

Summary of Risk for RME Exposure

Pathway	NonThreshold Risks	Threshold Risks Hazard Index
Residents (Chronic Exposures)		
Inhalation of COPC Indoors in Basement		0.00017
Inhalation of COPC Indoors		0.00003
Inhalation of COPC Outdoors		0.0000001
Total Risk		0.00020
Lifetime Risk (Chronic)		
		0.00020

VAPOUR PARTITIONING, EMISSION AND AIR DISPERSION MODEL FOR CONTAMINATED GROUNDWATER
Using USEPA Vapor Migration Guidance (2003), Johnson Ettinger Model

Site Specific Physical Input Parameters	Units	Abbrev.	Value	Comments
Depth of Top of Contaminated Aquifer (BGS)	[m]	d	0.5	Calculated from layers in this instance capillary fringe in layer 2 > thickness of layer 2 therefore capillary fringe = thickness of layer 2 + capillary fringe
Thickness of Capillary Fringe	[m]	cd	0.5	thickness in layer 1 from soil type
Thickness of Vadose Zone	[m]	vd	0.5	Calculated from layers
Average Soil Temperature	[C]	T	25	site-specific assumption
<u>Vadose Zone Layer 1 Characteristics</u>				<u>CRC Care - Sand, Sandy Clay</u>
Depth of Layer 1 from Foundations	[m]	vd1	0.2	
Moisture Content	[ml/g]	mocon	0.0800	Estimated for soil type
Organic Carbon Fraction	-	foc	0.003	Estimated for soil type
Soil Bulk Density	[g/ml]	rhob	1.625	Estimated for soil type
Density of Solids	[g/ml]	sd	2.65	default
Total Soil Porosity	[ml/ml]	theta	0.39	1 - (rhob/sd)
Volumetric Water Content	[ml/ml]	wacon	0.130	mocon*rhob
Volumetric Air Content	[ml/ml]	acon	0.257	theta-wacon
<u>Vadose Zone Layer 2 Characteristics</u>				<u>CRC Care - Silt, Silty Clay</u>
Depth of Layer 2 to Water Table	[m]	vd2	0.3	
Moisture Content	[ml/g]	mocon2	0.22	Estimated for soil type
Organic Carbon Fraction	-	foc2	0.003	Estimated for soil type
Soil Bulk Density	[g/ml]	rhob2	1.367	Estimated for soil type
Density of Solids	[g/ml]	sd2	2.65	default
Total Soil Porosity	[ml/ml]	theta2	0.48	1 - (rhob2/sd2)
Volumetric Water Content	[ml/ml]	wacon2	0.301	mocon2*rhob2
Volumetric Air Content	[ml/ml]	acon2	0.183	theta2-wacon2
<u>Capillary Fringe</u>				
Volumetric Water Content	[ml/ml]	cfwacon	0.45	Value representative of capillary fringe, ASTM (2002)
Volumetric Air Content	[ml/ml]	cfacon	0.03	theta2-cfwacon

Receptor Specific Input Parameters	Units	Abbrev.	Value	Comments
Building Characteristics				Residential - Basement
Depth of Basement	[m]	basement	3	Depth of basement below ground level
Width of Building	[m]	bwidth	40	Site specific assumption
Length of Building	[m]	blength	160	Site specific assumption
Area of Emission - Building Area	[m ²]	emarea	7600	Assume whole building above source
Foundation/wall thickness	[m]	fthick	0.25	Site specific assumption
Height of Room	[m]	boxh	2.7	Assumption for basement
Hourly Volume Exchange of Fresh Air	[exch/hr]	exchanges	1.5	
Fraction of Cracks in Walls and foundation	-	cracks	0.005	Max from CRC CARE 2011
Qbuilding	[cm ³ /s]	Qb	7200000	Calculated from building volume and exchange rate
Qsoil	[cm ³ /s]	Qs	36000	Calculated from default of Qs:Qb (CRC Care 2010)
Ratio of Qs:Qb	-	Qs/Qb	0.005	Defaults are 0.005 (Res) and 0.001 (Comm) (CRC CARE)
Area of Cracks (ACrack)	[cm ²]	Ac	380000	Calculated from building area and crack ratio, USEPA 2003
Volumetric Water Content in foundation/wall cracks	[ml/ml]	fwacon	0.12	Default Value ASTM 1739-95
Volumetric Air Content in foundation/wall cracks	[ml/ml]	facon	0.26	Default Value ASTM 1739-95
Outdoor Air Characteristics				
Length of Contaminated Area	[m]	length	10	site-specific assumption
Width of Contaminated Area	[m]	width	10	site-specific assumption
Wind Speed Outdoors	[m/s]	wspd	4	site-specific assumption
Height of Outdoor Mixing Zone	[m]	outboxh	1.5	Default Value

Chemical Specific Parameters	Water Solubility (mg/L)	MW (g/mol)	Koc (cm ³ /g)	Air Diffusion Coefficient (cm ² /s)	Water Diffusion Coefficient (cm ² /s)	Vapour Pressure (mmHg)	Henry's Law Constant (unitless)
C10-C16 Aromatic	31.26	140.00	3.16E+03	6.00E-02	8.00E-06	0.714	3.40E-01
C10-C16 Aliphatic	0.1	160.00	3.16E+05	5.00E-02	6.00E-06	0.55	1.60E+02

Vapour Transport Calculations	Deff Layer 1 (cm ² /s)	Deff Layer 2 (cm ² /s)	Deff Foundations and Cracks (cm ² /s)	Deff Capillary Fringe (cm ² /s)	Total Effective Diffusion (cm ² /s) to indoor air
C10-C16 Aromatic	4.32E-3	8.99E-4	4.50E-3	9.38E-6	1.86E-5
C10-C16 Aliphatic	3.60E-3	7.48E-4	3.75E-3	1.80E-6	3.60E-6

Phase Partitioning Results	Dissolved Phase Concentration (mg/L)	Vapour Phase Concentration (g/cm ³)	Saturated Vapour Concentration (g/cm ³)	Free Phase Mole Fraction (mol/mol)	Concentration above Free Phase (g/cm ³)	Calculation Vapour Phase Concentration Adopted (g/cm ³)
C10-C16 Aromatic	0.055	1.9E-08	5.4E-06			1.9E-08
C10-C16 Aliphatic	0.055	8.8E-06	4.7E-06			4.7E-06

Calculated Air Concentrations (with advection)	Vapour Phase Concentration at Source (ug/m ³)	Vapour Phase Concentration at Source (mg/m ³)	JE Attenuation Coefficient (unitless)	Indoor Air Concentration (mg/m ³)
C10-C16 Aromatic	1.9E+04	1.9E+01	3.9E-06	7.3E-05
C10-C16 Aliphatic	4.7E+06	4.7E+03	7.6E-07	3.6E-03

[illegible]

Toxicity and Dermal Absorption Parameters

C = calculated from chronic value, Ch = chronic value adopted

[illegible]

Toxicity and Derma

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[illegible]

Chronic Exposures

<p><i>Inhalation Exposure Concentration = Concentration in Air x Intake Factor (ref: USEPA 2009)</i></p> <p><i>NonThreshold Risk = Inhalation Exposure Concentration x Unit Risk</i></p> <p><i>Hazard Quotients = (Inhalation Exposure Concentration/Allowable TC air)</i></p>	
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Add comments regarding concentrations here

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