

CAB/J-BK093 (R002b)
Geo-Environmental Investigation
Pier Road, Littlehampton

APPENDIX D

Chemical Testing Results and Assessment Criteria

Methodology for the Screening of Soils in Terms of the Risk to Human Health (Including the OJP Methodology for Calculating Tier 1 Screening Values)

The legislative framework for the regulation of contaminated land is contained in Part IIA of the Environmental Protection Act 1990, which was implemented in the Contaminated Land (England) Regulations 2000. This legislation allows for the identification and remediation of land where contamination is causing unacceptable risks to human health or the wider environment. The basis of the UK contaminated land policy is the 'Suitable for Use' approach, which states that land should be suitable for its current use and made suitable for any new use as official permission (through the planning process) is given for that use.

Under Part IIA of the Environmental Protection Act 1990, contaminated land is defined as land where significant harm is being caused or there is a significant possibility of such harm being caused or where pollution of controlled waters is being, or is likely to be caused. For significant harm to occur, a pollutant linkage must exist i.e. there must be a contamination source, a relevant receptor and a plausible migration pathway by which the contaminant can cause significant harm to the receptor.

OPUS Joynes Pike have calculated Tier 1 screening values for various contaminants, currently utilising version 2008.2 dated 15th August 2008. In the complete absence of existing United Kingdom soil screening guidelines (The EA have indicated that new SGV's will be published in March 2009) and the rapid nature of the withdrawal of previous official Soil Guideline Values without warning, it is recognised that these Tier 1 screening values are produced in line with the initial CLEA model as published by the UK Government on 14th March 2002 (with subsequent addendum) rather than the revised scientific policy update of 15th August 2008.

However it is noted that the former Soil Guideline Values in any case were not intended to represent binding standards or statutory objectives. Consequently in the context of defining a set of initial Tier 1 screening values as an interim measure these values are considered to be acceptable whilst the implications of the shift in policy are digested and assessed.

The methodology employed to calculate these values is as follows:

Where available, United Kingdom based toxicological data, presented in the appropriate Environment Agency CLR TOX series of reports has been used. When new TOX reports are issued, the Tier 1 values will be updated accordingly.

However, where a TOX report is not available, reference has again been made to the Risk Assessment Information System (RAIS) database (<http://rais.ornl.gov>) for toxicological information, with the exception of banded TPH where reference is made to the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) documents, which contain both toxicological information and physio-chemical properties. These documents are utilised for "threshold" (i.e. non-carcinogenic) contaminants only, with the toxicological data adjusted for average UK bodyweight (70kg). This exercise generates a Tolerable Daily Intake (TDI).

It is noted that the Environment Agency publication P5-080/TR3 (The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils), identifies three carbon bands at the "heavy" end of the spectrum, which would be characterised by

immobile highly unreactive compounds. However, since no toxicological data exists currently for these additional bands, Joynes Pike & Associates have continued to utilise the data contained within the TPHCWG publications. Additionally the Tier 1 screening values do not consider the additive or synergistic effects of any compounds.

To model the Tier 1 values, OJP have used a variety of appropriate software models including SNIFFER, CLEA UK and RISC 4.0. The SNIFFER model (LQM01) has been used for non-organic contaminants, whilst the RISC 4.0 model has been utilised for the majority of the organic contaminants. RISC 4.0 uses the Johnson & Ettinger model with respect to the volatilisation of compounds from soil and is therefore considered to be appropriate.

The CLEA UK (beta) model has only been utilised for benzo(a)pyrene at this stage since the EA currently state that the beta version of the software has only been tested for a limited range of chemicals and scenarios and should be applied with caution. Benzo(a)pyrene was a compound within the initial CLEA 2002 software and it's use has been continued within the CLEA UK model.

The default parameters are accepted when running the model at a Tier 1 level to give the most conservative model except that the SOM is calculated with a range from 0.25% to 5% to be in line with the published Soil Guideline Values but also to look at natural soils which may have a lower SOM.

With regards to plant uptake, the guidance offered by the Environment Agency within their publication SC50021/SR has been adopted where possible. Furthermore the relevant soil parameters have been adjusted to 10° C in accordance with CLEA Briefing Note 2.



4041

M CERTS

environmentalscience

Craig Bulga
Opus Joynes Pike
Suite 3
3800 Parkside
Birmingham Business Park
Birmingham
B37 7YG

t: 0121 3291560
f: 0121 7880757
e: craig.bulga@opusjoynespikes.co.uk

i2 Analytical Ltd.
Building 19,
BRE,
Garston,
Watford,
WD25 9XX

t: 01923 67 00 20
f: 01923 67 00 30
e: info@i2analytical.com

Analytical Report Number : 08-15998 B

Replaces Analytical Report Number : 08-15998, issue no. 1

Project / Site name: Pier rd, Littlehampton

Samples received on: 24/07/2008

Your job number:

Samples instructed on: 24/07/2008

Your order number: 27553

Analysis completed by: 04/08/2008

Report Issue Number: 2

Report issued on: 05/08/2008

Samples Analysed: Samples WSA - WSD

Signed: _____

Russell Jarvis
General Manager
For & on behalf of i2 Analytical Ltd.

Signed: _____

Kevin Old
Quality Manager
For & on behalf of i2 Analytical Ltd.

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland



4041



environmental science

Analytical Report Number: 08-15998

Project / Site name: Pier rd, Littlehampton

Lab Sample Number				110255	110256	110257	110258	110259
Sample Reference				WSA	WSA	WSA	WSB	WSB
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth				0.65-0.90	1.30-1.40	1.70-2.00	0.20-0.50	2.70-3.00
Date Sampled				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Moisture Content	%	N/A	NONE	10	3.0	24	15	25
Total mass of sample received	kg	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Fibrous Material (Screen)	P/A	N/A	NONE	Absent	N/A	N/A	Absent	N/A

General Inorganics

pH	pH Units	N/A	MCERTS	7.4	N/A	8.1	7.6	8.0
Total Cyanide	mg/kg	1	MCERTS	< 1.0	N/A	N/A	< 1.0	N/A
Total Sulphate as SO ₄	mg/kg	100	NONE	1300	N/A	N/A	7400	N/A
Water Soluble Sulphate as SO ₄ (2:1)	g/l	0.005	NONE	0.83	N/A	0.13	4.7	1.9
Water Soluble Sulphate as SO ₄ (2:1)	mg/kg	2.5	NONE	420	N/A	65	2400	950
Sulphide	mg/kg	1	NONE	< 1.0	N/A	N/A	45	N/A
Elemental Sulphur	mg/kg	20	MCERTS	31	N/A	N/A	85	N/A

Phenols by GC-MS

Phenol	mg/kg	0.1	ISO 17025	N/A	N/A	N/A	N/A	N/A
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	N/A	N/A	N/A	N/A	N/A
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	N/A	N/A	N/A	N/A	N/A
2,4-Dichlorophenol	mg/kg	0.1	ISO 17025	N/A	N/A	N/A	N/A	N/A
2,4-Dimethylphenol	mg/kg	0.1	ISO 17025	N/A	N/A	N/A	N/A	N/A
2-Chlorophenol	mg/kg	0.1	MCERTS	N/A	N/A	N/A	N/A	N/A
2-Methylphenol	mg/kg	0.05	MCERTS	N/A	N/A	N/A	N/A	N/A
2-Nitrophenol	mg/kg	0.1	MCERTS	N/A	N/A	N/A	N/A	N/A
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	N/A	N/A	N/A	N/A	N/A
4-Methylphenol	mg/kg	0.2	MCERTS	N/A	N/A	N/A	N/A	N/A

Total Phenols

Total Phenols (monohydric)	mg/kg	4	MCERTS	< 4.0	N/A	N/A	< 4.0	N/A
Total Phenols (GC-MS)	mg/kg	1	NONE	N/A	N/A	N/A	N/A	N/A

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.20	N/A	N/A	0.08	N/A
Acenaphthylene	mg/kg	0.05	MCERTS	0.76	N/A	N/A	0.08	N/A
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	N/A	N/A	< 0.05	N/A
Fluorene	mg/kg	0.05	MCERTS	0.15	N/A	N/A	< 0.05	N/A
Phenanthrene	mg/kg	0.05	MCERTS	4.6	N/A	N/A	1.0	N/A
Anthracene	mg/kg	0.05	MCERTS	1.5	N/A	N/A	0.41	N/A
Fluoranthene	mg/kg	0.1	MCERTS	15	N/A	N/A	2.0	N/A
Pyrene	mg/kg	0.05	MCERTS	12	N/A	N/A	1.8	N/A
Benzo(a)anthracene	mg/kg	0.2	MCERTS	7.6	N/A	N/A	1.7	N/A
Chrysene	mg/kg	0.05	MCERTS	8.7	N/A	N/A	1.9	N/A
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	8.5	N/A	N/A	2.0	N/A
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	6.0	N/A	N/A	1.4	N/A
Benzo(a)pyrene	mg/kg	0.1	MCERTS	7.9	N/A	N/A	1.7	N/A
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	4.8	N/A	N/A	1.0	N/A
Dibenzo(a,h)anthracene	mg/kg	0.05	MCERTS	0.57	N/A	N/A	0.09	N/A
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	5.0	N/A	N/A	1.3	N/A

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	83	N/A	N/A	17	N/A
-----------------------------	-------	-----	--------	----	-----	-----	----	-----

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	2	MCERTS	16	N/A	N/A	12	N/A
Boron (water soluble)	mg/kg	0.2	NONE	3.8	N/A	N/A	5.3	N/A
Cadmium (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	N/A	N/A	< 0.3	N/A
Chromium (aqua regia extractable)	mg/kg	5	MCERTS	26	N/A	N/A	23	N/A
Copper (aqua regia extractable)	mg/kg	10	MCERTS	69	N/A	N/A	45	N/A
Lead (aqua regia extractable)	mg/kg	5	MCERTS	390	N/A	N/A	70	N/A
Mercury (aqua regia extractable)	mg/kg	0.2	MCERTS	0.3	N/A	N/A	< 0.2	N/A
Nickel (aqua regia extractable)	mg/kg	2	MCERTS	19	N/A	N/A	26	N/A
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	N/A	N/A	< 1.0	N/A
Zinc (aqua regia extractable)	mg/kg	7	MCERTS	410	N/A	N/A	130	N/A



4041



environmentalscience

Analytical Report Number: 08-15998

Project / Site name: Pier rd, Littlehampton

Lab Sample Number				110255	110256	110257	110258	110259
Sample Reference				WSA	WSA	WSA	WSB	WSB
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth				0.65-0.90	1.30-1.40	1.70-2.00	0.20-0.50	2.70-3.00
Date Sampled				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		

Monoaromatics

Benzene	µg/kg	1	MCERTS	N/A	< 1.0	N/A	N/A	N/A
Toluene	µg/kg	1	MCERTS	N/A	< 1.0	N/A	N/A	N/A
Ethylbenzene	µg/kg	1	MCERTS	N/A	< 1.0	N/A	N/A	N/A
p & m-xylene	µg/kg	1	ISO 17025	N/A	< 1.0	N/A	N/A	N/A
o-xylene	µg/kg	1	MCERTS	N/A	< 1.0	N/A	N/A	N/A
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	N/A	< 1.0	N/A	N/A	N/A

Petroleum Hydrocarbons

TPH7 - Aliphatic >C5 - C6	mg/kg	0.1	NONE	N/A	< 0.1	N/A	N/A	N/A
TPH7 - Aliphatic >C6 - C8	mg/kg	0.1	NONE	N/A	< 0.1	N/A	N/A	N/A
TPH7 - Aliphatic >C8 - C10	mg/kg	0.1	NONE	N/A	< 0.1	N/A	N/A	N/A
TPH7 - Aliphatic >C10 - C12	mg/kg	1	NONE	N/A	< 1.0	N/A	N/A	N/A
TPH7 - Aliphatic >C12 - C16	mg/kg	10	NONE	N/A	< 10	N/A	N/A	N/A
TPH7 - Aliphatic >C16 - C21	mg/kg	10	NONE	N/A	< 10	N/A	N/A	N/A
TPH7 - Aliphatic >C21 - C34	mg/kg	10	NONE	N/A	< 10	N/A	N/A	N/A
TPH7 - Aliphatic (C5 - C34)	mg/kg	10	NONE	N/A	< 10	N/A	N/A	N/A
TPH7 - Aromatic >C5 - C7	mg/kg	0.1	NONE	N/A	< 0.1	N/A	N/A	N/A
TPH7 - Aromatic >C7 - C8	mg/kg	0.1	NONE	N/A	< 0.1	N/A	N/A	N/A
TPH7 - Aromatic >C8 - C10	mg/kg	0.1	NONE	N/A	< 0.1	N/A	N/A	N/A
TPH7 - Aromatic >C10 - C12	mg/kg	1	NONE	N/A	3.9	N/A	N/A	N/A
TPH7 - Aromatic >C12 - C16	mg/kg	10	NONE	N/A	< 10	N/A	N/A	N/A
TPH7 - Aromatic >C16 - C21	mg/kg	10	NONE	N/A	< 10	N/A	N/A	N/A
TPH7 - Aromatic >C21 - C35	mg/kg	10	NONE	N/A	24	N/A	N/A	N/A
TPH7 - Aromatic (C5 - C35)	mg/kg	10	NONE	N/A	28	N/A	N/A	N/A



4041



environmentalscience

Analytical Report Number: 08-15998

Project / Site name: Pier rd, Littlehampton

Lab Sample Number				110260	110261	110262	110263	110264
Sample Reference				WSC	WSC	WSD	WSD	WSD
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth				0.40-0.65	1.70-2.00	0.35-0.55	0.70-1.00	1.70-2.00
Date Sampled				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Moisture Content	%	N/A	NONE	16	24	13	24	23
Total mass of sample recieved	kg	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Fibrous Material (Screen)	P/A	N/A	NONE	N/A	N/A	Absent	N/A	N/A

General Inorganics

pH	pH Units	N/A	MCERTS	N/A	7.9	7.4	N/A	N/A
Total Cyanide	mg/kg	1	MCERTS	N/A	N/A	< 1.0	N/A	N/A
Total Sulphate as SO ₄	mg/kg	100	NONE	N/A	N/A	450	N/A	N/A
Water Soluble Sulphate as SO ₄ (2:1)	g/l	0.005	NONE	N/A	0.18	0.21	N/A	N/A
Water Soluble Sulphate as SO ₄ (2:1)	mg/kg	2.5	NONE	N/A	90	110	N/A	N/A
Sulphide	mg/kg	1	NONE	N/A	N/A	< 1.0	N/A	N/A
Elemental Sulphur	mg/kg	20	MCERTS	N/A	N/A	< 20	N/A	N/A

Phenols by GC-MS

Phenol	mg/kg	0.1	ISO 17025	0.3	N/A	N/A	3.4	N/A
2,4,5-Trichlorophenol	mg/kg	0.2	NONE	< 0.2	N/A	N/A	< 0.2	N/A
2,4,6-Trichlorophenol	mg/kg	0.1	NONE	< 0.1	N/A	N/A	< 0.1	N/A
2,4-Dichlorophenol	mg/kg	0.1	ISO 17025	< 0.1	N/A	N/A	< 0.1	N/A
2,4-Dimethylphenol	mg/kg	0.1	ISO 17025	< 0.1	N/A	N/A	< 0.1	N/A
2-Chlorophenol	mg/kg	0.1	MCERTS	< 0.1	N/A	N/A	< 0.1	N/A
2-Methylphenol	mg/kg	0.05	MCERTS	< 0.1	N/A	N/A	< 0.1	N/A
2-Nitrophenol	mg/kg	0.1	MCERTS	< 0.1	N/A	N/A	< 0.1	N/A
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	< 0.1	N/A	N/A	< 0.1	N/A
4-Methylphenol	mg/kg	0.2	MCERTS	< 0.2	N/A	N/A	< 0.2	N/A

Total Phenols

Total Phenols (monohydric)	mg/kg	4	MCERTS	N/A	N/A	< 4.0	N/A	N/A
Total Phenols (GC-MS)	mg/kg	1	NONE	< 1.0	N/A	N/A	3.4	N/A

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	N/A	N/A	< 0.05	N/A	N/A
Acenaphthylene	mg/kg	0.05	MCERTS	N/A	N/A	< 0.05	N/A	N/A
Acenaphthene	mg/kg	0.05	MCERTS	N/A	N/A	< 0.05	N/A	N/A
Fluorene	mg/kg	0.05	MCERTS	N/A	N/A	< 0.05	N/A	N/A
Phenanthrene	mg/kg	0.05	MCERTS	N/A	N/A	0.21	N/A	N/A
Anthracene	mg/kg	0.05	MCERTS	N/A	N/A	0.09	N/A	N/A
Fluoranthene	mg/kg	0.1	MCERTS	N/A	N/A	0.55	N/A	N/A
Pyrene	mg/kg	0.05	MCERTS	N/A	N/A	0.46	N/A	N/A
Benzo(a)anthracene	mg/kg	0.2	MCERTS	N/A	N/A	0.26	N/A	N/A
Chrysene	mg/kg	0.05	MCERTS	N/A	N/A	0.34	N/A	N/A
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	N/A	N/A	0.29	N/A	N/A
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	N/A	N/A	0.21	N/A	N/A
Benzo(a)pyrene	mg/kg	0.1	MCERTS	N/A	N/A	0.30	N/A	N/A
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	N/A	N/A	0.09	N/A	N/A
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	N/A	N/A	< 0.05	N/A	N/A
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	N/A	N/A	0.23	N/A	N/A

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	N/A	N/A	3.0	N/A	N/A
-----------------------------	-------	-----	--------	-----	-----	-----	-----	-----

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	2	MCERTS	N/A	N/A	11	N/A	N/A
Boron (water soluble)	mg/kg	0.2	NONE	N/A	N/A	3.6	N/A	N/A
Cadmium (aqua regia extractable)	mg/kg	0.3	MCERTS	N/A	N/A	< 0.3	N/A	N/A
Chromium (aqua regia extractable)	mg/kg	5	MCERTS	N/A	N/A	24	N/A	N/A
Copper (aqua regia extractable)	mg/kg	10	MCERTS	N/A	N/A	16	N/A	N/A
Lead (aqua regia extractable)	mg/kg	5	MCERTS	N/A	N/A	120	N/A	N/A
Mercury (aqua regia extractable)	mg/kg	0.2	MCERTS	N/A	N/A	< 0.2	N/A	N/A
Nickel (aqua regia extractable)	mg/kg	2	MCERTS	N/A	N/A	16	N/A	N/A
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	N/A	N/A	< 1.0	N/A	N/A
Zinc (aqua regia extractable)	mg/kg	7	MCERTS	N/A	N/A	62	N/A	N/A



4041



MCERTS



environmentalscience

Analytical Report Number: 08-15998

Project / Site name: Pler rd, Littlehampton

Lab Sample Number	110260	110261	110262	110263	110264
Sample Reference	WSC	WSC	WSD	WSD	WSD
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth	0.40-0.65	1.70-2.00	0.35-0.55	0.70-1.00	1.70-2.00
Date Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Monoaromatics

Benzene	µg/kg	1	MCERTS	N/A	N/A	N/A	N/A	< 1.0
Toluene	µg/kg	1	MCERTS	N/A	N/A	N/A	N/A	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	N/A	N/A	N/A	N/A	< 1.0
p & m-xylene	µg/kg	1	ISO 17025	N/A	N/A	N/A	N/A	< 1.0
o-xylene	µg/kg	1	MCERTS	N/A	N/A	N/A	N/A	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	N/A	N/A	N/A	N/A	< 1.0

Petroleum Hydrocarbons

TPH7 - Aliphatic >C5 - C6	mg/kg	0.1	NONE	N/A	N/A	N/A	N/A	< 0.1
TPH7 - Aliphatic >C6 - C8	mg/kg	0.1	NONE	N/A	N/A	N/A	N/A	< 0.1
TPH7 - Aliphatic >C8 - C10	mg/kg	0.1	NONE	N/A	N/A	N/A	N/A	< 0.1
TPH7 - Aliphatic >C10 - C12	mg/kg	1	NONE	N/A	N/A	N/A	N/A	1.0
TPH7 - Aliphatic >C12 - C16	mg/kg	10	NONE	N/A	N/A	N/A	N/A	45
TPH7 - Aliphatic >C16 - C21	mg/kg	10	NONE	N/A	N/A	N/A	N/A	37
TPH7 - Aliphatic >C21 - C34	mg/kg	10	NONE	N/A	N/A	N/A	N/A	28
TPH7 - Aliphatic (C5 - C34)	mg/kg	10	NONE	N/A	N/A	N/A	N/A	110
TPH7 - Aromatic >C5 - C7	mg/kg	0.1	NONE	N/A	N/A	N/A	N/A	< 0.1
TPH7 - Aromatic >C7 - C8	mg/kg	0.1	NONE	N/A	N/A	N/A	N/A	< 0.1
TPH7 - Aromatic >C8 - C10	mg/kg	0.1	NONE	N/A	N/A	N/A	N/A	< 0.1
TPH7 - Aromatic >C10 - C12	mg/kg	1	NONE	N/A	N/A	N/A	N/A	16
TPH7 - Aromatic >C12 - C16	mg/kg	10	NONE	N/A	N/A	N/A	N/A	96
TPH7 - Aromatic >C16 - C21	mg/kg	10	NONE	N/A	N/A	N/A	N/A	94
TPH7 - Aromatic >C21 - C35	mg/kg	10	NONE	N/A	N/A	N/A	N/A	97
TPH7 - Aromatic (C5 - C35)	mg/kg	10	NONE	N/A	N/A	N/A	N/A	300



4041



environmentalscience

Analytical Report Number: 08-15998

Project / Site name: Pier rd, Littlehampton

Lab Sample Number	Sample Reference	Sample Number	Depth	Sample Description
110255	WSA	None Supplied	0.65-0.90	Black topsoil and clay.
110256	WSA	None Supplied	1.30-1.40	Brown sandy clay.
110257	WSA	None Supplied	1.70-2.00	Brown clay.
110258	WSB	None Supplied	0.20-0.50	Black gravelly clay with stones.
110259	WSB	None Supplied	2.70-3.00	Grey clay.
110260	WSC	None Supplied	0.40-0.65	Brown sand.
110261	WSC	None Supplied	1.70-2.00	Brown clay.
110262	WSD	None Supplied	0.35-0.55	Brown clay and sand.
110263	WSD	None Supplied	0.70-1.00	Brown clay.
110264	WSD	None Supplied	1.70-2.00	Grey clay.



4041

MCERTS



environmentalscience

#REF!

#REF!

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-UK	D	NONE
BTEX and MTBE in soil	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8262	L017-UK	W	MCERTS
Elemental sulphur in soil	Determination of elemental sulphur in soil by extraction in dichloromethane followed by HPLC.	In-house method based on Secondsite Property Holdings Guidance for Assessing and Managing Potential	L021-UK	D	MCERTS
Fibrous Material in soil screening	Visual screening of samples for fibrous material.	In-house method based on HSG 248	L050-UK	W	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil	L038-UK	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L006-UK	W	MCERTS
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-UK	W	MCERTS
Phenols, speciated, in soil, by GCMS	Determination of speciated phenols in soil by extraction in dichloromethane and hexane followed by GC-MS.	In-house method based on USEPA 8270	L061-UK	D	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-UK	D	MCERTS
Sulphate, water soluble, in soil	Determination of water soluble sulphate by extraction with water followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-UK	D	NONE
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L010-UK	D	NONE
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L007-UK	W	MCERTS
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-UK	D	NONE
TPH7 (Soil)	Determination of dichloromethane/hexane extractable hydrocarbons in soil by GC-MS.	In-house method	L064-UK	D	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.



Craig Bulga
Opus Joynes Pike
Suite 3
3800 Parkside
Birmingham Business Park
Birmingham
B37 7YG

i2 Analytical Ltd.
Building 19,
BRE,
Garston,
Watford,
WD25 9XX

t: 0121 3291560
f: 0121 7880757
e: craiq.bulga@opusjoynespikes.co.uk

t: 01923 67 00 20
f: 01923 67 00 30
e: info@i2analytical.com

Analytical Report Number : 08-16130

Project / Site name: Pier Road, Little Hampton

Samples received on: 01/08/2008

Your job number: J-BK093

Samples instructed on: 01/08/2008

Your order number: 29953

Analysis completed by: 11/08/2008

Report Issue Number: 1

Report issued on: 19/08/2008

Samples Analysed: 2 water samples 110845, 110846

Signed: _____

Russell Jarvis
General Manager
For & on behalf of i2 Analytical Ltd.

Signed: _____

Kevin Old
Quality Manager
For & on behalf of i2 Analytical Ltd.

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland



Analytical Report Number: 08-16130

Project / Site name: Pier Road, Little Hampton

Lab Sample Number	110845	110846					
Sample Reference	WSB	WSD					
Sample Number	None Supplied	None Supplied					
Depth	None Supplied	None Supplied					
Date Sampled	None Supplied	None Supplied					
Time Taken	None Supplied	None Supplied					
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status				

General Inorganics

pH	pH units	N/A	ISO 17025	8.1	8.6		
Total Cyanide	µg/l	25	ISO 17025	< 25	< 25		
Sulphate as SO ₄	µg/l	1000	NONE	1300000	170000		
Sulphide	µg/l	5	NONE	< 5.0	< 5.0		

Phenols by GC-MS

Phenol	µg/l	10	NONE	N/A	< 10		
2,4,5-Trichlorophenol	µg/l	10	NONE	N/A	< 10		
2,4,6-Trichlorophenol	µg/l	10	NONE	N/A	< 10		
2,4-Dichlorophenol	µg/l	10	NONE	N/A	< 10		
2,4-Dimethylphenol	µg/l	10	NONE	N/A	< 10		
2-Chlorophenol	µg/l	10	NONE	N/A	< 10		
2-Methylphenol	µg/l	10	NONE	N/A	< 10		
2-Nitrophenol	µg/l	10	NONE	N/A	< 10		
4-Chloro-3-methylphenol	µg/l	10	NONE	N/A	< 10		
4-Methylphenol	µg/l	10	NONE	N/A	< 10		

Total Phenols

Total Phenols (monohydric)	µg/l	130	ISO 17025	< 130	< 130		
Total Phenols (GC-MS)	µg/l	50	NONE	N/A	< 50		
Total Phenols (GC-MS)	µg/l	50	NONE	N/A	< 50		

Speciated PAHs

Naphthalene	µg/l	0.01	NONE	< 0.01	< 0.01		
Acenaphthylene	µg/l	0.01	NONE	< 0.01	< 0.01		
Acenaphthene	µg/l	0.01	NONE	< 0.01	< 0.01		
Fluorene	µg/l	0.01	NONE	< 0.01	< 0.01		
Phenanthrene	µg/l	0.01	NONE	< 0.01	< 0.01		
Anthracene	µg/l	0.01	NONE	< 0.01	< 0.01		
Fluoranthene	µg/l	0.01	NONE	< 0.01	< 0.01		
Pyrene	µg/l	0.01	NONE	< 0.01	< 0.01		
Benzo(a)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01		
Chrysene	µg/l	0.01	NONE	< 0.01	< 0.01		
Benzo(b)fluoranthene	µg/l	0.01	NONE	< 0.01	< 0.01		
Benzo(k)fluoranthene	µg/l	0.01	NONE	< 0.01	< 0.01		
Benzo(a)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01		
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01	< 0.01		
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01	< 0.01		
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01	< 0.01		

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2	< 0.2		
-------------------	------	-----	------	-------	-------	--	--

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	10	ISO 17025	73	67		
Boron (dissolved)	µg/l	10	NONE	2500	2100		
Cadmium (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5		
Chromium (dissolved)	µg/l	1	ISO 17025	< 1.0	1.3		
Copper (dissolved)	µg/l	3	ISO 17025	< 3.0	5.5		
Lead (dissolved)	µg/l	5	ISO 17025	9.5	< 5.0		
Mercury (dissolved)	µg/l	1.5	ISO 17025	< 1.5	< 1.5		
Nickel (dissolved)	µg/l	1	ISO 17025	5.7	4.7		
Selenium (dissolved)	µg/l	10	ISO 17025	< 10	< 10		
Zinc (dissolved)	µg/l	5	ISO 17025	16	< 5.0		



Analytical Report Number: 08-16130

Project / Site name: Pier Road, Little Hampton

Lab Sample Number	110845	110846					
Sample Reference	WSB	WSD					
Sample Number	None Supplied	None Supplied					
Depth	None Supplied	None Supplied					
Date Sampled	None Supplied	None Supplied					
Time Taken	None Supplied	None Supplied					
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status				

Monoaromatics

Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0		
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0		
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0		
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0		
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0		
MTBE (Methyl Tertiary Butyl Ether)	µg/l	10	ISO 17025	< 10	< 10		

Petroleum Hydrocarbons

TPH7 - Aliphatic >C5 - C6	µg/l	10	NONE	< 10	< 10		
TPH7 - Aliphatic >C6 - C8	µg/l	10	NONE	< 10	< 10		
TPH7 - Aliphatic >C8 - C10	µg/l	10	NONE	< 10	< 10		
TPH7 - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10		
TPH7 - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10		
TPH7 - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10		
TPH7 - Aliphatic >C21 - C34	µg/l	10	NONE	< 10	< 10		
TPH7 - Aliphatic (C5 - C34)	µg/l	10	NONE	< 10	< 10		

TPH7 - Aromatic >C5 - C7	µg/l	10	NONE	< 10	< 10		
TPH7 - Aromatic >C7 - C8	µg/l	10	NONE	< 10	< 10		
TPH7 - Aromatic >C8 - C10	µg/l	10	NONE	< 10	< 10		
TPH7 - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10		
TPH7 - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10		
TPH7 - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10		
TPH7 - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10		
TPH7 - Aromatic (C5 - C35)	µg/l	10	NONE	< 10	< 10		



Analytical Report Number: 08-16130

Project / Site name: Pler Road, Little Hampton

Lab Sample Number				110845	110846				
Sample Reference				WSB	WSD				
Sample Number				None Supplied	None Supplied				
Depth				None Supplied	None Supplied				
Date Sampled				None Supplied	None Supplied				
Time Taken				None Supplied	None Supplied				
Analytical Parameter (Water Analysis)									
	Units	Limit of detection	Accreditation Status						

VOCs

Chloromethane	µg/l	10	ISO 17025	N/A	< 10				
Chloroethane	µg/l	10	ISO 17025	N/A	< 10				
Bromomethane	µg/l	10	ISO 17025	N/A	< 10				
Vinyl Chloride	µg/l	10	ISO 17025	N/A	< 10				
Trichlorofluoromethane	µg/l	10	ISO 17025	N/A	< 10				
1,1-dichloroethene	µg/l	10	NONE	N/A	< 10				
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/l	10	ISO 17025	N/A	< 10				
Cis-1,2-dichloroethene	µg/l	1	NONE	N/A	< 1.0				
MTBE (Methyl Tertiary Butyl Ether)	µg/l	10	ISO 17025	N/A	< 10				
1,1-dichloroethane	µg/l	1	ISO 17025	N/A	< 1.0				
2,2-Dichloropropane	µg/l	1	ISO 17025	N/A	< 1.0				
Trichloromethane	µg/l	1	ISO 17025	N/A	< 1.0				
1,1,1-Trichloroethane	µg/l	1	ISO 17025	N/A	< 1.0				
1,2-dichloroethane	µg/l	1	ISO 17025	N/A	< 1.0				
1,1-Dichloropropene	µg/l	1	ISO 17025	N/A	< 1.0				
Trans-1,2-dichloroethene	µg/l	1	NONE	N/A	< 1.0				
Benzene	µg/l	1	ISO 17025	N/A	< 1.0				
Tetrachloromethane	µg/l	1	ISO 17025	N/A	< 1.0				
1,2-dichloropropane	µg/l	1	ISO 17025	N/A	< 1.0				
Trichloroethene	µg/l	1	NONE	N/A	< 1.0				
Dibromomethane	µg/l	1	ISO 17025	N/A	< 1.0				
Bromodichloromethane	µg/l	1	ISO 17025	N/A	< 1.0				
Cis-1,3-dichloropropene	µg/l	1	ISO 17025	N/A	< 1.0				
Trans-1,3-dichloropropene	µg/l	1	ISO 17025	N/A	< 1.0				
Toluene	µg/l	1	ISO 17025	N/A	< 1.0				
1,1,2-Trichloroethane	µg/l	1	ISO 17025	N/A	< 1.0				
1,3-Dichloropropane	µg/l	1	ISO 17025	N/A	< 1.0				
Dibromochloromethane	µg/l	1	ISO 17025	N/A	< 1.0				
Tetrachloroethene	µg/l	1	ISO 17025	N/A	< 1.0				
1,2-Dibromoethane	µg/l	1	ISO 17025	N/A	< 1.0				
Chlorobenzene	µg/l	1	ISO 17025	N/A	< 1.0				
1,1,1,2-Tetrachloroethane	µg/l	1	ISO 17025	N/A	< 1.0				
Ethylbenzene	µg/l	1	ISO 17025	N/A	< 1.0				
p & m-xylene	µg/l	1	ISO 17025	N/A	< 1.0				
Styrene	µg/l	1	ISO 17025	N/A	< 1.0				
Tri bromomethane	µg/l	1	ISO 17025	N/A	< 1.0				
o-xylene	µg/l	1	NONE	N/A	< 1.0				
Isopropylbenzene	µg/l	1	ISO 17025	N/A	< 1.0				
Bromobenzene	µg/l	1	ISO 17025	N/A	< 1.0				
N-Propylbenzene	µg/l	1	ISO 17025	N/A	< 1.0				
2-Chlorotoluene	µg/l	1	ISO 17025	N/A	< 1.0				
4-Chlorotoluene	µg/l	1	ISO 17025	N/A	< 1.0				
1,3,5-Trimethylbenzene	µg/l	1	ISO 17025	N/A	< 1.0				
Tert-Butylbenzene	µg/l	1	ISO 17025	N/A	< 1.0				
1,2,4-Trimethylbenzene	µg/l	1	ISO 17025	N/A	< 1.0				
Sec-Butylbenzene	µg/l	1	ISO 17025	N/A	< 1.0				
1,3-dichlorobenzene	µg/l	1	ISO 17025	N/A	< 1.0				
P-Isopropyltoluene	µg/l	1	ISO 17025	N/A	< 1.0				
1,2-dichlorobenzene	µg/l	1	ISO 17025	N/A	< 1.0				
1,4-dichlorobenzene	µg/l	1	ISO 17025	N/A	< 1.0				
Butylbenzene	µg/l	1	ISO 17025	N/A	< 1.0				
1,2-Dibromo-3-chloropropane	µg/l	1	ISO 17025	N/A	< 1.0				
1,2,4-Trichlorobenzene	µg/l	1	ISO 17025	N/A	< 1.0				
Hexachlorobutadiene	µg/l	10	ISO 17025	N/A	< 10				
1,2,3-Trichlorobenzene	µg/l	10	ISO 17025	N/A	< 10				



Analytical Report Number: 08-16130

Project / Site name: Pier Road, Little Hampton

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Boron in water	Determination of boron by acidification followed by ICP-OES.	In-house method based on MEWAM	L039-UK	W	NONE
BTEX and MTBE in water	Determination of BTEX and MTBE in water by headspace GC-MS.	In-house method based on USEPA8263	L017-UK	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES.	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil™	L039-UK	W	ISO 17025
Monohydric phenols in water	Determination of phenols in water by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L006-UK	W	ISO 17025
pH in water	Determination of pH in water by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests™	L005-UK	W	ISO 17025
Phenols, speciated, in water, by GC-MS	Determination of speciated phenols in water by extraction in hexane followed by GC-MS.	In-house method based on USEPA 8270	L061-UK	W	NONE
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L009-UK	W	NONE
Sulphate in water	Determination of sulphate in water by acidification followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests™	L039-UK	W	NONE
Sulphide in water	Determination of sulphide in water by ion selective electrode.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L010-UK	W	NONE
Total cyanide in water	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L007-UK	W	ISO 17025
TPH7 (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS.	In-house method	L016-UK	W	NONE
Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS.	In-house method based on USEPA8260	L036-UK	W	ISO 17025

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.