2139

Derwentside Environmental Testing Services

Certificate of Analysis

Certificate Number : 06-06147_M01

Client Reference:		**Date of issue:**	17/07/2006
Our Reference:	06-06147	**Report no:**	06-06147_M01
Clients Name:	Sirius Geotechnical & Environmental		
Clients Address:	Suite 3 Bowcliffe Grange Bowcliffe Hall Estate Bramham LS23 6LP		

Contract Title:	Barough Green
Description:	3 water samples
Date Received:	11/07/2006
Date Commenced:	11/07/2006
Date Completed:	17/07/2006

RECEIVED
19 JUL 2006
RHBMB

Notes:

Test procedures are identified by prefix DETSn (details available upon request)
Observations and Interpretations are outside the UKAS Accreditation Scope
* Denotes test not included in laboratory scope of accreditation
$ Denotes test carried out by approved subcontractor
I/S Denotes insufficient sample to carry out test
N/S Denotes that the sample is not suitable for testing
Samples will be disposed of 1 month after the date of issue of this test Certificate.

Approved By:

R Bennett	R Brown	M Hopgood
Director	Business Manager	Technical Manager

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Derwentside Environmental Testing Services Limited.
Unit 2a/2b, Park Road Industrial Estate South, Consett, Co Durham. DH8 5PY
Tel: 01207 582333 • Fax: 01207 582444 • Email: info@dets.co.uk • www.dets.co.uk
Registered in England No. 370 5645 • VAT No. 708 978 678

Client Reference Barough Green

Laboratory Reference 06-06147

Summary of Chemical Analysis

Borehole or Trial Pit	Depth	Sample No	Sample Type	Lab Ref No	DETS 010 Arsenic ug/l	DETS 042 Cadmium Dissolved ug/l	DETS 042 Chromium Dissolved ug/l	DETS 042 Copper Dissolved ug/l	DETS 042 Lead Dissolved ug/l	DETS 078* Mercury ug/l	DETS 042 Nickel Dissolved ug/l	DETS 012 Selenium ug/l	DETS 042 Zinc Dissolved ug/l	DETS 055 Sulphate mg/l
BH6			Water	40701	< 1	< 2	< 10	< 2	< 5	< 0.2	< 10	< 3	510	19
BH10			Water	40702	< 1	< 2	< 10	< 2	< 5	< 0.2	< 10	< 3	260	17
BH5			Water	40703	< 1	< 2	< 10	< 2	< 5	< 0.2	21	< 3	190	18

Client Reference

Laboratory Reference 06-06147

Barough Green

Summary of Chemical Analysis

Borehole or Trial Pit	Depth	Sample No	Sample Type	Lab Ref No	DETS 009 Conductivity uS/cm	DETS 042 Hardness mg/l	DETS 019 Ammoniacal Nitrogen as N mg/l	DETS 008 pH	DETS 050* Acenaphthlene ug/l	DETS 050* Acenapthylene ug/l	DETS 050* Anthracene ug/l	DETS 050* Benzo(a)anthracene ug/l	DETS 050* Benzo(a)pyrene ug/l	DETS 050* Benzo(b)fluoranthene ug/l
BH6			Water	40701	670	410	0.82	6.2	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
BH10			Water	40702	1500	600	0.79	6.7	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
BH5			Water	40703	1400	430	0.12	5.7	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Client Reference

Laboratory Reference 06-06147

Barough Green

Summary of Chemical Analysis

Borehole or Trial Pit	Depth	Sample No	Sample Type	Lab Ref No	DETS 050* Benzo(k)fluoranthene ug/l	DETS 050* Benzo(g,h,i)perylene ug/l	DETS 050* Chrysene ug/l	DETS 050* Dibenzo(a,h)anthracene ug/l	DETS 050* Flouranthene ug/l	DETS 050* Fluorene ug/l	DETS 050* Indeno(1,2,3-c,d)pyrene ug/l	DETS 050* Napthalene ug/l	DETS 050* Phenanthrene ug/l	DETS 050* Pyrene ug/l
BH6			Water	40701	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
BH10			Water	40702	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
BH5			Water	40703	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

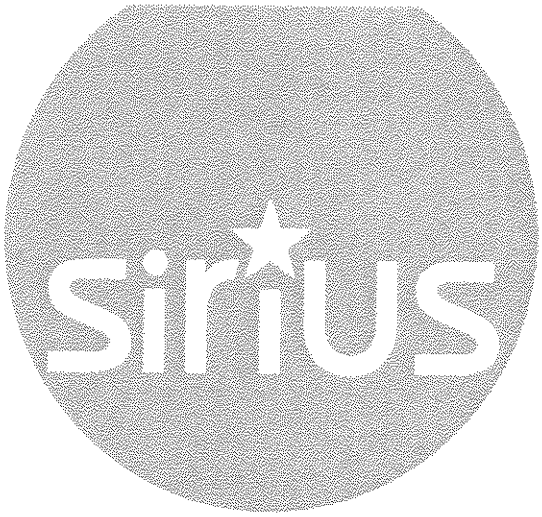
Client Reference

Laboratory Reference 06-06147

Barough Green

Summary of Chemical Analysis

Borehole or Trial Pit	Depth	Sample No	Sample Type	Lab Ref No	DETS 050* PAH ug/l	DETS 054* Phenol ug/l
BH6			Water	40701	< 0.20	< 0.50
BH10			Water	40702	< 0.20	< 0.50
BH5			Water	40703	< 0.20	< 0.50



APPENDIX F
GAS / GROUNDWATER MONITORING RESULTS

MONITORING RESULTS

Client:	Hallam Land Management Ltd		
Site:	Barugh Green, Barnsley	Job No:	C1277
Date:	30/06/06 (Visit 1)	Sheet:	**1 of 1**

Ambient concentration (% Volume): CH_4 ND CO_2 ND
O_2 21.0

Monitoring Point		Gas Concentration							Gas Emission Rate	
		Highest			Steady			(Lowest)		
Ref	GWL	CH_4		CO_2	CH_4		CO_2	O_2	Litre / Hour	
	(m) bgl	% lel	% v/v	(%)	% lel	% v/v	(%)	(%)	I	C
R5	8.60	ND	ND	0.9	ND	ND	0.9	19.3	ND	ND
R6	0.93	ND	ND	0.4	ND	ND	0.4	20.5	0.8	ND
R10	0.79	ND	ND	0.2	ND	ND	0.2	20.5	ND	ND
R11	0.92	ND	ND	ND	ND	ND	ND	20.7	-2.2	ND
R13	3.77	ND	ND	2.4	ND	ND	2.4	19.3	ND	ND
WS5	Dry	ND	ND	1.3	ND	ND	1.3	19.6	ND	ND
WS6	Dry	ND	ND	0.1	ND	ND	ND	20.9	ND	ND
WS7	Dry	ND	ND	2.6	ND	ND	2.6	17.3	ND	ND

Barometric Pressure:	**1013**	**Monitoring Equipment:**	**LMSx Multigas Analyser**
Weather:	**Cloudy, sunny spells**	**Date of Last Calibration:**	**05/06/06**
Ground:	**Grass**	**Operator**	**MW**

Key	Remarks
ND - None Detected **NR - Not Recorded** **I – Instantaneous Flow** **C – Constant Flow**	**PID Readings: R5 ND, R6 1.0ppm, R10 0.5ppm, R11 ND, R13 ND, WS5 ND, WS6 ND, WS7 0.7ppm.**

		Checked	**MB**	**Approved:**	**RIH**

MONITORING RESULTS

Client: Hallam Land Management Ltd
Site: Barugh Green, Barnsley
Date: 07/07/06 (Visit 2)

Job No: C1277
Sheet: **1 of 1**

Ambient concentration (% Volume): CH_4 ND CO_2 ND
O_2 21.0

Monitoring Point		Gas Concentration							Gas Emission Rate	
		Highest			Steady			(Lowest)		
Ref	GWL	CH_4		CO_2	CH_4		CO_2	O_2	Litre / Hour	
	(m) bgl	% lel	% v/v	(%)	% lel	% v/v	(%)	(%)	I	C
R5	8.68	ND	ND	0.8	ND	ND	0.8	19.3	ND	ND
R6	1.24	ND	ND	0.4	ND	ND	0.4	20.4	ND	ND
R10	1.38	ND	ND	0.2	ND	ND	0.1	20.6	ND	ND
R11	0.93	ND	ND	0.6	ND	ND	0.6	20.4	-0.7	ND
R13	3.79	ND	ND	2.3	ND	ND	2.3	19.2	ND	ND
WS5	Dry	ND	ND	3.5	ND	ND	3.5	16.4	-0.7	ND
WS6	Dry	ND	ND	1.9	ND	ND	1.9	17.9	ND	ND
WS7	Dry	ND	ND	2.7	ND	ND	2.7	15.2	ND	ND

Barometric Pressure: 1006
Monitoring Equipment: LMSx Multigas Analyser
Weather: Cloudy, sunny spells
Date of Last Calibration: 04/07/06
Ground: Grass
Operator MW

Key	Remarks
ND - None Detected NR - Not Recorded I – Instantaneous Flow C – Constant Flow	

Checked:	MB	Approved:	RIH

MONITORING RESULTS

Client: Hallam Land Management Ltd
Site: Barugh Green, Barnsley
Date: 13/07/06 (Visit 3)

Job No: C1277
Sheet: **1 of 1**

Ambient concentration (% Volume): **CH_4** ND **CO_2** ND **O_2** 21.0

Monitoring Point		Gas Concentration							Gas Emission Rate	
		Highest			Steady			(Lowest)		
Ref	GWL	CH_4		CO_2	CH_4		CO_2	O_2	Litre / Hour	
	(m) bgl	% lel	% v/v	(%)	% lel	% v/v	(%)	(%)	I	C
R5	8.70	ND	ND	0.8	ND	ND	0.8	19.7	ND	ND
R6	1.15	ND	ND	0.1	ND	ND	0.1	21.0	ND	ND
R10	1.46	ND	ND	ND	ND	ND	ND	20.9	ND	ND
R11	1.12	ND	ND	ND	ND	ND	ND	20.9	-0.1	ND
R13	3.80	ND	ND	ND	ND	ND	ND	21.2	ND	ND
WS5	Dry	ND	ND	3.3	ND	ND	3.3	17.5	ND	ND
WS6	Dry	ND	ND	3.6	ND	ND	3.6	15.9	ND	ND
WS7	Dry	ND	ND	2.1	ND	ND	2.1	18.1	ND	ND

Barometric Pressure: 1019 **Monitoring Equipment:** LMSx Multigas Analyser

Weather: Sunny **Date of Last Calibration:** 04/07/06

Ground: Grass **Operator** MW

Key	Remarks
ND - None Detected NR - Not Recorded I – Instantaneous Flow C – Constant Flow	PID Readings: R5 ND, R6 ND, R10 ND, R11 ND, R13 ND, WS5 31.7ppm, WS6 19.4ppm, WS7 ND.

Checked:	MB	Approved:	RIH

MONITORING RESULTS

Client: Hallam Land Management Ltd
Site: Barugh Green, Barnsley
Date: 19/07/06 (Visit 4)

Job No: C1277
Sheet: **1 of 1**

Ambient concentration (% Volume): CH_4 ND O_2 21.0 CO_2 ND

Monitoring Point		Gas Concentration							Gas Emission Rate	
		Highest			Steady			(Lowest)		
Ref	GWL	CH_4		CO_2	CH_4		CO_2	O_2	Litre / Hour	
	(m) bgl	% lel	% v/v	(%)	% lel	% v/v	(%)	(%)	I	C
R5	8.70	ND	ND	0.8	ND	ND	0.8	19.8	ND	ND
R6	1.18	ND	ND	ND	ND	ND	ND	21.1	ND	ND
R10	1.38	ND	ND	0.3	ND	ND	0.3	20.7	ND	ND
R11	1.38	ND	ND	ND	ND	ND	ND	21.1	ND	ND
R13	3.75	ND	ND	1.5	ND	ND	1.5	20.3	ND	ND
WS5	Dry	ND	ND	2.4	ND	ND	2.4	17.2	ND	ND
WS6	Dry	ND	ND	2.8	ND	ND	2.8	16.8	ND	ND
WS7	Dry	ND	ND	3.0	ND	ND	3.0	16.0	ND	ND

Barometric Pressure: 1008 **Monitoring Equipment:** LMSx Multigas Analyser

Weather: Sunny **Date of Last Calibration:** 04/07/06

Ground: Grass **Operator** MW

Key	Remarks
ND - None Detected NR - Not Recorded I – Instantaneous Flow C – Constant Flow	PID Readings: R5 ND, R6 ND, R10 8.2ppm, R11 ND, R13 ND, WS5 ND, WS6 ND, WS7 ND.

Checked:	MB	Approved:	RIH

APPENDIX F

SIRIUS GENERIC ASSESSMENT CRITERIA

SIRIUS GENERIC ASSESSMENT CRITERIA

LEGISLATIVE AND RISK ASSESSMENT FRAMEWORK

Under the Town and Country Planning Legislation, in order that a site may be redeveloped, the site needs to be suitable for its intended use. Part IIA of the Environmental Protection Act 1990 (EPA) provides a legal framework for identifying and dealing with contaminated land.

The Contaminated Land (England) Regulations 2000 were issued in accordance with the provision with the EPA. The regulations define Contaminated Land as land "in such condition, by reason of substances in, on, or under the land, that: significant harm is being caused, or pollution of controlled waters is being or is likely to be caused".

In the UK the determination of whether land can be classified as contaminated land and whether land is suitable for its intended use are both based upon risk assessment. The methodology for undertaking such risk assessments has been published by DEFRA and the Environment Agency. This is based upon the concept of potential source-pathway-receptor relationships to determine whether there are pollutant linkages operating in a particular end use.

The framework for conducting site investigations, risk assessments and undertaking any necessary remedial works is presented in the Environment Agency report CLR11 "Model Procedures for the Management of Contaminated Land". This presents a tiered approach to risk assessment: analysis of potential pollutant linkages via a Conceptual Site Model; comparison of contaminant concentrations with Soil Guideline Values or other Generic Assessment Criteria (Generic Quantitative Risk Assessment; GQRA); and, if required, a Detailed Quantitative Risk Assessment (DQRA) based on site-specific conditions.

Human Health

Where Soil Guideline Values (SGV) have been published by the Environment Agency, these have been used by Sirius as the basis for human health Generic Assessment Criteria (GAC).

For metals and metalloids, SGVs have been applied directly for the "Residential With Plant Uptake" and "Commercial" land uses as the SGVs are not sensitive to soil type nor soil organic matter content. For the "Residential Without Plant Uptake" land use, GAC values have been derived by Sirius using CLEA versions 1.04 and 1.06, the contaminant parameter values presented in the SGV reports and the relevant guidance presented in the Environment Agency Science Report SC050021 series. For organics, GAC values have been derived using the same approach for a sandy soil type at a range of SOM contents. The sandy soil type is conservative for the majority of soils (including made ground) encountered on historically contaminated sites.

In the absence of published SGVs, Sirius has normally derived GAC values using CLEA versions 1.04 and 1.06 and the authoritative parameter data presented in Nathanail *et al*. (2009) "The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment", 2nd edition, Land Quality Press, Nottingham.

Where neither SGVs nor authoritative third party reports were available, GAC values were derived by Sirius using the CLEA version 1.04 and 1.06 models in accordance with the guidance published by the Environment Agency in the SC050021 report series. Full details of the derivation of these GAC values can be provided upon request.

Controlled Waters

The Environment Agency's "Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources", R&D Publication 20, provides a framework for assessing the potential for pollution of controlled waters and for deriving remedial target concentrations in soil and groundwater. In relation to the standards for controlled waters, there are currently no generic groundwater nor surface water standards that are applicable to all sites. However, the UK Drinking Water Standards and the Environment Agency's national Environmental Quality Standards (EQS) are considered appropriate assessment criteria for many cases.

Soil Leachability

A screening assessment has been carried out using leachability data obtained from tests performed on soils at the site, to assess the potential risks to local controlled waters, including groundwater. The Environment Agency's Remedial Targets

Methodology recommends the use of the BS EN 12475 leachate methods and this is adopted by Sirius.

The results of the leachate analysis have been compared to relevant criteria derived from Environment Agency (2002) “Technical Advice to Third Parties on Pollution of Controlled Waters for Part IIA, EPA1990” and The Water Supply (Water Quality) Regulations 1989, as amended (2001 and 2007).

Buried Concrete

A generic assessment is made in relation to the potential impact on buried concrete by reference to BRE Special Digest No. 1; 3rd Edition (2005) “Concrete in Aggressive Ground”.

SIRIUS HUMAN HEALTH GENERIC ASSESSMENT CRITERIA – SOILS

Parameter	Residential (mg/kg, unless otherwise stated)						Commercial / Industrial (mg/kg, unless otherwise stated)			Source
	With Plant Uptake			Without Plant Uptake						
	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	
Metals/Metalloids										
Arsenic (inorganic)	32			35			640			Arsenic SGV [a]
Boron	290			10300			190000			Sirius/LQM/CIEH [b]
Cadmium [c]	10			18			230			Cadmium SGV
Chromium (III) [d]	3000			3000			30000			Sirius/LQM/CIEH
Copper	200 [e]			6200			72000			See note [e]
Lead	450			450			750			SGV10 [f]
Mercury (inorganic) [g]	170			240			3600			Mercury SGV
Nickel	130			130			1800			Nickel SGV
Selenium	350			600			13000			Selenium SGV
Vanadium	74			190			3200			Sirius/LQM/CIEH
Zinc	450 [e]			40000			600000			See note [e]
Other Inorganics										
pH	<5			<5			<5			
Total Sulphate	2400			2400			2400			BRE (2005) [h]
Water-Soluble Sulphate	0.5 g/l			0.5 g/l			0.5 g/l			BRE (2005)
Free Cyanide	34			34			1400			Acute risk calc. [i]
Organics										
PAHs										
Acenaphthene	200	460	840	1400	2400	3200	77000	93000	100000	Sirius/LQM/CIEH
Acenaphthylene	160	380	710	1400	2400	3200	77000	93000	100000	Sirius/LQM/CIEH
Anthracene	2200	4900	8200	19000	22000	23000	520000	540000	540000	Sirius/LQM/CIEH
Benzo(a)anthracene	3.3	4.9	5.8	4.1	5.5	6.2	91	96	98	Sirius/LQM/CIEH
Benzo(a)pyrene	0.83	0.94	1.0	1.0	1.0	1.0	14	14	15	Sirius/LQM/CIEH
Benzo(b)fluoranthene	5.6	6.5	7.0	7.0	7.3	7.4	100	100	100	Sirius/LQM/CIEH
Benzo(g,h,i)perylene	44	46	47	47	47	48	660	660	660	Sirius/LQM/CIEH
Benzo(k)fluoranthene	8.5	9.6	10	10	10	10	140	140	140	Sirius/LQM/CIEH

Parameter	Residential (mg/kg, unless otherwise stated)						Commercial / Industrial (mg/kg, unless otherwise stated)			Source
	With Plant Uptake			Without Plant Uptake						
	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	
Chrysene	6.1	8.1	9.1	9.0	9.8	10	140	140	140	Sirius/LQM/CIEH
Dibenz(a,h)anthracene	0.77	0.86	0.90	0.87	0.91	0.93	13	13	13	Sirius/LQM/CIEH
Fluoranthene	260	460	630	980	1000	1000	23000	23000	23000	Sirius/LQM/CIEH
Fluorene	160	370	660	1500	2200	2600	61000	67000	70000	Sirius/LQM/CIEH
Indeno(1,2,3-cd)pyrene	3.2	3.9	4.1	4.2	4.4	4.4	61	62	62	Sirius/LQM/CIEH
Naphthalene	0.68	1.6	3.2	0.7	1.7	3.3	110	270	540	Sirius/LQM/CIEH
Phenanthrene	92	200	330	820	920	960	22000	22000	23000	Sirius/LQM/CIEH
Pyrene	560	1000	1500	2300	2400	2400	54000	54000	55000	Sirius/LQM/CIEH
BTEX and related										
Benzene	0.054	0.11	0.20	0.11	0.21	0.38	16	30	52	Sirius/CLEA [j]
Toluene	92	210	410	260	570	1070	840	1900	3600	Sirius/CLEA
Ethylbenzene	42	100	200	70	160	320	510	1200	2400	Sirius/CLEA
Xylenes (total) [k]	20	47	92	22	52	100	470	1100	2200	Sirius/CLEA
1,2,4-trimethylbenzene	0.16	0.39	0.76	0.17	0.41	0.81	23	55	110	Sirius/CLEA/EIC [l]
Iso-propylbenzene	4.7	11	23	4.8	12	23	750	1800	3600	Sirius/CLEA/EIC
Propylbenzene	15	37	54	16	40	79	2200	5400	10400	Sirius/CLEA/EIC
Styrene	6.1	14	28	15	34	65	2000	4100	6900	Sirius/CLEA/EIC
TPH										
Aliphatic EC 5-6	17	28	47	29	53	93	2500	4300	7200	Sirius/LQM/CIEH
Aliphatic EC >6-8	36	77	150	70	160	300	5500	12000	22000	Sirius/LQM/CIEH
Aliphatic EC >8-10	8.8	22	42	18	44	88	1300	3200	6300	Sirius/LQM/CIEH
Aliphatic EC >10-12	43	110	210	90	220	440	6400	15000	29000	Sirius/LQM/CIEH
Aliphatic EC >12-16	350	850	1600	720	1600	2700	44000	73000	85000	Sirius/LQM/CIEH
Aliphatic EC >16-35	29000	48000	62000	44000	64000	74000	No GAC [m]	No GAC	No GAC	Sirius/LQM/CIEH
Aliphatic EC >35-44	29000	48000	62000	44000	64000	74000	No GAC	No GAC	No GAC	Sirius/LQM/CIEH
Aromatic EC >5-7	0.054	0.11	0.20	0.11	0.21	0.38	16	30	52	Set as benzene
Aromatic EC >7-8	92	210	410	610	1290	2300	35000	71000	120000	Sirius/LQM/CIEH

Parameter	Residential (mg/kg, unless otherwise stated)						Commercial / Industrial (mg/kg, unless otherwise stated)			Source
	With Plant Uptake			Without Plant Uptake						
	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	
Aromatic EC >8-10	14	34	68	32	78	150	2300	5400	10000	Sirius/LQM/CIEH
Aromatic EC >10-12	54	130	250	170	400	730	11000	23000	30000	Sirius/LQM/CIEH
Aromatic EC >12-16	140	300	520	1200	1600	1700	35000	37000	38000	Sirius/LQM/CIEH
Aromatic EC >16-21	250	480	710	1300	1300	1300	28000	28000	28000	Sirius/LQM/CIEH
Aromatic EC >21-35	890	1100	1200	1300	1300	1300	28000	28000	28000	Sirius/LQM/CIEH
Aromatic EC >35-44	890	1100	1200	1300	1300	1300	28000	28000	28000	Sirius/LQM/CIEH
Chlorinated Organics										
Chlorobenzene	0.14	0.31	0.61	0.14	0.31	0.61	33	75	150	Sirius/LQM/CIEH
Dichloromethane (DCM)	0.41	0.7	1.0	0.83	1.2	1.7	140	200	290	Sirius/CLEA/EIC
1,1-dichloroethane (DCA)	1.0	1.7	2.8	1.0	1.7	2.9	150	250	420	Sirius/CLEA/EIC
1,2-dichloroethane (DCA)	0.0022	0.0035	0.0055	0.0024	0.0037	0.0059	0.36	0.55	0.86	Sirius/LQM/CIEH
1,1-dichloroethene (DCE)	0.10	0.18	0.32	0.10	0.18	0.32	15	28	48	Sirius/CLEA/EIC
cis-1,2-dichloroethene (DCE)	0.05	0.08	0.14	0.05	0.09	0.19	7.7	14	24	Sirius/CLEA/EIC
trans-1,2-dichloroethene (DCE)	0.08	0.15	0.27	0.08	0.15	0.27	12	23	41	Sirius/CLEA/EIC
Pentachlorophenol	0.54	1.3	2.5	23	31	35	1200	1300	1400	Sirius/LQM/CIEH
1,1,1,2-tetrachloroethane	0.41	0.96	1.9	0.44	1.0	2	63	150	280	Sirius/LQM/CIEH
1,1,2,2-tetrachloroethane	0.78	1.7	3.2	1.1	2.4	4.4	160	330	600	Sirius/LQM/CIEH
Tetrachloroethene (PCE)	0.41	0.94	1.8	0.43	0.96	1.9	72	163	310	Sirius/LQM/CIEH
Tetrachloromethane	0.0078	0.017	0.033	0.0078	0.017	0.033	1.7	3.8	7.3	Sirius/LQM/CIEH
1,1,1-trichloroethane (TCA)	2.6	5.5	10	2.7	5.5	10	390	820	1500	Sirius/LQM/CIEH
1,1,2-trichloroethane (TCA)	0.30	0.64	1.2	0.36	0.76	1.4	51	110	200	Sirius/CLEA/EIC
Trichloroethene (TCE)	0.045	0.1	0.18	0.046	0.098	0.19	6.6	14	27	Sirius/LQM/CIEH
Trichloromethane	0.34	0.63	1.1	0.37	0.68	1.2	57	110	190	Sirius/LQM/CIEH
Vinyl Chloride	0.00024	0.00032	0.00045	0.00026	0.00034	0.00047	0.04	0.052	0.072	Sirius/LQM/CIEH
Miscellaneous Organics										
Carbon disulphide	0.047	0.094	0.17	0.047	0.094	0.17	7.1	14	27	Sirius/LQM/CIEH
Di-(2-ethylhexyl)-phthalate	280	610	1000	2700	2800	2800	85000	86000	86000	Sirius/CLEA/EIC

Parameter	Residential (mg/kg, unless otherwise stated)						Commercial / Industrial (mg/kg, unless otherwise stated)			Source
	With Plant Uptake			Without Plant Uptake						
	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	1% SOM	2.5% SOM	5% SOM	
MTBE	23	40	70	28	48	81	4000	6900	12000	Sirius/CLEA/EIC
Phenol	180	290	392	310	420	510	3200 [n]			Phenol SGV
Methylphenols (cresols), total [o]	77	170	330	3900	5600	6800	160000	160000	160000	Sirius/CLEA/EIC
2,4-dimethylphenol (m-xylenol)	18	41	78	140	300	500	14000	22000	27000	Sirius/CLEA/EIC

All values are rounded to 1 or 2 significant figures.

Notes:

[a] SGV reports comprise the SGV, TOX and supporting contaminant-specific reports published by the Environment Agency as part of the Science Report SC050021 series. SGV values are applied directly as the criteria are not sensitive to soil type nor SOM content. For the “Residential Without Plant Uptake” land use, GAC values have been derived by Sirius using CLEA version 1.06 and the published model parameter and chemical property data.

[b] Calculated by Sirius for sandy soil in CLEA version 1.06 using the toxicological, model parameter and chemical property data presented in Nathanail et al. (2009) “The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment”, 2nd edition, Land Quality Press, Nottingham.

[c] The SGV and GAC values for cadmium are based on data for soils having a pH value in the range 6-8. Caution should be applied in applying them at pH values outside this range, especially at pH values <5.

[d] GAC for Cr (III) also applied for total chromium, as hexavalent chromium does not persist to a significant extent in soils under normal conditions (further information can be provided upon request). A SSAC will be required for sites where historical information indicate that Cr (VI) was handled or generated on site, when analytical data demonstrate Cr (VI) is present or when soil conditions indicate that Cr (VI) will persist in situ.

[e] For the 'Residential with Plant Uptake' end-use, the GAC values for Cu and Zn are based on potential phytotoxic effects and have been set at the maximum allowable concentrations for sewage sludge-amended soils presented in the "Sludge (Use in Agriculture) Regulations" (SI 1263/1989). The equivalent GAC values for human health protection in this land-use are: Cu, 2300 mg/kg; Zn, 3700 mg/kg (LQM/CIEH values - Nathanail et al., 2009). The GAC values for the other land uses presented are human health-based criteria presented in Nathanail et al. (2009). In cases where soils in those land uses may be used for vegetation purposes, then the 'Residential with Plant Uptake' GAC values may be applied. However, for all cases where the GAC is set on the basis of potential phytotoxicity, alternative criteria will be derived where elevated natural background soil concentrations of these metals have been demonstrated.

[f] SGV10 has been retained as the most appropriate source of a GAC for lead, given the specific blood lead calculation methods and input data applied.

[g] The SGV for mercury is based on inorganic mercury which represents the most common form encountered within the environment. This is considered appropriate for most sites as: “…the SGV for inorganic mercury can normally be compared with chemical analysis for total mercury content because the equilibrium concentrations of elemental and methylmercury compounds are likely to be very low” (SC050021/Mercury SGV). Analysis and specific assessment for elemental or methylated forms of mercury will need to be considered if historical land use or site-specific factors indicate that these forms of mercury are likely to be present.

[h] BRE (2005) Special Digest 1, 3rd Edition “Concrete in aggressive ground”. Sulphate is not considered to pose a potential risk to human health under normal circumstances – this GAC applies to construction cases only and is set at the upper limit for DS-1 Design Sulphate Class concrete.

[i] GAC calculated for acute risk. Further information can be provided upon request.

[j] Calculated by Sirius for all land uses using CLEA version 1.06 and the toxicological, model parameter and chemical property data published by the Environment Agency (Science Report SC050021 Series).

[k] For screening purposes, a single GAC has been set for total xylene. This is the lowest of the values calculated for the three individual xylene isomers.

[l] Calculated by Sirius for all land uses using CLEA version 1.06 and the toxicological, model parameter and chemical property data published by CL:AIRE in association with the AGS and EIC (December 2009).

[m] “No GAC” indicates that no value has been specified for this land use as the HCV cannot be exceeded at achievable soil concentrations.

[n] The GAC for Commercial/Industrial land use is based on the threshold protective of direct skin contact with phenol (See SR050021/Phenol SGV).

[o] For screening purposes, a single GAC has been set for total methylphenol. This is the lowest of the values calculated for the three individual methylphenol isomers.

[p] The Hazardous Waste (England and Wales) Regulations 2005. TOC content in itself does not represent a potential risk to human health. This GAC is provided for indicative assessment of disposal options, in the case that off-site landfill of soil is is undertaken. This GAC is specified at the ‘Inert’ waste threshold and should be considered as for information purposes only.

[q] ICRCL (1986) Guidance Note 61/84, 2nd Edition, Notes on the Fire Hazards of Contaminated Land. Calorific value is not an indication of chronic human health risk but may be useful in assessment of the potential fire risk posed by made ground or natural soils containing elevated concentrations of potentially combustible organic matter.

.

CONTROLLED WATERS GAC (SCREENING) VALUES FOR FRESH WATER

Parameter	Generic Assessment Criterion (µg/l unless otherwise stated)
Metals/Metalloids	
Arsenic	50 [(a)] 10 [(b)]
Cadmium	5 [(a, b)]
Chromium^{+}	5-250 [(a)] 50 [(b)]
Lead^{+}	4-250 [(a)] 25 [(b)]
Mercury	1 [(a, b)]
Boron	2,000 [(a)] 1,000 [(b)]
Selenium	10 [(b)]
Copper^{+}	1-28 [(a)] 2,000 [(b)]
Nickel^{+}	50-200 [(a)] 20 [(b)]
Zinc^{+}	8-500 [(a)] 5,000 [(b)]
Inorganics	
Sulphate	400 mg/l [(a)] 250 mg/l [(b)]
Ammonia (NH_3 as N) Ammonium (as NH_4^{+})	15 [(a)] 500 [(b)]
Organics	
Total TPH	10 [(b)]
Naphthalene	10 [(a)]
Benzo(a)pyrene	0.01 [(b)]
Benzo(b)fluoranthene*	0.1 [(b)]
Benzo(k)fluoranthene*	0.1 [(b)]
Benzo(ghi)perylene*	0.1 [(b)]
Indeno(1,2,3-cd)pyrene*	0.1 [(b)]
Sum PAH-4*	0.1 [(b)]
Benzene	30 [(a)] 1 [(b)]
Toluene	50 [(a)]
Ethylbenzene	20 [(c)] 300 [(d)]
Xylenes (sum)	30 [(a)]
MTBE	2,600 [(f)] 200 [(e)]
Phenol	30 [(a)] 0.5 [(b)]
Others	
Electrical Conductivity	2,500 µS/cm @ 20ºC [(b)]
pH	6-9 pH units [(g)]

(a) Environment Agency (2002) Environment Agency technical advice to third parties on pollution of controlled waters for Part IIA of the EPA 1990. Freshwater Environmental Quality Standards (EQS).

(b) The Water Supply (Water Quality) (Amendment) Regulations 2001 and 2007.

(c) SEPA (2004) Environmental Quality Standards, Issue No 1, October 2004

(d) World Health Organisation (WHO) Guidelines for Drinking Water Quality, 1984. Health value.

(e) Based on a 5-fold dilution of the USEPA (1997) Drinking Water Advisory on MTBE value for taint, EPA-822-F-97-009. Full justification can be provided on request.

(f) EU Risk Assessment Report (2002) MTBE, 3rd Priority List, Volume 19. PNEC value for fresh and sea water life.

(g) The Surface Waters (Fishlife) (Classification) Regulations 1997.

\+ Hardness related (Lowest values are applied in the absence of site-specific hardness data).

* The sum of all 4 individual PAHs marked with an asterisk (*)

CONTROLLED WATERS GAC (SCREENING) VALUES FOR SALT WATER

Parameter	Generic Assessment Criterion (µg/l unless otherwise stated)
Metals/Metalloids	
Arsenic	25 [(a)]
Cadmium	2.5 [(a)]
Chromium	15 [(a)]
Lead	25 [(a)]
Mercury	0.3 [(a)]
Boron	7,000 [(a)]
Selenium	10 [(b)]
Copper	5 [(a)]
Nickel	30 [(a)]
Zinc	40 [(a)]
Inorganics	
Sulphate	250 mg/l [(a, b)]
Ammonia (NH_3 as N)	21 [(a)]
Organics	
Total TPH	10 [(b)]
Naphthalene	10 [(a)]
Benzo(a)pyrene	0.01 [(b)]
Benzo(b)fluoranthene*	0.1 [(b)]
Benzo(k)fluoranthene*	0.1 [(b)]
Benzo(ghi)perylene*	0.1 [(b)]
Indeno(1,2,3-cd)pyrene*	0.1 [(b)]
Sum PAH-4*	0.1 [(b)]
Benzene	30 [(a)]
Toluene	40 [(a)]
Ethylbenzene	20 [(c)]
Xylenes (sum)	30 [(a)]
MTBE	2,600 [(d)]
Phenol	30 [(a)]
Others	
Electrical Conductivity	2,500 µS/cm @ 20ºC [(b)]
pH	6-9 pH units [(e)]

(a) Environment Agency (2002) Environment Agency technical advice to third parties on pollution of controlled waters for Part IIA of the EPA 1990. Saltwater EQS.

(b) The Water Supply (Water Quality) Regulations 1989 and (Amendment) 2001 and 2007.

(c) SEPA (2004) Environmental Quality Standards, Issue No 1, October 2004.

(d) EU Risk Assessment Report (2002) MTBE, 3rd Priority List, Volume 19. PNEC value for fresh and sea water life.

(e) The Surface Waters (Fishlife) (Classification) Regulations 1997.

* The sum of all 4 individual PAHs marked with an asterisk (*)

Revision no.: 7
Last edited by: PM
Last revision date: 23-Jun-12

GAC VALUES FOR CONTROLLED WATERS IN ENGLAND AND WALES

Parameter	GAC (µg/l, unless stated)			Notes
	Inland waters		Coastal and transition waters	
	EQS	DWS	EQS	
Metals and metalloids				
Arsenic	50	10	25	1
Cadmium	See separate table	5	0.2	1, 2
Chromium (total)	4.7	50	4.7	1, 3
Copper	See separate table	2000	5	1, 2
Lead	7.2	25	7.2	1
Mercury	0.05	1	0.05	1
Nickel	20	20	20	1
Zinc	See separate table	5000	40	1, 2
Misc. inorganics				
Ammonia (total, as N)	See separate table	N.A.	N.A.	2, 4
Ammonia (total, as $NH4^+$)	N.A.	500	N.A.	
Ammonia (un-ionised (NH3), as N)	N.A.	N.A.	21	
Sulphate	400 mg/l	250 mg/l	N.A.	5
Petroleum hydrocarbons and related				
TPH	See notes	See notes	See notes	6, 7
Benzene	10	1	8	
Toluene	50	700	40	8
Xylenes (sum)	30	500	30	8
MTBE	2600	200	2600	9, 10
PAHs				
Anthracene	0.1	N.A.	0.1	
Benzo(b)fluoranthene + Benzo(k)fluoranthene (sum)	0.03	Sum of 4 = 0.1	0.03	
Benzo(g,h,i)perylene + indeno(1,2,3-c,d)pyrene (sum)	0.002		0.002	
Benzo(a)pyrene	0.05	0.01	0.05	
Fluoranthene	0.1	N.A.	0.1	
Naphthalene	2.4	N.A.	1.2	
Phenol				
Phenol	7.7	0.5	7.7	

Cadmium - inland waters EQS	
Hardness (as mg/l CaCO3)	EQS (µg/l)
<40	0.08
40-50	0.08
50-100	0.09
100-200	0.15
>=200	0.25

Copper & zinc - inland waters EQS		
Hardness (as mg/l CaCO3)	EQS (µg/l)	
	Cu	Zn
0-50	1	8
50-100	6	50
100-250	10	75
>250	28	125

Ammonia - inland waters EQS		
Alkalinity (as mg/l CaCO3)	Altitude	EQS (µg/l)
<10	Any	300
10-50	Any	300
50-100	<80m	600
50-100	>80m	300
100-200	<80m	600
100-200	>80m	300
>200	Any	600

Parameter	GAC (µg/l, unless stated)			Notes
	Inland waters		Coastal and transition waters	
	EQS	DWS	EQS	
Chlorinated organics				
Dichloromethane	20	N.A.	20	
Trichloromethane (chloroform)	2.5	100	2.5	11
Tetrachloromethane (carbon tetrachloride)	12	3	12	
1,2-dichloroethane (1,2-DCA)	10	N.A.	10	
1,1,1-trichloroethane (1,1,1-TCA)	100	N.A.	100	
1,1,2-trichloroethane (1,1,2-TCA)	400	N.A.	300	
Trichloroethene (TCE)	10	Sum of 2 = 10	10	
Tetrachloroethene (PCE)	10		10	
Vinyl chloride	N.A.	0.5	N.A.	

Notes referenced in table:

1. Metals and metalloid EQS relate to dissolved contamination only (i.e. analysis of filtered samples).
2. Inland waters EQS for these parameters is dependent upon hardness or alkalinity of the *receiving water* . See separate tables.
3. Separate EQS standards exist for Cr III and CrVI in fresh water. Cr III value adopted as screening purposes for total Cr analysis as it is normally the predominant form in solution. Specific EQS for Cr VI (3.4µg/l in freshwater; 0.6µg/l in transition and coastal waters) must be applied where relevant.
4. EQS for ammonia in inland waters also depends on altitude of receptor water body. See separate table.
5. Inland waters EQS for sulphate is non-statutory.
6. No concentration based EQS exists for TPH. Hydrocarbons must not: form a visible film on the surface of the water; form costings on the beds of water bodies: impart a detectable 'hydrocarbon' taste to fish; or, produce harmful effects in fish.
7. No concentration based DWS exists for TPH. Subject to justification on a case-specific basis, it may be appropriate to apply 200µg/l TPH as a GAC on the basis that this is the DW2 Class threshold limit specified in the Surface Water (Abstraction for Drinking Water) (Classification) Regulations 1996. DW2 waters are generally suitable for abstraction as drinking water supplies, subject to standard filtration and chemical treatment.
8. World Health Organisation (WHO) Guidelines for Drinking Water Quality, 1984 - health value.
9. EQS for MTBE is the PNEC value for fresh and sea water life given in: EU Risk Assessment Report (2002) MTBE, 3rd Priority List, volume 19.
10. DWS for MTBE is a 5-fold dilution of the USEPA (1997) Drinking Water Advisory value for taint, EPA-822-F-97-009. Toxicological thresholds are significantly higher.
11. Sum trihalomethanes limit is 100µg/l but chloroform is only compound of this class normally encountered at contaminated sites.

Sources and general comments

Unless otherwise stated, EQS-based GACs relate to "Good Standard" annual average surface water quality criteria as given in: The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010.
Unless otherwise stated, drinking water standard-based GACs are taken from the Water Supply (Water Quality) (Amendment) Regulations 2000, 2001 and 2007 and relate to concentration at the supply point and/or consumers' taps.
This list presents recommended GAC values for commonly monitored analytes but is not exhaustive. A comprehensive database of criteria is available at: http://evidence.environment-agency.gov.uk/ChemicalStandards/home.aspx.
Other EQS-based criteria may apply in specific cases and regulatory guidance should be sought in case of doubt.