



Superseded Report:

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CERTIFICATE OF ANALYSIS

Validated

SDG: 251125-59
Client Ref.: 25-37526

Report Number: 784953
Location:

Superseded Report:

Table of Results - Appendix

Method No	Description
TM223	Determination of Dissolved C1-7 Hydrocarbon gases in waters

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden (Method codes TM).



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Test Completion Dates

Lab Sample No(s)	32510757	32510758	32510759	32510760	32510761	32510762	32510763
Customer Sample Ref.	2056270 W1	2056271 W1	2056272 W1	2056275 W1	2056276 W1	2056277 W1	2056278 W1
AGS Ref.							
Depth							
Type	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
Determination of Dissolved Gases	04-Dec-2025	04-Dec-2025	04-Dec-2025	04-Dec-2025	04-Dec-2025	04-Dec-2025	04-Dec-2025



CERTIFICATE OF ANALYSIS

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Appendix

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH₄ by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 15 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of 15 days after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur - e.g volatile mercury.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

General

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. Sample Deviations

If a sample is classed as deviated then the associated results may be compromised.

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Matrix interference
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to late arrival of instructions or samples
§	Sampled on date not provided

20. Asbestos

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2021), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

If during the search of the two 'pinch' samples by PLM only 1 or 2 fibres or fibre bundles are seen and identified as asbestos, the term 'trace asbestos identified' is reported.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials and soils are obtained from supplied bulk materials and soils which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2021).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining.

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Potentially respirable fibres are identified by using a Phase Contrast Microscope.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

21. 6:2 FTAB

Recovery of 6:2 FTAB in the quality control samples has been observed to be <50% of the target value. Please note the 6:2 FTAB result is supplied as indicative only.



Final Report

Report No.: 25-36980-1

Initial Date of Issue: 27-Nov-2025

Re-Issue Details:

Client Enzygo Geoenvironmental Ltd

Client Address: 168 Cowley Road
Cambridge
CB4 0DL

Contact(s): Geo
Radu-Mihai Ilie

Project CRM.1027.189 Ickleford Mill, Ickleford,
SG5 3UN

Quotation No.: Q25-37072 **Date Received:** 17-Nov-2025

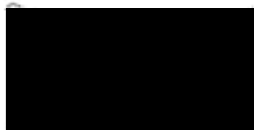
Order No.: **Date Instructed:** 17-Nov-2025

No. of Samples: 5

Turnaround (Wkdays): 10 **Results Due:** 28-Nov-2025

Date Approved: 27-Nov-2025

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: CRM.1027.189 Ickleford Mill, Ickleford, SG5 3UN

Client: Enzygo Geoenvironmental Ltd		Chemtest Job No.:		25-36980	25-36980	25-36980	25-36980	25-36980
Quotation No.: Q25-37072		Chemtest Sample ID.:		2054342	2054343	2054344	2054345	2054346
		Client Reference:		WS201	WS202	WS203	WS204	WS205
		Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):		0.60	0.20	0.40	1.20	1.40
		Bottom Depth (m):		1.00	0.80	0.80	1.50	1.70
		Date Sampled:		10-Nov-2025	10-Nov-2025	10-Nov-2025	11-Nov-2025	11-Nov-2025
Determinand	HWOL Code	Accred.	SOP	Units	LOD			
Moisture		N	2030	%	0.020	24	19	22
Soil Colour		N	2030		N/A	Brown	Brown	Brown
Other Material		N	2030		N/A	Stones	Stones and brick	Stones and Roots
Soil Texture		N	2030		N/A	Clay	Clay	Clay
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	4.8	4.4	4.6
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00	6.8	5.7	1.7
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	5.7	7.5	2.6
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00	14	26	21
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	< 10	< 10	< 10
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00	32	44	30
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	37	50	38
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	15	11	21
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	12	< 1.0	6.8
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	5.8	3.8	4.8
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	7.9	17	20
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	14	9.0	12
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	41	32	53
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00	55	41	65
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	73	76	83
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00	92	91	100
Naphthalene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluorene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		M	2800	mg/kg	0.10	< 0.10	0.59	0.29
Anthracene		M	2800	mg/kg	0.10	< 0.10	0.45	0.21
Fluoranthene		M	2800	mg/kg	0.10	< 0.10	2.0	0.86

Results - Soil

Project: CRM.1027.189 Ickleford Mill, Ickleford, SG5 3UN

Client: Enzygo Geoenvironmental Ltd		Chemtest Job No.:					25-36980	25-36980	25-36980	25-36980	25-36980
Quotation No.: Q25-37072		Chemtest Sample ID.:					2054342	2054343	2054344	2054345	2054346
		Client Reference:					WS201	WS202	WS203	WS204	WS205
		Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):					0.60	0.20	0.40	1.20	1.40
		Bottom Depth (m):					1.00	0.80	0.80	1.50	1.70
		Date Sampled:					10-Nov-2025	10-Nov-2025	10-Nov-2025	11-Nov-2025	11-Nov-2025
Determinand	HWOL Code	Accred.	SOP	Units	LOD						
Pyrene		M	2800	mg/kg	0.10	< 0.10	1.8	0.82	0.74	< 0.10	
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10	1.4	0.73	0.76	< 0.10	
Chrysene		M	2800	mg/kg	0.10	< 0.10	1.7	0.68	0.81	< 0.10	
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10	1.6	0.83	0.71	< 0.10	
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10	1.1	0.55	0.65	< 0.10	
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10	1.5	0.65	0.60	< 0.10	
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10	1.3	0.80	0.56	< 0.10	
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	0.87	0.59	0.44	< 0.10	
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10	1.4	0.81	0.56	< 0.10	
Total Of 16 PAH's		N	2800	mg/kg	2.0	< 2.0	16	7.8	7.0	< 2.0	

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8–C10 Aromatics: >C5–C7,>C7–C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Text example All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at $\leq 30^{\circ}\text{C}$ prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

Where analysis is performed on a dried and crushed sample, it has been prepared by crushing all of the sample. If material has been removed prior to crushing, or by request of the client, this will be stated on the report.

NEW_ASB Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL

DURHAM Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - The required amount of sample for analysis was not received
- H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water (Non-Regulatory)
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
cs@etuki.eurofins.com



Final Report

Report No.: 25-37526-1

Initial Date of Issue: 05-Dec-2025

Re-Issue Details:

Client *Enzygo Geoenvironmental Ltd*

Client Address: *168 Cowley Road
Cambridge
CB4 0DL*

Contact(s): *Radu-Mihai Ilie*

Project *CRM.1027.189 Ickleford Mill*

Quotation No.: **Date Received:** 21-Nov-2025

Order No.: P011406 **Date Instructed:** 21-Nov-2025

No. of Samples: 9

Turnaround (Wkdays): 11 **Results Due:** 05-Dec-2025

Date Approved: 05-Dec-2025

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Water

Project: CRM.1027.189 Ickleford Mill

Client: Enzygo Geoenvironmental Ltd		Chemtest Job No.:		25-37526	25-37526	25-37526	25-37526	25-37526	25-37526
Quotation No.:		Chemtest Sample ID.:		2056270	2056271	2056272	2056273	2056274	2056275
		Client Sample ID.:		W1	W1	W1	W1	W1	W1
		Client Reference:		WS201	WS202	WS203	WS204	WS205	WS103
		Sample Type:		WATER	WATER	WATER	WATER	WATER	WATER
		Sample Sub Type:		Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
		Top Depth (m):		2.200	1.500	2.600	2.516	2.037	1.200
		Date Sampled:		19-Nov-2025	19-Nov-2025	19-Nov-2025	18-Nov-2025	18-Nov-2025	19-Nov-2025
Determinand	HWOL Code	Accred.	SOP	Units	LOD				
Electrical Conductivity at 25C		U	1020	µS/cm	1.0	1200	1300	62	2000
Chemical Oxygen Demand		U	1100	mg O2/l	10	26	44	52	20
Alkalinity (Total)		U	1220	mg/l	10	300	450	400	190
Chloride		U	1220	mg/l	1.0	75	190	290	280
Nitrate as NO3		U	1220	mg/l	0.50	0.51	< 0.50	0.54	< 0.50
Sulphate		U	1220	mg/l	1.0	350	120	290	2.8
Hydrogen Sulphide		N	1325	mg/l	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Arsenic (Dissolved)		U	1455	µg/l	0.20	4.0	1.4	1.6	0.68
Cadmium (Dissolved)		U	1455	µg/l	0.11	< 0.11	< 0.11	< 0.11	< 0.11
Chromium (Dissolved)		U	1455	µg/l	0.50	< 0.50	0.98	< 0.50	< 0.50
Copper (Dissolved)		U	1455	µg/l	0.50	3.3	3.1	3.4	2.5
Mercury (Dissolved)		U	1455	µg/l	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nickel (Dissolved)		U	1455	µg/l	0.50	3.4	2.3	14	1.4
Lead (Dissolved)		U	1455	µg/l	0.50	0.63	0.54	0.59	< 0.50
Selenium (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	2.2	< 0.50
Vanadium (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Zinc (Dissolved)		U	1455	µg/l	2.5	4.3	5.2	8.3	4.0
Chromium (Hexavalent)		U	1490	µg/l	20	< 20	< 20	< 20	< 20
Total Organic Carbon		U	1610	mg/l	2.0	7.9	14	14	7.2
Aliphatic TPH >C5-C6	EH_2D_AL_#1	N	1780	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	EH_2D_AL_#1	N	1780	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	EH_2D_AL_#1	N	1780	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	EH_2D_AL_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	EH_2D_AL_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	EH_2D_AL_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	EH_2D_AL_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	EH_2D_AL_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	EH_2D_AL_#1	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	EH_2D_AR_#1	N	1780	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	EH_2D_AR_#1	N	1780	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	EH_2D_AR_#1	N	1780	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	EH_2D_AR_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	EH_2D_AR_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	EH_2D_AR_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	EH_2D_AR_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	EH_2D_AR_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	EH_2D_AR_#1	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0	< 5.0

Results - Water

Project: CRM.1027.189 Ickleford Mill

Client: Enzygo Geoenvironmental Ltd		Chemtest Job No.:	25-37526	25-37526	25-37526	25-37526	25-37526	25-37526
Quotation No.:		Chemtest Sample ID.:	2056270	2056271	2056272	2056273	2056274	2056275
		Client Sample ID.:	W1	W1	W1	W1	W1	W1
		Client Reference:	WS201	WS202	WS203	WS204	WS205	WS103
		Sample Type:	WATER	WATER	WATER	WATER	WATER	WATER
		Sample Sub Type:	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water	Ground Water
		Top Depth (m):	2.200	1.500	2.600	2.516	2.037	1.200
		Date Sampled:	19-Nov-2025	19-Nov-2025	19-Nov-2025	18-Nov-2025	18-Nov-2025	19-Nov-2025
Determinand	HWOL Code	Accred.	SOP	Units	LOD			
Total Petroleum Hydrocarbons	EH_2D_Total_#1	N	1675	µg/l	10	< 10	< 10	< 10
Benzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Toluene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
o-Xylene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether		N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Naphthalene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluorene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Anthracene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Pyrene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Chrysene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's		U	1800	µg/l	2.0	< 2.0	< 2.0	< 2.0
Dissolved Carbon Dioxide		SN		mg/l	1.30	See Attached	See Attached	See Attached
Dissolved Methane		SN		µg/l	1.00	See Attached	See Attached	See Attached

Results - Water

Project: CRM.1027.189 Ickleford Mill

Client: Enzygo Geoenvironmental Ltd		Chemtest Job No.:				25-37526	25-37526	25-37526
Quotation No.:		Chemtest Sample ID.:				2056276	2056277	2056278
		Client Sample ID.:				W1	W1	W1
		Client Reference:				BH104	WS107	WS110
		Sample Type:				WATER	WATER	WATER
		Sample Sub Type:				Ground Water	Ground Water	Ground Water
		Top Depth (m):				4.000	1.003	1.500
		Date Sampled:				19-Nov-2025	18-Nov-2025	19-Nov-2025
Determinand	HWOL Code	Accred.	SOP	Units	LOD			
Electrical Conductivity at 25C		U	1020	µS/cm	1.0	1000	450	990
Chemical Oxygen Demand		U	1100	mg O2/l	10	11	11	17
Alkalinity (Total)		U	1220	mg/l	10	200	420	480
Chloride		U	1220	mg/l	1.0	37	27	34
Nitrate as NO3		U	1220	mg/l	0.50	0.55	4.7	< 0.50
Sulphate		U	1220	mg/l	1.0	45	480	230
Hydrogen Sulphide		N	1325	mg/l	0.050	< 0.050	< 0.050	< 0.050
Arsenic (Dissolved)		U	1455	µg/l	0.20	1.1	5.2	1.9
Cadmium (Dissolved)		U	1455	µg/l	0.11	< 0.11	< 0.11	< 0.11
Chromium (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50
Copper (Dissolved)		U	1455	µg/l	0.50	3.8	5.8	3.2
Mercury (Dissolved)		U	1455	µg/l	0.05	< 0.05	< 0.05	< 0.05
Nickel (Dissolved)		U	1455	µg/l	0.50	0.96	3.3	28
Lead (Dissolved)		U	1455	µg/l	0.50	0.56	0.72	0.58
Selenium (Dissolved)		U	1455	µg/l	0.50	< 0.50	2.0	< 0.50
Vanadium (Dissolved)		U	1455	µg/l	0.50	< 0.50	12	< 0.50
Zinc (Dissolved)		U	1455	µg/l	2.5	17	33	5.6
Chromium (Hexavalent)		U	1490	µg/l	20	< 20	< 20	< 20
Total Organic Carbon		U	1610	mg/l	2.0	3.7	3.8	6.8
Aliphatic TPH >C5-C6	EH_2D_AL_#1	N	1780	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	EH_2D_AL_#1	N	1780	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	EH_2D_AL_#1	N	1780	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	EH_2D_AL_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	EH_2D_AL_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	EH_2D_AL_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	EH_2D_AL_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	EH_2D_AL_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	EH_2D_AL_#1	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	EH_2D_AR_#1	N	1780	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	EH_2D_AR_#1	N	1780	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	EH_2D_AR_#1	N	1780	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	EH_2D_AR_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	EH_2D_AR_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	EH_2D_AR_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	EH_2D_AR_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	EH_2D_AR_#1	N	1680	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	EH_2D_AR_#1	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0

Results - Water

Project: CRM.1027.189 Ickleford Mill

Client: Enzygo Geoenvironmental Ltd		Chemtest Job No.:				25-37526	25-37526	25-37526
Quotation No.:		Chemtest Sample ID.:				2056276	2056277	2056278
		Client Sample ID.:				W1	W1	W1
		Client Reference:				BH104	WS107	WS110
		Sample Type:				WATER	WATER	WATER
		Sample Sub Type:				Ground Water	Ground Water	Ground Water
		Top Depth (m):				4.000	1.003	1.500
		Date Sampled:				19-Nov-2025	18-Nov-2025	19-Nov-2025
Determinand	HWOL Code	Accred.	SOP	Units	LOD			
Total Petroleum Hydrocarbons	EH_2D_Total_#1	N	1675	µg/l	10	< 10	< 10	< 10
Benzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Toluene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
o-Xylene		U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether		N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Naphthalene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluorene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Anthracene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Pyrene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Chrysene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's		U	1800	µg/l	2.0	< 2.0	< 2.0	< 2.0
Dissolved Carbon Dioxide		SN		mg/l	1.30	See Attached	See Attached	See Attached
Dissolved Methane		SN		µg/l	1.00	See Attached	See Attached	See Attached

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity at 25°C and Total Dissolved Solids (TDS) in Waters	Conductivity Meter	TE LE SW GW
1100	Chemical Oxygen Demand	Chemical Oxygen demand (COD)	Dichromate oxidation of organic matter in sample followed by colorimetric determination of residual Cr[VI].	TE TS LE GW
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.	RE PW PL LE DW GW
1325	Sulphide in Waters	Sulphides	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using N,N-dimethyl-pphenylenediamine.	PL LE GW
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazine.	PL GW
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation	PL SW GW
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44 Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection	
1680	Extractable Petroleum Hydrocarbons	Aliphatics: >C5–C6, >C6–C8, >C8– C10*, >C10–C12*, >C12–C16*, >C16–C21*, >C21– C35*, >C35– C44 Aromatics: >C5–C7, >C7–C8, >C8– C10*, >C10–C12*, >C12–C16*, >C16– C21*, >C21– C35*, >C35– C44	Dichloromethane extraction / GCxGC FID detection	
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.	PL GW
1780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10 Aromatics: >C5–C6, >C6–C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection	PL GW SW

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Text example All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at $\leq 30^{\circ}\text{C}$ prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

Where analysis is performed on a dried and crushed sample, it has been prepared by crushing all of the sample. If material has been removed prior to crushing, or by request of the client, this will be stated on the report.

NEW_ASB Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL

DURHAM Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - The required amount of sample for analysis was not received
- H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water (Non-Regulatory)
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
cs@etuki.eurofins.com

Final Report

Report No.: 25-37691-1

Initial Date of Issue: 08-Dec-2025

Re-Issue Details:

Client *Enzygo Geoenvironmental Ltd*

Client Address: *168 Cowley Road
Cambridge
CB4 0DL*

Contact(s): *Radu-Mihai Ilie*

Project *CRM.1027.189 Ickleford Mill*

Quotation No.: **Date Received:** 21-Nov-2025

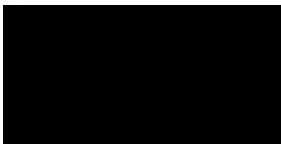
Order No.: **Date Instructed:** 25-Nov-2025

No. of Samples: 6

Turnaround (Wkdays): 10 **Results Due:** 08-Dec-2025

Date Approved: 08-Dec-2025

Approved By:



Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Leachate

Project: CRM.1027.189 Ickleford Mill

Client: Enzygo Geoenvironmental Ltd	Chemtest Job No.:					25-37691	25-37691
Quotation No.:	Chemtest Sample ID.:					2056878	2056883
	Client Reference:					TP1	TP3
	Sample Type:					SOIL	SOIL
	Top Depth (m):					1.10	2.00
	Bottom Depth (m):					1.80	2.30
	Date Sampled:					19-Nov-2025	19-Nov-2025
Determinand	Accred.	SOP	Type	Units	LOD		
Total TPH >C6-C40	U	1670	10:1	µg/l	10	< 10	< 10
Naphthalene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Acenaphthylene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Acenaphthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Fluorene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Phenanthrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Chrysene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1800	10:1	µg/l	0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	1800	10:1	µg/l	2.0	< 2.0	< 2.0

Results - Soil

Project: CRM.1027.189 Ickleford Mill

Client: Enzygo Geoenvironmental Ltd		Chemtest Job No.:		25-37691	25-37691	25-37691	25-37691	25-37691	25-37691	25-37691
Quotation No.:		Chemtest Sample ID.:		2056878	2056879	2056881	2056883	2056885	2056886	
		Client Reference:		TP1	TP1	TP2	TP3	TP4	TP5	
		Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	
		Top Depth (m):		1.10	1.80	0.50	2.00	0.40	0.50	
		Bottom Depth (m):		1.80	2.00	1.00	2.30	1.40	1.00	
		Date Sampled:		19-Nov-2025	19-Nov-2025	19-Nov-2025	19-Nov-2025	19-Nov-2025	19-Nov-2025	
Determinand	HWOL Code	Accred.	SOP	Units	LOD					
Moisture		N	2030	%	0.020	14	12	16	18	22
Soil Colour		N	2030		N/A	Brown	Brown	Brown	brown & black	Brown
Other Material		N	2030		N/A	cobbies	Stones	Stones and brick	Stones	Stones and Roots
Soil Texture		N	2030		N/A	Sand	Sand	Sand	Clay	Loam
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic VPH >C6-C8 (Sum)	HS_2D_AL	N	2780	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	U	2690	mg/kg	2.00	5.3	7.8	< 2.0	< 2.0	< 2.0
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	U	2690	mg/kg	1.00	23	33	17	1.4	< 1.0
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	U	2690	mg/kg	2.00	39	57	39	3.1	5.0
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	U	2690	mg/kg	3.00	100	92	170	34	41
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	120	140	24	< 10	10
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	U	2690	mg/kg	5.00	170	190	220	39	46
Total Aliphatic EPH >C10-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	290	330	250	49	56
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	7.6	7.8	4.3	3.4	4.2
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	53	31	5.3	< 1.0	< 1.0
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	120	78	25	3.1	3.2
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	73	130	45	< 2.0	6.6
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	250	350	11	1.5	< 1.0
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	250	250	80	8.0	14
Total Aromatic EPH >C10-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	10.00	500	590	91	< 10	15
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	420	440	300	47	60
Total EPH >C10-C40 MC	EH_2D_Total_#1	N	2690	mg/kg	10.00	780	920	340	59	71
Benzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether		U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: CRM.1027.189 Ickleford Mill

Client: Enzygo Geoenvironmental Ltd		Chemtest Job No.:						25-37691	25-37691	25-37691	25-37691	25-37691	25-37691
Quotation No.:		Chemtest Sample ID.:						2056878	2056879	2056881	2056883	2056885	2056886
		<i>Client Reference:</i>						TP1	TP1	TP2	TP3	TP4	TP5
		<i>Sample Type:</i>						SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		<i>Top Depth (m):</i>						1.10	1.80	0.50	2.00	0.40	0.50
		<i>Bottom Depth (m):</i>						1.80	2.00	1.00	2.30	1.40	1.00
		<i>Date Sampled:</i>						19-Nov-2025	19-Nov-2025	19-Nov-2025	19-Nov-2025	19-Nov-2025	19-Nov-2025
Determinand	HWOL Code	Accred.	SOP	Units	LOD								
Naphthalene		U	2800	mg/kg	0.10	0.21	0.38	0.13	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	0.31	0.29	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		U	2800	mg/kg	0.10	2.7	0.78	0.19	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene		U	2800	mg/kg	0.10	3.4	1.6	0.26	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		U	2800	mg/kg	0.10	30	7.6	1.6	0.28	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene		U	2800	mg/kg	0.10	5.7	0.39	0.41	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene		U	2800	mg/kg	0.10	41	10	2.2	0.51	0.15	0.14	0.14	0.14
Pyrene		U	2800	mg/kg	0.10	29	6.1	1.7	0.43	0.17	0.15	0.15	0.15
Benzo[a]anthracene		U	2800	mg/kg	0.10	13	1.8	0.88	0.21	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene		U	2800	mg/kg	0.10	13	3.6	0.84	0.15	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene		U	2800	mg/kg	0.10	15	4.9	1.2	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene		U	2800	mg/kg	0.10	5.9	1.7	0.53	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene		U	2800	mg/kg	0.10	8.5	< 0.10	0.90	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		U	2800	mg/kg	0.10	7.4	2.4	0.68	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	1.5	0.54	0.16	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		U	2800	mg/kg	0.10	6.3	< 0.10	0.58	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's		N	2800	mg/kg	2.0	180	42	12	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection	PL GW
1780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10 Aromatics: >C5–C6, >C6–C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection	PL GW SW
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge	

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Text example All items indicated in italic font represent customer-supplied information that may not be independently verified by the laboratory

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at $\leq 30^{\circ}\text{C}$ prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

Where analysis is performed on a dried and crushed sample, it has been prepared by crushing all of the sample. If material has been removed prior to crushing, or by request of the client, this will be stated on the report.

NEW_ASB Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL

DURHAM Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - The required amount of sample for analysis was not received
- H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

All water samples will be retained for 14 days from the date of receipt.

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water (Non-Regulatory)
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
cs@etuki.eurofins.com

Appendix 4 – Remedial Target Worksheet Outputs

Remedial Targets Worksheet , Release 3.2

Level 1 - Soil



Select the method of calculating the soil water
Partition Co-efficient by using the pull down menu
below

Calculate for non-polar organic chemicals

Contaminant
Target concentration

C_T

Aliphatics EC8-EC10
0.3 mg/l

Input Parameters
Standard entry

Variable

Value

Unit

Source of parameter value

Water filled soil porosity

θ_w

2.99E-01

fraction

Air filled soil porosity

θ_a

0.00E+00

fraction

Bulk density of soil zone material

ρ

1.95E+00

g/cm³

Henry's Law constant

H

8.00E+01

dimensionless

TPHCWG, 1999. Total Petroleum Hydrocarbon Crite

Entry if specify partition coefficient (option)

Soil water partition coefficient

K_d

l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)

f_{oc}

2.44E-01

fraction

Organic carbon partition coefficient

K_{oc}

3.02E+04

l/kg

Nathaniel C.P. et al (2015). The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.

Entry for ionic organic chemicals (option)

Sorption coefficient for neutral species

K_{oc,n}

l/kg

Sorption coefficient for ionised species

K_{oc,i}

l/kg

pH value

pH

pH units

Acid dissociation constant

pK_a

Fraction of organic carbon (in soil)

f_{oc}

fraction

Soil water partition coefficient used in Level Assessment

K_d

7.36E+03

l/kg

Calculated value

Level 1 Remedial Target

Level 1 Remedial Target

2.21E+03

mg/kg

(for comparison with soil analyses)

or

0.3

mg/l

(for comparison with leachate test results)

Site being assessed: Ickleford Mill

Completed by: RMI

Date: 12-Dec-25

Version: 1

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration

C_T

Aliphatics EC10-EC12
0.3

mg/l
from Level 1
from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamination' (Environment Agency 2006)

Input Parameters	Variable	Value	Unit	Source of parameter value
Standard entry				
Infiltration	Inf	4.10E-04	m/d	EA Values (Rainfall = 700mm/y; ET=500mm/y; Runoff=
Area of contaminant source	A	0.00E+00	m ²	Not used in calculation
Entry for groundwater flow below site				
Length of contaminant source in direction of groundwater flow	L	6.50E+00	m	Estimated based on site data.
Saturated aquifer thickness	da	1.79E+00	m	Site specific data.
Hydraulic Conductivity of aquifer in which dilution occurs	K	4.10E-02	m/d	Site specific data.
Hydraulic gradient of water table	i	3/70	fraction	Site specific data.
Width of contaminant source perpendicular to groundwater flow	w	1.00E+01	m	Estimated based on site data.
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l	Not used in calculation
Define mixing zone depth by specifying or calculating depth (using pull down list)		Calculate		
Enter mixing zone thickness	Mz		m	
Calculated mixing zone thickness	Mz	1.71E+00	m	

Calculated Parameters

Dilution Factor	DF	2.13E+00		
Level 2 Remedial Target		6.39E-01 or 3.89E+04	mg/l mg/kg	For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentration For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)	Cc	0.00E+00	mg/l	
Calculated concentration within receptor (dilution only)		0.00E+00	mg/l	0

Site being assessed:	Ickleford Mill
Completed by:	RMI
Date:	11-Dec-25
Version:	1

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration

C_T

Aliphatics EC12-EC16
0.3

mg/l
from Level 1
from Level 1

This sheet calculates the Level 2 remedial target for soils (mg/kg) or for pore water (mg/l).

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 2 remedial target to determine the need for further action. Equations presented in 'Hydrogeological risk assessment for land contamination' (Environment Agency 2006)

Input Parameters

Variable

Value

Unit

Source of parameter value

Standard entry

Infiltration
Area of contaminant source

Inf
A

4.10E-04
0.00E+00

m/d
m²

EA Values (Rainfall = 700mm/y; ET=500mm/y; Runoff=

Not used in calculation

Entry for groundwater flow below site

Length of contaminant source in direction of groundwater flow
Saturated aquifer thickness
Hydraulic Conductivity of aquifer in which dilution occurs
Hydraulic gradient of water table
Width of contaminant source perpendicular to groundwater flow
Background concentration of contaminant in groundwater beneath site

L
da
K
i
w
Cu

6.50E+00
1.79E+00
4.10E-02
3/70
1.00E+01
0.00E+00

m
m
m/d
fraction
m
mg/l

Estimated based on site data.
Site specific data.
Site specific data.
Site specific data.
Estimated based on site data.

Not used in calculation

Define mixing zone depth by specifying or calculating depth (using pull down list)

Enter mixing zone thickness
Calculated mixing zone thickness

Mz
Mz

Calculate
1.71E+00

m
m

Calculated Parameters

Dilution Factor

DF

2.13E+00

Level 2 Remedial Target

6.39E-01
or
7.78E+05

mg/l
mg/kg

For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentration

For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water

Additional option

Calculation of impact on receptor

Concentration of contaminant in contaminated discharge (entering receptor)

C_c

0.00E+00

mg/l

Calculated concentration within receptor (dilution only)

0.00E+00

mg/l

0

Site being assessed: Ickleford Mill
Completed by: RMI
Date: 11-Dec-25
Version: 1

R&D Publication 20 Remedial Targets Worksheet, Release 3.2



Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Variable	Value	Unit	Source
Contaminant	Aliphatics EC16-EC21		from Level 1
Target Concentration	3.00E-01	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
-------------	------------------------------

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	4.69E+01	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	1.25E+03	days	Groundtech Consulting Ltd 19/20485
Calculated decay rate	λ	5.55E-04	days ⁻¹	EA R&D Technical Report P2-228/TR, H
Width of plume in aquifer at source (perpendicular to flow)	Sz	1.00E+01	m	Estimated from site data
Plume thickness at source	Sy	1.71E+00	m	Estimated from site data
Saturated aquifer thickness	da	1.79E+00	m	Estimated from site data
Bulk density of aquifer materials	ρ	1.95E+00	g/cm ³	Estimated
Effective porosity of aquifer	n	2.00E-01	fraction	Estimated from site data
Hydraulic gradient	i	4.29E-02	fraction	Site specific
Hydraulic conductivity of aquifer	K	4.10E-02	m/d	Site specific
Distance to compliance point	x	4.90E+01	m	Site specific
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	Site specific
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only

Parameters values determined from options

Partition coefficient	Kd	1.53E+08	l/kg	see options
Longitudinal dispersivity	ax	2.95E+00	m	see options
Transverse dispersivity	az	2.95E-01	m	see options
Vertical dispersivity	ay	2.95E-02	m	see options

Calculated Parameters

Groundwater flow velocity	v	8.80E-03	m/d
Retardation factor	Rf	1.50E+09	fraction
Decay rate used	λ	3.71E-13	d ⁻¹
Rate of contaminant flow due to retardation	u	5.88E-12	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	1.46E+00	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	3.22E+01	

Remedial Targets

Remedial Target	9.67E+00	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	49	m	
Concentration of contaminant at compliance point	C _{ED} /C ₀	1.46E+00	mg/l
after	1.0E+100	days	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

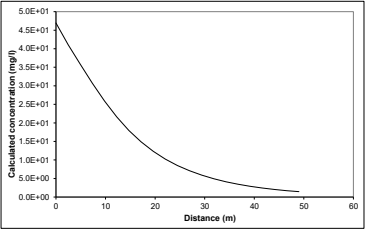
Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)	foc	2.44E-01	fraction
Fraction of organic carbon in aquifer	Koc	6.30E+08	l/kg
Organic carbon partition coefficient	K _{oc,n}		l/kg
Entry for ionic organic chemicals (option)	K _{oc,i}		l/kg
Sorption coefficient for related species	pH		
Sorption coefficient for ionised species	pKa		
acid dissociation constant	foc		fraction
Fraction of organic carbon in aquifer	Kd	1.53E+08	l/kg
Soil water partition coefficient			

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

		Enter value	Calc value Xu & Eckstein	m
Longitudinal dispersivity	ax	0.00E+00	4.90E+00	2.95E+00
Transverse dispersivity	az	0.00E+00	4.90E-01	2.95E-01
Vertical dispersivity	ay	0.00E+00	4.90E-02	2.95E-02
Note values of dispersivity must be > 0				
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x				
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ t) ^{0.414} ; az = ax/10, ay = ax/100 are assumed				



Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	4.7E+01
2.5	4.11E+01
4.9	3.58E+01
7.4	3.07E+01
9.8	2.59E+01
12.3	2.16E+01
14.7	1.80E+01
17.2	1.49E+01
19.6	1.24E+01
22.1	1.02E+01
24.5	8.51E+00
27.0	7.08E+00
29.4	5.90E+00
31.9	4.93E+00
34.3	4.12E+00
36.8	3.45E+00
39.2	2.90E+00
41.7	2.43E+00
44.1	2.05E+00
46.6	1.73E+00
49.0	1.46E+00

Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed:	Ickleford Mill
Completed by:	RMI
Date:	#####
Version:	1

Remedial Targets Worksheet , Release 3.2



Level 1 - Soil

Select the method of calculating the soil water
Partition Co-efficient by using the pull down menu
below

Calculate for non-polar organic chemicals

Contaminant
Target concentration

C_T

Aliphatics EC21-EC35
0.3 mg/l

Input Parameters
Standard entry

Variable

Value

Unit

Source of parameter value

Water filled soil porosity

θ_w

2.99E-01

fraction

Air filled soil porosity

θ_a

0.00E+00

fraction

Bulk density of soil zone material

ρ

1.95E+00

g/cm³

Henry's Law constant

H

4.90E+03

dimensionless

Total Petroleum Hydrocarbon Criteria Working Group

Entry if specify partition coefficient (option)

Soil water partition coefficient

K_d

l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)

f_{oc}

2.44E-01

fraction

Organic carbon partition coefficient

K_{oc}

6.31E+08

l/kg

Total Petroleum Hydrocarbon Criteria Working Group

Entry for ionic organic chemicals (option)

Sorption coefficient for neutral species

K_{oc,n}

l/kg

Sorption coefficient for ionised species

K_{oc,i}

l/kg

pH value

pH

pH units

Acid dissociation constant

pK_a

fraction

Fraction of organic carbon (in soil)

f_{oc}

fraction

Soil water partition coefficient used in Level Assessment

K_d

1.54E+08

l/kg

Calculated value

Level 1 Remedial Target

Level 1 Remedial Target

4.61E+07

mg/kg

(for comparison with soil analyses)

or

0.3

mg/l

(for comparison with leachate test results)

Site being assessed: Ickleford Mill

Completed by: RMI

Date: 11-Dec-25

Version: 1

R&D Publication 20 Remedial Targets Worksheet, Release 3.2



Level 3 - Groundwater See Note

Input Parameters (using pull down menu)	Variable	Value	Unit	Source
Contaminant		Aromatics EC10-EC12		from Level 1
Target Concentration	C _T	3.00E-01	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
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Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	2.00E-02	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	3.00E+02	days	Groundtech Consulting Ltd 19/20485
Calculated decay rate	λ	2.31E-03	days ⁻¹	EA R&D Technical Report P2-228/TR_Ha
Width of plume in aquifer at source (perpendicular to flow)	Sz	1.00E+01	m	Estimated from site data
Plume thickness at source	Sy	1.71E+00	m	Estimated from site data
Saturated aquifer thickness	da	1.79E+00	m	Estimated from site data
Bulk density of aquifer materials	ρ	1.95E+00	g/cm ³	Estimated
Effective porosity of aquifer	n	2.00E-01	fraction	Estimated from site data
Hydraulic gradient	i	4.29E-02	fraction	Site specific
Hydraulic conductivity of aquifer	K	4.10E-02	m/d	Site specific
Distance to compliance point	x	4.90E+01	m	Site specific
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	Site specific
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	Site specific
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only

Parameters values determined from options				
Partition coefficient	Kd	3.90E+02	l/kg	see options
Longitudinal dispersivity	ax	2.95E+00	m	see options
Transverse dispersivity	az	2.95E-01	m	see options
Vertical dispersivity	ay	2.95E-02	m	see options

Calculated Parameters Variable

Groundwater flow velocity	v	8.80E-03	m/d	
Retardation factor	Rf	3.80E+03	fraction	
Decay rate used	λ	6.08E-07	d ⁻¹	
Rate of contaminant flow due to retardation	u	2.32E-06	m/d	
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	1.79E-06	mg/l	
Attenuation factor (one way vertical dispersion, CO/CED)	AF	1.12E+04		

Remedial Targets

Remedial Target	3.35E+03	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	49	m	
Concentration of contaminant at compliance point	C _{ED} /C ₀	1.79E-06	mg/l
after		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)	Kd		l/kg
Soil water partition coefficient	foc	2.44E-01	fraction
Entry for non-polar organic chemicals (option)	Koc	1.60E+03	l/kg
Organic carbon partition coefficient	K _{oc,n}		l/kg
Entry for ionic organic chemicals (option)	K _{oc,i}		l/kg
Sorption coefficient for related species	pH		
Sorption coefficient for ionised species	pKa		
acid dissociation constant	foc		fraction
Fraction of organic carbon in aquifer	Kd	3.90E+02	l/kg
Soil water partition coefficient			

Define dispersivity (click brown cell and use pull down list)

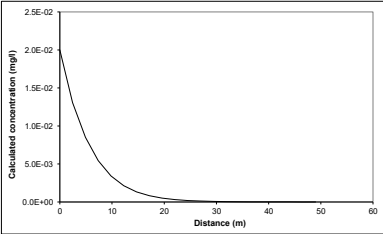
Dispersivity based on Xu & Eckstein (1995)

		Enter value	Calc value Xu & Eckstein	m
Longitudinal dispersivity	ax	0.00E+00	4.90E+00	2.95E+00
Transverse dispersivity	az	0.00E+00	4.90E-01	2.95E-01
Vertical dispersivity	ay	0.00E+00	4.90E-02	2.95E-02

Note: values of dispersivity must be > 0

For calculated value, assumes $\alpha_x = 0.1 \times x$, $\alpha_z = 0.01 \times x$, $\alpha_y = 0.001 \times x$

Xu & Eckstein (1995) report $\alpha_x = 0.83(\log_{10})^{2+14}$; $\alpha_z = \alpha_x/10$, $\alpha_y = \alpha_x/100$ are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed:	Ickleford Mill
Completed by:	RMI
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks	From calculation sheet
Distance	Concentration

	mg/l
0	2.0E-02
2.5	1.31E-02
4.9	8.50E-03
7.4	5.44E-03
9.8	3.42E-03
12.3	2.14E-03
14.7	1.32E-03
17.2	8.20E-04
19.6	5.07E-04
22.1	3.14E-04
24.5	1.95E-04
27.0	1.21E-04
29.4	7.53E-05
31.9	4.69E-05
34.3	2.93E-05
36.8	1.83E-05
39.2	1.15E-05
41.7	7.20E-06
44.1	4.52E-06
46.6	2.85E-06
49.0	1.79E-06

R&D Publication 20 Remedial Targets Worksheet, Release 3.2



Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Variable Value Unit Source

Contaminant Aromatics EC10-EC12 from Level 1
Target Concentration C_T 9.00E-02 mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core C₀ 4.72E+00 mg/l
Half life for degradation of contaminant in water t_{1/2} 3.00E+02 days
Calculated decay rate λ 2.31E-03 days⁻¹
Width of plume in aquifer at source (perpendicular to flow) S_z 1.00E+01 m
Plume thickness at source S_y 1.71E+00 m
Saturated aquifer thickness da 1.79E+00 m
Bulk density of aquifer materials ρ 1.95E+00 g/cm³
Effective porosity of aquifer n 2.00E-01
Hydraulic gradient i 4.29E-02
Hydraulic conductivity of aquifer K 4.10E-02 m/d
Distance to compliance point x 4.90E+01 m
Distance (lateral) to compliance point perpendicular to flow direction z 0.00E+00 m
Distance (depth) to compliance point perpendicular to flow direction y 0.00E+00 m
Time since pollutant entered groundwater t 1.00E+100 days
Parameters values determined from options

Partition coefficient K_d 6.09E+02 l/kg
Longitudinal dispersivity ax 2.95E+00 m
Transverse dispersivity az 2.95E-01 m
Vertical dispersivity ay 2.95E-02 m

Calculated Parameters Variable

Groundwater flow velocity v 8.80E-03 m/d
Retardation factor R_f 5.94E+03
Decay rate used λ 3.89E-07 d⁻¹
Rate of contaminant flow due to retardation u 1.48E-06 m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion C_{ED} 4.23E-04 mg/l
Attenuation factor (one way vertical dispersion, CO/CED) AF 1.12E+04

Select Method for deriving Partition Co-efficient (using pull down menu)

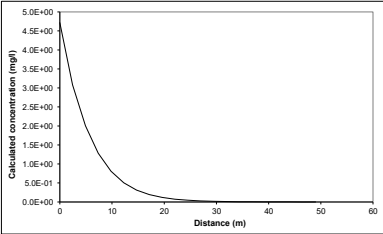
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)
Soil water partition coefficient K_d l/kg
Entry for non-polar organic chemicals (option)
Fraction of organic carbon in aquifer f_{oc} 2.44E-01 fraction
Organic carbon partition coefficient K_{oc} 2.50E+03 l/kg
Entry for ionic organic chemicals (option)
Sorption coefficient for related species K_{oc,rel} l/kg
Sorption coefficient for ionised species K_{oc,i} l/kg
pH value pH
acid dissociation constant pK_a
Fraction of organic carbon in aquifer f_{oc} fraction
Soil water partition coefficient K_d 6.09E+02 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

Longitudinal dispersivity ax 0.00E+00 m
Transverse dispersivity az 0.00E+00 m
Vertical dispersivity ay 0.00E+00 m
Note values of dispersivity must be > 0
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x
Xu & Eckstein (1995) report ax = 0.83(log₁₀ x)^{2.414}; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed: Ickleford Mill
Completed by: RMI
Date: #####
Version: 1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet
Distance Concentration

mg/l
0 4.7E+00
2.5 3.08E+00
4.9 2.00E+00
7.4 1.28E+00
9.8 8.08E-01
12.3 5.03E-01
14.7 3.12E-01
17.2 1.93E-01
19.6 1.20E-01
22.1 7.41E-02
24.5 4.60E-02
27.0 2.85E-02
29.4 1.78E-02
31.9 1.11E-02
34.3 6.91E-03
36.8 4.32E-03
39.2 2.71E-03
41.7 1.70E-03
44.1 1.07E-03
46.6 6.71E-04
49.0 4.23E-04

Remedial Targets

Remedial Target 1.00E+03 mg/l For comparison with measured groundwater concentration.
Ogata Banks
Distance to compliance point 49 m
Concentration of contaminant at compliance point C_{ED}/C₀ 4.23E-04 mg/l
after 1.0E+100 days Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note



Input Parameters (using pull down menu)

Variable Value Unit Source

Contaminant
Target Concentration
 C_T Aromatics EC12-EC16
9.00E-02 mg/l from Level 1
from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core
 C_0 2.55E+01 mg/l
Half life for degradation of contaminant in water
 $t_{1/2}$ 4.15E+02 days
Calculated decay rate
 λ 1.67E-03 days⁻¹
Width of plume in aquifer at source (perpendicular to flow)
 S_z 1.00E+01 m
Plume thickness at source
 S_y 1.71E+00 m
Saturated aquifer thickness
 d_a 1.79E+00 m
Bulk density of aquifer materials
 ρ 1.95E+00 g/cm³
Effective porosity of aquifer
 n 2.00E-01 fraction
Hydraulic gradient
 i 4.29E-02 fraction
Hydraulic conductivity of aquifer
 K 4.10E-02 m/d
Distance to compliance point
 x 4.90E+01 m
Distance (lateral) to compliance point perpendicular to flow direction
 z 0.00E+00 m
Distance (depth) to compliance point perpendicular to flow direction
 y 0.00E+00 m
Time since pollutant entered groundwater
 t 1.00E+100 days
time variant options only

Parameters values determined from options

Partition coefficient
 K_d 1.22E+03 l/kg
Longitudinal dispersivity
 α_x 2.95E+00 m
Transverse dispersivity
 α_z 2.95E-01 m
Vertical dispersivity
 α_y 2.95E-02 m

Calculated Parameters Variable

Groundwater flow velocity
 v 8.80E-03 m/d
Retardation factor
 R_f 1.19E+04 fraction
Decay rate used
 λ 1.41E-07 d⁻¹
Rate of contaminant flow due to retardation
 u 7.41E-07 m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion
 C_{ED} 1.48E-02 mg/l
Attenuation factor (one way vertical dispersion, CO/CED)
 AF 1.73E+03

Remedial Targets

Remedial Target 1.56E+02 mg/l
Ogata Banks
Distance to compliance point 49 m
Concentration of contaminant at compliance point after
 C_{ED}/C_0 1.48E-02 mg/l
1.0E+100 days Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient

 K_d l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer

 f_{oc} 2.44E-01 fraction

Organic carbon partition coefficient

 K_{oc} 5.00E+03 l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species

 $K_{oc,i}$ l/kg

Sorption coefficient for ionised species

 $K_{oc,i}$ l/kg

pH value

pH

acid dissociation constant

pKa

Fraction of organic carbon in aquifer

 f_{oc} fraction

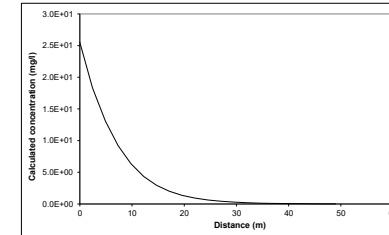
Soil water partition coefficient

 K_d 1.22E+03 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

Longitudinal dispersivity
 α_x 2.95E+00 m
Transverse dispersivity
 α_z 2.95E-01 m
Vertical dispersivity
 α_y 2.95E-02 m
Note values of dispersivity must be > 0
For calculated value, assumes $\alpha_x = 0.1 * x$, $\alpha_z = 0.01 * x$, $\alpha_y = 0.001 * x$
Xu & Eckstein (1995) report $\alpha_x = 0.83(\log_{10} x)^{2.414}$; $\alpha_z = \alpha_x/10$, $\alpha_y = \alpha_x/100$ are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed: Ickleford Mill

Completed by: RMI

Date: #####

Version: 1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet
Distance Concentration

mg/l
0 2.5E+01
2.5 1.83E+01
4.9 1.31E+01
7.4 9.18E+00
9.8 6.34E+00
12.3 4.34E+00
14.7 2.96E+00
17.2 2.01E+00
19.6 1.36E+00
22.1 9.28E-01
24.5 6.32E-01
27.0 4.31E-01
29.4 2.94E-01
31.9 2.01E-01
34.3 1.38E-01
36.8 9.47E-02
39.2 6.51E-02
41.7 4.48E-02
44.1 3.09E-02
46.6 2.13E-02
49.0 1.48E-02

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note



Input Parameters (using pull down menu)

Variable Value Unit Source

Contaminant
Target Concentration
C_T **Aromatics EC16-EC21** **9.00E-02** mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core
Half life for degradation of contaminant in water
Calculated decay rate
Width of plume in aquifer at source (perpendicular to flow)
Plume thickness at source
Saturated aquifer thickness
Bulk density of aquifer materials
Effective porosity of aquifer
Hydraulic gradient
Hydraulic conductivity of aquifer
Distance to compliance point
Distance (lateral) to compliance point perpendicular to flow direction
Distance (depth) to compliance point perpendicular to flow direction
Time since pollutant entered groundwater

C₀ **3.09E+01** mg/l
t_{1/2} **1.25E+03** days
λ **5.55E-04** days⁻¹
S_z **1.00E+01** m
S_y **1.71E+00** m
da **1.79E+00** m
ρ **1.95E+00** g/cm³
n **2.00E-01** fraction
i **4.29E-02** fraction
K **4.10E-02** m/d
x **4.90E+01** m
z **0.00E+00** m
y **0.00E+00** m
t **1.00E+100** days

Parameters values determined from options

Partition coefficient
Longitudinal dispersivity
Transverse dispersivity
Vertical dispersivity

K_d **3.90E+03** l/kg
ax **2.95E+00** m
az **2.95E-01** m
ay **2.95E-02** m

see options
see options
see options
see options

Calculated Parameters Variable

Groundwater flow velocity
Retardation factor
Decay rate used
Rate of contaminant flow due to retardation
Contaminant concentration at distance x, assuming one-way vertical dispersion
Attenuation factor (one way vertical dispersion, CO/CED)

v **8.80E-03** m/d
Rf **3.80E+04** fraction
λ **1.46E-08** d⁻¹
u **2.32E-07** m/d
C_{ED} **9.58E-01** mg/l
AF **3.22E+01**

Remedial Targets

Remedial Target **2.90E+00** **mg/l** For comparison with measured groundwater concentration.
Ogata Banks

Distance to compliance point **49** **m**

Concentration of contaminant at compliance point after **C_{ED}/C₀** **9.58E-01** **mg/l** Ogata Banks
1.0E+100 **days**

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)
Soil water partition coefficient
Entry for non-polar organic chemicals (option)
Fraction of organic carbon in aquifer
Organic carbon partition coefficient
Entry for ionic organic chemicals (option)
Sorption coefficient for related species
Sorption coefficient for ionised species
pH value
acid dissociation constant
Fraction of organic carbon in aquifer
Soil water partition coefficient

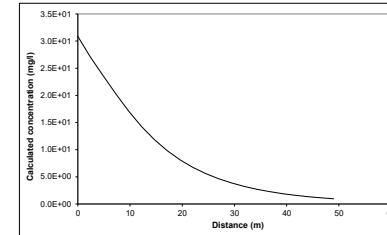
K_d **3.90E+03** l/kg
foc **2.44E-01** fraction
K_{oc} **1.60E+04** l/kg
K_{oc,ion} **1.60E+04** l/kg
K_{oc,ion} **1.60E+04** l/kg
pKa **1.60E+04** l/kg
foc **2.44E-01** fraction
K_d **3.90E+03** l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

Longitudinal dispersivity
Transverse dispersivity
Vertical dispersivity
Note values of dispersivity must be > 0
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x
Xu & Eckstein (1995) report ax = 0.83(log₁₀x)²⁺¹⁴; az = ax/10, ay = ax/100 are assumed

ax **2.95E+00** m
az **2.95E-01** m
ay **2.95E-02** m



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed: Ickleford Mill
Completed by: RMI
Date: #####
Version: 1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet
Distance Concentration

mg/l
0 3.1E+01
2.5 2.70E+01
4.9 2.35E+01
7.4 2.02E+01
9.8 1.70E+01
12.3 1.42E+01
14.7 1.18E+01
17.2 9.79E+00
19.6 8.12E+00
22.1 6.74E+00
24.5 5.60E+00
27.0 4.66E+00
29.4 3.88E+00
31.9 3.24E+00
34.3 2.71E+00
36.8 2.27E+00
39.2 1.90E+00
41.7 1.60E+00
44.1 1.35E+00
46.6 1.14E+00
49.0 9.58E-01

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Aromatics EC21-EC35		from Level 1
Target Concentration	C _T	0.09	mg/l	from Level 1
Dilution Factor	DF	1.95E+00		from Level 2

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
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Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to pollutants in all phases (e.g. field derived value).

Variable	Value	Unit	Source of parameter value
Soil concentration as mg/kg			
Enter soil concentration	210	mg/kg	
Half life for degradation of contaminant in water	3.00E+02	days	
Calculated decay rate	2.31E-03	days ⁻¹	calculated
Width of plume in aquifer at source	1.00E+01	m	from Level 2
Plume thickness in aquifer at source	1.44E+00	m	from Level 2
Bulk density of aquifer materials	1.95E+00	g/cm ³	
Effective porosity of aquifer	2.00E-01	fraction	
Hydraulic gradient	8.82E-02	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	4.10E-02	m/d	from Level 2
Distance (lateral) to compliance point	4.90E+01	m	
Distance (depth) to compliance point perpendicular to flow direction		m	
Time since pollutant entered groundwater	1.00E+99	days	time variant options only
Parameters values determined from options			
Partition coefficient	K _d	3.17E+04	l/kg see options
Longitudinal dispersivity	ax	2.947	m see options
Transverse dispersivity	az	0.295	m see options
Vertical dispersivity	ay	0.029	m see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	1.81E-02 m/d
Retardation factor	R _f	3.09E+05 fraction
Decay rate used	λ	2.31E-03 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	8.82E-02 fraction
Rate of contaminant flow due to retardation	u	5.85E-08 m/d
Ratio of Compliance Point to Source Concentration	C _{ED} /C ₀	0.00E+00 fraction
Attenuation factor (C ₀ /C _{ED})	AF	breakthrough at c ₀ fraction
Calculated soil leachate concentration	Co	6.63E-03 mg/l

Remedial Targets

Level 3 Remedial Target	No impact or	mg/l	For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentration.
Ogata Banks			
Distance to compliance point	No impact	49 m	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{ED} /C ₀	0.00E+00 fraction	Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99

Enter method of defining partition co-efficient (using pull down list)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient K_d l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc} 2.44E-01 fractionOrganic carbon partition coefficient K_{oc} 1.30E+05 l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species K_{ow} l/kgSorption coefficient for ionised species K_{ow} l/kg

pH value pH

Acid dissociation constant pKa

Fraction of organic carbon in aquifer f_{oc} fractionSoil water partition coefficient K_d 3.17E+04 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

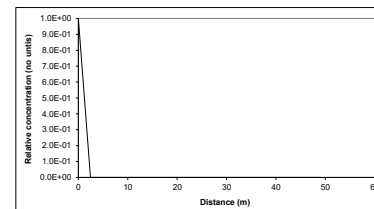
	Enter value	Calc value	Xu & Eckstein
Longitudinal dispersivity	ax	0.00E+00	2.95E+00 m
Transverse dispersivity	az	0.00E+00	2.95E-01 m
Vertical dispersivity	ay	0.00E+00	2.95E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀x)^{2.414}, az = ax/10, ay = ax/100 are assumed

Note

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used



Note: 'Relative concentration' is the ratio of calculated concentration at a given position compared to the source concentration. The calculations assume plume disperses from the top of the aquifer. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Calculated (relative) concentrations for distance-concentration graph

Ogata Banks	Relative concentration	Concentration
From calculation sheet		
Distance	(No units)	mg/l
0	1.0E+00	3.49E-03
2.5	1.09E-123	3.70E-126
4.9	1.17E-246	3.97E-249
7.4	0.00E+00	0.00E+00
9.8	0.00E+00	0.00E+00
12.3	0.00E+00	0.00E+00
14.7	0.00E+00	0.00E+00
17.2	0.00E+00	0.00E+00
19.6	0.00E+00	0.00E+00
22.1	0.00E+00	0.00E+00
24.5	0.00E+00	0.00E+00
27.0	0.00E+00	0.00E+00
29.4	0.00E+00	0.00E+00
31.9	0.00E+00	0.00E+00
34.3	0.00E+00	0.00E+00
36.8	0.00E+00	0.00E+00
39.2	0.00E+00	0.00E+00
41.7	0.00E+00	0.00E+00
44.1	0.00E+00	0.00E+00
46.6	0.00E+00	0.00E+00
49.0	0.00E+00	0.00E+00

This sheet calculates the Level 3 remedial target for soils(mg/kg) or for pore water (mg/l), based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks. By setting a long travel time (e.g. 9E99) it will give the steady state solution, which should always be used when calculating remedial targets.

The measured soil concentration as mg/kg or pore water concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.9E+99.

Site being assessed: Ickleford Mill
Completed by: RM
Date: #####
Version: 1

R&D Publication 20 Remedial Targets Worksheet, Release 3.2



Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Value	Unit	Source
Target Concentration	C _T	Aliphatics EC10-EC12 3.00E-01	mg/l	from Level 1 from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
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Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	5.70E-02	mg/l	Source of parameter value Groundtech Consulting Ltd 19/20485
Half life for degradation of contaminant in water	t _{1/2}	3.00E+02	days	EA R&D Technical Report P2-228/TR, H
Calculated decay rate	λ	2.31E-03	days ⁻¹	Estimated from site data
Width of plume in aquifer at source (perpendicular to flow)	Sz	3.00E+00	m	Estimated from site data
Plume thickness at source	Sy	8.69E-01	m	Estimated from site data
Saturated aquifer thickness	da	1.32E+00	m	Estimated from site data. In WS17, CLAY
Bulk density of aquifer materials	ρ	1.63E+00	g/cm ³	Estimated
Effective porosity of aquifer	n	1.30E-01	fraction	Estimated from site data
Hydraulic gradient	i	4.20E-02	fraction	Site specific
Hydraulic conductivity of aquifer	K	4.10E-02	m/d	Site specific
Distance to compliance point	x	2.50E+01	m	Site specific
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only

Parameters values determined from options

Partition coefficient	Kd	2.32E+04	l/kg	see options
Longitudinal dispersivity	ax	1.86E+00	m	see options
Transverse dispersivity	az	1.86E-01	m	see options
Vertical dispersivity	ay	1.86E-02	m	see options

Calculated Parameters

Groundwater flow velocity	v	1.32E-02	m/d
Retardation factor	Rf	2.91E+05	fraction
Decay rate used	λ	7.94E-09	d ⁻¹
Rate of contaminant flow due to retardation	u	4.55E-08	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	4.24E-04	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	1.34E+02	

Remedial Targets

Remedial Target	4.03E+01	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	25	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	4.24E-04	mg/l
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

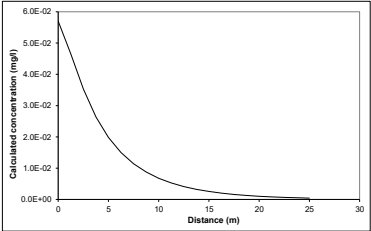
Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)	foc	9.28E-02	fraction
Fraction of organic carbon in aquifer	Koc	2.50E+05	l/kg
Organic carbon partition coefficient	K _{oc,n}		l/kg
Entry for ionic organic chemicals (option)	K _{oc,i}		l/kg
Sorption coefficient for related species	pH		
Sorption coefficient for ionised species	pKa		
acid dissociation constant	foc		fraction
Fraction of organic carbon in aquifer	Kd	2.32E+04	l/kg
Soil water partition coefficient			

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

Longitudinal dispersivity	ax	Enter value 0.00E+00	Calc value Xu & Eckstein 2.50E+00	1.86E+00	m
Transverse dispersivity	az	0.00E+00	2.50E-01	1.86E-01	m
Vertical dispersivity	ay	0.00E+00	2.50E-02	1.86E-02	m
Note values of dispersivity must be > 0					
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x					
Xu & Eckstein (1995) report ax = 0.83(log ₁₀ x) ²⁺¹⁴ ; az = ax/10, ay = ax/100 are assumed					



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed:	Ickleford Mill
Completed by:	RMI
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks	
From calculation sheet	
Distance	Concentration

	mg/l
0	5.7E-02
1.3	4.66E-02
2.5	3.53E-02
3.8	2.64E-02
5.0	1.98E-02
6.3	1.50E-02
7.5	1.14E-02
8.8	8.78E-03
10.0	6.78E-03
11.3	5.27E-03
12.5	4.12E-03
13.8	3.24E-03
15.0	2.55E-03
16.3	2.02E-03
17.5	1.60E-03
18.8	1.28E-03
20.0	1.02E-03
21.3	8.16E-04
22.5	6.55E-04
23.8	5.27E-04
25.0	4.24E-04

R&D Publication 20 Remedial Targets Worksheet, Release 3.2



Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Variable Value Unit Source

Contaminant Aliphatics EC12-EC16
Target Concentration C_T 3.00E-01 mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core C₀ 3.60E-01 mg/l
Half life for degradation of contaminant in water t_{1/2} 4.15E+02 days
Calculated decay rate λ 1.67E-03 days⁻¹
Width of plume in aquifer at source (perpendicular to flow) Sz 3.00E+00 m
Plume thickness at source Sy 8.69E-01 m
Saturated aquifer thickness da 1.32E+00 m
Bulk density of aquifer materials ρ 1.63E+00 g/cm³
Effective porosity of aquifer n 1.30E-01 fraction
Hydraulic gradient i 4.20E-02 fraction
Hydraulic conductivity of aquifer K 4.10E-02 m/d
Distance to compliance point x 2.50E+01 m
Distance (lateral) to compliance point perpendicular to flow direction z 0.00E+00 m
Distance (depth) to compliance point perpendicular to flow direction y 0.00E+00 m
Time since pollutant entered groundwater t 1.00E+100 days
Parameters values determined from options

Partition coefficient K_d 4.64E+05 l/kg
Longitudinal dispersivity ax 1.86E+00 m
Transverse dispersivity az 1.86E-01 m
Vertical dispersivity ay 1.86E-02 m

Calculated Parameters Variable

Groundwater flow velocity v 1.32E-02 m/d
Retardation factor R_f 5.82E+06 fraction
Decay rate used λ 2.87E-10 d⁻¹
Rate of contaminant flow due to retardation u 2.28E-09 m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion C_{ED} 6.15E-03 mg/l
Attenuation factor (one way vertical dispersion, CO/CED) AF 5.85E+01

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

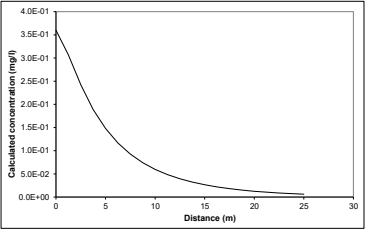
Entry if specify partition coefficient (option)

Soil water partition coefficient K_d 4.64E+05 l/kg
Fraction of organic carbon in aquifer f_{oc} 9.28E-02 fraction
Organic carbon partition coefficient K_{oc} 5.00E+06 l/kg
Sorption coefficient for related species K_{oc,rel} l/kg
Sorption coefficient for ionised species K_{oc,i} l/kg
pH value pH
acid dissociation constant pKa
Fraction of organic carbon in aquifer f_{oc} fraction

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

Longitudinal dispersivity ax 0.00E+00 m
Transverse dispersivity az 0.00E+00 m
Vertical dispersivity ay 0.00E+00 m
Note values of dispersivity must be > 0
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x
Xu & Eckstein (1995) report ax = 0.83(log₁₀x)²⁺¹⁴; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed: Ickleford Mill
Completed by: RMI
Date: #####
Version: 1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet
Distance Concentration

mg/l
0 3.6E-01
1.3 3.07E-01
2.5 2.42E-01
3.8 1.89E-01
5.0 1.48E-01
6.3 1.17E-01
7.5 9.26E-02
8.8 7.41E-02
10.0 5.97E-02
11.3 4.84E-02
12.5 3.94E-02
13.8 3.23E-02
15.0 2.65E-02
16.3 2.19E-02
17.5 1.81E-02
18.8 1.50E-02
20.0 1.25E-02
21.3 1.04E-02
22.5 8.74E-03
23.8 7.32E-03
25.0 6.15E-03

Remedial Targets

Remedial Target 1.76E+01 mg/l
Ogata Banks
Distance to compliance point 25 m
Concentration of contaminant at compliance point after C_{ED}/C₀ 6.15E-03 mg/l
1.0E+100 days Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2



Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Variable Value Unit Source

Contaminant Aliphatics EC16-EC21
Target Concentration C_T 3.00E-01 mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core C₀ 6.00E-01 mg/l
Half life for degradation of contaminant in water t_{1/2} 1.25E+03 days
Calculated decay rate λ 5.55E-04 days⁻¹
Width of plume in aquifer at source (perpendicular to flow) Sz 3.00E+00 m
Plume thickness at source Sy 8.69E-01 m
Saturated aquifer thickness da 1.32E+00 m
Bulk density of aquifer materials ρ 1.63E+00 g/cm³
Effective porosity of aquifer n 1.30E-01 fraction
Hydraulic gradient i 4.20E-02 fraction
Hydraulic conductivity of aquifer K 4.10E-02 m/d
Distance to compliance point x 2.50E+01 m
Distance (lateral) to compliance point perpendicular to flow direction z 0.00E+00 m
Distance (depth) to compliance point perpendicular to flow direction y 0.00E+00 m
Time since pollutant entered groundwater t 1.00E+100 days
Parameters values determined from options

Partition coefficient K_d 5.85E+07 l/kg
Longitudinal dispersivity ax 1.86E+00 m
Transverse dispersivity az 1.86E-01 m
Vertical dispersivity ay 1.86E-02 m

Calculated Parameters Variable

Groundwater flow velocity v 1.32E-02 m/d
Retardation factor R_f 7.33E+08 fraction
Decay rate used λ 7.56E-13 d⁻¹
Rate of contaminant flow due to retardation u 1.81E-11 m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion C_{ED} 5.39E-02 mg/l
Attenuation factor (one way vertical dispersion, CO/CED) AF 1.11E+01

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

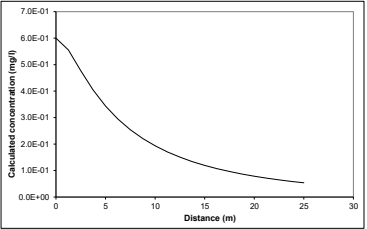
Entry if specify partition coefficient (option)

Soil water partition coefficient K_d l/kg
Entry for non-polar organic chemicals (option)
Fraction of organic carbon in aquifer f_{oc} 9.28E-02 fraction
Organic carbon partition coefficient K_{oc} 6.30E+08 l/kg
Entry for ionic organic chemicals (option)
Sorption coefficient for related species K_{oc,ion} l/kg
Sorption coefficient for ionised species K_{oc,i} l/kg
pH value pH
acid dissociation constant pKa
Fraction of organic carbon in aquifer f_{oc} fraction
Soil water partition coefficient K_d 5.85E+07 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

Longitudinal dispersivity ax 0.00E+00 m
Transverse dispersivity az 0.00E+00 m
Vertical dispersivity ay 0.00E+00 m
Note values of dispersivity must be > 0
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x
Xu & Eckstein (1995) report ax = 0.83(log₁₀x)²⁺¹⁴; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed: Ickleford Mill
Completed by: RMI
Date: #####
Version: 1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet
Distance Concentration

mg/l
0 6.0E-01
1.3 5.55E-01
2.5 4.77E-01
3.8 4.04E-01
5.0 3.44E-01
6.3 2.94E-01
7.5 2.54E-01
8.8 2.21E-01
10.0 1.93E-01
11.3 1.70E-01
12.5 1.51E-01
13.8 1.34E-01
15.0 1.20E-01
16.3 1.07E-01
17.5 9.64E-02
18.8 8.70E-02
20.0 7.87E-02
21.3 7.14E-02
22.5 6.48E-02
23.8 5.91E-02
25.0 5.39E-02

Remedial Targets

Remedial Target 3.34E+00 mg/l For comparison with measured groundwater concentration.
Ogata Banks
Distance to compliance point 25 m
Concentration of contaminant at compliance point after C_{ED}/C₀ 5.39E-02 mg/l
1.0E+100 days Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2



Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Variable Value Unit Source

Contaminant
Target Concentration
 C_T Aliphatics EC21-EC35
3.00E-01 mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core
 C_0 3.30E-01 mg/l
Half life for degradation of contaminant in water
 $t_{1/2}$ 1.25E+03 days
Calculated decay rate
 λ 5.55E-04 days⁻¹
Width of plume in aquifer at source (perpendicular to flow)
 S_z 3.00E+00 m
Plume thickness at source
 S_y 8.69E-01 m
Saturated aquifer thickness
 d_a 1.32E+00 m
Bulk density of aquifer materials
 ρ 1.63E+00 g/cm³
Effective porosity of aquifer
 n 1.30E-01 fraction
Hydraulic gradient
 i 4.20E-02 fraction
Hydraulic conductivity of aquifer
 K 4.10E-02 m/d
Distance to compliance point
 x 2.50E+01 m
Distance (lateral) to compliance point perpendicular to flow direction
 z 0.00E+00 m
Distance (depth) to compliance point perpendicular to flow direction
 y 0.00E+00 m
Time since pollutant entered groundwater
 t 1.00E+100 days

Parameters values determined from options

Partition coefficient
 K_d 5.86E+07 l/kg
Longitudinal dispersivity
 α_x 1.86E+00 m
Transverse dispersivity
 α_z 1.86E-01 m
Vertical dispersivity
 α_y 1.86E-02 m

Calculated Parameters Variable

Groundwater flow velocity
 v 1.32E-02 m/d
Retardation factor
 R_f 7.34E+08 fraction
Decay rate used
 λ 7.55E-13 d⁻¹
Rate of contaminant flow due to retardation
 u 1.80E-11 m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion
 C_{ED} 2.96E-02 mg/l
Attenuation factor (one way vertical dispersion, CO/CED)
 AF 1.11E+01

Remedial Targets

Remedial Target 3.34E+00 mg/l
Ogata Banks
Distance to compliance point 25 m
Concentration of contaminant at compliance point after
 C_{ED}/C_0 2.96E-02 mg/l
1.0E+100 days Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer

Organic carbon partition coefficient

Entry for ionic organic chemicals (option)

Sorption coefficient for related species

Sorption coefficient for ionised species

pH value

acid dissociation constant

Fraction of organic carbon in aquifer

Soil water partition coefficient

 K_d l/kg f_{oc} 9.28E-02 fraction K_{oc} 6.31E+08 l/kg $K_{oc,i}$ l/kg $K_{oc,i}$ l/kg

pH

pKa

 f_{oc} fraction K_d 5.86E+07 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

Longitudinal dispersivity

 α_x Enter value 0.00E+00 Calc value Xu & Eckstein 2.50E+01 1.86E+00 m

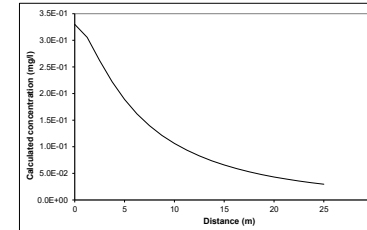
Transverse dispersivity

 α_z 0.00E+00 2.50E-01 1.86E-01 m

Vertical dispersivity

 α_y 0.00E+00 2.50E-01 1.86E-02 m

Note values of dispersivity must be > 0

For calculated value, assumes $\alpha_x = 0.1 * x$, $\alpha_z = 0.01 * x$, $\alpha_y = 0.001 * x$
Xu & Eckstein (1995) report $\alpha_x = 0.83(\log_{10} x)^{2.414}$; $\alpha_z = \alpha_x/10$, $\alpha_y = \alpha_x/100$ are assumed

Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed: Ickleford Mill

Completed by: RMI

Date: #####

Version: 1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet
Distance Concentration

mg/l
0 3.3E-01
1.3 3.05E-01
2.5 2.62E-01
3.8 2.22E-01
5.0 1.89E-01
6.3 1.62E-01
7.5 1.40E-01
8.8 1.21E-01
10.0 1.06E-01
11.3 9.36E-02
12.5 8.28E-02
13.8 7.37E-02
15.0 6.58E-02
16.3 5.90E-02
17.5 5.30E-02
18.8 4.78E-02
20.0 4.33E-02
21.3 3.92E-02
22.5 3.57E-02
23.8 3.25E-02
25.0 2.96E-02

R&D Publication 20 Remedial Targets Worksheet, Release 3.2



Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Variable Value Unit Source

Contaminant
Target Concentration
 C_T Aromatics EC10-EC12
9.00E-02 mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core
 C_0 7.00E-02 mg/l
Half life for degradation of contaminant in water
 $t_{1/2}$ 3.00E+02 days
Calculated decay rate
 λ 2.31E-03 days⁻¹
Width of plume in aquifer at source (perpendicular to flow)
 S_z 3.00E+00 m
Plume thickness at source
 S_y 8.69E-01 m
Saturated aquifer thickness
 d_a 1.32E+00 m
Bulk density of aquifer materials
 ρ 1.63E+00 g/cm³
Effective porosity of aquifer
 n 1.30E-01 fraction
Hydraulic gradient
 i 4.20E-02 fraction
Hydraulic conductivity of aquifer
 K 4.10E-02 m/d
Distance to compliance point
 x 2.50E+01 m
Distance (lateral) to compliance point perpendicular to flow direction
 z 0.00E+00 m
Distance (depth) to compliance point perpendicular to flow direction
 y 0.00E+00 m
Time since pollutant entered groundwater
 t 1.00E+100 days

Parameters values determined from options

Partition coefficient
 K_d 2.32E+02 l/kg
Longitudinal dispersivity
 α_x 1.86E+00 m
Transverse dispersivity
 α_z 1.86E-01 m
Vertical dispersivity
 α_y 1.86E-02 m

Calculated Parameters Variable

Groundwater flow velocity
 v 1.32E-02 m/d
Retardation factor
 R_f 2.91E+03 fraction
Decay rate used
 λ 7.94E-07 d⁻¹
Rate of contaminant flow due to retardation
 u 4.55E-06 m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion
 C_{ED} 5.21E-04 mg/l
Attenuation factor (one way vertical dispersion, CO/CED)
AF 1.34E+02

Remedial Targets

Remedial Target 1.21E+01 mg/l
Ogata Banks
Distance to compliance point 25 m
Concentration of contaminant at compliance point after
 C_{ED}/C_0 5.21E-04 mg/l
1.0E+100 days Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient

 K_d l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer

 f_{oc} 9.28E-02 fraction

Organic carbon partition coefficient

 K_{oc} 2.50E+03 l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species

 $K_{oc,i}$ l/kg

Sorption coefficient for ionised species

 $K_{oc,i}$ l/kg

pH value

pH

acid dissociation constant

pKa

Fraction of organic carbon in aquifer

 f_{oc} fraction

Soil water partition coefficient

 K_d 2.32E+02 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

Longitudinal dispersivity

 α_x 0.00E+00 m

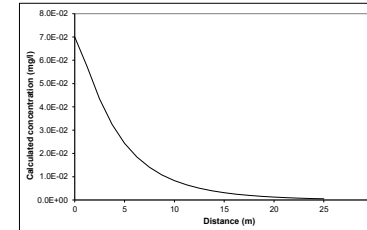
Transverse dispersivity

 α_z 0.00E+00 m

Vertical dispersivity

 α_y 0.00E+00 m

Note values of dispersivity must be > 0

For calculated value, assumes $\alpha_x = 0.1 \cdot x$, $\alpha_z = 0.01 \cdot x$, $\alpha_y = 0.001 \cdot x$
Xu & Eckstein (1995) report $\alpha_x = 0.83(\log_{10} x)^{2.14}$; $\alpha_z = \alpha_x/10$, $\alpha_y = \alpha_x/100$ are assumed

Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed: Ickleford Mill

Completed by: RMI

Date: #####

Version: 1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet
Distance Concentration

mg/l
0 7.0E-02
1.3 5.72E-02
2.5 4.34E-02
3.8 3.24E-02
5.0 2.44E-02
6.3 1.84E-02
7.5 1.40E-02
8.8 1.08E-02
10.0 8.33E-03
11.3 6.47E-03
12.5 5.06E-03
13.8 3.97E-03
15.0 3.13E-03
16.3 2.48E-03
17.5 1.97E-03
18.8 1.57E-03
20.0 1.25E-03
21.3 1.00E-03
22.5 8.05E-04
23.8 6.47E-04
25.0 5.21E-04

R&D Publication 20 Remedial Targets Worksheet, Release 3.2



Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Variable Value Unit Source

Contaminant
Target Concentration C_T Aromatics EC12-EC16
9.00E-02 mg/l from Level 1
from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core C₀ 2.90E-01 mg/l
Half life for degradation of contaminant in water t_{1/2} 4.15E+02 days
Calculated decay rate λ 1.67E-03 days⁻¹
Width of plume in aquifer at source (perpendicular to flow) Sz 3.00E+00 m
Plume thickness at source Sy 8.69E-01 m
Saturated aquifer thickness da 1.32E+00 m
Bulk density of aquifer materials ρ 1.63E+00 g/cm³
Effective porosity of aquifer n 1.30E-01 fraction
Hydraulic gradient i 4.20E-02 fraction
Hydraulic conductivity of aquifer K 4.10E-02 m/d
Distance to compliance point x 2.50E+01 m
Distance (lateral) to compliance point perpendicular to flow direction z 0.00E+00 m
Distance (depth) to compliance point perpendicular to flow direction y 0.00E+00 m
Time since pollutant entered groundwater t 1.00E+100 days
Parameters values determined from options

Partition coefficient K_d 4.64E+02 l/kg
Longitudinal dispersivity ax 1.86E+00 m
Transverse dispersivity az 1.86E-01 m
Vertical dispersivity ay 1.86E-02 m

Calculated Parameters Variable

Groundwater flow velocity v 1.32E-02 m/d
Retardation factor R_f 5.82E+03 fraction
Decay rate used λ 2.87E-07 d⁻¹
Rate of contaminant flow due to retardation u 2.28E-06 m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion C_{ED} 4.96E-03 mg/l
Attenuation factor (one way vertical dispersion, CO/CED) AF 5.85E+01

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

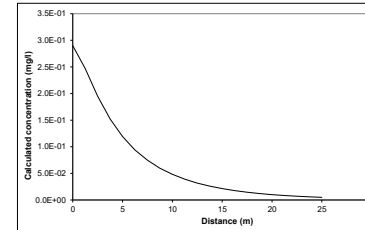
Entry if specify partition coefficient (option)

Soil water partition coefficient K_d l/kg
Fraction of organic carbon in aquifer f_{oc} 9.28E-02 fraction
Organic carbon partition coefficient K_{oc} 5.00E+03 l/kg
Sorption coefficient for related species K_{oc,rel} l/kg
Sorption coefficient for ionised species K_{oc,i} l/kg
pH value pH
acid dissociation constant pKa
Fraction of organic carbon in aquifer f_{oc} fraction
Soil water partition coefficient K_d 4.64E+02 l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

Longitudinal dispersivity ax 0.00E+00 2.50E+01 1.86E+00 m
Transverse dispersivity az 0.00E+00 2.80E-01 1.86E-01 m
Vertical dispersivity ay 0.00E+00 2.90E-02 1.86E-02 m
Note values of dispersivity must be > 0
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x
Xu & Eckstein (1995) report ax = 0.83(log₁₀x)²⁺¹⁴; az = ax/10, ay = ax/100 are assumed



Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet
Distance Concentration

mg/l
0 2.9E-01
1.3 2.47E-01
2.5 1.95E-01
3.8 1.52E-01
5.0 1.19E-01
6.3 9.39E-02
7.5 7.46E-02
8.8 5.97E-02
10.0 4.81E-02
11.3 3.90E-02
12.5 3.18E-02
13.8 2.60E-02
15.0 2.14E-02
16.3 1.76E-02
17.5 1.46E-02
18.8 1.21E-02
20.0 1.01E-02
21.3 8.42E-03
22.5 7.04E-03
23.8 5.90E-03
25.0 4.96E-03

Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed: Ickleford Mill
Completed by: RMI
Date: #####
Version: 1

Remedial Targets

Remedial Target 5.27E+00 mg/l For comparison with measured groundwater concentration.
Ogata Banks
Distance to compliance point 25 m
Concentration of contaminant at compliance point C_{ED}/C₀ 4.96E-03 mg/l
after 1.0E+100 days Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2



Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Variable Value Unit Source

Contaminant Aromatics EC16-EC21 from Level 1
Target Concentration C_T 9.00E-02 mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks Equations in HRA publication

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core C₀ 3.90E-01 mg/l
Half life for degradation of contaminant in water t_{1/2} 4.15E+02 days
Calculated decay rate λ 1.67E-03 days⁻¹
Width of plume in aquifer at source (perpendicular to flow) Sz 3.00E+00 m
Plume thickness at source Sy 8.69E-01 m
Saturated aquifer thickness da 1.32E+00 m
Bulk density of aquifer materials ρ 1.63E+00 g/cm³
Effective porosity of aquifer n 1.30E-01 fraction
Hydraulic gradient i 4.20E-02 fraction
Hydraulic conductivity of aquifer K 4.10E-02 m/d
Distance to compliance point x 2.50E+01 m
Distance (lateral) to compliance point perpendicular to flow direction z 0.00E+00 m
Distance (depth) to compliance point perpendicular to flow direction y 0.00E+00 m
Time since pollutant entered groundwater t 1.00E+100 days
Parameters values determined from options

Partition coefficient K_d 1.48E+03 l/kg
Longitudinal dispersivity ax 1.86E+00 m
Transverse dispersivity az 1.86E-01 m
Vertical dispersivity ay 1.86E-02 m

Calculated Parameters Variable

Groundwater flow velocity v 1.32E-02 m/d
Retardation factor R_f 1.86E+04 fraction
Decay rate used λ 8.97E-08 d⁻¹
Rate of contaminant flow due to retardation u 7.11E-07 m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion C_{ED} 6.66E-03 mg/l
Attenuation factor (one way vertical dispersion, CO/CED) AF 5.85E+01

Select Method for deriving Partition Co-efficient (using pull down menu)

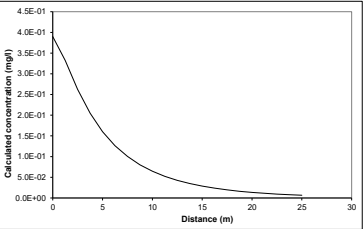
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)
Soil water partition coefficient K_d 1.48E+03 l/kg
Entry for non-polar organic chemicals (option)
Fraction of organic carbon in aquifer foc 9.28E-02 fraction
Organic carbon partition coefficient K_{oc} 1.60E+04 l/kg
Entry for ionic organic chemicals (option)
Sorption coefficient for related species K_{oc,rel} l/kg
Sorption coefficient for ionised species K_{oc,i} l/kg
pH value pH
acid dissociation constant pKa
Fraction of organic carbon in aquifer foc fraction

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

Longitudinal dispersivity ax 0.00E+00 m
Transverse dispersivity az 0.00E+00 m
Vertical dispersivity ay 0.00E+00 m
Note values of dispersivity must be > 0
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x
Xu & Eckstein (1995) report ax = 0.83(log₁₀x)²⁺¹⁴; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet
Distance Concentration

0 3.9E-01
1.3 3.32E-01
2.5 2.62E-01
3.8 2.05E-01
5.0 1.26E-01
6.3 1.00E-01
7.5 8.03E-02
8.8 6.47E-02
10.0 5.24E-02
11.3 4.27E-02
12.5 3.80E-02
13.8 2.87E-02
15.0 2.37E-02
16.3 1.96E-02
17.5 1.63E-02
18.8 1.36E-02
20.0 1.13E-02
21.3 9.47E-03
22.5 7.94E-03
23.8 6.66E-03
25.0

Remedial Targets

Remedial Target 5.27E+00 mg/l For comparison with measured groundwater concentration.
Ogata Banks
Distance to compliance point 25 m
Concentration of contaminant at compliance point after C_{ED}/C₀ 6.66E-03 mg/l
after 1.0E+100 days Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Site being assessed: Ickleford Mill
Completed by: RMI
Date: #####
Version: 1



Hydrogeological risk assessment for land contamination Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

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The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

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IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions

Details to be completed for each assessment

Site Name:	Ickleford Mill		
Site Address:	Arlesey Road		
Completed by:	RMI		
Date:	12-Dec-25	Version:	1
Contaminant	Aromatics EC21-EC35		
Target Concentration (C _T)	0.09	mg/l	Origin of C _T : WHO

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparison with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).

Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.

Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.

Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.

Data carried forward from an earlier worksheet are identified by a light green background

It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2



Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant				
Target Concentration	C _T	Benzo(a)pyrene	1.70E-04	mg/l

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
-------------	------------------------------

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	1.70E-04	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	1.40E+03	days	Groundtech Consulting Ltd 19/20485
Calculated decay rate	λ	4.35E-04	days ⁻¹	EA RD P45
Width of plume in aquifer at source (perpendicular to flow)	Sz	3.00E+00	m	Estimated from site data
Plume thickness at source	Sy	8.69E-01	m	Estimated from site data
Saturated aquifer thickness	da	1.32E+00	m	Estimated from site data. In WS17, CLAY
Bulk density of aquifer materials	ρ	1.63E+00	g/cm ³	Estimated
Effective porosity of aquifer	n	1.30E-01	fraction	Estimated from site data
Hydraulic gradient	i	4.20E-02	fraction	Site specific
Hydraulic conductivity of aquifer	K	4.10E-02	m/d	Site specific
Distance to compliance point	x	2.50E+01	m	Site specific
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	Site specific
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	Site specific
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only

Parameters values determined from options

Partition coefficient	Kd	8.50E+01	l/kg	see options
Longitudinal dispersivity	ax	1.86E+00	m	see options
Transverse dispersivity	az	1.86E-01	m	see options
Vertical dispersivity	ay	1.86E-02	m	see options

Calculated Parameters

Groundwater flow velocity	v	1.32E-02	m/d
Retardation factor	Rf	1.07E+03	fraction
Decay rate used	λ	4.64E-07	d ⁻¹
Rate of contaminant flow due to retardation	u	1.24E-05	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	1.68E-05	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	1.01E+01	

Remedial Targets

Remedial Target	1.72E-03	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	25	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	1.68E-05	mg/l
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)	foc	9.28E-02	fraction
Fraction of organic carbon in aquifer	Koc	9.16E+02	l/kg
Organic carbon partition coefficient	K _{oc, n}		l/kg
Sorption coefficient for related species	K _{oc, i}		l/kg
Sorption coefficient for ionised species	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	8.50E+01	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

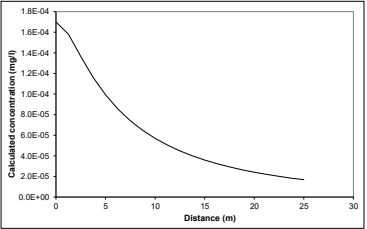
		Enter value	Calc value Xu & Eckstein	m
Longitudinal dispersivity	ax	0.00E+00	2.50E+00	1.86E+00
Transverse dispersivity	az	0.00E+00	2.50E-01	1.86E-01
Vertical dispersivity	ay	0.00E+00	2.50E-02	1.86E-02

Note: values of dispersivity must be > 0

For calculated value, assumes $\alpha_x = 0.1^* \times$, $\alpha_z = 0.01^* \times$, $\alpha_y = 0.001^* \times$

Xu & Eckstein (1995) report $\alpha_x = 0.83(\log_{10} \alpha_x)^{4.14}$; $\alpha_z = \alpha_{10}$, $\alpha_y = \alpha_{10}/10$ are assumed

Note values of dispersivity must be > 0
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x
Xu & Eckstein (1995) report ax = 0.83(log₁₀x)²⁺¹⁴; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed:	Ickleford Mill
Completed by:	RMT
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.7E-04
1.3	1.58E-04
2.5	1.36E-04
3.8	1.16E-04
5.0	9.93E-05
6.3	8.55E-05
7.5	7.41E-05
8.8	6.48E-05
10.0	5.70E-05
11.3	5.04E-05
12.5	4.48E-05
13.8	4.01E-05
15.0	3.60E-05
16.3	3.24E-05
17.5	2.93E-05
18.8	2.65E-05
20.0	2.41E-05
21.3	2.20E-05
22.5	2.01E-05
23.8	1.84E-05
25.0	1.68E-05

R&D Publication 20 Remedial Targets Worksheet, Release 3.2



Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Fluoranthene		from Level 1
Target Concentration	C _T	6.30E-06	mg/l from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks	Equations in HRA publication
-------------	------------------------------

Approach for simulating vertical dispersion:

Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants:

Apply degradation rate to dissolved pollutants only

Initial contaminant concentration in groundwater at plume core	C ₀	7.00E-05	mg/l	
Half life for degradation of contaminant in water	t _{1/2}	1.05E+03	days	Howard et al.
Calculated decay rate	λ	6.60E-04	days ⁻¹	Estimated
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+00	m	Site specific
Plume thickness at source	Sy	1.18E+00	m	Site specific
Saturated aquifer thickness	da	3.49E+00	m	Estimated
Bulk density of aquifer materials	ρ	1.95E+00	g/cm ³	Estimated
Effective porosity of aquifer	n	2.00E-01	fraction	Estimated
Hydraulic gradient	i	6.96E-02	fraction	Site specific
Hydraulic conductivity of aquifer	K	4.10E-02	m/d	Site specific
Distance to compliance point	x	2.50E+01	m	Site specific
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only

Parameters values determined from options

Partition coefficient	Kd	6.13E+02	l/kg	see options
Longitudinal dispersivity	ax	1.86E+00	m	see options
Transverse dispersivity	az	1.86E-01	m	see options
Vertical dispersivity	ay	1.86E-02	m	see options

Calculated Parameters

Groundwater flow velocity	v	1.43E-02	m/d
Retardation factor	Rf	5.97E+03	fraction
Decay rate used	λ	1.10E-07	d ⁻¹
Rate of contaminant flow due to retardation	u	2.39E-06	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{ED}	1.10E-05	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	AF	6.39E+00	

Remedial Targets

Remedial Target	4.02E-05	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	25	m	
Concentration of contaminant at compliance point after	C _{ED} /C ₀	1.10E-05	mg/l
		1.0E+100	days

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target. The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)	foc	2.20E-02	fraction
Fraction of organic carbon in aquifer	Koc	2.78E+04	l/kg
Organic carbon partition coefficient	K _{oc,n}		l/kg
Sorption coefficient for related species	K _{oc,r}		l/kg
Sorption coefficient for ionised species	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	6.13E+02	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivity based on Xu & Eckstein (1995)

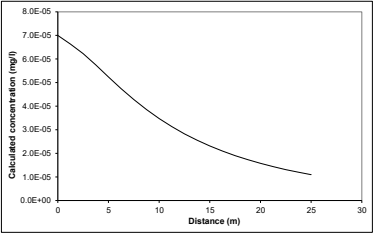
		Enter value	Calc value Xu & Eckstein	m
Longitudinal dispersivity	ax	0.00E+00	2.50E+00	1.86E+00
Transverse dispersivity	az	0.00E+00	2.50E-01	1.86E-01
Vertical dispersivity	ay	0.00E+00	2.50E-02	1.86E-02

Note: values of dispersivity must be > 0

For calculated value, assumes $\alpha_x = 0.1^* \times$, $\alpha_z = 0.01^* \times$, $\alpha_y = 0.001^* \times$

Xu & Eckstein (1995) report $\alpha_x = 0.83(\log_{10} \alpha_x)^{4.14}$; $\alpha_z = \alpha_{10}$, $\alpha_y = \alpha_{10}/10$ are assumed

Note values of dispersivity must be > 0
For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x
Xu & Eckstein (1995) report ax = 0.83(log₁₀)^{2.414}; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source. Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O₂, NO₃, SO₄ etc than an alternative solution should be used

Site being assessed:	Ickleford Mill
Completed by:	RMI
Date:	#####
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	7.0E-05
1.3	6.63E-05
2.5	6.23E-05
3.8	5.75E-05
5.0	5.24E-05
6.3	4.74E-05
7.5	4.28E-05
8.8	3.86E-05
10.0	3.47E-05
11.3	3.13E-05
12.5	2.83E-05
13.8	2.55E-05
15.0	2.31E-05
16.3	2.10E-05
17.5	1.90E-05
18.8	1.73E-05
20.0	1.57E-05
21.3	1.44E-05
22.5	1.31E-05
23.8	1.20E-05
25.0	1.10E-05

Appendix 5 – Risk Assessment Methodology

The potential risks to human health and environmental receptors have been considered in accordance with current national guidance and approach to contaminated land assessment. The risk assessment considers available information on the construction and operational phases of the proposed development.

The method for risk evaluation considers the magnitude of the potential severity of the hazard and the probability of occurrence. The risk characterisation has been assessed based on the qualitative method of interpretation set out in CIRIA C552 and NHBC risk classification methodology.

Table A3.1 Classification of Consequence (Severity)

Classification	Definition
Severe	Short-term (acute) risk to human health likely to result in 'significant harm' as defined by the Environmental Protection Act 1990, Part 2A. Short-term risk of pollution of a sensitive water resource. Catastrophic damage to buildings or property. A short-term risk to an ecosystem, or organism forming part of such ecosystem.
Medium	Chronic damage to human health. Pollution of a sensitive water resource. A significant change to an ecosystem, or organism forming part of such ecosystem.
Mild	Pollution of a non-sensitive water resource, such as non-classified groundwater. Damage to buildings, structures and services.
Minor	Harm which may result in a financial loss, or expenditure to resolve. Non-permanent effects to human health which could easily be prevented by means such as personal protective equipment (PPE). Easily repairable effects of damage to buildings, structures and services

Table A3.2 Classification of Probability

Classification	Definition
High likelihood	There is a contaminant linkage, and an event that either appears very likely in the short-term and almost inevitable over the long-term, or there is evidence at the receptor of harm or pollution.
Likely	There is a contaminant linkage, and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible over the short-term and likely over the long-term.
Low likelihood	There is a contaminant linkage, and circumstances are possible under which an event could occur. However, it is not certain that such an event would take place.
Unlikely	There is a contaminant linkage, but circumstances are such that it is improbable that an event would occur even in the very long-term.

Table A3.3 Risk Assessment Matrix

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High likelihood	Very high risk	High risk	Moderate risk	Moderate to low risk
	Likely	High risk	Moderate risk	Moderate to low risk	Low risk
	Low likelihood	Moderate risk	Moderate to low risk	Low risk	Very Low risk
	Unlikely	Moderate to low risk	Low risk	Very Low risk	Very Low risk

Table A3.2 Risk Classification

Classification	Description of risk
Very high	There is a high probability that severe harm could arise to a designated receptor from an identified contaminant linkage at the site without appropriate remediation action. Or there is evidence that severe harm to a designated receptor is currently happening. Realisation of the risk is likely to result in substantial liability.
High	Harm is likely to arise to a designated receptor from an identified contaminant linkage at the site without appropriate remediation action. Realisation of the risk is likely to present a substantial liability.
Moderate	It is possible that without appropriate remediation action harm could arise to a designated receptor from an identified contaminant linkage. It is relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely that such harm would be relatively mild.
Low	It is possible that harm could arise to a designated receptor from an identified contaminant linkage. It is likely that if any harm was realised at worst any effects would be mild.
Very low	The presence of an identified contaminant linkage does not give rise to the potential to cause harm to a designated receptor.



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