate of</p>	<p><b>Critical Study:</b> Per IRIS (12/01/1990); quantitative estimate of carcinogenic risk from oral exposure not available at this time. No human data and inadequate data from a single gavage study in rats and skin painting and injection studies in mice.</p> <p><b>Method(s):</b></p> <p><b>Carcinogen Weight-of-Evidence (WOE) Class:</b> D (Not classifiable as to human carcinogenicity)</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
	carcinogenic risk from oral exposure not available at this time. No human data and inadequate data from a single gavage study in rats and skin painting and injection studies in mice. EPA classification D: not classifiable at to human carcinogenicity. PPRTV (2009): CSF could not be derived due to "lack of suitable human and animal data".	<p><b>IRIS WOE Basis:</b> Based on no human data and inadequate data from a single gavage study in rats and skin painting and injection studies in mice  <b>Source and Date:</b> IRIS (12/01/1990)</p> <p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> Per IRIS (12/01/1990), no value at this time.  <b>PPRTV:</b> Per PPRTV (3/25/2009), no value at this time.  <b>MRL:</b> NA; MRLs are for non-cancer effects only.</p> <p><b>Tier 3 Sources:</b>  <b>MDEQ:</b> Per DEQ-CCD, no value at this time.</p>		
<b>Reference Concentration (RfC) or Initial Threshold Screening Level (ITSL) (<math>\mu\text{g}/\text{m}^3</math>)</b>	1.0E-1	1.0E-1	MDEQ, 1999	
<b>RfC/ITSL details</b>	Per AQD: Available toxicity data were insufficient for	<p><b>Tier 3 Source:</b>  <b>MDEQ:</b>  <b>Basis:</b> MDEQ is the only value returned in the Tier 3 search. See details below.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
	derivation of a screening level, so the ITSL was assigned a <b>default value of 0.1 ug/m<sup>3</sup></b> , annual averaging, per Rules 232(1) (i) and (2) ©. FINAL. AQD calculation date: 9/15/99.	<p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> Per IRIS (9/1/1994), no value at this time.  <b>PPRTV:</b> Per PPRTV (3/25/2009), no value at this time.  <b>MRL:</b> No MRL record available at this time.  <b>Tier 3 Sources:</b>  <b>Per MDEQ/AQD; ITSL = 1.0E-1 µg/m<sup>3</sup></b>  <b>Critical Study:</b> Per AQD (9/15/1999); Available toxicity data were insufficient for derivation of a screening level, so the ITSL was assigned a default value of 0.1 ug/m<sup>3</sup>, annual averaging, per Rules 232(1) (i) and (2) (c).  <b>Method(s):</b> annual averaging time  <b>Critical effect:</b> NA  <b>End point or Point of Departure (POD):</b> AQD default value 0.1 ug/m<sup>3</sup>  <b>Uncertainty Factors:</b> none – default value used.  <b>Source and date:</b> AQD/EPB-CCD (calculation date 9/15/1999)</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, The Netherlands (RIVM), ECHA (REACH) and OECD HPV.</p>		
<b>Inhalation Unit Risk Factor (IURF) ((µg/m<sup>3</sup>)<sup>-1</sup>)</b>	--	NA	MDEQ, 2015	
<b>IURF details</b>		<p><b>Carcinogen Weight-of-Evidence (WOE) Class:</b> D (Not classifiable as to human carcinogenicity)  <b>IRIS WOE Basis:</b> Based on no human data and inadequate data from a single gavage study in rats and skin painting and injection studies in mice  <b>Source and Date:</b> IRIS; 12/01/1990</p> <p><b>Tier 1 and 2 Sources:</b>  <b>IRIS:</b> Per IRIS (12/1/1990), no value at this time.  <b>PPRTV:</b> Per PPRTV (date 3/25/2009), no value at this time.</p>		Complete



	Part 201 Value	Updated Value	Source/Reference/Date	Comments/Notes/Issues
		<b>MRL:</b> NA; MRLs are for non-cancer effects only.  <b>Tier 3 Sources:</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>	--	NA 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 or RfC/ITSL is 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	
<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		



	Part 201 Value	Updated Value	Source/Reference/ Date	Comments/Notes /Issues
Others:				

**(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>	2 (M); 1.4
<b>Updated GSI value (µg/L)</b>	2 (M,X); 1.7
<b>Rule 57 Drinking Water Value (µg/L)</b>	1.7

	<b>Rule 57 Value (µg/L)</b>	<b>Verification Date</b>
<b>Human Non-cancer Values- Drinking water source (HNV-drink)</b>	ID* (1.7)	6/1997
<b>Human Non-Cancer Values- Non-drinking water sources (HNV-Non-drink)</b>	ID* (1.7)	6/1997
<b>Wildlife Value (WV)</b>	NA	NA
<b>Human Cancer Values for Drinking Water Source (HCV-drink)</b>	NA	NA
<b>Human Cancer values for non-drinking water source (HCV-Non-drink)</b>	NA	NA
<b>Final Chronic Value (FCV)</b>	1.7	10/2012
<b>Aquatic maximum value (AMV)</b>	5.7	10/2012
<b>Final Acute Value (FAV)</b>	11	10/2012

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>	2	MDEQ, 2015
<b>Target Detection Limit – Air (ppbv)</b>	1.40E-02	MDEQ, 2015
<b>Target Detection Limit – Soil Gas (ppbv)</b>	4.50E-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