

Enclosure B

Revised SSTC Calculations Scenario 1 and Scenario 2

1. General Information:

Site:Barangaroo

Address:Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000

Client:Lend Lease

Scenario:Scenario 1 - Lower Basement with Commercial Worker (Risk Based Calculations)

Header Colour (Defaults = Blue):

Blue

2. Select Receptor:

Commercial/Industrial

3. Select Exposure Pathways to Include:

Enter "x" in box, or select from dropdown box.

Soil Pathways

Incidental Ingestion of Soil

Dermal Contact with Soil

Inhalation of Surface Soil-Derived Dust in Indoor Air

Inhalation of Surface Soil-Derived Dust in Outdoor Air

Inhalation of Surface Soil-Derived Vapours in Outdoor Air

Inhalation of Soil-Derived Vapours From Excavation (USEPA 2002 method)

Inhalation of Subsurface Soil-Derived Vapours in Indoor Air

Inhalation of Subsurface Soil-Derived Vapours in Outdoor Air

Groundwater Pathways

Inhalation of Groundwater-Derived Vapours in Indoor Air

Inhalation of Groundwater-Derived Vapours in Outdoor Air

Ingestion of Potable Groundwater

Incidental Ingestion of Groundwater (Bathing or Excavation)

Dermal Contact with Groundwater (Bathing or Excavation)

Inhalation of Groundwater Vapours during Irrigation/ Showering

Ingestion of Vegetables Irrigated with Groundwater

Inhalation of Groundwater Vapours (Where GW Enters Trench)

x

Inhalation of vapour emissions from flowing water (groundwater in basement)

Inhalation of Soil Vapour-Derived Vapours in Indoor Air

Inhalation of Soil Vapour-Derived Vapours in Outdoor Air

Y

Soil RBSLs saturation limited?

Y

Groundwater RBSLs solubility limited?

4. Select Chemicals for Quantitative Assessment:	Target Hazard Index	Target Cancer Risk	5. Enter Chemical Concentrations (if only calculating RBSLs, enter 1 for media for which you want RBSLs):	
	default = 1 (or manually overwrite)	default = 1x10 ⁻⁵ (or manually overwrite)	Soil (mg/kg)	Groundwater (mg/L)
Acenaphthene	0.2	1.00E-05	511	4.48
Acenaphthylene	0.2	1.00E-05	1700	43.2
Ammonia	1	1.00E-05		348
Aniline	1	1.00E-05		0.212
Anthracene	0.2	1.00E-05	2150	15.4
Arsenic, Inorganic	1	1.00E-05		0.024
Barium	1	1.00E-05		2.23
Benz(a)anthracene			1470	12.6
Benzene	0.25	1.00E-05	1510	40.2
Benzo(a)pyrene			652	9.26
Benzo(b)fluoranthene			587	8.33
Benzo(g,h,i)perylene			305	4.22
Benzo(k)fluoranthene			231	2.93
Bis(2-ethylhexyl)phalate	1	1.00E-05		0.03
Cadmium (Water)	1	1.00E-05		0.108
Chromium(III), Insoluble Salts	1	1.00E-05	210	0.102
Chromium(VI)	1	1.00E-05	2.3	0.102
Chrysene			771	9.78
Cobalt	1	1.00E-05		0.057
Cresol, m-&p-	1	1.00E-05	2290	436
Cresol, o-	1	1.00E-05		182
Blank				
Dibenz(a,h)anthracene			71.4	0.822
Dibenzofuran	1	1.00E-05	277	10.2
Dimethylphenol, 2,4-	1	1.00E-05		38
Ethylbenzene	0.25	1.00E-05	261	3.02
Fluoranthene			2440	25.9
Fluorene	0.2	1.00E-05	2100	21.1
Indeno(1,2,3-cd)pyrene			247	3.05
Iron	1	1.00E-05	60600	187
Lead and Compounds	1	1.00E-05	13600	0.555
Manganese	1	1.00E-05		4.89
Methylnaphthalene, 2-	0.2	1.00E-05	7650	105
Naphthalene	0.2	1.00E-05	10200	283
Nickel Soluble Salts	1	1.00E-05		0.303
Phenanthrene	0.2	1.00E-05	5180	74.1
Phenol	1	1.00E-05		249
Pyrene	0.2	1.00E-05	2640	27.9
Styrene	1	1.00E-05		0.194
Toluene	0.25	1.00E-05	2650	17.6
TPH C06-C09 aliphatic	0.125	1.00E-05	593	6.08
TPH C10-C14 aliphatic	0.125	1.00E-05	69400	1730
TPH C10-C14 aromatic	0.125	1.00E-05	69400	1730
TPH C15-C28 aliphatic	0.125	1.00E-05	93200	1520
TPH C15-C28 aromatic	0.125	1.00E-05	93200	1520
TPH C29-C36 aliphatic	0.125	1.00E-05	20600	332
TPH C29-C36 aromatic	0.125	1.00E-05	20600	332
Trimethylbenzene, 1,2,4-	1	1.00E-05	220	0.92
Vanadium and compounds	1	1.00E-05	248	0.0228
Xylenes (total)	0.25	1.00E-05	2576	6.7

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

6. Confirm/Modify Exposure Parameters:

		Site-Specific Value (leave blank to use default value)		Value Used in Calculations	
		Adult	Child	Adult	Child
General receptor parameters: Units					
Body weight	kg	70	13	70	13
Exposure duration	yr	30	6	30	6
Averaging time (carcinogens)	yr	70	70	70	70
Averaging time (non-carcinogens)	yr	30	6	30	6
Incidental Soil Ingestion					
Daily soil ingestion rate	mg/day				
Exposure frequency for soil ingestion	days/yr				
Fraction of daily soil intake from site	unitless				
Dermal Absorption of Soil					
Exposed skin surface area for soil contact	cm2				
Soil to skin adherence factor	mg/cm2				
Exposure frequency for dermal contact with soil	days/yr				
Indoor Inhalation					
Exposure time (indoor air)	hrs/day				
Exposure frequency (indoor air)	days/yr				
Particulate emission factor (indoor air)	m3/kg				
Outdoor Inhalation					
Exposure time (outdoor air)	hrs/day				
Exposure frequency (outdoor air)	days/yr				
Particulate emission factor (outdoor air)	m3/kg				
Potable Water Ingestion					
Potable water intake rate	L/day				
Exposure frequency for potable water intake	days/yr				
Incidental Water Ingestion					
Incidental ingestion rate	L/day				
Exposure frequency for incidental water ingestion	days/yr				
Dermal Contact with Water					
Exposed skin surface for water contact	cm2				
Exposure time for dermal water contact	hr/day				
Exposure frequency for dermal water contact	days/yr				
Vapour Inhalation Shower/ Sprinkler					
Exposure frequency	days/yr				
Exposure time	min/ day				
Inhalation rate	m3/hr				
Inhalation Absorption Adjustment Factor	mg/mg				
Lung retention factor	unitless				
Ingestion of Home Grown Produce					
Proportion of homegrown produce ingested					
Exposure frequency	days/year				
Inhalation of Vapours from Flowing Water					
Exposure time	hrs/day	8	1	8	1
Exposure frequency	days/year	240	350	240	350

7. Enter Target Risk Levels for RBSL Calculation (per chemical)

	Target Hazard Index	Target Cancer Risk
Default Values:	1	1.00E-05
Site specific value (optional):		
Value Used in Calculations:	1	1.00E-05

Links to Model Setup:

- [Groundwater to Air Vapour Model Setup](#)
- [Soil to Air Vapour Model Setup](#)
- [Soil Vapour to Air Model Setup](#)
- [Calculation of source vapour concentrations from NAPL](#)
- [Groundwater to Plant Model Setup](#)
- [Shower/ Sprinkler Model](#)
- [Water with Flow](#)
- Links to RBSL and Risk Summaries:
- [RBSL Summary](#)
- [Risk Estimate Summary](#)

Links to Risk Calculation Detail:

- SOIL:
- [Soil Ingestion](#)
- [Soil Dermal Contact](#)
- [Soil-Derived Dust Inhalation - Indoors](#)
- [Soil-Derived Dust Inhalation - Outdoors](#)
- [Inhalation of Surface Soil Derived Vapours - Outdoors](#)
- [Inhalation of Soil Derived Vapours - Excavation](#)
- [Inhalation of Subsurface Soil Derived Vapours - Indoors](#)
- [Inhalation of Subsurface Soil Derived Vapours - Outdoors](#)
- GROUNDWATER:
- [Potable Groundwater Ingestion](#)
- [Incidental Groundwater Ingestion](#)
- [Dermal Contact with Groundwater](#)
- [Inhalation of GW Derived Vapours - Indoors](#)
- [Inhalation of GW Derived Vapours - Outdoors](#)
- [Inhalation of GW Derived Vapour- Shower/Sprinkler](#)
- [Ingestion of homegrown produce](#)
- [Inhalation of GW Vapours - Trench with Pooled Water](#)
- [Inhalation of vapour emissions from water with flow](#)
- SOIL VAPOUR:
- [Inhalation of SV Derived Vapours - Indoors](#)
- [Inhalation of SV Derived Vapours - Outdoors](#)

Links to RBSL Detail:

- [Soil - Adult Threshold](#)
- [Soil - Child Threshold](#)
- [Soil - Non-Threshold](#)
- [Groundwater - Adult Threshold](#)
- [Groundwater - Child Threshold](#)
- [Groundwater - Non-Threshold](#)
- [Soil Vapour - Adult Threshold](#)
- [Soil Vapour - Child Threshold](#)
- [Soil Vapour - Non-Threshold](#)

Calculation of Vapour Emissions from Water with Flow
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Commercial Basement) (Risk Based Calculations)

PARAMETERS								Dimensions of Wet Section of Basement/ Impoundment								Air exchange rate (exchanges/day)				7.60E+01	
Concrete permeability		(select from drop down list)	High permeability		Length (m)		59.0		Windspeed (m/s)		if < 3.5 m/sec		3.00E-02								
Permeability Rate (m/day)			8.6E-02		Width (m)		25.0				if = or > 3.5 m/sec										
Water Temperature (deg. C)			18.0		Depth of Water (m)		0.01														
Dimensions of Basement / Impoundment					Fetch/ Depth (m) ratio of Wet Basement Section		2500														
Height (m)			4.5		Volume of wet basement/ impoundment (m3)		14.8														
Width (m)			50.0		Area covered in water (m2)		1475														
Depth (m)			50.0		Effective diameter of impoundment/ basement) (m)		43.3														
Volume total basement/ impoundment (m3)			11250		Volume of water entering basement (m³/sec)		1.48E-05														
Parameter Definition	Volatile	Chemical Concentration in Water (mg/L)	Molecular weight (g/mol)	Vapour Pressure (mmHg)	Vapour Pressure (atm)	Henry's Law Coefficient (unitless)	Henry's Law Coefficient (calculated)	Equilibrium Coefficient (at 25 deg C)	Diffusivity in Water (cm²/sec)	Schmidt Number on Gas Side (*)	Gas Phase Mass Transfer Coefficient (m/sec)	Schmidt Number on Liquid Side #	Liquid Phase Mass Transfer Coefficient (m/s) <3.5 m/s	Overall Mass Transfer Coefficient (m/s) (windspeed <3.5 m/s)	Adopted Liquid Mass Transfer Coefficient (m/s)	Overall Mass Transfer Coefficient (m/s)	Diffusivity in Air (cm2/sec)	Equilibrium Concentration of water in Basement/ Impoundment (g/m³)	Air Emission Rate from Liquid Surface (g/sec)	Air Emission Rate from Liquid Surface (mg/day)	Adjusted Concentration in Basement Air (includes air exchange) (mg/m3)
		C	MW	Vap	Vap	unitless	atm.m3/g mol	K _{eq}	D _{water}	Sc _G	k _G	Sc _L	K _L	K	K _L	K	D _{air}	C _L	E	E	
Acenaphthene	Y	4.48	154	2.15E-03	2.83E-06	7.52E-03	1.80E-04	7.345E-03	8.33E-06	3.0E+00	9.939E-05	1.08E+03	2.7E-07	2.0E-07	2.7E-07	2.0E-07	0.0506	1.6E-01	4.63E-05	4.00E+03	4.68E-03
Acenaphthylene	Y	43.2	152	6.68E-03	8.79E-06	4.66E-03	1.11E-04	4.551E-03	6.98E-06	3.4E+00	9.188E-05	1.29E+03	2.4E-07	1.5E-07	2.4E-07	1.5E-07	0.045	1.7E+00	3.87E-04	3.34E+04	3.91E-02
Ammonia	Y	348	17	-	-	6.58E-04	1.57E-05	6.427E-04	1.10E-05	6.6E-01	2.725E-04	8.18E+02	3.3E-07	1.1E-07	3.3E-07	1.1E-07	0.228	1.0E+01	1.73E-03	1.49E+05	1.74E-01
Aniline	N	0.212	93.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	Y	15.4	178	6.53E-06	8.59E-09	2.27E-03	5.42E-05	2.217E-03	7.85E-06	3.9E+00	8.348E-05	1.15E+03	2.6E-07	1.1E-07	2.6E-07	1.1E-07	0.039	5.6E-01	9.03E-05	7.80E+03	9.12E-03
Arsenic, Inorganic	N	0.024	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	N	2.23	137	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	N	12.6	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	Y	40.2	78.1	9.48E+01	1.25E-01	2.27E-01	5.42E-03	2.217E-01	1.03E-05	1.7E+00	1.456E-04	8.74E+02	3.2E-07	3.1E-07	3.2E-07	3.1E-07	0.0895	1.2E+00	5.69E-04	4.92E+04	5.75E-02
Benzo(a)pyrene	N	9.26	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	N	8.33	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	N	4.22	276	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	N	2.93	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	N	0.03	391	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	N	0.108	112	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	N	0.102	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	N	0.102	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	N	9.78	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	N	0.057	58.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	N	436	108	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, o-	N	182	108	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	N	0.822	278	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	Y	10.2	168	2.48E-03	3.26E-06	8.71E-03	2.08E-04	8.507E-03	7.38E-06	3.7E+00	8.632E-05	1.22E+03	2.5E-07	1.9E-07	2.5E-07	1.9E-07	0.041	3.9E-01	1.08E-04	9.30E+03	1.09E-02
Dimethylphenol, 2,4-	N	38	122	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	Y	3.02	106	9.60E+00	1.26E-02	3.22E-01	7.69E-03	3.145E-01	8.46E-06	2.2E+00	1.217E-04	1.06E+03	2.8E-07	2.8E-07	2.8E-07	2.8E-07	0.0685	1.1E-01	4.27E-05	3.69E+03	4.31E-03
Fluoranthene	N	25.9	202	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	Y	21.1	166	6.00E-04	7.90E-07	3.93E-03	9.38E-05	3.838E-03	7.89E-06	3.4E+00	9.050E-05	1.14E+03	2.6E-07	1.5E-07	2.6E-07	1.5E-07	0.044	7.7E-01	1.70E-04	1.47E+04	1.72E-02
Indeno(1,2,3-cd)pyrene	N	3.05	276	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	N	187	55.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	N	0.555	207	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	N	4.89	54.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	Y	105	142	5.50E-02	7.24E-05	2.12E-02	5.06E-04	2.071E-02	7.78E-06	2.9E+00	1.017E-04	1.16E+03	2.6E-07	2.3E-07	2.6E-07	2.3E-07	0.0524	3.9E+00	1.33E-03	1.15E+05	1.34E-01
Naphthalene	Y	283	128	8.50E-02	1.12E-04	1.80E-02	4.30E-04	1.758E-02	8.38E-06	2.5E+00	1.120E-04	1.07E+03	2.8E-07	2.4E-07	2.8E-07	2.4E-07	0.0605	9.9E+00	3.53E-03	3.05E+05	3.57E-01
Nickel Soluble Salts	N	0.303	58.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	Y	74.1	178	1.21E-04	1.59E-07	1.73E-03	4.13E-05	1.690E-03	6.69E-06	4.4E+00	7.689E-05	1.35E+03	2.4E-07	8.4E-08	2.4E-07	8.4E-08	0.0345	3.0E+00	3.71E-04	3.21E+04	3.75E-02
Phenol	N	249	94.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	Y	27.9	202	4.50E-06	5.92E-09	4.87E-04	1.16E-05	4.756E-04	7.25E-06	5.4E+00	6.654E-05	1.24E+03	2.5E-07	2.8E-08	2.5E-07	2.8E-08	0.0278	1.1E+00	4.45E-05	3.84E+03	4.49E-03
Styrene	Y	0.194	104	6.40E+00	8.42E-03	1.12E-01	2.67E-03	1.094E-01	8.78E-06	2.1E+00	1.248E-04	1.03E+03	2.8E-07	2.8E-07	2.8E-07	2.8E-07	0.0711	6.6E-03	2.71E-06	2.34E+02	2.74E-04
Toluene	Y	17.6	92.1	2.84E+01	3.74E-02	2.71E-01	6.47E-03	2.647E-01	9.20E-06	1.9E+00	1.326E-04	9.78E+02	2.9E-07	2.9E-07	2.9E-07	2.9E-07	0.0778	5.8E-01	2.49E-04	2.15E+04	2.52E-02
TPH C06-C09 aliphatic	Y	6.08	103	9.16E+01	1.21E-01	5.05E+01	1.21E+00	4.932E+01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.1E-07	3.1E-07	3.1E-07	3.1E-07	0.1	1.9E-01	8.69E-05	7.51E+03	8.78E-03
TPH C10-C14 aliphatic	Y	1730	170	1.16E+00	1.53E-03	6.26E+01	1.49E+00	6.114E+01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.1E-07	3.1E-07	3.1E-07	3.1E-07	0.1	5.4E+01	2.47E-02	2.14E+06	2.50E+00
TPH C10-C14 aromatic	Y	1730	136	1.16E+00	1.53E-03	1.41E-01	3.37E-03	1.377E-01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.1E-07	3.1E-07	3.1E-07	3.1E-07	0.1	5.4E+01	2.44E-02	2.11E+06	2.46E+00
TPH C15-C28 aliphatic	n	1520	260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	n	1520	209	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	n	332	270	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	N	332	240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	Y	0.92	120	2.10E+00	2.76E-03	2.52E-01	6.02E-03	2.461E-01	7.92E-06	2.5E+00	1.123E-04	1.14E+03	2.7E-07	2.6E-07	2.7E-07	2.6E-07	0.0607	3.3E-02	1.30E-05	1.12E+03	1.31E-03
Vanadium and compounds	N	0.0228	50.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	Y	6.7	106	7.99E+00	1.05E-02	2.12E-01	5.06E-03	2.071E-01	9.90E-06	1.8E+00	1.404E-04	9.09E+02	3.1E-07	3.0E-07	3.1E-07	3.0E-07	0.0847	2.1E-01	9.47E-05	8.18E+03	9.57E-03

Summary of Derived RBSLs

Barangaroo

Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000

Scenario 1 - Lower Basement (Commercial Receptor) (Risk Based Calculations)

Chemical	Soil RBSLs (mg/kg)						Groundwater RBSLs (mg/L)					
	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Saturation Limited?	Site Concentration	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Solubility Limited?	Site Concentration
Acenaphthene	-	-	-	-	-	-	1.60E+02	8.75E+02	-	1.60E+02	>Sol	4.48E+00
Acenaphthylene	-	-	-	-	-	-	7.90E+01	4.33E+02	-	7.90E+01	>Sol	4.32E+01
Ammonia	-	-	-	-	-	-	6.32E+02	3.47E+03	-	6.32E+02	-	3.48E+02
Aniline	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	-	-	-	-	-	-	4.56E+00	2.50E+01	-	4.56E+00	>Sol	1.54E+01
Arsenic, Inorganic	-	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	-	-	-	-	-	-	7.65E+00	4.20E+01	1.20E+01	7.65E+00	-	4.02E+01
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, o-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	-	-	-	-	-	-	2.73E+02	1.50E+03	-	2.73E+02	>Sol	1.02E+01
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	-	-	-	-	1.04E+03	5.70E+03	-	1.04E+03	>Sol	3.02E+00
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	-	-	-	-	-	1.25E+01	6.88E+01	-	1.25E+01	>Sol	2.11E+01
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	-	-	-	-	-	-	2.34E+01	1.29E+02	-	2.34E+01	-	1.05E+02
Naphthalene	-	-	-	-	-	-	2.38E-01	1.30E+00	-	2.38E-01	-	2.83E+02
Nickel Soluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	5.87E+00	3.22E+01	-	5.87E+00	>Sol	7.41E+01
Phenol	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	2.88E+00	1.58E+01	-	2.88E+00	>Sol	2.79E+01
Styrene	-	-	-	-	-	-	8.41E+02	4.61E+03	-	8.41E+02	>Sol	1.94E-01
Toluene	-	-	-	-	-	-	3.99E+03	2.19E+04	-	3.99E+03	>Sol	1.76E+01
TPH C06-C09 aliphatic	-	-	-	-	-	-	7.27E+03	3.99E+04	-	7.27E+03	>Sol	6.08E+00
TPH C10-C14 aliphatic	-	-	-	-	-	-	5.70E-01	3.13E+00	-	5.70E-01	>Sol	1.73E+03
TPH C10-C14 aromatic	-	-	-	-	-	-	1.17E+00	6.43E+00	-	1.17E+00	-	1.73E+03
TPH C15-C28 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	-	-	-	-	-	-	2.24E+01	1.23E+02	-	2.24E+01	-	9.20E-01
Vanadium and compounds	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	-	-	-	-	-	-	1.76E+02	9.64E+02	-	1.76E+02	>Sol	6.70E+00

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Pathways included in derivation of Soil RBSL:

Pathways included in derivation of Soil Vapour RBSL:

Pathways included in derivation of Groundwater RBSL:

Scenario 1 - Lower Basement (Commercial Receptor) (Risk Based Calculations)

TOTAL

3.11E+01

5.66E+00

3.36E-05

Groundwater RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Commercial Receptor) (Risk Based Calculations)

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW vapours from flowing water	TOTAL (All Pathways)	GW vapours from flowing water	Total Vapour Pathways	TOTAL (All Pathways)					GW vapours from flowing water	TOTAL
Acenaphthene	4.48	3.90E+00	4.89E-03	4.89E-03	1.25E-03	1.25E-03	1.25E-03	1.60E+02	4.89E-03	4.89E-03	1.60E+02	2.4%	2.44%
Acenaphthylene	43.2	1.61E+01	4.08E-02	4.08E-02	2.53E-03	2.53E-03	2.53E-03	7.90E+01	4.08E-02	4.08E-02	7.90E+01	20.4%	20.39%
Ammonia	348	4.82E+05	5.50E-01	5.50E-01	1.58E-03	1.58E-03	1.58E-03	6.32E+02	1.00E+00	-	6.32E+02	100.0%	100.00%
Aniline	0.212	3.60E+04	-	-	-	-	-	-	-	-	-	-	-
Anthracene	15.4	4.34E-02	1.90E-03	1.90E-03	4.39E-02	4.39E-02	4.39E-02	4.56E+00	1.90E-03	1.90E-03	4.56E+00	1.0%	0.95%
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	-	-	-
Barium	2.23		-	-	-		-	-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	-	-	-
Benzene	40.2	1.79E+03	1.31E+00	1.31E+00	3.27E-02	3.27E-02	3.27E-02	7.65E+00	2.50E-01	-	7.65E+00	100.0%	100.00%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	-	-	-
Cobalt	0.057		-	-	-		-	-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	-	-	-		-	-	-	-	-	-	-
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	1.14E-02	1.14E-02	3.66E-03	3.66E-03	3.66E-03	2.73E+02	1.14E-02	1.14E-02	2.73E+02	1.1%	1.14%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	7.27E-04	7.27E-04	2.41E-04	2.41E-04	2.41E-04	1.04E+03	4.07E-02	4.07E-02	1.04E+03	16.3%	16.28%
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	-	-	-
Fluorene	21.1	1.69E+00	2.69E-02	2.69E-02	1.59E-02	1.59E-02	1.59E-02	1.25E+01	2.69E-02	2.69E-02	1.25E+01	13.5%	13.47%
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	-	-	-
Iron	187		-	-	-		-	-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	-	-	-
Manganese	4.89		-	-	-		-	-	-	-	-	-	-
Methylnaphthalene, 2-Naphthalene	105	2.46E+01	2.10E-01	2.10E-01	8.53E-03	8.53E-03	8.53E-03	2.34E+01	2.00E-01	-	2.34E+01	100.0%	100.00%
	283	3.10E+01	2.61E+01	2.61E+01	8.42E-01	8.42E-01	8.42E-01	2.38E-01	2.00E-01	-	2.38E-01	100.0%	100.00%
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	3.92E-02	3.92E-02	3.41E-02	3.41E-02	3.41E-02	5.87E+00	3.92E-02	3.92E-02	5.87E+00	19.6%	19.58%
Phenol	249	8.28E+04	-	-	-		-	-	-	-	-	-	-
Pyrene	27.9	1.35E-01	9.38E-03	9.38E-03	6.95E-02	6.95E-02	6.95E-02	2.88E+00	9.38E-03	9.38E-03	2.88E+00	4.7%	4.69%
Styrene	0.194	3.10E+02	2.31E-04	2.31E-04	1.19E-03	1.19E-03	1.19E-03	8.41E+02	3.69E-01	3.69E-01	8.41E+02	36.9%	36.86%
Toluene	17.6	5.26E+02	1.10E-03	1.10E-03	6.27E-05	6.27E-05	6.27E-05	3.99E+03	3.30E-02	3.30E-02	3.99E+03	13.2%	13.18%
TPH C06-C09 aliphatic	6.08	1.18E+01	1.05E-04	1.05E-04	1.72E-05	1.72E-05	1.72E-05	7.27E+03	2.03E-04	2.03E-04	7.27E+03	0.2%	0.16%
TPH C10-C14 aliphatic	1730	9.99E-02	2.19E-02	2.19E-02	2.19E-01	2.19E-01	2.19E-01	5.70E-01	2.19E-02	2.19E-02	5.70E-01	17.5%	17.52%
TPH C10-C14 aromatic	1730	2.53E+01	2.70E+00	2.70E+00	1.07E-01	1.07E-01	1.07E-01	1.17E+00	1.25E-01	-	1.17E+00	100.0%	100.00%
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	4.10E-02	4.10E-02	4.45E-02	4.45E-02	4.45E-02	2.24E+01	1.00E+00	-	2.24E+01	100.0%	100.00%
Vanadium and compounds	0.0228	-	-	-	-		-	-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+02	9.54E-03	9.54E-03	1.42E-03	1.42E-03	1.42E-03	1.76E+02	1.51E-01	1.51E-01	1.76E+02	60.3%	60.34%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Child Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Residential Receptor) (Risk Based Calculations)

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW Vapurs from Flowing Water	TOTAL (All Pathways)	GW Vapour from Flowing Water	Total Vapour Pathways	TOTAL (All Pathways)					GW Vapours from Flowing Water	TOTAL
			unitless	unitless	unitless	L/mg	L/mg				mg/L	%	%
Acenaphthene	4.48	3.90E+00	8.91E-04	8.91E-04	2.28E-04	2.28E-04	2.28E-04	8.75E+02	8.91E-04	8.91E-04	8.75E+02	0.4%	0.45%
Acenaphthylene	43.2	1.61E+01	7.43E-03	7.43E-03	4.62E-04	4.62E-04	4.62E-04	4.33E+02	7.43E-03	7.43E-03	4.33E+02	3.7%	3.72%
Ammonia	348	4.82E+05	1.00E-01	1.00E-01	2.88E-04	2.88E-04	2.88E-04	3.47E+03	1.00E+00	-	3.47E+03	100.0%	100.00%
Aniline	0.212	3.60E+04	-	-	-	-	-	-	-	-	-	-	-
Anthracene	15.4	4.34E-02	3.47E-04	3.47E-04	8.00E-03	8.00E-03	8.00E-03	2.50E+01	3.47E-04	3.47E-04	2.50E+01	0.2%	0.17%
Arsenic, Inorganic	0.024		-	-	-	-	-	-	-	-	-	-	-
Barium	2.23		-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-	-	-	-	-	-	-	-	-
Benzene	40.2	1.79E+03	2.39E-01	2.39E-01	5.95E-03	5.95E-03	5.95E-03	4.20E+01	2.50E-01	-	4.20E+01	100.0%	100.00%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-	-	-	-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-	-	-	-	-	-	-	-	-
Cobalt	0.057		-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	-	-	-	-	-	-	-	-	-	-	-
Cresol, o-	182	2.59E+04	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	2.07E-03	2.07E-03	6.68E-04	6.68E-04	6.68E-04	1.50E+03	2.07E-03	2.07E-03	1.50E+03	0.2%	0.21%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	1.33E-04	1.33E-04	4.39E-05	4.39E-05	4.39E-05	5.70E+03	7.42E-03	7.42E-03	5.70E+03	3.0%	2.97%
Fluoranthene	25.9	2.60E-01	-	-	-	-	-	-	-	-	-	-	-
Fluorene	21.1	1.69E+00	4.91E-03	4.91E-03	2.91E-03	2.91E-03	2.91E-03	6.88E+01	4.91E-03	4.91E-03	6.88E+01	2.5%	2.45%
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-	-	-	-	-	-	-	-	-
Iron	187		-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-	-	-	-	-	-	-	-	-
Manganese	4.89		-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-Naphthalene	105	2.46E+01	3.83E-02	3.83E-02	1.56E-03	1.56E-03	1.56E-03	1.29E+02	3.83E-02	3.83E-02	1.29E+02	19.1%	19.13%
	283	3.10E+01	4.76E+00	4.76E+00	1.53E-01	1.53E-01	1.53E-01	1.30E+00	2.00E-01	-	1.30E+00	100.0%	100.00%
Nickel Soluble Salts	0.303		-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	7.14E-03	7.14E-03	6.21E-03	6.21E-03	6.21E-03	3.22E+01	7.14E-03	7.14E-03	3.22E+01	3.6%	3.57%
Phenol	249	8.28E+04	-	-	-	-	-	-	-	-	-	-	-
Pyrene	27.9	1.35E-01	1.71E-03	1.71E-03	1.27E-02	1.27E-02	1.27E-02	1.58E+01	1.71E-03	1.71E-03	1.58E+01	0.9%	0.85%
Styrene	0.194	3.10E+02	4.20E-05	4.20E-05	2.17E-04	2.17E-04	2.17E-04	4.61E+03	6.72E-02	6.72E-02	4.61E+03	6.7%	6.72%
Toluene	17.6	5.26E+02	2.01E-04	2.01E-04	1.14E-05	1.14E-05	1.14E-05	2.19E+04	6.01E-03	6.01E-03	2.19E+04	2.4%	2.40%
TPH C06-C09 aliphatic	6.08	1.18E+01	1.91E-05	1.91E-05	3.14E-06	3.14E-06	3.14E-06	3.99E+04	3.70E-05	3.70E-05	3.99E+04	0.0%	0.03%
TPH C10-C14 aliphatic	1730	9.99E-02	3.99E-03	3.99E-03	4.00E-02	4.00E-02	4.00E-02	3.13E+00	3.99E-03	3.99E-03	3.13E+00	3.2%	3.19%
TPH C10-C14 aromatic	1730	2.53E+01	4.92E-01	4.92E-01	1.94E-02	1.94E-02	1.94E-02	6.43E+00	1.25E-01	-	6.43E+00	100.0%	100.00%
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	7.47E-03	7.47E-03	8.12E-03	8.12E-03	8.12E-03	1.23E+02	4.63E-01	4.63E-01	1.23E+02	46.3%	46.29%
Vanadium and compounds	0.0228	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+02	1.74E-03	1.74E-03	2.59E-04	2.59E-04	2.59E-04	9.64E+02	2.75E-02	2.75E-02	9.64E+02	11.0%	11.00%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Non-Threshold Health Effects
Barangaroo Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Commercial Receptor) (Risk Based Calculations)

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (ILCR)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW Vapours from Flowing Water	TOTAL (All Pathways)	GW Vapours from Flowing Water	Total Vapour Pathways	TOTAL (All Pathways)				GW Vapours from Flowing Water	TOTAL
	mg/L	mg/L	unitless	unitless	L/mg	L/mg	L/mg	mg/L		mg/L	%	%
Acenaphthene	4.48	3.90E+00	-	-	-		-	-	-	-	-	-
Acenaphthylene	43.2	1.61E+01	-	-	-		-	-	-	-	-	-
Ammonia	348	4.82E+05	-	-	-		-	-	-	-	-	-
Aniline	0.212	3.60E+04	-	-	-		-	-	-	-	-	-
Anthracene	15.4	4.34E-02	-	-	-		-	-	-	-	-	-
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	-	-
Barium	2.23		-	-	-		-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	-	-
Benzene	40.2	1.79E+03	3.36E-05	3.36E-05	8.36E-07	8.36E-07	8.36E-07	1.20E+01	1.00E-05	1.20E+01	100.00%	100.00%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	-	-
Cobalt	0.057		-	-	-		-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	-	-	-		-	-	-	-	-	-
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	-	-	-		-	-	-	-	-	-
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	-	-	-		-	-	-	-	-	-
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	-	-
Fluorene	21.1	1.69E+00	-	-	-		-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	-	-
Iron	187		-	-	-		-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	-	-
Manganese	4.89		-	-	-		-	-	-	-	-	-
Methylnaphthalene, 2-	105	2.46E+01	-	-	-		-	-	-	-	-	-
Naphthalene	283	3.10E+01	-	-	-		-	-	-	-	-	-
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	-	-	-		-	-	-	-	-	-
Phenol	249	8.28E+04	-	-	-		-	-	-	-	-	-
Pyrene	27.9	1.35E-01	-	-	-		-	-	-	-	-	-
Styrene	0.194	3.10E+02	-	-	-		-	-	-	-	-	-
Toluene	17.6	5.26E+02	-	-	-		-	-	-	-	-	-
TPH C06-C09 aliphatic	6.08	1.18E+01	-	-	-		-	-	-	-	-	-
TPH C10-C14 aliphatic	1730	9.99E-02	-	-	-		-	-	-	-	-	-
TPH C10-C14 aromatic	1730	2.53E+01	-	-	-		-	-	-	-	-	-
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	-	-	-		-	-	-	-	-	-
Vanadium and compounds	0.0228	-	-	-	-		-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+02	-	-	-		-	-	-	-	-	-

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

1. General Information:

Site:	Barangaroo
Address:	Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Client:	Lend Lease
Scenario:	Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations)

Header Colour (Defaults = Blue):

Blue

2. Select Receptor:

Commercial/Industrial

3. Select Exposure Pathways to Include:

Enter "x" in box, or select from dropdown box.

Soil Pathways

☐	Incidental Ingestion of Soil
☐	Dermal Contact with Soil
☐	Inhalation of Surface Soil-Derived Dust in Indoor Air
☐	Inhalation of Surface Soil-Derived Dust in Outdoor Air
☐	Inhalation of Surface Soil-Derived Vapours in Outdoor Air
☐	Inhalation of Soil-Derived Vapours From Excavation (USEPA 2002 method)
☒	Inhalation of Subsurface Soil-Derived Vapours in Indoor Air
☐	Inhalation of Subsurface Soil-Derived Vapours in Outdoor Air

Groundwater Pathways

☐	Inhalation of Groundwater-Derived Vapours in Indoor Air
☐	Inhalation of Groundwater-Derived Vapours in Outdoor Air
☐	Ingestion of Potable Groundwater
☐	Incidental Ingestion of Groundwater (Bathing or Excavation)
☐	Dermal Contact with Groundwater (Bathing or Excavation)
☐	Inhalation of Groundwater Vapours during Irrigation/ Showering
☐	Ingestion of Vegetables Irrigated with Groundwater
☐	Inhalation of Groundwater Vapours (Where GW Enters Trench)
☒	Inhalation of vapour emissions from flowing water (groundwater in basement)

☐	Inhalation of Soil Vapour-Derived Vapours in Indoor Air
☐	Inhalation of Soil Vapour-Derived Vapours in Outdoor Air

☐	Y	Soil RBSLs saturation limited?
☐	Y	Groundwater RBSLs solubility limited?

4. Select Chemicals for Quantitative Assessment:

	Target Hazard Index	Target Cancer Risk	5. Enter Chemical Concentrations (if only calculating RBSLs, enter 1 for media for which you want RBSLs):	
	default = 1 (or manually overwrite)	default = 1x10 ⁻⁵ (or manually overwrite)	Soil (mg/kg)	Groundwater (mg/L)
Acenaphthene	0.2	1.00E-05	511	4.48
Acenaphthylene	0.2	1.00E-05	1700	43.2
Ammonia	1	1.00E-05		348
Aniline	1	1.00E-05		0.212
Anthracene	0.2	1.00E-05	2150	15.4
Arsenic, Inorganic	1	1.00E-05		0.024
Barium	1	1.00E-05		2.23
Benz(a)anthracene			1470	12.6
Benzene	0.25	1.00E-05	1510	40.2
Benzo(a)pyrene			652	9.26
Benzo(b)fluoranthene			587	8.33
Benzo(g,h,i)perylene			305	4.22
Benzo(k)fluoranthene			231	2.93
Bis(2-ethylhexyl)phalate	1	1.00E-05		0.03
Cadmium (Water)	1	1.00E-05		0.108
Chromium(III), Insoluble Salts	1	1.00E-05	210	0.102
Chromium(VI)	1	1.00E-05	2.3	0.102
Chrysene			771	9.78
Cobalt	1	1.00E-05		0.057
Cresol, m-&p-	1	1.00E-05	2290	436
Cresol, o-	1	1.00E-05		182
Blank				
Dibenz(a,h)anthracene			71.4	0.822
Dibenzofuran	1	1.00E-05	277	10.2
Dimethylphenol, 2,4-	1	1.00E-05		38
Ethylbenzene	0.25	1.00E-05	261	3.02
Fluoranthene			2440	25.9
Fluorene	0.2	1.00E-05	2100	21.1
Indeno(1,2,3-cd)pyrene			247	3.05
Iron	1	1.00E-05	60600	187
Lead and Compounds	1	1.00E-05	13600	0.555
Manganese	1	1.00E-05		4.89
Methylnaphthalene, 2-	0.2	1.00E-05	7650	105
Naphthalene	0.2	1.00E-05	10200	283
Nickel Soluble Salts	1	1.00E-05		0.303
Phenanthrene	0.2	1.00E-05	5180	74.1
Phenol	1	1.00E-05		249
Pyrene	0.2	1.00E-05	2640	27.9
Styrene	1	1.00E-05		0.194
Toluene	0.25	1.00E-05	2650	17.6
TPH C06-C09 aliphatic	0.125	1.00E-05	593	6.08
TPH C10-C14 aliphatic	0.125	1.00E-05	69400	1730
TPH C10-C14 aromatic	0.125	1.00E-05	69400	1730
TPH C15-C28 aliphatic	0.125	1.00E-05	93200	1520
TPH C15-C28 aromatic	0.125	1.00E-05	93200	1520
TPH C29-C36 aliphatic	0.125	1.00E-05	20600	332
TPH C29-C36 aromatic	0.125	1.00E-05	20600	332
Trimethylbenzene, 1,2,4-	1	1.00E-05	220	0.92
Vanadium and compounds	1	1.00E-05	248	0.0228
Xylenes (total)	0.25	1.00E-05	2567	6.7

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

6. Confirm/Modify Exposure Parameters:

	Units	Site-Specific Value (leave blank to use default value)		Value Used in Calculations	
		Adult	Child	Adult	Child

General receptor parameters:

Body weight	kg	70	na	70	
Exposure duration	yr	30	na	30	
Averaging time (carcinogens)	yr	70	na	70	
Averaging time (non-carcinogens)	yr	30	na	30	

Incidental Soil Ingestion

Daily soil ingestion rate	mg/day				
Exposure frequency for soil ingestion	days/yr				
Fraction of daily soil intake from site	unitless				

Dermal Absorption of Soil

Exposed skin surface area for soil contact	cm2				
Soil to skin adherence factor	mg/cm2				
Exposure frequency for dermal contact with soil	days/yr				

Indoor Inhalation

Exposure time (indoor air)	hrs/day	8	8	8	8
Exposure frequency (indoor air)	days/yr	240	240	240	240
Particulate emission factor (indoor air)	m3/kg				

Outdoor Inhalation

Exposure time (outdoor air)	hrs/day				
Exposure frequency (outdoor air)	days/yr				
Particulate emission factor (outdoor air)	m3/kg				

Potable Water Ingestion

Potable water intake rate	L/day				
Exposure frequency for potable water intake	days/yr				

Incidental Water Ingestion

Incidental ingestion rate	L/day				
Exposure frequency for incidental water ingestion	days/yr				

Dermal Contact with Water

Exposed skin surface for water contact	cm2				
Exposure time for dermal water contact	hr/day				
Exposure frequency for dermal water contact	days/yr				

Vapour Inhalation Shower/ Sprinkler

Exposure frequency	days/yr				
Exposure time	min/ day				
Inhalation rate	m3/hr				
Inhalation Absorption Adjustment Factor	mg/mg				
Lung retention factor	unitless				

Ingestion of Home Grown Produce

Proportion of homegrown produce ingested					
Exposure frequency	days/year				

Inhalation of Vapours from Flowing Water

Exposure time	hrs/day	8	na	8	
Exposure frequency	days/year	240	na	240	

Vapour Modelling - Soil to Outdoor and Indoor Air
Barangaroo

[Back to User Input Sheet](#)

Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

A. Model Input Parameters

Parameter Definition	Units	Default Value (Shell 2007 unless otherwise noted)	Notes	Site-Specific Value (leave blank if adopting Shell default)	Label	Adopted Value for Model	Justification for Site-specific value, if applicable
Lower depth of surficial soil zone	cm	100			LDSSZ	100	
Depth to subsurface soil sources (below building, ground surface or trench)	cm	100			LS	0.001	Autocalculates from layer thicknesses
<u>Vadose Zone Layer 1 (soil type where source is)</u>							
Thickness	cm	100		0.001	HV	0.001	Negligible distance - assumes soil is adjacent building foundataion
SCS Soil Type:				Sand and gravel (<12% fines)			Conservative assumption for mixed fill.
Fraction of organic carbon	unitless	0.01		0.002	OC	0.002	
Soil bulk density	g/cm3	1.7		1.66	sbd	1.66	
Air-filled porosity (volumetric)	cm3/cm3	0.26		0.321	VACS	0.321	
Water-filled porosity (volumetric)	cm3/cm3	0.12		0.054	wvcvz	0.054	
Total soil porosity	cm3/cm3	0.38		0.375	TPOR	0.375	
Vapour phase source partitioning adjustment	unitless	1		10	VPPA	10	Adjustment for vapour partitioning; see text.
Vadose zone biodegradation adjustment	unitless	1		1	BioA	1	Conservatively assumes no soil vapour biodegradation
<u>Vadose Zone Layer 2 (lens)</u>							
Thickness	cm				Hvtwo		
SCS Soil Type:							
Air-filled porosity (volumetric)	cm3/cm3	NA			VACS2	NA	
Water-filled porosity (volumetric)	cm3/cm3	NA			wvcvz2	NA	
Total soil porosity	cm3/cm3	NA			TPOR2	NA	
<u>Vadose Zone Layer 3 (lens)</u>							
Thickness	cm				Hvthree		
SCS Soil Type:							
Air-filled porosity (volumetric)	cm3/cm3	NA			VACS3	NA	
Water-filled porosity (volumetric)	cm3/cm3	NA			Vwcvz3	NA	
Total soil porosity	cm3/cm3	NA			TPOR3	NA	
<u>Building Characteristics</u>							
Enclosed-space volume/infiltration area (ratio)	cm	300	(a)	5625	LB	5625	Assumes 50 m by 50 m by 4.5 m high basement section, with soil vapour infiltration through upper 2m of 2 of 4 walls only (no floor), ie volume = 11250 m3 and infiltration area = 200 m2. See text.
Enclosed-space foundation or wall thickness	cm	15		15	Lcrack	15	Conservative default
Enclosed-space air exchange rate	1/s	0.000555556		0.00088	ENCAER	8.80E-04	assumed to be 3.17 air exchanges per hour- as per information provided by Lend Lease
Areal fraction of cracks in foundations/walls	cm ² -cracks/cm ² -total area	0.0019	(b)	0.0002	NU	0.0002	USEPA (2004) default for basement foundation.
Volumetric air content in found./wall cracks	cc/cc	0.26		0.321	VACF	0.321	Assumes cracks in concrete are filled with sand
Volumetric water content in found./wall cracks	cc/cc	0.12		0.054	wvcfnd	0.054	Assumes cracks in concrete are filled with sand
<u>Convective vapour flow term</u>							
Calculate convective flow term?		Y		Y	Conv	Y	
Convective flow rate (if specified directly)	cm3/sec						
Convective flow through slab (calculated)	cm3/sec	10.88		380.3828744	Qs	380.38	
Slab Area	cm2	700000		2.70E+07	Ab	27000000	Area through which vapours may enter (conservatively includes floor and two walls)
Areal fraction of cracks in foundations/walls	cm ² -cracks/cm ² -total area	0.0019		0.0002	Nuc		
Soil vapour permeability	cm ²	1.00E-08		1.00E-07	kv	1.00E-07	Conservative default for coarse sand/gravel
Indoor-outdoor pressure differential	g/cm-s ²	40		40	dP	40	USEPA (2004b) default
Slab perimeter	cm	3400		20000	Xcrack	20000	Perimeter of basement footprint.
Depth below ground to bottom of slab	cm	15		200	Zcrack	200	Advection occurring to max depth of 2 m.
Viscosity of air	g/cm-s	1.81E-04		1.81E-04	uair	1.81E-04	Viscosity of air at 20 C

(a) Building Code of Australia minimum ceiling height for habitable dwelling.
(b) USEPA (2004) upper limit of range for slab on grade foundation.
(c) If receptor is construction/excavation worker, wind speed is default wind speed of 225 cm/s reduced by factor of 10 to account for reduced wind circulation within excavation. For other receptors, wind speed is default of 225 cm/s.
(d) For construction/excavation worker, default is 400 cm (assumes trench is 2 m long and 2 m deep, and vapours enter through both walls and floor). For other receptors, Shell (2007) default of 4500 cm is assumed.
(e) Equals exposure duration for selected receptor. For residential scenario, shortest (child) exposure duration is selected for conservative purposes.
(f) USEPA (2002) default (0.5 acre).

Vapour Modelling - Soil to Outdoor and Indoor Air
Barangaroo

[Back to User Input Sheet](#)

Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

B. Chemical-Specific Fate and Transport Parameters

CHEMICAL	Koc	Kd	H'	S	D ^{air}	D ^{wat}	MW	VP	Volatile?
	(cm ³ /g)	(cm ³ /g)	(cc-H ₂ O / cc-air)	(mg/l-water)	(cm ² /s)	(cm ² /s)	(g/mol)	(mmHg)	
Acenaphthene	5.03E+03	1.01E+01	7.52E-03	3.90E+00	5.06E-02	8.33E-06	1.54E+02	2.15E-03	Y
Acenaphthylene	5.03E+03	1.01E+01	4.66E-03	1.61E+01	4.50E-02	6.98E-06	1.52E+02	6.68E-03	Y
Ammonia	3.10E+00	6.20E-03	6.58E-04	4.82E+05	2.28E-01	1.10E-05	1.70E+01	-	Y
Aniline	7.02E+01	1.40E-01	8.26E-05	3.60E+04	8.30E-02	1.01E-05	9.31E+01	4.90E-01	N
Anthracene	1.64E+04	3.28E+01	2.27E-03	4.34E-02	3.90E-02	7.85E-06	1.78E+02	6.53E-06	Y
Arsenic, Inorganic	-	#VALUE!	-	-	-	-	7.80E+01	-	N
Barium	-	#VALUE!	-	-	-	-	1.37E+02	-	N
Benz(a)anthracene	1.77E+05	3.54E+02	1.37E-04	9.40E-03	5.10E-02	9.00E-06	2.28E+02	2.10E-07	N
Benzene	1.46E+02	2.92E-01	2.27E-01	1.79E+03	8.95E-02	1.03E-05	7.81E+01	9.48E+01	Y
Benzo(a)pyrene	5.87E+05	1.17E+03	1.87E-05	1.62E-03	4.30E-02	9.00E-06	2.52E+02	5.49E-09	N
Benzo(b)fluoranthene	5.99E+05	1.20E+03	2.69E-05	1.50E-03	2.26E-02	5.56E-06	2.52E+02	5.00E-07	N
Benzo(g,h,i)perylene	1.95E+06	3.90E+03	1.35E-05	2.60E-04	4.90E-02	5.56E-06	2.76E+02	1.00E-10	N
Benzo(k)fluoranthene	5.87E+05	1.17E+03	2.39E-05	8.00E-04	2.26E-02	5.56E-06	2.52E+02	9.65E-10	N
Bis(2-ethylhexyl)phalate	1.20E+05	2.40E+02	1.10E-05	2.70E-01	3.51E-02	3.66E-06	3.91E+02	1.42E-07	N
Cadmium (Water)	-	#VALUE!	-	-	-	-	1.12E+02	-	N
Chromium(III), Insoluble Salts	-	#VALUE!	-	-	-	-	5.20E+01	-	N
Chromium(VI)	-	#VALUE!	-	1.69E+06	-	-	5.20E+01	-	N
Chrysene	1.81E+05	3.62E+02	2.14E-04	2.00E-03	2.48E-02	6.21E-06	2.28E+02	6.23E-09	N
Cobalt	-	#VALUE!	-	-	-	-	5.89E+01	-	N
Cresol, m-&p-	3.00E+02	6.00E-01	3.50E-05	2.27E+04	7.29E-02	9.32E-06	1.08E+02	1.10E-01	N
Cresol, o-	3.07E+02	6.14E-01	4.91E-05	2.59E+04	7.28E-02	9.32E-06	1.08E+02	1.70E-01	N
Dibenz(a,h)anthracene	1.91E+06	3.82E+03	5.76E-06	2.49E-03	2.00E-02	5.24E-06	2.78E+02	9.55E-10	N
Dibenzofuran	9.16E+03	1.83E+01	8.71E-03	3.10E+00	4.10E-02	7.38E-06	1.68E+02	2.48E-03	Y
Dimethylphenol, 2,4-	4.92E+02	9.84E-01	3.89E-05	7.87E+03	6.22E-02	8.31E-06	1.22E+02	1.02E-01	N
Ethylbenzene	4.46E+02	8.92E-01	3.22E-01	1.69E+02	6.85E-02	8.46E-06	1.06E+02	9.60E+00	Y
Fluoranthene	5.55E+04	1.11E+02	3.62E-04	2.60E-01	3.02E-02	6.35E-06	2.02E+02	9.22E-06	N
Fluorene	9.16E+03	1.83E+01	3.93E-03	1.69E+00	4.40E-02	7.89E-06	1.66E+02	6.00E-04	Y
Indeno(1,2,3-cd)pyrene	1.95E+06	3.90E+03	1.42E-05	1.90E-04	2.30E-02	4.41E-06	2.76E+02	1.25E-10	N
Iron	-	#VALUE!	-	-	-	-	5.59E+01	-	N
Lead and Compounds	-	#VALUE!	-	-	-	-	2.07E+02	-	N
Manganese	-	#VALUE!	-	-	-	-	5.49E+01	-	N
Methylnaphthalene, 2-	2.48E+03	4.96E+00	2.12E-02	2.46E+01	5.24E-02	7.78E-06	1.42E+02	5.50E-02	Y
Naphthalene	1.54E+03	3.08E+00	1.80E-02	3.10E+01	6.05E-02	8.38E-06	1.28E+02	8.50E-02	Y
Nickel Soluble Salts	-	#VALUE!	-	-	-	-	5.87E+01	-	N
Phenanthrene	1.67E+04	3.34E+01	1.73E-03	1.15E+00	3.45E-02	6.69E-06	1.78E+02	1.21E-04	Y
Phenol	1.87E+02	3.74E-01	1.36E-05	8.28E+04	8.34E-02	1.03E-05	9.41E+01	3.50E-01	N
Pyrene	5.43E+04	1.09E+02	4.87E-04	1.35E-01	2.78E-02	7.25E-06	2.02E+02	4.50E-06	Y
Styrene	4.46E+02	8.92E-01	1.12E-01	3.10E+02	7.11E-02	8.78E-06	1.04E+02	6.40E+00	Y
Toluene	2.34E+02	4.68E-01	2.71E-01	5.26E+02	7.78E-02	9.20E-06	9.21E+01	2.84E+01	Y
TPH C06-C09 aliphatic	4.47E+03	8.94E+00	5.05E+01	1.18E+01	1.00E-01	1.00E-05	1.03E+02	9.16E+01	Y
TPH C10-C14 aliphatic	5.50E+05	1.10E+03	6.26E+01	9.99E-02	1.00E-01	1.00E-05	1.70E+02	1.16E+00	Y
TPH C10-C14 aromatic	3.02E+03	6.04E+00	1.41E-01	2.53E+01	1.00E-01	1.00E-05	1.36E+02	1.16E+00	Y
TPH C15-C28 aliphatic	3.16E+08	6.32E+05	8.27E+01	1.11E-04	1.00E-01	1.00E-05	2.60E+02	5.93E-03	N
TPH C15-C28 aromatic	3.79E+04	7.58E+01	4.90E-03	1.06E+00	1.00E-01	1.00E-05	2.09E+02	5.51E-03	N
TPH C29-C36 aliphatic	6.31E+08	1.26E+06	8.50E+01	2.50E-06	1.00E-01	1.00E-05	2.70E+02	8.36E-04	N
TPH C29-C36 aromatic	1.26E+05	2.52E+02	1.70E-05	6.60E-03	1.00E-01	1.00E-05	2.40E+02	3.34E-07	N
Trimethylbenzene, 1,2,4-	6.14E+02	1.23E+00	2.52E-01	5.70E+01	6.07E-02	7.92E-06	1.20E+02	2.10E+00	Y
Vanadium and compounds	-	#VALUE!	-	-	-	-	5.09E+01	-	N
Xylenes (total)	3.83E+02	7.66E-01	2.12E-01	1.06E+01	8.47E-02	9.90E-06	1.06E+02	7.99E+00	Y
	-	-	-	-	-	-	-	-	-

Definition of Parameters

Koc	Organic carbon partition coefficient	D ^{air}	Diffusion coefficient in air
Kd	Soil-water partition coefficient	D ^{wat}	Diffusion coefficient in water
H'	Dimensionless Henry's Law Constant	MW	Molecular weight
S	Solubility	VP	Vapopur pressure

Vapour Modelling - Soil to Outdoor and Indoor Air

[Back to User Input Sheet](#)

Barangaroo

Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000

Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

C. Chemical-Specific Diffusion Coefficients

CHEMICAL	D _{s1} (cm ² /s)	D _{s2} (cm ² /s)	D _{s3} (cm ² /s)	D _{stot} (cm ² /s)	D _{crack} (cm ² /s)	C _{sat} (mg/kg)	Convective Factor (unitless)	D _a (cm ² /s)	M _{excav} (g)
Acenaphthene	8.18E-03	-	-	8.18E-03	8.18E-03	3.94E+01	1.29E+02	3.66E-06	7.25E+04
Acenaphthylene	7.28E-03	-	-	7.28E-03	7.28E-03	1.63E+02	1.45E+02	2.02E-06	5.38E+04
Ammonia	3.69E-02	-	-	3.69E-02	3.69E-02	1.87E+04	2.87E+01	3.75E-04	7.34E+05
Aniline	NV	NV	NV	NV	NV	6.23E+03	NV	NV	NV
Anthracene	6.31E-03	-	-	6.31E-03	6.31E-03	1.42E+00	1.68E+02	2.62E-07	1.94E+04
Arsenic, Inorganic	NV	NV	NV	NV	NV		NV	NV	NV
Barium	NV	NV	NV	NV	NV		NV	NV	NV
Benz(a)anthracene	NV	NV	NV	NV	NV	3.33E+00	NV	NV	NV
Benzene	1.45E-02	-	-	1.45E-02	1.45E-02	6.59E+02	7.30E+01	5.35E-03	2.77E+06
Benzo(a)pyrene	NV	NV	NV	NV	NV	1.90E+00	NV	NV	NV
Benzo(b)fluoranthene	NV	NV	NV	NV	NV	1.80E+00	NV	NV	NV
Benzo(g,h,i)perylene	NV	NV	NV	NV	NV	1.01E+00	NV	NV	NV
Benzo(k)fluoranthene	NV	NV	NV	NV	NV	9.39E-01	NV	NV	NV
Bis(2-ethylhexyl)phalate	NV	NV	NV	NV	NV	6.48E+01	NV	NV	NV
Cadmium (Water)	NV	NV	NV	NV	NV		NV	NV	NV
Chromium(III), Insoluble Salts	NV	NV	NV	NV	NV		NV	NV	NV
Chromium(VI)	NV	NV	NV	NV	NV		NV	NV	NV
Chrysene	NV	NV	NV	NV	NV	7.24E-01	NV	NV	NV
Cobalt	NV	NV	NV	NV	NV		NV	NV	NV
Cresol, m-&p-	NV	NV	NV	NV	NV	1.44E+04	NV	NV	NV
Cresol, o-	NV	NV	NV	NV	NV	1.67E+04	NV	NV	NV
Dibenz(a,h)anthracene	NV	NV	NV	NV	NV	9.51E+00	NV	NV	NV
Dibenzofuran	6.63E-03	-	-	6.63E-03	6.63E-03	5.69E+01	1.59E+02	1.89E-06	5.21E+04
Dimethylphenol, 2,4-	NV	NV	NV	NV	NV	8.00E+03	NV	NV	NV
Ethylbenzene	1.11E-02	-	-	1.11E-02	1.11E-02	1.67E+02	9.54E+01	2.17E-03	1.77E+06
Fluoranthene	NV	NV	NV	NV	NV	2.89E+01	NV	NV	NV
Fluorene	7.11E-03	-	-	7.11E-03	7.11E-03	3.10E+01	1.49E+02	9.14E-07	3.62E+04
Indeno(1,2,3-cd)pyrene	NV	NV	NV	NV	NV	7.41E-01	NV	NV	NV
Iron	NV	NV	NV	NV	NV		NV	NV	NV
Lead and Compounds	NV	NV	NV	NV	NV		NV	NV	NV
Manganese	NV	NV	NV	NV	NV		NV	NV	NV
Methylnaphthalene, 2-	8.47E-03	-	-	8.47E-03	8.47E-03	1.23E+02	1.25E+02	2.16E-05	1.76E+05
Naphthalene	9.78E-03	-	-	9.78E-03	9.78E-03	9.66E+01	1.08E+02	3.39E-05	2.21E+05
Nickel Soluble Salts	NV	NV	NV	NV	NV		NV	NV	NV
Phenanthrene	5.58E-03	-	-	5.58E-03	5.58E-03	3.84E+01	1.89E+02	1.73E-07	1.58E+04
Phenol	NV	NV	NV	NV	NV	3.37E+04	NV	NV	NV
Pyrene	4.50E-03	-	-	4.50E-03	4.50E-03	1.47E+01	2.35E+02	1.21E-08	4.17E+03
Styrene	1.15E-02	-	-	1.15E-02	1.15E-02	2.93E+02	9.19E+01	8.17E-04	1.08E+06
Toluene	1.26E-02	-	-	1.26E-02	1.26E-02	2.91E+02	8.40E+01	3.70E-03	2.31E+06
TPH C06-C09 aliphatic	1.62E-02	-	-	1.62E-02	1.62E-02	2.21E+02	6.54E+01	2.61E-02	6.13E+06
TPH C10-C14 aliphatic	1.62E-02	-	-	1.62E-02	1.62E-02	1.11E+02	6.54E+01	5.46E-04	8.86E+05
TPH C10-C14 aromatic	1.62E-02	-	-	1.62E-02	1.62E-02	1.54E+02	6.54E+01	2.24E-04	5.68E+05
TPH C15-C28 aliphatic	NV	NV	NV	NV	NV	7.02E+01	NV	NV	NV
TPH C15-C28 aromatic	NV	NV	NV	NV	NV	8.04E+01	NV	NV	NV
TPH C29-C36 aliphatic	NV	NV	NV	NV	NV	3.16E+00	NV	NV	NV
TPH C29-C36 aromatic	NV	NV	NV	NV	NV	1.66E+00	NV	NV	NV
Trimethylbenzene, 1,2,4-	9.81E-03	-	-	9.81E-03	9.81E-03	7.46E+01	1.08E+02	1.13E-03	1.28E+06
Vanadium and compounds	NV	NV	NV	NV	NV		NV	NV	NV
Xylenes (total)	1.37E-02	-	-	1.37E-02	1.37E-02	8.90E+00	7.72E+01	2.08E-03	1.73E+06

Definition of Parameters

D _s	Effective diffusion coefficient in soil based on vapor-phase concentration	D _a = Apparent diffusivity (for construction scenario Volatilisation Factor)
D _{crack}	Effective diffusion coefficient through foundation cracks	M _{excav} = Cumulative unit mass emitted from excavation (Eq E-13 in USEPA, 2002).
C _{sat}	Soil concentration at which dissolved pore-water and vapor phases become saturated	

Vapour Modelling - Soil to Outdoor and Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

[Back to User Input Sheet](#)

D. Chemical-Specific Volatilisation Factors

CHEMICAL	VF _{as1}	VF _{as2}	VF _p (indoor)	VF _p (outdoor)	VF _{samb}	VF _{sevp}	VF _{excav}
	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)
Acenaphthene	1.17E-05	1.75E-05	-	-	3.35E-01	2.12E-06	-3.12E+08
Acenaphthylene	8.66E-06	1.75E-05	-	-	1.94E-01	1.31E-06	-2.32E+08
Ammonia	1.18E-04	1.75E-05	-	-	1.33E+01	4.82E-05	-3.16E+09
Aniline	NV	NV	-	-	NV	NV	NV
Anthracene	3.12E-06	1.75E-05	-	-	2.67E-02	1.97E-07	-8.35E+07
Arsenic, Inorganic	NV	NV	-	-	NV	NV	NV
Barium	NV	NV	-	-	NV	NV	NV
Benz(a)anthracene	NV	NV	-	-	NV	NV	NV
Benzene	4.46E-05	1.75E-05	-	-	3.64E+01	1.75E-04	-1.19E+10
Benzo(a)pyrene	NV	NV	-	-	NV	NV	NV
Benzo(b)fluoranthene	NV	NV	-	-	NV	NV	NV
Benzo(g,h,i)perylene	NV	NV	-	-	NV	NV	NV
Benzo(k)fluoranthene	NV	NV	-	-	NV	NV	NV
Bis(2-ethylhexyl)phalate	NV	NV	-	-	NV	NV	NV
Cadmium (Water)	NV	NV	-	-	NV	NV	NV
Chromium(III), Insoluble Salts	NV	NV	-	-	NV	NV	NV
Chromium(VI)	NV	NV	-	-	NV	NV	NV
Chrysene	NV	NV	-	-	NV	NV	NV
Cobalt	NV	NV	-	-	NV	NV	NV
Cresol, m-&p-	NV	NV	-	-	NV	NV	NV
Cresol, o-	NV	NV	-	-	NV	NV	NV
Dibenz(a,h)anthracene	NV	NV	-	-	NV	NV	NV
Dibenzofuran	8.38E-06	1.75E-05	-	-	1.89E-01	1.35E-06	-2.24E+08
Dimethylphenol, 2,4-	NV	NV	-	-	NV	NV	NV
Ethylbenzene	2.84E-05	1.75E-05	-	-	1.71E+01	9.29E-05	-7.61E+09
Fluoranthene	NV	NV	-	-	NV	NV	NV
Fluorene	5.84E-06	1.75E-05	-	-	8.90E-02	6.09E-07	-1.56E+08
Indeno(1,2,3-cd)pyrene	NV	NV	-	-	NV	NV	NV
Iron	NV	NV	-	-	NV	NV	NV
Lead and Compounds	NV	NV	-	-	NV	NV	NV
Manganese	NV	NV	-	-	NV	NV	NV
Methylnaphthalene, 2-	2.83E-05	1.75E-05	-	-	1.95E+00	1.21E-05	-7.59E+08
Naphthalene	3.55E-05	1.75E-05	-	-	3.14E+01	1.64E-05	-9.51E+08
Nickel Soluble Salts	NV	NV	-	-	NV	NV	NV
Phenanthrene	2.54E-06	1.75E-05	-	-	1.85E-02	1.47E-07	-6.80E+07
Phenol	NV	NV	-	-	NV	NV	NV
Pyrene	6.72E-07	1.75E-05	-	-	1.39E-03	1.28E-08	-1.80E+07
Styrene	1.74E-04	1.75E-05	-	-	6.33E+01	3.37E-04	-4.67E+09
Toluene	3.71E-05	1.75E-05	-	-	2.73E+01	1.39E-04	-9.93E+09
TPH C06-C09 aliphatic	9.87E-05	1.75E-05	-	-	1.67E+02	7.67E-04	-2.64E+10
TPH C10-C14 aliphatic	1.43E-05	1.75E-05	-	-	3.48E+00	1.60E-05	-3.82E+09
TPH C10-C14 aromatic	9.14E-06	1.75E-05	-	-	1.43E+00	6.58E-06	-2.45E+09
TPH C15-C28 aliphatic	NV	NV	-	-	NV	NV	NV
TPH C15-C28 aromatic	NV	NV	-	-	NV	NV	NV
TPH C29-C36 aliphatic	NV	NV	-	-	NV	NV	NV
TPH C29-C36 aromatic	NV	NV	-	-	NV	NV	NV
Trimethylbenzene, 1,2,4-	2.05E-04	1.75E-05	-	-	1.05E+03	5.48E-04	-5.50E+09
Vanadium and compounds	NV	NV	-	-	NV	NV	NV
Xylenes (total)	2.78E-05	1.75E-05	-	-	1.46E+01	7.19E-05	-7.44E+09

Definition of Parameters

VF _{as}	Volatilization factor from surficial soils to ambient air (vapors) - use lower of two values
VF _p	Volatilization factor from surficial soils to ambient air (particulates)
VF _{samb}	Volatilization factor from subsurface soils to ambient air
VF _{sevp}	Volatilization factor from soil to enclosed-space vapors
VF _{excav}	Volatilisation factor from subsurface soil to trench air (where soil contamination is below base of trench)

Calculation of Vapour Emissions from Water with Flow

Barangaroo

Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000

Scenario 2: Upper Basement Commercial Workers, Newtown (Risk Based Calculations) Scenario

Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Notes:
Assumes viscosity of air at 25 deg C
(*) Adopted density and viscosity of air values are those published in USEPA Air Emissions for Wast and Waste Water Nov 1994. (viscosity = 1.81×10^{-4} , density = 1.2×10^{-3})
** where windspeeds are greater than 3.25 m/s, F/D ratios greater than 51.2 and diffusivity of ether is 8.5×10^{-5}
where viscosity of water is assumed to be 9×10^{-3} g/cm per sec and density of water 1g/cm³.
Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Summary of Derived RBSLs

Barangaroo

Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000

Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Chemical	Soil RBSLs (mg/kg)						Groundwater RBSLs (mg/L)					
	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Saturation Limited?	Site Concentration	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Solubility Limited?	Site Concentration
Acenaphthene	9.04E+04	-	-	9.04E+04	>Sat	5.11E+02	1.82E+03	-	-	1.82E+03	>Sol	4.48E+00
Acenaphthylene	1.46E+05	-	-	1.46E+05	>Sat	1.70E+03	8.88E+02	-	-	8.88E+02	>Sol	4.32E+01
Ammonia	-	-	-	-	-	-	6.84E+03	-	-	6.84E+03	-	3.48E+02
Aniline	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	4.87E+06	-	-	4.87E+06	>Sat	2.15E+03	4.98E+01	-	-	4.98E+01	>Sol	1.54E+01
Arsenic, Inorganic	-	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	6.24E+01	-	1.01E+02	6.24E+01	-	1.51E+03	9.02E+01	-	1.46E+02	9.02E+01	-	4.02E+01
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, o-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	7.09E+05	-	-	7.09E+05	>Sat	2.77E+02	3.12E+03	-	-	3.12E+03	>Sol	1.02E+01
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	1.60E+04	-	-	1.60E+04	>Sat	2.61E+02	1.22E+04	-	-	1.22E+04	>Sol	3.02E+00
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	2.10E+05	-	-	2.10E+05	>Sat	2.10E+03	1.40E+02	-	-	1.40E+02	>Sol	2.11E+01
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	1.06E+04	-	-	1.06E+04	>Sat	7.65E+03	2.73E+02	-	-	2.73E+02	>Sol	1.05E+02
Naphthalene	1.67E+02	-	-	1.67E+02	>Sat	1.02E+04	2.76E+00	-	-	2.76E+00	-	2.83E+02
Nickel Soluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	1.30E+06	-	-	1.30E+06	>Sat	5.18E+03	6.36E+01	-	-	6.36E+01	>Sol	7.41E+01
Phenol	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	7.51E+06	-	-	7.51E+06	>Sat	2.64E+03	3.01E+01	-	-	3.01E+01	>Sol	2.79E+01
Styrene	-	-	-	-	-	-	9.90E+03	-	-	9.90E+03	>Sol	1.94E-01
Toluene	4.09E+04	-	-	4.09E+04	>Sat	2.65E+03	4.70E+04	-	-	4.70E+04	>Sol	1.76E+01
TPH C06-C09 aliphatic	1.37E+04	-	-	1.37E+04	>Sat	5.93E+02	8.58E+04	-	-	8.58E+04	>Sol	6.08E+00
TPH C10-C14 aliphatic	3.56E+04	-	-	3.56E+04	>Sat	6.94E+04	5.70E-01	-	-	5.70E-01	>Sol	1.73E+03
TPH C10-C14 aromatic	1.73E+04	-	-	1.73E+04	>Sat	6.94E+04	1.38E+01	-	-	1.38E+01	-	1.73E+03
TPH C15-C28 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	5.83E+01	-	-	5.83E+01	-	2.20E+02	2.65E+02	-	-	2.65E+02	>Sol	9.20E-01
Vanadium and compounds	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	3.49E+03	-	-	3.49E+03	>Sat	2.57E+03	2.07E+03	-	-	2.07E+03	>Sol	6.70E+00
	-	-	-	-	-	-	-	-	-	-	-	-

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Health Risk Calculations - Inhalation of Subsurface Soil-Derived Vapours in Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Chemical			Volatilisation Factor from Subsurface Soil to Indoor Air (mg/m3)/(mg/kg)	Vapour Concentration in Indoor Air (From Subsurface Soil) (mg/m3)	Threshold Intake and Risk Calculations			
	Soil Conc.	Csat			Inhalation RfC	Adult Exposure Factor (threshold)	Adult Exposure Adjusted Air Concentration (threshold)	Hazard Index (Adult)
	(mg/kg)	(mg/kg)			(mg/m3)	(kg/m3)	(mg/m3)	(unitless)
Acenaphthene	511	3.94E+01	2.12E-06	8.35E-05	2.10E-01	4.65E-07	1.83E-05	8.71E-05
Acenaphthylene	1700	1.63E+02	1.31E-06	2.14E-04	2.10E-01	2.88E-07	4.68E-05	2.23E-04
Ammonia	-	-	-	-	-	-	-	-
Aniline	-	-	NV	-	-	-	-	-
Anthracene	2150	1.42E+00	1.97E-07	2.80E-07	1.05E+00	4.31E-08	6.15E-08	5.85E-08
Arsenic, Inorganic	-	-	NV	-	-	-	-	-
Barium	-	-	NV	-	-	-	-	-
Benz(a)anthracene	1470	3.33E+00	NV	-	-	-	-	-
Benzene	1510	6.59E+02	1.75E-04	1.16E-01	9.60E-03	3.84E-05	2.53E-02	2.64E+00
Benzo(a)pyrene	652	1.90E+00	NV	-	-	-	-	-
Benzo(b)fluoranthene	587	1.80E+00	NV	-	-	-	-	-
Benzo(g,h,i)perylene	305	1.01E+00	NV	-	-	-	-	-
Benzo(k)fluoranthene	231	9.39E-01	NV	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	NV	-	-	-	-	-
Cadmium (Water)	-	-	NV	-	-	-	-	-
Chromium(III), Insoluble Salts	210		NV	-	1.00E-04	-	-	-
Chromium(VI)	2.3		NV	-	1.00E-04	-	-	-
Chrysene	771	7.24E-01	NV	-	--	-	-	-
Cobalt	-	-	NV	-	-	-	-	-
Cresol, m-&p-	2290	1.44E+04	NV	-	5.95E-01	-	-	-
Cresol, o-	-	-	NV	-	-	-	-	-
Dibenz(a,h)anthracene	71.4	9.51E+00	NV	-	--	-	-	-
Dibenzofuran	277	5.69E+01	1.35E-06	7.68E-05	2.10E-01	2.96E-07	1.68E-05	8.02E-05
Dimethylphenol, 2,4-	-	-	NV	-	-	-	-	-
Ethylbenzene	261	1.67E+02	9.29E-05	1.55E-02	1.30E+00	2.04E-05	3.39E-03	2.61E-03
Fluoranthene	2440	2.89E+01	NV	-	1.40E-01	-	-	-
Fluorene	2100	3.10E+01	6.09E-07	1.89E-05	1.40E-01	1.34E-07	4.14E-06	2.96E-05
Indeno(1,2,3-cd)pyrene	247	7.41E-01	NV	-	--	-	-	-
Iron	60600		NV	-	2.80E+00	-	-	-
Lead and Compounds	13600		NV	-	5.00E-04	-	-	-
Manganese	-	-	NV	-	-	-	-	-
Methylnaphthalene, 2-	7650	1.23E+02	1.21E-05	1.48E-03	1.40E-01	2.65E-06	3.25E-04	2.32E-03
Naphthalene	10200	9.66E+01	1.64E-05	1.59E-03	3.00E-03	3.60E-06	3.48E-04	1.16E-01
Nickel Soluble Salts	-	-	NV	-	-	-	-	-
Phenanthrene	5180	3.84E+01	1.47E-07	5.66E-06	2.10E-01	3.23E-08	1.24E-06	5.91E-06
Phenol	-	-	NV	-	-	-	-	-
Pyrene	2640	1.47E+01	1.28E-08	1.87E-07	1.05E-01	2.80E-09	4.10E-08	3.91E-07
Styrene	-	-	-	-	-	-	-	-
Toluene	2650	2.91E+02	1.39E-04	4.06E-02	5.00E+00	3.06E-05	8.89E-03	1.78E-03
TPH C06-C09 aliphatic	593	2.21E+02	7.67E-04	1.70E-01	1.84E+01	1.68E-04	3.72E-02	2.02E-03
TPH C10-C14 aliphatic	69400	1.11E+02	1.60E-05	1.78E-03	1.00E+00	3.51E-06	3.90E-04	3.90E-04
TPH C10-C14 aromatic	69400	1.54E+02	6.58E-06	1.02E-03	2.00E-01	1.44E-06	2.23E-04	1.11E-03
TPH C15-C28 aliphatic	93200	7.02E+01	NV	-	7.00E+00	-	-	-
TPH C15-C28 aromatic	93200	8.04E+01	NV	-	1.05E-01	-	-	-
TPH C29-C36 aliphatic	20600	3.16E+00	NV	-	7.00E+00	-	-	-
TPH C29-C36 aromatic	20600	1.66E+00	NV	-	1.05E-01	-	-	-
Trimethylbenzene, 1,2,4-	220	7.46E+01	5.48E-04	4.09E-02	7.00E-03	1.20E-04	8.96E-03	1.28E+00
Vanadium and compounds	248		NV	-	1.00E-03	-	-	-
Xylenes (total)	2567	8.90E+00	7.19E-05	6.40E-04	2.20E-01	1.58E-05	1.40E-04	6.37E-04

TOTAL	4.05E+00
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Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

[illegible]

6.52E-05

Barangaroo

Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

TOTAL	2.69E+00
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3/07/2012

2.75E-06

Soil RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Chemical	Csoil	Csat	Risk at Input Soil Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity) (kg/mg)			RBSL (assumes no sat limit)	Risk at RBSL (with sat)	Vapour Only Risk at Csat (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			Vapours from Subsurface Soil Indoors	TOTAL (All Pathways)	Vapours from Subsurface Soil Indoors	Total Vapour Pathways	TOTAL (All Pathways)					Vapours from Subsurface Soil Indoors	TOTAL
	mg/kg	mg/kg	unitless	unitless	kg/mg	kg/mg	kg/mg	mg/kg			mg/kg	%	%
Acenaphthene	511	3.94E+01	8.71E-05	8.71E-05	2.21E-06	2.21E-06	2.21E-06	9.04E+04	8.71E-05	8.71E-05	9.04E+04	0.04%	0.04%
Acenaphthylene	1700	1.63E+02	2.23E-04	2.23E-04	1.37E-06	1.37E-06	1.37E-06	1.46E+05	2.23E-04	2.23E-04	1.46E+05	0.11%	0.11%
Ammonia	-	-	-	-	-		-	-	-	-	-	-	
Aniline	-	-	-	-	-		-	-	-	-	-	-	
Anthracene	2150	1.42E+00	5.85E-08	5.85E-08	4.11E-08	4.11E-08	4.11E-08	4.87E+06	5.85E-08	5.85E-08	4.87E+06	0.00%	0.00%
Arsenic, Inorganic	-	-	-	-	-		-	-	-	-	-	-	
Barium	-	-	-	-	-		-	-	-	-	-	-	
Benz(a)anthracene	1470	3.33E+00	-	-	-		-	-	-	-	-	-	
Benzene	1510	6.59E+02	2.64E+00	2.64E+00	4.00E-03	4.00E-03	4.00E-03	6.24E+01	2.50E-01	-	6.24E+01	100.00%	100.00%
Benzo(a)pyrene	652	1.90E+00	-	-	-		-	-	-	-	-	-	
Benzo(b)fluoranthene	587	1.80E+00	-	-	-		-	-	-	-	-	-	
Benzo(g,h,i)perylene	305	1.01E+00	-	-	-		-	-	-	-	-	-	
Benzo(k)fluoranthene	231	9.39E-01	-	-	-		-	-	-	-	-	-	
Bis(2-ethylhexyl)phalate	-	-	-	-	-		-	-	-	-	-	-	
Cadmium (Water)	-	-	-	-	-		-	-	-	-	-	-	
Chromium(III), Insoluble Salts	210		-	-	-		-	-	-	-	-	-	
Chromium(VI)	2.3		-	-	-		-	-	-	-	-	-	
Chrysene	771	7.24E-01	-	-	-		-	-	-	-	-	-	
Cobalt	-	-	-	-	-		-	-	-	-	-	-	
Cresol, m-&p-	2290	1.44E+04	-	-	-		-	-	-	-	-	-	
Cresol, o-	-	-	-	-	-		-	-	-	-	-	-	
Dibenz(a,h)anthracene	71.4	9.51E+00	-	-	-		-	-	-	-	-	-	
Dibenzofuran	277	5.69E+01	8.02E-05	8.02E-05	1.41E-06	1.41E-06	1.41E-06	7.09E+05	8.02E-05	8.02E-05	7.09E+05	0.01%	0.01%
Dimethylphenol, 2,4-	-	-	-	-	-		-	-	-	-	-	-	
Ethylbenzene	261	1.67E+02	2.61E-03	2.61E-03	1.57E-05	1.57E-05	1.57E-05	1.60E+04	2.61E-03	2.61E-03	1.60E+04	1.04%	1.04%
Fluoranthene	2440	2.89E+01	-	-	-		-	-	-	-	-	-	
Fluorene	2100	3.10E+01	2.96E-05	2.96E-05	9.54E-07	9.54E-07	9.54E-07	2.10E+05	2.96E-05	2.96E-05	2.10E+05	0.01%	0.01%
Indeno(1,2,3-cd)pyrene	247	7.41E-01	-	-	-		-	-	-	-	-	-	
Iron	60600		-	-	-		-	-	-	-	-	-	
Lead and Compounds	13600		-	-	-		-	-	-	-	-	-	
Manganese	-	-	-	-	-		-	-	-	-	-	-	
Methylnaphthalene, 2-Naphthalene	7650	1.23E+02	2.32E-03	2.32E-03	1.89E-05	1.89E-05	1.89E-05	1.06E+04	2.32E-03	2.32E-03	1.06E+04	1.16%	1.16%
	10200	9.66E+01	1.16E-01	1.16E-01	1.20E-03	1.20E-03	1.20E-03	1.67E+02	1.16E-01	1.16E-01	1.67E+02	58.01%	58.01%
Nickel Soluble Salts	-	-	-	-	-		-	-	-	-	-	-	
Phenanthrene	5180	3.84E+01	5.91E-06	5.91E-06	1.54E-07	1.54E-07	1.54E-07	1.30E+06	5.91E-06	5.91E-06	1.30E+06	0.00%	0.00%
Phenol	-	-	-	-	-		-	-	-	-	-	-	
Pyrene	2640	1.47E+01	3.91E-07	3.91E-07	2.66E-08	2.66E-08	2.66E-08	7.51E+06	3.91E-07	3.91E-07	7.51E+06	0.00%	0.00%
Styrene	-	-	-	-	-		-	-	-	-	-	-	
Toluene	2650	2.91E+02	1.78E-03	1.78E-03	6.11E-06	6.11E-06	6.11E-06	4.09E+04	1.78E-03	1.78E-03	4.09E+04	0.71%	0.71%
TPH C06-C09 aliphatic	593	2.21E+02	2.02E-03	2.02E-03	9.14E-06	9.14E-06	9.14E-06	1.37E+04	2.02E-03	2.02E-03	1.37E+04	1.62%	1.62%
TPH C10-C14 aliphatic	69400	1.11E+02	3.90E-04	3.90E-04	3.51E-06	3.51E-06	3.51E-06	3.56E+04	3.90E-04	3.90E-04	3.56E+04	0.31%	0.31%
TPH C10-C14 aromatic	69400	1.54E+02	1.11E-03	1.11E-03	7.21E-06	7.21E-06	7.21E-06	1.73E+04	1.11E-03	1.11E-03	1.73E+04	0.89%	0.89%
TPH C15-C28 aliphatic	93200	7.02E+01	-	-	-		-	-	-	-	-	-	
TPH C15-C28 aromatic	93200	8.04E+01	-	-	-		-	-	-	-	-	-	
TPH C29-C36 aliphatic	20600	3.16E+00	-	-	-		-	-	-	-	-	-	
TPH C29-C36 aromatic	20600	1.66E+00	-	-	-		-	-	-	-	-	-	
Trimethylbenzene, 1,2,4-	220	7.46E+01	1.28E+00	1.28E+00	1.72E-02	1.72E-02	1.72E-02	5.83E+01	1.00E+00	-	5.83E+01	100.00%	100.00%
Vanadium and compounds	248		-	-	-		-	-	-	-	-	-	
Xylenes (total)	2567	8.90E+00	6.37E-04	6.37E-04	7.16E-05	7.16E-05	7.16E-05	3.49E+03	6.37E-04	6.37E-04	3.49E+03	0.25%	0.25%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Soil RBSL Derivation - Non-Threshold Lifetime Health Effects (Adult and Child)
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Chemical	Csoil	Csat	Risk at Input Soil Concentration (ILCR)		Risk/Soil Concentration (i.e., exposure and toxicity factor)			RBSL (assumes no sat limit)	Risk at RBSL (with sat)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			Vapours from Subsurface Soil Indoors	TOTAL	Vapours from Subsurface Soil Indoors	Total Vapour Pathways	TOTAL				Vapours from Subsurface Soil Indoors	TOTAL
	mg/kg	mg/kg	unitless	unitless	kg/mg	kg/mg	kg/mg	mg/kg		mg/kg	%	%
Acenaphthene	511	3.94E+01	-	-	-		-	-	-	-	-	-
Acenaphthylene	1700	1.63E+02	-	-	-		-	-	-	-	-	-
Ammonia	-	-	-	-	-		-	-	-	-	-	-
Aniline	-	-	-	-	-		-	-	-	-	-	-
Anthracene	2150	1.42E+00	-	-	-		-	-	-	-	-	-
Arsenic, Inorganic	-	-	-	-	-		-	-	-	-	-	-
Barium	-	-	-	-	-		-	-	-	-	-	-
Benz(a)anthracene	1470	3.33E+00	-	-	-		-	-	-	-	-	-
Benzene	1510	6.59E+02	6.52E-05	6.52E-05	9.88E-08	9.88E-08	9.88E-08	1.01E+02	1.00E-05	1.01E+02	100.00%	100.00%
Benzo(a)pyrene	652	1.90E+00	-	-	-		-	-	-	-	-	-
Benzo(b)fluoranthene	587	1.80E+00	-	-	-		-	-	-	-	-	-
Benzo(g,h,i)perylene	305	1.01E+00	-	-	-		-	-	-	-	-	-
Benzo(k)fluoranthene	231	9.39E-01	-	-	-		-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-		-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-		-	-	-	-	-	-
Chromium(III), Insoluble Salts	210		-	-	-		-	-	-	-	-	-
Chromium(VI)	2.3		-	-	-		-	-	-	-	-	-
Chrysene	771	7.24E-01	-	-	-		-	-	-	-	-	-
Cobalt	-	-	-	-	-		-	-	-	-	-	-
Cresol, m-&p-	2290	1.44E+04	-	-	-		-	-	-	-	-	-
Cresol, o-	-	-	-	-	-		-	-	-	-	-	-
Dibenz(a,h)anthracene	71.4	9.51E+00	-	-	-		-	-	-	-	-	-
Dibenzofuran	277	5.69E+01	-	-	-		-	-	-	-	-	-
Dimethylphenol, 2,4-	-	-	-	-	-		-	-	-	-	-	-
Ethylbenzene	261	1.67E+02	-	-	-		-	-	-	-	-	-
Fluoranthene	2440	2.89E+01	-	-	-		-	-	-	-	-	-
Fluorene	2100	3.10E+01	-	-	-		-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	247	7.41E-01	-	-	-		-	-	-	-	-	-
Iron	60600		-	-	-		-	-	-	-	-	-
Lead and Compounds	13600		-	-	-		-	-	-	-	-	-
Manganese	-	-	-	-	-		-	-	-	-	-	-
Methylnaphthalene, 2-	7650	1.23E+02	-	-	-		-	-	-	-	-	-
Naphthalene	10200	9.66E+01	-	-	-		-	-	-	-	-	-
Phenol	-	-	-	-	-		-	-	-	-	-	-
Pyrene	2640	3.84E+01	-	-	-		-	-	-	-	-	-
Styrene	-	-	-	-	-		-	-	-	-	-	-
Toluene	2650	1.47E+01	-	-	-		-	-	-	-	-	-
TPH C06-C09 aliphatic	593	2.93E+02	-	-	-		-	-	-	-	-	-
TPH C10-C14 aliphatic	69400	2.91E+02	-	-	-		-	-	-	-	-	-
TPH C10-C14 aromatic	69400	2.21E+02	-	-	-		-	-	-	-	-	-
TPH C15-C28 aliphatic	93200	1.11E+02	-	-	-		-	-	-	-	-	-
TPH C15-C28 aromatic	93200	1.54E+02	-	-	-		-	-	-	-	-	-
TPH C29-C36 aliphatic	20600	7.02E+01	-	-	-		-	-	-	-	-	-
TPH C29-C36 aromatic	20600	8.04E+01	-	-	-		-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	220	3.16E+00	-	-	-		-	-	-	-	-	-
Vanadium and compounds	248	1.66E+00	-	-	-		-	-	-	-	-	-
Xylenes (total)	2567	7.46E+01	-	-	-		-	-	-	-	-	-
	-	-	-	-	-		-	-	-	-	-	-
	-	-	-	-	-		-	-	-	-	-	-

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Chemical	Cgw mg/L	Solubility mg/L	Risk at Input Groundwater Concentration (ILCR)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit) mg/L	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL mg/L	Pathway Contributions to Total Estimated Risk at RBSL	
			GW vapours from flowing water	TOTAL (All Pathways)	GW vapours from flowing water	Total Vapour Pathways L/mg	TOTAL (All Pathways) L/mg					GW vapours from flowing water	
			unitless	unitless	unitless							%	%
Acenaphthene	4.48	3.90E+00	4.29E-04	4.29E-04	1.10E-04	1.10E-04	1.10E-04	1.82E+03	4.29E-04	4.29E-04	1.82E+03	0.2%	0.21%
Acenaphthylene	43.2	1.61E+01	3.63E-03	3.63E-03	2.25E-04	2.25E-04	2.25E-04	8.88E+02	3.63E-03	3.63E-03	8.88E+02	1.8%	1.81%
Ammonia	348	4.82E+05	5.09E-02	5.09E-02	1.46E-04	1.46E-04	1.46E-04	6.84E+03	1.00E+00	-	6.84E+03	100.0%	100.00%
Aniline	0.212	3.60E+04	-	-	-	-	-	-	-	-	-	-	-
Anthracene	15.4	4.34E-02	1.74E-04	1.74E-04	4.02E-03	4.02E-03	4.02E-03	4.98E+01	1.74E-04	1.74E-04	4.98E+01	0.1%	0.09%
Arsenic, Inorganic	0.024		-	-	-	-	-	-	-	-	-	-	-
Barium	2.23		-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-	-	-	-	-	-	-	-	-
Benzene	40.2	1.79E+03	1.11E-01	1.11E-01	2.77E-03	2.77E-03	2.77E-03	9.02E+01	2.50E-01	-	9.02E+01	100.0%	100.00%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-	-	-	-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-	-	-	-	-	-	-	-	-
Cobalt	0.057		-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	-	-	-	-	-	-	-	-	-	-	-
Cresol, o-	182	2.59E+04	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	9.94E-04	9.94E-04	3.21E-04	3.21E-04	3.21E-04	3.12E+03	9.94E-04	9.94E-04	3.12E+03	0.1%	0.10%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	6.17E-05	6.17E-05	2.04E-05	2.04E-05	2.04E-05	1.22E+04	3.45E-03	3.45E-03	1.22E+04	1.4%	1.38%
Fluoranthene	25.9	2.60E-01	-	-	-	-	-	-	-	-	-	-	-
Fluorene	21.1	1.69E+00	2.42E-03	2.42E-03	1.43E-03	1.43E-03	1.43E-03	1.40E+02	2.42E-03	2.42E-03	1.40E+02	1.2%	1.21%
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-	-	-	-	-	-	-	-	-
Iron	187		-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-	-	-	-	-	-	-	-	-
Manganese	4.89		-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	105	2.46E+01	1.80E-02	1.80E-02	7.33E-04	7.33E-04	7.33E-04	2.73E+02	1.80E-02	1.80E-02	2.73E+02	9.0%	9.02%
Naphthalene	283	3.10E+01	2.25E+00	2.25E+00	7.25E-02	7.25E-02	7.25E-02	2.76E+00	2.00E-01	-	2.76E+00	100.0%	100.00%
Nickel Soluble Salts	0.303		-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	3.62E-03	3.62E-03	3.14E-03	3.14E-03	3.14E-03	6.36E+01	3.62E-03	3.62E-03	6.36E+01	1.8%	1.81%
Phenol	249	8.28E+04	-	-	-	-	-	-	-	-	-	-	-
Pyrene	27.9	1.35E-01	8.96E-04	8.96E-04	6.63E-03	6.63E-03	6.63E-03	3.01E+01	8.96E-04	8.96E-04	3.01E+01	0.4%	0.45%
Styrene	0.194	3.10E+02	1.96E-05	1.96E-05	1.01E-04	1.01E-04	1.01E-04	9.90E+03	3.13E-02	3.13E-02	9.90E+03	3.1%	3.13%
Toluene	17.6	5.26E+02	9.36E-05	9.36E-05	5.32E-06	5.32E-06	5.32E-06	4.70E+04	2.80E-03	2.80E-03	4.70E+04	1.1%	1.12%
TPH C06-C09 aliphatic	6.08	1.18E+01	8.86E-06	8.86E-06	1.46E-06	1.46E-06	1.46E-06	8.58E+04	1.72E-05	1.72E-05	8.58E+04	0.0%	0.01%
TPH C10-C14 aliphatic	1730	9.99E-02	2.19E-02	2.19E-02	2.19E-01	2.19E-01	2.19E-01	5.70E-01	2.19E-02	2.19E-02	5.70E-01	17.5%	17.52%
TPH C10-C14 aromatic	1730	2.53E+01	2.29E-01	2.29E-01	9.06E-03	9.06E-03	9.06E-03	1.38E+01	1.25E-01	-	1.38E+01	100.0%	100.00%
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	3.48E-03	3.48E-03	3.78E-03	3.78E-03	3.78E-03	2.65E+02	2.15E-01	2.15E-01	2.65E+02	21.5%	21.54%
Vanadium and compounds	0.0228	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+01	8.09E-04	8.09E-04	1.21E-04	1.21E-04	1.21E-04	2.07E+03	1.28E-03	1.28E-03	2.07E+03	0.5%	0.51%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Non-Threshold Health Effects
Barangaroo Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - (Risk Based Calculations) Scenario

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (ILCR)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW Vapours from Flowing Water	TOTAL (All Pathways)	GW Vapours from Flowing Water	Total Vapour Pathways	TOTAL (All Pathways)				GW Vapours from Flowing Water	TOTAL
	mg/L	mg/L	unitless	unitless	L/mg	L/mg	L/mg	mg/L		mg/L	%	%
Acenaphthene	4.48	3.90E+00	-	-	-		-	-	-	-	-	-
Acenaphthylene	43.2	1.61E+01	-	-	-		-	-	-	-	-	-
Ammonia	348	4.82E+05	-	-	-		-	-	-	-	-	-
Aniline	0.212	3.60E+04	-	-	-		-	-	-	-	-	-
Anthracene	15.4	4.34E-02	-	-	-		-	-	-	-	-	-
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	-	-
Barium	2.23		-	-	-		-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	-	-
Benzene	40.2	1.79E+03	2.75E-06	2.75E-06	6.84E-08	6.84E-08	6.84E-08	1.46E+02	1.00E-05	1.46E+02	100.00%	100.00%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	-	-
Cobalt	0.057		-	-	-		-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	-	-	-		-	-	-	-	-	-
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	-	-	-		-	-	-	-	-	-
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	-	-	-		-	-	-	-	-	-
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	-	-
Fluorene	21.1	1.69E+00	-	-	-		-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	-	-
Iron	187		-	-	-		-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	-	-
Manganese	4.89		-	-	-		-	-	-	-	-	-
Methylnaphthalene, 2-	105	2.46E+01	-	-	-		-	-	-	-	-	-
Naphthalene	283	3.10E+01	-	-	-		-	-	-	-	-	-
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	-	-	-		-	-	-	-	-	-
Phenol	249	8.28E+04	-	-	-		-	-	-	-	-	-
Pyrene	27.9	1.35E-01	-	-	-		-	-	-	-	-	-
Styrene	0.194	3.10E+02	-	-	-		-	-	-	-	-	-
Toluene	17.6	5.26E+02	-	-	-		-	-	-	-	-	-
TPH C06-C09 aliphatic	6.08	1.18E+01	-	-	-		-	-	-	-	-	-
TPH C10-C14 aliphatic	1730	9.99E-02	-	-	-		-	-	-	-	-	-
TPH C10-C14 aromatic	1730	2.53E+01	-	-	-		-	-	-	-	-	-
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	-	-	-		-	-	-	-	-	-
Vanadium and compounds	0.0228	-	-	-	-		-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+01	-	-	-		-	-	-	-	-	-

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

1. General Information:

Site:	Barangaroo
Address:	Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Client:	Lend Lease
Scenario:	Scenario 1 - Lower Basement (Odour Based Calculations)

Header Colour (Defaults = Blue):

Blue

2. Select Receptor:

Commercial/Industrial

3. Select Exposure Pathways to Include:

Enter "x" in box, or select from dropdown box.

Soil Pathways

	Incidental Ingestion of Soil
	Dermal Contact with Soil
	Inhalation of Surface Soil-Derived Dust in Indoor Air
	Inhalation of Surface Soil-Derived Dust in Outdoor Air
	Inhalation of Surface Soil-Derived Vapours in Outdoor Air
	Inhalation of Soil-Derived Vapours From Excavation (USEPA 2002 method)
	Inhalation of Subsurface Soil-Derived Vapours in Indoor Air
	Inhalation of Subsurface Soil-Derived Vapours in Outdoor Air

Groundwater Pathways

	Inhalation of Groundwater-Derived Vapours in Indoor Air
	Inhalation of Groundwater-Derived Vapours in Outdoor Air
	Ingestion of Potable Groundwater
	Incidental Ingestion of Groundwater (Bathing or Excavation)
	Dermal Contact with Groundwater (Bathing or Excavation)
	Inhalation of Groundwater Vapours during Irrigation/ Showering
	Ingestion of Vegetables Irrigated with Groundwater
	Inhalation of Groundwater Vapours (Where GW Enters Trench)
x	Inhalation of vapour emissions from flowing water (groundwater in basement)

Y	Soil RBSLs saturation limited?
Y	Groundwater RBSLs solubility limited?

4. Select Chemicals for Quantitative Assessment:

	Target Hazard Index	Target Cancer Risk	5. Enter Chemical Concentrations (if only calculating RBSLs, enter 1 for media for which you want RBSLs):	
	default = 1 (or manually overwrite)	default = 1x10 ⁻⁵ (or manually overwrite)	Soil (mg/kg)	Groundwater (mg/L)
Acenaphthene	0.2	1.00E-05	511	4.48
Acenaphthylene	0.2	1.00E-05	1700	43.2
Ammonia	1	1.00E-05		348
Aniline	1	1.00E-05		0.212
Anthracene	0.2	1.00E-05	2150	15.4
Arsenic, Inorganic	1	1.00E-05		0.024
Barium	1	1.00E-05		2.23
Benz(a)anthracene		1.00E-05	1470	12.6
Benzene	0.25	1.00E-05	1510	40.2
Benzo(a)pyrene		1.00E-05	652	9.26
Benzo(b)fluoranthene		1.00E-05	587	8.33
Benzo(g,h,i)perylene		1.00E-05	305	4.22
Benzo(k)fluoranthene		1.00E-05	231	2.93
Bis(2-ethylhexyl)phalate	1	1.00E-05		0.03
Cadmium (Water)	1	1.00E-05		0.108
Chromium(III), Insoluble Salt	1	1.00E-05	210	0.102
Chromium(VI)	1	1.00E-05	2.3	0.102
Chrysene		1.00E-05	771	9.78
Cobalt	1	1.00E-05		0.057
Cresol, m-&p-	1	1.00E-05	2290	436
Cresol, o-	1	1.00E-05		182
	Blank			
Dibenz(a,h)anthracene		1.00E-05	71.4	0.822
Dibenzofuran	1	1.00E-05	277	10.2
Dimethylphenol, 2,4-	1	1.00E-05		38
Ethylbenzene	0.25	1.00E-05	261	3.02
Fluoranthene		1.00E-05	2440	25.9
Fluorene	0.2	1.00E-05	2100	21.1
Indeno(1,2,3-cd)pyrene		1.00E-05	247	3.05
Iron	1	1.00E-05	60600	187
Lead and Compounds	1	1.00E-05	13600	0.555
Manganese	1	1.00E-05		4.89
Methylnaphthalene, 2-	0.2	1.00E-05	7650	105
Naphthalene	0.2	1.00E-05	10200	283
Nickel Soluble Salts	1	1.00E-05		0.303
Phenanthrene	0.2	1.00E-05	5180	74.1
Phenol	1	1.00E-05		249
Pyrene	0.2	1.00E-05	2640	27.9
Styrene	1	1.00E-05		0.194
Toluene	0.25	1.00E-05	2650	17.6
TPH C06-C09 aliphatic	0.125	1.00E-05	593	6.08
TPH C10-C14 aliphatic	0.125	1.00E-05	69400	1730
TPH C10-C14 aromatic	0.125	1.00E-05	69400	1730
TPH C15-C28 aliphatic	0.125	1.00E-05	93200	1520
TPH C15-C28 aromatic	0.125	1.00E-05	93200	1520
TPH C29-C36 aliphatic	0.125	1.00E-05	20600	332
TPH C29-C36 aromatic	0.125	1.00E-05	20600	332
Trimethylbenzene, 1,2,4-	1	1.00E-05	220	0.92
Vanadium and compounds	1	1.00E-05	248	0.0228
Xylenes (total)	0.25	1.00E-05	2576	6.7

6. Confirm/Modify Exposure Parameters:

		Site-Specific Value (leave blank to use default value)		Value Used in Calculations	
		Adult	Child	Adult	Child

General receptor parameters:		Units			
Body weight	kg	70	13	70	13
Exposure duration	yr	64	6	64	6
Averaging time (carcinogens)	yr	70	70	70	70
Averaging time (non-carcinogens)	yr	30	6	30	6

Incidental Soil Ingestion

Daily soil ingestion rate	mg/day				
Exposure frequency for soil ingestion	days/yr				
Fraction of daily soil intake from site	unitless				

Dermal Absorption of Soil

Exposed skin surface area for soil contact	cm2				
Soil to skin adherence factor	mg/cm2				
Exposure frequency for dermal contact with soil	days/yr				

Indoor Inhalation

Exposure time (indoor air)	hrs/day				
Exposure frequency (indoor air)	days/yr				
Particulate emission factor (indoor air)	m3/kg				

Outdoor Inhalation

Exposure time (outdoor air)	hrs/day				
Exposure frequency (outdoor air)	days/yr				
Particulate emission factor (outdoor air)	m3/kg				

Potable Water Ingestion

Potable water intake rate	L/day				
Exposure frequency for potable water intake	days/yr				

Incidental Water Ingestion

Incidental ingestion rate	L/day				
Exposure frequency for incidental water ingestion	days/yr				

Dermal Contact with Water

Exposed skin surface for water contact	cm2				
Exposure time for dermal water contact	hr/day				
Exposure frequency for dermal water contact	days/yr				

Vapour Inhalation Shower/ Sprinkler

Exposure frequency	days/yr				
Exposure time	min/ day				
Inhalation rate	m3/hr				
Inhalation Absorption Adjustment Factor	mg/mg				
Lung retention factor	unitless				

Ingestion of Home Grown Produce

Proportion of homegrown produce ingested					
Exposure frequency	days/year				

Inhalation of Vapours from Flowing Water

Exposure time	hrs/day	8	1	8	1
Exposure frequency	days/year	240	350	240	350

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Calculation of Vapour Emissions from Water with Flow
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Odour Based Calculations) Scenario

PARAMETERS								Dimensions of Wet Section of Basement/ Impoundment								Air exchange rate (exchanges/day)			
Concrete permeability		(select from drop down list)		High permeability		Length (m)		59.0		Air exchange rate (exchanges/day)		7.60E+01							
Permeability Rate (m/day)				8.6.E-02		Width (m)		25.0		Windspeed (m/s)		if < 3.5m/sec		3.00E-02					
Water Temperature (deg. C)				18.0		Depth of Water (m)		0.01				if = or > 3.5m/sec							
Dimensions of Basement / Impoundment				Fetch/ Depth (m) ratio of Wet Basement Section				2500											
Height (m)		4.5		Volume of wet basement/ impoundment (m3)		14.7500													
Width (m)		50.0		Area covered in water (m2)		1475													
Depth (m)		50.0		Effective diameter of impoundment/ basement) (m)		43.3													
Volume total basement/ impoundment (m3)		11250		Volume of water entering basement (m³/sec)		1.48E-05													

Parameter Definition	Volatile	Chemical Concentration in Water (mg/L)	Molecular weight (g/mol)	Vapour Pressure (mmHg)	Vapour Pressure (atm)	Henry's Law Coefficient (unitless)	Henry's Law Coefficient (calculated)	Equilibrium Coefficient (at 25 deg C)	Diffusivity in Water (cm²/sec)	Schmidt Number on Gas Side (*)	Gas Phase Mass Transfer Coefficient (m/sec)	Schmidt Number on Liquid Side #	Liquid Phase Mass Transfer Coefficient (m/sec) **	Overall Mass Transfer Coefficient (m/s) (windspeed <3.5 m/s)	Diffusivity in Air (cm2/sec)	Equilibrium Concentration of water in Basement/ Impoundment (g/m³)	Air Emission Rate from Liquid Surface (g/sec)	Air Emission Rate from Liquid Surface (mg/day)	Adjusted Concentration in Basement Air (includes air exchange) (mg/m3)
		C	MW	Vap	Vap	unitless	atm.m3/g mol	K _{eq}	D _{water}	Sc _G	k _G	Sc _L	k _L	K	D _{air}	C _L		E	
Acenaphthene	Y	4.48	154	2.15E-03	2.83E-06	7.52E-03	1.80E-04	7.345E-03	8.33E-06	3.0E+00	9.939E-05	1.08E+03	2.74E-07	2.0E-07	0.0506	1.6E-01	4.63E-05	4.00E+03	4.68E-03
Acenaphthylene	Y	43.2	152	6.68E-03	8.79E-06	4.66E-03	1.11E-04	4.551E-03	6.98E-06	3.4E+00	9.188E-05	1.29E+03	2.44E-07	1.5E-07	0.045	1.7E+00	3.87E-04	3.34E+04	3.91E-02
Ammonia	Y	348	17	-	-	6.58E-04	1.57E-05	6.427E-04	1.10E-05	6.6E-01	2.725E-04	8.18E+02	3.30E-07	1.1E-07	0.228	1.0E+01	1.73E-03	1.49E+05	1.74E-01
Aniline	Y	0.212	93.1	4.90E-01	6.45E-04	8.26E-05	1.97E-06	8.067E-05	1.01E-05	1.8E+00	1.385E-04	8.91E+02	3.12E-07	1.1E-08	0.083	6.6E-03	1.05E-07	9.05E+00	1.06E-05
Anthracene	Y	15.4	178	6.53E-06	8.59E-09	2.27E-03	5.42E-05	2.217E-03	7.85E-06	3.9E+00	8.348E-05	1.15E+03	2.64E-07	1.1E-07	0.039	5.6E-01	9.03E-05	7.80E+03	9.12E-03
Arsenic, Inorganic	N	0.024	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	N	2.23	137	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	N	12.6	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	Y	40.2	78.1	9.48E+01	1.25E-01	2.27E-01	5.42E-03	2.217E-01	1.03E-05	1.7E+00	1.456E-04	8.74E+02	3.16E-07	3.1E-07	0.0895	1.2E+00	5.69E-04	4.92E+04	5.75E-02
Benzo(a)pyrene	N	9.26	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	N	8.33	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	N	4.22	276	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	N	2.93	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	N	0.03	391	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	N	0.108	112	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	N	0.102	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	N	0.102	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	N	9.78	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	N	0.057	58.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	Y	436	108	1.10E-01	1.45E-04	3.50E-05	8.36E-07	3.418E-05	9.32E-06	2.1E+00	1.269E-04	9.66E+02	2.96E-07	4.3E-09	0.0729	1.4E+01	9.00E-05	7.78E+03	9.09E-03
Cresol, o-	N	182	108	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	N	0.822	278	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	Y	10.2	168	2.48E-03	3.26E-06	8.71E-03	2.08E-04	8.507E-03	7.38E-06	3.7E+00	8.632E-05	1.22E+03	2.53E-07	1.9E-07	0.041	3.9E-01	1.08E-04	9.30E+03	1.09E-02
Dimethylphenol, 2,4-	Y	38	122	1.02E-01	1.34E-04	3.89E-05	9.29E-07	3.799E-05	8.31E-06	2.4E+00	1.141E-04	1.08E+03	2.74E-07	4.3E-09	0.0622	1.3E+00	8.43E-06	7.28E+02	8.52E-04
Ethylbenzene	Y	3.02	106	9.60E+00	1.26E-02	3.22E-01	7.69E-03	3.145E-01	8.46E-06	2.2E+00	1.217E-04	1.06E+03	2.77E-07	2.8E-07	0.0685	1.1E-01	4.27E-05	3.69E+03	4.31E-03
Fluoranthene	N	25.9	202	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	Y	21.1	166	6.00E-04	7.90E-07	3.93E-03	9.38E-05	3.838E-03	7.89E-06	3.4E+00	9.050E-05	1.14E+03	2.65E-07	1.5E-07	0.044	7.7E-01	1.70E-04	1.47E+04	1.72E-02
Indeno(1,2,3-cd)pyrene	N	3.05	276	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	N	187	55.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	N	0.555	207	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	N	4.89	54.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnapthalene, 2-	Y	105	142	5.50E-02	7.24E-05	2.12E-02	5.06E-04	2.071E-02	7.78E-06	2.9E+00	1.017E-04	1.16E+03	2.62E-07	2.3E-07	0.0524	3.9E+00	1.33E-03	1.15E+05	1.34E-01
Napthalene	Y	283	128	8.50E-02	1.12E-04	1.80E-02	4.30E-04	1.758E-02	8.38E-06	2.5E+00	1.120E-04	1.07E+03	2.75E-07	2.4E-07	0.0605	9.9E+00	3.53E-03	3.05E+05	3.57E-01
Nickel Soluble Salts	N	0.303	58.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	Y	74.1	178	1.21E-04	1.59E-07	1.73E-03	4.13E-05	1.690E-03	6.69E-06	4.4E+00	7.689E-05	1.35E+03	2.37E-07	8.4E-08	0.0345	3.0E+00	3.71E-04	3.21E+04	3.75E-02
Phenol	Y	249	94.1	3.50E-01	4.61E-04	1.36E-05	3.25E-07	1.328E-05	1.03E-05	1.8E+00	1.389E-04	8.74E+02	3.16E-07	1.8E-09	0.0834	7.6E+00	2.07E-05	1.79E+03	2.09E-03
Pyrene	Y	27.9	202	4.50E-06	5.92E-09	4.87E-04	1.16E-05	4.756E-04	7.25E-06	5.4E+00	6.654E-05	1.24E+03	2.50E-07	2.8E-08	0.0278	1.1E+00	4.45E-05	3.84E+03	4.49E-03
Styrene	Y	0.194	104	6.40E+00	8.42E-03	1.12E-01	2.67E-03	1.094E-01	8.78E-06	2.1E+00	1.248E-04	1.03E+03	2.84E-07	2.8E-07	0.0711	6.6E-03	2.71E-06	2.34E+02	2.74E-04
Toluene	Y	17.6	92.1	2.84E+01	3.74E-02	2.71E-01	6.47E-03	2.647E-01	9.20E-06	1.9E+00	1.326E-04	9.78E+02	2.93E-07	2.9E-07	0.0778	5.8E-01	2.49E-04	2.15E+04	2.52E-02
TPH C06-C09 aliphatic	Y	6.08	103	9.16E+01	1.21E-01	5.05E+01	1.21E+00	4.932E+01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.10E-07	3.1E-07	0.1	1.9E-01	8.69E-05	7.51E+03	8.78E-03
TPH C10-C14 aliphatic	Y	1730	170	1.16E+00	1.53E-03	6.26E+01	1.49E+00	6.114E+01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.10E-07	3.1E-07	0.1	5.4E+01	2.47E-02	2.14E+06	2.50E+00
TPH C10-C14 aromatic	Y	1730	136	1.16E+00	1.53E-03	1.41E-01	3.37E-03	1.377E-01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.10E-07	3.1E-07	0.1	5.4E+01	2.44E-02	2.11E+06	2.46E+00
TPH C15-C28 aliphatic	n	1520	260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	n	1520	209	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	n	332	270	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	N	332	240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	Y	0.92	120	2.10E+00	2.76E-03	2.52E-01	6.02E-03	2.461E-01	7.92E-06	2.5E+00	1.123E-04	1.14E+03	2.65E-07	2.6E-07	0.0607	3.3E-02	1.30E-05	1.12E+03	1.31E-03
Vanadium and compounds	N	0.0228	50.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	Y	6.7	106	7.99E+00	1.05E-02	2.12E-01	5.06E-03	2.071E-01	9.90E-06	1.8E+00	1.404E-04	9.09E+02	3.08E-07	3.0E-07	0.0847	2.1E-01	9.47E-05	8.18E+03	9.57E-03

Notes:
Assumes viscosity of air at 25 deg C
(*) Adopted density and viscosity of air values are those published in USEPA Air Emissions for Wast and Waste Water Nov 1994. (viscosity = 1.81 x 10⁻⁴, density = 1.2 x 10⁻³)
** where windspeeds are greater than 3.25 m/s, F/D ratios greater than 51.2 and diffusivity of ether is 8.5 x 10⁻⁵
Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Summary of Derived RBSLs

[Back to User Input Sheet](#)

Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Odour Based Calculations) Scenario

Chemical	Soil RBSLs (mg/kg)						Groundwater RBSLs (mg/L)					
	Adult Threshold	Child Threshold	Non- Threshold (Lifetime)	Adopted RBSL (Lowest)	Saturation Limited?	Site Concentra tion	Adult Threshold	2.58E+01	Non- Threshold (Lifetime)	Adopted RBSL (Lowest)	Solubility Limited?	Site Concentration
Acenaphthene	-	-	-	-	-	-	1.79E+02	2.10E+03	-	1.79E+02	>Sol	4.48E+00
Acenaphthylene	-	-	-	-	-	-	-	-	-	-	-	-
Ammonia	-	-	-	-	-	-	7.68E+04	8.98E+05	-	7.68E+04	-	3.48E+02
Aniline	-	-	-	-	-	-	1.79E+05	2.10E+06	-	1.79E+05	>Sol	2.12E-01
Anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic, Inorganic	-	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	-	-	-	-	-	-	4.07E+04	4.77E+05	-	4.07E+04	>Sol	4.02E+01
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	-	-	-	-	-	-	1.27E+02	1.49E+03	-	1.27E+02	-	4.36E+02
Cresol, o-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	-	-	-	-	-	-	6.10E+02	7.13E+03	-	6.10E+02	>Sol	1.02E+01
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	-	-	-	-	7.49E+02	8.76E+03	-	7.49E+02	>Sol	3.02E+00
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	-	-	-	-	-	-	4.56E+00	5.34E+01	-	4.56E+00	-	1.05E+02
Naphthalene	-	-	-	-	-	-	1.63E+01	1.91E+02	-	1.63E+01	-	2.83E+02
Nickel Soluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	-	-	-	-	-	-	3.93E+04	4.59E+05	-	3.93E+04	-	2.49E+02
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	2.06E+03	2.41E+04	-	2.06E+03	>Sol	1.94E-01
Toluene	-	-	-	-	-	-	1.13E+04	1.32E+05	-	1.13E+04	>Sol	1.76E+01
TPH C06-C09 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	-	-	-	-	-	-	2.95E+03	3.45E+04	-	2.95E+03	>Sol	9.20E-01
Vanadium and compounds	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	-	-	-	-	-	-	1.62E+03	1.90E+04	-	1.62E+03	>Sol	6.70E+00

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Pathways included in derivation of Soil RBSL:

Pathways included in derivation of Soil Vapour RBSL:

Pathways included in derivation of Groundwater RBSL:

Health Risk Calculations - Vapours from Flowing Water
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement A (Odour Based Calculations) Scenario

Chemical	Vapour Concentration in Basement/ Impoundment	Aqueous Solubility	Threshold Intake and Risk Calculations						
			Inhalation RfC	Adult Exposure Factor (threshold)	Adult Exposure Adjusted Air Concentration (threshold)	Hazard Index (Adult)	Child Exposure Factor (threshold)	Child Exposure Adjusted Air Concentration (threshold)	Hazard Index (Child)
	mg/m ³	(mg/L)	(mg/m3)	(L/m3)	(mg/m3)	(unitless)	(L/m3)	(mg/m3)	(unitless)
Acenaphthene	4.68E-03	3.90E+00	5.04E-01	4.68E-01	2.19E-03	4.35E-03	4.00E-02	1.87E-04	3.71E-04
Acenaphthylene	3.91E-02	1.61E+01	-	4.68E-01	-	-	4.00E-02	-	-
Ammonia	1.74E-01	4.82E+05	1.80E+01	4.68E-01	8.16E-02	4.53E-03	4.00E-02	6.97E-03	3.87E-04
Aniline	1.06E-05	3.60E+04	4.19E+00	4.68E-01	4.95E-06	1.18E-06	4.00E-02	4.23E-07	1.01E-07
Anthracene	9.12E-03	4.34E-02	-	4.68E-01	-	-	4.00E-02	-	-
Arsenic, Inorganic	-	0.00E+00	-	-	-	-	-	-	-
Barium	-	0.00E+00	-	-	-	-	-	-	-
Benz(a)anthracene	-	9.40E-03	-	-	-	-	-	-	-
Benzene	5.75E-02	1.79E+03	1.09E+02	4.68E-01	2.69E-02	2.47E-04	4.00E-02	2.30E-03	2.11E-05
Benzo(a)pyrene	-	1.62E-03	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	1.50E-03	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	2.60E-04	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	8.00E-04	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	2.70E-01	-	-	-	-	-	-	-
Cadmium (Water)	-	0.00E+00	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	0.00E+00	-	-	-	-	-	-	-
Chromium(VI)	-	1.69E+06	-	-	-	-	-	-	-
Chrysene	-	2.00E-03	-	-	-	-	-	-	-
Cobalt	-	0.00E+00	-	-	-	-	-	-	-
Cresol, m-&p-	9.09E-03	2.27E+04	1.24E-03	4.68E-01	4.25E-03	3.43E+00	4.00E-02	3.63E-04	2.93E-01
Cresol, o-	-	2.59E+04	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	2.49E-03	-	-	-	-	-	-	-
Dibenzofuran	1.09E-02	3.10E+00	1.00E+00	4.68E-01	5.09E-03	5.09E-03	4.00E-02	4.35E-04	4.35E-04
Dimethylphenol, 2,4-	8.52E-04	7.87E+03	-	4.68E-01	-	-	4.00E-02	-	-
Ethylbenzene	4.31E-03	1.69E+02	2.00E+00	4.68E-01	2.02E-03	1.01E-03	4.00E-02	1.72E-04	8.62E-05
Fluoranthene	-	2.60E-01	-	-	-	-	-	-	-
Fluorene	1.72E-02	1.69E+00	-	4.68E-01	-	-	4.00E-02	-	-
Indeno(1,2,3-cd)pyrene	-	1.90E-04	-	-	-	-	-	-	-
Iron	-	0.00E+00	-	-	-	-	-	-	-
Lead and Compounds	-	0.00E+00	-	-	-	-	-	-	-
Manganese	-	0.00E+00	-	-	-	-	-	-	-
Methylnaphthalene, 2-	1.34E-01	2.46E+01	5.81E-02	4.68E-01	6.27E-02	1.08E+00	4.00E-02	5.36E-03	9.22E-02
Naphthalene	3.57E-01	3.10E+01	4.40E-01	4.68E-01	1.67E-01	3.79E-01	4.00E-02	1.43E-02	3.24E-02
Nickel Soluble Salts	-	0.00E+00	-	-	-	-	-	-	-
Phenanthrene	3.75E-02	1.15E+00	-	4.68E-01	-	-	4.00E-02	-	-
Phenol	2.09E-03	8.28E+04	1.54E-01	4.68E-01	9.77E-04	6.34E-03	4.00E-02	8.34E-05	5.42E-04
Pyrene	4.49E-03	1.35E-01	-	4.68E-01	-	-	4.00E-02	-	-
Styrene	2.74E-04	3.10E+02	1.36E+00	4.68E-01	1.28E-04	9.41E-05	4.00E-02	1.09E-05	8.04E-06
Toluene	2.52E-02	5.26E+02	3.01E+01	4.68E-01	1.18E-02	3.90E-04	4.00E-02	1.01E-03	3.34E-05
TPH C06-C09 aliphatic	8.78E-03	1.18E+01	-	4.68E-01	-	-	4.00E-02	-	-
TPH C10-C14 aliphatic	2.50E+00	9.99E-02	-	4.68E-01	-	-	4.00E-02	-	-
TPH C10-C14 aromatic	2.46E+00	2.53E+01	-	4.68E-01	-	-	4.00E-02	-	-
TPH C15-C28 aliphatic	-	1.11E-04	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	1.06E+00	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	2.50E-06	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	6.60E-03	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	1.31E-03	5.70E+01	1.96E+00	4.68E-01	6.12E-04	3.12E-04	4.00E-02	5.23E-05	2.66E-05
Vanadium and compounds	-	-	-	-	-	-	-	-	-
Xylenes (total)	9.57E-03	1.06E+02	4.34E+00	4.68E-01	4.48E-03	1.03E-03	4.00E-02	3.82E-04	8.82E-05

TOTAL

4.92E+00

4.20E-01

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement A (Odour Based Calculations) Scenario

Chemical	Cgw mg/L	Solubility mg/L	Risk at Input Groundwater Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL mg/L	Pathway Contributions to Total Estimated Risk at RBSL	
			GW vapours from flowing water	TOTAL (All Pathways)	GW vapours from flowing water	Total Vapour Pathways	TOTAL (All Pathways)					GW vapours from flowing water	TOTAL
	mg/L	mg/L	unitless	unitless	unitless	L/mg	L/mg	mg/L				%	%
Acenaphthene	4.48	3.90E+00	4.35E-03	4.35E-03	1.11E-03	1.11E-03	1.11E-03	1.79E+02	4.35E-03	4.35E-03	1.79E+02	2.2%	2.17%
Acenaphthylene	43.2	1.61E+01	-	-	-	-	-	-	-	-	-	-	-
Ammonia	348	4.82E+05	4.53E-03	4.53E-03	1.30E-05	1.30E-05	1.30E-05	7.68E+04	1.00E+00	-	7.68E+04	100.0%	100.00%
Aniline	0.212	3.60E+04	1.18E-06	1.18E-06	5.57E-06	5.57E-06	5.57E-06	1.79E+05	2.01E-01	2.01E-01	1.79E+05	20.1%	20.06%
Anthracene	15.4	4.34E-02	-	-	-	-	-	-	-	-	-	-	-
Arsenic, Inorganic	0.024		-	-	-	-	-	-	-	-	-	-	-
Barium	2.23		-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-	-	-	-	-	-	-	-	-
Benzene	40.2	1.79E+03	2.47E-04	2.47E-04	6.14E-06	6.14E-06	6.14E-06	4.07E+04	1.10E-02	1.10E-02	4.07E+04	4.4%	4.39%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-	-	-	-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-	-	-	-	-	-	-	-	-
Cobalt	0.057		-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	3.43E+00	3.43E+00	7.87E-03	7.87E-03	7.87E-03	1.27E+02	1.00E+00	-	1.27E+02	100.0%	100.00%
Cresol, o-	182	2.59E+04	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	5.09E-03	5.09E-03	1.64E-03	1.64E-03	1.64E-03	6.10E+02	5.09E-03	5.09E-03	6.10E+02	0.5%	0.51%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	1.01E-03	1.01E-03	3.34E-04	3.34E-04	3.34E-04	7.49E+02	5.64E-02	5.64E-02	7.49E+02	22.6%	22.57%
Fluoranthene	25.9	2.60E-01	-	-	-	-	-	-	-	-	-	-	-
Fluorene	21.1	1.69E+00	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-	-	-	-	-	-	-	-	-
Iron	187		-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-	-	-	-	-	-	-	-	-
Manganese	4.89		-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	105	2.46E+01	1.08E+00	1.08E+00	4.39E-02	4.39E-02	4.39E-02	4.56E+00	2.00E-01	-	4.56E+00	100.0%	100.00%
Naphthalene	283	3.10E+01	3.79E-01	3.79E-01	1.22E-02	1.22E-02	1.22E-02	1.63E+01	2.00E-01	-	1.63E+01	100.0%	100.00%
Nickel Soluble Salts	0.303		-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	-	-	-	-	-	-	-	-	-	-	-
Phenol	249	8.28E+04	6.34E-03	6.34E-03	2.55E-05	2.55E-05	2.55E-05	3.93E+04	1.00E+00	-	3.93E+04	100.0%	100.00%
Pyrene	27.9	1.35E-01	-	-	-	-	-	-	-	-	-	-	-
Styrene	0.194	3.10E+02	9.41E-05	9.41E-05	4.85E-04	4.85E-04	4.85E-04	2.06E+03	1.50E-01	1.50E-01	2.06E+03	15.0%	15.03%
Toluene	17.6	5.26E+02	3.90E-04	3.90E-04	2.22E-05	2.22E-05	2.22E-05	1.13E+04	1.17E-02	1.17E-02	1.13E+04	4.7%	4.67%
TPH C06-C09 aliphatic	6.08	1.18E+01	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aliphatic	1730	9.99E-02	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aromatic	1730	2.53E+01	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	3.12E-04	3.12E-04	3.39E-04	3.39E-04	3.39E-04	2.95E+03	1.93E-02	1.93E-02	2.95E+03	1.9%	1.93%
Vanadium and compounds	0.0228	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+02	1.03E-03	1.03E-03	1.54E-04	1.54E-04	1.54E-04	1.62E+03	1.63E-02	1.63E-02	1.62E+03	6.5%	6.53%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Child Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement A(Odour Based Calculations) Scenario

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW Vapurs from Flowing Water	TOTAL (All Pathways)	GW Vapour from Flowing Water	Total Vapour Pathways	TOTAL (All Pathways)					GW Vapours from Flowing Water	TOTAL
	mg/L	mg/L	unitless	unitless	unitless	L/mg	L/mg	mg/L			mg/L	%	%
Acenaphthene	4.48	3.90E+00	3.71E-04	3.71E-04	9.52E-05	9.52E-05	9.52E-05	2.10E+03	3.71E-04	3.71E-04	2.10E+03	0.2%	0.19%
Acenaphthylene	43.2	1.61E+01	-	-	-		-	-	-	-	-	-	-
Ammonia	348	4.82E+05	3.87E-04	3.87E-04	1.11E-06	1.11E-06	1.11E-06	8.98E+05	5.36E-01	5.36E-01	8.98E+05	53.6%	53.65%
Aniline	0.212	3.60E+04	1.01E-07	1.01E-07	4.76E-07	4.76E-07	4.76E-07	2.10E+06	1.71E-02	1.71E-02	2.10E+06	1.7%	1.71%
Anthracene	15.4	4.34E-02	-	-	-		-	-	-	-	-	-	-
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	-	-	-
Barium	2.23		-	-	-		-	-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	-	-	-
Benzene	40.2	1.79E+03	2.11E-05	2.11E-05	5.24E-07	5.24E-07	5.24E-07	4.77E+05	9.39E-04	9.39E-04	4.77E+05	0.4%	0.38%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	-	-	-
Cobalt	0.057		-	-	-		-	-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	2.93E-01	2.93E-01	6.73E-04	6.73E-04	6.73E-04	1.49E+03	1.00E+00	-	1.49E+03	100.0%	100.00%
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	4.35E-04	4.35E-04	1.40E-04	1.40E-04	1.40E-04	7.13E+03	4.35E-04	4.35E-04	7.13E+03	0.0%	0.04%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	8.62E-05	8.62E-05	2.85E-05	2.85E-05	2.85E-05	8.76E+03	4.82E-03	4.82E-03	8.76E+03	1.9%	1.93%
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	-	-	-
Fluorene	21.1	1.69E+00	-	-	-		-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	-	-	-
Iron	187		-	-	-		-	-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	-	-	-
Manganese	4.89		-	-	-		-	-	-	-	-	-	-
Methylnaphthalene, 2-Naphthalene	105	2.46E+01	9.22E-02	9.22E-02	3.75E-03	3.75E-03	3.75E-03	5.34E+01	9.22E-02	9.22E-02	5.34E+01	46.1%	46.10%
	283	3.10E+01	3.24E-02	3.24E-02	1.05E-03	1.05E-03	1.05E-03	1.91E+02	3.24E-02	3.24E-02	1.91E+02	16.2%	16.21%
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	-	-	-		-	-	-	-	-	-	-
Phenol	249	8.28E+04	5.42E-04	5.42E-04	2.18E-06	2.18E-06	2.18E-06	4.59E+05	1.80E-01	1.80E-01	4.59E+05	18.0%	18.03%
Pyrene	27.9	1.35E-01	-	-	-		-	-	-	-	-	-	-
Styrene	0.194	3.10E+02	8.04E-06	8.04E-06	4.14E-05	4.14E-05	4.14E-05	2.41E+04	1.28E-02	1.28E-02	2.41E+04	1.3%	1.28%
Toluene	17.6	5.26E+02	3.34E-05	3.34E-05	1.90E-06	1.90E-06	1.90E-06	1.32E+05	9.97E-04	9.97E-04	1.32E+05	0.4%	0.40%
TPH C06-C09 aliphatic	6.08	1.18E+01	-	-	-		-	-	-	-	-	-	-
TPH C10-C14 aliphatic	1730	9.99E-02	-	-	-		-	-	-	-	-	-	-
TPH C10-C14 aromatic	1730	2.53E+01	-	-	-		-	-	-	-	-	-	-
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	2.66E-05	2.66E-05	2.90E-05	2.90E-05	2.90E-05	3.45E+04	1.65E-03	1.65E-03	3.45E+04	0.2%	0.17%
Vanadium and compounds	0.0228	-	-	-	-		-	-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+02	8.82E-05	8.82E-05	1.32E-05	1.32E-05	1.32E-05	1.90E+04	1.40E-03	1.40E-03	1.90E+04	0.6%	0.56%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

1. General Information:

Site:

Barangaroo

Address:

Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000

Client:

Lend Lease

Scenario:

Scenario 2 - Upper Basement (Odour Based Calculations)

Header Colour (Defaults = Blue):

Blue

2. Select Receptor:

Commercial/Industrial

3. Select Exposure Pathways to Include:

Enter "x" in box, or select from dropdown box.

Soil Pathways

Incidental Ingestion of Soil

Dermal Contact with Soil

Inhalation of Surface Soil-Derived Dust in Indoor Air

Inhalation of Surface Soil-Derived Dust in Outdoor Air

Inhalation of Surface Soil-Derived Vapours in Outdoor Air

Inhalation of Soil-Derived Vapours From Excavation (USEPA 2002 method)

x

Inhalation of Subsurface Soil-Derived Vapours in Indoor Air

Inhalation of Subsurface Soil-Derived Vapours in Outdoor Air

Groundwater Pathways

Inhalation of Groundwater-Derived Vapours in Indoor Air

Inhalation of Groundwater-Derived Vapours in Outdoor Air

Ingestion of Potable Groundwater

Incidental Ingestion of Groundwater (Bathing or Excavation)

Dermal Contact with Groundwater (Bathing or Excavation)

Inhalation of Groundwater Vapours during Irrigation/ Showering

Ingestion of Vegetables Irrigated with Groundwater

Inhalation of Groundwater Vapours (Where GW Enters Trench)

x

Inhalation of vapour emissions from flowing water (groundwater in basement)

Inhalation of Soil Vapour-Derived Vapours in Indoor Air

Inhalation of Soil Vapour-Derived Vapours in Outdoor Air

Y

Soil RBSLs saturation limited?

Y

Groundwater RBSLs solubility limited?

4. Select Chemicals for Quantitative Assessment:	Target Hazard Index	Target Cancer Risk	5. Enter Chemical Concentrations (if only calculating RBSLs, enter 1 for media for which you want RBSLs):	
	default = 1 (or manually overwrite)	default = 1x10 ⁻⁵ (or manually overwrite)	Soil (mg/kg)	Groundwater (mg/L)
Acenaphthene	0.2	1.00E-05	511	4.48
Acenaphthylene	0.2	1.00E-05	1700	43.2
Ammonia	1	1.00E-05		348
Aniline	1	1.00E-05		0.212
Anthracene	0.2	1.00E-05	2150	15.4
Arsenic, Inorganic	1	1.00E-05		0.024
Barium	1	1.00E-05		2.23
Benz(a)anthracene		1.00E-05	1470	12.6
Benzene	0.25	1.00E-05	1510	40.2
Benzo(a)pyrene		1.00E-05	652	9.26
Benzo(b)fluoranthene		1.00E-05	587	8.33
Benzo(g,h,i)perylene		1.00E-05	305	4.22
Benzo(k)fluoranthene		1.00E-05	231	2.93
Bis(2-ethylhexyl)phalate	1	1.00E-05		0.03
Cadmium (Water)	1	1.00E-05		0.108
Chromium(III), Insoluble Salt	1	1.00E-05	210	0.102
Chromium(VI)	1	1.00E-05	2.3	0.102
Chrysene		1.00E-05	771	9.78
Cobalt	1	1.00E-05		0.057
Cresol, m-&p-	1	1.00E-05	2290	436
Cresol, o-	1	1.00E-05		182
Blank				
Dibenz(a,h)anthracene		1.00E-05	71.4	0.822
Dibenzofuran	1	1.00E-05	277	10.2
Dimethylphenol, 2,4-	1	1.00E-05		38
Ethylbenzene	0.25	1.00E-05	261	3.02
Fluoranthene		1.00E-05	2440	25.9
Fluorene	0.2	1.00E-05	2100	21.1
Indeno(1,2,3-cd)pyrene		1.00E-05	247	3.05
Iron	1	1.00E-05	60600	187
Lead and Compounds	1	1.00E-05	13600	0.555
Manganese	1	1.00E-05		4.89
Methylnaphthalene, 2-	0.2	1.00E-05	7650	105
Naphthalene	0.2	1.00E-05	10200	283
Nickel Soluble Salts	1	1.00E-05		0.303
Phenanthrene	0.2	1.00E-05	5180	74.1
Phenol	1	1.00E-05		249
Pyrene	0.2	1.00E-05	2640	27.9
Styrene	1	1.00E-05		0.194
Toluene	0.25	1.00E-05	2650	17.6
TPH C06-C09 aliphatic	0.125	1.00E-05	593	6.08
TPH C10-C14 aliphatic	0.125	1.00E-05	69400	1730
TPH C10-C14 aromatic	0.125	1.00E-05	69400	1730
TPH C15-C28 aliphatic	0.125	1.00E-05	93200	1520
TPH C15-C28 aromatic	0.125	1.00E-05	93200	1520
TPH C29-C36 aliphatic	0.125	1.00E-05	20600	332
TPH C29-C36 aromatic	0.125	1.00E-05	20600	332
Trimethylbenzene, 1,2,4-	1	1.00E-05	220	0.92
Vanadium and compounds	1	1.00E-05	248	0.0228
Xylenes (total)	0.25	1.00E-05	2576	6.7

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

6. Confirm/Modify Exposure Parameters:

Site-Specific Value (leave blank to use default value)

Value Used in Calculations

Adult

Child

Adult

Child

General receptor parameters:

Units

Body weight

kg

70

na

70

Exposure duration

yr

30

na

30

Averaging time (carcinogens)

yr

70

na

70

Averaging time (non-carcinogens)

yr

30

na

30

Incidental Soil Ingestion

Daily soil ingestion rate

mg/day

Exposure frequency for soil ingestion

days/yr

Fraction of daily soil intake from site

unitless

Dermal Absorption of Soil

Exposed skin surface area for soil contact

cm2

Soil to skin adherence factor

mg/cm2

Exposure frequency for dermal contact with soil

days/yr

Indoor Inhalation

Exposure time (indoor air)

hrs/day

8

8

Exposure frequency (indoor air)

days/yr

240

240

Particulate emission factor (indoor air)

m3/kg

Outdoor Inhalation

Exposure time (outdoor air)

hrs/day

Exposure frequency (outdoor air)

days/yr

Particulate emission factor (outdoor air)

m3/kg

Potable Water Ingestion

Potable water intake rate

L/day

Exposure frequency for potable water intake

days/yr

Incidental Water Ingestion

Incidental ingestion rate

L/day

Exposure frequency for incidental water ingestion

days/yr

Dermal Contact with Water

Exposed skin surface for water contact

cm2

Exposure time for dermal water contact

hr/day

Exposure frequency for dermal water contact

days/yr

Vapour Inhalation Shower/ Sprinkler

Exposure frequency

days/yr

Exposure time

min/ day

Inhalation rate

m3/hr

Inhalation Absorption Adjustment Factor

mg/mg

Lung retention factor

unitless

Ingestion of Home Grown Produce

Proportion of homegrown produce ingested

Exposure frequency

days/year

Inhalation of Vapours from Flowing Water

Exposure time

hrs/day

8

8

8

8

Exposure frequency

days/year

240

240

240

240

A. Model Input Parameters

Parameter Definition	Units	Default Value (Shell 2007 unless otherwise noted)	Notes	Site-Specific Value (leave blank if adopting Shell default)	Label	Adopted Value for Model	Justification for Site-specific value, if applicable
Lower depth of surficial soil zone	cm	100			LDSSZ	100	
Depth to subsurface soil sources (below building, ground surface or trench)	cm	100			LS	0.001	Autocalculates from layer thicknesses
<i>Vadose Zone Layer 1 (soil type where source is)</i>							
Thickness	cm	100		0.001	HV	0.001	Negligible distance - assumes soil is adjacent building foundataion.
				Sand and gravel (<12% fines)			Conservative assumption for mixed fill.
SCS Soil Type:							
Fraction of organic carbon	unitless	0.01		0.002	OC	0.002	
Soil bulk density	g/cm3	1.7		1.66	sbd	1.66	
Air-filled porosity (volumetric)	cm3/cm3	0.26		0.321	VACS	0.321	
Water-filled porosity (volumetric)	cm3/cm3	0.12		0.054	wvcvz	0.054	
Total soil porosity	cm3/cm3	0.38		0.375	TPOR	0.375	
Vapour phase source partitioning adjustment	unitless	1		10	VPPA	10	Adjustment for vapour partitioning; see text.
Vadose zone biodegradation adjustment	unitless	1		1	BioA	1	Conservatively assumes no soil vapour biodegradation
<i>Building Characteristics</i>							
Enclosed-space volume/infiltration area (ratio)	cm	300	(a)	5625	LB	5625	Assumes 25 m by 25 m by 4.5 m high basement section, with soil vapour infiltration through upper 2 m of 2 of 4 walls only, ie volume = 11250 m3 and infiltration area = 200 m2. See text.
Enclosed-space foundation or wall thickness	cm	15		15	Lcrack	15	600 mm diaphragm outer wall assumed, as per LLD
Enclosed-space air exchange rate	1/s	0.00055556		0.00088	ENCAER	8.80E-04	4 per hour, in accordance with AS1668.2
Areal fraction of cracks in foundations/walls	cm ² -cracks/cm ² -total area	0.0019	(b)	0.0002	NU	0.0002	USEPA (2004) default for basement foundation.
Volumetric air content in found./wall cracks	cc/cc	0.26		0.321	VACF	0.321	Assumes cracks in concrete are filled with sand.
Volumetric water content in found./wall cracks	cc/cc	0.12		0.054	wvcfnd	0.054	Assumes cracks in concrete are filled with sand.
<i>Convective vapour flow term</i>							
Calculate convective flow term?		Y		y	Conv	y	
Convective flow rate (if specified directly)	cm3/sec			0.001			
Convective flow through slab (calculated)	cm3/sec	10.88		380.3828744	Qs	380.38	
Slab Area	cm2	700000		2.70E+07	Ab	27000000	Conservatively assumes area of 2 walls and floor
Areal fraction of cracks in foundations/walls	cm ² -cracks/cm ² -total area	0.0019		0.0002	Nuc		
Soil vapour permeability	cm ²	1.00E-08		1.00E-07	kv	1.00E-07	
Indoor-outdoor pressure differential	g/cm-s ²	40		4.00E+01	dP	40	
Slab perimeter	cm	3400		2.00E+04	Xcrack	20000	
Depth below ground to bottom of slab	cm	15		2.00E+02	Zcrack	200	
Viscosity of air	g/cm-s	1.81E-04		1.81E-04	uair	1.81E-04	

(a) Building Code of Australia minimum ceiling height for habitable dwelling.
(b) USEPA (2004) upper limit of range for slab on grade foundation.
(c) If receptor is construction/excavation worker, wind speed is default wind speed of 225 cm/s reduced by factor of 10 to account for reduced wind circulation within excavation. For other receptors, wind speed is default of 225 cm/s.
(d) For construction/excavation worker, default is 400 cm (assumes trench is 2 m long and 2 m deep, and vapours enter through both walls and floor). For other receptors, Shell (2007) default of 4500 cm is assumed.
(e) Equals exposure duration for selected receptor. For residential scenario, shortest (child) exposure duration is selected for conservative purposes.
(f) USEPA (2002) default (0.5 acre).

B. Chemical-Specific Fate and Transport Parameters

CHEMICAL	Koc	Kd	H ⁺	S	D ^{air}	D ^{soil}	MW	VP	Volatile?
	(cm ² /g)	(cm ² /g)	(cc-H ₂ O / cc-air)	(mg/l-water)	(cm ² /s)	(cm ² /s)	(g/mol)	(mmHg)	
Acenaphthene	5.03E+03	1.01E+01	7.52E-03	3.90E+00	5.06E-02	8.33E-06	1.54E+02	2.15E-03	Y
Acenaphthylene	5.03E+03	1.01E+01	4.66E-03	1.61E+01	4.50E-02	6.98E-06	1.52E+02	6.68E-03	Y
Ammonia	3.10E+00	6.20E-03	6.58E-04	4.82E+05	2.28E-01	1.10E-05	1.70E+01	-	Y
Aniline	7.02E+01	1.40E-01	8.26E-05	3.60E+04	8.30E-02	1.01E-05	9.31E+01	4.90E-01	Y
Anthracene	1.64E+04	3.28E+01	2.27E-03	4.34E-02	3.90E-02	7.85E-06	1.78E+02	6.53E-06	Y
Arsenic, Inorganic	-	-	-	-	-	-	7.80E+01	-	N
Barium	-	-	-	-	-	-	1.37E+02	-	N
Benz(a)anthracene	1.77E+05	3.54E+02	1.37E-04	9.40E-03	5.10E-02	9.00E-06	2.28E+02	2.10E-07	N
Benzene	1.46E+02	2.92E-01	2.27E-01	1.79E+03	8.95E-02	1.03E-05	7.81E+01	9.48E+01	Y
Benzo(a)pyrene	5.87E+05	1.17E+03	1.87E-05	1.62E-03	4.30E-02	9.00E-06	2.52E+02	5.49E-09	N
Benzo(b)fluoranthene	5.99E+05	1.20E+03	2.69E-05	1.50E-03	2.26E-02	5.56E-06	2.52E+02	5.00E-07	N
Benzo(g,h,i)perylene	1.95E+06	3.90E+03	1.35E-05	2.60E-04	4.90E-02	5.56E-06	2.76E+02	1.00E-10	N
Benzo(k)fluoranthene	5.87E+05	1.17E+03	2.39E-05	8.00E-04	2.26E-02	5.56E-06	2.52E+02	9.65E-10	N
Bis(2-ethylhexyl)phalate	1.20E+05	2.40E+02	1.10E-05	2.70E-01	3.51E-02	3.66E-06	3.91E+02	1.42E-07	N
Cadmium (Water)	-	-	-	-	-	-	1.12E+02	-	N
Chromium(III), Insoluble Salts	-	-	-	-	-	-	5.20E+01	-	N
Chromium(VI)	-	-	-	1.69E+06	-	-	5.20E+01	-	N
Chrysene	1.81E+05	3.62E+02	2.14E-04	2.00E-03	2.48E-02	6.21E-06	2.28E+02	6.23E-09	N
Cobalt	-	-	-	-	-	-	5.89E+01	-	N
Cresol, m-&p-	3.00E+02	6.00E-01	3.50E-05	2.27E+04	7.29E-02	9.32E-06	1.08E+02	1.10E-01	Y
Cresol, o-	3.07E+02	6.14E-01	4.91E-05	2.59E+04	7.28E-02	9.32E-06	1.08E+02	1.70E-01	N
Dibenz(a,h)anthracene	1.91E+06	3.82E+03	5.76E-06	2.49E-03	2.00E-02	5.24E-06	2.78E+02	9.55E-10	N

Vapour Modelling - Soil to Outdoor and Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

[Back to User Input Sheet](#)

Dibenzofuran	9.16E+03	1.83E+01	8.71E-03	3.10E+00	4.10E-02	7.38E-06	1.68E+02	2.48E-03	Y
Dimethylphenol, 2,4-	4.92E+02	9.84E-01	3.89E-05	7.87E+03	6.22E-02	8.31E-06	1.22E+02	1.02E-01	Y
Ethylbenzene	4.46E+02	8.92E-01	3.22E-01	1.69E+02	6.85E-02	8.46E-06	1.06E+02	9.60E+00	Y
Fluoranthene	5.55E+04	1.11E+02	3.62E-04	2.60E-01	3.02E-02	6.35E-06	2.02E+02	9.22E-06	N
Fluorene	9.16E+03	1.83E+01	3.93E-03	1.69E+00	4.40E-02	7.89E-06	1.66E+02	6.00E-04	Y
Indeno(1,2,3-cd)pyrene	1.95E+06	3.90E+03	1.42E-05	1.90E-04	2.30E-02	4.41E-06	2.76E+02	1.25E-10	N
Iron	-	-	-	-	-	-	5.59E+01	-	N
Lead and Compounds	-	-	-	-	-	-	2.07E+02	-	N
Manganese	-	-	-	-	-	-	5.49E+01	-	N
Methylnaphthalene, 2-	2.48E+03	4.96E+00	2.12E-02	2.46E+01	5.24E-02	7.78E-06	1.42E+02	5.50E-02	Y
Naphthalene	1.54E+03	3.08E+00	1.80E-02	3.10E+01	6.05E-02	8.38E-06	1.28E+02	8.50E-02	Y
Nickel Soluble Salts	-	-	-	-	-	-	5.87E+01	-	N
Phenanthrene	1.67E+04	3.34E+01	1.73E-03	1.15E+00	3.45E-02	6.69E-06	1.78E+02	1.21E-04	Y
Phenol	1.87E+02	3.74E-01	1.36E-05	8.28E+04	8.34E-02	1.03E-05	9.41E+01	3.50E-01	Y
Pyrene	5.43E+04	1.09E+02	4.87E-04	1.35E-01	2.78E-02	7.25E-06	2.02E+02	4.50E-06	Y
Styrene	4.46E+02	8.92E-01	1.12E-01	3.10E+02	7.11E-02	8.78E-06	1.04E+02	6.40E+00	Y
Toluene	2.34E+02	4.68E-01	2.71E-01	5.26E+02	7.78E-02	9.20E-06	9.21E+01	2.84E+01	Y
TPH C06-C09 aliphatic	4.47E+03	8.94E+00	5.05E+01	1.18E+01	1.00E-01	1.00E-05	1.03E+02	9.16E+01	Y
TPH C10-C14 aliphatic	5.50E+05	1.10E+03	6.26E+01	9.99E-02	1.00E+03	1.00E-05	1.70E+02	1.16E+00	Y
TPH C10-C14 aromatic	3.02E+03	6.04E+00	1.41E-01	2.53E+01	1.00E-01	1.00E-05	1.36E+02	1.16E+00	Y
TPH C15-C28 aliphatic	3.16E+08	6.32E+05	8.27E+01	1.11E-04	1.00E-01	1.00E-05	2.60E+02	5.93E-03	n
TPH C15-C28 aromatic	3.79E+04	7.58E+01	4.90E-03	1.06E+00	1.00E-01	1.00E-05	2.09E+02	5.51E-03	N
TPH C29-C36 aliphatic	6.31E+08	1.26E+06	8.50E+01	2.50E-06	1.00E-01	1.00E-05	2.70E+02	8.36E-04	N
TPH C29-C36 aromatic	1.26E+05	2.52E+02	1.70E-05	6.60E-03	1.00E-01	1.00E-05	2.40E+02	3.34E-07	N
Trimethylbenzene, 1,2,4-	6.14E+02	1.23E+00	2.52E-01	5.70E+01	6.07E-02	7.92E-06	1.20E+02	2.10E+00	Y
Vanadium and compounds	-	-	-	-	-	-	5.09E+01	-	N
Xylenes (total)	3.83E+02	7.66E-01	2.12E-01	1.06E+02	8.47E-02	9.90E-06	1.06E+02	7.99E+00	Y

Definition of Parameters

Koc	Organic carbon partition coefficient	D ^{air}	Diffusion coefficient in air
Kd	Soil-water partition coefficient	D ^{wat}	Diffusion coefficient in water
H'	Dimensionless Henry's Law Constant	MW	Molecular weight
S	Solubility	VP	Vapopur pressure

C. Chemical-Specific Diffusion Coefficients

CHEMICAL	D _{e1}	D _{e2}	D _{e3}	D _{cont}	D _{crack}	C _{ad}	Convective Factor	D _o	M _{outlet}
	(cm ² /s)	(cm ² /s)	(cm ² /s)	(cm ² /s)	(cm ² /s)	(mg/kg)	(unitless)	(cm ² /s)	(g)
Acenaphthene	8.18E-03	-	-	8.18E-03	8.18E-03	3.94E+01	1.29E+02	3.66E-06	7.25E+04
Acenaphthylene	7.28E-03	-	-	7.28E-03	7.28E-03	1.63E+02	1.45E+02	2.02E-06	5.38E+04
Ammonia	3.69E-02	-	-	3.69E-02	3.69E-02	1.87E+04	2.87E+01	3.75E-04	7.34E+05
Aniline	1.35E-02	-	-	1.35E-02	1.35E-02	6.23E+03	7.84E+01	3.86E-06	7.45E+04
Anthracene	6.31E-03	-	-	6.31E-03	6.31E-03	1.42E+00	1.68E+02	2.62E-07	1.94E+04
Arsenic, Inorganic	NV	NV	NV	NV	NV	-	NV	NV	NV
Barium	NV	NV	NV	NV	NV	-	NV	NV	NV
Benz(a)anthracene	NV	NV	NV	NV	NV	3.33E+00	NV	NV	NV
Benzene	1.45E-02	-	-	1.45E-02	1.45E-02	6.59E+02	7.30E+01	5.35E-03	2.77E+06
Benzo(a)pyrene	NV	NV	NV	NV	NV	1.90E+00	NV	NV	NV
Benzo(b)fluoranthene	NV	NV	NV	NV	NV	1.80E+00	NV	NV	NV
Benzo(g,h,i)perylene	NV	NV	NV	NV	NV	1.01E+00	NV	NV	NV
Benzo(k)fluoranthene	NV	NV	NV	NV	NV	9.39E-01	NV	NV	NV
Bis(2-ethylhexyl)phalate	NV	NV	NV	NV	NV	6.48E+01	NV	NV	NV
Cadmium (Water)	NV	NV	NV	NV	NV	-	NV	NV	NV
Chromium(III), Insoluble Salts	NV	NV	NV	NV	NV	-	NV	NV	NV
Chromium(VI)	NV	NV	NV	NV	NV	-	NV	NV	NV
Chrysene	NV	NV	NV	NV	NV	7.24E-01	NV	NV	NV
Cobalt	NV	NV	-	NV	NV	-	NV	NV	NV
Cresol, m-&p-	1.19E-02	-	-	1.19E-02	1.19E-02	1.44E+04	8.88E+01	3.95E-07	2.38E+04
Cresol, o-	NV	NV	NV	NV	NV	1.67E+04	NV	NV	NV
Blank	NV	NV	NV	NV	NV	6.48E+01	NV	NV	NV
Dibenz(a,h)anthracene	NV	NV	NV	NV	NV	9.51E+00	NV	NV	NV
Dibenzofuran	6.63E-03	-	-	6.63E-03	6.63E-03	5.69E+01	1.59E+02	1.89E-06	5.21E+04
Dimethylphenol, 2,4-	1.01E-02	-	-	1.01E-02	1.01E-02	8.00E+03	1.04E+02	2.33E-07	1.83E+04
Ethylbenzene	1.11E-02	-	-	1.11E-02	1.11E-02	1.67E+02	9.54E+01	2.17E-03	1.77E+06
Fluoranthene	NV	NV	NV	NV	NV	2.89E+01	NV	NV	NV
Fluorene	7.11E-03	-	-	7.11E-03	7.11E-03	3.10E+01	1.49E+02	9.14E-07	3.62E+04
Indeno(1,2,3-cd)pyrene	NV	NV	NV	NV	NV	7.41E-01	NV	NV	NV
Iron	NV	NV	NV	NV	NV	-	NV	NV	NV
Lead and Compounds	NV	NV	NV	NV	NV	-	NV	NV	NV
Manganese	NV	NV	NV	NV	NV	-	NV	NV	NV
Methylnaphthalene, 2-	8.47E-03	-	-	8.47E-03	8.47E-03	1.23E+02	1.25E+02	2.16E-05	1.76E+05
Naphthalene	9.78E-03	-	-	9.78E-03	9.78E-03	9.66E+01	1.08E+02	3.39E-05	2.21E+05
Nickel Soluble Salts	NV	NV	NV	NV	NV	-	NV	NV	NV
Phenanthrene	5.58E-03	-	-	5.58E-03	5.58E-03	3.84E+01	1.89E+02	1.73E-07	1.58E+04
Phenol	1.38E-02	-	-	1.38E-02	1.38E-02	3.37E+04	7.65E+01	2.77E-07	2.00E+04
Pyrene	4.50E-03	-	-	4.50E-03	4.50E-03	1.47E+01	2.35E+02	1.21E-08	4.17E+03
Styrene	1.15E-02	-	-	1.15E-02	1.15E-02	2.93E+02	9.19E+01	8.17E-04	1.08E+06
Toluene	1.26E-02	-	-	1.26E-02	1.26E-02	2.91E+02	8.40E+01	3.70E-03	2.31E+06
TPH C06-C09 aliphatic	1.62E-02	-	-	1.62E-02	1.62E-02	2.21E+02	6.54E+01	2.61E-02	6.13E+06
TPH C10-C14 aliphatic	1.62E-02	-	-	1.62E-02	1.62E-02	1.11E+02	6.54E+01	5.46E-04	8.86E+05
TPH C10-C14 aromatic	1.62E-02	-	-	1.62E-02	1.62E-02	1.54E+02	6.54E+01	2.24E-04	5.68E+05
TPH C15-C28 aliphatic	NV	NV	NV	NV	NV	7.02E+01	NV	NV	NV
TPH C15-C28 aromatic	NV	NV	NV	NV	NV	8.04E+01	NV	NV	NV
TPH C29-C36 aliphatic	NV	NV	NV	NV	NV	3.16E+00	NV	NV	NV
TPH C29-C36 aromatic	NV	NV	NV	NV	NV	1.66E+00	NV	NV	NV

Vapour Modelling - Soil to Outdoor and Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

[Back to User Input Sheet](#)

Trimethylbenzene, 1,2,4-	9.81E-03	-	-	9.81E-03	9.81E-03	7.46E+01	1.08E+02	1.13E-03	1.28E+06
Vanadium and compounds	NV	NV	NV	NV	NV	-	NV	NV	NV
Xylenes (total)	1.37E-02	-	-	1.37E-02	1.37E-02	8.90E+01	7.72E+01	2.08E-03	1.73E+06

Definition of Parameters

D_s Effective diffusion coefficient in soil based on vapor-phase concentration
D_{crack} Effective diffusion coefficient through foundation cracks
C_{sat} Soil concentration at which dissolved pore-water and vapor phases become saturated

D_a = Apparent diffusivity (for construction scenario Volatilisation Factor)
M_{excav} = Cumulative unit mass emitted from excavation (Eq E-13 in USEPA, 2002).

D. Chemical-Specific Volatilisation Factors

CHEMICAL	VF _{asL}	VF _{as2}	VF _{p (indoor)}	VF _{p (outdoor)}	VF _{samb}	VF _{sasp}	VF _{excav}
	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-s)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)
Acenaphthene	1.17E-05	1.75E-05	-	-	3.35E-01	2.12E-06	-3.12E+08
Acenaphthylene	8.66E-06	1.75E-05	-	-	1.94E-01	1.31E-06	-2.32E+08
Ammonia	1.18E-04	1.75E-05	-	-	1.33E+01	4.82E-05	-3.16E+09
Aniline	1.20E-05	1.75E-05	-	-	2.74E-01	1.36E-06	-3.21E+08
Anthracene	3.12E-06	1.75E-05	-	-	2.67E-02	1.97E-07	-8.35E+07
Arsenic, Inorganic	NV	NV	-	-	NV	NV	NV
Barium	NV	NV	-	-	NV	NV	NV
Benz(a)anthracene	NV	NV	-	-	NV	NV	NV
Benzene	4.46E-04	1.75E-05	-	-	3.64E+02	1.75E-03	-1.19E+10
Benzo(a)pyrene	NV	NV	-	-	NV	NV	NV
Benzo(b)fluoranthene	NV	NV	-	-	NV	NV	NV
Benzo(g,h,i)perylene	NV	NV	-	-	NV	NV	NV
Benzo(k)fluoranthene	NV	NV	-	-	NV	NV	NV
Bis(2-ethylhexyl)phalate	NV	NV	-	-	NV	NV	NV
Cadmium (Water)	NV	NV	-	-	NV	NV	NV
Chromium(III), Insoluble Salts	NV	NV	-	-	NV	NV	NV
Chromium(VI)	NV	NV	-	-	NV	NV	NV
Chrysene	NV	NV	-	-	NV	NV	NV
Cobalt	NV	NV	-	-	NV	NV	NV
Cresol, m-&p-	3.84E-06	1.75E-05	-	-	3.01E-02	1.57E-07	-1.03E+08
Cresol, o-	NV	NV	-	-	NV	NV	NV
Dibenz(a,h)anthracene	NV	NV	-	-	NV	NV	NV
Dibenzofuran	8.38E-06	1.75E-05	-	-	1.89E-01	1.35E-06	-2.24E+08
Dimethylphenol, 2,4-	2.95E-06	1.75E-05	-	-	1.93E-02	1.09E-07	-7.88E+07
Ethylbenzene	2.84E-04	1.75E-05	-	-	1.71E+02	9.29E-04	-7.61E+09
Fluoranthene	NV	NV	-	-	NV	NV	NV
Fluorene	5.84E-06	1.75E-05	-	-	8.90E-02	6.09E-07	-1.56E+08
Indeno(1,2,3-cd)pyrene	NV	NV	-	-	NV	NV	NV
Iron	NV	NV	-	-	NV	NV	NV
Lead and Compounds	NV	NV	-	-	NV	NV	NV
Manganese	NV	NV	-	-	NV	NV	NV
Methylnaphthalene, 2-	2.83E-05	1.75E-05	-	-	1.95E+00	1.21E-05	-7.59E+08
Naphthalene	3.55E-05	1.75E-05	-	-	2.86E+00	1.64E-05	-9.51E+08
Nickel Soluble Salts	NV	NV	-	-	NV	NV	NV
Phenanthrene	2.54E-06	1.75E-05	-	-	1.85E-02	1.47E-07	-6.80E+07
Phenol	3.21E-06	1.75E-05	-	-	1.94E-02	9.52E-08	-8.60E+07
Pyrene	6.72E-07	1.75E-05	-	-	1.39E-03	1.28E-08	-1.80E+07
Styrene	1.74E-04	1.75E-05	-	-	6.33E+01	3.37E-04	-4.67E+09
Toluene	3.71E-04	1.75E-05	-	-	2.73E+02	1.39E-03	-9.93E+09
TPH C06-C09 aliphatic	9.87E-04	1.75E-05	-	-	1.67E+03	7.67E-03	-2.64E+10
TPH C10-C14 aliphatic	1.43E-04	1.75E-05	-	-	3.48E+01	1.60E-04	-3.82E+09
TPH C10-C14 aromatic	9.14E-05	1.75E-05	-	-	1.43E+01	6.58E-05	-2.45E+09
TPH C15-C28 aliphatic	NV	NV	-	-	NV	NV	NV
TPH C15-C28 aromatic	NV	NV	-	-	NV	NV	NV
TPH C29-C36 aliphatic	NV	NV	-	-	NV	NV	NV
TPH C29-C36 aromatic	NV	NV	-	-	NV	NV	NV
Trimethylbenzene, 1,2,4-	2.05E-04	1.75E-05	-	-	9.53E+01	5.48E-04	-5.50E+09
Vanadium and compounds	NV	NV	-	-	NV	NV	NV
Xylenes (total)	2.78E-05	1.75E-05	-	-	1.46E+01	7.19E-05	-7.44E+09

Definition of Parameters

VF_{as} Volatilization factor from surficial soils to ambient air (vapors) - use lower of two values
VF_p Volatilization factor from surficial soils to ambient air (particulates)
VF_{samb} Volatilization factor from subsurface soils to ambient air
VF_{sasp} Volatilization factor from soil to enclosed-space vapors
VF_{excav} Volatilisation factor from subsurface soil to trench air (where soil contamination is below base of trench)

Calculation of Vapour Emissions from Water with Flow
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

PARAMETERS

Concrete permeability

(select from
drop down list)

High permeability

Permeability Rate (m/day)

8.6.E-02

Water Temperature (deg. C)

18.0

Dimensions of Basement / Impoundment

Height (m)

4.5

Width (m)

50.0

Depth (m)

50.0

Volume total basement/ impoundment (m3)

11250

Dimensions of Wet Section of Basement/ Impoundment

Length (m)

25.00

Width (m)

5.0

Depth of Water (m)

0.01

Fetch/ Depth (m) ratio of Wet Basement Section

500

Volume of wet basement/ impoundment (m3)

1.2500

Area covered in water (m2)

125

Effective diameter of impoundment/ basement) (m)

12.6

Volume of water entering basement (m³/sec)

1.25E-06

Air exchange rate (exchanges/day)

7.60E+01

Windspeed (m/s)

if < 3.5m/sec

3.00E-02

if = or > 3.5m/sec

Parameter Definition	Volatile	Chemical Concentration in Water (mg/L)	Molecular weight (g/mol)	Vapour Pressure (mmHg)	Vapour Pressure (atm)	Henry's Law Coefficient (unitless)	Henry's Law Coefficient (calculated)	Equilibrium Coefficient (at 25 deg C)	Diffusivity in Water (cm²/sec)	Schmidt Number on Gas Side (*)	Gas Phase Mass Transfer Coefficient (m/sec)	Schmidt Number on Liquid Side #	Liquid Phase Mass Transfer Coefficient (m/sec) **	Overall Mass Transfer Coefficient (m/s) <3.5 m/s)	Diffusivity in Air (cm2/sec)	Equilibrium Concentration of water in Basement/ Impoundment (g/m³)	Air Emission Rate from Liquid Surface (g/sec)	Air Emission Rate from Liquid Surface (mg/day)	Adjusted Concentration in Basement Air (includes air exchange) (mg/m3)
		C	MW	Vap	Vap	unitless	atm.m3/g mol	K _{eq}	D _{water}	Sc _G	k _G	Sc _L	k _L	K	D _{air}	C _L		E	
Acenaphthene	Y	4.48	154	2.15E-03	2.83E-06	7.52E-03	1.80E-04	7.345E-03	8.33E-06	3.0E+00	1.138E-04	1.08E+03	2.74E-07	2.1E-07	0.0506	1.6E-01	4.07E-06	3.52E+02	4.11E-04
Acenaphthylene	Y	43.2	152	6.68E-03	8.79E-06	4.66E-03	1.11E-04	4.551E-03	6.98E-06	3.4E+00	1.052E-04	1.29E+03	2.44E-07	1.6E-07	0.045	1.7E+00	3.44E-05	2.97E+03	3.47E-03
Ammonia	Y	348	17	-	-	6.58E-04	1.57E-05	6.427E-04	1.10E-05	6.6E-01	3.121E-04	8.18E+02	3.30E-07	1.2E-07	0.228	1.0E+01	1.60E-04	1.38E+04	1.61E-02
Aniline	Y	0.212	93.1	4.90E-01	6.45E-04	8.26E-05	1.97E-06	8.067E-05	1.01E-05	1.8E+00	1.586E-04	8.91E+02	3.12E-07	1.2E-08	0.083	6.6E-03	1.01E-08	8.74E-01	1.02E-06
Anthracene	Y	15.4	178	6.53E-06	8.59E-09	2.27E-03	5.42E-05	2.217E-03	7.85E-06	3.9E+00	9.561E-05	1.15E+03	2.64E-07	1.2E-07	0.039	5.6E-01	8.27E-06	7.14E+02	8.35E-04
Arsenic, Inorganic	N	0.024	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	N	2.23	137	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	N	12.6	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	Y	40.2	78.1	9.48E+01	1.25E-01	2.27E-01	5.42E-03	2.217E-01	1.03E-05	1.7E+00	1.668E-04	8.74E+02	3.16E-07	3.1E-07	0.0895	1.2E+00	4.83E-05	4.17E+03	4.88E-03
Benzo(a)pyrene	N	9.26	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	N	8.33	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	N	4.22	276	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	N	2.93	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	N	0.03	391	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	N	0.108	112	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	N	0.102	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	N	0.102	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	N	9.78	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	N	0.057	58.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	Y	436	108	1.10E-01	1.45E-04	3.50E-05	8.36E-07	3.418E-05	9.32E-06	2.1E+00	1.454E-04	9.66E+02	2.96E-07	4.9E-09	0.0729	1.4E+01	8.72E-06	7.53E+02	8.81E-04
Cresol, o-	N	182	108	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	N	0.822	278	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	Y	10.2	168	2.48E-03	3.26E-06	8.71E-03	2.08E-04	8.507E-03	7.38E-06	3.7E+00	9.887E-05	1.22E+03	2.53E-07	1.9E-07	0.041	3.9E-01	9.43E-06	8.15E+02	9.53E-04
Dimethylphenol, 2,4-	Y	38	122	1.02E-01	1.34E-04	3.89E-05	9.29E-07	3.799E-05	8.31E-06	2.4E+00	1.307E-04	1.08E+03	2.74E-07	4.9E-09	0.0622	1.3E+00	8.16E-07	7.05E+01	8.25E-05
Ethylbenzene	Y	3.02	106	9.60E+00	1.26E-02	3.22E-01	7.69E-03	3.145E-01	8.46E-06	2.2E+00	1.395E-04	1.06E+03	2.77E-07	2.8E-07	0.0685	1.1E-01	3.62E-06	3.13E+02	3.66E-04
Fluoranthene	N	25.9	202	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	Y	21.1	166	6.00E-04	7.90E-07	3.93E-03	9.38E-05	3.838E-03	7.89E-06	3.4E+00	1.037E-04	1.14E+03	2.65E-07	1.6E-07	0.044	7.7E-01	1.53E-05	1.32E+03	1.54E-03
Indeno(1,2,3-cd)pyrene	N	3.05	276	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	N	187	55.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	N	0.555	207	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	N	4.89	54.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	Y	105	142	5.50E-02	7.24E-05	2.12E-02	5.06E-04	2.071E-02	7.78E-06	2.9E+00	1.165E-04	1.16E+03	2.62E-07	2.4E-07	0.0524	3.9E+00	1.14E-04	9.85E+03	1.15E-02
Naphthalene	Y	283	128	8.50E-02	1.12E-04	1.80E-02	4.30E-04	1.758E-02	8.38E-06	2.5E+00	1.283E-04	1.07E+03	2.75E-07	2.5E-07	0.0605	9.9E+00	3.04E-04	2.63E+04	3.07E-02
Nickel Soluble Salts	N	0.303	58.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	Y	74.1	178	1.21E-04	1.59E-07	1.73E-03	4.13E-05	1.690E-03	6.69E-06	4.4E+00	8.807E-05	1.35E+03	2.37E-07	9.1E-08	0.0345	3.0E+00	3.43E-05	2.96E+03	3.46E-03
Phenol	Y	249	94.1	3.50E-01	4.61E-04	1.36E-05	3.25E-07	1.328E-05	1.03E-05	1.8E+00	1.591E-04	8.74E+02	3.16E-07	2.1E-09	0.0834	7.6E+00	2.00E-06	1.73E+02	2.03E-04
Pyrene	Y	27.9	202	4.50E-06	5.92E-09	4.87E-04	1.16E-05	4.756E-04	7.25E-06	5.4E+00	7.621E-05	1.24E+03	2.50E-07	3.2E-08	0.0278	1.1E+00	4.25E-06	3.67E+02	4.29E-04
Styrene	Y	0.194	104	6.40E+00	8.42E-03	1.12E-01	2.67E-03	1.094E-01	8.78E-06	2.1E+00	1.430E-04	1.03E+03	2.84E-07	2.8E-07	0.0711	6.6E-03	2.30E-07	1.99E+01	2.32E-05
Toluene	Y	17.6	92.1	2.84E+01	3.74E-02	2.71E-01	6.47E-03	2.647E-01	9.20E-06	1.9E+00	1.519E-04	9.78E+02	2.93E-07	2.9E-07	0.0778	5.8E-01	2.11E-05	1.82E+03	2.13E-03
TPH C06-C09 aliphatic	Y	6.08	103	9.16E+01	1.21E-01	5.05E+01	1.21E+00	4.932E+01	1.00E-05	1.5E+00	1.797E-04	9.00E+02	3.10E-07	3.1E-07	0.1	1.9E-01	7.36E-06	6.36E+02	7.44E-04
TPH C10-C14 aliphatic	Y	1730	170	1.16E+00	1.53E-03	6.26E+01	1.49E+00	6.114E+01	1.00E-05	1.5E+00	1.797E-04	9.00E+02	3.10E-07	3.1E-07	0.1	5.4E+01	2.09E-03	1.81E+05	2.12E-01
TPH C10-C14 aromatic	Y	1730	136	1.16E+00	1.53E-03	1.41E-01	3.37E-03	1.377E-01	1.00E-05	1.5E+00	1.797E-04	9.00E+02	3.10E-07	3.1E-07	0.1	5.4E+01	2.07E-03	1.79E+05	2.09E-01
TPH C15-C28 aliphatic	N	1520	260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	N	1520	209	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	N	332	270	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	N	332	240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	Y	0.92	120	2.10E+00	2.76E-03	2.52E-01	6.02E-03	2.461E-01	7.92E-06	2.5E+00	1.286E-04	1.14E+03	2.65E-07	2.6E-07	0.0607	3.3E-02	1.10E-06	9.50E+01	1.11E-04
Vanadium and compounds	N	0.0228	50.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	Y	6.7	106	7.99E+00	1.05E-02	2.12E-01	5.06E-03	2.071E-01	9.90E-06	1.8E+00	1.608E-04	9.09E+02	3.08E-07	3.0E-07	0.0847	2.1E-01	8.04E-06	6.94E+02	8.12E-04

Notes:

Assumes viscosity of air at 25 deg C

(*) Adopted density and viscosity of air values are those published in USEPA Air Emissions for Wast and Waste Water Nov 1994. (viscosity = 1.81 x 10⁻⁴, density = 1.2 x 10⁻³)

** where windspeeds are greater than 3.25 m/s, F/D ratios greater than 51.2 and diffusivity of ether is 8.5 x 10⁻⁵

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Summary of Derived RBSLs

[Back to User Input Sheet](#)

Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

Chemical	Soil RBSLs (mg/kg)						Groundwater RBSLs (mg/L)					
	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Saturation Limited?	Site Concentration	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Solubility Limited?	Site Concentration
Acenaphthene	2.17E+05	-	-	2.17E+05	>Sat	5.11E+02	4.36E+03	-	-	4.36E+03	>Sol	4.48E+00
Acenaphthylene	-	-	-	-	-	-	-	-	-	-	-	-
Ammonia	-	-	-	-	-	-	1.77E+06	-	-	1.77E+06	>Sol	3.48E+02
Aniline	-	-	-	-	-	-	3.96E+06	-	-	3.96E+06	>Sol	2.12E-01
Anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic, Inorganic	-	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	7.09E+04	-	-	7.09E+04	>Sat	1.51E+03	1.02E+06	-	-	1.02E+06	>Sol	4.02E+01
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	3.59E+04	-	-	3.59E+04	>Sat	2.29E+03	2.80E+03	-	-	2.80E+03	-	4.36E+02
Cresol, o-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	3.38E+06	-	-	3.38E+06	>Sat	2.77E+02	1.48E+04	-	-	1.48E+04	>Sol	1.02E+01
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	2.46E+03	-	-	2.46E+03	>Sat	2.61E+02	1.88E+04	-	-	1.88E+04	>Sol	3.02E+00
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	4.39E+03	-	-	4.39E+03	>Sat	7.65E+03	1.13E+02	-	-	1.13E+02	>Sol	1.05E+02
Naphthalene	2.44E+04	-	-	2.44E+04	>Sat	1.02E+04	4.05E+02	-	-	4.05E+02	>Sol	2.83E+02
Nickel Soluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	-	-	-	-	-	-	8.63E+05	-	-	8.63E+05	>Sol	2.49E+02
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	5.18E+04	-	-	5.18E+04	>Sol	1.94E-01
Toluene	2.46E+04	-	-	2.46E+04	>Sat	2.65E+03	2.83E+05	-	-	2.83E+05	>Sol	1.76E+01
TPH C06-C09 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	1.64E+04	-	-	1.64E+04	>Sat	2.20E+02	7.42E+04	-	-	7.42E+04	>Sol	9.20E-01
Vanadium and compounds	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	6.88E+04	-	-	6.88E+04	>Sat	2.58E+03	4.08E+04	-	-	4.08E+04	>Sol	6.70E+00

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Pathways included in derivation of Soil RBSL:

Pathways included in derivation of Soil Vapour RBSL:

Pathways included in derivation of Groundwater RBSL:

Health Risk Calculations - Inhalation of Subsurface Soil-Derived Vapours in Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

Chemical	Soil Conc. (mg/kg)	Csat (mg/kg)	Volatilisation Factor from Subsurface Soil to Indoor Air [(mg/m3)/(mg/kg)]	Vapour Concentration in Indoor Air (From Subsurface Soil) (mg/m3)	Threshold Intake and Risk Calculations			
					Inhalation RfC (mg/m3)	Adult Exposure Factor (threshold) (kg/m3)	Adult Exposure Adjusted Air Concentration (threshold) (mg/m3)	Hazard Index (Adult) (unitless)
Acenaphthene	511	3.94E+01	2.12E-06	8.35E-05	5.04E-01	4.65E-07	1.83E-05	3.63E-05
Acenaphthylene	1700	1.63E+02	1.31E-06	2.14E-04	-	-	-	-
Ammonia	-	-	-	-	-	-	-	-
Aniline	-	-	-	-	-	-	-	-
Anthracene	2150	1.42E+00	1.97E-07	2.80E-07	-	-	-	-
Arsenic, Inorganic	-	-	NV	-	-	-	-	-
Barium	-	-	NV	-	-	-	-	-
Benz(a)anthracene	1470	3.33E+00	NV	-	-	-	-	-
Benzene	1510	6.59E+02	1.75E-03	1.16E+00	1.09E+02	3.84E-04	2.53E-01	2.33E-03
Benzo(a)pyrene	652	1.90E+00	NV	-	-	-	-	-
Benzo(b)fluoranthene	587	1.80E+00	NV	-	-	-	-	-
Benzo(g,h,i)perylene	305	1.01E+00	NV	-	-	-	-	-
Benzo(k)fluoranthene	231	9.39E-01	NV	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	NV	-	-	-	-	-
Cadmium (Water)	-	-	NV	-	-	-	-	-
Chromium(III), Insoluble Salts	210	-	NV	-	-	-	-	-
Chromium(VI)	2.3	-	NV	-	-	-	-	-
Chrysene	771	7.24E-01	NV	-	-	-	-	-
Cobalt	-	-	NV	-	-	-	-	-
Cresol, m-&p-	2290	1.44E+04	1.57E-07	3.61E-04	1.24E-03	3.45E-08	7.90E-05	6.38E-02
Cresol, o-	-	-	NV	-	-	-	-	-
Blank	-	-	NV	-	-	-	-	-
Dibenz(a,h)anthracene	71.4	9.51E+00	NV	-	-	-	-	-
Dibenzofuran	277	5.69E+01	1.35E-06	7.68E-05	1.00E+00	2.96E-07	1.68E-05	1.68E-05
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-
Ethylbenzene	261	1.67E+02	9.29E-04	1.55E-01	2.00E+00	2.04E-04	3.39E-02	1.70E-02
Fluoranthene	2440	2.89E+01	NV	-	-	-	-	-
Fluorene	2100	3.10E+01	6.09E-07	1.89E-05	-	-	-	-
Indeno(1,2,3-cd)pyrene	247	7.41E-01	NV	-	-	-	-	-
Iron	60600	-	NV	-	-	-	-	-
Lead and Compounds	13600	-	NV	-	-	-	-	-
Manganese	-	-	NV	-	-	-	-	-
Methylnaphthalene, 2-	7650	1.23E+02	1.21E-05	1.48E-03	5.81E-02	2.65E-06	3.25E-04	5.60E-03
Naphthalene	10200	9.66E+01	1.64E-05	1.59E-03	4.40E-01	3.60E-06	3.48E-04	7.91E-04
Nickel Soluble Salts	-	-	NV	-	-	-	-	-
Phenanthrene	5180	3.84E+01	1.47E-07	5.66E-06	-	-	-	-
Phenol	-	-	-	-	-	-	-	-
Pyrene	2640	1.47E+01	1.28E-08	1.87E-07	-	-	-	-
Styrene	-	-	-	-	-	-	-	-
Toluene	2650	2.91E+02	1.39E-03	4.06E-01	3.01E+01	3.06E-04	8.89E-02	2.95E-03
TPH C06-C09 aliphatic	593	2.21E+02	7.67E-03	1.70E+00	-	-	-	-
TPH C10-C14 aliphatic	69400	1.11E+02	1.60E-04	1.78E-02	-	-	-	-
TPH C10-C14 aromatic	69400	1.54E+02	6.58E-05	1.02E-02	-	-	-	-
TPH C15-C28 aliphatic	93200	7.02E+01	NV	-	-	-	-	-
TPH C15-C28 aromatic	93200	8.04E+01	NV	-	-	-	-	-
TPH C29-C36 aliphatic	20600	3.16E+00	NV	-	-	-	-	-
TPH C29-C36 aromatic	20600	1.66E+00	NV	-	-	-	-	-
Trimethylbenzene, 1,2,4-	220	7.46E+01	5.48E-04	4.09E-02	1.96E+00	1.20E-04	8.96E-03	4.56E-03
Vanadium and compounds	248	-	NV	-	-	-	-	-
Xylenes (total)	2576	8.90E+01	7.19E-05	6.40E-03	4.34E+00	1.58E-05	1.40E-03	3.23E-04

TOTAL

9.74E-02

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Health Risk Calculations - Vapours from Flowing Water
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000

Scenario 2 - Upper Basement (Residential Receptor) (Odour Based Calculations) Scenario

Chemical	Vapour Concentration in Basement/ Impoundment	Aqueous Solubility	Threshold Intake and Risk Calculations			
			Inhalation RfC	Adult Exposure Factor (threshold)	Adult Exposure Adjusted Air Concentration (threshold)	Hazard Index (Adult)
	mg/m ³	(mg/L)	(mg/m3)	(L/m3)	(mg/m3)	(unitless)
Acenaphthene	4.11E-04	3.90E+00	5.04E-01	2.19E-01	9.01E-05	1.79E-04
Acenaphthylene	3.47E-03	1.61E+01	-	2.19E-01	7.61E-04	-
Ammonia	1.61E-02	4.82E+05	1.80E+01	2.19E-01	3.53E-03	1.96E-04
Aniline	1.02E-06	3.60E+04	4.19E+00	2.19E-01	2.24E-07	5.35E-08
Anthracene	8.35E-04	4.34E-02	-	2.19E-01	1.83E-04	-
Arsenic, Inorganic	-	0.00E+00	-	-	-	-
Barium	-	0.00E+00	-	-	-	-
Benz(a)anthracene	-	9.40E-03	-	-	-	-
Benzene	4.88E-03	1.79E+03	1.09E+02	2.19E-01	1.07E-03	9.81E-06
Benzo(a)pyrene	-	1.62E-03	-	-	-	-
Benzo(b)fluoranthene	-	1.50E-03	-	-	-	-
Benzo(g,h,i)perylene	-	2.60E-04	-	-	-	-
Benzo(k)fluoranthene	-	8.00E-04	-	-	-	-
Bis(2-ethylhexyl)phalate	-	2.70E-01	-	-	-	-
Cadmium (Water)	-	0.00E+00	-	-	-	-
Chromium(III), Insoluble Salts	-	0.00E+00	-	-	-	-
Chromium(VI)	-	1.69E+06	-	-	-	-
Chrysene	-	2.00E-03	-	-	-	-
Cobalt	-	0.00E+00	-	-	-	-
Cresol, m-&p-	8.81E-04	2.27E+04	1.24E-03	2.19E-01	1.93E-04	1.56E-01
Cresol, o-	-	2.59E+04	-	-	-	-
Dibenz(a,h)anthracene	-	2.49E-03	-	-	-	-
Dibenzofuran	9.53E-04	3.10E+00	1.00E+00	2.19E-01	2.09E-04	2.09E-04
Dimethylphenol, 2,4-	8.25E-05	7.87E+03	-	2.19E-01	1.81E-05	-
Ethylbenzene	3.66E-04	1.69E+02	2.00E+00	2.19E-01	8.02E-05	4.01E-05
Fluoranthene	-	2.60E-01	-	-	-	-
Fluorene	1.54E-03	1.69E+00	-	2.19E-01	3.38E-04	-
Indeno(1,2,3-cd)pyrene	-	1.90E-04	-	-	-	-
Iron	-	0.00E+00	-	-	-	-
Lead and Compounds	-	0.00E+00	-	-	-	-
Manganese	-	0.00E+00	-	-	-	-
Methylnaphthalene, 2-	1.15E-02	2.46E+01	5.81E-02	2.19E-01	2.53E-03	4.35E-02
Naphthalene	3.07E-02	3.10E+01	4.40E-01	2.19E-01	6.74E-03	1.53E-02
Nickel Soluble Salts	-	0.00E+00	-	-	-	-
Phenanthrene	3.46E-03	1.15E+00	-	2.19E-01	7.59E-04	-
Phenol	2.03E-04	8.28E+04	1.54E-01	2.19E-01	4.44E-05	2.88E-04
Pyrene	4.29E-04	1.35E-01	-	2.19E-01	9.40E-05	-
Styrene	2.32E-05	3.10E+02	1.36E+00	2.19E-01	5.10E-06	3.75E-06
Toluene	2.13E-03	5.26E+02	3.01E+01	2.19E-01	4.68E-04	1.55E-05
TPH C06-C09 aliphatic	7.44E-04	1.18E+01	-	2.19E-01	1.63E-04	-
TPH C10-C14 aliphatic	2.12E-01	9.99E-02	-	2.19E-01	2.19E-02	-
TPH C10-C14 aromatic	2.09E-01	2.53E+01	-	2.19E-01	4.58E-02	-
TPH C15-C28 aliphatic	-	1.11E-04	-	-	-	-
TPH C15-C28 aromatic	-	1.06E+00	-	-	-	-
TPH C29-C36 aliphatic	-	2.50E-06	-	-	-	-
TPH C29-C36 aromatic	-	6.60E-03	-	-	-	-
Trimethylbenzene, 1,2,4-	1.11E-04	5.70E+01	1.96E+00	2.19E-01	2.43E-05	1.24E-05
Vanadium and compounds	-	-	-	-	-	-
Xylenes (total)	8.12E-04	1.06E+02	4.34E+00	2.19E-01	1.78E-04	4.11E-05

TOTAL

2.16E-01

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Soil RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

Chemical	Csoil	Csat	Risk at Input Soil Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity) (kg/mg)			RBSL (assumes no sat limit)	Risk at RBSL (with sat)	Vapour Only Risk at Csat (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			Vapours from Subsurface Soil Indoors	TOTAL (All Pathways)	Vapours from Subsurface Soil Indoors	Total Vapour Pathways	TOTAL (All Pathways)					Vapours from Subsurface Soil Indoors	TOTAL
	mg/kg	mg/kg	unitless	unitless	kg/mg	kg/mg	kg/mg	mg/kg			mg/kg	%	%
Acenaphthene	511	3.94E+01	3.63E-05	3.63E-05	9.22E-07	9.22E-07	9.22E-07	2.17E+05	3.63E-05	3.63E-05	2.17E+05	0.00%	0.00%
Acenaphthylene	1700	1.63E+02	-	-	-		-	-	-	-	-	-	
Ammonia	-	-	-	-	-		-	-	-	-	-	-	
Aniline	-	-	-	-	-		-	-	-	-	-	-	
Anthracene	2150	1.42E+00	-	-	-		-	-	-	-	-	-	
Arsenic, Inorganic	-	-	-	-	-		-	-	-	-	-	-	
Barium	-	-	-	-	-		-	-	-	-	-	-	
Benz(a)anthracene	1470	3.33E+00	-	-	-		-	-	-	-	-	-	
Benzene	1510	6.59E+02	2.33E-03	2.33E-03	3.53E-06	3.53E-06	3.53E-06	7.09E+04	2.33E-03	2.33E-03	7.09E+04	0.23%	0.23%
Benzo(a)pyrene	652	1.90E+00	-	-	-		-	-	-	-	-	-	
Benzo(b)fluoranthene	587	1.80E+00	-	-	-		-	-	-	-	-	-	
Benzo(g,h,i)perylene	305	1.01E+00	-	-	-		-	-	-	-	-	-	
Benzo(k)fluoranthene	231	9.39E-01	-	-	-		-	-	-	-	-	-	
Bis(2-ethylhexyl)phalate	-	-	-	-	-		-	-	-	-	-	-	
Cadmium (Water)	-	-	-	-	-		-	-	-	-	-	-	
Chromium(III), Insoluble Salts	210	-	-	-	-		-	-	-	-	-	-	
Chromium(VI)	2.3	-	-	-	-		-	-	-	-	-	-	
Chrysene	771	7.24E-01	-	-	-		-	-	-	-	-	-	
Cobalt	-	-	-	-	-		-	-	-	-	-	-	
Cresol, m-&p-	2290	1.44E+04	6.38E-02	6.38E-02	2.79E-05	2.79E-05	2.79E-05	3.59E+04	4.00E-01	4.00E-01	3.59E+04	40.02%	40.02%
Cresol, o-	-	-	-	-	-		-	-	-	-	-	-	
Dibenz(a,h)anthracene	71.4	9.51E+00	-	-	-		-	-	-	-	-	-	
Dibenzofuran	277	5.69E+01	1.68E-05	1.68E-05	2.96E-07	2.96E-07	2.96E-07	3.38E+06	1.68E-05	1.68E-05	3.38E+06	0.00%	0.00%
Dimethylphenol, 2,4-	-	-	-	-	-		-	-	-	-	-	-	
Ethylbenzene	261	1.67E+02	1.70E-02	1.70E-02	1.02E-04	1.02E-04	1.02E-04	2.46E+03	1.70E-02	1.70E-02	2.46E+03	1.70%	1.70%
Fluoranthene	2440	2.89E+01	-	-	-		-	-	-	-	-	-	
Fluorene	2100	3.10E+01	-	-	-		-	-	-	-	-	-	
Indeno(1,2,3-cd)pyrene	247	7.41E-01	-	-	-		-	-	-	-	-	-	
Iron	60600	-	-	-	-		-	-	-	-	-	-	
Lead and Compounds	13600	-	-	-	-		-	-	-	-	-	-	
Manganese	-	-	-	-	-		-	-	-	-	-	-	
Methylnaphthalene, 2-	7650	1.23E+02	5.60E-03	5.60E-03	4.56E-05	4.56E-05	4.56E-05	4.39E+03	5.60E-03	5.60E-03	4.39E+03	0.56%	0.56%
Naphthalene	10200	9.66E+01	7.91E-04	7.91E-04	8.19E-06	8.19E-06	8.19E-06	2.44E+04	7.91E-04	7.91E-04	2.44E+04	0.08%	0.08%
Nickel Soluble Salts	-	-	-	-	-		-	-	-	-	-	-	
Phenanthrene	5180	3.84E+01	-	-	-		-	-	-	-	-	-	
Phenol	-	-	-	-	-		-	-	-	-	-	-	
Pyrene	2640	1.47E+01	-	-	-		-	-	-	-	-	-	
Styrene	-	-	-	-	-		-	-	-	-	-	-	
Toluene	2650	2.91E+02	2.95E-03	2.95E-03	1.01E-05	1.01E-05	1.01E-05	2.46E+04	2.95E-03	2.95E-03	2.46E+04	0.30%	0.30%
TPH C06-C09 aliphatic	593	2.21E+02	-	-	-		-	-	-	-	-	-	
TPH C10-C14 aliphatic	69400	1.11E+02	-	-	-		-	-	-	-	-	-	
TPH C10-C14 aromatic	69400	1.54E+02	-	-	-		-	-	-	-	-	-	
TPH C15-C28 aliphatic	93200	7.02E+01	-	-	-		-	-	-	-	-	-	
TPH C15-C28 aromatic	93200	8.04E+01	-	-	-		-	-	-	-	-	-	
TPH C29-C36 aliphatic	20600	3.16E+00	-	-	-		-	-	-	-	-	-	
TPH C29-C36 aromatic	20600	1.66E+00	-	-	-		-	-	-	-	-	-	
Trimethylbenzene, 1,2,4-	220	7.46E+01	4.56E-03	4.56E-03	6.12E-05	6.12E-05	6.12E-05	1.64E+04	4.56E-03	4.56E-03	1.64E+04	0.46%	0.46%
Vanadium and compounds	248	-	-	-	-		-	-	-	-	-	-	
Xylenes (total)	2576	8.90E+01	3.23E-04	3.23E-04	3.63E-06	3.63E-06	3.63E-06	6.88E+04	3.23E-04	3.23E-04	6.88E+04	0.03%	0.03%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

Chemical	Cgw mg/L	Solubility mg/L	Risk at Input Groundwater Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit) mg/L	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL mg/L	Pathway Contributions to Total Estimated Risk at RBSL	
			GW vapours from flowing water unitless	TOTAL (All Pathways) unitless	GW vapours from flowing water unitless	Total Vapour Pathways L/mg	TOTAL (All Pathways) L/mg					GW vapours from flowing water %	TOTAL %
Acenaphthene	4.48	3.90E+00	1.79E-04	1.79E-04	4.59E-05	4.59E-05	4.59E-05	4.36E+03	1.79E-04	1.79E-04	4.36E+03	0.1%	0.09%
Acenaphthylene	43.2	1.61E+01	-	-	-	-	-	-	-	-	-	-	-
Ammonia	348	4.82E+05	1.96E-04	1.96E-04	5.64E-07	5.64E-07	5.64E-07	1.77E+06	2.72E-01	2.72E-01	1.77E+06	27.2%	27.20%
Aniline	0.212	3.60E+04	5.35E-08	5.35E-08	2.52E-07	2.52E-07	2.52E-07	3.96E+06	9.08E-03	9.08E-03	3.96E+06	0.9%	0.91%
Anthracene	15.4	4.34E-02	-	-	-	-	-	-	-	-	-	-	-
Arsenic, Inorganic	0.024		-	-	-	-	-	-	-	-	-	-	-
Barium	2.23		-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-	-	-	-	-	-	-	-	-
Benzene	40.2	1.79E+03	9.81E-06	9.81E-06	2.44E-07	2.44E-07	2.44E-07	1.02E+06	4.37E-04	4.37E-04	1.02E+06	0.2%	0.17%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-	-	-	-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-	-	-	-	-	-	-	-	-
Cobalt	0.057		-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	1.56E-01	1.56E-01	3.58E-04	3.58E-04	3.58E-04	2.80E+03	1.00E+00	-	2.80E+03	100.0%	100.00%
Cresol, o-	182	2.59E+04	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	2.09E-04	2.09E-04	6.74E-05	6.74E-05	6.74E-05	1.48E+04	2.09E-04	2.09E-04	1.48E+04	0.0%	0.02%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	4.01E-05	4.01E-05	1.33E-05	1.33E-05	1.33E-05	1.88E+04	2.24E-03	2.24E-03	1.88E+04	0.9%	0.90%
Fluoranthene	25.9	2.60E-01	-	-	-	-	-	-	-	-	-	-	-
Fluorene	21.1	1.69E+00	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-	-	-	-	-	-	-	-	-
Iron	187		-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-	-	-	-	-	-	-	-	-
Manganese	4.89		-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	105	2.46E+01	4.35E-02	4.35E-02	1.77E-03	1.77E-03	1.77E-03	1.13E+02	4.35E-02	4.35E-02	1.13E+02	21.7%	21.74%
Naphthalene	283	3.10E+01	1.53E-02	1.53E-02	4.94E-04	4.94E-04	4.94E-04	4.05E+02	1.53E-02	1.53E-02	4.05E+02	7.7%	7.66%
Nickel Soluble Salts	0.303		-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	-	-	-	-	-	-	-	-	-	-	-
Phenol	249	8.28E+04	2.88E-04	2.88E-04	1.16E-06	1.16E-06	1.16E-06	8.63E+05	9.59E-02	9.59E-02	8.63E+05	9.6%	9.59%
Pyrene	27.9	1.35E-01	-	-	-	-	-	-	-	-	-	-	-
Styrene	0.194	3.10E+02	3.75E-06	3.75E-06	1.93E-05	1.93E-05	1.93E-05	5.18E+04	5.99E-03	5.99E-03	5.18E+04	0.6%	0.60%
Toluene	17.6	5.26E+02	1.55E-05	1.55E-05	8.82E-07	8.82E-07	8.82E-07	2.83E+05	4.64E-04	4.64E-04	2.83E+05	0.2%	0.19%
TPH C06-C09 aliphatic	6.08	1.18E+01	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aliphatic	1730	9.99E-02	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aromatic	1730	2.53E+01	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	1.24E-05	1.24E-05	1.35E-05	1.35E-05	1.35E-05	7.42E+04	7.68E-04	7.68E-04	7.42E+04	0.1%	0.08%
Vanadium and compounds	0.0228	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+02	4.11E-05	4.11E-05	6.13E-06	6.13E-06	6.13E-06	4.08E+04	6.50E-04	6.50E-04	4.08E+04	0.3%	0.26%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Appendix D

Compliance with SEPP 55 (1998) and NSW EPA (2011)

Appendix D Compliance with SEPP 55 (1998) and NSW EPA (2011)

The following summary provides an assessment of compliance with the SEPP 55 (1998) *Managing Land Contamination (Remediation of Land)* and the NSW EPA (2011) *Consultants Reporting on Contaminated Sites*:

Table 21 Assessment of Compliance with SEPP 55 (1998) and NSW EPA (2011)

Legislative Requirement	Relevant Works and RAP Section
SEPP 55 (1998)	
Can the site be appropriately remediated? Consider the RAP and any statement by the proponent's consultant certifying that remediation is practical.	Refer to Section 8.0 to Section 11.0, and Table T19.
Are the proposed clean-up criteria appropriate for the future use of the site, considering possible human health and environmental impacts?	Refer to Section 7.0.
Are the proposed plans for remediation work acceptable? For example, do they include an occupational health and safety plan, community relations plan, contingency plan?	Refer to references listed against the NSW EPA (2011) criteria below
Is a site audit of the RAP necessary?	This RAP will be submitted to the NSW EPA Accredited Site Auditor, Graeme Nyland, for approval before implementation.
NSW EPA (2011)	
<i>Environmental Summary</i> including background; objectives; scope of works; summary of sampling results; summary of conclusions and recommendations	Refer to the Executive Summary Section
<i>Scope of Work</i>	Refer to Section 1.3
<i>Site Identification</i> including a. street number, street name and suburb; b. lot and deposited plan number; co-ordinates; locality map; c. site layout plan	Refer to: a. & b. in Table 1; c. Figure F1 and F2
<i>Site History</i> including a. past, present and proposed zoning; b. past, present and proposed land-use; c. summary of council rezoning, relevant development and building approvals; d. chronological list of site uses; e. aerial photograph review; f. site photographs; g. inventory and locations of waste and chemicals; h. contaminant sources and potential off-site effects; i. site layout plans showing past and present industrial processes; j. sewer and service plans; k. manufacturing processes; l. USTs and ASTs; m. product spill and loss history; n. discharges to land, water and air; o. disposal locations; p. complaint history; q. local knowledge; r. permits, licences, approvals, trade waste agreements; s. adjacent site history; t. local literature; u. local usage of ground and surface water; v. integrity assessment;	Refer to: a. Table 1; b. Section 3.2, Table 1, Section 5.0, Section 6.1, Section 6.2; c. Section 2.2, Section 3.3; d. Section 3.2; e. Section 3.2 and 6.4.1; f. Section 3.2; g. Table 2, Section 3.2; Section 3.3, Figure F2; h. Figure F2, Section 3.2; Section 3.3, Section 5.0, Section 6.6 and Section 6.7; i. Figure F2; j. Figure F9; k. Section 3.2; l. Table 2, Section 3.2, Section 5.0, Figure F2; m. to q. N/A; r. Section 3.2.3; s. Section 3.2; t. Section 3.2; u. to v. N/A.

Legislative Requirement	Relevant Works and RAP Section
<i>Site Condition and Surrounding Environment</i> including a. topography; b. site boundary conditions; c. visible signs of contamination; d. signs of plant stress; e. drums, wastes and fill; f. odours; g. surface water quality; h. flood potential; i. sensitive local environments	Refer to: a. Section 6.3; b. to d. N/A e. Section 3.2.3 and 6.4.2; f. Section 5.0; g. Section 5.0 and 6.3; h. N/A; i. Section 6.7.
<i>Geology and Hydrogeology</i> including a. soil stratigraphy; b. location and extent of fill material; c. soil bore logs; d. monitoring wells; e. springs; f. groundwater depth; g. groundwater flow rate and direction; h. surface water run-off direction; i. background water quality; j. preferential water courses; k. meteorology	Refer to: a. Section 5.0, 6.4.1 and 6.4.2; b. Section 5.0, 6.4.2 and 7.2 c. Section 5.0; d. Section 5.0, Figure F3; e. N/A; f. Section 6.5; g. Section 5.12, 6.5 7.2 and 11.5; h. Section 6.3; i. Section 6.4.1; j. Section 6.3 and 6.5; k. N/A
<i>Basis for Assessment Criteria</i> including a. selected assessment criteria and references; b. rationale for appropriateness of the criteria; c. assumptions of limitations of criteria	Refer to: a. Table T1 and T2; b. Section 7.0 c. Section 7.0
<i>Results</i> including a. summary of previous results; b summary of results in a table that show sample numbers and sampling depths, assessment criteria and highlights results exceeding the assessment criteria; c. site plan showing sampling locations, identification numbers and depths; d; site plan showing extent of soil and groundwater contamination	Refer to: a. Section 5.0; b. Table 3, Figure F4 to Figure F5, Table T3 to T16; c. Figure F3; d. Figure F4 to Figure F8
<i>Site Characterisation</i> including a. assessment of type of contamination; b. assessment of extent of contamination including offsite; c. assessment of chemical degradation products; d. assessment of routes of exposure	Refer to: a. Section 6.6; b. Section 7.2; c. VMP HHERA (AECOM, 2012b) Section 5.16; d. Section 6.7 and VMP HHERA (AECOM, 2012b)
<i>Remedial Action Plan</i> including a. remediation goal; b. extent of remediation required; c. remedial options appraisal; d. rational for selected remedial option; e. validation testing; f. contingency plan; g. interim site management plan; h. operational management plan including stormwater, soil, noise, dust, odour and OH&S plan; i. remediation schedule; j. operation hours; k. contingency plans to respond to emergencies; l. regulatory compliance requirements; m. appropriate personnel contact details; n. community relation plans; o. stages progress reporting; p. long-term site management plan	Refer to: a. Section 7.0; b. Section 7.2; c. Section 10.0 and 11.0; d. Section 11.0; e. Section 19.0; f. Section 20; g. Section 20.5; h. Section 14.0 to 17.0, 20.0 and 21.0; i. Section 12.2; j. Section 13.4.2; k. Section 1.7, 13.1 and 20; l. Section 2.0 and this Appendix; m. Section 24.0; n. Section 22.0; o. Section 19.12; p. Section 20.5;

Legislative Requirement	Relevant Works and RAP Section
<i>Conclusions and Recommendations</i> including a. brief summary of all findings; b. assumptions in reaching conclusions; c. extent of uncertainties in the results; d. list summarising activities and physical changes to site where remedial action has been undertaken; e. suitability of site statement; f. statement of limitations and constraints of the site use; g. recommendations	Refer to a. Section 25.0

Based on the above table, AECOM concludes that this RAP has been appropriately prepared to comply with the overall aims and principles of the SEPP 55 (1998) and the NSW EPA (2011) guidelines.

Appendix E

Environmental Protection Licence 13336

Licence Variation

Licence - 13336



Office of
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& Heritage

BARANGAROO DELIVERY AUTHORITY (BDA)

ABN 94 567 807 277

LEVEL 21 201 KENT STREET

SYDNEY NSW 2000

Attention:

Notice Number 1500535
File Number LIC10/940
Date 13-Dec-2011

NOTICE OF VARIATION OF LICENCE NO. 13336

BACKGROUND

- A. BARANGAROO DELIVERY AUTHORITY (BDA) ("the licensee") is the holder of Environment Protection Licence No. 13336 ("the licence") issued under the *Protection of the Environment Operations Act 1997* ("the Act"). The licence authorises the carrying out of activities at and a portion of Hickson Rd (near to 30-38 Hickson Rd), MILLERS POINT, NSW, 2000.
 - B. On 31 May 2011 the EPA received an email transmission from the licensee's contractors requesting a variation to the licence to add relevant conditions associated with the SISCO and SEPR Pilot Trials at block 5 (Works Approved by Project Approval MP10_0087).
 - C. On 31 May 2011 the EPA received an application from the licensee requesting a variation to the licence to add the category of 'scheduled development works' and relevant conditions associated with the relocation of a sewer on the premises and along Towns Place and Hickson Road.
 - D. On 16 May 2011 the EPA received an application from the licensee requesting a variation to the licence to add the Scheduled Activities of Crushing Grinding or Separating and Extractive Industries and relevant conditions associated with works at Headland Park.
 - E. The EPA has sought and considered additional information from the licensee to support its applications.
1. The EPA has considered the above applications and has decided to vary the licence by:
 - Adding a scheduled development works description at condition A1;
 - Adding new scheduled activities at condition A1;
 - Varying the premises description at A2;
 - Adding air discharge points at P1;
 - Adding concentration limits at L2;

Licence Variation



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- Varying condition L4;
- Adding Monitoring conditions at M2;
- Adding an Operating conditions at O5;
- Varying Monitoring conditions at M2 and M8; and
- Renumbering Special conditions and adding conditions at E2, E3, E4, E5, E6 and E7.

VARIATION OF LICENCE NO. 13336

2. By this notice the EPA varies licence No. 13336. The attached licence document contains all variations that are made to the licence by this notice.
3. The following variation have been made to the licence:
 -

Greg Sheehy
Manager
Metropolitan - Sydney Industry
(by Delegation)

INFORMATION ABOUT THIS NOTICE

- This notice is issued under section 58(5) of the Act.
- Details provided in this notice, along with an updated version of the licence, will be available on the EPA's Public Register (<http://www.environment.nsw.gov.au/prpoeo/index.htm>) in accordance with section 308 of the Act.

Appeals against this decision

- You can appeal to the Land and Environment Court against this decision. The deadline for lodging the appeal is 21 days after you were given notice of this decision.

When this notice begins to operate

- The variations to the licence specified in this notice begin to operate immediately from the date of this notice, unless another date is specified in this notice.
- If an appeal is made against this decision to vary the licence and the Land and Environment Court directs that the decision is stayed the decision does not operate until the stay ceases to have effect or the Land and Environment Court confirms the decision or the appeal is withdrawn (whichever occurs first).

Environment Protection Licence

Licence - 13336



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Licence Details

Number: 13336
Anniversary Date: 25-October

Licensee

BARANGAROO DELIVERY AUTHORITY (BDA)

LEVEL 21 201 KENT STREET

SYDNEY NSW 2000

Premises

BARANGAROO
AND A PORTION OF HICKSON RD (NEAR TO 30-38
HICKSON RD)
MILLERS POINT NSW 2000

Scheduled Activity

Contaminated Groundwater Treatment
Crushing, Grinding or Separating
Extractive Activities

Fee Based Activity

Contaminated groundwater treatment

Crushing, grinding or separating

Land-based extractive activity

Scale

Any handling capacity

> 100000-500000 T processed

> 100000-500000 T extracted, processed or
stored

Region

Metropolitan - Sydney Industry
Level 3, NSW Govt Offices, 84 Crown Street
WOLLONGONG NSW 2500
Phone: (02) 9995 5000
Fax: (02) 9995 6900

PO Box 513 WOLLONGONG EAST
NSW 2520

Environment Protection Licence

Licence - 13336



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INFORMATION ABOUT THIS LICENCE	4
Dictionary	4
Responsibilities of licensee	4
Duration of licence	4
Licence review	4
Fees and annual return to be sent to the EPA	4
Transfer of licence	5
Public register and access to monitoring data	5
1 ADMINISTRATIVE CONDITIONS	6
A1 What the licence authorises and regulates	6
A2 Premises or plant to which this licence applies	6
A3 Other activities	7
A4 Information supplied to the EPA	7
2 DISCHARGES TO AIR AND WATER AND APPLICATIONS TO LAND	7
P1 Location of monitoring/discharge points and areas	7
3 LIMIT CONDITIONS	9
L1 Pollution of waters	9
L2 Concentration limits	9
L3 Volume and mass limits	12
L4 Hours of operation	12
L5 Potentially offensive odour	13
4 OPERATING CONDITIONS	14
O1 Activities must be carried out in a competent manner	14
O2 Maintenance of plant and equipment	14
O3 Dust	14
O4 Waste management	14
O5 Other operating conditions	14
5 MONITORING AND RECORDING CONDITIONS	15
M1 Monitoring records	15
M2 Requirement to monitor concentration of pollutants discharged	15
M3 Testing methods - concentration limits	19
M4 Environmental monitoring	19
M5 Recording of pollution complaints	20
M6 Telephone complaints line	20
M7 Requirement to monitor volume or mass	20

Environment Protection Licence

Licence - 13336



Office of
Environment
& Heritage

M8	Other monitoring and recording conditions	21
6	REPORTING CONDITIONS	21
R1	Annual return documents	21
R2	Notification of environmental harm	22
R3	Written report	23
7	GENERAL CONDITIONS	23
G1	Copy of licence kept at the premises or plant	23
G2	Signage	23
8	SPECIAL CONDITIONS	24
E1	Site Wide Air Emissions Reporting	24
E2	Barangaroo South Water Treatment Plant	24
E3	Headland Park - Early Works	25
E4	SISCO and SEPR Trial	28
E5	Ambient Water Quality	29
E6	Completed PRPs	30
E7	Special Dictionary	30
DICTIONARY		32
	General Dictionary	32

Environment Protection Licence

Licence - 13336



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Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 ("the Act") and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 - 132 of the Act); and
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).

Environment Protection Licence

Licence - 13336



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The EPA publication "A Guide to Licensing" contains information about how to calculate your licence fees. The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

BARANGAROO DELIVERY AUTHORITY (BDA)

LEVEL 21 201 KENT STREET

SYDNEY NSW 2000

subject to the conditions which follow.

Environment Protection Licence

Licence - 13336



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1 Administrative Conditions

A1 What the licence authorises and regulates

A1.1 This licence authorises the carrying out of the scheduled development work listed below at the premises listed in A2:

Preparation for scheduled activities, other activities; and.

A1.2 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity	Fee Based Activity	Scale
Contaminated Groundwater Treatment	Contaminated groundwater treatment	Any handling capacity
Crushing, Grinding or Separating	Crushing, grinding or separating	> 100000 - 500000 T processed
Extractive Activities	Land-based extractive activity	> 100000 - 500000 T extracted, processed or stored

A1.3 The licensee must not carry on any scheduled activities until the scheduled development works are completed, except as elsewhere provided in this licence.

A1.4 To further clarify condition A1.1 above, "other activities" means preparation for the scheduled activities to be undertaken at the premises once planning permission is granted, namely:

Preparation for Chemical storage;

Preparation for Contaminated soil treatment;

Preparation for Sewage Treatment Systems (relocation of sewer).

Other activities also means the activities associated with the SISCO and SEPR Pilot Trials.

Activities permitted by Project Approval including those approved by:

1. MP10_0023 (Bulk Excavation and Basement Car Park);

2. MP10_0025 (Commercial Building C4)

3. MP10_0047 (Headland Park Early Works); and

3. MP10_0087 (SISCO and SEPR Pilot Trials).

A2 Premises or plant to which this licence applies

A2.1 The licence applies to the following premises:

Premises Details

BARANGAROO

AND A PORTION OF HICKSON RD (NEAR TO 30-38 HICKSON RD)

MILLERS POINT

Environment Protection Licence

Licence - 13336



Office of
Environment
& Heritage

NSW 2000

LOT 1 DP 876514, LOT 3 DP 876514, LOT 4 DP 876514, LOT 5 DP 876514,
LOT 6 DP 876514

BARANGAROO SOUTH, CENTRAL AND HEADLAND PARK AND
NORTHERN COVE INCLUDING STP 162 [HICKSON ROAD DECLARATION
AREA 3221] BEING THE PART OF HICKSON ROAD ADJACENT TO
NUMBERS: 30-34 HICKSON ROAD (LOT 11 IN DP 1065410); 36 HICKSON
ROAD (BEING LOT 6 IN DP 873158 AND LOT 12 IN DP 1065410); AND 38
HICKSON ROAD (SP72797) MILLERS POINT. THE PREMISES ALSO
INCLUDES THE WORK AREA AT TOWNS PLACE AND HICKSON ROAD AS
SHADED AND LABELLED AS "AREA OF SEWER WORKS" IN MAP TITLED
"BARANGAROO ENVIRONMENT PROTECTION LICENCE VARIATION 003
FIGURE 2.1" SUBMITTED WITH LICENCE VARIATION APPLICATION
DATED 31 MAY 2011.

A3 Other activities

A3.1 This licence applies to all other activities carried on at the premises, including:

Ancillary Activity

SISCO and SEPR Pilot Trials

A4 Information supplied to the EPA

A4.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:

- a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
- b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

2 Discharges to Air and Water and Applications to Land

P1 Location of monitoring/discharge points and areas

P1.1 The following points referred to in the table below are identified in this licence for the purposes of monitoring and/or the setting of limits for the emission of pollutants to the air from the point.

Air			
EPA identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description

Environment Protection Licence

Licence - 13336



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5	Ambient air monitoring		Location 1 as depicted on Figure 5.6, page 28 of the report supporting LVA supplied to the EPA on 10 Dec 2010.
8	Ambient air monitoring		Location 4 as depicted on Figure 5.6, page 28 of the report supporting LVA supplied to the EPA on 10 Dec 2010.
13	Ambient air monitoring		Location 9 as depicted on Figure 5.6, page 28 of the report supporting LVA supplied to the EPA on 10 Dec 2010.
14	Discharge to air - Air quality monitoring	Discharge to air - Air quality monitoring	Stack serving the MPE/SVE System titled SVE 1 as depicted in drawing titled "Block 5 and Hickson Road Pilot Trial - Block 5 System Set-up area" supplied to the EPA on 31 May 2011.
15	Discharge to air - Air quality monitoring	Discharge to air - Air quality monitoring	Stack serving the MPE/SVE System titled SVE 2 as depicted in drawing titled "Block 5 and Hickson Road Pilot Trial - Block 5 System Set-up area" supplied to the EPA on 31 May 2011.
16	Discharge to air - Air quality monitoring	Discharge to air - Air quality monitoring	Stack serving the MPE/SVE System titled SVE 3 as depicted in drawing titled "Block 5 and Hickson Road Pilot Trial - Block 5 System Set-up area" supplied to the EPA on 31 May 2011.
17	Discharge to air - Air quality monitoring.	Discharge to air - Air quality monitoring.	Vent serving the air strippers on the Wastewater Treatment Plant as depicted on drawing No EN-10 in the document titled Air Quality Impact Assessment: Water Treatment Plant supplied to the EPA on 28 July 2011.
18	Discharge to air - Air quality monitoring	Discharge to air - Air quality monitoring	Vent serving the displacement tank on the Wastewater Treatment Plant as depicted on drawing No EN-10 in the document titled Air Quality Impact Assessment: Water Treatment Plant supplied to the EPA on 28 July 2011.

P1.2 The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.

P1.3 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.

Water and land

EPA Identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
1	Discharge to waters Water quality monitoring	Discharge to waters Water quality monitoring	Discharge pipe installed through existing slab as described in document titled Barangaroo South S.1 Bulk Exc & Basement Carpark EPL variation Appl. 10 Dec 2010.
2	Ambient water quality monitoring North Near Field Turbidity Monitoring		Site NF1 as generally described in Fig 5.3 in LVA supporting information supplied to the EPA on 10 Dec 2010. Final location to be agreed in writing by the EPA.

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Licence - 13336



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3	Ambient water quality monitoring South Near Field Turbidity Monitoring	Site NF2 as generally described in Fig 5.3 in LVA supporting information supplied to the EPA on 10 Dec 2010. Final location to be agreed in writing by the EPA.
4	Ambient water quality monitoring Reference Turbidity Monitoring Point	Site BG1 as described in Fig 5.3 in LVA supporting information supplied to the EPA on 10 Dec 2010.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2. Concentration limits

L2.1 For each monitoring/discharge point or utilisation area specified in the table\>s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.

L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.

L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\>s.

L2.4 Air Concentration Limits

POINT 14,15,16

Pollutant	Units of measure	100 percentile concentration limit	Reference conditions	Oxygen correction	Averaging period
volatile organic compounds as n-propane equivalent	milligrams per cubic metre	20	Dry, 273K 101.3kPa		

POINT 17,18

Pollutant	Units of measure	100 percentile concentration limit	Reference conditions	Oxygen correction	Averaging period
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Licence - 13336



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volatile organic compounds as n-propane equivalent	milligrams per cubic metre	20	Dry, 273K 101.3kPa
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L2.5 Water and/or Land Concentration Limits

POINT 1

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Acenaphthene	micrograms per litre				2
Acenaphthylene	micrograms per litre				2
Ammonia	micrograms per litre				910
Anthracene	micrograms per litre				2
Arsenic	micrograms per litre				2.3
Benzene	micrograms per litre				500
Benzo(a)anthracene	micrograms per litre				2
Benzo(a)pyrene	micrograms per litre				2
Benzo(b)fluoranthene	micrograms per litre				2
Benzo(k)fluoranthene	micrograms per litre				2
Benzo[ghi]perylene	micrograms per litre				2
Cadmium	micrograms per litre				0.7
Chromium (trivalent)	micrograms per litre				27
Chromium (VI) Compounds	micrograms per litre				4.4

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Licence - 13336



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Chrysene	micrograms per litre	2
Copper	micrograms per litre	1.3
Cyanide	micrograms per litre	4
Dibenz[a,h]anthracene	micrograms per litre	2
Ethyl benzene	micrograms per litre	80
Fluoranthene	micrograms per litre	2
Fluorene	micrograms per litre	2
Indeno(1,2,3-cd)pyrene	micrograms per litre	2
Lead	micrograms per litre	4.4
m+p-Xylene	micrograms per litre	75
Mercury	micrograms per litre	0.1
Naphthalene	micrograms per litre	50
Nickel	micrograms per litre	7
Oil and Grease	milligrams per litre	10
o-Xylene	micrograms per litre	350
pH	pH	6.5-8.5
Phenanthrene	micrograms per litre	2
Phenol	micrograms per litre	400
Pyrene	micrograms per litre	2
Toluene	micrograms per litre	180

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Licence - 13336



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Total Petroleum Hydrocarbons C10-C14 Fraction	micrograms per litre	50
Total Petroleum Hydrocarbons C15-C28 Fraction	micrograms per litre	100
Total Petroleum Hydrocarbons C29-C36 Fraction	micrograms per litre	50
Total Petroleum Hydrocarbons C6-C9 Fraction	micrograms per litre	20
TSS	milligrams per litre	50
Zinc	micrograms per litre	15

L3 Volume and mass limits

- L3.1 For each discharge point or utilisation area specified below (by a point number), the volume/mass of:
- a) liquids discharged to water; or;
 - b) solids or liquids applied to the area;
- must not exceed the volume/mass limit specified for that discharge point or area.

Point	Unit of Measure	Volume/Mass Limit
1	kilolitres per day	6480

L4 Hours of operation

L4.1

Bulk Excavation and Basement Car Park

For the purposes of construction permitted by project Approval MP10_0023, work at the premises must be conducted between 7am and 6pm Monday to Friday and between 7am and 5pm Saturdays and at no time on Sundays and public holidays, unless inaudible at any residential premises.

Building C4

For the purposes of construction permitted by project Approval MP10_0025, work at the premises

Environment Protection Licence

Licence - 13336



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must be conducted between 7am and 7pm Monday to Friday and between 7am and 5pm Saturdays and at no time on Sundays and public holidays, unless inaudible at any residential premises.

SISCO and SEPR Trial

For the purposes of construction permitted by project Approval MP10_0087, work at the premises must be conducted between 7am and 7pm Monday to Friday and between 7am and 6pm Saturdays and at no time on Sundays and public holidays, unless inaudible at any residential premises.

Works outside these hours are not permitted except as explicitly specified below or in other conditions and include:

- (a) the delivery of materials which is required outside these hours as requested by Police or other authorities for safety reasons;
- (b) emergency work to avoid the loss of lives, damage to property and/or to prevent environmental harm; or
- (c) Approved out of standard hours works identified in a CNVMP.

Headland Park Early Works

For the purposes of works and activities permitted by project Approval MP10_0047, work at the premises must be conducted between 7am and 6pm Monday to Friday and between 8am and 3pm Saturdays and at no time on Sundays and public holidays, unless inaudible at any residential premises.

Works outside these hours are not permitted except as explicitly specified below or in other conditions and include:

- (a) the delivery of materials which is required outside these hours as requested by Police or other authorities for safety reasons;
- (b) emergency work to avoid the loss of lives, damage to property and/or to prevent environmental harm; or
- (c) Approved out of standard hours works identified in a CNVMP.

L5 · Potentially offensive odour

Note: Section 129 of the Protection of the Environment Operations Act 1997, provides that the licensee must not cause or permit the emission of any offensive odour from the premises but provides a defence if the emission is identified in the relevant environment protection licence as a potentially offensive odour and the odour was emitted in accordance with the conditions of a licence directed at minimising odour.

- L5.1 The licensee must not cause or permit the emission of offensive odour beyond the boundary of the premises.

4 Operating Conditions

Environment Protection Licence

Licence - 13336



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O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.

This includes:

- a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
- b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:

- a) must be maintained in a proper and efficient condition; and
- b) must be operated in a proper and efficient manner.

O3 Dust

O3.1 All activities on the site must be undertaken with the objective of preventing visible emissions of dust beyond the boundary of the premises. Should such visible dust emissions occur at any time, the licensee must identify and implement all practicable dust mitigation measures, including cessation of relevant works, as appropriate, such that emissions of visible dust cease.

O4 Waste management

O4.1 The licensee must not cause, permit or allow any waste generated:

- a) Outside the premises to be received at the premises; and
 - b) On-site to be disposed of outside of the premises except as permitted by c) and d) below.
- c) The licensee must assess, classify and manage any waste generated at the premises in accordance with the Waste Classification Guidelines 2009 prior to transporting the waste off site.
- d) If waste is transported from the premises, the licensee must ensure that the waste is transported by a waste transporter authorised to transport such waste and is transported to a place that can lawfully accept that waste.

O5 Other operating conditions

O5.1 Sewer Relocation

For the purposes of the scheduled development works described as "Preparation for Sewage Treatment Systems" as authorised in condition A1, the licensee must not undertake any sewer relocation works within the Declared Area being the area defined by Declaration Number 21122 until written permission from the EPA is sought and granted.

O5.2 SISCO and SEPR Trial

This condition relates to discharge points 14, 15 and 16. The stacks must be installed and maintained at a height of not less than 2 metres above ground level. When operating the

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Licence - 13336



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minimum stack discharge velocity must be maintained at 15m/s.

O5.3 Water Treatment Plant

The discharge point height of stacks at Points 17 and 18 must be maintained at least 2.77 m above ground level.

By 16 December 2011 the licensee must provide a report to the EPA which demonstrates the air impacts under the actual discharge velocities for points 17 & 18 will not result in any exceedence of the EPA's assessment criteria.

5 Monitoring and Recording Conditions

M1 Monitoring records

- M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.
- M1.2 All records required to be kept by this licence must be:
- in a legible form, or in a form that can readily be reduced to a legible form;
 - kept for at least 4 years after the monitoring or event to which they relate took place; and
 - produced in a legible form to any authorised officer of the EPA who asks to see them.
- M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:
- the date(s) on which the sample was taken;
 - the time(s) at which the sample was collected;
 - the point at which the sample was taken; and
 - the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

- M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:

M2.2 Air Monitoring Requirements

POINT 13,8,5

Pollutant	Units of measure	Frequency	Sampling Method
Lead	micrograms per cubic metre	Special Frequency 3	Other Approved Method 1
Metallic Compounds	micrograms per cubic metre	Special Frequency 3	AM-15
PM10	micrograms per cubic metre	Continuous	AM-22

Environment Protection Licence

Licence - 13336



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Polycyclic aromatic hydrocarbons	milligrams per cubic metre	Special Frequency 3	AM-15
Total Solid Particles	micrograms per cubic metre	Special Frequency 3	AM-15
Volatile organic compounds	milligrams per cubic metre	Continuous	Special Method 1

POINT 14,15,16

Pollutant	Units of measure	Frequency	Sampling Method
volatile organic compounds as n-propane equivalent	milligrams per cubic metre	Continuous	CEM-9
Volumetric flowrate	normalised cubic metres per second	Continuous during discharge	No method specified

POINT 17,18

Pollutant	Units of measure	Frequency	Sampling Method
Dry gas density	kilograms per cubic metre	Special Frequency 6	TM-23
Oxygen (O ₂)	percent	Special Frequency 6	TM-25
Temperature	degrees Celsius	Special Frequency 6	TM-2

POINT 17

Pollutant	Units of measure	Frequency	Sampling Method
volatile organic compounds as n-propane equivalent	milligrams per cubic metre	Special Frequency 5	Method approved in writing by the Authority

POINT 17,18

Pollutant	Units of measure	Frequency	Sampling Method
Volumetric flowrate	cubic metres per second	Special Frequency 6	TM-2

POINT 18

Pollutant	Units of measure	Frequency	Sampling Method
volatile organic compounds as n-propane equivalent	milligrams per cubic metre	Special Frequency 6	Method approved in writing by the Authority

M2.3 Water and/ or Land Monitoring Requirements

Environment Protection Licence

Licence - 13336



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POINT 1

Pollutant	Units of measure	Frequency	Sampling Method
Acenaphthene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Acenaphthylene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Ammonia	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Anthracene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Arsenic	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzo(a)anthracene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzo(a)pyrene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzo(b)fluoranthene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzo(k)fluoranthene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzo[ghi]perylene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Cadmium	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Chromium (trivalent)	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Chromium (VI) Compounds	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Chrysene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Conductivity	millisiemens per centimetre	Special Frequency 1	Method approved in writing by the Authority
Copper	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Cyanide	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Dibenz[a,h]anthracene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Dissolved Oxygen	milligrams per litre	Special Frequency 1	Method approved in writing by the Authority
Ethyl benzene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Fluoranthene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Fluorene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Indeno(1,2,3-cd)pyrene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Lead	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority

Environment Protection Licence

Licence - 13336



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Environment
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m+p-Xylene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Mercury	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Naphthalene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Nickel	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Oil and Grease	milligrams per litre	Special Frequency 1	Method approved in writing by the Authority
o-Xylene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
PCBs	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
pH	pH	Special Frequency 1	Method approved in writing by the Authority
Phenanthrene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Phenol	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Pyrene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Toluene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Total Petroleum Hydrocarbons C10-C14 Fraction	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Total Petroleum Hydrocarbons C15-C28 Fraction	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Total Petroleum Hydrocarbons C29-C36 Fraction	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Total Petroleum Hydrocarbons C6-C9 Fraction	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Total suspended solids	milligrams per litre	Special Frequency 1	Method approved in writing by the Authority
Turbidity	nephelometric turbidity units	Special Frequency 1	Method approved in writing by the Authority
Zinc	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority

POINT 2

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	millisiemens per centimetre	Special Frequency 2	Method approved in writing by the Authority
pH	pH	Special Frequency 2	Method approved in writing by the Authority
Temperature	degrees Celsius	Special Frequency 2	Method approved in writing by the Authority
Turbidity	nephelometric turbidity units	Special Frequency 2	Method approved in writing by the Authority

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Licence - 13336



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POINT 3

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	millisiemens per centimetre	Special Frequency 2	Method approved in writing by the Authority
pH	pH	Special Frequency 2	Method approved in writing by the Authority
Temperature	degrees Celsius	Special Frequency 2	Method approved in writing by the Authority
Turbidity	nephelometric turbidity units	Special Frequency 2	Method approved in writing by the Authority

POINT 4

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	millisiemens per centimetre	Special Frequency 2	Method approved in writing by the Authority
pH	pH	Special Frequency 2	Method approved in writing by the Authority
Temperature	degrees Celsius	Special Frequency 2	Method approved in writing by the Authority
Turbidity	nephelometric turbidity units	Special Frequency 2	Method approved in writing by the Authority

M3 Testing methods - concentration limits

M3.1 Monitoring for the concentration of a pollutant emitted to the air required to be conducted by this licence must be done in accordance with:

- any methodology which is required by or under the Act to be used for the testing of the concentration of the pollutant; or
- if no such requirement is imposed by or under the Act, any methodology which a condition of this licence requires to be used for that testing; or
- if no such requirement is imposed by or under the Act or by a condition of this licence, any methodology approved in writing by the EPA for the purposes of that testing prior to the testing taking place.

M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

Note: The *Protection of the Environment Operations (Clean Air) Regulation 2010* requires testing for certain purposes to be conducted in accordance with test methods contained in the publication "Approved Methods for the Sampling and Analysis of Air Pollutants in NSW".

M4 Environmental monitoring

Environment Protection Licence

Licence - 13336



- M4.1 All noise and vibration monitoring must be done in accordance with the relevant Construction Noise and Vibration Management Plan unless otherwise required in writing by the EPA.

M5 Recording of pollution complaints

- M5.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.
- M5.2 The record must include details of the following:
- a) the date and time of the complaint;
 - b) the method by which the complaint was made;
 - c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
 - d) the nature of the complaint;
 - e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
 - f) if no action was taken by the licensee, the reasons why no action was taken.
- M5.3 The record of a complaint must be kept for at least 4 years after the complaint was made.
- M5.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M6 Telephone complaints line

- M6.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.
- M6.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.
- M6.3 The preceding two conditions do not apply until 3 months after:
- a) the date of the issue of this licence or
 - b) if this licence is a replacement licence within the meaning of the Protection of the Environment Operations (Savings and Transitional) Regulation 1998, the date on which a copy of the licence was served on the licensee under clause 10 of that regulation.

M7 Requirement to monitor volume or mass

- M7.1 For each discharge point or utilisation area specified below, the licensee must monitor:
- a) the volume of liquids discharged to water or applied to the area;
 - b) the mass of solids applied to the area;
 - c) the mass of pollutants emitted to the air;
- at the frequency and using the method and units of measure, specified below.

Environment Protection Licence

Licence - 13336



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POINT 1

Frequency	Unit of Measure	Sampling Method
Daily	kilolitres per day	No method specified

M8 Other monitoring and recording conditions

M8.1 For the purposes of the tables above:

Discharges to Waters - Water Quality Monitoring - WTP (point 1)

Special Frequency 1 means: Once daily for the first fourteen days then weekly.

Ambient Water Quality - Water Quality Monitoring - (points 2, 3 and 4)

Special Frequency 2 means: Every 15 Minutes.

Ambient Air Quality - (points 5, 8 and 13)

Special Frequency 3 means: 24 Hours every 6 days;

In relation to VOC monitoring - Special Method 1 means: As per table 5.7 in Licence Variation

Application dated 10 Dec 2010; and

In relation to Lead monitoring - Other Approved Method 1 means: Either AM-11 or an alternative method to AM-11 for interim use that has been approved in writing by EPA.

Discharges to Air - WTP air emission monitoring (point 17 - stripper)

Other method approved in writing by the Authority means: Stack Test as interim and then CEMS as described in the document titled "Air Quality and Odour Management Sub-Plan - Document No: PLAN-EN-04- Revision D".

Special Frequency 5 means: as agreed to in writing by EPA.

Discharges to Air - WTP air emission monitoring (point 18 - displacement tank)

Other method approved in writing by the Authority means: As described in the document titled "Air Quality and Odour Management Sub-Plan - Document No: PLAN-EN-04- Revision D".

Special Frequency 6 means: as agreed to in writing by EPA.

6 Reporting Conditions

R1 Annual return documents

R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:

- a) a Statement of Compliance; and
- b) a Monitoring and Complaints Summary.

At the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.

R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided

Environment Protection Licence

Licence - 13336



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below.

- R1.3 Where this licence is transferred from the licensee to a new licensee:
- a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
 - b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.
- R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:
- a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or
 - b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.
- R1.5 The Annual Return for the reporting period must be supplied to the EPA by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').
- R1.6 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.
- R1.7 Within the Annual Return, the Statement of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:
- a) the licence holder; or
 - b) by a person approved in writing by the EPA to sign on behalf of the licence holder.
- R1.8 A person who has been given written approval to certify a certificate of compliance under a licence issued under the Pollution Control Act 1970 is taken to be approved for the purpose of this condition until the date of first review of this licence.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

R2 Notification of environmental harm

- R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.
- R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.

Note: The licensee or its employees must notify the EPA of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.

Environment Protection Licence

Licence - 13336



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R3 Written report

- R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:
- a) where this licence applies to premises, an event has occurred at the premises; or
 - b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence,
- and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.
- R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.
- R3.3 The request may require a report which includes any or all of the following information:
- a) the cause, time and duration of the event;
 - b) the type, volume and concentration of every pollutant discharged as a result of the event;
 - c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
 - d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
 - e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
 - f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
 - g) any other relevant matters.
- R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

7 General Conditions

G1 Copy of licence kept at the premises or plant

- G1.1 A copy of this licence must be kept at the premises to which the licence applies.
- G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.
- G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

G2 Signage

- G2.1 Each monitoring and discharge point must be clearly marked by a sign that indicates the EPA point identification number.

Environment Protection Licence

Licence - 13336



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8 Special Conditions

E1 Site Wide Air Emissions Reporting

- E1.1 30 days after commencement of works and monthly thereafter unless otherwise agreed in writing by the EPA, the licensee must submit to the Manager Sydney Industry, Environment Protection Authority, PO Box 668 Parramatta NSW 2124, a monthly air emissions monitoring report. The report must review all air monitoring data collected in compliance with the conditions of this licence and any Air Quality Management Plan and provide an interpretation of those results and any relevant site management responses.

E2 Barangaroo South Water Treatment Plant

E2.1 WTP Performance Report

Commencing one month from the first day of operations of the WTP and monthly thereafter or unless otherwise agreed in writing by the EPA, the licensee must submit to the Manager Sydney Industry, Environment Protection Authority, PO Box 668 Parramatta NSW 2124, a monthly WTP Performance Report. The report must review and compare the performance of the WTP against the requirements of this EPL, including Discharge Point 1 concentration limits, discharge volumes, recycled water quantities and quality as well as ambient monitoring results. The report must outline the circumstances which will trigger additional monitoring arrangements and include details about incidents and responses. The report must include the results of the visual inspections of water quality controls including silt curtains and any remedial action undertaken to ensure compliance with licence conditions including O1 and O2.

E2.2 WTP Commissioning Report

Within 60 days from the date of commissioning of the Water Treatment Plant (WTP) the licensee must submit to the Manager Sydney Industry, Environment Protection Authority, PO Box 668 Parramatta NSW 2124, a WTP commissioning report ("the report"). The report must include but not be limited to details about plant performance when treating a representative range of influents encountered during the initial stage of the works, namely, establishment works and installation of the perimeter retaining wall. The report must be updated ("the updated report") as works progress and as other influents are encountered at the site and directed to the WTP for treatment (for example contaminated groundwater, clean storm-water/surface water; contaminated storm-water/surface water; stockpile leachate etc). The updated report must be made available to an Authorised EPA officer on request.

E2.3 Air Quality Management Plan

The licensee must develop and implement an air quality management plan (AQMP) including an air quality monitoring program and VOC breakthrough action plan that will ensure WTP emissions will be controlled by best practice techniques and not cause any adverse environmental or health impact.

The AQMP must be submitted for OEH's review prior to WTP commissioning.

Environment Protection Licence

Licence - 13336



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E2.4 Air Quality Monitoring Program

The licensee must develop an Air Quality Monitoring Program which must be submitted for EPA's review and approval prior to WTP commissioning. The monitoring program must include fit for purpose monitoring strategies and methods that will demonstrate air stripper and displacement tank emissions will meet emission limits while the WTP is in operation. The licensee must ensure the air quality monitoring program has commenced when WTP operations begin to demonstrate the effective operation of the WTP emission control system.

E2.5 VOC Breakthrough Action Plan

Prior to the commencement of WTP operations, the licensee must submit a VOC breakthrough action plan to EPA for review and comment. As a minimum, the plan must:

1. propose a preferred method to monitor VOC breakthrough in the activated carbon treatment units. The preferred method must have an adequate lower detection limit to achieve meaningful comparison with licensee defined carbon breakthrough trigger(s);
2. nominate a VOC breakthrough trigger(s); and
3. define, in detail, breakthrough actions for implementation upon measurement of a VOC concentration at and above the nominated breakthrough trigger level.

The licensee must ensure the VOC breakthrough action plan has commenced when WTP operations begin.

E3 Headland Park - Early Works

E3.1 Air Quality Management Plan

The licensee must develop and implement an Air Quality Management Plan (AQMP) for the Headland Park Early Works Project. The AQMP must include work and management practices that represent best available technology and best environmental practice for emission control.

E3.2 Ambient Air Monitoring Program and Reactive Management Strategy

The licensee must develop and implement an Ambient Air Monitoring Program (AAMP) and a Reactive Management Strategy (RMS) to monitor fugitive emissions from the project and prevent exceedences of air quality criteria.

The AAMP must include each of the following elements:

1. the nomination and establishment of a network of real-time particulate monitoring sites within and/or beyond the project boundary for the purposes of monitoring project emissions using short (maximum 15 minute) averaging periods. These "management" monitoring sites shall be used to inform day to day reactive management measures. The management monitors should be fit for purpose but need not comply with AM 22 of the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*;
2. the nomination and establishment of a suitable number of ambient PM10 monitoring sites at relevant locations, that are predicted to be the most impacted, for the purpose of determining compliance with OEH 24 hour average concentration criterion of 50 µg/m³. These "compliance" monitoring sites must be maintained so as to be capable of continuously monitoring the parameters specified in the table below;
3. the nomination and establishment of a suitable number of ambient monitoring sites to monitor chemicals known to be present in the contaminated soil to be used on-site as fill, for the purpose of determining compliance with the criteria used in the document *Air Quality and Health Impact*

Environment Protection Licence

Licence - 13336



Office of
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Assessment Early Works – Headland Park dated September 2011;

4. the establishment of a suitable program to monitor odour at locations on and off site; and
5. the establishment of a real time meteorological monitoring station.

The RMS must include:

1. at least hourly review of real time monitoring data;
2. well defined monitoring trigger levels and appropriate trigger actions to prevent any exceedence of air quality criteria; and
3. regular review of monitoring activities, trigger levels and mitigation actions, that are based on monitoring data and site emission control performance.

Details of the AAMP and RMS including the type, location and frequency of monitoring to be undertaken, trigger levels and trigger level actions, must be submitted to the EPA for comment.

Site operations must not commence until the licensee receives and implements all formal written requests from the EPA on the program and strategy.

The licensee must ensure that the ambient air monitoring program is underway when excavation begins in order to demonstrate the effective operation of the emission controls used for the project.

Any sampling required by the licensee must be analysed by a laboratory accredited by NATA or equivalent, for the relevant sample analysis and matrix.

Parameter	Units of measure	Frequency	Averaging period	sampling method
PM10	ug/m3	Continuous	24-hour	AM-22
Siting				AM-1 and AM-4
Measurement				AM-2 and AM-4

E3.3 Tar hot spot works management

Pre-excavation investigation works must be undertaken to accurately identify the geographic extent and location of the hot spot.

Excavation of the hot spot must only occur:

1. between the hours of 10am and 4pm; and
2. when the wind direction is from the south south west, being between the angles of 190° and 220°.

Tar impacted materials must be immediately removed from the site to an appropriately licensed facility in covered vehicles. However, if immediate removal is not possible due to prevailing circumstances at the site, tar impacted materials must be immediately placed in a sealed container and stored in such a manner that prevents air emissions until the material is removed from the site.

Environment Protection Licence

Licence - 13336



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Controls to eliminate odour from the tar hot spot works must include the provision of covers for the excavation, minimisation of exposed surface areas, application of dust suppressants where appropriate and the placement of unaffected material as soon as possible.

In the event the excavation of the tar hotspot cannot occur under the wind direction requirements outlined above and the wind conditions remain unfavourable for an extended period of time, the tar hotspot excavation may be undertaken within a temporary enclosure.

If a temporary enclosure is to be used to cover the tar hot spot excavation site, the licensee must provide the EPA with sufficient information to demonstrate emissions from hot spot excavation works will be captured and treated effectively.

E3.4 On-site meteorological weather station establishment, measurements and actions.

A real time meteorological weather station must be established and maintained on site so as to be capable of continuously monitoring the parameters specified in the table below.

Web based telemetry including the capability of notifying appropriate staff where wind speed trigger levels are reached must be established and implemented using meteorological station data.

A site inspection must be undertaken to review dust control measures:

1. During work hours where wind speed exceeds 8 m/s during work hours; and
2. Outside of work hours where wind speed exceeds 8 m/s averaged over a 1 hour period and is dominated by an easterly direction.

Parameter	Units of measure	Frequency	Averaging period	Sampling method
Rainfall	mm	Continuous	1 hour	AM-4
Wind speed @10 metres	m/s	Continuous	15 minute	AM2 and AM-4
Wind direction @ 10 metres	Degrees	Continuous	15 minute	AM2 and AM-4
Temperature @ 2 metres	Degrees C	Continuous	15 minute	AM-2 & AM-4
Temperature @ 10 metres	Degrees C	Continuous	15 minute	AM-4
Sigma theta @ 10 metres	Degrees	Continuous	15 minute	AM-2 & AM-4
Solar radiation	W/m2	Continuous	15 minute	AM-4
Additional requirements Siting and Measurement				AM-2 & AM-4

E3.5 Fill material pre-classification

Site materials originating from parts of the Barangaroo Site other than the Headland Park Site that

Environment Protection Licence

Licence - 13336



Office of
Environment
& Heritage

are to be used as fill must comply with the maximum criteria and daily mean criteria listed in the table below.

Prior to the receipt of materials from parts of the Barangaroo site other than the Headland Park site, material testing results for the material to be received must be reviewed and compared with the criteria in accordance with the project Materials Compliance Management System.

Materials originating from parts of the Barangaroo Site other than the Headland Park site must not be received on the Headland Park site until test results have been reviewed and it is confirmed that the material complies with the fill criteria.

Constituent	Maximum Criteria mg/kg	Daily Mean mg/kg
Benzene	5.2	2.8
Ethylbenzene	10	2.8
Toluene	12	3.3
Xylene (total)	43	12
2-methylnaphthalene	200	55
Cyanide	2	0.6
Acenaphthene	19	5.2
Naphthalene	170	160
Phenol	3	0.8
Dibenzofuran	53	15
Trimethylbenzenes	30	8
Styrene	7	2

E3.6 Exception reporting

The licensee must submit to the EPA an exception report within two working days of notification of a result where the project criteria have been exceeded (see note below). The report must include details of the exceedence and outline the circumstances that led to the exceedence and any changes to site management practices to prevent future exceedences.

Note: Exceedences of PM10 criteria must be investigated and actioned, but details may be reported to the EPA monthly in the Air Emission Monitoring Report required by condition E1.1

- E3.7 Wet cutting methods must be used for sandstone extraction and block shaping. Water sprays and/or misting facilities must be used to prevent visible dust emissions from sandstone extraction and block shaping where wet cutting is not adequate.

E4 SISCO and SEPR Trial

- E4.1 For the purposes of the SISCO and SEPR Pilot Trial ("the trial") authorised by licence condition A1.1 and A1.4 the trial must be conducted in accordance with the document titled "*Revised WORK PLAN and TRIAL MANAGEMENT PLAN Surfactant Enhanced In Situ Chemical Oxidation*"

Environment Protection Licence

Licence - 13336



Office of
Environment
& Heritage

(S-ISCO®) & Surfactant Enhanced Product Recovery (SEPR™) Block 5 and Hickson Road Pilot Trial – September 2011". ("the WP&TMP"). The soil and groundwater, soil vapour sampling and process and performance monitoring results must be carried out as specified in the WP&TMP. A summary and interpretation of all monitoring activities and sampling results specified in the WP&TMP must be provided to the EPA on a weekly basis. This summary must report against contingency triggers in the WP&TMP. The report must demonstrate that the management controls and procedures are sufficiently and accurately assessing the location of the injection front to determine plume movement and temperature. The report must include also any instances where triggers have been reached and a description of what contingencies were implemented. As soon as practicable after the completion of the trial and in any case within a maximum of 18 weeks of completion, the licensee must prepare and submit to the EPA a detailed assessment report on the trial. The report must summarise all aspects of the trial including a commentary on the success or otherwise on the stated objectives. The report must be provided to the Manager Sydney Industry, Environment Protection Authority, PO Box 668, Parramatta NSW 2124. Note: The summary and interpretation of sampling and monitoring results required in paragraph 2. above, may be submitted to the EPA by email.

E4.2 The trial success soil/groundwater criteria as noted in Appendix I of the TMP must be revised. The revised criteria can be either:

(a) The criteria for Area A from the ORWS HHERA; or

(b) OEHL will accept a commitment from the applicant to formulate appropriate ecological criteria and present these in the ORWN HHERA.

The vapours from the pressure relief valves on the tanks used for treating water must be vented through the SVE charcoal bed;

Any treated water proposed for re-use or re-injection must meet the concentration limits specified in EPL condition L3 at Point 1; and

With respect to Contingency table (T21) an increased temperature of 15 degrees Celsius must trigger the addition of cold water into the wells.

E4.3 For the purposes of discharge points 14, 15 and 16 - the the breakthrough trigger for contingencies as per the Trial Management Plan is a VOC stack concentration of 10mg/m3 (5.1 ppm).

E5 Ambient Water Quality

E5.1 Ambient Water Quality Monitoring Reporting

Commencing one month from the first day of operations of the ambient water quality monitoring network and monthly thereafter or unless otherwise agreed in writing by the EPA, the licensee must submit to the Manager Sydney Industry, Environment Protection Authority, PO Box 668 Parramatta NSW 2124, a monthly Ambient Water Quality Monitoring Report. The report must include all results for ambient water quality monitoring around the site, an interpretation of those results and any relevant site management responses.

E5.2 Ambient Water Quality Trigger

A management trigger for turbidity at Points 2 and 3 must be established as outlined in Section

Environment Protection Licence

Licence - 13336



Office of
Environment
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3.3.2 of Appendix 4 of the document entitled WATER & STORMWATER MANAGEMENT SUB-PLAN - BARANGAROO STAGE 1 prior to any discharges from the works. If the trigger is exceeded the licensee must implement the actions listed in Section 3.3.6 of Appendix 4 of this document.

E6 Completed PRPs

E6.1

PRP Number	Description	Completed Date
U1	Provide Discharge Dilution Criteria Report and Revised Stormwater and Water Management Plan	June 2011

E7 Special Dictionary

Note: SPECIAL DICTIONARY

For the purposes of the monitoring requirements in condition M2.2 (Points 5, 8 and 13) – under the heading Pollutant the words "metallic compounds" means the heavy metals copper, zinc and mercury (organic and inorganic).

For the purposes of the monitoring requirements in condition M2.2 (Points 1 – 4) under the heading Sampling Method the words "Method approved in writing by the Authority" means the Approved Methods Publication as in the Protection of the Environment Operations (General) Regulation 1998.

For the purposes of condition P1.1 the acronym LVA means Licence Variation Application. For the purposes of condition O3.1 the acronym CNVMP means construction noise and vibration management plan.

Note: Clarifying Notes.

To further clarify the terms of this licence the licensee should note:

The licensee is responsible for compliance with all activities permitted by this licence:

Administrative (A) conditions

All relate to the premises.

Discharge Points (P) conditions

Points 5, 8 and 13 relate to Ambient Air Monitoring Stations;

Points 14, 15 and 16 relate to the SISCO and SEPR Trial;

Points 17 & 18 relate to air discharges from the Water Treatment Plant;

Point 1 relates to water discharges from the Water Treatment Plant; and

Points 2, 3 and 4 relate to Ambient Water Quality Monitoring.

Environment Protection Licence

Licence - 13336



Office of
Environment
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Limit (L) Conditions

L1.1, L2.1, L2.2, and L2.3 relate to the premises;
L2.4 relates to specific Points as noted;
L3.1 relates to specific Points as noted;
L4.1 relates to hours of work at specific locations as permitted by Project Approvals (as noted);
and
L5 and L5.1 relates to the premises.

Operating (O) Conditions

O1.1, O2.1, O3.1 O4.1 relate to the premises;
O5.1 relates to the sewer relocation activity;
O5.2 relates to the SISCO and SEPR Trial; and
O5.3 relates to the Water Treatment Plant.

Monitoring (M) Conditions

M1.1, M1.2 and M1.3 relate to the premises;
M2.1 and M2.2 relate to specific Points as noted;
M3.1 and M3.2 relate to the premises;
M4.1 relates to the premises;
M5.1, M5.2, M5.3 and M5.4 relate to the premises;
M6.1, M6.2 and M6.3 relate to the premises;
M7.1 relates to specific Points as noted; and
M8.1 relates to specific Points as noted.

Reporting (R) Conditions

R1.1, R1.2, R1.3, R1.4, R1.5, R1.6, R1.7, R1.8 relate to the premises;
R2.1 and R2.2 relate to the premises; and
R3.1, R3.2, R3.3 and R3.4 relate to the premises.

General (G) Conditions

G1.1, G1.2 and G1.3 relate to the premises; and
G2.1 relates to the premises.

Special (E) Conditions

E1.1 relates to the premises;
E2.1, E2.2, E2.3, E2.4 and E2.5 relate to the Water Treatment Plant;
E3.1, E3.2, E3.3 E3.4, E3.5, E3.6 and E3.7 relates to Headland Park Early Works;
E4.1, E4.2 and E4.3 relate to the SISCO and SEPR Trial;
E5.1 and E5.2 (Ambient Water Quality) relate primarily to works at Barangaroo South; and
E6 relates to the premises as noted.

Environment Protection Licence

Licence - 13336



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Environment
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Dictionary

General Dictionary

3DGM [in relation to a concentration limit]	Means the three day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples
Act	Means the Protection of the Environment Operations Act 1997
activity	Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment Operations Act 1997
actual load	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
AM	Together with a number, means an ambient air monitoring method of that number prescribed by the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> .
AMG	Australian Map Grid
anniversary date	The anniversary date is the anniversary each year of the date of issue of the licence. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
annual return	Is defined in R1.1
Approved Methods Publication	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
assessable pollutants	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
BOD	Means biochemical oxygen demand
CEM	Together with a number, means a continuous emission monitoring method of that number prescribed by the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> .
COD	Means chemical oxygen demand
composite sample	Unless otherwise specifically approved in writing by the EPA, a sample consisting of 24 individual samples collected at hourly intervals and each having an equivalent volume.
cond.	Means conductivity
environment	Has the same meaning as in the Protection of the Environment Operations Act 1997
environment protection legislation	Has the same meaning as in the Protection of the Environment Administration Act 1991
EPA	Means Environment Protection Authority of New South Wales.
fee-based activity classification	Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations (General) Regulation 2009.
general solid waste (non-putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997

Environment Protection Licence

Licence - 13336



Office of
Environment
& Heritage

flow weighted composite sample	Means a sample whose composites are sized in proportion to the flow at each composites time of collection.
general solid waste (putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
grab sample	Means a single sample taken at a point at a single time
hazardous waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
licensee	Means the licence holder described at the front of this licence
load calculation protocol	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
local authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
material harm	Has the same meaning as in section 147 Protection of the Environment Operations Act 1997
MBAS	Means methylene blue active substances
Minister	Means the Minister administering the Protection of the Environment Operations Act 1997
mobile plant	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
motor vehicle	Has the same meaning as in the Protection of the Environment Operations Act 1997
O&G	Means oil and grease
percentile [in relation to a concentration limit of a sample]	Means that percentage [eg.50%] of the number of samples taken that must meet the concentration limit specified in the licence for that pollutant over a specified period of time. In this licence, the specified period of time is the Reporting Period unless otherwise stated in this licence.
plant	Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.
pollution of waters [or water pollution]	Has the same meaning as in the Protection of the Environment Operations Act 1997
premises	Means the premises described in condition A2.1
public authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
regional office	Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence
reporting period	For the purposes of this licence; the reporting period means the period of 12 months after the issue of the licence, and each subsequent period of 12 months. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
restricted solid waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
scheduled activity	Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997
special waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
TM	Together with a number, means a test method of that number prescribed by the <i>Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales</i> .

Environment Protection Licence

Licence - 13336



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TSP	Means total suspended particles
TSS	Means total suspended solids
Type 1 substance	Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements
Type 2 substance	Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements
utilisation area	Means any area shown as a utilisation area on a map submitted with the application for this licence
waste	Has the same meaning as in the Protection of the Environment Operations Act 1997
waste type	Means liquid, restricted solid waste, general solid waste (putrescible), general solid waste (non-putrescible), special waste or hazardous waste

Mr Stuart Clark

Environment Protection Authority

(By Delegation)

Date of this edition: 25-October-2010

End Notes

- 1 Licence varied by notice 1123651, issued on 06-Jun-2011, which came into effect on 06-Jun-2011.