

Appendix 5B

Volatilisation modelling

Table 5B1a Volatilisation from surface and sub-surface soils, and groundwater to outdoor air and enclosed spaces SAND Soil Type

Chemical	Dair cm ² /s	Dwat cm ² /s	H @ 20°C L-H ₂ O/L-air	Koc	Deff cm ² /s	ks cm ³ H ₂ O/g-soil	Defcrack cm ² /s	Defcap cm ² /s	Deffws (2m) cm ² /s	Deffws (4m) cm ² /s	Deffws (8m) cm ² /s
C ₇ - C ₉	0.06	7.10E-06	1.2E+02	10000	4.7E-03	30	4.68E-03	7.76E-06	2.92E-04	5.49E-04	9.83E-04
C ₁₀ - C ₁₄	0.042	4.80E-06	1.6E+02	1258925	3.3E-03	3776.775	3.28E-03	5.43E-06	2.04E-04	3.84E-04	6.88E-04
C ₁₅ - C ₃₄	0.033	3.80E-06	1.4E+02	501187233	2.6E-03	1503561.699	2.58E-03	4.27E-06	1.60E-04	3.02E-04	5.40E-04
benzene	0.093	1.1E-05	2.2E-01	83	7.3E-03	0.249	7.26E-03	2.17E-05	7.78E-04	1.41E-03	2.36E-03
toluene	0.085	9.40E-06	2.6E-01	302	6.6E-03	0.906	6.63E-03	1.80E-05	6.51E-04	1.19E-03	2.01E-03
ethylbenzene	0.076	8.50E-06	3.2E-01	1096	5.9E-03	3.288	5.93E-03	1.50E-05	5.45E-04	9.99E-04	1.71E-03
xylene	0.072	8.50E-06	2.9E-01	240	5.6E-03	0.72	5.62E-03	1.50E-05	5.43E-04	9.91E-04	1.68E-03
naphthalene	0.072	9.40E-06	4.9E-02	1288	5.6E-03	3.864	5.62E-03	4.66E-05	1.41E-03	2.25E-03	3.22E-03
pyrene	0.048	7.24E-06	2.2E-04	38019	3.9E-03	114.057	3.94E-03	6.40E-03	3.98E-03	3.96E-03	3.95E-03
benzo(a)pyrene	0.05	5.80E-06	2.0E-05	389045	5.6E-03	1167.135	5.63E-03	5.64E-02	5.76E-03	5.69E-03	5.66E-03

Volatilisation Factor - Soil to Outdoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Year Average - Non Carcinogenic</i>						
C ₇ - C ₉	5.12E-04	7.65E-05	6.04E-04	7.65E-05	5.06E-04	7.65E-05
C ₁₀ - C ₁₄	5.47E-05	7.65E-05	4.02E-05	7.65E-05	1.46E-05	7.65E-05
C ₁₅ - C ₃₆	2.24E-06	7.65E-05	1.03E-07	7.65E-05	2.57E-08	7.65E-05
toluene	1.93E-04	7.65E-05	2.06E-04	7.65E-05	1.33E-04	7.65E-05
ethylbenzene	1.10E-04	7.65E-05	1.05E-04	7.65E-05	5.30E-05	7.65E-05
xylene	2.07E-04	7.65E-05	2.24E-04	7.65E-05	1.48E-04	7.65E-05
naphthalene	3.89E-05	7.65E-05	2.37E-05	7.65E-05	7.59E-06	7.65E-05
pyrene	4.06E-07	7.65E-05	3.38E-09	7.65E-05	8.44E-10	7.65E-05
<i>20 Year Average - Carcinogenic</i>						
benzene	1.88E-04	2.68E-05	2.23E-04	2.68E-05	1.88E-04	2.68E-05
benzo(a)pyrene	2.70E-08	2.68E-05	4.28E-11	2.68E-05	1.07E-11	2.68E-05
<i>30 Year Average - Carcinogenic</i>						
benzene	1.54E-04	1.79E-05	1.84E-04	1.79E-05	1.60E-04	1.79E-05
benzo(a)pyrene	2.21E-08	1.79E-05	4.28E-11	1.79E-05	1.07E-11	1.79E-05

Volatilisation Factor - Groundwater to Outdoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	7.78E-03	7.32E-03	6.55E-03
C ₁₀ - C ₁₄	7.25E-03	6.83E-03	6.11E-03
C ₁₅ - C ₃₆	4.81E-03	4.53E-03	4.05E-03
toluene	3.76E-05	3.43E-05	2.91E-05
ethylbenzene	3.88E-05	3.55E-05	3.04E-05
xylene	3.50E-05	3.19E-05	2.71E-05
naphthalene	1.53E-05	1.23E-05	8.75E-06
pyrene	1.95E-07	9.68E-08	4.83E-08
<i>Carcinogenic</i>			
benzene	3.81E-05	3.44E-05	2.88E-05
benzo(a)pyrene	2.56E-08	1.26E-08	6.29E-09

Volatilisation Factor - Soil to Indoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Yearly Average - Non Carcinogenic</i>						
C ₇ - C ₉	4.66E-02	1.54E-02	4.51E-02	1.54E-02	4.05E-02	1.54E-02
C ₁₀ - C ₁₄	6.12E-04	1.54E-02	5.86E-04	1.54E-02	5.13E-04	1.54E-02
C ₁₅ - C ₃₆	1.03E-06	1.54E-02	9.83E-07	1.54E-02	8.60E-07	1.54E-02
toluene	7.45E-03	1.54E-02	7.14E-03	1.54E-02	6.28E-03	1.54E-02
ethylbenzene	2.46E-03	1.54E-02	2.36E-03	1.54E-02	2.07E-03	1.54E-02
xylene	8.56E-03	1.54E-02	8.21E-03	1.54E-02	7.23E-03	1.54E-02
naphthalene	3.11E-04	1.54E-02	2.97E-04	1.54E-02	2.60E-04	1.54E-02
pyrene	3.38E-08	1.54E-02	3.23E-08	1.54E-02	2.83E-08	1.54E-02
<i>20 Year Average - Carcinogenic</i>						
benzene	1.78E-02	5.38E-03	1.72E-02	5.38E-03	1.55E-02	5.38E-03
benzo(a)pyrene	4.28E-10	5.38E-03	4.10E-10	5.38E-03	3.59E-10	5.38E-03
<i>30 Year Average - Carcinogenic</i>						
benzene	1.68E-02	3.59E-03	1.63E-02	3.59E-03	1.48E-02	3.59E-03
benzo(a)pyrene	4.28E-10	3.59E-03	4.10E-10	3.59E-03	3.59E-10	3.59E-03

Volatilisation Factor - Groundwater to Indoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	9.63E-01	9.27E-01	8.63E-01
C ₁₀ - C ₁₄	8.98E-01	8.65E-01	8.05E-01
C ₁₅ - C ₃₆	5.96E-01	5.74E-01	5.34E-01
toluene	3.81E-03	3.63E-03	3.32E-03
ethylbenzene	4.06E-03	3.87E-03	3.55E-03
xylene	3.58E-03	3.41E-03	3.12E-03
naphthalene	8.79E-04	8.20E-04	7.24E-04
pyrene	3.52E-06	3.23E-06	2.77E-06
<i>Carcinogenic</i>			
benzene	3.69E-03	3.51E-03	3.19E-03
benzo(a)pyrene	4.58E-07	4.19E-07	3.59E-07

**Guidelines for the Assessment and Management of Petroleum Hydrocarbon Contaminated Sites in New Zealand
Appendix 5B -Volatilisation Modelling**

**Table 5B2a Preliminary Health Risk Based Acceptance Criteria - Groundwater -
Residential and Agricultural Site Use SAND Soil Type**

Site Use:	Residential	Exposure Frequency:	350 d/yr	Inhalation rate indoor:	15 m ³ /d
Receptor:	Adults	Averaging Time (carc):	70 yr	Inhalation rate outdoor:	20 m ³ /d
		(non carc):	30 yr		
Target Risk:	0.00001	Exposure Dur:	30 yr		
Target HI:	1	Body Weight:	70 kg		

Contaminant	SF (1/mg/kg/d) Inhalation	RfD (mg/kg/d) Inhalation	Acceptable CDI		Volatilisation factor (mg/m ³ /mg/L-H ₂ O)							
			Carcinogenic	Non-car.	Indoors			Outdoors				
			Inhalation	Inhalation	2m	4m	8m	2m	4m	8m		
Alkanes												
C ₇ - C ₉		5		5	9.63E-01	9.27E-01	8.63E-01	7.78E-03	7.32E-03	6.55E-03		
C ₁₀ - C ₁₄		0.3		0.3	8.98E-01	8.65E-01	8.05E-01	7.25E-03	6.83E-03	6.11E-03		
C ₁₅ - C ₃₆		1.5		1.5	5.96E-01	5.74E-01	5.34E-01	4.81E-03	4.53E-03	4.05E-03		
MAHs												
benzene	0.029		3.45E-04		3.69E-03	3.51E-03	3.19E-03	3.81E-05	3.44E-05	2.88E-05		
toluene		0.11		0.11	3.81E-03	3.63E-03	3.32E-03	3.76E-05	3.43E-05	2.91E-05		
ethylbenzene		0.029		0.029	4.06E-03	3.87E-03	3.55E-03	3.88E-05	3.55E-05	3.04E-05		
xylene		0.09		0.09	3.58E-03	3.41E-03	3.12E-03	3.50E-05	3.19E-05	2.71E-05		
Aromatics												
naphthalene		0.004		0.004	8.79E-04	8.20E-04	7.24E-04	1.53E-05	1.23E-05	8.75E-06		
pyrene		0.03		0.03	3.52E-06	3.23E-06	2.77E-06	1.95E-07	9.68E-08	4.83E-08		
benzo (a) pyrene	7.3		1.37E-06		4.58E-07	4.19E-07	3.59E-07	2.56E-08	1.26E-08	6.29E-09		

Contaminant	Risk Based Screening Level (mg/L-H ₂ O)											
	Carcinogenic						Non-carcinogenic					
	Outdoors			Indoors			Outdoors			Indoors		
	2m	4m	8m	2m	4m	8m	2m	4m	8m	2m	4m	8m
Alkanes												
C ₇ - C ₉							2.35E+03	2.49E+03	2.79E+03	2.53E+01	2.62E+01	2.82E+01
C ₁₀ - C ₁₄							1.51E+02	1.60E+02	1.79E+02	1.63E+00	1.69E+00	1.81E+00
C ₁₅ - C ₃₆							1.14E+03	1.21E+03	1.35E+03	1.23E+01	1.27E+01	1.37E+01
MAHs												
benzene	7.72E+01	8.54E+01	1.02E+02	1.06E+00	1.12E+00	1.23E+00						
toluene							1.07E+04	1.17E+04	1.38E+04	1.40E+02	1.47E+02	1.61E+02
ethylbenzene							2.73E+03	2.98E+03	3.48E+03	3.48E+01	3.64E+01	3.98E+01
xylene							9.38E+03	1.03E+04	1.21E+04	1.22E+02	1.29E+02	1.41E+02
PAHs												
naphthalene							9.52E+02	1.19E+03	1.67E+03	2.22E+01	2.37E+01	2.69E+01
pyrene							5.63E+05	1.13E+06	2.27E+06	4.15E+04	4.52E+04	5.28E+04
benzo (a) pyrene	4.56E+02	9.23E+02	1.86E+03	3.40E+01	3.71E+01	4.33E+01						

**Table 5B3a Preliminary Health Risk Based Acceptance Criteria - Groundwater -
Commercial/Industrial Site use SAND Soil Type**

Site Use:	Commercial	Exposure Frequency:	240 d/yr	Inhalation rate indoor:	10 m ³ /d
Receptor:	Workers	Averaging Time (carc):	70 yr	Inhalation rate outdoor:	10 m ³ /d
		(non carc):	20 yr		
Target Risk:	0.00001	Exposure Dur:	20 yr		
Target HI:	1	Body Weight:	70 kg		

Contaminant	SF (1/mg/kg/d)	RfD (mg/kg/d)	Acceptable CDI		Volatilisation factor (mg/m ³ /mg/L-H ₂ O)							
			Carcinogenic	Non-car.	Indoors			Outdoors				
			Inhalation	Inhalation	2m	4m	8m	2m	4m	8m		
Alkanes												
C ₇ - C ₉		5		5	6.42E-01	6.18E-01	5.75E-01	7.78E-03	7.32E-03	6.55E-03		
C ₁₀ - C ₁₄		0.3		0.3	5.99E-01	5.77E-01	5.37E-01	7.25E-03	6.83E-03	6.11E-03		
C ₁₅ - C ₃₆		1.5		1.5	3.97E-01	3.82E-01	3.56E-01	4.81E-03	4.53E-03	4.05E-03		
MAHs												
benzene	0.029		3.45E-04		2.46E-03	2.34E-03	2.13E-03	3.81E-05	3.44E-05	2.88E-05		
toluene		0.11		0.11	2.54E-03	2.42E-03	2.21E-03	3.76E-05	3.43E-05	2.91E-05		
ethylbenzene		0.029		0.029	2.71E-03	2.58E-03	2.37E-03	3.88E-05	3.55E-05	3.04E-05		
xylene		0.09		0.09	2.38E-03	2.27E-03	2.08E-03	3.50E-05	3.19E-05	2.71E-05		
Aromatics												
naphthalene		0.004		0.004	5.86E-04	5.47E-04	4.82E-04	1.53E-05	1.23E-05	8.75E-06		
pyrene		0.03		0.03	2.35E-06	2.15E-06	1.84E-06	1.95E-07	9.68E-08	4.83E-08		
benzo (a) pyrene	7.3		1.37E-06		3.05E-07	2.80E-07	2.40E-07	2.56E-08	1.26E-08	6.29E-09		

Contaminant	Risk Based Screening Level (mg/L-H ₂ O)											
	Carcinogenic						Non-carcinogenic					
	Outdoors			Indoors			Outdoors			Indoors		
	2m	4m	8m	2m	4m	8m	2m	4m	8m	2m	4m	8m
Alkanes												
C ₇ - C ₉							6.85E+03	7.27E+03	8.12E+03	8.29E+01	8.61E+01	9.25E+01
C ₁₀ - C ₁₄							4.40E+02	4.68E+02	5.22E+02	5.33E+00	5.54E+00	5.95E+00
C ₁₅ - C ₃₆							3.32E+03	3.53E+03	3.94E+03	4.02E+01	4.18E+01	4.49E+01
MAHs												
benzene	3.38E+02	3.74E+02	4.46E+02	5.22E+00	5.50E+00	6.04E+00	3.11E+04	3.42E+04	4.03E+04	4.60E+02	4.83E+02	5.29E+02
toluene							7.96E+03	8.69E+03	1.02E+04	1.14E+02	1.20E+02	1.30E+02
ethylbenzene							2.74E+04	3.00E+04	3.53E+04	4.02E+02	4.22E+02	4.61E+02
xylene												
PAHs												
naphthalene							2.78E+03	3.47E+03	4.86E+03	7.27E+01	7.79E+01	8.83E+01
pyrene							1.64E+06	3.30E+06	6.61E+06	1.36E+05	1.48E+05	1.73E+05
benzo (a) pyrene	2.00E+03	4.04E+03	8.12E+03	1.67E+02	1.83E+02	2.13E+02						

Table 5B1b Volatilisation from surface and sub-surface soils, and groundwater to outdoor air and enclosed spaces SILT Soil Type

Chemical	Dair cm ² /s	Dwat cm ² /s	H @ 20°C L-H ₂ O/L-air	Koc	Deff cm ² /s	ks cm ³ H ₂ O/g-soil	Defcrack cm ² /s	Defcap cm ² /s	Defws (2m) cm ² /s	Defws (4m) cm ² /s	Defws (8m) cm ² /s
C ₇ - C ₉	0.06	7.10E-06	1.2E+02	10000	9.8E-04	30	4.68E-03	5.54E-06	3.58E-05	6.91E-05	1.29E-04
C ₁₀ - C ₁₄	0.042	4.80E-06	1.6E+02	1258925	6.9E-04	3776.775	3.28E-03	3.88E-06	2.50E-05	4.83E-05	9.03E-05
C ₁₅ - C ₃₄	0.033	3.80E-06	1.4E+02	501187233	5.4E-04	1503561.699	2.58E-03	3.05E-06	1.97E-05	3.80E-05	7.10E-05
benzene	0.093	1.1E-05	2.2E-01	83	1.5E-03	0.249	7.26E-03	2.15E-05	1.32E-04	2.44E-04	4.20E-04
toluene	0.085	9.40E-06	2.6E-01	302	1.4E-03	0.906	6.63E-03	1.71E-05	1.07E-04	1.98E-04	3.47E-04
ethylbenzene	0.076	8.50E-06	3.2E-01	1096	1.2E-03	3.288	5.93E-03	1.38E-05	8.68E-05	1.62E-04	2.87E-04
xylene	0.072	8.50E-06	2.9E-01	240	1.2E-03	0.72	5.62E-03	1.42E-05	8.85E-05	1.65E-04	2.89E-04
naphthalene	0.072	9.40E-06	4.9E-02	1288	1.2E-03	3.864	5.62E-03	5.61E-05	2.95E-04	4.73E-04	6.77E-04
pyrene	0.048	7.24E-06	2.2E-04	38019	2.9E-03	114.057	3.94E-03	8.49E-03	3.18E-03	3.01E-03	2.93E-03
benzo(a)pyrene	0.05	5.80E-06	2.0E-05	389045	1.9E-02	1167.135	5.63E-03	7.47E-02	2.15E-02	2.02E-02	1.97E-02

Volatilisation Factor - Soil to Outdoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Year Average - Non Carcinogenic</i>						
C ₇ - C ₉	2.48E-04	7.65E-05	2.75E-04	7.65E-05	1.93E-04	7.65E-05
C ₁₀ - C ₁₄	2.51E-05	7.65E-05	1.12E-05	7.65E-05	3.19E-06	7.65E-05
C ₁₅ - C ₃₆	1.02E-06	7.65E-05	2.15E-08	7.65E-05	5.38E-09	7.65E-05
toluene	8.55E-05	7.65E-05	7.55E-05	7.65E-05	3.38E-05	7.65E-05
ethylbenzene	4.99E-05	7.65E-05	3.51E-05	7.65E-05	1.23E-05	7.65E-05
xylene	9.13E-05	7.65E-05	8.23E-05	7.65E-05	3.80E-05	7.65E-05
naphthalene	1.77E-05	7.65E-05	5.99E-06	7.65E-05	1.61E-06	7.65E-05
pyrene	3.46E-07	7.65E-05	2.45E-09	7.65E-05	6.13E-10	7.65E-05
<i>20 Year Average - Carcinogenic</i>						
benzene	7.85E-05	2.68E-05	8.59E-05	2.68E-05	5.85E-05	2.68E-05
benzo(a)pyrene	4.98E-08	2.68E-05	1.46E-10	2.68E-05	3.64E-11	2.68E-05
<i>30 Year Average - Carcinogenic</i>						
benzene	6.41E-05	1.79E-05	7.19E-05	1.79E-05	5.22E-05	1.79E-05
benzo(a)pyrene	4.07E-08	1.79E-05	1.46E-10	1.79E-05	3.64E-11	1.79E-05

Volatilisation Factor - Groundwater to Outdoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	9.55E-04	9.21E-04	8.60E-04
C ₁₀ - C ₁₄	8.90E-04	8.59E-04	8.03E-04
C ₁₅ - C ₃₆	5.90E-04	5.70E-04	5.32E-04
toluene	6.17E-06	5.73E-06	5.02E-06
ethylbenzene	6.17E-06	5.77E-06	5.11E-06
xylene	5.71E-06	5.31E-06	4.66E-06
naphthalene	3.21E-06	2.57E-06	1.84E-06
pyrene	1.55E-07	7.36E-08	3.59E-08
<i>Carcinogenic</i>			
benzene	6.48E-06	5.96E-06	5.14E-06
benzo(a)pyrene	9.56E-08	4.50E-08	2.18E-08

Volatilisation Factor - Soil to Indoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Yearly Average - Non Carcinogenic</i>						
C ₇ - C ₉	3.76E-02	1.54E-02	3.42E-02	1.54E-02	2.57E-02	1.54E-02
C ₁₀ - C ₁₄	5.98E-04	1.54E-02	4.95E-04	1.54E-02	3.15E-04	1.54E-02
C ₁₅ - C ₃₆	1.01E-06	1.54E-02	8.33E-07	1.54E-02	5.28E-07	1.54E-02
toluene	6.39E-03	1.54E-02	5.43E-03	1.54E-02	3.57E-03	1.54E-02
ethylbenzene	2.31E-03	1.54E-02	1.93E-03	1.54E-02	1.24E-03	1.54E-02
xylene	7.20E-03	1.54E-02	6.13E-03	1.54E-02	4.06E-03	1.54E-02
naphthalene	2.98E-04	1.54E-02	2.47E-04	1.54E-02	1.57E-04	1.54E-02
pyrene	3.37E-08	1.54E-02	3.17E-08	1.54E-02	2.66E-08	1.54E-02
<i>20 Year Average - Carcinogenic</i>						
benzene	1.13E-02	5.38E-03	1.02E-02	5.38E-03	7.57E-03	5.38E-03
benzo(a)pyrene	4.30E-10	5.38E-03	4.24E-10	5.38E-03	4.06E-10	5.38E-03
<i>30 Year Average - Carcinogenic</i>						
benzene	1.02E-02	3.59E-03	9.32E-03	3.59E-03	7.13E-03	3.59E-03
benzo(a)pyrene	4.30E-10	3.59E-03	4.24E-10	3.59E-03	4.06E-10	3.59E-03

Volatilisation Factor - Groundwater to Indoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	1.78E-01	1.72E-01	1.62E-01
C ₁₀ - C ₁₄	1.66E-01	1.61E-01	1.51E-01
C ₁₅ - C ₃₆	1.10E-01	1.07E-01	1.00E-01
toluene	1.07E-03	1.00E-03	8.91E-04
ethylbenzene	1.08E-03	1.02E-03	9.15E-04
xylene	9.90E-04	9.30E-04	8.29E-04
naphthalene	4.23E-04	3.64E-04	2.84E-04
pyrene	3.44E-06	3.07E-06	2.52E-06
<i>Carcinogenic</i>			
benzene	1.10E-03	1.02E-03	9.01E-04
benzo(a)pyrene	4.89E-07	4.76E-07	4.51E-07

Table 5B3b Preliminary Health Risk Based Acceptance Criteria - Groundwater, , , , , , , , , , , ,
 Commercial/Industrial Site use
 SILT Soil Type, , , , , , , , , , , ,

Site Use: Commercial Exposure Frequency: 240 d/yr Inhalation rate indoor: 10 m³/d
 Receptor: Workers Averaging Time (carc): 70 yr Inhalation rate outdoor: 10 m³/d
 (non carc): 20 yr
 Target Risk: 0.00001 Exposure Dur: 20 yr
 Target HI: 1 Body Weight: 70 kg

Contaminant	SF (1/mg/kg/d) Inhalation	RfD (mg/kg/d) Inhalation	Acceptable CDI		Volatilisation factor (mg/m ³ /mg/L-H ₂ O)							
			Carcinogeni c	Non-car. Inhalation	Indoors			Outdoors				
					Inhalation	2m	4m	8m	2m	4m	8m	
Alkanes												
C ₇ - C ₉		5		5	1.19E-01	1.15E-01	1.08E-01	9.55E-04	9.21E-04	8.60E-04		
C ₁₀ - C ₁₄		0.3		0.3	1.11E-01	1.07E-01	1.01E-01	8.90E-04	8.59E-04	8.03E-04		
C ₁₅ - C ₃₆		1.5		1.5	7.35E-02	7.11E-02	6.67E-02	5.90E-04	5.70E-04	5.32E-04		
MAHs												
benzene	0.029		3.45E-04		7.33E-04	6.83E-04	6.01E-04	6.48E-06	5.96E-06	5.14E-06		
toluene		0.11		0.11	7.12E-04	6.68E-04	5.94E-04	6.17E-06	5.73E-06	5.02E-06		
ethylbenzene		0.029		0.029	7.21E-04	6.80E-04	6.10E-04	6.17E-06	5.77E-06	5.11E-06		
xylene		0.09		0.09	6.60E-04	6.20E-04	5.53E-04	5.71E-06	5.31E-06	4.66E-06		
PAHs												
naphthalene		0.004		0.004	2.82E-04	2.43E-04	1.90E-04	3.21E-06	2.57E-06	1.84E-06		
pyrene		0.03		0.03	2.30E-06	2.05E-06	1.68E-06	1.55E-07	7.36E-08	3.59E-08		
benzo (a) pyrene	7.3		1.37E-06		3.26E-07	3.17E-07	3.00E-07	9.56E-08	4.50E-08	2.18E-08		

Contaminant	Risk Based Screening Level (mg/L-H ₂ O)											
	Carcinogenic						Non-carcinogenic					
	Outdoors			Indoors			Outdoors			Indoors		
	2m	4m	8m	2m	4m	8m	2m	4m	8m	2m	4m	8m
Alkanes												
C ₇ - C ₉							5.58E+04	5.78E+04	6.19E+04	4.48E+02	4.63E+02	4.94E+02
C ₁₀ - C ₁₄							3.59E+03	3.72E+03	3.98E+03	2.88E+01	2.98E+01	3.18E+01
C ₁₅ - C ₃₆							2.70E+04	2.80E+04	3.00E+04	2.17E+02	2.25E+02	2.39E+02
MAHs												
benzene	1.98E+03	2.16E+03	2.50E+03	1.75E+01	1.88E+01	2.14E+01						
toluene							1.90E+05	2.04E+05	2.33E+05	1.64E+03	1.75E+03	1.97E+03
ethylbenzene							5.00E+04	5.35E+04	6.05E+04	4.28E+02	4.54E+02	5.06E+02
xylene							1.68E+05	1.81E+05	2.06E+05	1.45E+03	1.55E+03	1.73E+03
PAHs												
naphthalene							1.33E+04	1.65E+04	2.31E+04	1.51E+02	1.75E+02	2.25E+02
pyrene							2.06E+06	4.34E+06	8.90E+06	1.39E+05	1.56E+05	1.90E+05
benzo (a) pyrene	5.34E+02	1.13E+03	2.34E+03	1.56E+02	1.61E+02	1.70E+02						

Table 5B1c Volatilisation from surface and sub-surface soils, and groundwater to outdoor air and enclosed spaces SILTY CLAY Soil Type

Chemical	Dair cm ² /s	Dwat cm ² /s	H @ 20°C L-H ₂ O/L-air	Koc	Deff cm ² /s	ks cm ³ H ₂ O/g-soil	Defcrack cm ² /s	Defcap cm ² /s	Deffws (2m) cm ² /s	Deffws (4m) cm ² /s	Deffws (8m) cm ² /s
C ₇ - C ₉	0.06	7.10E-06	1.2E+02	10000	2.1E-05	30	4.68E-03	4.49E-06	8.46E-06	1.20E-05	1.51E-05
C ₁₀ - C ₁₄	0.042	4.80E-06	1.6E+02	1258925	1.4E-05	3776.775	3.28E-03	3.14E-06	5.91E-06	8.37E-06	1.06E-05
C ₁₅ - C ₃₄	0.033	3.80E-06	1.4E+02	501187233	1.1E-05	1503561.699	2.58E-03	2.47E-06	4.65E-06	6.58E-06	8.31E-06
benzene	0.093	1.1E-05	2.2E-01	83	4.5E-05	0.249	7.26E-03	2.22E-05	3.18E-05	3.72E-05	4.06E-05
toluene	0.085	9.40E-06	2.6E-01	302	3.8E-05	0.906	6.63E-03	1.74E-05	2.59E-05	3.09E-05	3.43E-05
ethylbenzene	0.076	8.50E-06	3.2E-01	1096	3.3E-05	3.288	5.93E-03	1.38E-05	2.12E-05	2.57E-05	2.89E-05
xylene	0.072	8.50E-06	2.9E-01	240	3.2E-05	0.72	5.62E-03	1.43E-05	2.15E-05	2.58E-05	2.86E-05
naphthalene	0.072	9.40E-06	4.9E-02	1288	7.4E-05	3.864	5.62E-03	6.40E-05	6.99E-05	7.21E-05	7.32E-05
pyrene	0.048	7.24E-06	2.2E-04	38019	8.6E-03	114.057	3.94E-03	1.01E-02	9.11E-03	8.83E-03	8.70E-03
benzo(a)pyrene	0.05	5.80E-06	2.0E-05	389045	7.5E-02	1167.135	5.63E-03	8.87E-02	8.02E-02	7.77E-02	7.65E-02

Volatilisation Factor - Soil to Outdoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Year Average - Non Carcinogenic</i>						
C ₇ - C ₉	3.84E-05	7.25E-05	2.40E-05	7.25E-05	7.77E-06	7.25E-05
C ₁₀ - C ₁₄	3.53E-06	7.25E-05	2.69E-07	7.25E-05	6.74E-08	7.25E-05
C ₁₅ - C ₃₆	1.44E-07	7.25E-05	4.50E-10	7.25E-05	1.12E-10	7.25E-05
toluene	1.33E-05	7.25E-05	3.65E-06	7.25E-05	9.54E-07	7.25E-05
ethylbenzene	7.80E-06	7.25E-05	1.30E-06	7.25E-05	3.29E-07	7.25E-05
xylene	1.40E-05	7.25E-05	4.04E-06	7.25E-05	1.06E-06	7.25E-05
naphthalene	4.27E-06	7.25E-05	3.92E-07	7.25E-05	9.86E-08	7.25E-05
pyrene	5.82E-07	7.25E-05	7.33E-09	7.25E-05	1.83E-09	7.25E-05
<i>20 Year Average - Carcinogenic</i>						
benzene	1.19E-05	2.54E-05	6.87E-06	2.54E-05	2.14E-06	2.54E-05
benzo(a)pyrene	9.63E-08	2.54E-05	5.74E-10	2.54E-05	1.43E-10	2.54E-05
<i>30 Year Average - Carcinogenic</i>						
benzene	9.70E-06	1.69E-05	6.35E-06	1.69E-05	2.12E-06	1.69E-05
benzo(a)pyrene	7.86E-08	1.69E-05	5.74E-10	1.69E-05	1.43E-10	1.69E-05

Volatilisation Factor - Groundwater to Outdoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	2.25E-04	1.60E-04	1.01E-04
C ₁₀ - C ₁₄	2.10E-04	1.49E-04	9.40E-05
C ₁₅ - C ₃₆	1.39E-04	9.87E-05	6.23E-05
toluene	1.50E-06	8.94E-07	4.95E-07
ethylbenzene	1.50E-06	9.15E-07	5.13E-07
xylene	1.38E-06	8.30E-07	4.61E-07
naphthalene	7.61E-07	3.92E-07	1.99E-07
pyrene	4.45E-07	2.16E-07	1.06E-07
<i>Carcinogenic</i>			
benzene	1.56E-06	9.09E-07	4.97E-07
benzo(a)pyrene	3.56E-07	1.73E-07	8.50E-08

Volatilisation Factor - Soil to Indoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Yearly Average - Non Carcinogenic</i>						
C ₇ - C ₉	8.39E-03	1.46E-02	4.58E-03	1.46E-02	1.53E-03	1.46E-02
C ₁₀ - C ₁₄	2.64E-04	1.46E-02	4.97E-05	1.46E-02	1.33E-05	1.46E-02
C ₁₅ - C ₃₆	4.82E-07	1.46E-02	8.31E-08	1.46E-02	2.21E-08	1.46E-02
toluene	2.13E-03	1.46E-02	6.63E-04	1.46E-02	1.86E-04	1.46E-02
ethylbenzene	9.58E-04	1.46E-02	2.35E-04	1.46E-02	6.44E-05	1.46E-02
xylene	2.30E-03	1.46E-02	7.35E-04	1.46E-02	2.07E-04	1.46E-02
naphthalene	2.09E-04	1.46E-02	6.24E-05	1.46E-02	1.86E-05	1.46E-02
pyrene	3.38E-08	1.46E-02	3.31E-08	1.46E-02	3.10E-08	1.46E-02
<i>20 Year Average - Carcinogenic</i>						
benzene	2.48E-03	5.10E-03	1.28E-03	5.10E-03	4.17E-04	5.10E-03
benzo(a)pyrene	4.30E-10	5.10E-03	4.29E-10	5.10E-03	4.24E-10	5.10E-03
<i>30 Year Average - Carcinogenic</i>						
benzene	2.09E-03	3.40E-03	1.19E-03	3.40E-03	4.13E-04	3.40E-03
benzo(a)pyrene	4.30E-10	3.40E-03	4.29E-10	3.40E-03	4.24E-10	3.40E-03

Volatilisation Factor - Groundwater to Indoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	4.45E-02	3.17E-02	2.01E-02
C ₁₀ - C ₁₄	4.15E-02	2.95E-02	1.87E-02
C ₁₅ - C ₃₆	2.75E-02	1.96E-02	1.24E-02
toluene	2.89E-04	1.75E-04	9.82E-05
ethylbenzene	2.92E-04	1.80E-04	1.02E-04
xylene	2.68E-04	1.63E-04	9.15E-05
naphthalene	1.36E-04	7.41E-05	3.88E-05
pyrene	3.71E-06	3.55E-06	3.28E-06
<i>Carcinogenic</i>			
benzene	3.00E-04	1.78E-04	9.84E-05
benzo(a)pyrene	4.99E-07	4.95E-07	4.88E-07

Table 5B2c Preliminary Health Risk Based Acceptance Criteria - Groundwater - Residential and Agricultural Site Use SILTY CLAY Soil Type

Site Use:	Residential	Exposure Frequency:	350 d/yr	Inhalation rate indoor:	15 m ³ /d
Receptor:	Adults	Averaging Time (carc):	70 yr	Inhalation rate outdoor:	20 m ³ /d
		(non carc):	30 yr		
Target Risk:	0.00001	Exposure Dur:	30 yr		
Target HI:	1	Body Weight:	70 kg		

Contaminant	SF (1/mg/kg/d)	RfD (mg/kg/d)	Acceptable CDI		Volatilisation factor (mg/m ³ /mg/L-H ₂ O)					
			Carcinogenic	Non-car.	Indoors			Outdoors		
			Inhalation	Inhalation	2m	4m	8m	2m	4m	8m
Alkanes C ₇ - C ₉ C ₁₀ - C ₁₄ C ₁₅ - C ₃₆		5 0.3 1.5		5 0.3 1.5	4.45E-02 4.15E-02 2.75E-02	3.17E-02 2.95E-02 1.96E-02	2.01E-02 1.87E-02 1.24E-02	2.25E-04 2.10E-04 1.39E-04	1.60E-04 1.49E-04 9.87E-05	1.01E-04 9.40E-05 6.23E-05
MAHs benzene toluene ethylbenzene xylene	0.029		3.45E-04		3.00E-04 2.89E-04 2.92E-04 2.68E-04	1.78E-04 1.75E-04 1.80E-04 1.63E-04	9.84E-05 9.82E-05 1.02E-04 9.15E-05	1.56E-06 1.50E-06 1.50E-06 1.38E-06	9.09E-07 8.94E-07 9.15E-07 8.30E-07	4.97E-07 4.95E-07 5.13E-07 4.61E-07
PAHs naphthalene pyrene benzo (a) pyrene		0.004 0.03 7.3		0.004 0.03	1.36E-04 3.71E-06 4.99E-07	7.41E-05 3.55E-06 4.95E-07	3.88E-05 3.28E-06 4.88E-07	7.61E-07 4.45E-07 3.56E-07	3.92E-07 2.16E-07 1.73E-07	1.99E-07 1.06E-07 8.50E-08

Contaminant	Risk Based Screening Level (mg/L-H ₂ O)											
	Carcinogenic						Non-carcinogenic					
	Outdoors			Indoors			Outdoors			Indoors		
	2m	4m	8m	2m	4m	8m	2m	4m	8m	2m	4m	8m
Alkanes C ₇ - C ₉ C ₁₀ - C ₁₄ C ₁₅ - C ₃₆							8.09E+04 5.21E+03 3.93E+04	1.14E+05 7.35E+03 5.54E+04	1.81E+05 1.16E+04 8.78E+04	5.47E+02 3.52E+01 2.65E+02	7.68E+02 4.94E+01 3.73E+02	1.21E+03 7.79E+01 5.88E+02
MAHs benzene toluene ethylbenzene xylene	1.89E+03	3.23E+03	5.91E+03	1.31E+01	2.20E+01	3.98E+01	2.68E+05 7.04E+04 2.37E+05	4.49E+05 1.16E+05 3.96E+05	8.11E+05 2.06E+05 7.12E+05	1.85E+03 4.84E+02 1.63E+03	3.05E+03 7.84E+02 2.69E+03	5.45E+03 1.39E+03 4.79E+03
PAHs naphthalene pyrene benzo (a) pyrene	3.27E+01	6.76E+01	1.37E+02	3.12E+01	3.14E+01	3.19E+01	1.92E+04 2.46E+05	3.72E+04 5.07E+05	7.32E+04 1.03E+06	1.43E+02 3.93E+04	2.63E+02 4.11E+04	5.02E+02 4.46E+04

Table 5B1d Volatilisation from surface and sub-surface soils, and groundwater to outdoor air and enclosed spaces, CLAY Soil Type

Chemical	Dair cm ² /s	Dwat cm ² /s	H @ 20°C L-H ₂ O/L-air	Koc	Deff cm ² /s	ks cm ³ H ₂ O/g-soil	Defcrack cm ² /s	Defcap cm ² /s	Deffws (2m) cm ² /s	Deffws (4m) cm ² /s	Deffws (8m) cm ² /s
C ₇ - C ₉	0.06	7.10E-06	1.2E+02	10000	5.5E-07	30	4.68E-03	4.49E-06	9.78E-07	7.03E-07	6.16E-07
C ₁₀ - C ₁₄	0.042	4.80E-06	1.6E+02	1258925	3.8E-07	3776.775	3.28E-03	3.14E-06	6.78E-07	4.87E-07	4.27E-07
C ₁₅ - C ₃₄	0.033	3.80E-06	1.4E+02	501187233	3.0E-07	1503561.699	2.58E-03	2.47E-06	5.35E-07	3.85E-07	3.37E-07
benzene	0.093	1.1E-05	2.2E-01	83	1.8E-05	0.249	7.26E-03	2.22E-05	2.00E-05	1.90E-05	1.86E-05
toluene	0.085	9.40E-06	2.6E-01	302	1.3E-05	0.906	6.63E-03	1.74E-05	1.51E-05	1.41E-05	1.37E-05
ethylbenzene	0.076	8.50E-06	3.2E-01	1096	9.9E-06	3.288	5.93E-03	1.38E-05	1.15E-05	1.06E-05	1.03E-05
xylene	0.072	8.50E-06	2.9E-01	240	1.1E-05	0.72	5.62E-03	1.43E-05	1.23E-05	1.15E-05	1.12E-05
naphthalene	0.072	9.40E-06	4.9E-02	1288	6.7E-05	3.864	5.62E-03	6.40E-05	6.56E-05	6.64E-05	6.68E-05
pyrene	0.048	7.24E-06	2.2E-04	38019	1.1E-02	114.057	3.94E-03	1.01E-02	1.07E-02	1.11E-02	1.12E-02
benzo(a)pyrene	0.05	5.80E-06	2.0E-05	389045	1.0E-01	1167.135	5.63E-03	8.87E-02	9.43E-02	9.74E-02	9.90E-02

Volatilisation Factor - Soil to Outdoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Year Average - Non Carcinogenic</i>						
C ₇ - C ₉	6.54E-06	7.25E-05	9.14E-07	7.25E-05	2.31E-07	7.25E-05
C ₁₀ - C ₁₄	5.75E-07	7.25E-05	7.15E-09	7.25E-05	1.79E-09	7.25E-05
C ₁₅ - C ₃₆	2.35E-08	7.25E-05	1.20E-11	7.25E-05	2.99E-12	7.25E-05
toluene	7.77E-06	7.25E-05	1.28E-06	7.25E-05	3.27E-07	7.25E-05
ethylbenzene	4.27E-06	7.25E-05	3.93E-07	7.25E-05	9.88E-08	7.25E-05
xylene	8.06E-06	7.25E-05	1.38E-06	7.25E-05	3.51E-07	7.25E-05
naphthalene	4.05E-06	7.25E-05	3.53E-07	7.25E-05	8.86E-08	7.25E-05
pyrene	6.72E-07	7.25E-05	9.77E-09	7.25E-05	2.44E-09	7.25E-05
<i>20 Year Average - Carcinogenic</i>						
benzene	7.45E-06	2.54E-05	3.06E-06	2.54E-05	8.51E-07	2.54E-05
benzo(a)pyrene	1.11E-07	2.54E-05	7.67E-10	2.54E-05	1.92E-10	2.54E-05
<i>30 Year Average - Carcinogenic</i>						
benzene	6.08E-06	1.69E-05	2.92E-06	1.69E-05	8.47E-07	1.69E-05
benzo(a)pyrene	9.09E-08	1.69E-05	7.67E-10	1.69E-05	1.92E-10	1.69E-05

Volatilisation Factor - Groundwater to Outdoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	2.61E-05	9.37E-06	4.11E-06
C ₁₀ - C ₁₄	2.41E-05	8.66E-06	3.79E-06
C ₁₅ - C ₃₆	1.61E-05	5.77E-06	2.53E-06
toluene	8.71E-07	4.08E-07	1.98E-07
ethylbenzene	8.19E-07	3.78E-07	1.82E-07
xylene	7.94E-07	3.71E-07	1.80E-07
naphthalene	7.14E-07	3.62E-07	1.82E-07
pyrene	5.23E-07	2.70E-07	1.37E-07
<i>Carcinogenic</i>			
benzene	9.78E-07	4.66E-07	2.27E-07
benzo(a)pyrene	4.19E-07	2.16E-07	1.10E-07

Volatilisation Factor - Soil to Indoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Yearly Average - Non Carcinogenic</i>						
C ₇ - C ₉	1.06E-03	1.46E-02	1.83E-04	1.46E-02	4.64E-05	1.46E-02
C ₁₀ - C ₁₄	1.39E-05	1.46E-02	1.43E-06	1.46E-02	3.59E-07	1.46E-02
C ₁₅ - C ₃₆	2.35E-08	1.46E-02	2.40E-09	1.46E-02	6.01E-10	1.46E-02
toluene	1.19E-03	1.46E-02	2.48E-04	1.46E-02	6.49E-05	1.46E-02
ethylbenzene	4.78E-04	1.46E-02	7.65E-05	1.46E-02	1.97E-05	1.46E-02
xylene	1.26E-03	1.46E-02	2.68E-04	1.46E-02	6.99E-05	1.46E-02
naphthalene	2.02E-04	1.46E-02	5.73E-05	1.46E-02	1.68E-05	1.46E-02
pyrene	3.38E-08	1.46E-02	3.33E-08	1.46E-02	3.17E-08	1.46E-02
<i>20 Year Average - Carcinogenic</i>						
benzene	1.53E-03	5.10E-03	5.91E-04	5.10E-03	1.69E-04	5.10E-03
benzo(a)pyrene	4.30E-10	5.10E-03	4.29E-10	5.10E-03	4.26E-10	5.10E-03
<i>30 Year Average - Carcinogenic</i>						
benzene	1.30E-03	3.40E-03	5.66E-04	3.40E-03	1.68E-04	3.40E-03
benzo(a)pyrene	4.30E-10	3.40E-03	4.29E-10	3.40E-03	4.26E-10	3.40E-03

Volatilisation Factor - Groundwater to Indoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	5.23E-03	1.88E-03	8.25E-04
C ₁₀ - C ₁₄	4.83E-03	1.74E-03	7.62E-04
C ₁₅ - C ₃₆	3.22E-03	1.16E-03	5.08E-04
toluene	1.71E-04	8.12E-05	3.96E-05
ethylbenzene	1.61E-04	7.54E-05	3.65E-05
xylene	1.56E-04	7.38E-05	3.59E-05
naphthalene	1.28E-04	6.86E-05	3.55E-05
pyrene	3.73E-06	3.61E-06	3.39E-06
<i>Carcinogenic</i>			
benzene	1.91E-04	9.23E-05	4.54E-05
benzo(a)pyrene	4.99E-07	4.97E-07	4.91E-07

**Table 5B2d Preliminary Health Risk Based Acceptance Criteria - Groundwater
Residential and Agricultural Site Use CLAY Soil Type**

Site Use: Residential	Exposure Frequency:	350 d/yr	Inhalation rate indoor:	15 m ³ /d
Receptor: Adults	Averaging Time (carc):	70 yr	Inhalation rate outdoor:	20 m ³ /d
	(non carc):	30 yr		
Target Risk:	Exposure Dur:	30 yr		
Target HI:	Body Weight:	70 kg		

Contaminant	SF (1/mg/kg/d)	RfD (mg/kg/d)	Acceptable CDI		Volatilisation factor (mg/m ³ /mg/L-H ₂ O)						
			Carcinogenic	Non-car.	Indoors			Outdoors			
			Inhalation	Inhalation	2m	4m	8m	2m	4m	8m	
Alkanes											
C ₇ - C ₉		5		5	5.23E-03	1.88E-03	8.25E-04	2.61E-05	9.37E-06	4.11E-06	
C ₁₀ - C ₁₄		0.3		0.3	4.83E-03	1.74E-03	7.62E-04	2.41E-05	8.66E-06	3.79E-06	
C ₁₅ - C ₃₆		1.5		1.5	3.22E-03	1.16E-03	5.08E-04	1.61E-05	5.77E-06	2.53E-06	
MAHs											
benzene	0.029		3.45E-04		1.91E-04	9.23E-05	4.54E-05	9.78E-07	4.66E-07	2.27E-07	
toluene		0.11		0.11	1.71E-04	8.12E-05	3.96E-05	8.71E-07	4.08E-07	1.98E-07	
ethylbenzene		0.029		0.029	1.61E-04	7.54E-05	3.65E-05	8.19E-07	3.78E-07	1.82E-07	
xylene		0.09		0.09	1.56E-04	7.38E-05	3.59E-05	7.94E-07	3.71E-07	1.80E-07	
PAHs											
naphthalene		0.004		0.004	1.28E-04	6.86E-05	3.55E-05	7.14E-07	3.62E-07	1.82E-07	
pyrene		0.03		0.03	3.73E-06	3.61E-06	3.39E-06	5.23E-07	2.70E-07	1.37E-07	
benzo (a) pyrene	7.3		1.37E-06		4.99E-07	4.97E-07	4.91E-07	4.19E-07	2.16E-07	1.10E-07	

Contaminant	Risk Based Screening Level (mg/L-H ₂ O)											
	Carcinogenic						Non-carcinogenic					
	Outdoors			Indoors			Outdoors			Indoors		
	2m	4m	8m	2m	4m	8m	2m	4m	8m	2m	4m	8m
Alkanes												
C ₇ - C ₉							7.00E+05	1.95E+06	4.44E+06	4.66E+03	1.29E+04	2.95E+04
C ₁₀ - C ₁₄							4.54E+04	1.26E+05	2.89E+05	3.02E+02	8.40E+02	1.92E+03
C ₁₅ - C ₃₆							3.41E+05	9.49E+05	2.16E+06	2.27E+03	6.30E+03	1.44E+04
MAHs												
benzene	3.00E+03	6.31E+03	1.29E+04	2.05E+01	4.24E+01	8.63E+01						
toluene							4.61E+05	9.83E+05	2.03E+06	3.13E+03	6.60E+03	1.35E+04
ethylbenzene							1.29E+05	2.80E+05	5.81E+05	8.74E+02	1.87E+03	3.87E+03
xylene							4.14E+05	8.85E+05	1.83E+06	2.81E+03	5.93E+03	1.22E+04
PAHs												
naphthalene							2.04E+04	4.04E+04	8.03E+04	1.52E+02	2.84E+02	5.49E+02
pyrene							2.09E+05	4.05E+05	7.97E+05	3.91E+04	4.04E+04	4.30E+04
benzo (a) pyrene	2.78E+01	5.39E+01	1.06E+02	3.12E+01	3.13E+01	3.17E+01						

Table 5B3d Preliminary Health Risk Based Acceptance Criteria - Groundwater - Commercial/Industrial Site use CLAY Soil Type

Site Use:	Commercial	Exposure Frequency:	240 d/yr	Inhalation rate indoor:	10 m ³ /d
Receptor:	Workers	Averaging Time (carc):	70 yr	Inhalation rate outdoor:	10 m ³ /d
		(non carc):	20 yr		
Target Risk:	0.00001	Exposure Dur:	20 yr		
Target HI:	1	Body Weight:	70 kg		

Contaminant	SF (1/mg/kg/d)	RfD (mg/kg/d)	Acceptable CDI		Volatilisation factor (mg/m ³ /mg/L-H ₂ O)							
			Carcinogenic	Non-car.	Indoors			Outdoors				
			Inhalation	Inhalation	2m	4m	8m	2m	4m	8m		
Alkanes												
C ₇ - C ₉		5		5	3.48E-03	1.25E-03	5.50E-04	2.61E-05	9.37E-06	4.11E-06		
C ₁₀ - C ₁₄		0.3		0.3	3.22E-03	1.16E-03	5.08E-04	2.41E-05	8.66E-06	3.79E-06		
C ₁₅ - C ₃₆		1.5		1.5	2.15E-03	7.72E-04	3.39E-04	1.61E-05	5.77E-06	2.53E-06		
MAHs												
benzene	0.029		3.45E-04		1.27E-04	6.15E-05	3.03E-05	9.78E-07	4.66E-07	2.27E-07		
toluene		0.11		0.11	1.14E-04	5.41E-05	2.64E-05	8.71E-07	4.08E-07	1.98E-07		
ethylbenzene		0.029		0.029	1.08E-04	5.02E-05	2.43E-05	8.19E-07	3.78E-07	1.82E-07		
xylene		0.09		0.09	1.04E-04	4.92E-05	2.39E-05	7.94E-07	3.71E-07	1.80E-07		
PAHs												
naphthalene		0.004		0.004	8.57E-05	4.57E-05	2.37E-05	7.14E-07	3.62E-07	1.82E-07		
pyrene		0.03		0.03	2.49E-06	2.41E-06	2.26E-06	5.23E-07	2.70E-07	1.37E-07		
benzo (a) pyrene	7.3		1.37E-06		3.33E-07	3.31E-07	3.27E-07	4.19E-07	2.16E-07	1.10E-07		

Contaminant	Risk Based Screening Level (mg/L-H ₂ O)											
	Carcinogenic						Non-carcinogenic					
	Outdoors			Indoors			Outdoors			Indoors		
	2m	4m	8m	2m	4m	8m	2m	4m	8m	2m	4m	8m
Alkanes												
C ₇ - C ₉							2.04E+06	5.68E+06	1.30E+07	1.53E+04	4.24E+04	9.68E+04
C ₁₀ - C ₁₄							1.32E+05	3.69E+05	8.42E+05	9.91E+02	2.76E+03	6.29E+03
C ₁₅ - C ₃₆							9.94E+05	2.77E+06	6.31E+06	7.44E+03	2.07E+04	4.72E+04
MAHs												
benzene	1.31E+04	2.76E+04	5.65E+04	1.01E+02	2.09E+02	4.25E+02						
toluene							1.34E+06	2.87E+06	5.92E+06	1.03E+04	2.16E+04	4.44E+04
ethylbenzene							3.77E+05	8.16E+05	1.69E+06	2.87E+03	6.15E+03	1.27E+04
xylene							1.21E+06	2.58E+06	5.33E+06	9.20E+03	1.95E+04	4.00E+04
PAHs												
naphthalene							5.96E+04	1.18E+05	2.34E+05	4.97E+02	9.31E+02	1.80E+03
pyrene							6.10E+05	1.18E+06	2.33E+06	1.28E+05	1.33E+05	1.41E+05
benzo (a) pyrene	1.22E+02	2.36E+02	4.64E+02	1.53E+02	1.54E+02	1.56E+02						

Table 5B1e Volatilisation from surface and sub-surface soils, and groundwater to outdoor air and enclosed spaces PUMICE Soil Type

Chemical	Dair cm ² /s	Dwat cm ² /s	H @ 20°C L-H ₂ O/L-air	Koc	Deff cm ² /s	ks cm ³ H ₂ O/g-soil	Defcrack cm ² /s	Defcap cm ² /s	Deffw (2m) cm ² /s	Deffw (4m) cm ² /s	Deffw (8m) cm ² /s
C ₇ - C ₉	0.06	7.10E-06	1.2E+02	10000	9.3E-04	50	4.68E-03	3.72E-06	1.47E-05	2.90E-05	5.62E-05
C ₁₀ - C ₁₄	0.042	4.80E-06	1.6E+02	1258925	6.5E-04	6294.625	3.28E-03	2.60E-06	1.03E-05	2.02E-05	3.93E-05
C ₁₅ - C ₃₄	0.033	3.80E-06	1.4E+02	501187233	5.1E-04	2505936.165	2.58E-03	2.04E-06	8.08E-06	1.59E-05	3.09E-05
benzene	0.093	1.1E-05	2.2E-01	83	1.5E-03	0.415	7.26E-03	2.35E-05	8.97E-05	1.69E-04	3.03E-04
toluene	0.085	9.40E-06	2.6E-01	302	1.3E-03	1.51	6.63E-03	1.81E-05	6.96E-05	1.32E-04	2.40E-04
ethylbenzene	0.076	8.50E-06	3.2E-01	1096	1.2E-03	5.48	5.93E-03	1.41E-05	5.46E-05	1.04E-04	1.92E-04
xylene	0.072	8.50E-06	2.9E-01	240	1.1E-03	1.2	5.62E-03	1.49E-05	5.72E-05	1.09E-04	1.98E-04
naphthalene	0.072	9.40E-06	4.9E-02	1288	1.1E-03	6.44	5.62E-03	7.27E-05	2.44E-04	4.02E-04	5.94E-04
pyrene	0.048	7.24E-06	2.2E-04	38019	4.0E-03	190.095	3.94E-03	1.17E-02	4.84E-03	4.41E-03	4.22E-03
benzo(a)pyrene	0.05	5.80E-06	2.0E-05	389045	3.0E-02	1945.225	5.63E-03	1.03E-01	3.63E-02	3.28E-02	3.12E-02

Volatilisation Factor - Soil to Outdoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Year Average - Non Carcinogenic</i>						
C ₇ - C ₉	1.84E-04	6.85E-05	1.98E-04	6.85E-05	1.31E-04	6.85E-05
C ₁₀ - C ₁₄	1.79E-05	6.85E-05	6.70E-06	6.85E-05	1.83E-06	6.85E-05
C ₁₅ - C ₃₆	7.32E-07	6.85E-05	1.23E-08	6.85E-05	3.07E-09	6.85E-05
toluene	6.18E-05	6.85E-05	5.05E-05	6.85E-05	2.04E-05	6.85E-05
ethylbenzene	3.58E-05	6.85E-05	2.22E-05	6.85E-05	7.17E-06	6.85E-05
xylene	6.62E-05	6.85E-05	5.55E-05	6.85E-05	2.32E-05	6.85E-05
naphthalene	1.27E-05	6.85E-05	3.54E-06	6.85E-05	9.29E-07	6.85E-05
pyrene	3.01E-07	6.85E-05	2.08E-09	6.85E-05	5.20E-10	6.85E-05
<i>20 Year Average - Carcinogenic</i>						
benzene	5.79E-05	2.40E-05	6.15E-05	2.40E-05	3.90E-05	2.40E-05
benzo(a)pyrene	4.56E-08	2.40E-05	1.36E-10	2.40E-05	3.41E-11	2.40E-05
<i>30 Year Average - Carcinogenic</i>						
benzene	4.72E-05	1.60E-05	5.17E-05	1.60E-05	3.53E-05	1.60E-05
benzo(a)pyrene	3.72E-08	1.60E-05	1.36E-10	1.60E-05	3.41E-11	1.60E-05

Volatilisation Factor - Groundwater to Outdoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	3.92E-04	3.86E-04	3.74E-04
C ₁₀ - C ₁₄	3.65E-04	3.60E-04	3.49E-04
C ₁₅ - C ₃₆	2.42E-04	2.39E-04	2.32E-04
toluene	4.02E-06	3.82E-06	3.47E-06
ethylbenzene	3.88E-06	3.71E-06	3.41E-06
xylene	3.69E-06	3.51E-06	3.20E-06
naphthalene	2.66E-06	2.19E-06	1.62E-06
pyrene	2.36E-07	1.08E-07	5.15E-08
<i>Carcinogenic</i>			
benzene	4.39E-06	4.13E-06	3.70E-06
benzo(a)pyrene	1.61E-07	7.28E-08	3.47E-08

Volatilisation Factor - Soil to Indoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Yearly Average - Non Carcinogenic</i>						
C ₇ - C ₉	2.60E-02	1.38E-02	2.33E-02	1.38E-02	1.69E-02	1.38E-02
C ₁₀ - C ₁₄	3.59E-04	1.38E-02	2.95E-04	1.38E-02	1.85E-04	1.38E-02
C ₁₅ - C ₃₆	6.04E-07	1.38E-02	4.95E-07	1.38E-02	3.09E-07	1.38E-02
toluene	4.01E-03	1.38E-02	3.36E-03	1.38E-02	2.16E-03	1.38E-02
ethylbenzene	1.41E-03	1.38E-02	1.16E-03	1.38E-02	7.35E-04	1.38E-02
xylene	4.56E-03	1.38E-02	3.83E-03	1.38E-02	2.47E-03	1.38E-02
naphthalene	1.80E-04	1.38E-02	1.48E-04	1.38E-02	9.29E-05	1.38E-02
pyrene	2.02E-08	1.38E-02	1.94E-08	1.38E-02	1.70E-08	1.38E-02
<i>20 Year Average - Carcinogenic</i>						
benzene	7.73E-03	4.81E-03	6.86E-03	4.81E-03	4.89E-03	4.81E-03
benzo(a)pyrene	2.58E-10	4.81E-03	2.56E-10	4.81E-03	2.49E-10	4.81E-03
<i>30 Year Average - Carcinogenic</i>						
benzene	7.01E-03	3.21E-03	6.32E-03	3.21E-03	4.66E-03	3.21E-03
benzo(a)pyrene	2.58E-10	3.21E-03	2.56E-10	3.21E-03	2.49E-10	3.21E-03

Volatilisation Factor - Groundwater to Indoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	7.64E-02	7.52E-02	7.30E-02
C ₁₀ - C ₁₄	7.12E-02	7.01E-02	6.81E-02
C ₁₅ - C ₃₆	4.72E-02	4.65E-02	4.52E-02
toluene	7.31E-04	6.98E-04	6.40E-04
ethylbenzene	7.14E-04	6.85E-04	6.34E-04
xylene	6.72E-04	6.42E-04	5.90E-04
naphthalene	3.72E-04	3.24E-04	2.57E-04
pyrene	3.58E-06	3.28E-06	2.82E-06
<i>Carcinogenic</i>			
benzene	7.84E-04	7.43E-04	6.73E-04
benzo(a)pyrene	4.95E-07	4.86E-07	4.69E-07

Table 5B1f Volatilisation from surface and sub-surface soils, and groundwater to outdoor air and enclosed spaces, PEATS AND HIGH ORGANIC Soil Type,

Chemical	Dair cm ² /s	Dwat cm ² /s	H @ 20°C L-H ₂ O/L-air	Koc	Defl cm ² /s	ks cm ³ H ₂ O/g-soil	Defcrack cm ² /s	Defcap cm ² /s	Deflws (2m) cm ² /s	Deflws (4m) cm ² /s	Deflws (8m) cm ² /s
C ₇ - C ₉	0.06	7.10E-06	1.2E+02	10000	2.1E-03	1200	4.68E-03	5.30E-06	3.49E-05	6.86E-05	1.33E-04
C ₁₀ - C ₁₄	0.042	4.80E-06	1.6E+02	1258925	1.5E-03	151071	3.28E-03	3.71E-06	2.44E-05	4.80E-05	9.30E-05
C ₁₅ - C ₃₄	0.033	3.80E-06	1.4E+02	501187233	1.2E-03	60142467.96	2.58E-03	2.92E-06	1.92E-05	3.77E-05	7.31E-05
benzene	0.093	1.1E-05	2.2E-01	83	3.3E-03	9.96	7.26E-03	2.16E-05	1.39E-04	2.66E-04	4.92E-04
toluene	0.085	9.40E-06	2.6E-01	302	3.0E-03	36.24	6.63E-03	1.72E-05	1.11E-04	2.14E-04	3.99E-04
ethylbenzene	0.076	8.50E-06	3.2E-01	1096	2.7E-03	131.52	5.93E-03	1.38E-05	8.94E-05	1.73E-04	3.25E-04
xylene	0.072	8.50E-06	2.9E-01	240	2.6E-03	28.8	5.62E-03	1.42E-05	9.16E-05	1.77E-04	3.31E-04
naphthalene	0.072	9.40E-06	4.9E-02	1288	2.6E-03	154.56	5.62E-03	5.76E-05	3.40E-04	6.01E-04	9.73E-04
pyrene	0.048	7.24E-06	2.2E-04	38019	2.9E-03	4562.28	3.94E-03	8.80E-03	3.19E-03	3.02E-03	2.94E-03
benzo(a)pyrene	0.05	5.80E-06	2.0E-05	389045	1.2E-02	46685.4	5.63E-03	7.75E-02	1.38E-02	1.29E-02	1.24E-02

Volatilisation Factor - Soil to Outdoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Yearly Average - Non Carcinogenic</i>						
C ₇ - C ₉	6.18E-05	6.44E-05	5.17E-05	6.44E-05	2.15E-05	6.44E-05
C ₁₀ - C ₁₄	5.36E-06	6.44E-05	6.92E-07	6.44E-05	1.75E-07	6.44E-05
C ₁₅ - C ₃₆	2.19E-07	6.44E-05	1.17E-09	6.44E-05	2.91E-10	6.44E-05
toluene	1.98E-05	6.44E-05	8.44E-06	6.44E-05	2.37E-06	6.44E-05
ethylbenzene	1.09E-05	6.44E-05	2.79E-06	6.44E-05	7.25E-07	6.44E-05
xylene	2.16E-05	6.44E-05	9.84E-06	6.44E-05	2.80E-06	6.44E-05
naphthalene	3.84E-06	6.44E-05	3.58E-07	6.44E-05	8.99E-08	6.44E-05
pyrene	5.02E-08	6.44E-05	6.14E-11	6.44E-05	1.53E-11	6.44E-05
<i>20 Year Average - Carcinogenic</i>						
benzene	2.14E-05	2.25E-05	1.78E-05	2.25E-05	7.35E-06	2.25E-05
benzo(a)pyrene	5.74E-09	2.25E-05	2.29E-12	2.25E-05	5.73E-13	2.25E-05
<i>30 Year Average - Carcinogenic</i>						
benzene	1.74E-05	1.50E-05	1.56E-05	1.50E-05	7.11E-06	1.50E-05
benzo(a)pyrene	4.68E-09	1.50E-05	2.29E-12	1.50E-05	5.73E-13	1.50E-05

Volatilisation Factor - Groundwater to Outdoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	9.30E-04	9.15E-04	8.86E-04
C ₁₀ - C ₁₄	8.67E-04	8.53E-04	8.26E-04
C ₁₅ - C ₃₆	5.75E-04	5.66E-04	5.48E-04
toluene	6.40E-06	6.17E-06	5.76E-06
ethylbenzene	6.36E-06	6.15E-06	5.78E-06
xylene	5.90E-06	5.70E-06	5.33E-06
naphthalene	3.71E-06	3.27E-06	2.65E-06
pyrene	1.56E-07	7.37E-08	3.59E-08
<i>Carcinogenic</i>			
benzene	6.77E-06	6.50E-06	6.02E-06
benzo(a)pyrene	6.13E-08	2.86E-08	1.38E-08

Volatilisation Factor - Soil to Indoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Yearly Average - Non Carcinogenic</i>						
C ₇ - C ₉	2.00E-03	1.29E-02	1.83E-03	1.29E-02	1.42E-03	1.29E-02
C ₁₀ - C ₁₄	1.53E-05	1.29E-02	1.40E-05	1.29E-02	1.08E-05	1.29E-02
C ₁₅ - C ₃₆	2.55E-08	1.29E-02	2.32E-08	1.29E-02	1.79E-08	1.29E-02
toluene	2.09E-04	1.29E-02	1.90E-04	1.29E-02	1.47E-04	1.29E-02
ethylbenzene	6.36E-05	1.29E-02	5.79E-05	1.29E-02	4.46E-05	1.29E-02
xylene	2.48E-04	1.29E-02	2.26E-04	1.29E-02	1.74E-04	1.29E-02
naphthalene	7.86E-06	1.29E-02	7.16E-06	1.29E-02	5.52E-06	1.29E-02
pyrene	8.43E-10	1.29E-02	7.94E-10	1.29E-02	6.65E-10	1.29E-02
<i>20 Year Average - Carcinogenic</i>						
benzene	6.84E-04	4.53E-03	6.25E-04	4.53E-03	4.84E-04	4.53E-03
benzo(a)pyrene	1.07E-11	4.53E-03	1.05E-11	4.53E-03	9.84E-12	4.53E-03
<i>30 Year Average - Carcinogenic</i>						
benzene	6.79E-04	3.02E-03	6.21E-04	3.02E-03	4.82E-04	3.02E-03
benzo(a)pyrene	1.07E-11	3.02E-03	1.05E-11	3.02E-03	9.84E-12	3.02E-03

Volatilisation Factor - Groundwater to Indoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	1.74E-01	1.71E-01	1.66E-01
C ₁₀ - C ₁₄	1.62E-01	1.60E-01	1.55E-01
C ₁₅ - C ₃₆	1.08E-01	1.06E-01	1.03E-01
toluene	1.10E-03	1.07E-03	1.01E-03
ethylbenzene	1.11E-03	1.08E-03	1.02E-03
xylene	1.02E-03	9.89E-04	9.33E-04
naphthalene	4.64E-04	4.28E-04	3.71E-04
pyrene	3.44E-06	3.07E-06	2.52E-06
<i>Carcinogenic</i>			
benzene	1.14E-03	1.10E-03	1.03E-03
benzo(a)pyrene	4.83E-07	4.62E-07	4.25E-07

Table 5B1g Volatilisation from surface and sub-surface soils, and groundwater to outdoor air and enclosed spaces FRACTURED BASALTS with Shallow Overlaying Soil

Chemical	Dair cm ² /s	Dwat cm ² /s	H @ 20°C L-H ₂ O/L-air	Koc	Deff cm ² /s	Deff-over cm ² /s	ks cm ³ H ₂ O/g-soil	Defcrack cm ² /s	Defcap cm ² /s	Deffws (2m) cm ² /s	Deffws (4m) cm ² /s	Deffws (8m) cm ² /s
C ₇ - C ₉	0.06	7.10E-06	1.2E+02	10000	1.1E-03	2.1E-05	10	4.68E-03	9.25E-05	3.99E-05	7.69E-05	1.44E-04
C ₁₀ - C ₁₄	0.042	4.80E-06	1.6E+02	1258925	7.7E-04	1.4E-05	1258.925	3.28E-03	6.47E-05	2.79E-05	5.38E-05	1.01E-04
C ₁₅ - C ₃₄	0.033	3.80E-06	1.4E+02	501187233	6.1E-04	1.1E-05	501187.233	2.58E-03	5.09E-05	2.19E-05	4.23E-05	7.91E-05
benzene	0.093	1.1E-05	2.2E-01	83	1.7E-03	4.5E-05	0.083	7.26E-03	1.44E-04	8.60E-05	1.64E-04	2.99E-04
toluene	0.085	9.40E-06	2.6E-01	302	1.6E-03	3.8E-05	0.302	6.63E-03	1.31E-04	7.40E-05	1.41E-04	2.59E-04
ethylbenzene	0.076	8.50E-06	3.2E-01	1096	1.4E-03	3.3E-05	1.096	5.93E-03	1.17E-04	6.34E-05	1.21E-04	2.23E-04
xylene	0.072	8.50E-06	2.9E-01	240	1.3E-03	3.2E-05	0.24	5.62E-03	1.11E-04	6.21E-05	1.19E-04	2.18E-04
naphthalene	0.072	9.40E-06	4.9E-02	1288	1.3E-03	7.4E-05	1.288	5.62E-03	1.13E-04	1.37E-04	2.48E-04	4.18E-04
pyrene	0.048	7.24E-06	2.2E-04	38019	9.1E-04	8.6E-03	38.019	3.94E-03	5.00E-04	1.58E-03	1.15E-03	1.01E-03
benzo(a)pyrene	0.05	5.80E-06	2.0E-05	389045	1.1E-03	7.5E-02	389.045	5.63E-03	3.83E-03	2.29E-03	1.51E-03	1.29E-03

Volatilisation Factor - Soil to Outdoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Year Average - Non Carcinogenic</i>						
C ₇ - C ₉	5.08E-04	9.66E-05	5.91E-04	9.66E-05	4.72E-04	9.66E-05
C ₁₀ - C ₁₄	5.17E-05	9.66E-05	3.25E-05	9.66E-05	1.06E-05	9.66E-05
C ₁₅ - C ₃₆	2.11E-06	9.66E-05	7.26E-08	9.66E-05	1.82E-08	9.66E-05
toluene	1.85E-04	9.66E-05	1.89E-04	9.66E-05	1.09E-04	9.66E-05
ethylbenzene	1.05E-04	9.66E-05	9.13E-05	9.66E-05	4.02E-05	9.66E-05
xylene	2.00E-04	9.66E-05	2.07E-04	9.66E-05	1.23E-04	9.66E-05
naphthalene	3.69E-05	9.66E-05	1.86E-05	9.66E-05	5.46E-06	9.66E-05
pyrene	3.79E-07	9.66E-05	2.33E-09	9.66E-05	5.82E-10	9.66E-05
<i>20 Year Average - Carcinogenic</i>						
benzene	1.87E-04	3.38E-05	2.18E-04	3.38E-05	1.76E-04	3.38E-05
benzo(a)pyrene	2.35E-08	3.38E-05	2.57E-11	3.38E-05	6.41E-12	3.38E-05
<i>30 Year Average - Carcinogenic</i>						
benzene	1.53E-04	2.25E-05	1.81E-04	2.25E-05	1.52E-04	2.25E-05
benzo(a)pyrene	1.92E-08	2.25E-05	2.57E-11	2.25E-05	6.41E-12	2.25E-05

Volatilisation Factor - Groundwater to Outdoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	1.06E-03	1.03E-03	9.59E-04
C ₁₀ - C ₁₄	9.92E-04	9.57E-04	8.95E-04
C ₁₅ - C ₃₆	6.58E-04	6.35E-04	5.93E-04
toluene	4.28E-06	4.08E-06	3.74E-06
ethylbenzene	4.51E-06	4.31E-06	3.97E-06
xylene	4.00E-06	3.82E-06	3.51E-06
naphthalene	1.49E-06	1.35E-06	1.14E-06
pyrene	7.73E-08	2.81E-08	1.24E-08
<i>Carcinogenic</i>			
benzene	4.21E-06	4.00E-06	3.65E-06
benzo(a)pyrene	1.02E-08	3.35E-09	1.43E-09

Volatilisation Factor - Soil to Indoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Yearly Average - Non Carcinogenic</i>						
C ₇ - C ₉	8.95E-02	1.94E-02	8.40E-02	1.94E-02	6.88E-02	1.94E-02
C ₁₀ - C ₁₄	1.78E-03	1.94E-02	1.51E-03	1.94E-02	9.96E-04	1.94E-02
C ₁₅ - C ₃₆	3.03E-06	1.94E-02	2.55E-06	1.94E-02	1.67E-06	1.94E-02
toluene	1.93E-02	1.94E-02	1.70E-02	1.94E-02	1.20E-02	1.94E-02
ethylbenzene	6.90E-03	1.94E-02	5.93E-03	1.94E-02	4.00E-03	1.94E-02
xylene	2.20E-02	1.94E-02	1.95E-02	1.94E-02	1.39E-02	1.94E-02
naphthalene	9.15E-04	1.94E-02	7.73E-04	1.94E-02	5.09E-04	1.94E-02
pyrene	9.96E-08	1.94E-02	8.36E-08	1.94E-02	5.44E-08	1.94E-02
<i>20 Year Average - Carcinogenic</i>						
benzene	3.35E-02	6.79E-03	3.15E-02	6.79E-03	2.60E-02	6.79E-03
benzo(a)pyrene	1.26E-09	6.79E-03	1.03E-09	6.79E-03	6.45E-10	6.79E-03
<i>30 Year Average - Carcinogenic</i>						
benzene	2.91E-02	4.53E-03	2.76E-02	4.53E-03	2.35E-02	4.53E-03
benzo(a)pyrene	1.26E-09	4.53E-03	1.03E-09	4.53E-03	6.45E-10	4.53E-03

Volatilisation Factor - Groundwater to Indoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	1.97E-01	1.90E-01	1.79E-01
C ₁₀ - C ₁₄	1.84E-01	1.78E-01	1.67E-01
C ₁₅ - C ₃₆	1.22E-01	1.18E-01	1.11E-01
toluene	7.73E-04	7.41E-04	6.85E-04
ethylbenzene	8.18E-04	7.86E-04	7.29E-04
xylene	7.24E-04	6.94E-04	6.42E-04
naphthalene	2.41E-04	2.23E-04	1.93E-04
pyrene	3.10E-06	2.30E-06	1.52E-06
<i>Carcinogenic</i>			
benzene	7.55E-04	7.23E-04	6.66E-04
benzo(a)pyrene	4.03E-07	2.88E-07	1.83E-07

**Table 5B3g Preliminary Health Risk Based Acceptance Criteria - Groundwater
Commercial/Industrial Site use FRACTURED BASALTS with Shallow Overlaying Soil**

Site Use:	Commercial	Exposure Frequency:	240 d/yr	Inhalation rate indoor:	10 m ³ /d
Receptor:	Workers	Averaging Time (carc):	70 yr	Inhalation rate outdoor:	10 m ³ /d
		(non carc):	20 yr		
Target Risk:	0.00001	Exposure Dur:	20 yr		
Target HI:	1	Body Weight:	70 kg		

Contaminant	SF (1/mg/kg/d) Inhalation	RfD (mg/kg/d) Inhalation	Acceptable CDI		Volatilisation factor (mg/m ³ /mg/L-H ₂ O)						
			Carcinogenic	Non-car.	Indoors			Outdoors			
			Inhalation	Inhalation	2m	4m	8m	2m	4m	8m	
Alkanes											
C ₇ - C ₉		5		5	1.31E-01	1.27E-01	1.19E-01	1.06E-03	1.03E-03	9.59E-04	
C ₁₀ - C ₁₄		0.3		0.3	1.22E-01	1.18E-01	1.11E-01	9.92E-04	9.57E-04	8.95E-04	
C ₁₅ - C ₃₆		1.5		1.5	8.12E-02	7.85E-02	7.38E-02	6.58E-04	6.35E-04	5.93E-04	
MAHs											
benzene	0.029		3.45E-04		5.04E-04	4.82E-04	4.44E-04	4.21E-06	4.00E-06	3.65E-06	
toluene		0.11		0.11	5.15E-04	4.94E-04	4.57E-04	4.28E-06	4.08E-06	3.74E-06	
ethylbenzene		0.029		0.029	5.46E-04	5.24E-04	4.86E-04	4.51E-06	4.31E-06	3.97E-06	
xylene		0.09		0.09	4.82E-04	4.63E-04	4.28E-04	4.00E-06	3.82E-06	3.51E-06	
PAHs											
naphthalene		0.004		0.004	1.61E-04	1.48E-04	1.29E-04	1.49E-06	1.35E-06	1.14E-06	
pyrene		0.03		0.03	2.07E-06	1.53E-06	1.01E-06	7.73E-08	2.81E-08	1.24E-08	
benzo (a) pyrene	7.3		1.37E-06		2.69E-07	1.92E-07	1.22E-07	1.02E-08	3.35E-09	1.43E-09	

Table 5B1h Volatilisation from surface and sub-surface soils, and groundwater to outdoor air and enclosed spaces GRAVEL with Overlaying Soil

Chemical	Dair cm ² /s	Dwat cm ² /s	H @ 20°C L-H ₂ O/L-air	Koc	Deff cm ² /s	Deff-over cm ² /s	ks cm ³ H ₂ O/g-soil	Defcrack cm ² /s	Defcap cm ² /s	Deffws (2m) cm ² /s	Deffws (4m) cm ² /s	Deffws (8m) cm ² /s
C ₇ - C ₉	0.06	7.10E-06	1.2E+02	10000	7.6E-03	9.8E-04	10	4.68E-03	1.43E-05	4.30E-04	8.15E-04	1.47E-03
C ₁₀ - C ₁₄	0.042	4.80E-06	1.6E+02	1258925	5.3E-03	6.9E-04	1258.925	3.28E-03	9.99E-06	3.01E-04	5.70E-04	1.03E-03
C ₁₅ - C ₃₄	0.033	3.80E-06	1.4E+02	501187233	4.2E-03	5.4E-04	501187.233	2.58E-03	7.85E-06	2.37E-04	4.48E-04	8.09E-04
benzene	0.093	1.1E-05	2.2E-01	83	1.2E-02	1.5E-03	0.083	7.26E-03	2.78E-05	7.88E-04	1.48E-03	2.62E-03
toluene	0.085	9.40E-06	2.6E-01	302	1.1E-02	1.4E-03	0.302	6.63E-03	2.43E-05	6.98E-04	1.31E-03	2.34E-03
ethylbenzene	0.076	8.50E-06	3.2E-01	1096	9.6E-03	1.2E-03	1.096	5.93E-03	2.11E-05	6.11E-04	1.15E-03	2.05E-03
xylene	0.072	8.50E-06	2.9E-01	240	9.1E-03	1.2E-03	0.24	5.62E-03	2.04E-05	5.89E-04	1.11E-03	1.97E-03
naphthalene	0.072	9.40E-06	4.9E-02	1288	9.1E-03	1.2E-03	1.288	5.62E-03	3.88E-05	8.96E-04	1.63E-03	2.77E-03
pyrene	0.048	7.24E-06	2.2E-04	38019	6.1E-03	2.9E-03	38.019	3.94E-03	3.74E-03	3.85E-03	4.71E-03	5.30E-03
benzo(a)pyrene	0.05	5.80E-06	2.0E-05	389045	6.3E-03	1.9E-02	389.045	5.63E-03	3.28E-02	9.82E-03	7.70E-03	6.95E-03

Volatilisation Factor - Soil to Outdoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Year Average - Non Carcinogenic</i>						
C ₇ - C ₉	9.10E-04	8.05E-05	1.10E-03	8.05E-05	9.90E-04	8.05E-05
C ₁₀ - C ₁₄	1.23E-04	8.05E-05	1.19E-04	8.05E-05	6.18E-05	8.05E-05
C ₁₅ - C ₃₆	5.06E-06	8.05E-05	4.95E-07	8.05E-05	1.25E-07	8.05E-05
toluene	4.26E-04	8.05E-05	4.96E-04	8.05E-05	3.97E-04	8.05E-05
ethylbenzene	2.46E-04	8.05E-05	2.71E-04	8.05E-05	1.87E-04	8.05E-05
xylene	4.54E-04	8.05E-05	5.30E-04	8.05E-05	4.30E-04	8.05E-05
naphthalene	8.80E-05	8.05E-05	7.72E-05	8.05E-05	3.41E-05	8.05E-05
pyrene	8.94E-07	8.05E-05	1.56E-08	8.05E-05	3.89E-09	8.05E-05
<i>20 Year Average - Carcinogenic</i>						
benzene	4.05E-04	2.82E-05	4.94E-04	2.82E-05	4.54E-04	2.82E-05
benzo(a)pyrene	5.10E-08	2.82E-05	1.45E-10	2.82E-05	3.62E-11	2.82E-05
<i>30 Year Average - Carcinogenic</i>						
benzene	3.31E-04	1.88E-05	4.05E-04	1.88E-05	3.79E-04	1.88E-05
benzo(a)pyrene	4.16E-08	1.88E-05	1.45E-10	1.88E-05	3.62E-11	1.88E-05

Volatilisation Factor - Groundwater to Outdoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	1.15E-02	1.09E-02	9.81E-03
C ₁₀ - C ₁₄	1.07E-02	1.01E-02	9.15E-03
C ₁₅ - C ₃₆	7.10E-03	6.72E-03	6.07E-03
toluene	4.04E-05	3.79E-05	3.38E-05
ethylbenzene	4.34E-05	4.08E-05	3.65E-05
xylene	3.79E-05	3.56E-05	3.18E-05
naphthalene	9.75E-06	8.88E-06	7.53E-06
pyrene	1.88E-07	1.15E-07	6.47E-08
<i>Carcinogenic</i>			
benzene	3.85E-05	3.61E-05	3.21E-05
benzo(a)pyrene	4.36E-08	1.71E-08	7.73E-09

Volatilisation Factor - Soil to Indoor Air (Johnson-Ettinger)

Chemical	Soil Volatilisation Factor (kg-soil/m ³ -air)					
	Surface Soil		>1 m		>4m	
	(1)	(2)	(1)	(2)	(1)	(2)
<i>Yearly Average - Non Carcinogenic</i>						
C ₇ - C ₉	8.59E-02	1.62E-02	8.41E-02	1.62E-02	7.87E-02	1.62E-02
C ₁₀ - C ₁₄	1.82E-03	1.62E-02	1.77E-03	1.62E-02	1.62E-03	1.62E-02
C ₁₅ - C ₃₆	3.09E-06	1.62E-02	3.00E-06	1.62E-02	2.76E-06	1.62E-02
toluene	2.11E-02	1.62E-02	2.06E-02	1.62E-02	1.90E-02	1.62E-02
ethylbenzene	7.24E-03	1.62E-02	7.05E-03	1.62E-02	6.48E-03	1.62E-02
xylene	2.38E-02	1.62E-02	2.32E-02	1.62E-02	2.14E-02	1.62E-02
naphthalene	9.34E-04	1.62E-02	9.09E-04	1.62E-02	8.34E-04	1.62E-02
pyrene	1.01E-07	1.62E-02	9.86E-08	1.62E-02	9.01E-08	1.62E-02
<i>20 Year Average - Carcinogenic</i>						
benzene	4.54E-02	5.66E-03	4.46E-02	5.66E-03	4.20E-02	5.66E-03
benzo(a)pyrene	1.29E-09	5.66E-03	1.24E-09	5.66E-03	1.10E-09	5.66E-03
<i>30 Year Average - Carcinogenic</i>						
benzene	4.21E-02	3.77E-03	4.14E-02	3.77E-03	3.93E-02	3.77E-03
benzo(a)pyrene	1.29E-09	3.77E-03	1.24E-09	3.77E-03	1.10E-09	3.77E-03

Volatilisation Factor - Groundwater to Indoor Air

Chemical	GW Volatilisation Factor (L-H ₂ O/m ³ -air)		
	2 m	4 m	8 m
<i>Non-Carcinogenic</i>			
C ₇ - C ₉	1.20E+00	1.17E+00	1.10E+00
C ₁₀ - C ₁₄	1.12E+00	1.09E+00	1.03E+00
C ₁₅ - C ₃₆	7.43E-01	7.22E-01	6.83E-01
toluene	3.95E-03	3.83E-03	3.61E-03
ethylbenzene	4.30E-03	4.17E-03	3.93E-03
xylene	3.72E-03	3.61E-03	3.40E-03
naphthalene	7.55E-04	7.28E-04	6.78E-04
pyrene	3.51E-06	3.32E-06	2.98E-06
<i>Carcinogenic</i>			
benzene	3.71E-03	3.60E-03	3.38E-03
benzo(a)pyrene	4.75E-07	4.38E-07	3.79E-07

