



SGN Commercial Services Limited

GAS HOLDER SITE, READING

Controlled Waters Detailed Quantitative Risk
Assessment





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Controlled Waters Detailed Quantitative Risk Assessment

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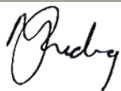
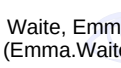
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CONTENTS

EXECUTIVE SUMMARY

1.	INTRODUCTION	3
1.1.	AIM	3
1.2.	PREVIOUS INVESTIGATION REPORTING	3
1.3.	CONFIDENTIALITY STATEMENT AND LIMITATIONS	4
2.	LEGISLATIVE CONTEXT	5
3.	CONCEPTUAL SITE MODEL (CSM)	7
3.1.	INTRODUCTION	7
4.	POTENTIAL CONTAMINANT LINKAGES	13
5.	DETAILED QUANTITATIVE RISK ASSESSMENT	16
5.1.	INTRODUCTION	16
5.2.	PRIORITY CONTAMINANTS	16
5.3.	GENERAL MODEL INPUT PARAMETERS – P20	24
5.4.	P20 MODEL RESULTS	25
5.5.	P20 MODEL SENSITIVITY	29
5.6.	P20 SUMMARY	30
6.	BIOCHLOR RISK ASSESSMENT	31
6.1.	BIOCHLOR MODEL PARAMETERS	31
6.2.	BIOCHLOR MODEL CALIBRATION AND RESULTS	40
6.3.	BIOCHLOR SUMMARY	52
7.	CONCLUSIONS AND RECOMMENDATIONS	53
7.1.	RECOMMENDATIONS	53

TABLES

Table 4-1 – Revised Potential Contaminant Linkages (PCL)	14
Table 5-1 - Selection of Priority Contaminants Driving the Risk to the Surface Waters	18
Table 5-2 – Selection of Priority Contaminants Driving the Risk to Chalk Aquifer Resource Potential	21
Table 5-3 - Summary of Exceedances of the Groundwater L3 SSAC Derived for the Protection of the Surface Waters. (Concentrations within the Chalk not included)	26
Table 5-4 – Summary of Exceedances of the L3 SSAC for Soils Derived for the Protection of the Groundwater Resource	28
Table 5-5 - Summary of Exceedances of the L3 SSAC for Groundwater Derived for the Protection of the Groundwater Resource	28
Table 6-1 - Observed Distribution (% mass) of Chlorinated Solvents by Location	33
Table 6-2 - Distribution (% mass) of the Chlorinated Solvents by species	34
Table 6-3 - Summary Statistics and Pure Phase Solubility Limits (µg/l). Number of observations 51.	35
Table 6-4 - Source Concentrations taken from 2020 monitoring (all units µg/l) used to populate models 1 and 2	37
Table 6-5 - The First Order Decay Coefficients applied in our initial BIOCHLOR Model	40
Table 6-6 - Observed Concentrations in BH105 (all units are µg/l)	40
Table 6-7 - Biochlor Model Results – Risk to the River Thames	45
Table 6-8 - Dilution calculation parameters (worst case values)	46
Table 6-9 - Level 4 Assessment Results	47
Table 6-10 - Biochlor Model 2 Results – Risk to future resource potential at 400m distance in the Chalk	48
Table 6-11 - BIOCHLOR Results – Baseline Model 1 Scenario vs Worst Case Conditions (+40% K and i)	50
Table 6-12 - Biochlor Model 1 Scenario Sensitivity Analysis Results – Risk to the River Thames	51

FIGURES

Figure 3-1 – Interpolated Groundwater flows within the RTG and Chalk Aquifer (9 and 19 April 2019, 1 October 2019 and 10 February 2020).	9
Figure 6-1 - Concentrations of the chlorinated species in groundwaters at BH101 suggestive of a depleting mass	36
Figure 6-2 – Rate of Declining Concentrations at BH101	36
Figure 6-3 - BIOCHLOR model calibration set up	42
Figure 6-4 BIOCHLOR model 1 calibration results by species.	43

APPENDICES

APPENDIX A - DRAWINGS

APPENDIX B - REPORT LIMITATIONS

APPENDIX C - MODEL SUPPORTING INFORMATION

APPENDIX D - SCREENING TABLES

APPENDIX E - P20 WORKSHEETS

EXECUTIVE SUMMARY

Site	Gas Holder Site, Alexander Turner Close, Reading
Client	SGN Commercial Services Limited
Aim	The primary aim of this assessment has been to provide a detailed and updated evaluation of potential risks to Controlled Waters from historically observed contamination at the Site.
Principal Contaminant Sources	Site investigation has previously identified several leachate and groundwater contaminant exceedances in a comparison against generic and conservative screening criteria, including hydrocarbons, metals and inorganics. These have been identified principally towards the Site's western corner adjacent to gas holder No.4 and in proximity of a former tar tank. Contaminants of potential concern identified within the historic generic screening included: • Metals (iron manganese and zinc); • Ammoniacal nitrogen and Cyanide; • Benzo(a)pyrene and Polyaromatic hydrocarbons (PAH sum of 4); • Benzene; • Aromatics >C8-C10 and C10-C12 hydrocarbons; and • Chlorinated solvents (PCE, TCE, DCE and Vinyl Chloride).
Evidence of Free Product (NAPL)	During drilling in April 2019 strong hydrocarbon odours and an oil sheen were reported from one location (BH202) within the River Terrace Gravels at 6 m bgl and from within fractures in the Chalk at ~14-16 m bgl at this same location. During the development and purging of this well, evidence of gross hydrocarbons in the form of globules and sheen were recorded, however no measurable NAPL thickness was recorded in the well. Subsequently three boreholes drilled in September 2019 (BH301-303) in proximity to BH202 confirmed strong visual and olfactory evidence of residual hydrocarbon contamination in the Chalk in BH301 & BH302; hydrocarbon impact (including sheens and globules of hydrocarbon product) were also noted with the Made Ground and River Terrace Gravels above the Chalk in these locations. No NAPL thickness in wells was observed during the following monitoring rounds, however, black globules and sheen were noted in waters retrieved from BH302A. In summary, no measurable NAPL has been recorded in any monitoring wells at the site and the enclosed DQRA has assessed risk from the recorded dissolved phase only. Any residual gross contamination in the form of globules will continue to represent an ongoing source of dissolved phase contamination.
Potential Receptors to dissolved phase	■ Potential Contaminant Linkage 3 (PCL3) – Receptor: Dependent Surface Waters as the River Thames at 240 m northwest from the Site; and ■ Potential Contaminant Linkage 4 (PCL4) – Receptor: Future Resource Protection (Chalk aquifer) at 400 m distance. (Currently, closest water abstraction at 619 m east). Note the numbering of the contaminant linkages follow historic reporting.
Model Approach	Site specific assessment criteria have been derived using the Remedial Target Worksheet (RTM P20 Model). In addition, the risks from the chlorinated solvents have been assessed using BIOCHLOR, to account for the generation of degradation of PCE and TCE daughter products.

Principal Assumptions	The modelling has assumed: ■ Linear soil water partitioning; ■ No vertical migration and attenuation through the Alluvium and River Terrace Gravels; ■ A hydraulic connection to exist from groundwaters below the site to the confluence of the River Thames and River Kennet under precautionary principles; ■ No account for dilution in the River Thames that would reduce risks; ■ No account for attenuation in the hyporheic zone of the River that may also reduce risks; and that ■ A theoretical potable abstraction may arise in the future so as to be compliant with the expectations of guidance.
Summary of Projected Risks	Despite the delivery of a greater site-specific assessment, a risk projection remains e.g. ■ Potential Contaminant Linkage 3 (PPL3) – Receptor: Dependent Surface Waters – Low to Moderate Risk (from TCE, PCE, cyanide and TPH C8-C10) ■ Potential Contaminant Linkage 4 (PPL4) – Receptor: Future resource protection – Low Moderate Risk (from ammoniacal nitrogen and cyanide)
Conclusions & Recommendations	Based on the results of this DQRA, conditions at the Site remain to suggest a potential risk to controlled water receptors. Remedial works are required to reduce these identified theoretical risks to groundwaters and surface water prior to Site redevelopment in-line with the Remediation Scheme which will be developed for the Site. Finally, the decision to remediate should strike a reasonable balance between: (a) dealing with risks raised by contaminants in land and the benefits of remediating land to remove or reduce those risks; and (b) the financial costs to whoever will pay for remediation, health and environmental impacts of taking action, property blight, and burdens on affected people. The authority should take a precautionary approach to the risks raised by contamination, whilst avoiding a disproportionate approach given the circumstances of each case. The aim should be to consider the various benefits and costs of acting, with a view to ensuring that remediation produces net benefits, taking account of local circumstances. It is considered likely that if dilution into surface waters were to be considered then risk to this receptor would reduce below concern.

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1. INTRODUCTION

WSP was instructed by Danescroft (Kenavon Drive Project Management) LLP (“the Client”) on behalf of SGN Commercial Services Limited (SGN) to undertake a Controlled Waters Detailed Quantitative Risk Assessment (DQRA). The works are required to support a detailed planning application for the proposed residential development of ‘Gas Holder No.4 Site’ at Alexander Turner Close, Reading (“the Site”). WSP was instructed by SGN to update this risk assessment following additional rounds of monitoring and agreements from the Environment Agency on adoption of refined compliance points. The updates have been conducted with reference to WSP proposal, dated 10 June 2021 (SGN reference 2820003081).

Statutory guidance identifies that for the pollution of the Controlled Waters to occur; poisonous, noxious, polluting or solid waste matter must be entering such waters or must be considered more likely than not to enter such waters in the future.

The Site’s location and its current layout plan are presented respectively in Drawings 70031882-001 and 70031882-002 in **Appendix A**.

The contents of this report have been delivered specifically for the attention of suitably qualified persons and the regulator. Consequently, the developer is directed towards its conclusions and the Remediation Scheme that are to be delivered under separate cover. The latter document has been prepared as outline recommendations with the remedial contractor being responsible for any future detailed remediation designs.

1.1. AIM

Both Part IIA of the Environmental Protection Act 1990 and planning allows consideration of a Detailed Quantitative Risk Assessment (DQRA) should the available data suggest a potential hazard to Controlled Waters as historically reported onsite. A DQRA should aim to make greater use of site-specific data to conduct a more accurate assessment of risk. Such a phased assessment of risk is compliant with the advice of Land Contamination Risk Management (LCRM)¹. Note that should the absence of significant risks be robustly demonstrated then the use and development of a DQRA can, on occasion, reduce/negate the need for physical intervention (remediation) at a site.

The principal aim of this assessment has consequently been to provide an updated and detailed evaluation of the potential risks to Controlled Waters from the Site.

1.2. PREVIOUS INVESTIGATION REPORTING

The following site investigation reports are available. They have been referred to by their corresponding numbers throughout this report and should be considered in full:

- 1 WSP (2016) Factual Site Investigation Report, Gas Holder No. 4, Kenavon Drive, Reading, May 2016, Project No. 287642I, Revision 1 (for SGN);

¹Environment Agency ‘Land Condition Risk Management’, LCRM October 2020 (updated April 2021).

- 2 WSP (2016) Interpretative Site Investigation Report, Gas Holder No. 4, Kenavon Drive, Reading, May 2016, Project No. 287642I, Revision 1 (for SGN);
- 3 WSP (2017) Off-Site Environmental Liability Assessment, Reading Gas Holder No. 4, June 2017, Project No. 70031882 (for Danescroft);
- 4 Gas Holder Site, Reading, Phase 2 Geo-Environmental and Geotechnical Site Assessment, WSP, April 2019. 70031882 (for Danescroft);
- 5 Gas Holder Site, Reading, Supplementary Phase 2 Geo-Environmental and Geotechnical Site Assessment, WSP, July 2019. 70031882-006 (for Danescroft); and
- 6 Gas Holder Site, Reading, Supplementary Site Investigation and Monitoring Report, WSP, March 2020 (for Danescroft). 70031882-011

Report Ref. [5] has previously summarised those site investigations undertaken by WSP from 2015 (reported in 2016) to 2019. Within Ref. [5] a conceptual site model (CSM) for the Site was developed and a Generic Quantitative Risk Assessment (GQRA) for Controlled Waters delivered.

Report Ref. [6] has since reported further investigation and monitoring undertaken in September and October 2019, and February 2020. The enclosed reporting now seeks to refine our understanding of this risk by more detailed assessment inclusive of the new field data.

Note that all site investigation locations referred to herein are as shown on Drawing 70031882-004 within **Appendix A**.

1.3. CONFIDENTIALITY STATEMENT AND LIMITATIONS

This report is addressed to and may be relied upon by SGN Limited and Danescroft. It may not be relied upon or transferred to any other parties without the express agreement of WSP UK Limited in writing. The report should be read and used in full. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party.

Third party information not directly commissioned by WSP UK Limited and used in the production of this report has been relied upon as being accurate. WSP UK Limited cannot and will not accept any liability for errors and/or omissions in data provided by others nor warrant the works of others. Report limitations are presented in **Appendix B**.

2. LEGISLATIVE CONTEXT

The presence of contaminated materials on a site is generally only of concern if an actual or potentially unacceptable risk exists. Part IIA was introduced into the Environmental Protection Act 1990.

Relevant sections of the Act as reflected under the planning legislation include:

- Section 78A(2): “contaminated land” as any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land that – (a) significant harm is being caused or there is a significant possibility of such harm being caused; or (b) significant pollution of Controlled Waters is being caused, or there is a significant possibility of such pollution being caused; while
- Section 78A(9) defines the term pollution of Controlled Waters in terms of the direct or indirect introduction into the water environment of substances which may give rise to harm to human health or the quality of ecosystems, result in damage to material property or impair or interfere with amenities and other legitimate uses of the water environment.

The following types of pollution are considered to constitute significant pollution of Controlled Waters:

- Pollution equivalent to “environmental damage” to surface water or groundwater as defined by The Environmental Damage (Prevention and Remediation) Regulations 2009, but which cannot be dealt with under those Regulations;
- Inputs resulting in deterioration of the quality of water abstracted, or intended to be used in the future, for human consumption such that additional treatment would be required to enable that use;
- A breach of a statutory surface water Environment Quality Standard (EQS), either directly or via a groundwater pathway; and/or
- Input of a substance into groundwater resulting in a significant and sustained upward trend in the concentration of contaminants (as defined in Article 2(3) of the Groundwater Daughter Directive (2006/118/EC)).

The Governments approach to protecting Controlled Waters additionally seeks to achieve the objectives of the relevant European Directives for those regulatory regimes where groundwater quality is, or may be, affected by inputs of polluting substances. The principles described are based on the European Commission Common Implementation Strategy for the Water Framework Directive (WFD) Guidance Document 17, ‘Guidance on Preventing or Limiting Inputs in the context of the Groundwater Directive 2006/118/EC (GWD)’ and the UK Technical Advisory Group (UKTAG) technical report 11 b (iii) ‘Application of Groundwater Standards to Regulation’, where these do not conflict with existing legislation.

In relation to the Site:

- Part IIA of The Environmental Protection Act 1990 effectively controls the passive release of contaminants from land where the original activity that led to the contamination has ceased. (If subsequent activities disturb the land and cause a release of contaminants that discharge to groundwater, an Environmental Permit may be required at that stage);
- The observed hydrocarbons and solvents reported at this Site would be classified as hazardous substances. Hazardous substances are defined in the WFD as “substances or groups of

substances that are toxic, persistent and liable to bio-accumulate, and other substances or groups of substances which give rise to an equivalent level of concern”;

- Where groundwater contamination already exists, as at the Site (Minimum Reporting Value/Level of Detection (LoD) exceeded), the regulator would typically seek the problem holder to:
 - Minimise expansion of the groundwater contaminant plume to protect future groundwater users and offsite receptors;
 - Prevent future pollution/damage of dependent surface water bodies; and
 - Prevent future deterioration in status of a groundwater or associated surface water bodies.
- Finally, it should be noted that some evidence of gross hydrocarbon contamination (potential residual Non-Aqueous Phase Liquid (NAPL)) has been observed at the Site, however no measurable NAPL has been observed to date. Residual NAPL is the fraction of a NAPL body that will remain immobile and hydraulically unrecoverable under prevailing hydraulic conditions (i.e., will not flow into a well). Residual NAPL represents a pore-scale concept whereby NAPL occupies a fraction of pore space that is discontinuous and too small for NAPL flow to occur. Residual NAPL is immobile/hydraulically unrecoverable and therefore should not contribute to migration risk. Residual NAPL may however continue to act as a source of dissolved phase contamination. Consequently, the risk assessment herein must continue to account for this dissolved phase risk. Supplementary site investigation works were undertaken in September 2019 to provide a better understanding of the potential residual NAPL. Results are presented under separate cover (Supplementary Site Investigation & Monitoring Report, March 2020 Ref.[6]).

The framework for assessing the risks to groundwater and surface water risk from contaminants are the:

- Environment Agency, ‘Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination’ 2006. (RTM); and
- Groundwater Protection, Groundwater Protection guides covering requirements, permissions, risk assessments and controls (previously covered in GP3), 2017.

3. CONCEPTUAL SITE MODEL (CSM)

3.1. INTRODUCTION

A CSM of plausible contaminant linkages including Controlled Waters was developed within our 2019 Supplementary Phase 2 Report (Ref. [5]); a summary of which is included below.

3.1.1. SITE SETTING AND HISTORY

The Site is located in the centre of Reading and in a mixed commercial and residential area. Centred on National Grid Reference 472925, 173675, the Site is generally flat, with an area of ~0.1Ha and sits at ~37 m AOD. The Site comprises a decommissioned gas holder and a vacant yard formerly utilised by SGN for the storage of plant and equipment. The Site contains a small electrical substation in its northwest corner. Railway tracks lie near to its northern boundary and the surrounding area has notable historic and current trade directory entries within proximity to the Site (including a car breakdown service, a scrap yard, electronic equipment manufacture, and a photographic processor).

A gasworks had been developed on the Site by the late 1890's, with gasworks structures (including a liquor tank, tar mains, purifiers and sulphate of ammonia plant) situated on its northern Site boundary and with railway lines passing through the centre of the Site. Gas holder no. 3, which crosses the current western Site boundary, was constructed in 1901. Notable off-site structures relative to the current red line boundary to the west at this time included a second gas holder, a tar tank, oil storage tank, a relief holder and a carburetted water gas (CWG) plant. Other notable historic off-site uses since the cessation of the gasworks included a photographic processor and a tin manufactures.

Gas holder no.4, located in the centre of the western portion of the Site was built in the late 1920's. The Site is shown in its current layout by 1990. Drawing 70031882-004 within **Appendix A** presents the historic Site structures.

3.1.2. HYDROLOGY, GEOLOGY AND HYDROGEOLOGY

The River Kennet bounds the Site to the southeast flowing northeast towards the River Thames. The confluence of both rivers occurs ~180 m northeast of the Sites boundary. The River Kennet is canalised adjacent to the Site.

The Site is underlain by Made Ground, generally including a sandy gravelly clay, with occasional cobbles and an average thickness of ~1.4 m. Alluvium deposits consisting of a soft silt with sandy gravelly clay and clayey sand layers underlay the Made Ground to approximately 4 m below ground level (m bgl). This Alluvium is in turn underlain by the Kempton Park Gravel Member of the River Terrace Gravels (RTG), which consist of sandy gravel and gravelly sand deposits approximately 5 m thick. Underlying these drift deposits the bedrock geology comprises the Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated).

The Environment Agency has classified the Alluvium and RTG as secondary aquifers and the Seaford Chalk Formation and Newhaven Chalk Formation as Principal Aquifers. The Site is also situated within a total catchment Source Protection Zone (SPZ) driven by a potable water abstraction located approximately 2 km south of the Site. Further potable water abstractions are located ~619 m east and 1 km southwest of the Site.

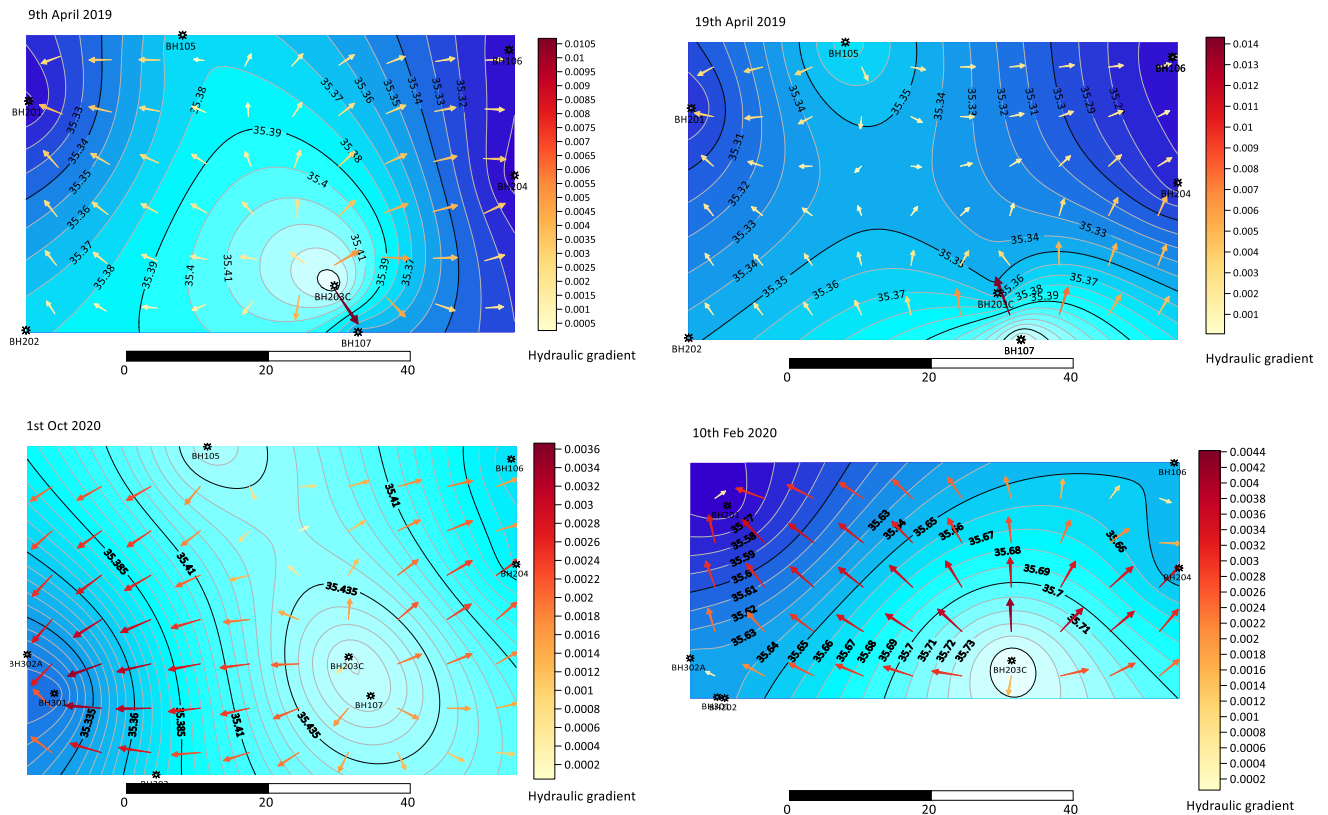
3.1.3. OBSERVED GROUNDWATERS

Groundwater monitoring has identified perched water within the Made Ground at between 1.28 and 1.36 m bgl. The relatively low permeable Alluvium (see hydraulic conductivity tests included in Ref. [5]) suggests a potential to confine the underlying RTG and Chalk aquifers. However, sandy pockets within the Alluvium, deep below ground structures (such as Gas Holder no. 3) which penetrate the Alluvium, and areas of deep Made Ground appear to have prevented the Alluvium as acting as a confining layer across the Site. Next, monitoring from within the RTG and Chalk present similar groundwater levels, noted between 1.71-2.0 m bgl and 1.89-1.98 m bgl, respectively, suggesting they are in hydraulic continuity. This has since been confirmed by the data gathered during the two monitoring rounds undertaken in October 2019 and February 2020.

As included in Ref. [5], groundwater monitoring data from April 2019 suggested that the groundwater within the RTG flowed to the north or northeast towards the River Thames (180 m northeast from the Site boundary), and the groundwater flow within the Chalk flowed to the east. However, when looking at the whole data set including the October 2019 and February 2020 monitoring rounds (Ref [6]), data shows a temporal variation of groundwater flow direction. Given that the River Kennet is lined in immediate proximity of the Site, a north-easterly direction towards the confluence of the River Kennet and the River Thames could be considered to be precautionary.

The hydraulic gradients for the RTG and Chalk aquifer were calculated for the P20 DQRA during the 2019 Supplementary Phase 2 Report. Five rounds of monitoring are now available these would suggest low gradients ranging 0.0005 to 0.0044 with a typical value of 0.002.

Figure 3-1 – Interpolated Groundwater flows within the RTG and Chalk Aquifer (9 and 19 April 2019, 1 October 2019 and 10 February 2020).



Groundwater Flow Regime (interpolated)

Includes those results from the River Terrace Gravels (RTG) and Chalk only

3.1.4. THE OBSERVED DISTRIBUTION OF CONTAMINANTS

Impacts have been observed within both the Made Ground, drift deposits and the Chalk. The top 1 m bgl of Made Ground soils are generally noted to be impacted across the Site irrespective of historic source locations. However, limited impact to groundwater has been observed in the east and southeast of the Site with groundwater concentrations generally low or below their laboratory level of detection (LoD) in boreholes BH203C (RTG), BH204 (RTG) and BH107 (Chalk) (Drawings 70031882-005 to 008 in **Appendix A** of Ref [5] and 70031882-004 to 005 in **Appendix A** of Ref [6]).

A summary of the main contamination observed from the recent site investigations and following the Controlled Waters GQRA is included below:

Soil Sampling Results

Soil quality data has highlighted evidence throughout the Site of metals, ammoniacal nitrogen, cyanide, Total Petroleum Hydrocarbons (TPH), and Polyaromatic Hydrocarbon (PAH) compounds. The TPH and PAH compounds have been detected in samples taken throughout the Site, however, the highest concentrations have generally only been found from within samples taken from within the top metre.

VOCs have generally been detected below their LoD except for benzene detected in:

- Made Ground samples taken from the north-eastern areas of the Site in proximity of the former tar tank (i.e. BH103, TP102 TP103 and TP104);
- Alluvial deposits in the central and northern areas of the Site (i.e. BH203C at 3.5 m bgl and BH106 at 3.6 m bgl); and,
- From samples taken within the Chalk close to the western boundary of the Site (i.e. BH202 and BH301 at 15 m bgl and BH101 at 8.2 m bgl) in proximity of the former tar mains and within the former cross-boundary gas holder.

Concentrations of chlorinated solvents have generally been detected below their LoD in soils except for two marginal detections of cis 1,2 dichloroethene (DCE) and several detections of tetrachloroethene (PCE) to the west and north of gas holder no. 4, with a maximum concentration of PCE (31.9 mg/kg) at VW201A adjacent to the cross-boundary holder in the west of the Site.

Leachate Test Results

Leachate results have been consistent with the soil concentrations revealing a potential hazard from ammoniacal nitrogen, cyanide, metals, PAH and TPH throughout the Site. Significant concentrations have been detected mainly from within the Made Ground at HP103, HP104A, BH202 and TP103 (maximum TPH 5.68 mg/l at HP103 at 0.3 m bgl).

Groundwater Test Results

- Ammoniacal nitrogen has been detected from all locations sampled and from within all the groundwater bodies across the Site;
- Total cyanide concentrations have also been detected in perched waters in the west of the Site (WS206 and BH101) and in groundwaters within the drift deposits to the west and north of gas holder no. 4 (BH201, BH102B), adjacent to the tar tank (BH103A) and on the south-eastern Site boundary (BH104). Total cyanide concentrations have been detected in the Chalk aquifer in samples taken from BH105 in the north of the Site and BH202 and BH303 in the southwest;

- PAHs compounds have been detected within all boreholes within the western half of the Site in groundwater from Made Ground, drift deposits and Chalk (WS206, BH201, BH102B, BH105, BH202, BH301 and BH302A). In addition, PAH compounds have also been detected in groundwater from the drift deposits in BH103A adjacent to the tar tank, and from BH104 on the south-eastern Site boundary. The highest concentrations have been found in groundwater from the Chalk deposits located southwest of the gas holder No.4 (BH301) particularly naphthalene concentrations (2,720 µg/l), likely sample contamination due to a sheen and black globules noted within sample. The next highest concentrations have been detected in the drift deposits in BH102B (49.2 µg/l) located in the north of the Site within proximity to the former liquor tank and ammonia works;
- TPH compounds have been detected in the west, north and east of the Site within all aquifers. However, relatively high concentrations have only been detected in samples taken from BH202, BH301 and BH302A (Chalk), BH102B (drift) and WS206 (Made Ground), all located within the northern and western areas of the Site. The TPH signature differs between aquifers, with the perched water comprising predominantly light aliphatic fractions and deeper groundwater light and medium aromatic fractions.
- BTEX compounds have been detected in groundwater samples taken from WS206 and BH101 (Made Ground), BH201 and BH102B (drift) and BH202, BH301, BH302, BH105 and BH106 (Chalk). However, relatively high concentrations (mainly benzene) have only been found in BH202, BH301, BH302, BH102B and WS206, again in the north and west of the Site.
- Chlorinated solvents (trichloroethene (TCE), DCE, PCE and vinyl chloride (VC)) have been detected in the perched water in the Made Ground (BH101, WS206), and from groundwater in the drift deposits (BH201) and Chalk deposits (BH202 and BH105) within the west and northwest of the Site. Maximum concentrations were detected in samples taken from WS206 (VC 2.75 mg/l, DCE 5.61 mg/l).

NAPL (Free Phase Product) Observations

Strong hydrocarbon odours, staining and oily sheens were observed within the RTG from 6 m bgl in BH202 during drilling. Brown globules of free phase product were noted also within Chalk fractures from depths between ~14-16 m bgl at this same location. Subsequently, free phase product was noted in the purged groundwater in BH202 during its well development only. This had a very strong coal tar / creosote / hydrocarbon odour and was emulsified within the groundwater. Analysis of this purged water containing the NAPL/groundwater emulsion identified high TPH (21.5 mg/l), BTEX compounds (benzene 3.04 mg/l) and PAH concentrations (naphthalene 4.01 mg/l). Chlorinated solvents concentrations were relatively lower at 16.7 µg/l. No measurable NAPL has been detected at BH202 during any of the monitoring rounds.

The supplementary investigation undertaken on September 2019 undertaken to further investigate the potential free phase in the southwest of the Site also identified strong hydrocarbon odours between 1.5 to 7.4 m bgl and staining and oily sheens from 5 to 7.4 m bgl at BH301 (located adjacent to BH202). Borehole BH302A located 10 m north of BH202 presented visual (staining) and olfactory evidence of hydrocarbons between 4.5 m and 7.2 m bgl and further odours between 16 and 19 m bgl. Slight odour and sheen were also noted 2 m bgl at BH303 located 15 m southeast of BH301. Laboratory results confirmed the presence of oil inclusions in the soil samples taken from BH301 and 7 m bgl and BH302A at 5.7 m bgl.

Groundwater sampled during the subsequent monitoring (two rounds) from BH302A identified a hydrocarbon sheen and dark brown globules, however, no measurable NAPL has been attained at any monitoring wells on the Site.

Surface Water Monitoring Results

Water from the River Kennet has been sampled and analysed on five occasions (November and December 2015, April and October 2019 and February 2020). Samples have been retained from both upstream and downstream locations. Analysis results (Ref. [5] and [6]) have highlighted all TPH and VOC concentrations to be below their LOD. A marginal detection of ammoniacal nitrogen was recorded from a downstream sample taken in October 2019 with all the remaining samples presenting concentrations below their LOD. PAH compounds above their LOD have been detected upstream and downstream of the Site (highest benzo(a)pyrene concentration (0.037 µg/l) detected upstream) suggesting that they are likely unrelated to site inputs. Metal concentrations have also been detected above their LOD, however, downstream and upstream concentrations have been very similar. Given that this River is canalised and presumably hydrogeologically isolated from groundwaters in proximity to the Site then an increase in contaminant loading from the Site was not anticipated as confirmed by the available surface water monitoring results.

4. POTENTIAL CONTAMINANT LINKAGES

4.1.1. POTENTIAL CONTAMINANT LINKAGE 1 – RECEPTOR: GROUNDWATER

The Water Framework Directive (WFD) presents the concepts of “prevent” and “limit” in respect to Article 6 of Directive 2006/118/EC (the Groundwater ‘Daughter’ Directive or GWDD). Hazardous substances should be prevented from entering groundwater with an assessment point identified as the base of the unsaturated zone. The observed contamination at the Site is, however, considered as a passive input resulting from previous activity that has now ceased i.e. has already entered the water environment. Focus should presumably therefore be on limiting its further impact/damage and understanding if the observed dissolved phase risk may be presenting a contemporary/future risk.

4.1.2. POTENTIAL CONTAMINANT LINKAGE 2 – RECEPTOR: DOMESTIC GROUNDWATER ABSTRACTION

Registered potable groundwater abstractions are known to exist within a 1000 m radius of the subject Site, with the closest located ~619 m east. Given the distance and direction to this abstraction well, the plausibility of a contaminant linkage is considered unlikely and it has not therefore been considered further.

4.1.3. POTENTIAL CONTAMINANT LINKAGE 3 – RECEPTOR: DEPENDENT SURFACE WATERS

No recorded Groundwater Dependent Terrestrial Ecosystems (GWDTE) necessitating further consideration have been identified within proximity to the Site. GWDTE have consequently been considered no further.

The River Kennet is located adjacent to the southern boundary of the Site. However, in proximity to the Site its wetted perimeter is also lined and may consequently be considered as being hydrogeologically isolated from Site groundwaters. Surface water monitoring has not suggested an increase in contaminant loading as waters pass by the Site, lending further support to the idea that its base flows are not connected to Site groundwaters.

The River Thames located approximately 180 m north east of the Site. Albeit some ambiguity exists in respect of a clear groundwater flow direction. Given the River Kennet is lined it has been assumed that the River Thames represents the next most plausible surface water receptor if adopting the precautionary principle.

It should be noted, however, that instantaneous dilution within this large water body (River Thames) will likely reduce the risk. In order to formally assess the effect dilution factors have on reducing risks to the River Thames, a Level 4 assessment has been undertaken for demonstrative purposes only within this document in Section 6.2.1. The River Thames has a low flow (Q95) at Reading gauging station² 1.28 km upstream of the confluence with the River Kennet, of 454,464 m³/d. The River

² <https://nrfa.ceh.ac.uk/data/station/info/39130>

Kennet at Theale gauging station³, 8 km upstream of the Site has a low flow reported at 328,320 m³/d. These flows have the potential to dilute the groundwater concentrations by up to three orders of magnitude (Based Remedial Targets Methodology guidance; calculations are included in in **Appendix C**).

4.1.4. POTENTIAL CONTAMINANT LINKAGE 4 – RECEPTOR: FUTURE RESOURCE PROTECTION

The closest contemporary groundwater abstraction currently exists ~619 m east of the Site, too far to be considered as a primary receptor. A pollution assessment point for groundwater must, however, be identified to prevent harm where harm is interpreted by UK TAG to mean ‘impairment of either existing human uses or potential future human uses of groundwater’. In effect this means that groundwater resources should be protected to allow future exploitation even where no current abstraction exists or planned. Within this report, a 400m compliance point has been adopted, which represents approximately half the distance to the closest registered potable water abstraction (Royal Berkshire Hospital) located circa. 1 km southwest (supposed upgradient) of the Site. Compliance at this distance would therefore remain strongly precautionary and practicable.

The drift aquifer (RTG) is considered to have a lower resource potential relative to the Chalk. In addition, the River Thames represents a major discharge zone for the RTG, therefore the Chalk has been considered as the receptor for future resource potential.

4.2. SUMMARY OF POTENTIAL CONTAMINANT LINKAGES (PCL)

A summary of potential linkages is given in the table below noting that PCL3 and PCL4 are considered to be the priority for reporting herein.

Table 4-1 – Revised Potential Contaminant Linkages (PCL)

PCL	Contaminant	Receptor	Assessment Point	Assessment limit	Comment	Taken to DQRA
PCL1	Hydrocarbon distillates, PAH, ammoniacal nitrogen and chlorinated solvents (hazardous)	Groundwater	Base of unsaturated zone	Minimum Reporting Value/LoD	“Prevent” not possible as already in groundwaters therefore focus must be on “limit”. PCL taken no further herein albeit any residual NAPL may continue to represent a source to dissolved phase.	N
PCL2	Hydrocarbon distillates, PAH, ammoniacal	Domestic groundwater abstraction	Abstracted water	Drinking Water Standard	Closest contemporary domestic abstraction is reported at ~619 m	N

³ <https://nrfa.ceh.ac.uk/data/station/info/39016>

PCL	Contaminant	Receptor	Assessment Point	Assessment limit	Comment	Taken to DQRA
	nitrogen and chlorinated solvents (hazardous)				PCL taken no further as unlikely a plausible PCL	
PCL3	Hydrocarbon distillates, PAH, ammoniacal nitrogen and chlorinated solvents (hazardous)	Surface Water including Groundwater Dependent Terrestrial Ecosystems (GWDTE)	Pre- dilution within the receiving surface waters	Environmental Quality Standard (AA-EQS)	Conservative comparison against AA-EQS made with updated results and DQRA required as herein GWDTE excluded as absent River Thames to be assumed as the critical receptor given its proximity	Y
PCL4	Hydrocarbon distillates, PAH, ammoniacal nitrogen and chlorinated solvents (hazardous)	Groundwater Resource	In strata at 400 m from source, as agreed with the Environment Agency	Drinking Water Standard	PCL taken to DQRA given the sensitivity of the Chalk aquifer	Y

PCLs highlighted in red are assessed further within this DQRA.

5. DETAILED QUANTITATIVE RISK ASSESSMENT

5.1. INTRODUCTION

A GQRA for the Site was included in Ref [5]. All groundwater and leachate quality data gathered between November 2015 and April 2019 was screened against generic assessment criteria (GAC) for the protection of surface waters (AA-EQS) and groundwater resource potential (DWS). Contaminants with exceeding concentrations were selected as Contaminants of Concern (CoC) and included for further detailed assessment in this DQRA. Plans showing the GAC exceedances were included in the 2019 Supplementary Phase 2 Report (Ref. [5]) (Drawings 70031882-005 to 008).

Quality data from the second phase of supplementary investigation undertaken in September 2019 and subsequent monitoring in February 2020 was also screened against their appropriate GAC and included in the Supplementary Site Investigation Report Ref [6] (exceedance plans are contained in **Appendix A** of Ref [6]). The distribution of impact detected during the September 2019 supplementary investigation has remained consistent with the impact detected previously and consequently depicted within the selected CoCs and Conceptual Site Model included in Ref [5].

To further assess the significance of the CoCs identified through the GQRA then Level 3 (L3) Site Specific Assessment Criteria (SSAC) have now been derived using the Environmental Agency Remedial Targets Worksheet v3.1. Supporting information for this Controlled Waters assessment is presented in **Appendix C**. The model outputs (P20 worksheets) are contained within **Appendix E**.

The L3 assessment has required the definition of site-specific parameters to determine the potential impact of the identified source material at the off-site “assessment points” selected to be protective of Controlled Waters.

Each parameter input has been determined based on the conditions specific to the Site. However, where such information has been unavailable, conservative input values have been selected. In all cases the parameter input values are considered suitably site-specific and/or conservative to provide a balanced assessment of risk at the Site.

Based on the CSM, two sets of site-specific criteria (SSAC) have been derived to assess the risk of the surface waters and the groundwater resource, respectively. The models have been established as follows:

- Model 1: evaluates the risk to surface waters. This model has assumed the RTG as the pathway to the surface waters with the River Thames as the receptor; and
- Model 2: considers the risk to future groundwater resource. This model has assumed the Chalk as the likely pathway and receptor for the Site.

Each model has a set of input parameters which are detailed in Tables C.1 and C.2 in **Appendix C** and summarised in the following section.

5.2. PRIORITY CONTAMINANTS

To identify which contaminants are important for further DQRA and avoid disproportionate regulation, a discussion of the significance of the detected generic exceedances is presented below in Table 5-1 and Table 5-2.

Regarding the risk to the surface waters from metals as copper, lead, manganese, nickel and zinc the value of their AA-EQS depends on their bioavailability. The initial GQRA (Ref. [5]) assumed 100% bioavailability, however their AA-EQS has been updated to account for bioavailability in the receiving waters. Bioavailability calculations⁴ are included in Tables C9 and C.10 in **Appendix C**; calculations have been based on information from an Environment Agency sampling point⁵ located at the River Kennet 100 m above River Thames (pH, DOC and Ca data has been taken from 20 samples taken between April 2018 and September 2019).

Note also that in respect of fluoranthene and benzo[a]pyrene the standards applied in the previous GQRA (Ref. [5] and [6]) for these analytes were taken from guidance based upon the consumption of fishery products i.e. the protection of humans by secondary poisoning rather than direct toxicity to fauna (conservative). However, when adopting values protective of pelagic fauna⁶ as a more realistic conceptual model at the Site, then AA EQS of 0.022 µg/l benzo[a]pyrene and 0.12 µg/l fluoranthene are considered more applicable. The regular acquisition and consumption of shellfish from this area of the River Thames is considered a low plausibility.

Based on the significance of the exceedances included in the tables below then the following contaminants have been selected to be further assessed in the DQRA:

- Risk to the surface waters: Iron, manganese, zinc, free cyanide, benzo(a)pyrene, benzene, PCE, TCE and aromatics >C8-C10;
- Risk to the aquifer resource: ammoniacal nitrogen as NH₄, total cyanide, manganese, iron, aromatics >C8-C10 and C10-C12, benzo(a)pyrene, PAH sum of 4, benzene, PCE, TCE, DCE and vinyl chloride.

⁴ Metal Bioavailability Assessment Tool (M-BAT).

⁵ <https://environment.data.gov.uk/water-quality/data/sample/TH-PKER0025-20180606-1282208.html>

⁶ PAH-5-6-rings EQS dossier 2011, <https://circabc.europa.eu/sd/d/4e13a4c4-07b9-4e55-a43d-823e7cd4ce82/PAH%20EQS%20dossier%202011.pdf>

Table 5-1 - Selection of Priority Contaminants Driving the Risk to the Surface Waters

Determinant	AA-EQS (µg/l)	Leachate			Shallow Groundwater			Priority Contam. (Y/N)	Comment
		Max Conc. (µg/l)	#exd #samples	% Exceed	Max Conc. (µg/l)	#exd #samples	% Exceed		
Free Ammonia (calculated)	600	1,498	2 of 22	5	465	None	0	N	Limited and conservative leachate test results not reflected in actual groundwaters
Free Cyanide	1	1.12	None	0	80.3	8 of 53	15	Y	Marginal exceedances with the exception of relatively high concentrations detected at BH102B and BH302A
Arsenic	50	192	4 of 22	18	69.5	2 of 31	6	N	Two marginal groundwater exceedances only
Cadmium	0.25	0.436	2 of 22	9	< 0.1	None	0	N	Conservative leachate test results not reflected in actual groundwaters
Iron	1,000	N/A	N/A	N/A	34,600	4 of 16	25	Y	Limited groundwater exceedances however, significant in magnitude
Copper	7.33*	52.2	10 of 22	45	4.93	None	0	N	Single marginal groundwater exceedance after applying bioavailable AA-EQS
Lead	3.35*	43.9	4 of 22	18	14.9	1 of 31	3	N	
Manganese	219.5*	N/A	N/A	N/A	3,800	7 of 8	88	Y	Significant groundwater exceedance throughout
Nickel	8.03*	19.7	9 of 22	13	21.3	2 of 31	13	N	After applying bioavailable AA-EQS, groundwater exceedances are limited to a marginal exceedance (10.8 µg/l) in BH102B within the Alluvium and a relatively high exceedance in BH101 in the Made Ground. However, exceedances are not considered significant due to their magnitude and/or location.
Zinc	24.64*	29.1	1 of 22	5	197	2 of 31	6	Y	After applying bioavailable AA-EQS, there are two groundwater exceedances, however its magnitude is relatively high and located within the Alluvium / RTG.
Phenol	7.7	290	2 of 22	9	10	1 of 18	5	N	Single marginal groundwater exceedance

Determinant	AA-EQS (µg/l)	Leachate			Shallow Groundwater			Priority Contam. (Y/N)	Comment
		Max Conc. (µg/l)	#exd #samples	% Exceed	Max Conc. (µg/l)	#exd #samples	% Exceed		
Naphthalene	2	2,170	6 of 22	27	0.031	None	0	N	No groundwater exceedances
Fluoranthene	0.12^	23.9	12 of 22	55	3.45	8 of 31	25	N	Groundwater exceedances limited to samples taken in 2015. No exceedances have since been detected in samples taken from 2019 at same locations.
Anthracene	0.1	36.1	9 of 22	41	5.05	2 of 31	6	N	
Benzo(a)pyrene	0.022^	0.283	7 of 22	32	1.09	14 of 31	45	Y	Significant groundwater exceedances
Benzene	10	< 1	None	0	45.2	3 of 31	9	Y	Limited exceedances however both detected in 2019 and within the same area (north west of the Site)
Ethylbenzene	20	10.5	None	0	22.5	1 of 31	3	N	Groundwater exceedances limited to samples taken in 2015. No exceedances detected in samples taken from 2019
Xylene (total)	30	41	1 of 12	8	149	2 of 31	6	N	
Trichloroethene	10	< 1	None	0	155	5 of 29	17	Y	Limited but significant groundwater exceedances
Tetrachloroethene	10	< 1	None	0	956	6 of 29	20	Y	
Aromatics >EC5-EC7**	10	< 10	None	0	38	3 of 31	9	N	Same magnitude concentrations and locations as benzene. Benzene taken as proxy.
Aromatics >EC8-EC10**	20	314	9 of 22	41	235	8 of 31	25	Y	Majority of groundwater exceedances detected in 2015, however two exceedances detected in 2019
Aromatics >EC10-EC12**	2	722	9 of 22	41	200	3 of 31	9	N	Groundwater exceedances generally limited to samples taken in 2015 with only very marginal exceedances detected in samples taken from 2019
Aromatics >EC12-EC16**	2	3,030	9 of 22	41	478	4 of 31	12	N	
Aromatics >EC16-EC21**	0.1	821	9 of 22	41	134	2 of 31	6	N	

Determinant	AA-EQS (µg/l)	Leachate			Shallow Groundwater			Priority Contam. (Y/N)	Comment
		Max Conc. (µg/l)	#exd #samples	% Exceed	Max Conc. (µg/l)	#exd #samples	% Exceed		
Aromatics >EC21- EC35**	0.022^	513,000	9 of 22	41	115	2 of 31	6	N	

N/A: not analysed

* bioavailable EQS

^ EQS protective of pelagic fauna ** surrogate indicators applied following CL:aire 2017

Table 5-2 – Selection of Priority Contaminants Driving the Risk to Chalk Aquifer Resource Potential

Determinant	GAC (µg/l)	Leachate			Groundwater			Priority Contam. (Y/N)	Comment
		Max Conc. (µg/l)	#exd # Samp	% Exceed	Max Conc. (µg/l)	#exd # Samp	% Exceed		
Nitrite	500	N/A	N/A	N/A	2,360	5 of 14	36	N	Nitrate and nitrite detections have only been identified from within the samples taken from the Chalk suggesting that the concentrations may not be related to the Site conditions but reflect the wider aquifer.
Nitrate as NO ₃	50,000	N/A	N/A	N/A	72,500	2 of 15	13	N	
Sulphate	250,000	1,570,000	10 of 22	45	1,250,000	12 of 41	30	N	A total of 12 exceedances have been detected, however exceedances within the actual Chalk have been limited to one sample taken in 2015 and again a marginal exceedance in 2020, with no exceedances detected in the rest of the samples taken from the Chalk in following rounds in 2015, 2019 or 2020. Furthermore, its DWS is considered is related to taste rather than adverse human health effects.
Ammoniacal Nitrogen as NH ₄	500	183,000	11 of 22	50	44,177	42 of 53	79	Y	Significant groundwater exceedance throughout
Total cyanide	50	4,170	8 of 12	67	2,160	28 of 53	52	Y	Significant groundwater exceedance throughout
Arsenic	10	192	7 of 22	32	68.5	13 of 53	24	N	Those exceedances detected within the actual Chalk have been marginal (10.4 and 14.5 µg/l) and none detected in the last two rounds.
Lead	10	44	1 of 22	5	14.9	1 of 53	1	N	A single and marginal groundwater exceedance only.
Manganese	50	N/A	N/A	N/A	3,800	12 of 14	86	Y	Significant groundwater exceedance throughout

Determinant	GAC (µg/l)	Leachate			Groundwater			Priority Contam. (Y/N)	Comment
		Max Conc. (µg/l)	#exd # Samp	% Exceed	Max Conc. (µg/l)	#exd # Samp	% Exceed		
Iron	200	N/A	N/A	N/A	34,600	22 of 53	41	Y	Essential element in human nutrition. The iron DWS of 0.2 mg/l is related to taste and colour. A value of 2 mg/l represents 10% of maximum tolerable daily intake established as precaution of excessive iron in the body. Only ten of 53 samples exceed 2 mg/l however two have been in the Chalk. Iron represents ~75% of the total mass within metals.
Nickel	20	20	None	0	27.3	5 of 53	9	N	Limited exceedances and marginal
Selenium	10	56	3 of 22	14	23.5	3 of 53	5	N	Limited exceedances and relatively low
Aliphatics >C8-C10	300	322	1 of 22	5	840	3 of 53	4	N	Exceedance limited to samples taken from BH202D, BH301 and BH302A adjacent to each other in the Chalk. According to CL:AIRE 2017 aliphatics >C8-C12 have an overall low to very low mobility.
Aliphatics >C10-C12	300	1,080	6 of 22	27	2,570	4 of 53	7	N	
Aromatics >EC5-EC7	1	<10	None	0	2,140	9 of 53	16	N	Locations identified and magnitude of concentrations as per benzene detections, therefore benzene modelled as proxy.
Aromatics >EC8-EC10	500	<10	None	0	1,070	4 of 53	7	Y	Exceedances mainly related to a sample taken from BH202D, BH301, BH302A in the Chalk and a sample taken from BH102B in 2015. The remaining limited exceedances have been marginal. According to CL:AIRE 2017 aromatics >C16-C35 have an overall low to very low mobility. Aromatics >C12-C16 has a moderate mobility however the exceedance
Aromatics >EC10-EC12	90	722	6 of 22	27	1,710	5 of 53	9	Y	
Aromatics >EC12-EC16	90	3,030	5 of 22	23	875	7 of 53	13	N	

Determinant	GAC (µg/l)	Leachate			Groundwater			Priority Contam. (Y/N)	Comment
		Max Conc. (µg/l)	#exd # Samp	% Exceed	Max Conc. (µg/l)	#exd # Samp	% Exceed		
Aromatics >EC16-EC21	90	821	6 of 22	27	347	5 of 53	9	N	detected in the Chalk is relatively low (875 ug/l). Aromatics >C8-C12 and C10-C12 represent 19% of the TPH mass in groundwater and are included in the model
Aromatics >EC21-EC35	90	513,000	1 of 22	5	351	4 of 53	7	N	
Benzo(a)pyrene	0.01	0.201	5 of 22	23	1.09	28 of 53	52	Y	Significant groundwater exceedances
PAH (sum of 4)	0.1	0.247	4 of 22	18	2.25	23 of 53	52	Y	Significant groundwater exceedances
Benzene	1	3	1 of 12	8	2,890	21 of 53	39	Y	Significant groundwater exceedances
Vinyl chloride	0.5	<1	None	0	2,750	13 of 49	26	Y	Significant groundwater exceedances of DCE, TCE and PCE were only detected in water from the Made Ground and RTG, However, vinyl chloride (which is a daughter product of those contaminants) exceeds the DWS in samples taken from Made Ground, RTG and the Chalk. All chlorinated solvents however have been included in the model
cis-1,2-Dichloroethene (DCE)	50	<1	None	0	5,610	8 of 49	16	Y	
Trichloroethene (TCE)	10	<1	None	0	155	5 of 49	10	Y	
Tetrachloroethene (PCE)	10	5	None	0	956	6 of 49	12	Y	

N/A: not analysed

5.3. GENERAL MODEL INPUT PARAMETERS – P20

The input parameters used to populate the models, the range of values and sources of the data are defined in **Appendix C** within Table C.1. Site specific environmental input parameter values are presented in Table C.2. Notwithstanding, a discussion is presented below with respect to the following critical parameters:

- Assessment point selection;
- Hydraulic conductivity of the aquifer;
- Hydraulic gradient in the aquifer; and
- Degradation rates.

5.3.1. POLLUTANT ASSESSMENT POINTS (PAP)

The River Thames and the Chalk (Principal Aquifer) have been identified as plausible receptors for the dissolved phase contaminants migrating from the Site. In accordance with Groundwater Protection: Principles and Practice (GP3) (EA, 2013), the assessment point for the groundwater resources (Principal Aquifer) and the River Thames have been as follows:

- Model 1: River Thames as a receptor, 240 m north east as measured by the distance from the source to the River; and
- Model 2: Groundwater resource as a receptor, 400 m from the Site boundary within the Chalk groundwater body. This distance represents approximately half the distance to the closest registered potable water abstraction located circa. 1 km southwest (Royal Berkshire Hospital). Compliance at this distance would therefore remain strongly precautionary and practicable.

5.3.2. HYDRAULIC CONDUCTIVITY

In-situ hydraulic conductivity test results are available from the Alluvium, RTG and Chalk deposits (results are presented in Ref [5]). Results have indicated that the RTG has a hydraulic conductivity of between 41.5 m/d and 177 m/d with a geometric mean of 105 m/d (from 10 tests undertaken in two wells). Test results have provided lower hydraulic conductivity values for the Chalk, between 3.52 m/d and 12.1 m/d with a geometric mean of ~7 m/d (from 12 tests undertaken in two wells). Based on these results model input parameters have been selected as:

- Model 1: RTG as pathway, K value of 105 m/d; and
- Model 2: Chalk as pathway, K value of 7 m/d.

5.3.3. HYDRAULIC GRADIENT

Calculated hydraulic gradients for the RTG and Chalk aquifer range between 0.0005 and 0.004 with a typical value of 0.002. Both aquifers are considered to be in continuity therefore a single value of 0.002 has been input in both models.

5.3.4. EFFECTIVE POROSITY

Effective porosity of the aquifer has been selected based literature data for both models:

- Model 1: 0.24, average value between minimum and maximum values for a medium gravel taken from Brady & Kunkel, 2003⁷;
- Model 2: 0.2, approximately 50% of the geometric mean value (38.8 %) of the Chalk at the Thames and Chilterns area Chalk aquifer from BGS, “The physical properties of major aquifers in England and Wales”.

5.3.5. RETARDATION AND BIODEGRADATION

Degradation is often a sensitive parameter in the calculation of an attenuation factor in terms of its assumed rate and the mode in which the degradation occurs.

In the absence of site-specific degradation rates, literature-based values have been utilised (sources are presented in **Appendix C**). Field data indicates that dissolved oxygen levels within the Alluvium and RTG range between 0.3 to 3.66 mg/l with a geometric mean of 1.08 mg/l suggesting aerobic conditions within the superficial aquifer. Within the Chalk aquifer, dissolved oxygen levels have been between 0.35 to 3.48 mg/l with a geometric mean of 0.99 mg/l, also suggestive of aerobic conditions. However, the presence of vinyl chloride in the groundwater (BH201, BH105 and BH202D) indicates that degradation of chlorinated solvents has locally been taking place, which is more likely to occur in anaerobic conditions. Given the uncertainty between aerobic versus anaerobic condition, where a range of literature values have been identified, the slowest degradation value has been adopted to provide a precautionary approach.

5.4. P20 MODEL RESULTS

5.4.1. CONTAMINANT TRAVEL TIMES

In accordance with EA RTM guidance⁸, it is considered acceptable for no action to be taken in the case of low flow groundwater systems and/or contaminants which are characterised by a high partition coefficient (e.g. some PAH compounds), where the resulting travel time to the receptor exceeds 1,000 years.

Calculated travel times are presented in Table C.4 within **Appendix C**.

5.4.2. P20 MODEL 1 - PROJECTED RISKS TO SURFACE WATERS

Soil, leachate and groundwater concentrations have been screened against their L3 SSAC derived for the protection of the River Thames. Screening results are presented in Tables A1-A4 in **Appendix D**. Plans showing the exceedance locations are presented as Drawings 70031882-005 within **Appendix A**. A summary of the projected exceedances is detailed below.

⁷ A Practical Technique for Quantifying Drainage Porosity. Michael Mark Brady and Larry A. Kunkel, PTS Laboratories, 2003.

⁸ Remedial Targets Methodology. Hydrogeological Risk Assessment for Land Contamination. Environment Agency, 2006.

Soil exceedances

- Six marginal exceedances of free cyanide detected in samples taken from BH102B at 1 m bgl (4.59 mg/kg), BH105 at 0.25 m bgl (4.51 mg/kg), HP101 at 0.10 m bgl (1.12mg/l), HP103 at 0.3 m bgl (1.02mg/l), HP101A at 0.20m bgl (1.02mg/l) and TT101 at 0.2m bgl (1.02mg/l). It should be noted that the laboratory limit of detection exceeds the Level 3 SSAC. The exceedances specified here are the samples in which concentrations of free cyanide exceeded the laboratory detection limit.

Leachate exceedances

None of the available leachate concentrations have exceeded their L3 SSAC.

Groundwater exceedances

Concentrations of four contaminants with travel times lower than 1,000 years have been found in excess of the L3 SSAC as per Table 5-3. These exceedances are also presented upon Drawing 70031882-005.

Table 5-3 - Summary of Exceedances of the Groundwater L3 SSAC Derived for the Protection of the Surface Waters. (Concentrations within the Chalk not included)

Determinant	L3 SSAC (µg/l)	Max Concentration (µg/l)	Number of Samples Exceeding	Location of Exceedances
Free Cyanide	4.99	80.3	3 / 7	BH102B(ALV/RTG), BH103A(ALV/RTG), BH201 (RTG) (2019*)
Aromatics>C8-C10	145.3	235	1 / 31	BH102B (ALV/RTG) (in 2015)
Trichloroethene (TCE)	34	155	4 / 29	BH101 (Made Ground) (2015 and 2019); WS206 (Made Ground) (2015 and 2019)
Tetrachloroethene (PCE)	34	956	6 / 29	BH101 (Made Ground) (2015, 2019); WS206 (Made Ground) (2019 and 2020)

*Low level cyanide only analysed for in 2019

Summary of Model 1 Results

Results of the P20 Model 1 has highlighted potential exceedances of their L3 SSAC derived for precautionary protection yet pre-dilution in the River Thames. However:

- Free cyanide: Six marginal exceedances in soils from the top 1 m of soil profile within the northern and central area of the Site, adjacent to gas holder No 4. Exceedances in groundwater are limited to BH102B, BH103A and BH201 in 2019 (low level free cyanide was only analysed in 2019). Soil concentrations are consistent with groundwater concentrations observed on Site, with the maximum soil and groundwater concentrations consistently detected at BH102B (4.59 mg/kg in soil and 80.3 ug/l in groundwater).
- Aromatics >C8-C10 in groundwater: a single concentration detected in a sample taken from BH102B in 2015 only. Subsequent monitoring at this same location and in its general area would no longer suggest a risk. Therefore, this isolated historic failure is now considered trivial.

- TCE in groundwater: exceedances limited to concentrations detected in the sample taken from BH101 (MG) in 2015 and 2019 (no exceedance detected in 2020), and from WS206 (Made Ground) since installed in 2019. The high concentration does not reflect wider conditions and therefore is deemed over conservative. A materially significant volume of analytical data is available from the site to make a reasonable consideration of average/normal concentrations.
- PCE in groundwater: exceedances related to concentrations detected in samples from Made Ground (BH101 in all monitoring rounds and WS206 since installed in 2019).

Chlorinated solvent exceedances have been primarily related to concentrations detected within the perched water in the west of the Site, adjacent to the cross-boundary gas holder (WS206) and within the cross-boundary gas holder (BH101), consistent with the chlorinated solvent soil source detected at the adjacent investigation location, VW201A. The model does not account for degradation and the production of future daughter products. Therefore, potential future increases in the concentrations of TCE, DCE or VC have not been accounted for here. This potential for degradation has been assessed in Section 6 of the report using an alternate model named BIOCHLOR.

In summary, model results have continued to indicate that groundwater concentrations at the Site may pose a potential risk to the River Thames. However, this level of assessment remains conservative as dilution within this receiving water body may reduce the risk significantly.

As indicated in Section 4.1.3, flows at the River Thames (as well as River Kennet) have the potential to dilute the concentrations by at least three orders of magnitude (**Appendix C**, Table C.11). In order to formally assess the effect dilution factors, have on reducing risks to the River Thames a hypothetical Level 4 assessment has been undertaken in Section 6.2.1.

5.4.3. P20 MODEL 2 - RISKS TO FUTURE GROUNDWATER RESOURCE

Soil, leachate and groundwater concentrations have been screened against their L3 SSAC derived for the protection of a theoretical future groundwater resource (Principal Aquifer). Screening results are presented in Tables B1-B4 and summarised within **Appendix D**. Plans showing the exceedance locations are presented as Drawing 70031882-006.

Soil exceedances

Soil concentrations of only one determinand, with travel times lower than 1,000 years, have been found to exceed its respective L3 SSAC, as per Table 5-4.

- Exceedances of ammoniacal nitrogen have been detected throughout the Site from ground level to 3.5 m bgl.

Table 5-4 – Summary of Exceedances of the L3 SSAC for Soils Derived for the Protection of the Groundwater Resource

Determinant	L3 SSAC (mg/kg)	Max Concentration (mg/kg)	Number of Samples Exceeding	Location of Exceedances
Ammoniacal Nitrogen as NH ₄	207.85	5,150	11 / 50	Throughout between 0.3 to 3.6 m bgl

Leachate exceedances

Model results indicate that leachate concentrations do not exceed the derived L3 SSAC at the 400m compliance point.

Groundwater exceedances

Maximum groundwater concentrations of three contaminants, with travel times lower than 1,000 years, have been detected in exceedance of their L3 SSAC as per Table 5-5. Exceedances are presented in Drawing 70031882-006.

- Ammoniacal nitrogen concentrations have exceeded their L3 SSAC in eight samples; and
- Chlorinated solvent concentrations of DCE and VC, exceed their L3 SSAC in samples taken from BH101, WS206 and BH201 screened in the Made Ground and RTG and located west of the Site and in proximity of the cross-boundary gas holder.

Table 5-5 - Summary of Exceedances of the L3 SSAC for Groundwater Derived for the Protection of the Groundwater Resource

Determinant	L3 SSAC (µg/l)	Max Concentration (µg/l)	Number of Samples Exceeding	Location of Exceedances
Ammoniacal Nitrogen as NH ₄	47,511	179,000	8 of 53	BH302A, BH202D, BH202, BH301, BH102B, BH104
Vinyl chloride	33.9	2,750	5 of 49	BH101 (Made Ground); WS206 (Made Ground); BH201 (RTG);
cis-1,2-Dichloroethene (DCE)	3,392	5,610	2 of 49	BH101 (Made Ground); WS206 (Made Ground)

Summary of Model 2 Results

A summary of the exceedances of L3SSAC for the protection of the aquifer as a resource is provided below:

- Ammoniacal nitrogen: eight samples within six locations exceed the SSAC. Also, some of these exceedances are historic (e.g. BH102B and BH104 show exceedances in 2015 only) and were detected in the drift deposits only (BH102B and BH104). The only exceedances suggestive of a potential risk to future resource potential and potable supplies within the groundwater within the Chalk have been localised to southwest corner of the site. However, it should also be noted that despite a UK DWS being used for ammoniacal nitrogen, according to the WHO, ammonia has a

toxic effect on healthy humans only if the intake becomes higher than the capacity to detoxify and is not considered to be of direct importance for health in the concentrations to be expected in drinking-water. Therefore, a health-based guideline has not been derived by WHO.

- Vinyl Chloride (VC): exceedances occur in Made Ground samples (BH101 in 2015 and WS206 in 2020) and within the RTG (BH201 in 2019 and 2020). In essence, the only exceedances of VC are limited to historic observations and those in the groundwater within the drift deposits. No concentrations detected in samples taken from the Chalk exceed the updated SSAC.
- Cis 1, 2 DCE: exceedances are again limited to those samples taken from the Made Ground (BH101 in 2015 and WS206 in 2020). This is unsurprising as DCE and VC are the likely degradation products of the PCE and TCE and are often referred to and anticipated to be coincident with one another. As is the case with VC, DCE does not appear to have reached Chalk aquifer and hence intervention for the attainment of aquifer protection at 400 m would appear unreasonable.

In conclusion, groundwater concentrations observed on Site would suggest a low risk to future potable waters at 400 m, which can be regarded as conservative as the approximate distance of the abstraction from site is 1km.

Model results indicate that leachate concentrations do not exceed the derived L3 SSAC for a 400 m compliance point.

Ammoniacal nitrogen in soils exceed the derived L3 SSAC for a 400 m compliance point. Locations exceeding the SSAC are generally coincident with the ammoniacal nitrogen seen in groundwaters. Nonetheless P20 is known to over project the leachate concentrations as it uses a linear soil-water partition relation. Furthermore, actual ammoniacal nitrogen exceedances in groundwaters have been limited and are considered of low significance.

5.5. P20 MODEL SENSITIVITY

To identify those parameters driving the risk projections, a sensitivity analysis has been made varying parameters by $\pm 20\%$ from the value selected and results compared.

Model 1 sensitivity analysis has indicated that:

- the groundwater results are only moderately sensitive to changes in the hydraulic conductivity, gradient, half-life and effective porosity, with L3 SSAC changing up to 16%. However, L3 SSAC remain generally within the same order of magnitude and the overall results are not affected; with regards to soil L3 SSAC, soil infiltration has had the greatest influence on the L3 SSAC values followed by hydraulic conductivity and gradient. These parameters can change the L3 SSAC values between 18 to 24%. As per groundwater L3 SSAC values, however, remain within the same order of magnitude.

Model 2 sensitivity analysis has indicated that:

- Groundwater L3 SSAC results are sensitive to changes in degradation rates, hydraulic conductivity, gradient, and effective porosity with L3 SSAC values changing up to 86%; and
- With regards to the soils parameters that have the biggest influence the model results are half-life, effective porosity and infiltration.

Parameters such as hydraulic conductivity and gradient have been based on site specific data. The site-specific hydraulic conductivities used are also within the expected range for a sandy gravel and

Chalk respectively, therefore considered reasonable. Meanwhile the hydraulic gradient has been calculated based on five rounds of groundwater monitoring.

Next, only literature derived data has been available for half-life's and the effective porosity of the aquifer. As indicated in Section 5.3.5, low degradation rates have been applied in the model. No robust justification currently exists for using higher rates.

With regards to infiltration, the value selected has been based on annual rainfall assuming 40% evapotranspiration and then 10% infiltration due to hard standing. It is understood that the Site will in the future predominantly be developed with hardstand and buildings.

Details of the sensitivity analysis are presented in **Appendix C** (Tables C.5-C.8).

5.6. P20 SUMMARY

Of note;

- P20 is a deterministic model with parameters and processes represented by single values despite heterogeneity in the real world. However, the selected values based on site specific data and literature maybe considered as generally reasonable;
- The model does, however, assume linear soil water partitioning therefore, soil SSACs maybe intrinsically conservative;
- The models have not considered vertical migration and attenuation through the Alluvium and RTG. Therefore, exceedances related to those concentrations detected in the Made Ground and Alluvium for Model 1 and Made Ground, Alluvium and River Terrace gravels for Model 2 may also be considered conservative;
- A hydraulic connection at the confluence of the River Thames and River Kennet has been presumed under precautionary principles;
- No account for dilution in the River Thames has been made (though this has been modelled and presented separately to the risk assessment for demonstrative purposes only);
- No account for attenuation in the hyporheic zone has also been included;
- The risk to the Secondary A Aquifer has been discounted based on its unlikely potential to be developed as a resource; meanwhile
- The Principal Aquifer of the Chalk has been assessed but assuming a theoretical future abstraction that is considered unlikely at this location.

Based on the P20 model results, soil and groundwater concentrations detected beneath the Site are considered as continuing to pose a moderate risk to both the surface waters (River Thames) and the groundwater resource (Chalk aquifer). Additional modelling undertaken demonstrated that the risk to the surface waters could be significantly reduced once the dilution in the river is taken into account, though this was not incorporated into the risk assessment. In addition, the risk to groundwater resource is based on a hypothetical water abstraction located 400 m from the Site boundary. It is considered unlikely that such an abstraction will arise, and the closest groundwater abstraction point to the site is located at a distance of 619 m to the east.

6. BIOCHLOR RISK ASSESSMENT

To further deliver an understanding of the potential for the future generation of chlorinated degradation products the software package BIOCHLOR has been selected. Neither the Remedial Targets Methodology (RTM and P20) or the use of ConSim as traditionally deployed account for the sequential creation of future PCE/TCE degradation products. The BIOCHLOR Natural Attenuation software is based on a sequential, first-order, coupled reactive transport model developed by the US EPA. The transport problem is analytically solved using the Domenico model like P20. The model assumes a fully penetrating vertical plane source oriented perpendicular to groundwater flow to simulate the release of organics to moving groundwater. It accounts for the effects of one-dimensional advective transport, three-dimensional dispersion, linear adsorption, and first-order decay. Note the model works in imperial measurements as opposed to metric so for completeness both are given where referenced in the text.

The following model scenarios have been performed as per the P20 DQRA:

- Model Scenario 1: An assessment of the observed chlorinated solvents to impact surface waters (the River Thames noting that the River Kennet to the south has been ignored given it is lined); and
- Model Scenario 2: An assessment of the observed chlorinated solvent concentrations to impact at a point of potential future resource protection.

The BIOCHLOR worksheets are contained within **Appendix C**.

6.1. BIOCHLOR MODEL PARAMETERS

Model input parameters have been derived from site specific data where possible or from reasoned published values where necessary. The principal assumption being the adoption of the existing model parameters used in the P20 modelling unless stated otherwise within the following sections.

6.1.1. BIOCHLOR SOURCE AREA

Of the observed chlorinated solvents, ~98.2% of the mass has been observed distributed within just three locations as listed in Table 6-1. These three locations are clustered together and towards the north-western corner of the Site as illustrated upon Drawing 70031882-004. Smaller isolated observations have been seen elsewhere. However, based on the data available then these trace observations are considered trivial relative to those locations listed. Some spatial uncertainty does arise in the centre of the Site due to limited access due to the presence of the gas holder. However, most of the chlorinated mass is located towards the north / northwest and in the direction of River Thames. These same locations containing the greatest observed groundwater mass are also noted as observing the only reported area of shallow chlorinated solvent soil concentrations (Ref. [5]). In consequence, BIOCHLOR modelling has prioritised its efforts towards this northern cluster (herein referred to as the cluster).

The provenance of these solvents remains to be confirmed. Free phase PCE/TCE is a Dense Non-Aqueous Phase Liquid (DNAPL)⁹. Once released, it will typically migrate downwards through the unsaturated zone until it reaches the water table. Along its migration pathway, some will adsorb to soil organic material, some may volatilise, and some may dissolve into pore water. Furthermore, some free phase liquid may become entrained in small pore throats and spaces (termed residual contamination). Its vertical movement is, however, typically determined by the geological properties of the material; i.e., the granular size of sand or clay lenses. Both PCE and TCE will also tend to pool on these impermeable features.

The installed response zones where the largest proportion of the solvent mass has been identified (BH101 and WS206) have been within the Made Ground and Alluvium predominantly described as a CLAY within the logs of **Appendix C** included in Ref [6]. Groundwater levels at these locations have typically been high suggestive of perched waters relative to those seen in both the River Terrace Gravels and Chalk. It is speculated that the vertical migration of the chlorinated solvents may have largely been limited to been limited by the CLAY in the Made Ground and Alluvium, however dissolved phase is also seen in BH201 (installed in the RTG) but no visual or olfactory evidence of gross contamination was observed, and drilling was concluded in the top of the Chalk strata.

Despite the possibility that the solvents and groundwaters may be largely perched and isolated, such cannot be assumed. Trace concentrations of all the chlorinated species have been seen in BH105 (see Drawing 70031882-004 for location, ~25m northeast of BH201), screened in the deeper Chalk at 8.5-10.5 m bgl. Similarly trace concentrations have been seen in BH302A circa 30 m south of the cluster, screened in the Chalk at 10 to 19 m bgl. Consequently, a degree of hydraulic connection with the Chalk must be assumed. Confirmatory boreholes with response zones directly in the Chalk are not, however, available from within the cluster. Under precautionary approach then the observed shallow source concentrations are to be assumed to exist also in the deeper Chalk. To reiterate then, no geological formation is completely impermeable. The presence of low permeability deposits beneath a site does not permit an assumption that a groundwater body will not be impacted in the future, although significant attenuation may have occurred before this happens. BH201 screened in the River Terrace Gravels within the cluster has contained ~16% of the observed solvents confirming leakage from the Made Ground and Alluvium.

The model requires the assumption of a single plane of constant concentration. This is considered conservative and recommended for centreline simulations. It has been given a conservative geometry of 25m (~82ft) extending across the width of the affected borehole cluster.

⁹ Dense non-aqueous phase liquids (DNAPLs) are heavier-than-water organic liquids. DNAPLs are only slightly soluble in water, and therefore exist in the subsurface as a separate fluid phase, immiscible with both water and air. Both PCE and TCE are DNAPLs that have the ability to migrate to significant depths below the water Table where they may slowly dissolve into flowing groundwater, giving rise to aqueous phase plumes. A release of DNAPL at the ground surface can therefore lead to long-term contamination of both the unsaturated and saturated zones at a site.

Table 6-1 - Observed Distribution (% mass) of Chlorinated Solvents by Location

Borehole Location	% of Total Observed Chlorinated Solvents
WS206	47.34
BH101	34.68
BH201	16.18
Total	98.21

Of note:

- These analytes are often described as coincident. Coincidence means that the maximum concentrations of the parent and daughter products may occur at the same well and for this reason discussions often focus on the parent analytes. Evidence of coincidence can be seen in the results;
- The most commonly accepted degradation mechanism for chlorinated ethenes and ethanes is biological reductive dechlorination under anaerobic conditions. The existence of this process at a site is relatively straightforward to prove by the observation of the sequential production of less chlorinated daughter products. The detection of these daughter products, along with the geochemical indicators of anaerobic conditions, commonly forms the basis for “proving” natural attenuation as capable of reducing its residual mass. The process occurs when the anaerobic bacteria take electrons from small organic compounds (the “electron donors”) and produce hydrogen. If the Site soil and groundwater contain organic electron donors, this process can proceed until all of the chlorine atoms are removed, and PCE/TCE is dechlorinated completely via DCE and VC to ethene gas. These degradation products have all been reported in onsite groundwaters;
- PCE is reported to be present at a greater mass on site than TCE suggestive of PCE being the initial spill parent product as illustrated in Table 6-2;
- The presence of cis-DCE at the Site is highly indicative of degradation of the parent occurring. It is possible that VC and some DCE isomers can be primary contaminants in some groundwater systems. However, VC is not normally present as a primary contaminant in solvent spills. Thus, the presence of VC in groundwater associated with a chlorinated ethene spill is considered strong evidence of reductive dichlorination;
- cis-DCE (rather than trans-DCE) is usually produced from the reductive dechlorination of PCE/TCE. As a rule of thumb, if the ratio of cis-1,2-DCE to trans-1,2-DCE plus 1,1-DCE is greater than about 5:1, the DCE is probably of biogenic origin. Based on these concepts, VC and cis-DCE observed at the Site is suggestive of a biogenic origin;
- The degradation process requires two essential elements, the requisite bacteria and a fermentable carbon substrate e.g. a hydrocarbon. The coincident presence of BTEX to a chlorinated solvent can provide an additional carbon and energy source to drive dechlorination. Benzene has historically been reported in groundwaters at WS206 and BH201 while Aromatic hydrocarbons C8-C10 have been reported at BH101. These hydrocarbons may be providing an additional carbon and energy source promoting dechlorination;
- In each stage of biological reductive dechlorination, a chlorine atom is replaced by a hydrogen atom. This requires the addition of hydrogen. The reaction produces a lower chlorinated species

and hydrochloric acid. The desired product of this process is ethene, a non-chlorinated hydrocarbon. Dissolved ethene has been measured in groundwaters. It has largely been absent except at those locations containing the chlorinated solvent mass. This is considered indicative of it being a product of degradation from the chlorinated solvents at these same locations;

- Dehalococcoides, is the only known bacterial group capable of delivering complete reductive dechlorination of TCE to ethene. The presence of ethene suggests indirectly that Dehalococcoides may be present;
- However, the efficiency of reductive dechlorination depends on the hydrologic and geochemical characteristics of the groundwater system to which they are introduced in particular anaerobic conditions. Dissolved oxygen can suppress the reductive pathway at higher concentrations. Field measurements of dissolved oxygen have been highly variable suggestive at times of unfavourable aerobic conditions. This parameter is however often subject to field error and the results would appear at times to be contradictory to the evidence of daughter products and the dissolved ethene;
- Finally, in addition to reductive dechlorination, chlorinated solvents can also be degraded by co-metabolism. Co-metabolism is a process in which a contaminant is degraded by an enzyme or cofactor that is fortuitously produced by other organisms. In general, co-metabolism of chlorinated ethenes is mediated by monooxygenase enzymes with 'relaxed' specificity that oxidize a primary (growth supporting) substrate (e.g. methane) and co-oxidize the chlorinated compound (e.g. PCE). Co-metabolism is however typically slow and would be considered unlikely to have generated the observed ratio of degradation products as witnessed.

Table 6-2 - Distribution (% mass) of the Chlorinated Solvents by species

Borehole Location	% of Total Observed Chlorinated Solvents
Tetrachloroethene	12.81
Trichloroethene	1.56
cis-1,2-Dichloroethene	59.62
trans-1,2-Dichloroethene	0.32
Vinyl chloride	20.79
Ethene, dissolved	4.90

6.1.2. BIOCHLOR SOURCE CONCENTRATIONS

None of the observed concentrations have been witnessed close or above their respective solubility limits suggestive of free phase as illustrated in Table 6-3. Meanwhile the species trans 1,2 DCE has been observed to contribute only 0.32% towards the total observed mass and hence focus has instead been given to its more abundant isomer cis-1,2 DCE.

Table 6-3 - Summary Statistics and Pure Phase Solubility Limits (µg/l). Number of observations 51.

Species	Minimum	Maximum	Mean	Geomean	SD	Solubility Limit 25deg
Tetrachloroethene (PCE)	1	956	59.76	2.239	186.1	225,000*
Trichloroethene (TCE)	1	155	7.269	1.627	23.75	1,370,000*
Cis 1,2-Dichloroethene	1	5610	278.2	4.298	967.7	7,550,000**
Trans-1,2-Dichloroethene	1	14.3	1.482	1.161	2.062	5,250,000**
Vinyl chloride	1	2750	97.01	2.565	424.1	2,760,000**

* Science Report – SC050021/SR7 ** EIC, CL:AIRE Report

Since 2015, the available data generally suggests that concentrations have reduced albeit the timeseries data is limited for the three affected boreholes, with monitoring limited to 2, 3 and 4 rounds at WS206, BH210 and BH101, respectively.

Figure 6-1 presents the results from BH101 (4 rounds) that has contained 34% of all the observed chlorinated mass in groundwaters reported to date. A reduction in mass can be seen since 2015 suggestive of a potentially declining source. With cis-1,2 DCE representing ~59.6% of the total observed mass, BH101 concentrations have apparently decreased with a slope factor of ~0.6 (rate) (**Figure 6-2**). As a legacy source that appears to be degrading, consideration of a declining source could be considered as a reasonable assumption for inclusion in the model. To account for uncertainty yet allow for some source depletion, a rate of 0.06 has been applied as opposed to 0.6. A small increase in PCE has been noted in BH101 and WS206, the reason for this variation is unknown, however could be due to sample variation. DCE represents the greatest mass and has been decreasing, therefore a slowly decreasing source overall has been included in the models.

Figure 6-1 - Concentrations of the chlorinated species in groundwaters at BH101 suggestive of a depleting mass

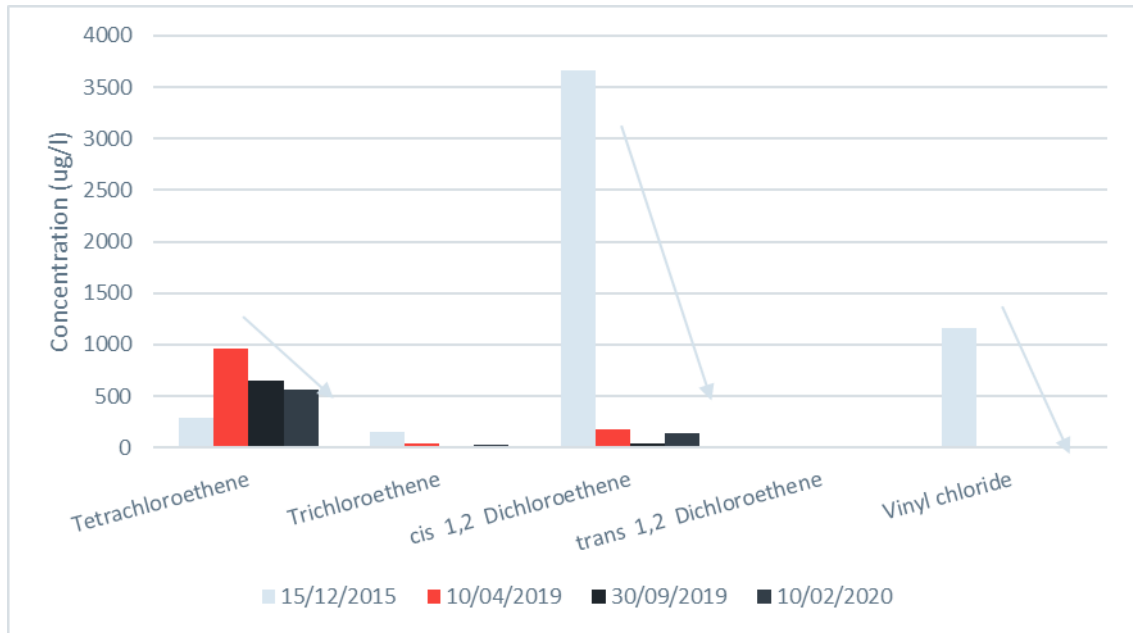
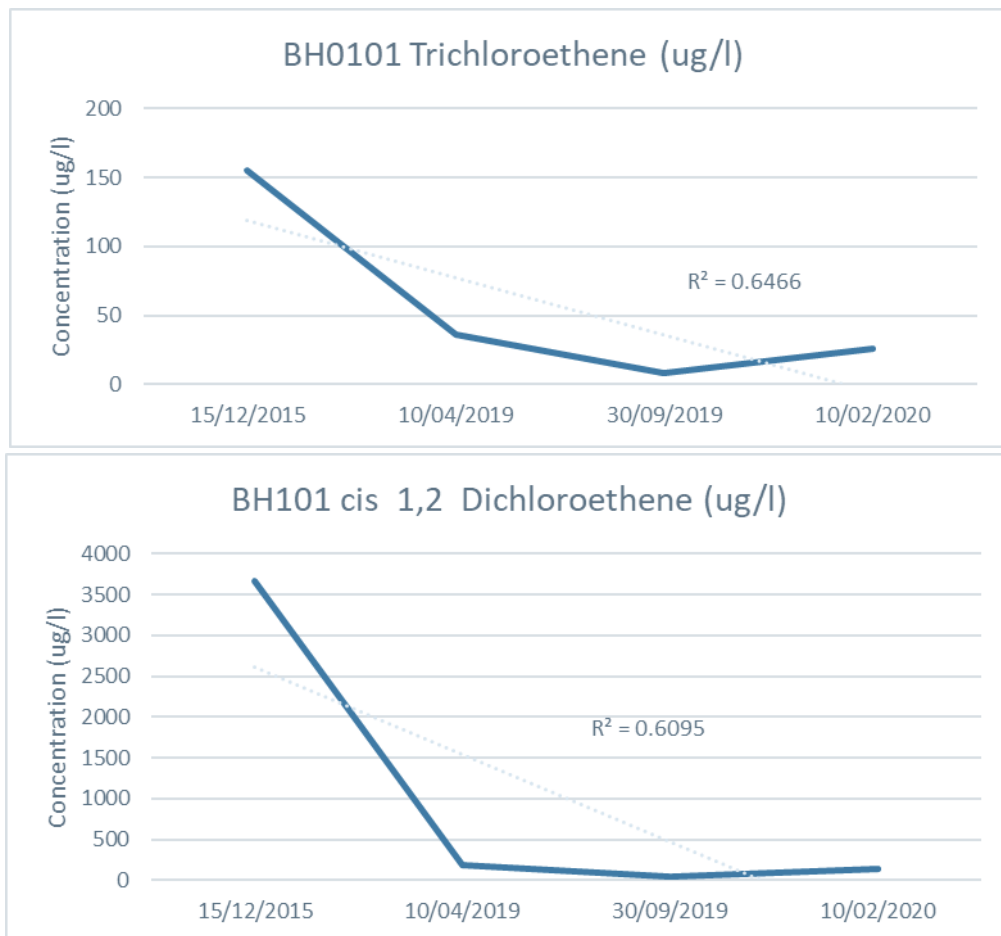


Figure 6-2 – Rate of Declining Concentrations at BH101



In populating source concentrations in both models, the maximum concentrations seen in 2020 have been applied from within the solvent cluster as per Table 6-4.

Table 6-4 - Source Concentrations taken from 2020 monitoring (all units µg/l) used to populate models 1 and 2

Species	Concentration used	Concentration recorded from
Tetrachloroethene (PCE)	568	BH101
Trichloroethene (TCE)	41.3	WS206
Cis 1,2-Dichloroethene	1100	WS206
Vinyl chloride	192	BH210

6.1.3. POLLUTANT ASSESSMENT POINTS (PAP)

Five rounds of groundwater monitoring are now available since the 9th April 2019. The boreholes screened in River Terrace Gravels and Chalk have consistently demonstrated generally similar water levels suggestive of hydraulic continuity. Those in the Made Ground and Alluvium have been observed much closer to surface suggestive of perched waters. **Figure 3-1** has previously presented an interpolation of the flow regime for four of these rounds of data inclusive of the River Terrace Gravels and Chalk only. Hydraulic gradients have in the River Terrace Gravels and Chalk been low yet flow directions highly variable albeit reflecting only small changes in actual water levels. It is speculated that as the Site includes numerous buried structures and services such may be exerting a control on the variability in directions reported.

Next, the affected cluster has been observed to be perched in the Made Ground while trace concentrations of chlorinated solvents have been seen both south (BH302A) and northeast (BH105) in the Chalk. In the absence of a clearly defined and strong groundwater vector it is consequently conjectured that migration of the chlorinated solvents may in part have included gravity driven radial flow away from the perched cluster. However, in the absence of a clear groundwater vector then the pollutant assessment points selected have remained unchanged from the P20 DQRA i.e. to the northeast in the direction of the most sensitive surface waters i.e. the confluence of the River Thames and Kennet (the River Kennet itself to the south being lined and isolated from groundwaters).

6.1.4. GENERAL MODEL INPUT PARAMETERS - BIOCHLOR

Note that where possible site-specific data has been applied:

- Seepage velocity: calculated by multiplying hydraulic conductivity by hydraulic gradient and dividing by effective porosity; and
- Hydraulic Conductivity (K) (cm/sec).

In detail;

- **Hydraulic Conductivity.** In-situ hydraulic conductivity tests were conducted for the Alluvium, RTG and Chalk deposits (results are presented in the 2019 Supplementary Phase 2 Report Ref

[5]). Results indicated that the RTG have a hydraulic conductivity between 41.5 m/d and 177 m/d with a geometric mean of 105 m/d. Test results provide lower hydraulic conductivity values for the Chalk, between 3.7 m/d and 12.1 m/d with a geometric mean of 7 m/d. Based on these results model input parameters as per DQRA have been selected as:

- Model 1: RTG to be the pathway to surface waters, K value of 105 m/d (0.121cm/sec).
 - Model 2: Chalk to be the pathway to a potable future borehole, K value of 7 m/d (0.008cm/sec).
- **Hydraulic Gradient (i).** The hydraulic gradients for the RTG and Chalk aquifer were calculated for the P20 DQRA during the 2019 Supplementary Phase 2 Report (Ref. [5]). Five rounds of monitoring are however now available these would suggest low gradients ranging 0.0005 to 0.0044 but a typical value of 0.002 (see previous **Figure 3-1**);
- **Effective Porosity (n).** This is the dimensionless ratio of the volume of interconnected voids to the bulk volume of the aquifer matrix. The effective porosity as opposed to total porosity at the Site remains unknown however the range for a medium gravel (Brady & Kunkel, 2003¹⁰) may be expected to range from 0.192 to 0.28 representative of the RTG in model 1. Given the observed response within the permeability tests then it has been considered reasonable to presume a high effective porosity. For the purpose of modelling an effective porosity of 0.24 has been applied in Model 1. A value of 0.2 has been applied in Model 2 based on ~50% of the geomean value of the total porosity in the Chalk at the Thames and Chilterns area (38.8% total porosity) (BGS, The physical properties of major aquifers in England and Wales);
- **Longitudinal Dispersivity (alpha x). Transverse Dispersivity (alpha y) and Vertical Dispersivity (alpha z).** Dispersion refers to the process whereby a dissolved analyte will be spatially distributed longitudinally (along the direction of ground-water flow), transversely (perpendicular to ground-water flow), and vertically (downward) because of mechanical mixing and chemical diffusion in the aquifer. These values have been calculated in the models based upon a plume length (Model 1 as distance to the river of ~240m (787ft) and Model 2 distance to a theoretical future abstraction ~400m from the source (1,312ft));
- **Aquifer Matrix Bulk Density (pb).** Although this value can be measured in the lab, in most cases estimated values are used. The ConSim database would suggest for sandy gravel a range of 1.37 to 1.8 mg/l (Literature data for gravels (Wiedemeier, T. et al., 1995¹¹)). A value of 1.77g/cm³ has been adopted (Model 1)). The mean bulk density of Chalk at Thames and Chilterns area (BGS, the physical properties of major aquifers in England and Wales pg. 24) would suggest a range of 1.576 to 2.364 with a value of 1.97 applied (Model 2).

¹⁰ A Practical Technique for Quantifying Drainage Porosity. Michael Mark Brady and Larry A. Kunkel, PTS Laboratories, 2003.

¹¹ Wiedemeier, T. et al., Technical Protocol for Implementing Intrinsic Remediation with Long Term Monitoring for Natural Attenuation of Fuel Contamination Dissolved in Groundwater Vol. 1 and 2, Air Force Centre for Environmental Excellence, Brooks Air Force Base, San Antonio, TX, 1995.

- **Fraction Organic Carbon (foc).** This is the fraction of the aquifer soil matrix comprised of natural organic carbon in uncontaminated areas. More natural organic carbon means more adsorption of organic constituents on the aquifer matrix. A total of 25 samples have been subject to %SOM or foc at the Site. SOM values have been converted to foc by multiplying by 0.0058. Average foc is generally within the same order of magnitude across the different lithologies with a geometric mean of 0.0074 and 0.002 Models 1 (RTG) and 2 (Chalk) respectively.
- **Model Area Length and Width (L and W).** This is the physical dimensions (in feet) of the rectangular area to be modelled – 164ft (50m) to future resource protection, 590ft (180m) to the Thames and 164ft (50m) wide. Note that the width has been estimated to encompass the zone containing the greatest mass (all 3 locations containing 98% of the mass) yet, doubled to allow downgradient lateral dispersion;
- **Source Area Width (ft).** This parameter has been taken to be 82ft (25m) to initially encompass the line of the three affected boreholes towards the north-eastern limits of the Site. The source area is typically defined as containing the area with contaminated groundwaters having witnessed the highest concentrations; and
- **Source Thickness in the Saturated Zone (Z).** This is the thickness of dissolved solvent in the source area. The P20 model assumed in Model 1 a maximum plume thickness of 5m (16.4ft) based on the River Terrace Gravels to represent the thickness that may reasonably be in potential hydraulic connection with the wetted perimeter of the distant surface waters and 5.91m (19.3ft) in Model 2. However, in proximity to the three most affected wells chlorinated solvents have been seen at trace concentrations to 19m in BH302A. A thickness of 20m (65ft) has been assumed under precautionary principles in Model 2. In summary under precautionary approach we have applied the source concentrations seen in the Made Ground to both the River Terrace Gravels (Model 1) and the Chalk (Model 2). This is potentially a conservative assumption as vertical migration and attenuation will from the Made Ground will presumably have occurred.

6.1.5. BIOCHLOR MODEL SPECIFIC PARAMETERS

The Koc applied for the chlorinated solvents (l/kg) have been taken from assumed as per the P20 DQRA as:

- Tetrachloroethene (PCE) – 94.9 l/kg;
- Trichloroethene (TCE) – 87 l/kg;
- Cis 1,2-dichloroethene (1,2 cis-DCE), trans-1,2-dichloroethane (1,2 trans-DCE), 1,1-dichloroethene (1,1 DCE) - 132 l/kg;
- Vinyl Chloride (VC) – 23.4 l/kg; and
- Ethene (ETH) – 302 l/kg.

First order decay coefficients have next been taken as per Table 6-5 for Models 1 and 2. As noted in Section 5.3.5 it is considered that degradation has/is occurring. Literature values for half-life were previously taken in the DQRA from “Howard, P, H., Boethling, R, S., Jarvis, W, F., Meylan, W, M. & Michalenko, E, M. (1991) Handbook of environmental degradation rates. Chelsea, Michigan. Lewis Publishers”. However, BIOCHLOR applies first order decay coefficients and suggests a likely range. Some uncertainty remains associated with the available dissolved oxygen results, hence adopting

the fastest rates could be considered as being misrepresentative. Conversely, given the rates of degradation observed from **Figure 6-2** then the slowest rates may also be misrepresentative. The mid points of the BIOCHLOR ranges have now been applied.

Table 6-5 - The First Order Decay Coefficients applied in our initial BIOCHLOR Model

Determinand	(1/yr)	
	Range value	Value used
Tetrachloroethene	0.8-2.4	1.6
Trichloroethene	0.3-2.4	1.35
Cis 1,2 dichloroethene	0.1-2.2	1.15
Vinyl chloride	0.4-4.9	2.65

6.1.6. BIOCHLOR ADDITIONAL MODEL ASSUMPTIONS

No attenuation in the riparian and hyporheic environments has been considered. However, research has shown that increased attenuation of certain contaminants can occur in such environments as a result of steep chemical and hydraulic gradients, greater organic content than the adjacent aquifer and a dense and more readily replenished microbial community.

Next for existing and passive inputs if surface water has capacity then dilution in surface waters is allowed up to its AA-EQS. We have assumed no dilution or attenuation in the surface waters. By this means, no matter what volume of groundwater enters the watercourse, the AA-EQS cannot be compromised. A second iteration (if justified) could be to consider the potential interaction between the groundwater body and the watercourse and the effects of attenuation in the hyporheic zone, and subsequently instantaneous dilution within the watercourse.

6.2. BIOCHLOR MODEL CALIBRATION AND RESULTS

If a plume is in a steady-state or diminishing condition, then such models can on occasion be used to determine first-order decay coefficients that best match the observed site concentrations i.e. be calibrated. This is done by using a trial-and-error procedure or by using the Bushek/Alcantar method. However, insufficient centre line data down gradient of the cluster is available for using the Bushek/Alcantar method.

Presumed down gradient borehole, BH105 has observed some evidence of dissolved PCE and TCE together with its degradation products as per Table 6-6. This well is located at circa 40 m (130ft) northeast of the observed solvent cluster.

Table 6-6 - Observed Concentrations in BH105 (all units are µg/l)

Determinand	BH105 11/02/2020	BH105 10/04/2019	BH105 15/12/2015	BH105 24/11/2015
Tetrachloroethene	<1	<1	6.05	6.33
Trichloroethene	<1	<1	1.84	2
Cis 1,2 dichloroethene	9.14	47.6	1.18	1.18
trans 1,2 dichloroethene	<1	<1	<1	<1

Determinand	BH105 11/02/2020	BH105 10/04/2019	BH105 15/12/2015	BH105 24/11/2015
Vinyl chloride	13.3	26.4	2.83	2.63
Ethene	9.56	14		

The highest observed site concentrations in 2015 were observed from BH101 (Made Ground). Approximately 4.2 years later then concentrations as above are available from BH105 (Chalk) including February 2020 and April 2019. Question arises as to whether BH101 (2015) concentrations can be modelled by trial and error to reproduce those results seen later in BH105 (2020) post fate and transport. Such would then lend confidence to the production and outputs of BIOCHLOR Models 1 and 2.

In summary, model projections unfortunately over project the observed concentrations reported at BH105 in 2020 as per **Figure 6-3** and **6-4**. This could be as expected given that source concentrations were in the Made Ground, yet BH105 reflects the Chalk and similar concentrations may not exist below the source in the Chalk. This has been necessitated as responses zone results from within the Chalk and the source at a similar depth to BH105 are not available. Furthermore, the model has assumed a direct centre line comparison and yet available flow directions have been variable (BH105 may not be centreline). Unrealistically fast rates of degradation would be required to reconstruct the data at BH105. In conclusion, calibrating the model to generate site specific first order decay coefficients cannot be confidently made with the data available. Yet it is also noted that use of a model that still over projects could be considered as being precautionary.

Figure 6-3 - BIOCHLOR model calibration set up

BIOCHLOR Natural Attenuation Decision Support System
Version 2.2
Excel 2000

Reading Model
Calibratic #####
Run Name

1. ADVECTION
TYPE OF CHLORINATED SOLVENT: Ethenes ☒ Ethanes ☐
Seepage Velocity* Vs 82.8 (ft/yr)
Hydraulic Conductivity K 8.0E-03 (cm/sec)
Hydraulic Gradient i 0.002 (ft/ft)
Effective Porosity n 0.2 (-)

2. DISPERSION
Alpha x* 16.4 (ft)
(Alpha y) / (Alpha x)* 0.1 (-)
(Alpha z) / (Alpha x)* 1.E-99 (-)
Calc. Alpha x

3. ADSORPTION
Retardation Factor* R
Soil Bulk Density, rho 1.97 (kg/L)
Fraction Organic Carbon, f_{oc} 2.0E-3 (-)
Partition Coefficient K_{oc}
PCE 95 (L/kg) 2.87 (-)
TCE 87 (L/kg) 2.71 (-)
DCE 132 (L/kg) 3.60 (-)
VC 23 (L/kg) 1.46 (-)
ETH 302 (L/kg) 6.95 (-)
Common R (used in model)* = 2.87

4. BIOTRANSFORMATION 1st Order Decay Coefficient
Zone 1
PCE TCE 0.800 half-life (yrs) 0.79
TCE DCE 0.300 half-life (yrs) 0.74
DCE VC 0.100 half-life (yrs) 0.64
VC H 0.400 half-life (yrs) 0.45
Zone 2
PCE TCE 0.000 half-life (yrs)
TCE DCE 0.000 half-life (yrs)
DCE VC 0.000 half-life (yrs)
VC H 0.000 half-life (yrs)

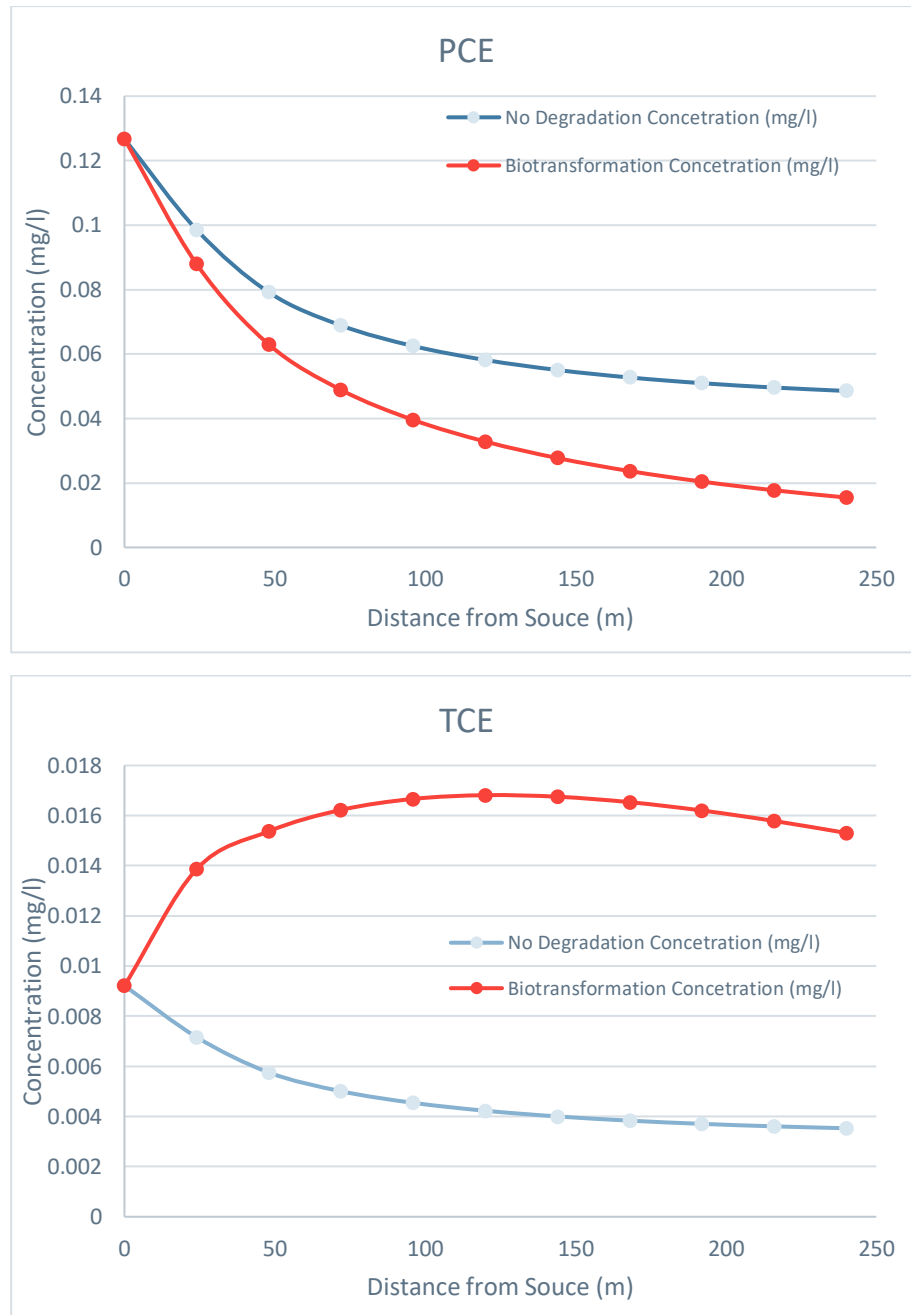
5. GENERAL
Simulation Time* 4 (yr)
Modeled Area Width* 164 (ft)
Modeled Area Length* 164 (ft)
Zone 1 Length* 164 (ft)
Zone 2 Length* 0 (ft)
Zone 2 = L - Zone 1

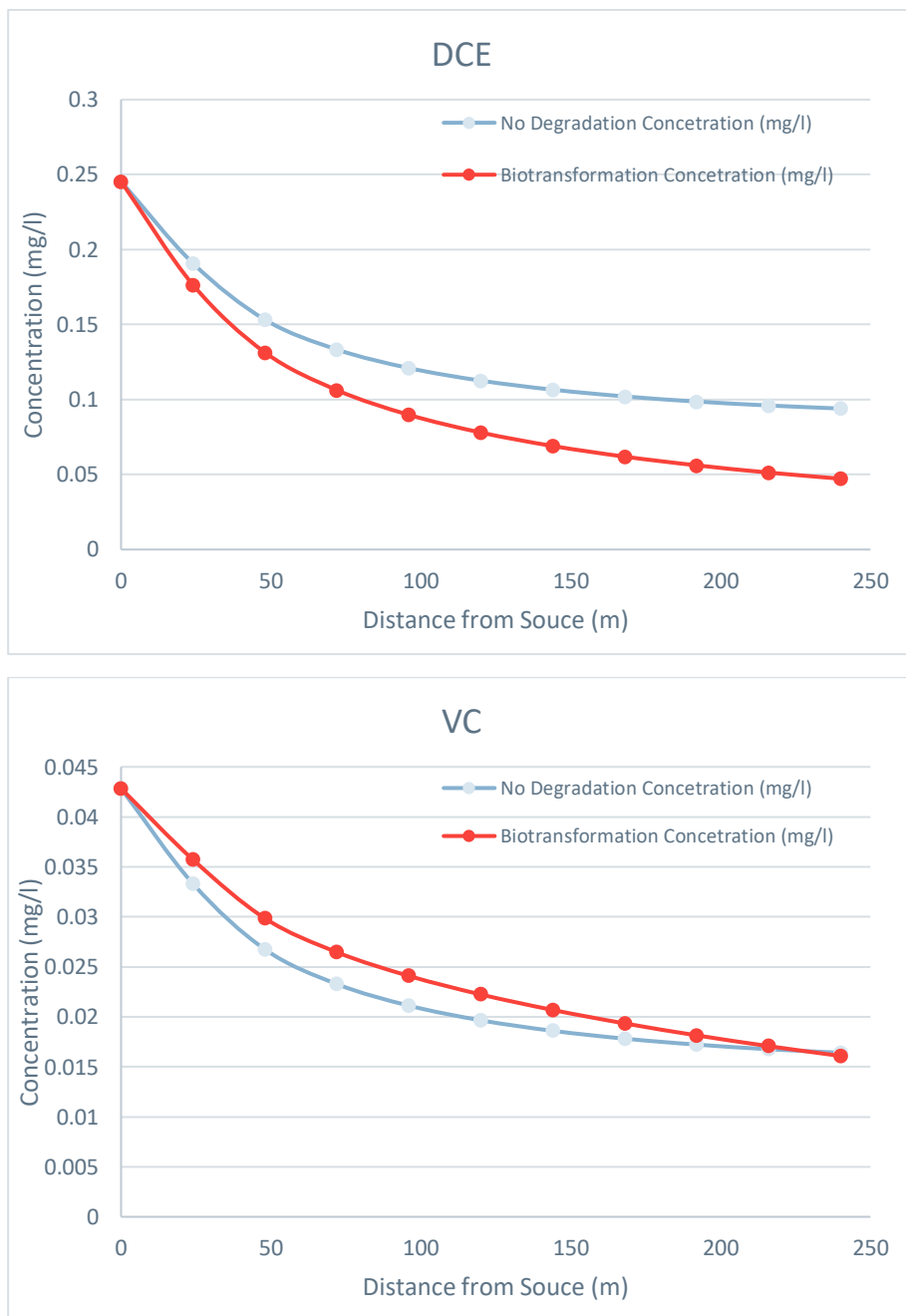
6. SOURCE DATA
Source Options
TYPE: Decaying Single Planar
Source Thickness in Sat. Zone Y1 65 (ft)
Width* (ft) 82
Conc. (mg/L)* C1
PCE .293
TCE .155
DCE 3.66
VC 1.16
ETH 0.01
k_s* (1/yr) 0.06
View of Plume Looking Down
Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON
PCE Conc. (mg/L) .001 .001
TCE Conc. (mg/L) .001 .001
DCE Conc. (mg/L) .009 .048
VC Conc. (mg/L) .013 .026
ETH Conc. (mg/L) .01 .014
Distance from Source (ft) 130 130
Date Data Collected 2020

8. CHOOSE TYPE OF OUTPUT TO SEE:
RUN CENTERLINE
RUN ARRAY
Help
Restore Formulas
RESET
SEE
Paste
Unprotect

Figure 6-4 BIOCHLOR model 1 calibration results by species. Note that the field data from BH105 has been plotted as the distance from BH101. This calibration model has included 2015 source concentrations (BH101)





To reiterate despite an absence of conclusive calibration, the model input parameters remain in part precautionary and hence BIOCHLOR Model 1 and 2 run projections are now included as below.

6.2.1. RESULTS OF BIOCHLOR FATE AND TRANSPORT MODELLING TO SURFACE WATERS - MODEL SCENARIO 1

No freshwater EQS exists for either DCE or VC. The value for both PCE and TCE at 0.01mg/l has therefore been assumed for all four species. The River Thames has been assumed to be the receptor located at ~240m (787ft) northeast from the Site's boundary. Given the high conductivities in the River Terrace Gravels, a simulation time of only 25 years has been made to capture a

declining source. Migration has been assumed to occur via the River Terrace Gravels and contamination has been seen in the River Terrace Gravels at BH201 within the source cluster.

Model results indicate that predicted groundwater concentrations of all solvents at 240 m may still exceed the selected AA-EQS (Table 2).

Table 6-7 - Biochlor Model Results – Risk to the River Thames

Determinand	Source concentration (mg/l)	AA-EQS (mg/l)	Predicted concentration at 240 m
PCE	0.568 (BH101, MG)	0.01	0.015
TCE	0.041 (WS206, MG)	0.01	0.015
DCE	1.1 (WS206, MG)	0.01 *	0.047
Vinyl Chloride	0.192 (BH201 RTG)	0.01 *	0.016

*no AA-EQS available, proxy taken from TCE

The assessment has, however, assumed the AA-EQS for DCE and VC to be equivalent to that of TCE when in actuality a statutory EQS for these species is absent.

In addition, no account for the dilution in the River Thames has been made. It is important to note that the Level 4 assessment has not been used in the risk assessment process, but has been conducted here for illustrative purposes only.

The precautionary approach adopted by this document established the compliance point within the groundwater body immediately up-gradient of the watercourse and fixed the target groundwater concentration as being equal to the target concentrations that would be applied in the watercourse (the relevant AA-EQS). By this means, no matter what volume of groundwater enters the watercourse, the AA-EQS could not be compromised.

As a second iteration, consideration of the potential interaction between the groundwater body and the watercourse and the effects of attenuation in the hyporheic zone and dilution in the watercourse can be considered.

A higher organic carbon content in riparian / hyporheic zones (i.e. the shallow groundwater and surface water mixing zones), may cause oxygen depletion and result in reducing conditions. Studies have shown increased nitrification and reduction of other reducible pollutants. Similarly, higher organic carbon and clay mineral content in alluvial sediments may increase retardation (sorption) of pollutants. However, the riparian and hyporheic zones are typically highly heterogeneous and relatively thin. Pollutant movement times may be small and variable. If such was to be considered, then investigations of natural attenuation processes at the groundwater / surface water interface would need to be established. Consequently, quantifying the effects of attenuation in the hyporheic zone has been ignored despite their potential to reduce flux.

A dilution factor may still however be calculated at low river flows – typically the river flow exceeded 95 per cent of the time (Q95 flow) taken from an up-stream location.

The dilution capacity of the River Thames at the site location is likely to be high. It is likely that even assuming worst case conditions the water in the river would dilute any contributing groundwater concentrations to below the AA-EQS. To support this assumption, dilution into the River Thames has been calculated below (a Level 4 assessment) using a set of worst-case input parameters and projected concentrations selected via worst case analysis.

Following, the Environment Agency, 2006, Remedial Targets Methodology then dilution factors (DF) have been calculated as:

$$D_f = (Q_c + Q_u) / Q_c$$

where:

D_f = dilution factor

Q_c = groundwater flow below the site; $Q_c = K \times l \times M_z \times w$

Q_u = surface water flow upstream of discharge point (Q_{95})

These have, however, included even further conservatism by way of inclusion of +40% uplift in hydraulic gradients and permeabilities (see BIOCHLOR Sensitivity Analysis in Section 6.2.3). Also, when comparing projections against dilution then again, we have assumed worst case conditions (+40% K and i parameters).

Table 6-8 - Dilution calculation parameters (worst case values)

Parameter	Value	Units	Reference
K	147	m/d	40% increase over baseline (worst case condition see sensitivity analysis)
w	50	m	NW-SE site section
Mz	5	m	From log data
i	0.0028		40% increase over baseline (worst case condition see sensitivity analysis)
Qc	102.9	m ³ /d	Calculated ($K \cdot i \cdot M_z \cdot w$)
Qu(Q95)	4.56E+05	m ³ /d	From River Thames gauging station
Dilution Factor = 4,434			

The Level 4 SSAC has then been calculated as:

$$SSAC = 10\% \text{ GAC} \times DF$$

Derived SSACs are included in Table 6-9.

Table 6-9 - Level 4 Assessment Results

Determinand	Source concentration (mg/l)	Predicted concentrations worst case conditions (mg/l) from sensitivity analysis	AA EQS (mg/l)	L4 SSAC (mg/l)
PCE	0.568 (BH101, MG)	0.202	0.01	4.434
TCE	0.041 (WS206, MG)	0.119	0.01	4.434
DCE	1.1 (WS206, MG)	2.640	0.01 *	4.434
Vinyl Chloride	0.192 (BH201 RTG)	0.831	0.01 *	4.434
Free Cyanide	0.0803^	N/A	0.001	0.443

*no AA-EQS available, proxy taken from TCE

^ L4 SSAC compared to maximum site concentration

None of the predicted groundwater concentrations with worst case conditions at 240 m from the site exceed the derived L4 SSAC, which would be up to one order of magnitude higher.

6.2.1.1. Summary

Groundwater concentrations of chlorinated solvents, aromatics >C8-C10 and free cyanide exceeded L3 SSAC derived for the 240 m compliance point. However, the exceedances are not considered significant due to:

- Aromatics C8-C10 exceedances have been limited to one location and only in n 2015.

In addition, although not taken considered as part of this L3 assessment, it has also been shown that the River Thames dilution capacity is high enough to reduce the groundwater concentrations to below the AA-EQS even when accounting for worst case conditions (40% increase in K and i).

6.2.2. RESULTS OF BIOCHLOR FATE AND TRANSPORT MODELLING TO FUTURE RESOURCE PROTECTION - MODEL SCENARIO 2

This model has included an assessment of observed groundwater concentrations to conservatively impact a theoretical future groundwater abstraction i.e. for future resource protection at a distance 400m (1,312ft) northeast from the cluster. Both contaminant transport and abstraction have been assumed to be from within the Chalk. The latter has also been assigned similar source concentrations as seen in the Made Ground in the absence of testing within the Chalk from within the cluster.

Drinking water standards are only available for DCE and VC at 50 and 0.5µg/l. Model projections for these two analytes suggest that at the theoretical assessment point, DCE concentrations are to be below its drinking water standard. Conversely, vinyl chloride projections may arise above its own much lower target value.

Model results indicate that only concentrations of vinyl chloride (VC) potentially exceed the Drinking Water Standard (DWS) (**Table 6-10**). It should be noted, however, that the VC concentration is strongly influenced by the rate of ingrowth from its parents PCE, TCE and DCE degradation (degradation rates). BIOCHLOR applies first order decay coefficients and suggests a likely range. Some uncertainty remains associated with the available dissolved oxygen results, hence adopting the fastest rates could be considered as being misrepresentative, and conversely, given the evidence of degradation products observed from site data, the slowest rates may also be misrepresentative. The mid points of the BIOCHLOR ranges have therefore been applied as a conservative approach, however, in reality degradation rates may be faster. Furthermore, the model has assumed the highest source concentrations detected on the site irrespective of location, while average site concentrations may be much lower. Attenuation along the vertical pathway from the drift (where the highest concentrations have been observed) to the groundwater within the Chalk has also not been assessed in this model, therefore offering further conservatism.

Table 6-10 - Biochlor Model 2 Results – Risk to future resource potential at 400m distance in the Chalk

Determinand	Source concentration (mg/l)	DWS (mg/l)	Predicted concentration at 400 m
PCE	0.568 (BH101, MG)	0.01	0.003
TCE	0.041 (WS206, MG)	0.01	0.006
DCE	1.1 (WS206, MG)	0.05	0.016
Vinyl Chloride	0.192 (BH201 RTG)	0.0005	0.006

Red shading indicates an exceedance of the DWS

When accounting for ingrowth of VC then BIOCHLOR supports the finding of the P20 model in respect of VC being suggestive of a risk. Yet as noted the concentrations detected and applied in these models has only been detected in the drift and not the Chalk. The plausibility of this risk being realised continues to be low.

Note that:

- No groundwater abstractions currently exist on site or under its planned continued use or in its proximity. The Environment Agency classifies the Seaford Chalk Formation and Newhaven Chalk Formation as Principal Aquifers. The Site is situated within a total catchment Source Protection Zone (SPZ) driven by a potable water abstraction located approximately 2 km south of the Site. Further potable water abstractions are located ~619 m east and 1 km southwest of the Site.

6.2.2.1. Summary

Based on the results of the updated models, the risk to a hypothetical future abstraction would appear limited to:

- Ammoniacal nitrogen concentrations detected within the southwest corner of site (BH201 and BH302); and
- Solvent concentrations detected at the northwest corner of the site (BH101, WS206 and BH201).

However, these risk projections still contain conservative assumptions; in summary, a toxic effect to human health from ammoniacal nitrogen consumption in drinking waters is unlikely and the nearest abstraction resides up not down gradient. Meanwhile the chlorinated solvents on site would appear to be perched with the concentrations applied in model 2 being found in the drift and not the Chalk. Furthermore, chlorinated solvent risks have assumed the highest concentrations seen as their source and therefore not necessarily the most representative concentrations.

6.2.3. BIOCHLOR MODEL SENSITIVITY

An assessment of concentrations at the receptor 25 years after present (AP) would appear to be controlled predominately within the model by aquifer conductivity, source concentrations, together with the biodegradation rates applied.

The aquifer conductivity applied has been based upon field tests. The values applied do however, reside within literature ranges for the observed geology. However, it may also be ventured that the CLAY rich Made Ground and Alluvium of the source may act in part to limit the vertical migration of the chlorinated solvents. Given trace observations of the solvents in for example BH105 then it has however, been assumed that hydraulic connection exists unimpeded to both the River Terrace Gravels and the Chalk until proven otherwise. BH201 in the River Terrace Gravels has witnessed ~16% of the observed mass. Given the volume of services on site it is unlikely that the Alluvium could be considered as totally confining and protective of the underlying geology.

Identifying a degradation rate from within the literature offers a range of values. The user must subjectively select a value from such a range knowing that they will be site specific. It is typically considered better where possible to calibrate a model with actual down gradient data. Such calibrations can only ever be approximations as they are assuming plume centreline and steady state conditions amongst other assumptions. Model calibration has failed herein without invoking unrealistic (very fast) rates of biodegradation at the Site. Precise rates of biodegradation remain unknown, however, given the evidence of high DCE and VC daughter product condemnations within the source area, then assuming the midpoint in the available literature rates suggested within BIOCHLOR could be considered as generally reasonable at this time. In addition, concentrations in the source in 2020, albeit they have generally decreased post 2015, have remained high relative to their standards and hence the projected exceedances.

For completeness, given uncertainty in the potential hydraulic properties of the path length we have also performed a further assessment of sensitivity in particular respect of the chlorinated solvents and risks to the closest receptor, surface waters (the River Thames).

This sensitivity analysis has been undertaken by increasing by +40% (arbitrary) the input parameters included in the BIOCHLOR Model 1 scenario for hydraulic permeability (K), hydraulic gradient (i), effective porosity (n) and bulk density. The aim being to generate a “what if scenario” i.e. what if we have underestimated fate and transport? Note we have also previously applied this +40% in Table 6-8, dilution calculation parameters (strongly precautionary).

Projected output concentrations using these arbitrary worst-case input parameters are shown in Table 6-11. Results of the sensitivity analysis are summarised on Table 6-12. This simulation increases projected concentration by the river significantly. Yet when accounting for dilution (Table 6-9), such risks would still be negated i.e. even if we have underestimated path length properties than dilution would in the receiving water still appear sufficient to mitigate the hazard.

Table 6-11 - BIOCHLOR Results – Baseline Model 1 Scenario vs Worst Case Conditions (+40% K and i)

Determinand	Source concentration (mg/l)	AA EQS (mg/l)	Baseline Predicted concentration at 240 m	Predicted Concentrations worst case conditions	% over baseline
PCE	0.568 (BH101, MG)	0.01	0.015	0.202	1,198
TCE	0.041 (WS206, MG)	0.01	0.015	0.119	678
DCE	1.1 (WS206, MG)	0.01*	0.047	2.640	5,479
Vinyl Chloride	0.192 (BH201 RTG)	0.01*	0.016	0.831	5,061

Cells highlighted in red indicate concentration exceeds AA-EQS

* No AA-EQS available, proxy taken from TCE

Table 6-12 - Biochlor Model 1 Scenario Sensitivity Analysis Results – Risk to the River Thames

Determinand	AA EQS (mg/l)	Baseline Predicted concentration at 240 m	+40%		-40%	
			Pred. Conc	% over baseline	Pred. Conc	% over baseline
K						
PCE	0.01	0.015	0.020	26	0.009	-40
TCE	0.01	0.015	0.014	-6	0.015	-5
DCE	0.01*	0.047	0.052	10	0.039	-18
Vinyl Chloride	0.01*	0.016	0.016	2	0.014	-11
i						
PCE	0.01	0.015	0.020	26	0.009	-40
TCE	0.01	0.015	0.014	-6	0.015	-5
DCE	0.01*	0.047	0.052	10	0.039	-18
Vinyl Chloride	0.01*	0.016	0.016	2	0.014	-11
n						
PCE	0.01	0.015	0.011	-32	0.023	50
TCE	0.01	0.015	0.014	-9	0.015	-2
DCE	0.01*	0.047	0.039	-19	0.059	25
Vinyl Chloride	0.01*	0.016	0.014	-14	0.018	12
Bulk density						
PCE	0.01	0.015	0.017	8	0.014	-8
TCE	0.01	0.015	0.017	10	0.014	-9
DCE	0.01*	0.047	0.052	9	0.043	-8
Vinyl Chloride	0.01*	0.016	0.018	10	0.015	-9

Cells highlighted in red indicate concentration exceeds AA-EQS

*no AA-EQS available, proxy taken from TCE

6.3. BIOCHLOR SUMMARY

Generic risk assessment (Ref. [5]) identified a potential risk to Controlled Waters from chlorinated solvents. To further deliver an understanding of the potential for the future generation of chlorinated degradation products to accumulate, the software package BIOCHLOR has been used to project their fate and transport. The chlorinated mass has been observed as a cluster. Greatest mass has been observed within the Made Ground and Alluvium. These lithologies have been described as CLAY rich and such may be limiting/attenuating the vertical migration of the chlorinated solvents. However, for modelling it has been assumed that those concentrations seen in the Made Ground and Alluvium also exist in both the River Terrace Gravels and Chalk. Borehole BH201 screened within the River Terrace Gravels has reported ~16% of the observed mass.

From the available data, the results suggest that source degradation has been occurring. Furthermore, post 2015 the mass of the different chlorinated species has generally been decreasing rapidly. However, a theoretical risk to both surface waters and resource protection still arises based on the observed 2020 concentrations and the BIOCHLOR model projections. It should be noted, however, that this modelling has continued to retain a degree of conservatism.

To conclude, monitoring in 2020 has continued to observe a cluster of chlorinated solvents and precautionary modelling has now suggested that dissolved phase risks based on the available data to both surface waters and future resource protection maybe considered as low to moderate, respectively.

7. CONCLUSIONS AND RECOMMENDATIONS

WSP was instructed by SGN to update the Controlled Waters DQRA undertaken at Alexander Turner Close, Reading. This request has followed several phases of historic intrusive investigation and supplementary monitoring works. A GQRA protective of Controlled Waters was produced following initial investigations in which the Principal Aquifer (Chalk formations) and River Thames were identified as potential Controlled Waters receptors. Generic exceedances of several determinands both organic and inorganic were subsequently identified highlighting a potential risk. A more refined site-specific assessment of this risk has now been performed.

Site Specific Assessment Criteria (SSAC) have been derived and screened against the available soil, leachate and groundwater analytical data. Similarly, a specific model has been applied to consider the potential for the ingrowth of chlorinated daughter products. Concentrations of several determinants continue to be identified in exceedance of their respective SSAC for the protection of both surface water and groundwaters.

Model results have identified the following potential exceedances, and therefore potential risks:

- In respect of surface waters and the River Thames (pre-dilution):
 - Chlorinated solvents: TCE in perched waters and PCE in groundwater in the west of the Site (consistent with shallow soil concentrations);
 - Free cyanide: in shallow soils (<1m) in the north of the site; and
 - Total petroleum hydrocarbons (TPH): in a single sample of groundwater from 2015 in the northwest of the Site.
- In respect of groundwater resource and theoretical future abstraction (400 m CP);
 - Ammoniacal nitrogen: detected within all groundwater bodies throughout the Site (consistent with Made Ground soil concentration); and
 - Chlorinated solvents: DCE and VC detected in groundwater within the western area of the Site.

The overall risk of the Site is considered to be low to moderate. However, this level of risk is based on a series of conservative assumptions, and the risk to the surface waters could be significantly reduced if dilution in the river were to be accounted for.

7.1. RECOMMENDATIONS

Based on the results of this DQRA, conditions at the Site remain to suggest a potential risk to controlled water receptors from the observed dissolved phase concentrations. Remedial works are required to reduce these identified theoretical risks to groundwaters and surface water prior to Site redevelopment in-line with the Remediation Scheme which will be developed for the Site.

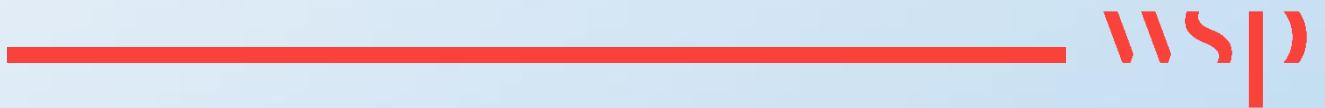
Finally, it should also be noted that under Part IIA as reflected in planning, a reasonable balance is required between: (a) dealing with risks raised by contaminants in land and the benefits of remediating land to remove or reduce those risks; and (b) the financial costs to whoever will pay for remediation, health and environmental impacts of taking action, property blight, and burdens on affected people.



The regulator and problem holder should take a precautionary approach to the risks raised by contamination, whilst avoiding a disproportionate approach given the circumstances of each case. It is considered likely that if the surface water dilution calculations demonstrated in this document were adopted, the risk to this receptor would reduce below concern.

Appendix A

DRAWINGS





KEY

— SITE BOUNDARY

Contains Ordnance Survey data ©Crown copyright and database right (2019)



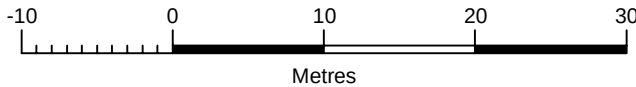
Kings Orchard
1 Queen Street
Bristol BS2 0HQ

Tel: 44-(0)1179-306200

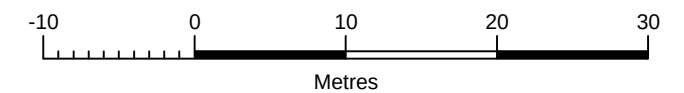
Client/Project:
**DANESCROFT (KENAVON DRIVE
PROJECT MANAGEMENT) LLP
GASHOLDER SITE AT ALEXANDER
TURNER CLOSE, READING**

Title:
SITE LOCATION PLAN

Drawn: CEW		Checked: EW	
Designed: EW		Approved:	
Date: 09/07/2019	Scale: 1:20,000	A4	Sheet:
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Rev	Date	Description	By	Chk	App	Notes	Client:	Title:	<table><tr><td>Drawn:</td><td>CEW</td><td>Checked:</td><td>EW</td></tr><tr><td>Designed:</td><td>EW</td><td colspan="2">Approved:</td></tr><tr><td>Date:</td><td>22/05/2019</td><td>Scale:</td><td>1:500 A3 Sheet:</td></tr><tr><td>Project Number:</td><td colspan="2">Drawing Number:</td><td>Revision:</td></tr><tr><td colspan="2">70031882</td><td colspan="2">002</td></tr><tr><td colspan="4">© WSP UK Ltd</td></tr></table>	Drawn:	CEW	Checked:	EW	Designed:	EW	Approved:		Date:	22/05/2019	Scale:	1:500 A3 Sheet:	Project Number:	Drawing Number:		Revision:	70031882		002		© WSP UK Ltd			
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70031882		002																															
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							 3rd Floor, Kings Orchard, 1 Queen St, Bristol, BS2 0HQ, UK T+ 44 (0) 1179 306 200 wsp.com	DANESCROFT (KENAVON DRIVE PROJECT MANAGEMENT) LLP Project: GASHOLDER SITE AT ALEXANDER TURNER CLOSE, READING	SITE LAYOUT																								

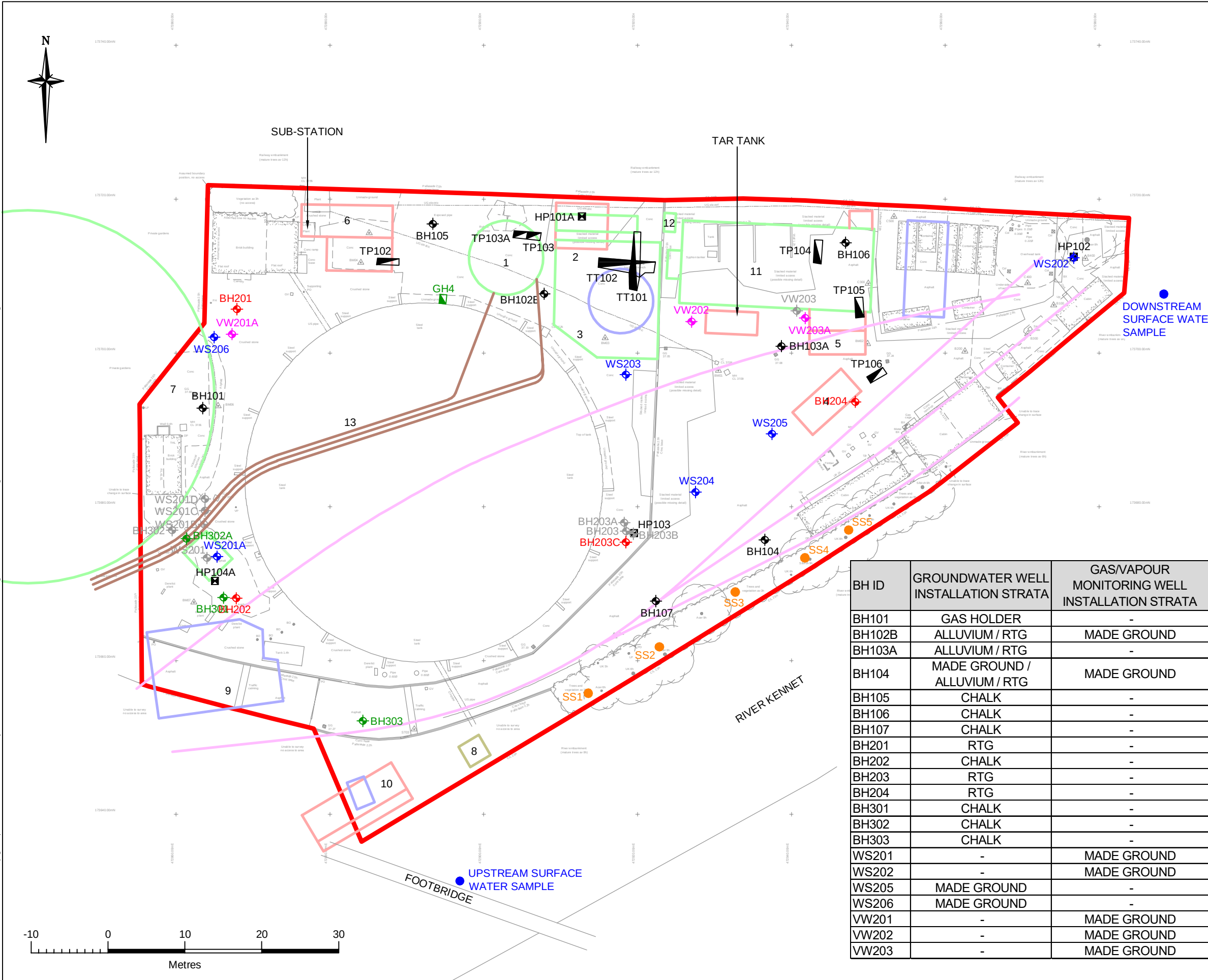


— EL — ELECTRIC CABLE

Rev	Date	Description	By	Chk	App	Notes:		Client:	Title:	Drawn: NB	Checked: KS
						1. SERVICE LOCATIONS ARE APPROXIMATE AND BASED ON THIRD PARTY INFORMATION. WSP TAKE NO RESPONSIBILITY FOR THE ACCURACY OF THIS INFORMATION. WHEN LOCATING SERVICES ON SITE REFER TO SERVICE PROVIDER PLANS.	 3rd Floor, Kings Orchard, 1 Queen St, Bristol, BS2 0HQ, UK T+ 44 (0) 1179 306 200 wsp.com	DANESCROFT (KENAVON DRIVE PROJECT MANAGEMENT) LLP	COMPOSITE SERVICE PLAN	Designed: EW	Approved: PD
								Project:		Date: 05/07/2018	Scale: 1:500 A3 Sheet:
										Project Number:	Drawing Number:
								GASHOLDER No. 4		287642I	003
								KENAVON DRIVE, READING		© WSP UK Ltd	

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Login: Waite, Emma
Plot Date: 08/03/2020 16:56:44

Drawn: EW
Checked: EW
Date: 28/11/2019
Scale: 1:500
A3
Sheet: 004



- KEY**
- SITE BOUNDARY
 - BH BOREHOLE LOCATION (2019)
 - BH SUPPLEMENTARY BOREHOLE (2019)
 - GH4 SUPPLEMENTARY TRIAL PIT (2019)
 - WS WINDOW SAMPLE LOCATION (2019)
 - VW VAPOUR WELL LOCATION (2019)
 - SS SOIL SAMPLE LOCATION (2019)
 - BH, WS, VW EXPLORATORY HOLE REFUSAL (2019)

- 2015 EXPLORATORY HOLE LOCATIONS**
- BH
 - HP
 - TP
 - TT

- KEY TO HISTORICAL STRUCTURES**
- DATE FIRST APPEARS ON OS PLAN
- 1899 - 1930
 - 1931 - 1970
 - 1971 ONWARD
- HISTORICAL STRUCTURE (FROM ENGINEERING DRAWING)
- HISTORICAL RAIL LINE (CENTRELINE)
- HISTORICAL TAR MAINS

- STRUCTURES**
- LIQUOR TANK (PRESENT 1899-1938)
 - PURIFIERS (PRESENT 1899-1933)
 - SULPHATE OF AMMONIA WORKS (PRESENT 1899-1933)
 - LIME STORE (PRESENT 1931-1938)
 - OVERHEAD ACID TANKS, LATER CARPENTERS SHOP UNDER (PRESENT 1931-1972)
 - SEPARATING PITS (PRESENT 1957)
 - GASHOLDER (PRESENT 1912-1962)
 - BOOSTER (DATE UNKNOWN)
 - LPG AIR ENRICHMENT PLANT (PRESENT 1973)
 - SCAFFOLD STORE (PRESENT 1957-1972)
 - CONCENTRATED LIQUOR & SULPHATE PLANT (PRESENT 1899-1979)
 - CHIMNEY (PRESENT 1899-1931)
 - TAR MAINS

BH ID	GROUNDWATER WELL INSTALLATION STRATA	GAS/VAPOUR MONITORING WELL INSTALLATION STRATA
BH101	GAS HOLDER	-
BH102B	ALLUVIUM / RTG	MADE GROUND
BH103A	ALLUVIUM / RTG	-
BH104	MADE GROUND / ALLUVIUM / RTG	MADE GROUND
BH105	CHALK	-
BH106	CHALK	-
BH107	CHALK	-
BH201	RTG	-
BH202	CHALK	-
BH203	RTG	-
BH204	RTG	-
BH301	CHALK	-
BH302	CHALK	-
BH303	CHALK	-
WS201	-	MADE GROUND
WS202	-	MADE GROUND
WS205	MADE GROUND	-
WS206	MADE GROUND	-
VW201	-	MADE GROUND
VW202	-	MADE GROUND
VW203	-	MADE GROUND

Rev	Date	Description	By	Chk	App	Notes

Kings Orchard
1 Queen Street
Bristol BS2 0HQ
Tel: 44-(0)1179-306200

Client:
DANESCROFT (KENAVON DRIVE PROJECT MANAGEMENT) LLP

Project:
GASHOLDER SITE AT ALEXANDER TURNER CLOSE, READING

Title:
PLAN SHOWING HISTORIC SITE STRUCTURES AND EXPLORATORY HOLE LOCATIONS

Drawn: CEW	Checked: EW		
Designed: EW	Approved:		
Date: 28/11/2019	Scale: 1:500	A3	Sheet:
Project Number: 70031882	Drawing Number: 004	Revision:	

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- KEY**
- SITE BOUNDARY
 - BH BOREHOLE LOCATION (2019)
 - BH SUPPLEMENTARY BOREHOLE (2019)
 - GH4 SUPPLEMENTARY TRIAL PIT (2019)
 - WS WINDOW SAMPLE LOCATION (2019)
 - VW VAPOUR WELL LOCATION (2019)
 - SS SOIL SAMPLE LOCATION (2019)
 - BH, WS, VW EXPLORATORY HOLE REFUSAL (2019)
 - BH
HP
TP
TT

2015 EXPLORATORY HOLE LOCATIONS

BH102B		
Date	24/11/2015 (µg/l)	01/10/2019 (µg/l)
Aromatics >EC8-EC10	235	-
Cyanide, Free (low level)	-	80.3

BH201	
Date	30/09/2019 (µg/l)
Cyanide, Free (low level)	5.96

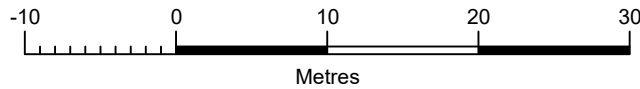
WS206		
Date	17/4/2019 (µg/l)	10/2/2020 (µg/l)
Trichloroethene	42.8	41.3
Tetrachloroethene	127	284

BH101				
Date	15/12/2015 (µg/l)	10/4/2019 (µg/l)	30/09/2019 (µg/l)	10/02/2020 (µg/l)
Trichloroethene	155	36.4	-	-
Tetrachloroethene	293	956	647	568

BH103A	
Date	01/10/2019 (µg/l)
Cyanide, Free (low level)	8.47

Screening Criteria	
Determinand	L3SSAC (µg/l)
Trichloroethene	34
Tetrachloroethene	34
Aromatics >EC8-EC10	145.3
Cyanide, Free (low level)	4.99

Rev	Date	Description	By	Chk	App
 3rd Floor, Kings Orchard, 1 Queen St, Bristol, BS2 0HQ, UK T+ 44 (0) 1179 306 200 wsp.com					
Client: DANESCROFT (KENAVON DRIVE PROJECT MANAGEMENT) LLP					
Site/Project: GASHOLDER SITE AT ALEXANDER TURNER CLOSE READING					
Title: GROUNDWATER & SURFACE WATER CONTAMINANTS EXCEEDING L3SSAC FOR THE PROTECTION OF SURFACE WATERS					
Drawn: NB			Checked: EW		
Designed: AJ			Approved:		
Date: March 2020		Scale: 1:500	A2	Sheet:	
Project Number:			Drawing Number:		Revision:
70031882			005		
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WS206	
Date	17/4/2019 (µg/l)
Vinyl Chloride	2750
cis-1, 2-Dichloroethene	5610

BH201			
Date	10/4/2019 (µg/l)	30/09/2019 (µg/l)	10/02/2020 (µg/l)
Vinyl Chloride	323	206	192

BH101	
Date	15/12/2015 (µg/l)
Vinyl Chloride	1160
cis-1, 2-Dichloroethene	3660

BH302A		
Date	01/10/2019 (µg/l)	10/02/2020 (µg/l)
Ammoniacal Nitrogen (as NH4)	134000	53600

BH301	
Date	10/02/2020 (µg/l)
Ammoniacal Nitrogen (as NH4)	64900

BH202		
Date	20/06/2019 (µg/l)	10/02/2020 (µg/l)
Ammoniacal Nitrogen (as NH4)	179000	130000

BH102B	
Date	24/11/2015 (µg/l)
Ammoniacal Nitrogen (as NH4)	56800

BH104		
Date	24/11/2015 (µg/l)	15/12/2015 (µg/l)
Ammoniacal Nitrogen (as NH4)	50300	50100

- KEY
- SITE BOUNDARY
- BH

BOREHOLE LOCATION (2019)
- BH

SUPPLEMENTARY BOREHOLE (2019)
- GH4

SUPPLEMENTARY TRIAL PIT (2019)
- WS

WINDOW SAMPLE LOCATION (2019)
- VW

VAPOUR WELL LOCATION (2019)
- SS

SOIL SAMPLE LOCATION (2019)
- BH, WS, VW

EXPLORATORY HOLE REFUSAL (2019)
- BH

HP

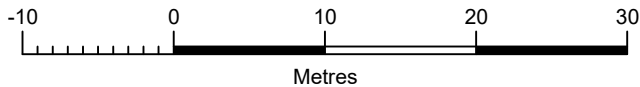
TP

TT

2015 EXPLORATORY HOLE LOCATIONS

Screening Criteria	
Determinand	L3SSAC (µg/l)
Ammoniacal Nitrogen (as NH4)	47,511
Vinyl Chloride	33.9
cis-1, 2-Dichloroethene	3,392

Rev	Date	Description	By	Chk	App
3rd Floor, Kings Orchard, 1 Queen St, Bristol, BS2 0HQ, UK T+ 44 (0) 1179 306 200 wsp.com					
Client: DANESCROFT (KENAVON DRIVE PROJECT MANAGEMENT) LLP					
Site/Project: GASHOLDER SITE AT ALEXANDER TURNER CLOSE READING					
Title: GROUNDWATER CONTAMINANTS EXCEEDING L3SSAC FOR THE PROTECTION OF THE GROUNDWATER RESOURCE					
Drawn: NB			Checked: EW		
Designed: AJ			Approved:		
Date: March 2020		Scale: 1:500	A2	Sheet:	
Project Number:			Drawing Number:		Revision:
70031882			006		
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Appendix B

REPORT LIMITATIONS



REPORT LIMITATIONS - GROUND RISK AND REMEDIATION

GENERAL

1. WSP UK Limited has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed and outlined in the body of the report.
2. Unless explicitly agreed otherwise, in writing, this report has been prepared under WSP UK Limited standard Terms and Conditions as included within our proposal to the Client.
3. Project specific appointment documents may be agreed at our discretion and a charge may be levied for both the time to review and finalise appointments documents and also for associated changes to the appointment terms. WSP UK Limited reserves the right to amend the fee should any changes to the appointment terms create an increase risk to WSP UK Limited.
4. The report needs to be considered in the light of the WSP UK Limited proposal and associated limitations of scope. The report needs to be read in full and isolated sections cannot be used without full reference to other elements of the report and any previous works referenced within the report.

PHASE 1 GEO ENVIRONMENTAL AND PRELIMINARY RISK ASSESSMENTS

Coverage: *This section covers reports with the following titles or combination of titles: phase 1; desk top study; geo environmental assessment; development appraisal; preliminary environmental risk assessment; constraints report; due diligence report; geotechnical development review; environmental statement; environmental chapter; project scope summary report (PSSR), program environmental impact report (PEIR), geotechnical development risk register; and, baseline environmental assessment.*

5. The works undertaken to prepare this report comprised a study of available and easily documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the Site and correspondence with relevant authorities and other interested parties. Due to the short timescales associated with these projects responses may not have been received from all parties. WSP UK Limited cannot be held responsible for any disclosures that are provided post production of our report and will not automatically update our report.
6. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only for the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, WSP UK Limited reserves the right to review such information and, if warranted, to modify the opinions accordingly.
7. It should be noted that any risks identified in this report are perceived risks based on the information reviewed. Actual risks can only be assessed following intrusive investigations of the site.
8. WSP UK Limited does not warrant work / data undertaken / provided by others.

REPORT LIMITATIONS - GROUND RISK AND REMEDIATION

INTRUSIVE INVESTIGATION REPORTS

Coverage: *The following report titles (or combination) may cover this category of work: geo environmental site investigation; geotechnical assessment; GIR (Ground Investigation reports); preliminary environmental and geotechnical risk assessment; and, geotechnical risk register.*

9. The investigation has been undertaken to provide information concerning either:
 - i. The type and degree of contamination present at the site in order to allow a generic quantitative risk assessment to be undertaken; or
 - ii. Information on the soil properties present at the site to allow for geotechnical development constraints to be considered.
10. The scope of the investigation was selected on the basis of the specific development and land use scenario proposed by the Client and may be inappropriate to another form of development or scheme. If the development layout was not known at the time of the investigation the report findings may need revisiting once the development layout is confirmed.
11. For contamination purposes, the objectives of the investigation are limited to establishing the risks associated with potential contamination sources with the potential to cause harm to human health, building materials, the environment (including adjacent land), or controlled waters.
12. For geotechnical investigations the purpose is to broadly consider potential development constraints associated with the physical property of the soils underlying the site within the context of the proposed future or continued use of the site, as stated within the report.
13. The amount of exploratory work, soil property testing and chemical testing undertaken has necessarily been restricted by various factors which may include accessibility, the presence of services; existing buildings; current site usage or short timescales. The exploratory holes completed assess only a small percentage of the area in relation to the overall size of the Site, and as such can only provide a general indication of conditions.
14. The number of sampling points and the methods of sampling and testing do not preclude the possible existence of contamination where concentrations may be significantly higher than those actually encountered or ground conditions that vary from those identified. In addition, there may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.
15. The inspection, testing and monitoring records relate specifically to the investigation points and the timeframe that the works were undertaken. They will also be limited by the techniques employed. As part of this assessment, WSP UK Limited has used reasonable skill and care to extrapolate conditions between these points based upon assumptions to develop our interpretation and conclusions. The assumption made in forming our conclusions is that the ground and groundwater conditions (both chemically and physically) are the same as have been encountered during the works undertaken at the specific points of investigation. Conditions can change between investigation points and these interpretations should be considered indicative.
16. The risk assessment and opinions provided are based on currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values. Specific assumptions associated

REPORT LIMITATIONS - GROUND RISK AND REMEDIATION

with the WSP UK Limited risk assessment process have been outlined within the body or associated appendix of the report.

17. Additional investigations may be required in order to satisfy relevant planning conditions or to resolve any engineering and environmental issues.
18. Where soil contamination concentrations recorded as part of this investigation are used for commentary on potential waste classification of soils for disposal purposes, these should be classed as indicative only. Due consideration should be given to the variability of contaminant concentrations taken from targeted samples versus bulk excavated soils and the potential variability of contaminant concentrations between sampling locations. Where major waste disposal operations are considered, targeted waste classification investigations should be designed.
19. The results of the asbestos testing are factually reported and interpretation given as to how this relates to the previous use of the site, the types of ground encountered and site conceptualisation. This does not however constitute a formal asbestos assessment. These results should be treated cautiously and should not be relied upon to provide detailed and representative information on the delineation, type and extent of bulk ACMs and / or trace loose asbestos fibres within the soil matrix at the site.
20. If costs have been included in relation to additional site works, and / or site remediation works these must be considered as indicative only and must be confirmed by a qualified quantity surveyor.

EUROCODE 7: GEOTECHNICAL DESIGN

21. On 1st April 2010, BS EN 1997-1:2004 (Eurocode 7: Geotechnical Design – Part 1) became the mandatory baseline standard for geotechnical ground investigations.
22. In terms of geotechnical design for foundations, slopes, retaining walls and earthworks, EC7 sets guidance on design procedures including specific guidance on the numbers and spacings of boreholes for geotechnical design, there are limits to methods of ground investigation and the quality of data obtained and there are also prescriptive methods of assessing soil strengths and methods of design. Unless otherwise explicitly stated, the work has not been undertaken in accordance with EC7. A standard geotechnical interpretative report will not meet the requirements of the Geotechnical Design Report (GDR) under Eurocode 7. The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. The report is likely to represent a Ground Investigation Report (GIR) under the Eurocode 7 guidance.

DETAILED QUANTITATIVE RISK ASSESSMENTS AND REMEDIAL STRATEGY REPORTS

23. These reports build upon previous report versions and associated notes. The scope of the investigation, further testing and monitoring and associated risk assessments were selected on the basis of the specific development and land use scenario proposed by the Client and may not be appropriate to another form of development or scheme layout. The risk assessment and opinions provided are based on currently available approaches in the generation of Site Specific Assessment Criteria relating to contamination concentrations and are not considered to represent a risk in a specific land use scenario to a specific receptor. No liability can be accepted for the retrospective effects of any future changes or amendments to these values, associated models or associated guidance.



REPORT LIMITATIONS - GROUND RISK AND REMEDIATION

- 24. The outputs of the Detailed Quantitative Risk Assessments are based upon WSP UK Limited manipulation of standard risk assessment models. These are our interpretation of the risk assessment criteria.
- 25. Prior to adoption on site they will need discussing and agreeing with the Regulatory Authorities prior to adoption on site. The regulatory discussion and engagement process may result in an alternative interpretation being determined and agreed. The process and timescales associated with the Regulatory Authority engagement are not within the control of WSP UK Limited. All costs and programmes presented as a result of this process should be validated by a quantity surveyor and should be presumed to be indicative.

GEOTECHNICAL DESIGN REPORT (GDR)

- 26. The GDR can only be prepared following confirmation of all structural loads and serviceability requirements. All the relevant information needs to be provided to allow for a GDR to be produced.

MONITORING (INCLUDING REMEDIATION MONITORING REPORTS)

- 27. These reports are factual in nature and comprise monitoring, normally groundwater and ground gas and data provided by contractors as part of an earthworks or remedial works.
- 28. The data is presented and will be compared with assessment criteria.

Appendix C

MODEL SUPPORTING INFORMATION

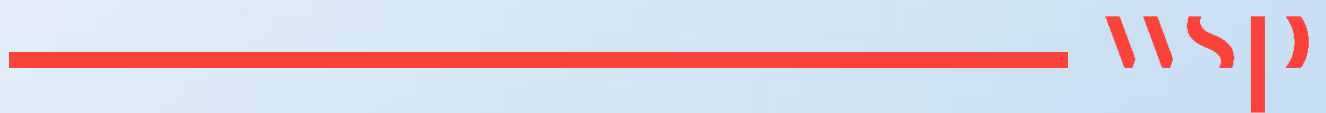


Table C-1 - Contaminant Properties

Determinand	GAC (µg/l)		Koc (l/kg)	Henry's Constant	Half-life (days)		Solubility (mg/l)
	EQS ⁽¹⁾	DWS ⁽²⁾			Range value	Value used	
Ammoniacal Nitrogen	600	500	1 ⁽¹¹⁾	7.81E-5 ⁽¹¹⁾	2190 ⁽¹¹⁾	2109	855000 ⁽⁹⁾
Free/Total Cyanide	1	50	10 ⁽¹³⁾	4.18E-11 ⁽¹⁰⁾	365 ⁽¹⁰⁾	365	95400 ⁽⁹⁾
Iron	1000	200	250 ⁽⁹⁾	N/A	9E+99 ⁽¹²⁾	9E+99	250 ⁽⁹⁾
Manganese	123 / 219.5 ⁽⁸⁾	50	650 ⁽⁹⁾	N/A	9E+99 ⁽¹²⁾	9E+99	650 ⁽⁹⁾
Zinc	10.9 ⁽⁸⁾	N/A	500 ⁽⁹⁾	N/A	9E+99 ⁽¹²⁾	9E+99	6060000 ⁽⁹⁾
Benzo(a)pyrene	0.00017	0.01	131000 ⁽³⁾	1.86E-5 ⁽³⁾	1400-4500 ⁽⁴⁾	4500	0.0083 ⁽³⁾
PAH sum of 4	N/A	0.1	121000 ⁽³⁾	6.46E-6 ⁽³⁾	1820-4270 ⁽⁴⁾	4270	0.0008 ⁽³⁾
Benzene	10	1	81.2 ⁽³⁾	0.225 ⁽³⁾	50-350 ⁽⁶⁾	350	1780 ⁽³⁾
Aromatics >C8-C10	20	500	1585 ⁽³⁾	0.48 ⁽³⁾	50-200 ⁽⁶⁾	200	110 ⁽³⁾
Aromatics >C10-C12	2	90	2511 ⁽³⁾	0.14 ⁽³⁾	100-300 ⁽⁶⁾	300	25 ⁽³⁾
Tetrachloroethene	10	10	94.9 ⁽⁹⁾	0.0177 ⁽⁹⁾	98 - 720 ⁽⁵⁾	720	206 ⁽⁹⁾
Trichloroethene	10	10	87 ⁽⁹⁾	0.435 ⁽⁹⁾	98 - 1653 ⁽⁵⁾	1653	1280 ⁽⁹⁾
Cis 1,2 dichloroethene	N/A	50	132 ⁽⁹⁾	0.0271 ⁽⁹⁾	56 - 2875 ⁽⁵⁾	2875	6410 ⁽⁹⁾
Vinyl chloride	N/A	0.5	23.74 ⁽⁹⁾	3.58 ⁽⁹⁾	56 - 2875 ⁽⁵⁾	2875	8800 ⁽⁹⁾

(1) River Basin District Surface Water and Groundwater Classification (Water Framework Directive) (England and Wales) Directions 2015

(2) Water Supply Regulations (2000)

(3) Total Petroleum Hydrocarbon Criteria Working Group Series, Volume 3: Selection of Representative TPH Fractions based on Fate and Transport Considerations, 1997.EA, 2008

(4) Polycyclic Aromatic Hydrocarbons (PAH): Priorities for Environmental Quality Standard Development R & D Technical Report P45

(5) Howard, P. H., Boethling, R. S., Jarvis, W. F., Meylan, W. M. & Michalenko, E. M. (1991) Handbook of environmental degradation rates. Chelsea, Michigan. Lewis Publishers

(6) The Effects of Contaminant Concentration on the Potential for Natural Attenuation R & D Technical Report P2-228/TR

(8) Bioavailability applied

(9) RBCA Risk Assessment Software (USEPA)

(10) The Chemistry and Treatment of Cyanidation Wastes. Adrian Smith and Terry Mudder. Mining Journal Books Limited, London, p293.

(11) Transport of Ammonium in aquifers: retardation and degradation (Erskine, QJEG 00, 2000)

(12) Conservative assumption

Table C-2 - Model Input Parameters

Site Parameters	Units	Inputs	Sensitivity Range		Source of Data
			Min	Max	
Unsaturated Zone					
Water filled soil porosity	fraction	0.48	-	-	Literature value for sandy gravelly clay (Made Ground) – Methodology to Determine the Degree of Soils Clean-up Required to Protect Water Resources. EA R&D Technical Report P13 (1996).
Air filled soil porosity	fraction	0.02	-	-	Literature value for sandy gravelly clay (Made Ground) – Methodology to Determine the Degree of Soils Clean-up Required to Protect Water Resources. EA R&D Technical Report P13 (1996).
Bulk density of soil zone material	g/cm³	1.6	-	-	Literature value for sandy gravelly clay (Made Ground) – Methodology to Determine the Degree of Soils Clean-up Required to Protect Water Resources. EA R&D Technical Report P13 (1996).
Fraction of organic carbon (in soil)	fraction	0.0175	-	-	Based on geomean of 25 uncontaminated samples from the unsaturated zone
Infiltration	m/d (mm/yr)	1.13x10-4	9.04E-4	1.36E-4	Annual rainfall is 693 mm/y (Reading Gauging Station at River Thames (SU718741)). Assuming 40% Evapotranspiration and 10% infiltration due to hardstanding, effective infiltration is 41.5 mm/y. 20%variation
Length of contaminant source in direction of groundwater flow	m	50	-	-	Based on the western half area of the site where the main contamination has been detected.
Saturated Zone					
Saturated aquifer thickness	m	Model 1: 5	-	-	Based on average thickness of RTG from borehole logs.
		Model 2: 30	-	-	Based on general effective permeable thickness of the Chalk.
Hydraulic Conductivity of aquifer in which dilution occurs	m/d	Model 1: 105	84	130	Based on slug test from the RTG (geomean of 10 tests) and 20% variation

Site Parameters	Units	Inputs	Sensitivity Range		Source of Data
			Min	Max	
		Model 2: 7	5.6	8.4	Based on slug tests on the Chalk (geomean of 12 tests) and 20% variation
Hydraulic gradient of water table	-	0.002	0.0005	0.004	Typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Width of contaminant source perpendicular to groundwater flow	m	50	-	-	Based on the western half area of the site where the main contamination has been detected.
Plume thickness at source	m	Model 1: 5;	-	-	Maximum saturated thickness of RTG.
		Model 2: 5.91	-	-	P20 calculated
Longitudinal dispersivity	m	Model 1: 18	-	-	10% of compliance point
		Model 2: 5			
Transversal dispersivity	m	Model 1: 5.4	-	-	30 % of longitudinal dispersivity
		Model 2: 1.5	-	-	
Vertical dispersivity	m	Model 1: 9E-99	-	-	No vertical dispersivity due to thin aquifer
		Model 2: 0.05	-	-	0.1% of compliance point
Fraction of organic carbon (in aquifer)	fraction	Model 1: 0.0074	-	-	Based on geomean of 22 uncontaminated samples from the RTG
		Model 2: 0.002	-	0.0022	Based on geomean of 3 uncontaminated samples from the Chalk. +20% variation
Bulk density of aquifer materials	g/cm ³	Model 1: 1.77	-	-	Literature data for gravels (Wiedemeier, T. et al., 1995)
		Model 2: 1.97	1.576	2.364	Mean bulk density of Chalk at Thames and Chilterns area (BGS, The physical properties of major aquifers in England and Wales pg 24). 20% variation
Effective porosity of aquifer	fraction	Model1: 0.24	0.192	0.28	Value for medium gravels (Brady & Kunkel, 2003). 20% variation

Site Parameters	Units	Inputs	Sensitivity Range		Source of Data
			Min	Max	
		Model 2: 0.2	0.16	0.24	Conservative value based on geomean value of total porosity in the Chalk at the Thames and Chilterns area (38.8) (BGS The physical properties of major aquifers in England and Wales). 20% variation
Distance to compliance point	m	Model 1: 240	-	-	River Thames 240m northeast of the site, in the direction of flow within the RTG
		Model 2: 400	-	-	Agreed with the Environment Agency.

Table C-3 – Level 3 SSAC Derived for Surface Water Protection (CP set at 240 m)

Determinand	Soil			Leachate			Groundwater			Travel time to receptor (years)
	Max conc. (mg/kg)	Level 3 SSAC (mg/kg)	No of Exceed.	Max conc. (µg/l)	Level 3 SSAC (µg/l)	No of Exceed.	Max conc. (µg/l)	Level 3 SSAC (µg/l)	No of Exceed.	
Iron	N/A	108,938	N/A	N/A	435,000	N/A	34,600	2,329	N/A	1,040
Manganese	N/A	62,125	N/A	N/A	96,000	N/A	3,800	511	N/A	2,702
Zinc	3,260	4,930	N/A	29.1	9,900	N/A	197	52.7	N/A	2,079
Free Cyanide	4.59	0.441	2	<50	0.633	N/A	80.3	4.987	3	1
Benzo(a)pyrene	382	22.7	N/A	0.28	10	N/A	1.09	0.053	N/A	4,337
Benzene	16.4	11.1	1	3.07	6,400	0	45.2	50.9	0	3
Trichloroethene	1.8	8.7	0	N/A	4,700	N/A	155	34	4	3
Tetrachloroethene	31.9	9.3	1	N/A	4,700	N/A	956	34	6	4
Aromatics >C8-C10	35.4	475	0	314	16,900	0	235	145.3	1	53

Cells shaded red indicate that the maximum concentration exceeds the calculated SSAC and travel times do not exceed 1,000 years.

Cells shaded grey indicate that travel times 1,000 years and risk is deemed negligible.



Table C-4 – Level 3 SSAC Derived for Groundwater Protection (CP set at 400 m)

Determinand	Soil			Leachate			Groundwater			Travel time to receptor (years)
	Max conc. (mg/kg)	Level 3 SSAC (mg/kg)	No of Exceed	Max conc. (µg/l)	Level 3 SSAC (µg/l)	No of Exceed	Max conc. (µg/l)	Level 3 SSAC (µg/l)	No of Exceed	
Ammoniacal Nitrogen as NH ₄	5,150	207.85	11	183,000	9,790	5	179,00	47,511	8	2
Total Cyanide	1,170	3,658	0	4,170	7,701,050	0	4,430	698,850	0	2
Iron	N/A	797	N/A	N/A	3,190	N/A	34,600	210		4,821
Manganese	N/A	517	N/A	N/A	796	N/A	3,800	52.7	N/A	12,531
Aromatics>C8-C10	35.4	1,548	0	314	55,200	0	1,070	4,111	0	63
Aromatics>C10-C12	63.8	246	0	722	5,570	0	1,710	3,338,935	0	99
Benzo(a)pyrene	382	0.404	N/A	0.283	0.176	N/A	1.09	0.01	N/A	5,052
PAH sum of 4	1,158	3.755	N/A	1.12	1.77	N/A	2.25	0.118	N/A	4,667
Benzene	16.4	321.56	0	3.07	51.9	0	2,890	17,063	0	5
Vinyl chloride	<1.2	0.007	0	N/A	9.33	0	2,750	33.9	5	3
Cis1,2 Dichloroethene	0.0172	2.436	0	N/A	933	0	5,610	3,392	2	7

Determinand	Soil			Leachate			Groundwater			Travel time to receptor (years)
	Max conc. (mg/kg)	Level 3 SSAC (mg/kg)	No of Exceed	Max conc. (µg/l)	Level 3 SSAC (µg/l)	No of Exceed	Max conc. (µg/l)	Level 3 SSAC (µg/l)	No of Exceed	
Trichloroethene	1.8	36.1	0	N/A	209	0	155	1,466	0	5
Tetrachloroethene	31.9	247.7	0	N/A	292	0	956	10,277	0	6

Cells shaded red indicate that the maximum concentration exceeds the calculated SSAC and travel times do not exceed 1,000 years.

Cells shaded grey indicate that travel times 1,000 years and risk is deemed negligible.

BIOCHLOR Natural Attenuation Decision Support System
Version 2.2
Excel 2000

Reading Model 1

Surface Wate #####

Run Name

Data Input Instructions:

1. Enter value directly....or

2. Calculate by filling in gray cells. Press Enter, then **C**

(To restore formulas, hit "Restore Formulas" button)

Variable* Data used directly in model.

Test if
Biotransformation
is Occurring → Natural Attenuation
Screening Protocol

Ethenes ☒

Ethanes ☐

Seepage Velocity*	Vs	3422.9	(ft/yr)
or			
Hydraulic Conductivity	K	1.7E-01	(cm/sec)
Hydraulic Gradient	i	0.0028	(ft/ft)
Effective Porosity	n	0.144	(-)

Alpha x*	78.8	(ft)	Calc. Alpha x
(Alpha y) / (Alpha x)*	0.1	(-)	
(Alpha z) / (Alpha x)*	1.E-99	(-)	

Retardation Factor*	→ R		
or			
Soil Bulk Density, rho	2.478	(kg/L)	
Fraction Organic Carbon, f _{oc}	7.4E-3	(-)	
Partition Coefficient	K _{oc}		
PCE	95	(L/kg)	13.08 (-)
TCE	87	(L/kg)	12.08 (-)
DCE	132	(L/kg)	17.81 (-)
VC	23	(L/kg)	3.98 (-)
ETH	302	(L/kg)	39.46 (-)
Common R (used in model)* =			13.08

Zone 1		λ (1/yr)	half-life (yrs)	Yield
PCE	TCE	1.600		0.79
DCE	DCE	1.350		0.74
CE	VC	1.150		0.64
VC	E	2.650		0.45

Zone 2		λ (1/yr)	half-life (yrs)	Yield
PCE	TCE	0.000		0.00
DCE	DCE	0.000		0.00
CE	VC	0.000		0.00
VC	E	0.000		0.00

Simulation Time*	25	(yr)
Modeled Area Width*	164	(ft)
Modeled Area Length*	788	(ft)
Zone 1 Length*	788	(ft)
Zone 2 Length*	0	(ft)

Zone 2 =
L - Zone 1

Source Options

Source Thickness in Sat. Zone* 16.4 (ft)

Y1

Width* (ft) 82

Conc. (mg/L)*	C1
PCE	.568
TCE	.041
DCE	1.1
VC	.192
ETH	

Single Planar

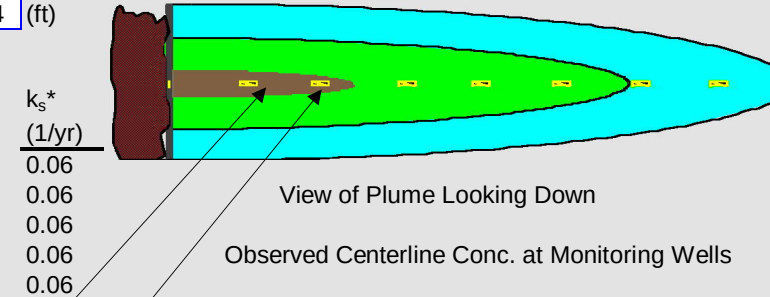
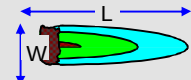
k_s^*

 (1/yr)

0.06
0.06
0.06
0.06
0.06

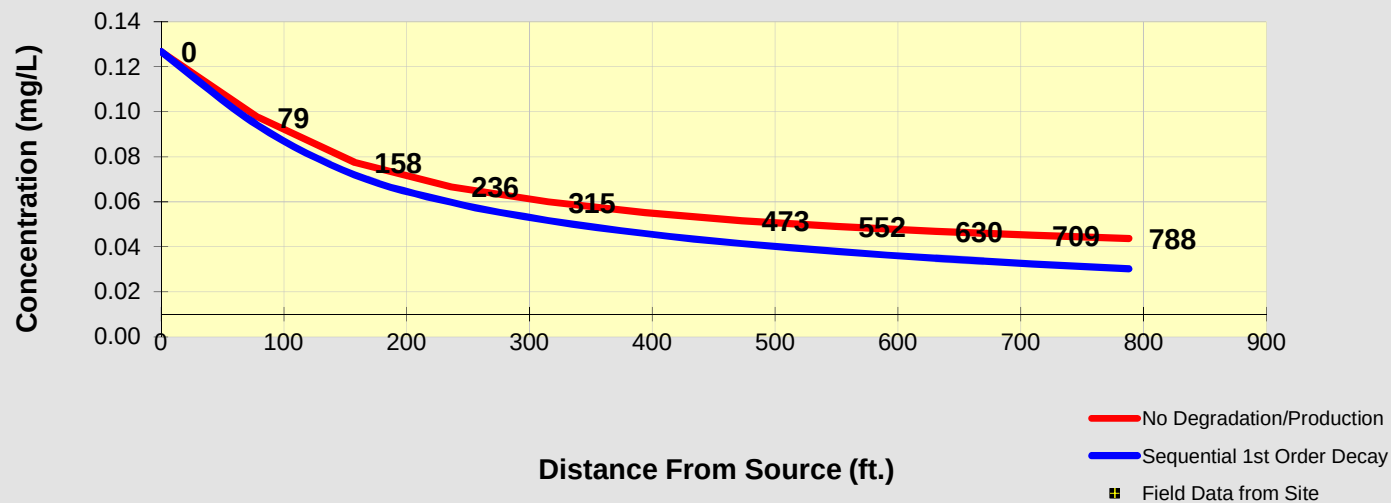
PCE Conc. (mg/L)									
TCE Conc. (mg/L)									
DCE Conc. (mg/L)									
VC Conc. (mg/L)									
ETH Conc. (mg/L)									
Distance from Source (ft)									
Date Data Collected	2020								

RUN CENTERLINE **RUN ARRAY** *Help* Restore RESET
SEE OUTPUT Paste



DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

PCE	Distance from Source (ft)										
	0	79	158	236	315	394	473	552	630	709	788
No Degradation	0.127	0.098	0.077	0.067	0.060	0.055	0.052	0.049	0.047	0.045	0.044
Biotransformation	0.1267	0.094	0.072	0.060	0.052	0.046	0.041	0.038	0.035	0.032	0.030
Monitoring Well Locations (ft)											
Field Data from Site											



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

25.0 Years

Log $\leftrightarrow$ Linear

Return to
Input

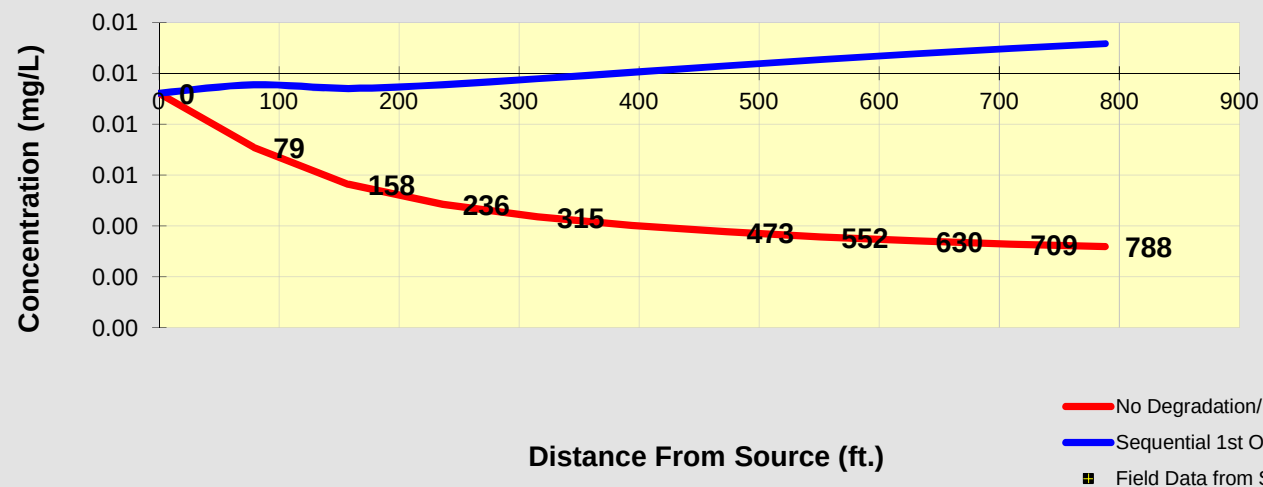
To All

To Array

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

TCE	Distance from Source (ft)										
	0	79	158	236	315	394	473	552	630	709	788
No Degradation	0.009	0.007	0.006	0.005	0.004	0.004	0.004	0.004	0.003	0.003	0.003
Biotransformation	0.0092	0.010	0.009	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011

Monitoring Well Locations (ft)										
Field Data from Site										



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

25.0 Years

Log ⇌ Linear

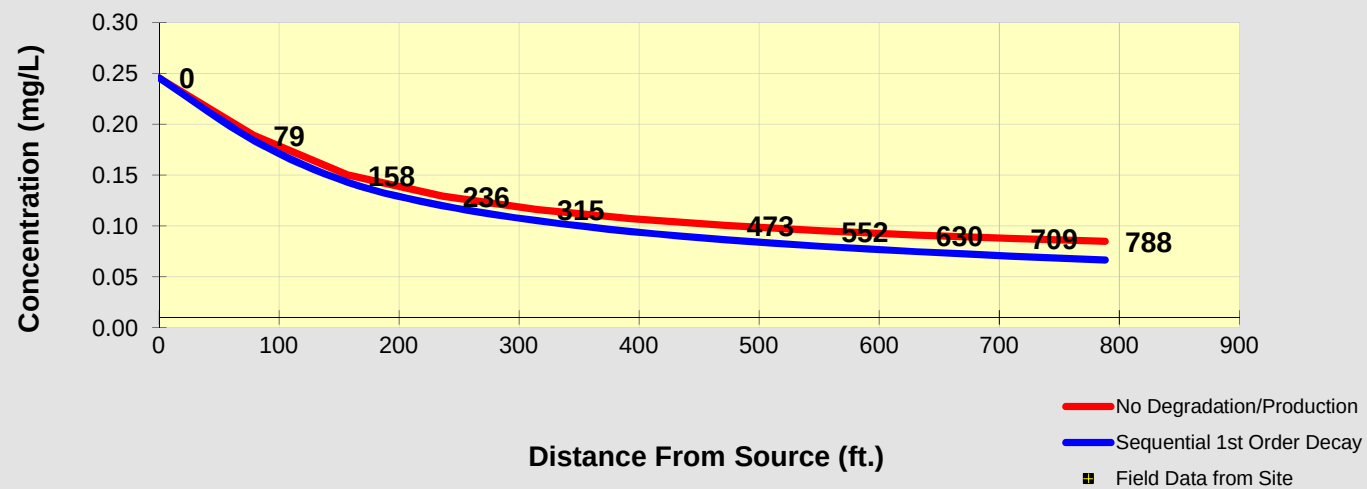
Return to
Input

To All

To Array

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

	Distance from Source (ft)										
DCE	0	79	158	236	315	394	473	552	630	709	788
No Degradation	0.245	0.189	0.150	0.129	0.116	0.107	0.100	0.095	0.091	0.087	0.085
Biotransformation	0.2454	0.184	0.143	0.120	0.105	0.094	0.086	0.080	0.075	0.070	0.067
	Monitoring Well Locations (ft)										
Field Data from Site											



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

25.0 Years

Log ☒ Linear

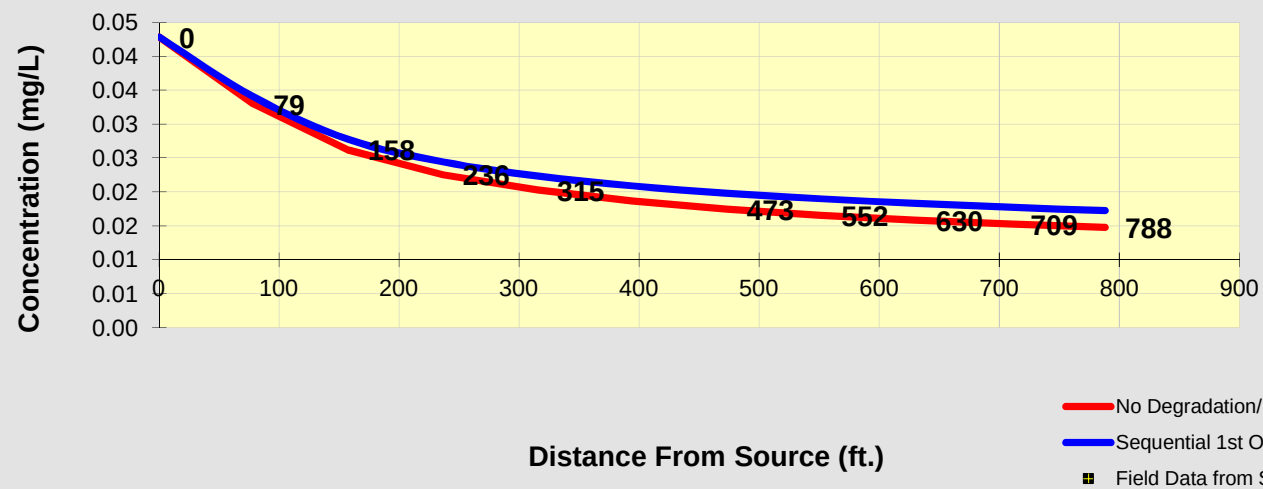
Return to
Input

To All

To Array

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

VC	Distance from Source (ft)										
	0	79	158	236	315	394	473	552	630	709	788
No Degradation	0.043	0.033	0.026	0.023	0.020	0.019	0.017	0.017	0.016	0.015	0.015
Biotransformation	0.0428	0.034	0.028	0.024	0.022	0.021	0.020	0.019	0.018	0.018	0.017
Monitoring Well Locations (ft)											
Field Data from Site											



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

25.0 Years

Log ↔ Linear

Return to
Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.2
Excel 2000

Reading Model 2

Aquifer P. #####

Run Name

TYPE OF CHLORINATED SOLVENT:

Ethenes ☒
Ethanes ☐

1. ADVECTION

Seepage Velocity* Vs 115.9 (ft/yr)
or
Hydraulic Conductivity K 8.0E-03 (cm/sec)
Hydraulic Gradient i 0.0028 (ft/ft)
Effective Porosity n 0.2 (-)

2. DISPERSION

Alpha x* 131.2 (ft) Calc. Alpha x
(Alpha y) / (Alpha x)* 0.1 (-)
(Alpha z) / (Alpha x)* 1.E-99 (-)

3. ADSORPTION

Retardation Factor* R
or
Soil Bulk Density, rho 1.77 (kg/L)
Fraction Organic Carbon, foc 2.0E-3 (-)
Partition Coefficient Koc
PCE 95 (L/kg) 2.68 (-)
TCE 87 (L/kg) 2.54 (-)
DCE 132 (L/kg) 3.34 (-)
VC 23 (L/kg) 1.41 (-)
ETH 302 (L/kg) 6.35 (-)
Common R (used in model)* = 2.68

4. BIOTRANSFORMATION

Zone 1
TCE 1.600 (1/yr) half-life (yrs) 0.79
DCE 1.350 (1/yr) half-life (yrs) 0.74
VC 1.150 (1/yr) half-life (yrs) 0.64
E 2.650 (1/yr) half-life (yrs) 0.45
Zone 2
TCE 0.000 (1/yr) half-life (yrs)
DCE 0.000 (1/yr) half-life (yrs)
VC 0.000 (1/yr) half-life (yrs)
E 0.000 (1/yr) half-life (yrs)

5. GENERAL

Simulation Time* 25 (yr)
Modeled Area Width* 164 (ft)
Modeled Area Length* 1312 (ft)
Zone 1 Length* 1312 (ft)
Zone 2 Length* 0 (ft)

6. SOURCE DATA

Source Options
Source Thickness in Sat. Zone* 19.3 (ft)
Width* (ft) 82
Conc. (mg/L)* C1
PCE .568
TCE .041
DCE 1.1
VC .192
ETH
TYPE: Decaying Single Planar
Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)
TCE Conc. (mg/L)
DCE Conc. (mg/L)
VC Conc. (mg/L)
ETH Conc. (mg/L)
Distance from Source (ft)
Date Data Collected 2020

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE

RUN ARRAY

Help

Restore

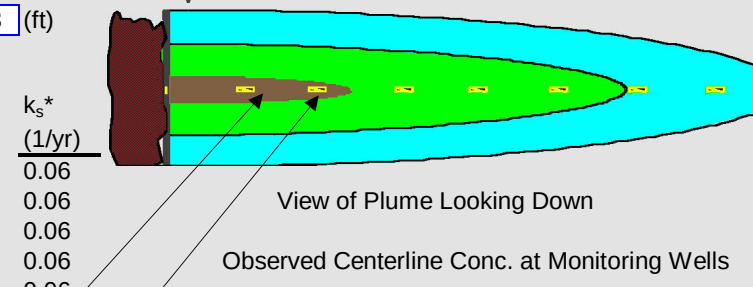
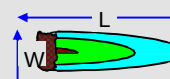
RESET

SEE OUTPUT

Paste

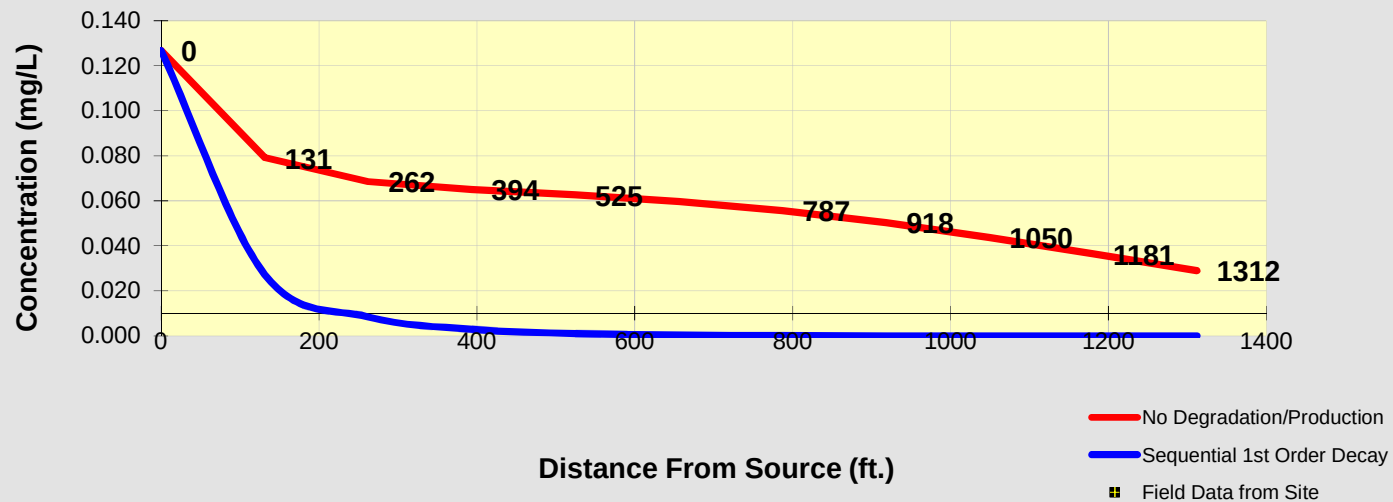
Data Input Instructions:

115 1. Enter value directly....or
0.02 2. Calculate by filling in gray cells. Press Enter, then C
(To restore formulas, hit "Restore Formulas" button)
Variable* Data used directly in model.
Test if Biotransformation is Occurring Natural Attenuation Screening Protocol



DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

PCE	Distance from Source (ft)										
	0	131	262	394	525	656	787	918	1050	1181	1312
No Degradation	0.127	0.079	0.069	0.065	0.063	0.060	0.056	0.050	0.044	0.036	0.029
Biotransformation	0.1267	0.027	0.008	0.003	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Monitoring Well Locations (ft)											
Field Data from Site											



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

25.0 Years

Log $\leftrightarrow$ Linear

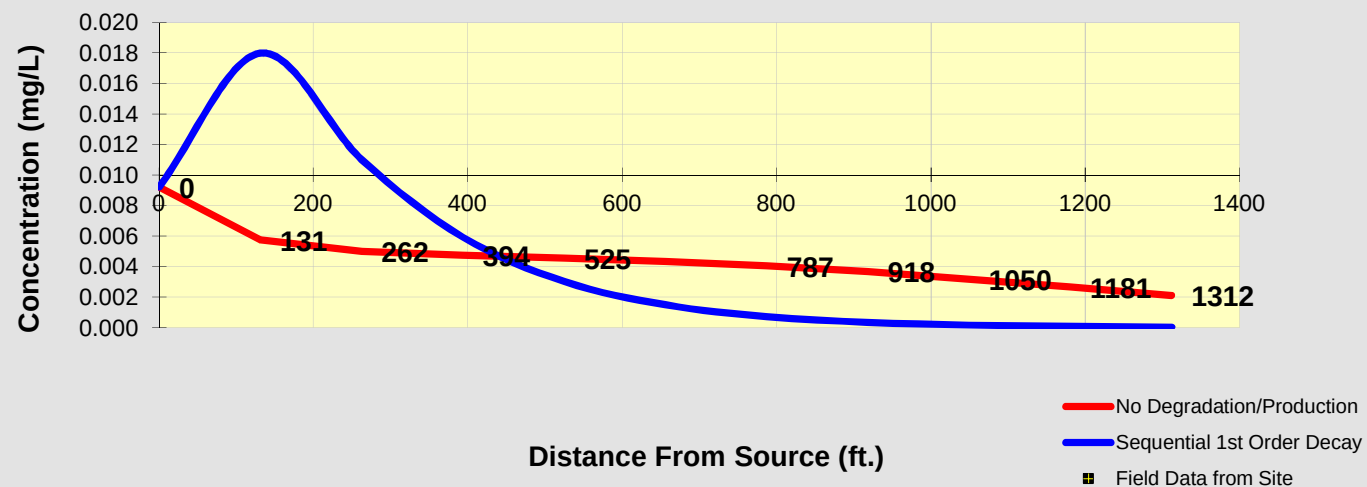
Return to
Input

To All

To Array

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

TCE	Distance from Source (ft)										
	0	131	262	394	525	656	787	918	1050	1181	1312
No Degradation	0.009	0.006	0.005	0.005	0.005	0.004	0.004	0.004	0.003	0.003	0.002
Biotransformation	0.0092	0.018	0.011	0.006	0.003	0.001	0.001	0.000	0.000	0.000	0.000
Monitoring Well Locations (ft)											
Field Data from Site											



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

25.0 Years

Log ⇌ Linear

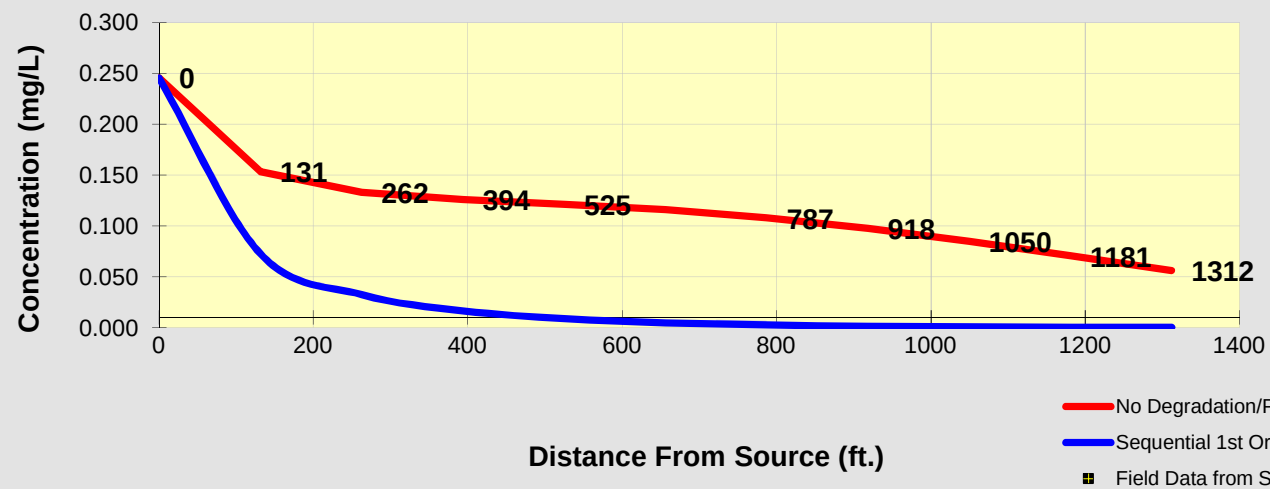
Return to
Input

To All

To Array

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

DCE	Distance from Source (ft)										
	0	131	262	394	525	656	787	918	1050	1181	1312
No Degradation	0.245	0.153	0.133	0.126	0.121	0.116	0.108	0.097	0.085	0.070	0.056
Biotransformation	0.2454	0.073	0.032	0.017	0.009	0.005	0.003	0.001	0.001	0.000	0.000
Monitoring Well Locations (ft)											
Field Data from Site											



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

25.0 Years

Log $\leftrightarrow$ Linear

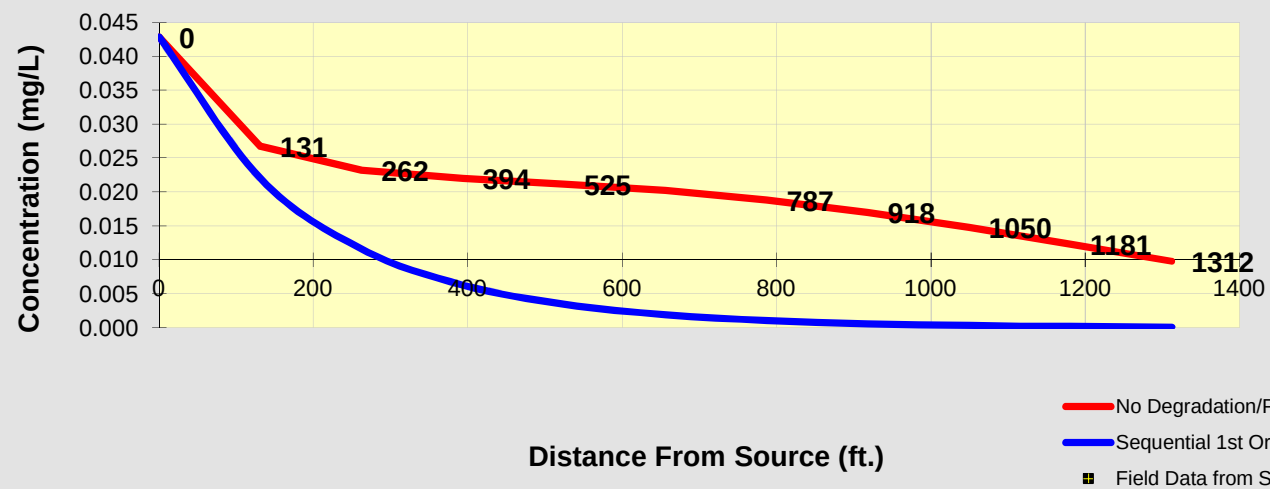
Return to
Input

To All

To Array

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

VC	Distance from Source (ft)										
	0	131	262	394	525	656	787	918	1050	1181	1312
No Degradation	0.043	0.027	0.023	0.022	0.021	0.020	0.019	0.017	0.015	0.012	0.010
Biotransformation	0.0428	0.022	0.012	0.006	0.003	0.002	0.001	0.001	0.000	0.000	0.000
Monitoring Well Locations (ft)											
Field Data from Site											



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

25.0 Years

Log $\leftrightarrow$ Linear

Return to
Input

To All

To Array

Appendix D

SCREENING TABLES



	<0.000	Concentration below the LOD
	0.000	Concentration in exceedance of the GAC
	0.000	Concentration in exceedance of the L3 SSAC
	N/A	Not applicable
	LTT	Long travel time - risk negligible

					BH105	BH106	BH107	BH105	TP102	TP105	BH105	TP106	BH103A	TP106	BH107	BH104	TP102	BH101	BH107	TP102	BH101	BH104
					9.20-	9.20-	8.20-	5.50-	2.20-	1.70-	2.40-	2.00-	2.00-	0.50-	3.90-	1.30-	1.80-	8.20-	0.95-	0.90-	0.25-	4.40-
Test	Units	LOD	Max	L3 EQS	10/11/2015	13/11/2015	11/11/2015	09/11/2015	06/11/2015	09/11/2015	10/11/2015	10/11/2015	12/11/2015	10/11/2015	11/11/2015	10/11/2015	06/11/2015	05/11/2015	09/11/2015	06/11/2015	03/11/2015	11/11/2015
Sample Description																						
Colour	No units		-	-	White	White	Cream	Dark Brown	Light Brown	Dark Brown	Beige	Light Brown	Dark Brown	Dark Brown	Beige	Light Brown	Dark Brown	Beige	Dark Brown	Light Brown	Orange	Grey
Description	No units		-	-	Chalk	Chalk	Clay	Stone/Soil	Silty Clay	Silty Clay Loam	Clay Loam	Silty Clay	Silty Clay Loam	Sandy Silt Loam	Stone/Soil	Sandy Clay Loam	Silt Loam	Sandy Clay Loam	Sandy Silt Loam	Sandy Clay	Sand	Sand
Grain Size	No units		-	-	<0.063 mm	0.063 - 0.1 mm	0.063 - 0.1 mm	2 - 10 mm	0.063 - 0.1 mm	0.063 - 0.1 mm	0.063 - 0.1 mm	0.063 - 0.1 mm	0.1 - 2 mm	0.1 - 2 mm	2 - 10 mm	0.063 - 0.1 mm	0.063 - 0.1 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm
Inclusion 1)	No units		-	-	None	N/A	Stones	Stones	None	None	None	Stones	Stones	Brick	Stones	Stones	None	Oil/Petroleum	Brick	Stones	Stones	Stones
Inclusion 2)	No units		-	-	None	N/A	N/A	None	None	None	None	N/A	Vegetation	Stones	N/A	N/A	None	Stones	N/A	None	N/A	None
Moisture Content Ratio (% of as received sample)	%		-	-	22	20	23	7.7	28	29	31	26	27	17	24	15	30	18	16	40	6.1	11
Asbestos																						
Asbestos Quantification - Gravimetric - %	%	<0.001	-	-																		
Date of Analysis	No units		-	-											17/11/15					16/11/15		11/11/2015
Analysed By	No units		-	-										Simon Postlewhite					Chris Swindells		Renata Hatos	
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-	-																		
Additional Asbestos Components (Using TM048)	No units		-	-																		
Analysts Comments	No units		-	-																		
Asbestos Quantification - Total - %	%	<0.001	-	-																		
Chrysotile (White) Asbestos	No units		-	-										Not Detected					Not Detected		Not Detected	
Amosite (Brown) Asbestos	No units		-	-										Not Detected					Not Detected		Not Detected	
Crocidolite (Blue) Asbestos	No units		-	-										Not Detected					Not Detected		Not Detected	
Fibrous Anthophyllite	No units		-	-										Not Detected					Not Detected		Not Detected	
Fibrous Tremolite	No units		-	-										Not Detected					Not Detected		Not Detected	
Fibrous Actinolite	No units		-	-										Not Detected					Not Detected		Not Detected	
Non-Asbestos Fibre	No units		-	-										Not Detected					Not Detected		Not Detected	
Comments	No units		-	-										0					0		0	
Carbon																						
Organic Carbon, Total	%	<0.2	-	-																		
Fraction Organic Carbon (FOC)	No units	<0.002	-	-																		
Soil Organic Matter (SOM)	%	<0.35	-	-	<0.350	<0.350	<0.350	<0.350	0.765	1.56	0.86	2.33	1.1	1.37	1.56	2.26	4.07	<0.350	4.84	1.4	0.595	<0.350
Inorganics																						
Water Soluble Sulphate as SO4 2:1 Extract	g/l	<0.004	3.31	-	0.042	0.0159	0.0166	0.0223	0.304	2.52	0.18	0.216	0.124	0.0305	0.0306	0.125	0.488	0.0511	0.182	1.53	0.175	0.0208
pH	pH Units	<1	10.1	-	8.89	8.7	8.92	8.08	8.21	8.54	8.43	8.62	9.04	7.59	8.88	8.14	8.51	8.96	7.85	7.8	10.1	8.64
ANC @ pH 4	mol/kg	<0.03	2.77	-																		
ANC @ pH 6	mol/kg	<0.03	0.113	-																		
Nitrite as NO2, 2:1 water soluble	mg/kg	<0.1	2.12	-																		
Ammoniacal N as NH4 in 2:1 extract BRE	g/l	<0.0003	0.157	-																		
Loss on ignition	%	<0.7	11.6	-																		
Sulphide, Easily liberated	mg/kg	<15	477	-																		
Cyanide, Total	mg/kg	<1	1170	-	<1.000	<1.000	<1.000	<1.000	289	1.47	155	<1.000	<1.000	<1.000	<1.000	2.24	56	<1.000	1.27	513	<1.000	<1.000
Cyanide, Free	mg/kg	<1	10	0.441	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Exchangeable Ammonia as NH4	mg/kg	<15	5150	-	<15.000	<15.000	<15.000	<15.000	<15.000	4330	257	517	1310	<15.000	<15.000	<15.000	137	67.9	29.4	39.1	<15.000	24.3
Cyanide, Complex	mg/kg	<1	1170	-	<1.000	<1.000	<1.000	<1.000	289	1.47	155	<1.000	<1.000	<1.000	<1.000	2.24	55.7	<1.000	1.27	512	<1.000	<1.000
Exchangeable Ammonia as N	mg/kg	<12	4000	-	<15.000	<15.000	<15.000	<15.000	<15.000	3370	200	402	1020	<15.000	<15.000	<15.000	107	52.8	22.9	30.4	<15.000	18.9
Cyanide, Complex (low level)	mg/kg	<0.5	2390	-																		
Metals - (Solids)																						
Chromium, Hexavalent	mg/kg	<0.6	3	-	<0.600	<0.600	<0.600	<0.600		<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600		<3.000	<0.600		<0.600	<0.600
Boron, water soluble	mg/kg	<1	5.36	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	2.3	<1.000	<1.000	<1.000	<1.000	2.69	<1.000	<1.000	<1.000	<1.000	<1.000
Arsenic	mg/kg	<0.6	268	N/A	<0.600	<0.600	1.33	7.13	4.51	6.51	4.98	7.24	11.1	<1.000	<1.000	<1.000	12.6	<1.000	<1.000	<1.000	<1.000	<1.000
Barium	mg/kg	<0.6	862	-	16.7	11.9	17.7	11	55.5	84.3	65.8	67.7	98.3	110	16.1	74.7	65.1	18.2	108	52.1	18.3	14.8
Beryllium	mg/kg	<0.01	2.85	-	0.0652	0.0208	0.036	0.438	0.716	0.964	0.774	0.723	0.821	0.739	0.194	0.872	1.17	0.42	0.966	0.338	0.556	0.193
Cadmium	mg/kg	<0.02	19.6	-	0.118	0.118	0.0959	0.185	0.335	0.392	0.357	0.28	1.24	0.363	0.0989	0.31	0.447	0.389	0.444	0.102	0.342	0.0429
Chromium	mg/kg	<0.9	74	-	0.97	<0.900	<0.900	10	15	19.6	15.4	17.2	18.7	14.7	5.53	18.1	27.5	6.22	15	6.36	16.6	5.86
Copper	mg/kg	<1.4	648	N/A	<1.400	<1.400	1.42	3.31	5.08	8.21	5.02	20.5	6	63.5	2.25	32.8	16.4	2.03	197	7.15	3.36	2.36
Lead	mg/kg	<0.7	31000	-	<0.700	<0.700	<0.700	3.22	4.72	13.2	4.89	41.4	9.94	171	2.12	91.6	35.4	2.02	176	18.1	14.3	2.82
Mercury	mg/kg	<0.14	278	-	<0.140	<0.140	<0.140	<0.140	<0.140	<0.140	<0.140	<0.140	<0.140	1.06	<0.140	0.828	<0.140	<0.140	0.754	<0.140	<0.140	<0.140
Nickel	mg/kg	<0.2	135	N/A	1.44	1.46	8.72	14	17.4	20.9	17.2	16.6	22.8	21.1	7.72	19.9	24.2	16	21.8	17.2	18.6	7.19
Selenium	mg/kg	<1	46.4	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.14	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Vanadium	mg/kg	<0.2	119	-	1.98	1.16	2.22	30.3	19.1	23.4	19.1	32.4	30.9	11.6	34.3	<1.000	<1.000	<1.000	31.5	8.97	41.7	10.7
Zinc	mg/kg	<1.9	3260	LTT	12.3	11.5	12.6	20.5	42.6	59.3	44.8	50.4	54	134	15.1	81.4	62.7	26.7	127	105	47	12.2
Metals - (Liquid)																						
Chromium, Trivalent	mg/kg	<0.9	74	-	0.97	<0.900	<0.900	10		19.6	15.4	17.2	18.7	14.7	5.53	18.1		6.22	15		16.6	5.86
Calcium	mg/kg	<210	224000	-																		
Phenols																						
Phenol	mg/kg	<0.01	90.5	N/A	<0.010	<0.010	<0.010	<0.010	<0.010	0.0141	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0242	<0.010	<0.010	<0.010	<0.010
Cresols	mg/kg	<0.01	398	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0117	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Xylenols	mg/kg	<0.015	1150	-	<0.015	<0.015	<0.015	<0.015	<0.015	0.423	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.0242	<0.015	<0.015	<0.015	<0.015
2,3,5-Trimethylphenol	mg/kg	<0.01	156	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.31	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
2-Isopropylphenol	mg/kg	<0.015	792	-	<0.015	<0.015	<0.015	<0.015	<0.015	0.761	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Phenols, Total Detected monohydric	mg/kg	<0.035	2.39	-																		
Phenols, Total Detected 5 speciated	mg/kg	<0.06	2560	-	<0.060	<0.060	<0.060	<0.060	<0.060	1.51	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060	<0.060
TPH Criteria Working Group (TPH CWG)																						
GRO Surrogate % recovery**	%		153	-	103	113	1															

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

					BH105	BH106	BH107	BH105	TP102	TP105	BH105	TP106	BH103A	TP106	BH107	BH104	TP102	BH101	BH107	TP102	BH101	BH104
					9.20-	9.20-	8.20-	5.50-	2.20-	1.70-	2.40-	2.00-	2.00-	0.50-	3.90-	1.30-	1.80-	8.20-	0.95-	0.90-	0.25-	4.40-
Test	Units	LOD	Max	L3 EQS	10/11/2015	13/11/2015	11/11/2015	09/11/2015	06/11/2015	09/11/2015	10/11/2015	10/11/2015	12/11/2015	10/11/2015	11/11/2015	10/11/2015	06/11/2015	05/11/2015	09/11/2015	06/11/2015	03/11/2015	11/11/2015
Benzene	mg/kg	<0.01	9.68	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.0353	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.282	<0.010	<0.010	<0.010	<0.010
Toluene	mg/kg	<0.002	11.3	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0303	0.00236	<0.002	<0.002	<0.002
Ethylbenzene	mg/kg	<0.003	2.3	-	<0.003	<0.003	<0.003	<0.003	<0.003	0.00564	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.11	<0.003	<0.003	<0.003	<0.003
m,p-Xylene	mg/kg	<0.006	12.7	-	<0.006	<0.006	<0.006	<0.006	<0.006	0.0127	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.203	<0.006	<0.006	<0.006	<0.006
o-Xylene	mg/kg	<0.003	5.53	-	<0.003	<0.003	<0.003	<0.003	<0.003	0.0296	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.0992	<0.003	<0.003	<0.003	<0.003
sum of detected mpo xylene by GC	mg/kg	<0.009	18.2	-	<0.009	<0.009	<0.009	<0.009	<0.009	0.0423	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	0.302	<0.009	<0.009	<0.009	<0.009
sum of detected BTEX by GC	mg/kg	<0.024	41.5	-	<0.024	<0.024	<0.024	<0.024	<0.024	0.0832	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024	0.724	<0.024	<0.024	<0.024	<0.024
Aliphatics >C5-C6	mg/kg	<0.01	1.63	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0685	<0.010	<0.010	<0.010	0.0129	<0.010	0.0106	0.0133	<0.010	0.328
Aliphatics >C6-C8	mg/kg	<0.01	9.89	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.347	<0.010	<0.010	<0.010	0.0172	0.103	0.0189	0.0332	0.016	0.379
Aliphatics >C8-C10	mg/kg	<0.01	22.3	-	<0.010	<0.010	<0.010	<0.010	0.0111	0.0254	<0.010	<0.010	0.893	<0.010	<0.010	<0.010	0.0272	0.455	1.2	0.118	0.0373	0.669
Aliphatics >C10-C12	mg/kg	<0.01	95.8	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.0606	<0.010	<0.010	1.06	<0.010	<0.010	<0.010	0.0157	0.8	0.53	0.0315	0.112	0.542
Aliphatics >C12-C16	mg/kg	<0.1	4990	-	<0.100	<0.100	<0.100	<0.100	0.664	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.262	0.171	<0.100	<0.100	1.31	<0.100
Aliphatics >C16-C21	mg/kg	<0.1	5000	-	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	3.48	2.72
Aliphatics >C16-C35	mg/kg	<0.1	616	-																		
Aliphatics >C21-C35	mg/kg	<0.1	5330	-	<0.100	<0.100	<0.100	<0.100	0.813	<0.100	2.25	<0.100	<0.100	<0.100	4.14	<0.100	4.12	<0.100	<0.100	4.72	4.89	18.1
Aliphatics >C35-C44	mg/kg	<0.1	2030	-	<0.100	<0.100	<0.100	0.345	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.776	<0.100	<0.100	<0.100	<0.100	<0.100	0.674	6.73
Total Aliphatics >C12-C44	mg/kg	<0.1	15700	-	<0.100	<0.100	<0.100	0.345	1.48	<0.100	2.25	<0.100	<0.100	<0.100	5.44	<0.100	4.38	0.171	<0.100	4.72	10.4	27.5
Aromatics >EC5-EC7	mg/kg	<0.01	9.68	N/A	<0.010	<0.010	<0.010	<0.010	<0.010	0.0353	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.282	<0.010	<0.010	<0.010	<0.010
Aromatics >EC7-EC8	mg/kg	<0.01	11.3	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0303	<0.010	<0.010	<0.010	<0.010
Aromatics >EC8-EC10	mg/kg	<0.01	35.4	759.37	<0.010	<0.010	<0.010	<0.010	<0.010	0.0649	<0.010	<0.010	0.596	<0.010	<0.010	<0.010	0.0186	0.716	0.801	0.0797	0.0256	0.446
Aromatics >EC10-EC12	mg/kg	<0.01	63.8	N/A	<0.010	<0.010	<0.010	<0.010	<0.010	0.0409	<0.010	<0.010	0.71	<0.010	<0.010	<0.010	0.01	0.534	0.353	0.0216	0.0746	0.362
Aromatics >EC12-EC16	mg/kg	<0.1	5800	N/A	<0.100	<0.100	<0.100	<0.100	<0.100	0.525	<0.100	<0.100	0.452	<0.100	<0.100	<0.100	<0.100	2.57	0.261	1.58	1.18	<0.100
Aromatics >EC16-EC21	mg/kg	<0.1	6570	N/A	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.253	<0.100	<0.100	<0.100	1.29	<0.100	2.92	2.76	1.98	3.37
Aromatics >EC21-EC35	mg/kg	<0.1	9710	N/A	<0.100	<0.100	<0.100	<0.100	0.626	1.34	1.58	2.49	<0.100	3.69	0.903	5.84	3.91	2.28	13	16.1	12.4	0.536
Aromatics >EC35-EC44	mg/kg	<0.1	1510	-	<0.100	<0.100	<0.100	<0.100	<0.100	0.525	<0.100	1.46	0.127	0.907	<0.100	1.63	0.875	<0.100	3.72	2.2	3.54	0.997
Aromatics >EC40-EC44	mg/kg	<0.1	574	-	<0.100	<0.100	<0.100	<0.100	<0.100	0.725	<0.100	0.35	<0.100	<0.100	<0.100	0.283	<0.100	<0.100	1.44	0.39	1.3	0.61
Total Aromatics >EC12-EC44	mg/kg	<0.1	21200	-	<0.100	<0.100	<0.100	<0.100	0.626	2.39	1.58	3.96	0.833	4.59	0.903	8.75	4.79	7.78	19.7	21.8	20.4	1.53
Total Aliphatics & Aromatics >C5-C44	mg/kg	<0.1	34600	-	<0.100	<0.100	<0.100	0.345	2.13	2.63	3.83	3.97	4.51	4.59	6.35	8.75	9.27	10.9	22.6	26.8	31.1	31.8
Polyaromatic Hydrocarbons (PAHs)																						
Coronene	mg/kg	<0.2	6.55	-																		
Naphthalene-d8 % recovery**	%		197	-	95.7	98.5	95.3	97.9	98.3	107	101	98.2	111	97.7	95.8	97.7	166	83.5	96.4	110	83.7	101
Acenaphthene-d10 % recovery**	%		195	-	99.7	95.4	92.2	93.7	95.1	103	101	96.2	109	103	92.5	95.4	159	85.6	97.8	106	82.9	97.4
Phenanthrene-d10 % recovery**	%		186	-	101	94.8	90.9	93.9	95.7	106	104	98.1	111	105	91.6	95.5	156	87				

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

					BH105	BH106	BH107	BH105	TP102	TP105	BH103A	TP106	BH103A	TP106	BH107	BH104	TP102	BH101	BH107	TP102	BH101	BH104	
					9.20-	9.20-	8.20-	5.50-	2.20-	1.70-	2.40-	2.00-	2.00-	0.50-	3.90-	1.30-	1.80-	8.20-	0.95-	0.90-	0.25-	4.40-	
Test	Units	LOD	Max	L3 EQS	10/11/2015	13/11/2015	11/11/2015	09/11/2015	06/11/2015	09/11/2015	10/11/2015	10/11/2015	12/11/2015	10/11/2015	11/11/2015	10/11/2015	06/11/2015	05/11/2015	09/11/2015	06/11/2015	03/11/2015	11/11/2015	
bis(2-Chloroethyl)ether	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
Azobenzene	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
4-Nitrophenol	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
4-Nitroaniline	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
4-Methylphenol	mg/kg	<0.1	341	-				<0.100				<0.100	<0.100				<0.100	<0.100					
4-Chlorophenylphenylether	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
4-Chloroaniline	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
4-Chloro-3-methylphenol	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
4-Bromophenylphenylether	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
3-Nitroaniline	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
2-Nitrophenol	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
2-Nitroaniline	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
2-Methylphenol	mg/kg	<0.1	304	-				<0.100				<0.100	<0.100				<0.100	<0.100					
1,2,4-Trichlorobenzene	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
2-Chlorophenol	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
2,6-Dinitrotoluene	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
2,4-Dinitrotoluene	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
2,4-Dimethylphenol	mg/kg	<0.1	922	-				<0.100				<0.100	<0.100				<0.100	<0.100					
2,4-Dichlorophenol	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
2,4,6-Trichlorophenol	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
2,4,5-Trichlorophenol	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
1,4-Dichlorobenzene	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
1,3-Dichlorobenzene	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
1,2-Dichlorobenzene	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
2-Chloronaphthalene	mg/kg	<0.1	5	-				<0.100				<0.100	<0.100				<0.100	<0.100					
2-Methylnaphthalene	mg/kg	<0.1	323	-				<0.100				<0.100	<0.100				<0.100	0.499					
Acenaphthylene	mg/kg	<0.1	277	-				<0.100				<0.100	<0.100				<0.100	<0.100					
Acenaphthene	mg/kg	<0.1	105	-				<0.100				<0.100	<0.100				<0.100	<0.100					
Anthracene	mg/kg	<0.1	258	-				<0.100				<0.100	<0.100				<0.100	<0.100					
Benzo(a)anthracene	mg/kg	<0.1	260	-				<0.100				<0.100	<0.100				<0.100	<0.100					
Benzo(b)fluoranthene	mg/kg	<0.1	175	-				<0.100				<0.100	<0.100				<0.100	<0.100					
Benzo(k)fluoranthene	mg/kg	<0.1	172	-				<0.100				<0.100	<0.100				<0.100	<0.100					
Benzo(a)pyrene	mg/kg	<0.1	232	-				<0.100				<0.100	<0.100				<0.100	<0.100					
Benzo(g,h,i)perylene	mg/kg	<0.1	149	-				<0.100				<0.100	<0.100				<0.100	<0.100					
Chrysene	mg/kg	<0.1	219	-				<0.100				<0.100	<0.100				<0.100	<0.100					
Fluoranthene	mg/kg	<0.1	747	-				<0.100				<0.100	<0.100				<0.100	<0.100					
Fluorene	mg/kg	<0.1	212	-				<0.100				<0.100	<0.100				<0.100	<0.100					
Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	175	-				<0.100				<0.100	<0.100				<0.100	<0.100					
Phenanthrene	mg/kg	<0.1	890	-				<0.100				<0.100	<0.100				<0.100	0.211					
Pyrene	mg/kg	<0.1	627	-				<0.100				<0.100	<0.100				<0.100	<0.100					
Naphthalene	mg/kg	<0.1	1630	-				<0.100				<0.100	<0.100				<0.100	0.867					
Dibenzo(a,h)anthracene	mg/kg	<0.1	26	-				<0.100				<0.100	<0.100				<0.100	<0.100					
Bis(2-chloroisopropyl) ether	mg/kg	<0.1	5	-																			
Volatile Organic Compounds (VOCs)																							
Dibromofluoromethane**	%		166	-				166				103	126				108	111					
Toluene-d8**	%		104	-	104	104		97.8	101	96	103	97.7	103	101		102	90.5	101	94.6	99.8		101	
4-Bromofluorobenzene**	%		102	-				90.6				73.7	91.9				70.6	91.3					
Dichlorodifluoromethane	mg/kg	<0.006	1.2	-				<0.006				<0.006	<0.006				<0.006	<0.006					
Chloromethane	mg/kg	<0.007	1.4	-				<0.007				<0.007	<0.007				<0.007	<0.007					
Vinyl Chloride	mg/kg	<0.006	1.2	-				<0.006				<0.006	<0.006				<0.006	<0.006					
Bromomethane	mg/kg	&lt																					

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

					BH105	BH106	BH107	BH105	TP102	TP105	BH105	TP106	BH103A	TP106	BH107	BH104	TP102	BH101	BH107	TP102	BH101	BH104
					9.20-	9.20-	8.20-	5.50-	2.20-	1.70-	2.40-	2.00-	2.00-	0.50-	3.90-	1.30-	1.80-	8.20-	0.95-	0.90-	0.25-	4.40-
Test	Units	LOD	Max	L3 EQS	10/11/2015	13/11/2015	11/11/2015	09/11/2015	06/11/2015	09/11/2015	10/11/2015	10/11/2015	12/11/2015	10/11/2015	11/11/2015	10/11/2015	06/11/2015	05/11/2015	09/11/2015	06/11/2015	03/11/2015	11/11/2015
cis-1,3-Dichloropropene	mg/kg	<0.01	2	-				<0.010				<0.010	<0.010				<0.010	<0.010				
Toluene	mg/kg	<0.007	40.2	-	<0.007	<0.007		0.0089	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007		<0.007	<0.007	0.0289	<0.007	0.0242		<0.007
trans-1,3-Dichloropropene	mg/kg	<0.01	2	-				<0.010				<0.010	<0.010				<0.010	<0.010				
1,1,2-Trichloroethane	mg/kg	<0.01	2	-				<0.010				<0.010	<0.010				<0.010	<0.010				
1,3-Dichloropropane	mg/kg	<0.007	1.4	-				<0.007				<0.007	<0.007				<0.007	<0.007				
Tetrachloroethene	mg/kg	<0.005	31.9	12.46				<0.005				<0.005	<0.005				<0.005	<0.005				
Dibromochloromethane	mg/kg	<0.01	2	-				<0.010				<0.010	<0.010				<0.010	<0.010				
1,2-Dibromoethane	mg/kg	<0.01	2	-				<0.010				<0.010	<0.010				<0.010	<0.010				
Chlorobenzene	mg/kg	<0.005	1	-				<0.005				<0.005	<0.005				<0.005	<0.005				
1,1,1,2-Tetrachloroethane	mg/kg	<0.01	2	-				<0.010				<0.010	<0.010				<0.010	<0.010				
Ethylbenzene	mg/kg	<0.004	13.6	N/A	<0.004	<0.004		<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004		<0.004	<0.004	0.0709	<0.004	<0.004		<0.004
p/m-Xylene	mg/kg	<0.01	88.5	-	<0.010	<0.010		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010		<0.010	<0.010	0.117	<0.010	<0.010		<0.010
o-Xylene	mg/kg	<0.01	40	-	<0.010	<0.010		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010		<0.010	<0.010	0.0398	<0.010	<0.010		<0.010
Total Xylenes (calculated)	mg/kg		128.5	N/A	<0.020	<0.020	<0.000	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.000	<0.020	<0.020	<0.157	<0.020	<0.020		<0.020
Styrene	mg/kg	<0.01	2	-				<0.010				<0.010	<0.010				<0.010	<0.010				
Bromofom	mg/kg	<0.01	2	-				<0.010				<0.010	<0.010				<0.010	<0.010				
Isopropylbenzene	mg/kg	<0.005	2.83	-				<0.005				<0.005	<0.005				<0.005	<0.005				
1,1,2,2-Tetrachloroethane	mg/kg	<0.01	2	-				<0.010				<0.010	<0.010				<0.010	<0.010				
1,2,3-Trichloropropane	mg/kg	<0.016	3.2	-				<0.016				<0.016	<0.016				<0.016	<0.016				
Bromobenzene	mg/kg	<0.01	2	-				<0.010				<0.010	<0.010				<0.010	<0.010				
Propylbenzene	mg/kg	<0.01	6.33	-				<0.010				<0.010	<0.010				<0.010	<0.010				
2-Chlorotoluene	mg/kg	<0.009	1.8	-				<0.009				<0.009	<0.009				<0.009	<0.009				
1,3,5-Trimethylbenzene	mg/kg	<0.008	29.4	-				<0.008				<0.008	<0.008				<0.008	0.0189				
4-Chlorotoluene	mg/kg	<0.01	2	-				<0.010				<0.010	<0.010				<0.010	<0.010				
tert-Butylbenzene	mg/kg	<0.014	2.8	-				<0.014				<0.014	<0.014				<0.014	<0.014				
1,2,4-Trimethylbenzene	mg/kg	<0.009	88.4	-				<0.009				<0.009	<0.009				<0.009	0.071				
sec-Butylbenzene	mg/kg	<0.01	2	-				<0.010				<0.010	<0.010				<0.010	<0.010				
4-Isopropyltoluene	mg/kg	<0.01	2	-				<0.010				<0.010	<0.010				<0.010	<0.010				
1,3-Dichlorobenzene	mg/kg	<0.008	1.6	-				<0.008				<0.008	<0.008				<0.008	<0.008				
1,4-Dichlorobenzene	mg/kg	<0.005	1	-				<0.005				<0.005	<0.005				<0.005	<0.005				
n-Butylbenzene	mg/kg	<0.011	2.2	-				<0.011				<0.011	<0.011				<0.011	<0.011				
1,2-Dichlorobenzene	mg/kg	<0.01	2	-				<0.010				<0.010	<0.010				<0.010	<0.010				
1,2-Dibromo-3-chloropropane	mg/kg	<0.014	2.8	-				<0.014				<0.014	<0.014				<0.014	<0.014				
Tert-amyl methyl ether	mg/kg	<0.01	2	-				<0.010				<0.010	<0.010				<0.010	<0.010				
1,2,4-Trichlorobenzene	mg/kg	<0.02	4	-				<0.020				<0.020	<0.020				<0.020	<0.020				
Hexachlorobutadiene	mg/kg	<0.02	4	-				<0.020				<0.020	<0.020				<0.020	<0.020				
Naphthalene	mg/kg	<0.013	699	-				<0.013				<0.013	<0.013				<0.013	1.51				
1,2,3-Trichlorobenzene	mg/kg	<0.02	4	-				<0.020				<0.020	<0.020				<0.020	<0.020				
Sum of Detected Xylenes	mg/kg	<0.2	0.2	-																		
Sum of BTEX	mg/kg	<0.4	0.4	-																		

	<0.000	Concentration below the LOD
	0.000	Concentration in exceedance of the GAC
	0.000	Concentration in exceedance of the L3 SSAC
	N/A	Not applicable
	LTT	Long travel time - risk negligible

[illegible]

		<0.000	Concentration below the LOD																				
		0.000	Concentration in exceedance of the GAC																				
		0.000	Concentration in exceedance of the L3 SSAC																				
		N/A	Not applicable																				
		LTT	Long travel time - risk negligible																				
					BH103A	BH106	BH105	BH104	BH106	TP104	HP102	TP104	BH101	BH102	BH106	BH103A	BH104	BH107	BH102A	TT101	HP102	TT102	
					4.30-	1.70-	0.90-	1.90-	3.60-	2.00-	1.20-	1.10-	3.50-	0.80-	1.10-	0.40-	0.40-	0.35-	0.40-	1.00-	0.50-	0.35-	
Test	Units	LOD	Max	L3 EQS	12/11/2015	13/11/2015	02/11/2015	11/11/2015	13/11/2015	10/11/2015	04/11/2015	10/11/2015	04/11/2015	02/11/2015	10/11/2015	10/11/2015	10/11/2015	09/11/2015	03/11/2015	05/11/2015	04/11/2015	05/11/2015	
Benzene	mg/kg	<0.01	9.68	-	<0.010	0.115	<0.010	<0.010	0.878	0.33	<0.010	<0.010	<0.010	<0.010	<0.010	0.0293	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Toluene	mg/kg	<0.002	11.3	-	<0.002	0.0377	<0.002	<0.002	0.335	0.0138	0.00678	0.0024	<0.002	0.00792	<0.002	0.016	0.00258	0.0146	0.0116	0.00252	0.00784	0.00595	
Ethylbenzene	mg/kg	<0.003	2.3	-	<0.003	0.0251	<0.003	<0.003	0.0869	0.138	<0.003	<0.003	0.0955	<0.003	<0.003	0.00532	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	
m,p-Xylene	mg/kg	<0.006	12.7	-	<0.006	0.157	<0.006	<0.006	0.393	0.368	<0.006	<0.006	<0.006	<0.006	<0.006	0.0253	<0.006	<0.006	0.0116	<0.006	<0.006	<0.006	
o-Xylene	mg/kg	<0.003	5.53	-	<0.003	0.102	<0.003	<0.003	0.241	0.434	<0.003	<0.003	<0.003	<0.003	<0.003	0.0226	<0.003	0.00366	0.00928	<0.003	<0.003	0.00357	
sum of detected mpo xylene by GC	mg/kg	<0.009	18.2	-	<0.009	0.259	<0.009	<0.009	0.634	0.802	<0.009	<0.009	<0.009	<0.009	<0.009	0.0479	<0.009	<0.009	0.0209	<0.009	<0.009	<0.009	
sum of detected BTEX by GC	mg/kg	<0.024	41.5	-	<0.024	0.437	<0.024	<0.024	1.93	1.28	<0.024	<0.024	0.0955	<0.024	<0.024	0.0985	<0.024	<0.024	0.0325	<0.024	<0.024	<0.024	
Aliphatics >C5-C6	mg/kg	<0.01	1.63	-	0.342	0.0141	<0.010	0.586	0.0272	0.0311	<0.010	<0.010	0.0426	0.0119	<0.010	0.0279	<0.010	0.0268	<0.010	<0.010	<0.010	<0.010	
Aliphatics >C6-C8	mg/kg	<0.01	9.89	-	0.418	0.0659	0.0116	0.807	0.272	0.13	<0.010	<0.010	1.15	0.029	<0.010	0.165	0.0168	0.0622	0.0174	0.0176	<0.010	0.0202	
Aliphatics >C8-C10	mg/kg	<0.01	22.3	-	0.593	0.334	0.0374	0.547	0.252	0.981	<0.010	<0.010	3.64	0.0185	0.0181	0.335	0.0671	7.72	0.0336	0.0365	<0.010	0.0333	
Aliphatics >C10-C12	mg/kg	<0.01	95.8	-	0.65	0.675	<0.010	0.49	0.378	1.36	<0.010	0.012	4.59	0.125	0.0497	0.108	0.0735	2.65	0.0418	0.058	<0.010	0.0476	
Aliphatics >C12-C16	mg/kg	<0.1	4990	-	<0.100	<0.100	0.568	0.425	<0.100	<0.100	<0.100	3.97	51.6	34	1.35	3	6.38	8.11	4.76	4.25	2.81	10.6	
Aliphatics >C16-C21	mg/kg	<0.1	5000	-	3.55	<0.100	0.85	1.06	1.44	3.19	4.1	101	173	84.7	0.609	15.4	21.1	26.6	23.4	25.2	7.11	24.8	
Aliphatics >C16-C35	mg/kg	<0.1	616	-																			
Aliphatics >C21-C35	mg/kg	<0.1	5330	-	19.2	8.34	5.22	4.48	20.2	11.3	72.5	147	55.9	44.9	0.671	45.4	54	88.3	56.2	220	21.7	45.3	
Aliphatics >C35-C44	mg/kg	<0.1	2030	-	6.09	0.664	<0.100	0.192	1.33	0.26	9.18	2.3	1.63	2	<0.100	4.97	10.3	19.5	10.5	20.5	2.71	2.96	
Total Aliphatics >C12-C44	mg/kg	<0.1	15700	-	28.8	9	6.4	6.15	282	23	14.8	85.8	254	282	166	2.63	68.7	91.7	143	94.8	270	34.3	83.6
Aromatics >EC5-EC7	mg/kg	<0.01	9.68	N/A	<0.010	0.115	<0.010	<0.010	0.878	0.33	<0.010	<0.010	<0.010	<0.010	<0.010	0.0293	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Aromatics >EC7-EC8	mg/kg	<0.01	11.3	-	<0.010	0.0377	<0.010	<0.010	0.335	0.0138	<0.010	<0.010	<0.010	<0.010	<0.010	0.016	<0.010	0.0146	0.0116	<0.010	<0.010	<0.010	
Aromatics >EC8-EC10	mg/kg	<0.01	35.4	759.37	0.396	0.507	0.0245	0.365	0.887	1.6	<0.010	<0.010	2.52	0.0185	0.0136	0.277	0.0516	5.15	0.0464	0.029	<0.010	0.0309	
Aromatics >EC10-EC12	mg/kg	<0.01	63.8	N/A	0.433	0.451	<0.010	0.327	0.252	0.91	<0.010	<0.010	3.06	0.0832	0.0328	0.0718	0.049	1.77	0.0278	0.0391	<0.010	0.0321	
Aromatics >EC12-EC16	mg/kg	<0.1	5800	N/A	<0.100	5.9	0.952	2.22	9.26	14.4	<0.100	0.818	20.1	27.4	17.8	4.67	10.8	13.8	16.7	21.2	24.9	59.6	
Aromatics >EC16-EC21	mg/kg	<0.1	6570	N/A	<0.100	1.23	5.51	14.1	2.71	10.6	4.57	18.6	84	85.4	115	52.2	62.1	65.2	181	261	374	466	
Aromatics >EC21-EC35	mg/kg	<0.1	9710	N/A	1.29	18.2	21.7	29.7	31.3	37	33.5	71.3	37.1	169	286	314	315	310	698	659	938	1280	
Aromatics >EC35-EC44	mg/kg	<0.1	1510	-	<0.100	3.58	7.7	7.81	7.45	10.8	13.3	8.84	2.76	31.1	68.6	79.7	91.4	88.2	173	160	253	266	
Aromatics >EC40-EC44	mg/kg	<0.1	574	-	<0.100	1.11	3.13	2.93	2.4	3.07	4.95	3.87	0.925	9.27	21.3	25.1	27.1	32.8	58.3	48	85	77.7	
Total Aromatics >EC12-EC44	mg/kg	<0.1	21200	-	1.29	28.9	51.4	53.9	50.7	72.8	51.4	99.5	144	313	488	451	479	478	1070	1100	1590	2070	
Total Aliphatics & Aromatics >C5-C44	mg/kg	<0.1	34600	-	33	40.1	42.6	63.1	77	93	137	354	441	479	491	521	571	638	1160	1370	1620	2160	
Polyaromatic Hydrocarbons (PAHs)																							
Coronene	mg/kg	<0.2	6.55	-																			
Naphthalene-d8 % recovery**	%		197	-	105	90	101	116	197	121	93	94.5	83.5	86.5	95.6	128	106	94.4	85.5	92.9	92.8	95.3	
Acenaphthene-d10 % recovery**	%		195	-	104	83.8	100	116	195	124	92.7	92.9	83	86.7	93.2	131	107	96.9	81.9	87	92.8	94.1	
Phenanthrene-d10 % recovery**	%		186	-	106	81.9	100	115	186	121	94.6	93.8	84.9	85.8	93.3	127	110	97.7	81.8	89	94.7	98	
Chrysene-d12 % recovery**	%		170	-	110	74.3	92.9	116	170	120	92.3	95.6	81.8	85.8	87.1	119	109	109	85.3	89.6	91.3	93.1	
Perylene-d12 % recovery**	%		177	-	113	77.8	104	119	177	126	95.4	100	88.7	89.8	87.4	125	119	111	80.8	85.3	97.4	98.9	
Naphthalene	mg/kg	<0.009	2350	-	0.0393	2.69	0.0161	<0.009	1.21	20.2	0.134												

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

					BH103A	BH106	BH105	BH104	BH106	TP104	HP102	TP104	BH101	BH102	BH106	BH103A	BH104	BH107	BH102A	TT101	HP102	TT102
					4.30-	1.70-	0.90-	1.90-	3.60-	2.00-	1.20-	1.10-	3.50-	0.80-	1.10-	0.40-	0.40-	0.35-	0.40-	1.00-	0.50-	0.35-
Test	Units	LOD	Max	L3 EQS	12/11/2015	13/11/2015	02/11/2015	11/11/2015	13/11/2015	10/11/2015	04/11/2015	10/11/2015	04/11/2015	02/11/2015	10/11/2015	10/11/2015	10/11/2015	09/11/2015	03/11/2015	05/11/2015	04/11/2015	05/11/2015
bis(2-Chloroethyl)ether	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
Azobenzene	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
4-Nitrophenol	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
4-Nitroaniline	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
4-Methylphenol	mg/kg	<0.1	341	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
4-Chlorophenylphenylether	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
4-Chloroaniline	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
4-Chloro-3-methylphenol	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
4-Bromophenylphenylether	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
3-Nitroaniline	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
2-Nitrophenol	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
2-Nitroaniline	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
2-Methylphenol	mg/kg	<0.1	304	-	<0.100		<0.100	<0.100	50.8				<0.100	<1.000		<0.200				<0.200		
1,2,4-Trichlorobenzene	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
2-Chlorophenol	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
2,6-Dinitrotoluene	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
2,4-Dinitrotoluene	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
2,4-Dimethylphenol	mg/kg	<0.1	922	-	<0.100		<0.100	<0.100	9.47				<0.100	<1.000		<0.200				0.376		
2,4-Dichlorophenol	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
2,4,6-Trichlorophenol	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
2,4,5-Trichlorophenol	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
1,4-Dichlorobenzene	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
1,3-Dichlorobenzene	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
1,2-Dichlorobenzene	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
2-Chloronaphthalene	mg/kg	<0.1	5	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		<0.200				<0.200		
2-Methylnaphthalene	mg/kg	<0.1	323	-	<0.100		<0.100	<0.100	<0.100				<0.100	3.59		0.544				0.383		
Acenaphthylene	mg/kg	<0.1	277	-	<0.100		<0.100	<0.100	<0.100				<0.100	16.1		2.7				6.32		
Acenaphthene	mg/kg	<0.1	105	-	<0.100		<0.100	<0.100	<0.100				<0.100	<1.000		1.06				0.468		
Anthracene	mg/kg	<0.1	258	-	<0.100		<0.100	<0.100	<0.100				0.15	9.36		4.54				11.5		
Benzo(a)anthracene	mg/kg	<0.1	260	-	<0.100		<0.100	<0.100	<0.100				0.178	16.6		23.5				41.7		
Benzo(b)fluoranthene	mg/kg	<0.1	175	-	<0.100		<0.100	<0.100	<0.100				0.137	9.85		24.1				36.1		
Benzo(k)fluoranthene	mg/kg	<0.1	172	-	<0.100		<0.100	<0.100	<0.100				<0.100	9.02		21.1				33.2		
Benzo(a)pyrene	mg/kg	<0.1	232	-	<0.100		0.129	<0.100	<0.100				0.146	13.7		30.4				44.2		
Benzo(g,h,i)perylene	mg/kg	<0.1	149	-	<0.100		<0.100	<0.100	<0.100				<0.100	7.64		19.5				29.4		
Chrysene	mg/kg	<0.1	219	-	<0.100		0.129	<0.100	<0.100				0.173	15.5		21.5				40.1		
Fluoranthene	mg/kg	<0.1	747	-	<0.100		0.232	<0.100	<0.100				0.513	28		36.3				65.3		
Fluorene	mg/kg	<0.1	212	-	<0.100		<0.100	<0.100	<0.100				0.215	2.3		1.02				1.48		
Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	175	-	<0.100		<0.100	<0.100	<0.100				<0.100	9.19		24.2				35.9		
Phenanthrene	mg/kg	<0.1	890	-	<0.100		0.168	<0.100	<0.100				0.298	19.2		12.1				29.9		
Pyrene	mg/kg	<0.1	627	-	<0.100		0.206	<0.100	<0.100				0.471	30.1		33.3				59.8		
Naphthalene	mg/kg	<0.1	1630	-	<0.100		<0.100	<0.100	0.53				<0.100	3.18		2.01				1.5		
Dibenzo(a,h)anthracene	mg/kg	<0.1	26	-	<0.100		<0.100	<0.100	<0.100				<0.100	2.1		3.83				6.65		
Bis(2-chloroisopropyl) ether	mg/kg	<0.1	5	-																		

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

					BH103A	BH106	BH105	BH104	BH106	TP104	HP102	TP104	BH101	BH102	BH106	BH103A	BH104	BH107	BH102A	TT101	HP102	TT102
					4.30-	1.70-	0.90-	1.90-	3.60-	2.00-	1.20-	1.10-	3.50-	0.80-	1.10-	0.40-	0.40-	0.35-	0.40-	1.00-	0.50-	0.35-
Test	Units	LOD	Max	L3 EQS	12/11/2015	13/11/2015	02/11/2015	11/11/2015	13/11/2015	10/11/2015	04/11/2015	10/11/2015	04/11/2015	02/11/2015	10/11/2015	10/11/2015	10/11/2015	09/11/2015	03/11/2015	05/11/2015	04/11/2015	05/11/2015
cis-1,3-Dichloropropene	mg/kg	<0.01	2	-	<0.010		<0.010	<0.010	<0.100				<0.010	<0.100		<0.100			<0.100			
Toluene	mg/kg	<0.007	40.2	-	<0.007	0.0214	<0.007	<0.007	0.2	0.0135		<0.007	<0.007	<0.070	<0.007	0.144	<0.007	0.0171	<0.070			0.0148
trans-1,3-Dichloropropene	mg/kg	<0.01	2	-	<0.010		<0.010	<0.010	<0.100				<0.010	<0.100		<0.100			<0.100			
1,1,2-Trichloroethane	mg/kg	<0.01	2	-	<0.010		<0.010	<0.010	<0.100				<0.010	<0.100		<0.100			<0.100			
1,3-Dichloropropane	mg/kg	<0.007	1.4	-	<0.007		<0.007	<0.007	<0.070				<0.007	<0.070		<0.070			<0.070			
Tetrachloroethene	mg/kg	<0.005	31.9	12.46	<0.005		0.323	<0.005	<0.050				<0.005	<0.050		0.132			<0.050			
Dibromochloromethane	mg/kg	<0.01	2	-	<0.010		<0.010	<0.010	<0.100				<0.010	<0.100		<0.100			<0.100			
1,2-Dibromoethane	mg/kg	<0.01	2	-	<0.010		<0.010	<0.010	<0.100				<0.010	<0.100		<0.100			<0.100			
Chlorobenzene	mg/kg	<0.005	1	-	<0.005		<0.005	<0.005	<0.050				<0.005	<0.050		<0.050			<0.050			
1,1,1,2-Tetrachloroethane	mg/kg	<0.01	2	-	<0.010		<0.010	<0.010	<0.100				<0.010	<0.100		<0.100			<0.100			
Ethylbenzene	mg/kg	<0.004	13.6	N/A	<0.004	0.00945	<0.004	<0.004	<0.040	0.0977		<0.004	0.0188	<0.040	<0.004	<0.040	<0.004	<0.004	<0.040			<0.004
p/m-Xylene	mg/kg	<0.01	88.5	-	<0.010	0.0483	<0.010	<0.010	<0.100	0.216		<0.010	<0.010	<0.100	<0.010	<0.100	<0.010	<0.010	<0.100			<0.010
o-Xylene	mg/kg	<0.01	40	-	<0.010	0.0289	<0.010	<0.010	<0.100	0.271		<0.010	<0.010	<0.100	<0.010	<0.100	<0.010	<0.010	<0.100			<0.010
Total Xylenes (calculated)	mg/kg		128.5	N/A	<0.020	<0.077	<0.020	<0.020	<0.200	<0.487	<0.000	<0.020	<0.020	<0.200	<0.020	<0.200	<0.020	<0.020	<0.200	<0.000	<0.000	<0.020
Styrene	mg/kg	<0.01	2	-	<0.010		<0.010	<0.010	<0.100				<0.010	<0.100		<0.100			<0.100			
Bromoform	mg/kg	<0.01	2	-	<0.010		<0.010	<0.010	<0.100				<0.010	<0.100		<0.100			<0.100			
Isopropylbenzene	mg/kg	<0.005	2.83	-	<0.005		<0.005	<0.005	<0.050				0.0118	<0.050		<0.050			<0.050			
1,1,2,2-Tetrachloroethane	mg/kg	<0.01	2	-	<0.010		<0.010	<0.010	<0.100				<0.010	<0.100		<0.100			<0.100			
1,2,3-Trichloropropane	mg/kg	<0.016	3.2	-	<0.016		<0.016	<0.016	<0.160				<0.016	<0.160		<0.160			<0.160			
Bromobenzene	mg/kg	<0.01	2	-	<0.010		<0.010	<0.010	<0.100				<0.010	<0.100		<0.100			<0.100			
Propylbenzene	mg/kg	<0.01	6.33	-	<0.010		<0.010	<0.010	<0.100				0.0122	<0.100		<0.100			<0.100			
2-Chlorotoluene	mg/kg	<0.009	1.8	-	<0.009		<0.009	<0.009	<0.090				<0.009	<0.090		<0.090			<0.090			
1,3,5-Trimethylbenzene	mg/kg	<0.008	29.4	-	<0.008		<0.008	<0.008	<0.080				<0.008	<0.080		<0.080			<0.080			
4-Chlorotoluene	mg/kg	<0.01	2	-	<0.010		<0.010	<0.010	<0.100				<0.010	<0.100		<0.100			<0.100			
tert-Butylbenzene	mg/kg	<0.014	2.8	-	<0.014		<0.014	<0.014	<0.140				<0.014	<0.140		<0.140			<0.140			
1,2,4-Trimethylbenzene	mg/kg	<0.009	88.4	-	<0.009		<0.009	<0.009	<0.090				0.0647	<0.090		<0.090			<0.090			
sec-Butylbenzene	mg/kg	<0.01	2	-	<0.010		<0.010	<0.010	<0.100				0.0141	<0.100		<0.100			<0.100			
4-Isopropyltoluene	mg/kg	<0.01	2	-	<0.010		<0.010	<0.010	<0.100				<0.010	<0.100		<0.100			<0.100			
1,3-Dichlorobenzene	mg/kg	<0.008	1.6	-	<0.008		<0.008	<0.008	<0.080				<0.008	<0.080		<0.080			<0.080			
1,4-Dichlorobenzene	mg/kg	<0.005	1	-	<0.005		<0.005	<0.005	<0.050				<0.005	<0.050		<0.050			<0.050			
n-Butylbenzene	mg/kg	<0.011	2.2	-	<0.011		<0.011	<0.011	<0.110				<0.011	<0.110		<0.110			<0.110			
1,2-Dichlorobenzene	mg/kg	<0.01	2	-	<0.010		<0.010	<0.010	<0.100				<0.010	<0.100		<0.100			<0.100			
1,2-Dibromo-3-chloropropane	mg/kg	<0.014	2.8	-	<0.014		<0.014	<0.014	<0.140				<0.014	<0.140		<0.140			<0.140			
Tert-amyl methyl ether	mg/kg	<0.01	2	-	<0.010		<0.010	<0.010	<0.100				<0.010	<0.100		<0.100			<0.100			
1,2,4-Trichlorobenzene	mg/kg	<0.02	4	-	<0.020		<0.020	<0.020	<0.200				<0.020	<0.200		<0.200			<0.200			
Hexachlorobutadiene	mg/kg	<0.02	4	-	<0.020		<0.020	<0.020	<0.200				<0.020	<0.200		<0.200			<0.200			
Naphthalene	mg/kg	<0.013	699	-	<0.013		<0.013	<0.013	<0.130				0.0552	0.359		<0.130			<0.130			
1,2,3-Trichlorobenzene	mg/kg	<0.02	4	-	<0.020		<0.020	<0.020	<0.200				<0.020	<0.200		<0.200			<0.200			
Sum of Detected Xylenes	mg/kg	<0.2	0.2	-																		
Sum of BTEX	mg/kg	<0.4	0.4	-																		

	<0.000	Concentration below the LOD																			
	0.000	Concentration in exceedance of the GAC																			
	0.000	Concentration in exceedance of the L3 SSAC																			
	N/A	Not applicable																			
	LTT	Long travel time - risk negligible																			

					HP104	BH102B	TP105	TP103A	HP104A	BH103	BH103	HP101A	TT101	HP101	HP103	TT102	BH105	BH102B	TP103	TT101	BH203C	VP201
					0.40-	0.30-	0.50-	0.40-	0.70-	0.30-	0.90-	0.20-	0.20-	0.10-	0.30-	0.70-	0.25-	1.00-	0.80-	0.50-	2.20-2.30	1.30-1.40
Test	Units	LOD	Max	L3 EQS	03/11/2015	04/11/2015	09/11/2015	06/11/2015	03/11/2015	04/11/2015	04/11/2015	03/11/2015	05/11/2015	03/11/2015	02/11/2015	05/11/2015	02/11/2015	04/11/2015	06/11/2015	05/11/2015	01/04/2019	25/03/2019
Sample Description																						
Colour	No units		-	-	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Black	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Black	Dark Brown	Dark Brown	Black	Dark Brown	Dark Brown	Dark Brown
Description	No units		-	-	Loamy Sand	Sandy Clay Loam	Sand	Sandy Clay Loam	Loamy Sand	Sandy Clay	Silty Clay Loam	Loamy Sand	Sandy Clay Loam	Loamy Sand	Loamy Sand	Sandy Silt Loam	Loamy Sand	Clay	Sandy Clay Loam	Sandy Loam	Silty Clay Loam	Loamy Sand
Grain Size	No units		-	-	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.063 - 0.1 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	<0.063 mm	0.1 - 2 mm	0.1 - 2 mm	-	-
Inclusion 1)	No units		-	-	Vegetation	Brick	Stones	Brick	Stones	Fibres	Oil/Petroleum	Fibres	Glass & Stones	Vegetation	Vegetation	Brick	Vegetation	Stones	N/A	Stones	Vegetation	Vegetation
Inclusion 2)	No units		-	-	Stones	Stones	None	Vegetation	Vegetation	Stones	Fibres	Stones	Vegetation	Stones	Stones	Stones	Stones	None	Stones	Vegetation	None	Stones
Moisture Content Ratio (% of as received sample)	%		-	-	15	16	12	19	21	25	35	11	19	12	8.2	21	17	31	22	19	29	22
Asbestos																						
Asbestos Quantification - Gravimetric - %	%	<0.001	-	-	0.0056	<0.001					19.2	<0.001		2.89	<0.001	0.0012				0.0011		
Date of Analysis	No units		-	-	10/11/2015	11/11/2015	16/11/15	11/11/15	10/11/2015	12/11/15	16/11/15	10/11/2015		10/11/2015	10/11/2015	11/11/15	10/11/2015		11/11/15	12/11/15	09/04/2019	03/04/19
Analysed By	No units		-	-	Rebecca Rawlings	Renata Hatos	Chris Swindells	Kevin Hughes	Rebecca Rawlings	Simon Postlewhite	Kevin Hughes	Rebecca Rawlings		Rebecca Rawlings	Rebecca Rawlings	Kevin Hughes	Rebecca Rawlings		Kevin Hughes	Simon Postlewhite	barbara UrbanekWals	Andrzej Ferrecki
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-	-	0.0017	<0.001					0.0378	<0.001		0.0213	<0.001	<0.001				0.0011		
Additional Asbestos Components (Using TM048)	No units		-	-	None	None					None	None		None	None	Amosite				Crocidolite		
Analysts Comments	No units		-	-	N/C	N/C					N/C	N/C		N/C	N/C	Loose fibres in soil				Loose fibres in soil		
Asbestos Quantification - Total - %	%	<0.001	-	-	0.0073	<0.001					19.2	<0.001		2.91	<0.001	0.0012				0.0022		
Chrysotile (White) Asbestos	No units		-	-	Not Detected	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Detected	Detected		Detected	Detected	Not Detected	Not Detected		Not Detected	Detected	Not Detected	Not Detected
Amosite (Brown) Asbestos	No units		-	-	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Detected	Detected		Detected	Not Detected	Not Detected	Not Detected		Not Detected	Detected	Not Detected	Not Detected
Crocidolite (Blue) Asbestos	No units		-	-	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected	Detected	Not Detected		Not Detected	Not Detected	Not Detected	Not Detected
Fibrous Anthophyllite	No units		-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected	Not Detected	Not Detected
Fibrous Tremolite	No units		-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected	Not Detected	Not Detected
Fibrous Actinolite	No units		-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected	Not Detected	Not Detected
Non-Asbestos Fibre	No units		-	-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Detected	Not Detected	Not Detected		Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected	Not Detected	Not Detected
Comments	No units		-	-	Fibre bundles in soil	Loose fibres in soil	0	0	0	0	ing ACM debris and	fibres and fibre bundles in soil		Soil containing ACM debris	Loose fibres in soil	Loose fibres in soil	0		0	0		
Carbon																						
Organic Carbon, Total	%	<0.2	-	-																		
Fraction Organic Carbon (FOC)	No units	<0.002	-	-																	0.00796	0.0065
Soil Organic Matter (SOM)	%	<0.35	-	-	9	13.2	2	9.9	16.3	8.24	15.2	2.67	9.74	7	40.7	12.1	11.3	1.03	12.8	17.2		
Inorganics																						
Water Soluble Sulphate as SO4 2:1 Extract	g/l	<0.004	3.31	-	0.224	1.45	1.52	1.49	0.124	0.614	0.676	0.0689	0.348	0.219	1.47	1.05	0.106	1.38	1.53	0.505		
pH	pH Units	<1	10.1	-	8.11	8.77	7.65	7.25	7.14	9.67	10	8.19	8.26	8.2	7.6	8.61	7.96	8.21	8.05	7.79	8.9	7.68
ANC @ pH 4	mol/kg	<0.03	2.77	-																		
ANC @ pH 6	mol/kg	<0.03	0.113	-																		
Nitrite as NO2, 2:1 water soluble	mg/kg	<0.1	2.12	-																1.35	0.88	
Ammoniacal N as NH4 in 2:1 extract BRE	g/l	<0.0003	0.157	-																0.0773	0.00262	
Loss on Ignition	%	<0.7	11.6	-																		
Sulphide, Easily liberated	mg/kg	<15	477	-																201	<15.000	
Cyanide, Total	mg/kg	<1	1170	-	113	47.6	<1.000	173	29.3	<1.000	<1.000	106	28.8	246	216	137	67.5	1170	295	241		
Cyanide, Free	mg/kg	<1	10	0.441	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.02	1.02	1.12	1.12	<2.000	4.51	4.59	<10.000	<10.000		
Exchangeable Ammonia as NH4	mg/kg	<15	5150	-	<15.000	<15.000	<15.000	<15.000	83.7	994	1470	<15.000	<15.000	<15.000	42.8	22.6	<15.000	159	119			
Cyanide, Complex	mg/kg	<1	1170	-	112	47.4	<1.000	172	29	<1.000	<1.000	105	27.8	245	215	136	63	1170	293	241		
Exchangeable Ammonia as N	mg/kg	<12	4000	-	<15.000	<15.000	<15.000	<15.000	65.1	773	1150	<15.000	<15.000	<15.000	33.3	<15.000	<15.000	124	92.5			
Cyanide, Complex (low level)	mg/kg	<0.5	2390	-																<0.500	<0.500	
Metals - (Solids)																						
Chromium, Hexavalent	mg/kg	<0.6	3	-	<0.600	<0.600	<0.600		1.31	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600		<0.600	<0.600		<0.600	<0.600	<0.600
Boron, water soluble	mg/kg	<1	5.36	-	<1.000	<1.000	<1.000	<1.000	<1.000	2.77	1.52	1.6	<1.000	1.16	<1.000	1.01	<1.000	1.09	1.58	<1.000	1.96	<1.000
Arsenic	mg/kg	<0.6	268	N/A	38.8	34.9	78	50.6	17.2	14.7	33.2	15.1	22.1	36.1	146	28.5	48.5	4.34	35.7	57.6	30.9	16.4
Barium	mg/kg	<0.6	862	-	239	131	26.4	143	88.8	151	103	198	141	518	156	138	180	73.9	101	113	85.1	99.1
Beryllium	mg/kg	<0.01	2.85	-	2.06	1.07	0.449	1.36	1.13	0.396	0.546	1.27	1.02	2.85	1.59	0.988	1.17	0.805	1.2	0.726	0.637	0.644
Cadmium	mg/kg	<0.02	19.6	-	0.756	0.481	0.425	0.778	0.326	1.75	3.16	0.593	0.555	17.2	3.55	0.425	0.685	0.372	0.608	1.95	0.247	0.398
Chromium	mg/kg	<0.9	74	-	31.3	19.4	7.61	31.8	13.1	31.2	57.1	26.2	21.5	74	15	13.5	36	17.4	37.7	18.6	15	15.2
Copper	mg/kg	<1.4	648	N/A	193	77.5	8.89	99.7	26.8	41.8	92.7	293	52.1	648	203	45.4	95.2	21.8	45.1	63.4	137	17.7
Lead	mg/kg	<0.7	31000	-	340	1250	34.8	1530	2310	344	3150	581	483	990	575	304	462	38.5	866	232	31.5	36.8
Mercury	mg/kg	<0.14	278	-	12	0.894	0.292	<1.400	0.334	12.1	21.1	4.55	0.42	2.9	7.66	0.933	0.963	0.489	7.68	0.33	0.215	<0.140
Nickel	mg/kg	<0.2	135	N/A	38.3	28.5	14.7	50.2	19.4	53.8	43.7	64.6	32.1	135	64.9	24						

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

					HP104	BH102B	TP105	TP103A	HP104A	BH103	BH103	HP101A	TT101	HP101	HP103	TT102	BH105	BH102B	TP103	TT101	BH203C	VP201
					0.40-	0.30-	0.50-	0.40-	0.70-	0.30-	0.90-	0.20-	0.20-	0.10-	0.30-	0.70-	0.25-	1.00-	0.80-	0.50-	2.20-2.30	1.30-1.40
Test	Units	LOD	Max	L3 EQS	03/11/2015	04/11/2015	09/11/2015	06/11/2015	03/11/2015	04/11/2015	04/11/2015	03/11/2015	05/11/2015	03/11/2015	02/11/2015	05/11/2015	02/11/2015	04/11/2015	06/11/2015	05/11/2015	01/04/2019	25/03/2019
Benzene	mg/kg	<0.01	9.68	-	<0.010	<0.010	<0.010	<0.010	<0.010	1.89	9.68	<0.010	0.0172	<0.010	<0.010	0.0279	<0.010	<0.010	0.468	0.0123		
Toluene	mg/kg	<0.002	11.3	-	0.0105	0.00714	<0.002	0.00248	0.309	2.08	11.3	0.00339	0.00984	0.00339	0.00653	0.00762	0.0048	<0.002	0.545	0.00492		
Ethylbenzene	mg/kg	<0.003	2.3	-	0.0211	<0.003	<0.003	<0.003	0.721	0.271	2.3	<0.003	<0.003	<0.003	0.00436	0.0102	<0.003	<0.003	0.709	0.00861		
m,p-Xylene	mg/kg	<0.006	12.7	-	0.0374	<0.006	<0.006	<0.006	0.673	1.59	12.7	<0.006	<0.006	<0.006	0.0414	0.014	<0.006	<0.006	1.72	0.0123		
o-Xylene	mg/kg	<0.003	5.53	-	0.0363	0.00357	<0.003	<0.003	0.485	0.709	5.53	<0.003	<0.003	<0.003	0.0261	0.00889	<0.003	<0.003	1.05	0.00738		
sum of detected mpo xylene by GC	mg/kg	<0.009	18.2	-	0.0737	<0.009	<0.009	<0.009	1.16	2.3	18.2	<0.009	<0.009	<0.009	0.0675	0.0229	<0.009	<0.009	2.77	0.0197		
sum of detected BTEX by GC	mg/kg	<0.024	41.5	-	0.105	<0.024	<0.024	<0.024	2.19	6.54	41.5	<0.024	0.027	<0.024	0.0784	0.0686	<0.024	<0.024	4.49	0.0455		
Aliphatics >C5-C6	mg/kg	<0.01	1.63	-	0.0164	<0.010	<0.010	<0.010	0.134	0.126	1.63	<0.010	<0.010	<0.010	0.0131	0.0178	<0.010	<0.010	0.0678	0.0135	0.0252	0.0141
Aliphatics >C6-C8	mg/kg	<0.01	9.89	-	0.0854	0.0167	<0.010	0.0112	1.52	0.737	9.89	0.0181	0.0234	0.0181	0.0403	0.0787	0.0216	0.0161	0.682	0.0701	0.0882	0.479
Aliphatics >C8-C10	mg/kg	<0.01	22.3	-	0.433	0.0238	<0.010	0.0533	6.08	2.28	22.3	0.0136	0.048	0.0113	0.584	0.166	0.0684	0.0409	3.7	0.121	0.468	0.0461
Aliphatics >C10-C12	mg/kg	<0.01	95.8	-	1.33	0.0345	<0.010	0.0967	10.7	6.09	35.3	0.0192	0.0517	0.0226	4.1	0.385	<0.010	0.0701	11.2	0.198	0.424	0.0154
Aliphatics >C12-C16	mg/kg	<0.1	4990	-	107	13.6	16.7	20	1580	1420	4990	10.3	4.95	20	1440	3	1.2	<0.100	16.1	11.2	0.174	<0.100
Aliphatics >C16-C21	mg/kg	<0.1	5000	-	309	55	8.25	46.5	2790	2470	5000	145	14.7	174	1300	4.98	10.1	<0.100	24.2	26.6		<0.100
Aliphatics >C16-C35	mg/kg	<0.1	616	-																	<0.100	
Aliphatics >C21-C35	mg/kg	<0.1	5330	-	378	95.5	7.11	75.9	2140	5330	4790	279	33.2	324	1320	6.08	45	1.1	38.7	49.7		<0.100
Aliphatics >C35-C44	mg/kg	<0.1	2030	-	65.4	8.99	<0.100	4.69	195	2030	878	44.3	2.78	59.9	126	3.85	4.57	<0.100	<0.100	5.82	<0.100	<0.100
Total Aliphatics >C12-C44	mg/kg	<0.1	15700	-	860	173	15700	32.1	147	6700	15700	478	55.7	577	4190	17.9	60.8	1.1	78.9	93.3	0.174	<0.100
Aromatics >EC5-EC7	mg/kg	<0.01	9.68	N/A	<0.010	<0.010	<0.010	<0.010	<0.010	1.89	9.68	<0.010	0.0172	<0.010	<0.010	0.0279	<0.010	<0.010	0.468	0.0123	<0.010	<0.010
Aromatics >EC7-EC8	mg/kg	<0.01	11.3	-	0.0105	<0.010	<0.010	<0.010	0.309	2.08	11.3	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.545	<0.010	<0.010	<0.010
Aromatics >EC8-EC10	mg/kg	<0.01	35.4	759.37	0.383	0.0274	<0.010	0.0397	5.93	4.09	35.4	0.0113	0.0369	0.0102	0.462	0.144	0.0468	0.0277	5.94	0.109	0.312	0.0307
Aromatics >EC10-EC12	mg/kg	<0.01	63.8	N/A	0.89	0.0238	<0.010	0.0645	7.16	4.06	23.6	0.0124	0.0344	0.0158	2.74	0.257	<0.010	0.0467	7.44	0.132	0.283	0.0102
Aromatics >EC12-EC16	mg/kg	<0.1	5800	N/A	200	46.6	119	90.9	1100	1780	5800	14	30.8	13.5	3490	20	23.5	2.89	116	112	<0.100	<0.100
Aromatics >EC16-EC21	mg/kg	<0.1	6570	N/A	470	624	1010	856	2090	2340	5960	109	382	117	6570	61.2	56.8	16.3	375	478	<0.100	0.372
Aromatics >EC21-EC35	mg/kg	<0.1	9710	N/A	1050	1710	1810	2370	2580	3910	5800	509	701	537	9710	84.2	206	40.6	513	695	<0.100	2.95
Aromatics >EC35-EC44	mg/kg	<0.1	1510	-	247	358	348	461	387	1510	1180	167	137	179	1440	16.5	51.2	10.1	121	110	<0.100	<0.100
Aromatics >EC40-EC44	mg/kg	<0.1	574	-	78.5	115	107	139	107	574	424	61.4	40	59.1	428	5.22	16.2	3.41	37.8	32.1	<0.100	<0.100
Total Aromatics >EC12-EC44	mg/kg	<0.1	21200	-	1960	2740	3290	3780	6170	9540	18700	799	1250	847	21200	182	337	69.9	1130	1400	<0.100	3.32
Total Aliphatics & Aromatics >C5-C44	mg/kg	<0.1	34600	-	2820	2910	3320	3930	12900	20800	34600	1280	1310	1420	25400	201	398	71.2	1230	1490	1.77	3.92
Polyaromatic Hydrocarbons (PAHs)																						
Coronene	mg/kg	<0.2	6.55	-																		
Naphthalene-d8 % recovery**	%		197	-	96.8	80.5	95.8	104	99.6	111	82.7	93.1	92.3	93.7	101	110	106	110	114	94.3	88.1	93.8
Acenaphthene-d10 % recovery**	%		195	-	101	78.3	96.2	110	108	101	109	91.2	90.2	92.4	119	113	108	96.3	116	96	84.4	92.1
Phenanthrene-d10 % recovery**	%		186	-	101	76.1	98.3	112	106	98.5	106	92.4	90.2	93.1	110	113	107	88.4	116	94.8	87	96.5
Chrysene-d12 % recovery**	%		170	-	99.2	77.7	104	113	102	95.8	104	88.7	111	89.3	101	114	108	66.4	115	91.5	78.4	96.5
Perylene-d12 % recovery**	%		177	-	112	85.7	109	125	116	93.1	100	101	112	98.7	109	129	116	64.9	126	93	82.8	99.9
Naphthalene	mg/kg	<0.009	2350	-	2.54	1.41	0.123	1.74	31.2	2010	2350	0.732	1.93	0.543								

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

					HP104	BH102B	TP105	TP103A	HP104A	BH103	BH103	HP101A	TT101	HP101	HP103	TT102	BH105	BH102B	TP103	TT101	BH203C	VP201
					0.40-	0.30-	0.50-	0.40-	0.70-	0.30-	0.90-	0.20-	0.20-	0.10-	0.30-	0.70-	0.25-	1.00-	0.80-	0.50-	2.20-2.30	1.30-1.40
Test	Units	LOD	Max	L3 EQS	03/11/2015	04/11/2015	09/11/2015	06/11/2015	03/11/2015	04/11/2015	04/11/2015	03/11/2015	05/11/2015	03/11/2015	02/11/2015	05/11/2015	02/11/2015	04/11/2015	06/11/2015	05/11/2015	01/04/2019	25/03/2019
bis(2-Chloroethyl)ether	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
Azobenzene	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
4-Nitrophenol	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
4-Nitroaniline	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
4-Methylphenol	mg/kg	<0.1	341	-	<1.000				<1.000	251	341				<4.000		<0.100	<0.100	2.43	<2.000		<0.100
4-Chlorophenylphenylether	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
4-Chloroaniline	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
4-Chloro-3-methylphenol	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
4-Bromophenylphenylether	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
3-Nitroaniline	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
2-Nitrophenol	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
2-Nitroaniline	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
2-Methylphenol	mg/kg	<0.1	304	-	<1.000				<1.000	240	304				<4.000		<0.100	<0.100	2.32	<2.000		<0.100
1,2,4-Trichlorobenzene	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
2-Chlorophenol	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
2,6-Dinitrotoluene	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
2,4-Dinitrotoluene	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
2,4-Dimethylphenol	mg/kg	<0.1	922	-	<1.000				<1.000	639	922				14.7		<0.100	<0.100	3.31	<2.000		<0.100
2,4-Dichlorophenol	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
2,4,6-Trichlorophenol	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
2,4,5-Trichlorophenol	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
1,4-Dichlorobenzene	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
1,3-Dichlorobenzene	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
1,2-Dichlorobenzene	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
2-Chloronaphthalene	mg/kg	<0.1	5	-	<1.000				<1.000	<4.000	<5.000				<4.000		<0.100	<0.100	<0.200	<2.000		<0.100
2-Methylnaphthalene	mg/kg	<0.1	323	-	2.45				35.6	189	323				307		<0.100	<0.100	1.22	3.16		<0.100
Acenaphthylene	mg/kg	<0.1	277	-	8.06				15.9	102	185				277		0.852	<0.100	10.5	27.1		<0.100
Acenaphthene	mg/kg	<0.1	105	-	2.39				16.3	91.7	105				56.6		0.216	<0.100	3.13	45.7		<0.100
Anthracene	mg/kg	<0.1	258	-	7.29				20.1	137	192				258		1.13	0.19	10.3	121		<0.100
Benzo(a)anthracene	mg/kg	<0.1	260	-	23.2				13.4	95	89.3				260		6.26	0.467	15.9	174		<0.100
Benzo(b)fluoranthene	mg/kg	<0.1	175	-	18				8.88	56.6	60.4				175		5.72	0.409	10.5	115		<0.100
Benzo(k)fluoranthene	mg/kg	<0.1	172	-	15.9				7.98	57.7	52.2				172		5.32	0.336	10.4	113		<0.100
Benzo(a)pyrene	mg/kg	<0.1	232	-	23.2				14.9	72.5	68.9				232		7.28	0.496	14.3	152		<0.100
Benzo(g,h,i)perylene	mg/kg	<0.1	149	-	13.9				11.4	42.7	41.4				149		5.44	0.277	7.33	98.5		<0.100
Chrysene	mg/kg	<0.1	219	-	22.5				12.6	85.7	79.5				219		5.9	0.511	13.3	151		<0.100
Fluoranthene	mg/kg	<0.1	747	-	34.9				28.4	324	375				747		8.6	1.04	40	521		<0.100
Fluorene	mg/kg	<0.1	212	-	5.1				24.8	137	201				212		0.168	<0.100	7.62	83		<0.100
Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	175	-	17.2				12.7	54.4	52.8				175		6.43	0.336	9.61	115		<0.100
Phenanthrene	mg/kg	<0.1	890	-	19.4				57.1	448	632				890		3.2	0.336	37	316		<0.100
Pyrene	mg/kg	<0.1	627	-	36.8				34.3	253	291				627		8.34	0.905	35.4	431		<0.100
Naphthalene	mg/kg	<0.1	1630	-	3.7				89.5	918												

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

					HP104	BH102B	TP105	TP103A	HP104A	BH103	BH103	HP101A	TT101	HP101	HP103	TT102	BH105	BH102B	TP103	TT101	BH203C	VP201
					0.40-	0.30-	0.50-	0.40-	0.70-	0.30-	0.90-	0.20-	0.20-	0.10-	0.30-	0.70-	0.25-	1.00-	0.80-	0.50-	2.20-2.30	1.30-1.40
Test	Units	LOD	Max	L3 EQS	03/11/2015	04/11/2015	09/11/2015	06/11/2015	03/11/2015	04/11/2015	04/11/2015	03/11/2015	05/11/2015	03/11/2015	02/11/2015	05/11/2015	02/11/2015	04/11/2015	06/11/2015	05/11/2015	01/04/2019	25/03/2019
cis-1,3-Dichloropropene	mg/kg	<0.01	2	-	<0.020				<0.200	<2.000	<2.000				<0.200		<0.100	<0.010	<0.200	<0.100		<0.100
Toluene	mg/kg	<0.007	40.2	-	<0.014		<0.007	<0.007	0.446	10.7	40.2	<0.007		<0.007	<0.140	<0.007	<0.070	<0.007	0.284	<0.070	<0.070	<0.070
trans-1,3-Dichloropropene	mg/kg	<0.01	2	-	<0.020				<0.200	<2.000	<2.000				<0.200		<0.100	<0.010	<0.200	<0.100		<0.100
1,1,2-Trichloroethane	mg/kg	<0.01	2	-	<0.020				<0.200	<2.000	<2.000				<0.200		<0.100	<0.010	<0.200	<0.100		<0.100
1,3-Dichloropropane	mg/kg	<0.007	1.4	-	<0.014				<0.140	<1.400	<1.400				<0.140		<0.070	<0.007	<0.140	<0.070		<0.070
Tetrachloroethene	mg/kg	<0.005	31.9	12.46	0.0419				0.225	<1.000	4.77				<0.100		0.623	<0.005	<0.100	<0.050		1.8
Dibromochloromethane	mg/kg	<0.01	2	-	<0.020				<0.200	<2.000	<2.000				<0.200		<0.100	<0.010	<0.200	<0.100		<0.100
1,2-Dibromoethane	mg/kg	<0.01	2	-	<0.020				<0.200	<2.000	<2.000				<0.200		<0.100	<0.010	<0.200	<0.100		<0.100
Chlorobenzene	mg/kg	<0.005	1	-	<0.010				<0.100	<1.000	<1.000				<0.100		<0.050	<0.005	<0.100	<0.050		<0.050
1,1,1,2-Tetrachloroethane	mg/kg	<0.01	2	-	<0.020				<0.200	<2.000	<2.000				<0.200		<0.100	<0.010	<0.200	<0.100		<0.100
Ethylbenzene	mg/kg	<0.004	13.6	N/A	0.0126		<0.004	<0.004	1.39	2	13.6	<0.004		<0.004	<0.080	<0.004	<0.040	<0.004	0.507	<0.040	<0.040	<0.040
p/m-Xylene	mg/kg	<0.01	88.5	-	<0.020		<0.010	<0.010	1.22	10.4	88.5	<0.010		<0.010	<0.200	<0.010	<0.100	<0.010	0.537	<0.100	<0.100	<0.100
o-Xylene	mg/kg	<0.01	40	-	<0.020		<0.010	<0.010	0.955	4.56	40	<0.010		<0.010	<0.200	<0.010	<0.100	<0.010	0.503	<0.100	<0.100	<0.100
Total Xylenes (calculated)	mg/kg		128.5	N/A	<0.040	<0.000	<0.020	<0.020	<2.175	<14.960	<128.500	<0.020	<0.000	<0.020	<0.400	<0.020	<0.200	<0.020	<1.040	<0.200	<0.200	<0.200
Styrene	mg/kg	<0.01	2	-	<0.020				<0.200	<2.000	<2.000				0.545		<0.100	<0.010	<0.200	<0.100		<0.100
Bromoform	mg/kg	<0.01	2	-	<0.020				<0.200	<2.000	<2.000				<0.200		<0.100	<0.010	<0.200	<0.100		<0.100
Isopropylbenzene	mg/kg	<0.005	2.83	-	<0.010				0.223	<1.000	2.83				<0.100		<0.050	<0.005	<0.100	<0.050		<0.050
1,1,2,2-Tetrachloroethane	mg/kg	<0.01	2	-	<0.020				<0.200	<2.000	<2.000				<0.200		<0.100	<0.010	<0.200	<0.100		<0.100
1,2,3-Trichloropropane	mg/kg	<0.016	3.2	-	<0.032				<0.320	<3.200	<3.200				<0.320		<0.160	<0.016	<0.320	<0.160		<0.160
Bromobenzene	mg/kg	<0.01	2	-	<0.020				<0.200	<2.000	<2.000				<0.200		<0.100	<0.010	<0.200	<0.100		<0.100
Propylbenzene	mg/kg	<0.01	6.33	-	<0.020				0.258	<2.000	6.33				<0.200		<0.100	<0.010	<0.200	<0.100		<0.100
2-Chlorotoluene	mg/kg	<0.009	1.8	-	<0.018				<0.180	<1.800	<1.800				<0.180		<0.090	<0.009	<0.180	<0.090		<0.090
1,3,5-Trimethylbenzene	mg/kg	<0.008	29.4	-	0.0294				1.85	3.02	29.4				0.486		<0.080	<0.008	0.22	<0.080		<0.080
4-Chlorotoluene	mg/kg	<0.01	2	-	<0.020				<0.200	<2.000	<2.000				<0.200		<0.100	<0.010	<0.200	<0.100		<0.100
tert-Butylbenzene	mg/kg	<0.014	2.8	-	<0.028				<0.280	<2.800	<2.800				<0.280		<0.140	<0.014	<0.280	<0.140		<0.140
1,2,4-Trimethylbenzene	mg/kg	<0.009	88.4	-	0.0773				5.8	7.95	88.4				1.34		<0.090	<0.009	0.924	<0.090		<0.090
sec-Butylbenzene	mg/kg	<0.01	2	-	<0.020				<0.200	<2.000	<2.000				<0.200		<0.100	<0.010	<0.200	<0.100		<0.100
4-Isopropyltoluene	mg/kg	<0.01	2	-	<0.020				<0.200	<2.000	<2.000				<0.200		<0.100	<0.010	<0.200	<0.100		<0.100
1,3-Dichlorobenzene	mg/kg	<0.008	1.6	-	<0.016				<0.160	<1.600	<1.600				<0.160		<0.080	<0.008	<0.160	<0.080		<0.080
1,4-Dichlorobenzene	mg/kg	<0.005	1	-	<0.010				<0.100	<1.000	<1.000				<0.100		<0.050	<0.005	<0.100	<0.050		<0.050
n-Butylbenzene	mg/kg	<0.011	2.2	-	<0.022				<0.220	<2.200	<2.200				<0.220		<0.110	<0.011	<0.220	<0.110		<0.110
1,2-Dichlorobenzene	mg/kg	<0.01	2	-	<0.020				<0.200	<2.000	<2.000				<0.200		<0.100	<0.010	<0.200	<0.100		<0.100
1,2-Dibromo-3-chloropropane	mg/kg	<0.014	2.8	-	<0.028				<0.280	<2.800	<2.800				<0.280		<0.140	<0.014	<0.280	<0.140		<0.140
Tert-amyl methyl ether	mg/kg	<0.01	2	-	<0.020				<0.200	<2.000	<2.000				<0.200		<0.100	<0.010	<0.200	<0.100	<0.100	<0.100
1,2,4-Trichlorobenzene	mg/kg	<0.02	4	-	<0.040				<0.400	<4.000	<4.000				<0.400		<0.200	<0.020	<0.400	<0.200		<0.200
Hexachlorobutadiene	mg/kg	<0.02	4	-	<0.040				<0.400	<4.000	<4.000				<0.400		<0.200	<0.020	<0.400	<0.200		<0.200
Naphthalene	mg/kg	<0.013	699	-	2.74				68.1	240	699				627		0.42	<0.013	37.4	<0.130		<0.130
1,2,3-Trichlorobenzene	mg/kg	<0.02	4	-	<0.040				<0.400	<4.000	<4.000				<0.400		<0.200	<0.020	<0.400	<0.200		<0.200
Sum of Detected Xylenes	mg/kg	<0.2	0.2	-																		<0.200
Sum of BTEX	mg/kg	<0.4	0.4	-																		<0.400

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

					WS206	WS205	BH202	BH201	BH204	BH204	WS203	BH201	VW203A	WS203	WS205	BH204	BH203C	VP201	WS204	VW202	WS204	BH201	
					4.20-4.30	2.30-2.40	3.00-	5.10-5.20	4.80-5.00	1.80-2.00	3.40-3.50	1.10-1.20	0.80-1.00	1.10-1.20	0.50-0.60	0.60-0.70	3.50-3.60	0.30-0.40	2.50-2.60	0.40-0.50	1.05-1.10	0.30-0.40	
Test	Units	LOD	Max	L3 EQS	05/04/2019	05/04/2019	27/03/2019	29/03/2019	28/03/2019	28/03/2019	04/04/2019	25/03/2019	27/03/2019	26/03/2019	27/03/2019	27/03/2019	01/04/2019	25/03/2019	04/04/2019	26/03/2019	27/03/2019	25/03/2019	
Sample Description																							
Colour	No units		-	-	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Light Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	
Description	No units		-	-	N/A	N/A	Loamy Sand	Silty Sand	Sand	Silty Clay Loam	Silty Clay Loam	Sandy Clay Loam	Loamy Sand	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Loamy Sand	Loamy Sand	Sandy Loam	Loamy Sand	Sandy Loam	
Grain Size	No units		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Inclusion 1)	No units		-	-	None	None	Vegetation	Stones	Stones	Stones	None	Stones	Vegetation	Vegetation	Stones	Vegetation	Stones	Vegetation	Stones	Vegetation	None	Vegetation	
Inclusion 2)	No units		-	-	None	None	Stones	None	None	None	None	None	Stones	Stones	Vegetation	Stones	Vegetation	Stones	Brick	Stones	None	Stones	
Moisture Content Ratio (% of as received sample)	%		-	-	41	30	36	5.1	3.7	21	35	31	17	18	17	9.7	29	17	14	16	13	13	
Asbestos																							
Asbestos Quantification - Gravimetric - %	%	<0.001	-	-									0.0348					<0.001					
Date of Analysis	No units		-	-								03/04/19	04/04/19	02/04/19	05/04/2019	04/04/19		03/04/19	10/04/2019	02/04/19	04/04/19	03/04/19	
Analysed By	No units		-	-								Andrzej Ferlecki	Andrzej Ferlecki	Andrzej Ferlecki	James Richards	Andrzej Ferlecki		Andrzej Ferlecki	Lucy Caroe	Andrzej Ferlecki	Andrzej Ferlecki	Andrzej Ferlecki	
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-	-									0.006					<0.001					
Additional Asbestos Components (Using TM048)	No units		-	-									None					None					
Analysts Comments	No units		-	-								PCOM analysis showed fibres typical of Amphibole asbestos.							N/C				
Asbestos Quantification - Total - %	%	<0.001	-	-									0.0408					<0.001					
Chrysotile (White) Asbestos	No units		-	-								Not Detected	Detected	Not Detected	Not Detected	Not Detected		Detected	Detected	Not Detected	Not Detected	Not Detected	
Amosite (Brown) Asbestos	No units		-	-								Not Detected	Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	
Crocidolite (Blue) Asbestos	No units		-	-								Not Detected	Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	
Fibrous Anthophyllite	No units		-	-								Not Detected	Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	
Fibrous Tremolite	No units		-	-								Not Detected	Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	
Fibrous Actinolite	No units		-	-								Not Detected	Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	
Non-Asbestos Fibre	No units		-	-								Not Detected	Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	
Comments	No units		-	-									loose fibres in soil					loose fibres in soil	Loose fibres in soil				
Carbon																							
Organic Carbon, Total	%	<0.2	-	-								1.88	0.746				4.82			9.92			
Fraction Organic Carbon (FOC)	No units	<0.002	-	-	0.0109	0.00812	0.00409	<0.002	<0.002	0.00984	0.0086	0.0188	0.00746	0.0127	0.0464	0.0482	0.0509	0.0416	0.0615	0.0992	0.0678	0.175	
Soil Organic Matter (SOM)	%	<0.35	-	-																			
Inorganics																							
Water Soluble Sulphate as SO4 2:1 Extract	g/l	<0.004	3.31	-																			
pH	pH Units	<1	10.1	-	8.46	8.59	8.46	8.23	8.6	8.14	9.22	8.4	7.66	7.44	7.77	8.26	8.19	7.7	7.22	8.39	7.61	7.91	
ANC @ pH 4	mol/kg	<0.03	2.77	-								2.77	0.354			0.273				0.597			
ANC @ pH 6	mol/kg	<0.03	0.113	-								0.113	0.0306			0.0789				0.0497			
Nitrite as NO2, 2:1 water soluble	mg/kg	<0.1	2.12	-		1.21	2.12	<0.100			<0.100	0.54	0.5	0.35		0.62				0.45		0.9	
Ammoniacal N as NH4 in 2:1 extract BRE	g/l	<0.0003	0.157	-		0.0686	0.157	0.00369			0.103	0.0016	0.00236	0.00317		0.00185				0.0027		0.00272	
Loss on ignition	%	<0.7	11.6	-								7.72	2.53			4.44				5.28			
Sulphide, Easily liberated	mg/kg	<15	477	-		156	26.8	31.1			26.9	<15.000	<15.000	473		<15.000				<15.000		21.7	
Cyanide, Total	mg/kg	<1	1170	-																			
Cyanide, Free	mg/kg	<1	10	0.441																			
Exchangeable Ammonia as NH4	mg/kg	<15	5150	-																			
Cyanide, Complex	mg/kg	<1	1170	-																			
Exchangeable Ammonia as N	mg/kg	<12	4000	-																			
Cyanide, Complex (low level)	mg/kg	<0.5	2390	-	1.72	<0.500	17.8	<0.500	<0.500	<0.500	123	2.2	5.71	134	33.7	83.7	13.1	108	312	16.6	2390	20.4	
Metals - (Solids)																							
Chromium, Hexavalent	mg/kg	<0.6	3	-	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	1.66	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	0.726	<0.600	<0.600	<0.600	
Boron, water soluble	mg/kg	<1	5.36	-	<1.000	1.29	<1.000	<1.000	<1.000	<1.000	1.18	<1.000	<1.000	<1.000	<1.000	<1.000	3.51	<1.000	<1.000	<1.000	1.29	<1.000	
Arsenic	mg/kg	<0.6	268	N/A	18.9	3.38	13.7	26.2	9.51	38.2	33.1	27.5	15.8	18.8	27.8	19.2	18.8	117	21.4	31.6	94	262	
Barium	mg/kg	<0.6	862	-	48	72.6	153	20.3	19.5	69.6	85.7	215	33	66.2	478	129	83	452	76	123	309	862	
Beryllium	mg/kg	<0.01	2.85	-	0.589	0.582	0.655	0.648	0.392	0.666	0.668	0.869	0.222	0.357	1.16	0.928	0.517	0.525	0.43	0.765	1.72	0.784	
Cadmium	mg/kg	<0.02	19.6	-	0.262	0.243	0.235	<0.020	0.123	0.241	0.374	0.382	0.404	0.239	0.395	0.299	0.258	0.951	0.348	0.327	19.6	1.43	
Chromium	mg/kg	<0.9	74	-	9.62	14.9	6.78	9.13	6.08	16.5	10.2	12.9	5.43	4.55	6.99	11.7	5.55	15.8	1.66	5.27	2.21	5.73	
Copper	mg/kg	<1.4	648	N/A	14.8	8.01	15.6	4.6	5.26	14	7.46	38.7	15.9	36.3	81.3	42.4	86.5	51.3	26.4	51.2	64.9	83.3	
Lead	mg/kg	<0.7	31000	-	6.29	25.9	109	10	30.1	27.7	4.33	582	89.3	92.2	276	205	50.7	380	145	653	19700	1270	
Mercury	mg/kg	<0.14	278	-	<0.140	<0.140	<0.140	<0.140	<0.140	<0.140	<0.140	1.73	<0.140	<0.140	0.228	0.516	0.488	<0.140	0.341	0.863	278	<0.140	
Nickel	mg/kg	<0.2	135	N/A	22.4	17.4	35.6	33.5	13.5	17.5	27.2	30.7	8.79	14.5	30.7	21.5	11.7	28.6	13.2	22.7	35.8	27.5	
Selenium	mg/kg	<1	46.4	-	2.94	<1.000	2.26	<1.000	3.44	<1.000	46.4	<1.000	<1.000	2.42	1.24	<1.000	2.46	<1.000	<1.000	1.48	8.24	1.32	
Vanadium	mg/kg	<0.2	119	-	35.8	22	28.5	61.8	20.1	24.5	15.7	38.2	12.4	22.1	37.2	22.7	19.4	35.2	15.3	26.7	37.4	45.1	
Zinc	mg/kg	<1.9	3260	LTT	37	48.7	88	57.8	25.6	76.5	53.9	211	74.8	59.6	109	390	93						

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

					WS206	WS205	BH202	BH201	BH204	BH204	WS203	BH201	VW203A	WS203	WS205	BH204	BH203C	VP201	WS204	VW202	WS204	BH201
					4.20-4.30	2.30-2.40	3.00-	5.10-5.20	4.80-5.00	1.80-2.00	3.40-3.50	1.10-1.20	0.80-1.00	1.10-1.20	0.50-0.60	0.60-0.70	3.50-3.60	0.30-0.40	2.50-2.60	0.40-0.50	1.05-1.10	0.30-0.40
Test	Units	LOD	Max	L3 EQS	05/04/2019	05/04/2019	27/03/2019	29/03/2019	28/03/2019	28/03/2019	04/04/2019	25/03/2019	27/03/2019	26/03/2019	27/03/2019	27/03/2019	01/04/2019	25/03/2019	04/04/2019	26/03/2019	27/03/2019	25/03/2019
Benzene	mg/kg	<0.01	9.68	-																		
Toluene	mg/kg	<0.002	11.3	-																		
Ethylbenzene	mg/kg	<0.003	2.3	-																		
m,p-Xylene	mg/kg	<0.006	12.7	-																		
o-Xylene	mg/kg	<0.003	5.53	-																		
sum of detected mpo xylene by GC	mg/kg	<0.009	18.2	-																		
sum of detected BTEX by GC	mg/kg	<0.024	41.5	-																		
Aliphatics >C5-C6	mg/kg	<0.01	1.63	-	1.09	<0.010	0.0248	0.0137	<0.010	<0.010	0.0231	0.0102	<0.010	<0.010	0.0288	<0.010	0.0322	0.0288	0.0209	<0.010	0.0127	0.0276
Aliphatics >C6-C8	mg/kg	<0.01	9.89	-	0.0992	<0.010	0.153	0.0274	0.0374	0.0102	0.288	0.309	0.012	0.0146	0.066	0.0255	0.475	4.97	0.117	0.036	0.0495	2.33
Aliphatics >C8-C10	mg/kg	<0.01	22.3	-	0.139	<0.010	0.539	0.232	0.0311	<0.010	2.27	0.029	0.012	0.022	0.212	0.0278	5.35	0.304	0.198	0.118	0.458	0.136
Aliphatics >C10-C12	mg/kg	<0.01	95.8	-	0.145	<0.010	3.31	0.247	0.0862	0.0114	5.37	0.0102	0.0108	0.0232	0.344	0.03	2.37	0.066	0.289	0.09	2.61	0.0173
Aliphatics >C12-C16	mg/kg	<0.1	4990	-	1.36	0.209	<0.100	<0.100	4.54	<0.100	<0.100	<0.100	<0.100	<0.100	2.67	1.03	0.969	1.26	<0.100	3.5	25.9	5.83
Aliphatics >C16-C21	mg/kg	<0.1	5000	-								<0.100						8.52				11.7
Aliphatics >C16-C35	mg/kg	<0.1	616	-	<0.100	2.52	<0.100	8.25	3.33	8.25	0.667		<0.100	3.46	22.8	4.78	19.8		21	38.5	33.8	
Aliphatics >C21-C35	mg/kg	<0.1	5330	-								<0.100						9.46				114
Aliphatics >C35-C44	mg/kg	<0.1	2030	-	0.352	0.849	<0.100	0.726	0.321	<0.100	1.05	<0.100	<0.100	1.11	2.17	0.292	1.56	<0.100	4.44	2.89	1.71	10.4
Total Aliphatics >C12-C44	mg/kg	<0.1	15700	-	2.18	3.89	<0.100	9.65	8.21	9.33	1.94	<0.100	<0.100	4.57	27.6	6.1	22.3	19.2	25.4	44.9	61.4	142
Aromatics >EC5-EC7	mg/kg	<0.01	9.68	N/A	0.0205	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0432	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Aromatics >EC7-EC8	mg/kg	<0.01	11.3	-	0.0616	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0938	<0.010	<0.010	<0.010	<0.010	<0.010
Aromatics >EC8-EC10	mg/kg	<0.01	35.4	759.37	0.0923	<0.010	0.36	0.155	0.0208	<0.010	1.51	0.0189	<0.010	0.0146	0.142	0.0178	3.56	0.203	0.132	0.0792	0.306	0.0909
Aromatics >EC10-EC12	mg/kg	<0.01	63.8	N/A	0.0975	<0.010	2.21	0.165	0.0571	<0.010	3.58	<0.010	<0.010	0.0159	0.229	0.02	1.58	0.0432	0.193	0.06	1.74	0.0115
Aromatics >EC12-EC16	mg/kg	<0.1	5800	N/A	<0.100	<0.100	2.7	<0.100	0.12	<0.100	7.01	0.486	<0.100	0.908	1.73	1.71	17.8	1.96	19.3	1.88	21.6	14.9
Aromatics >EC16-EC21	mg/kg	<0.1	6570	N/A	0.74	<0.100	<0.100	<0.100	0.876	<0.100	0.691	5.66	6.92	2.9	6.36	11.7	9.88	16.5	100	23.6	95	84.7
Aromatics >EC21-EC35	mg/kg	<0.1	9710	N/A	1.53	4.17	<0.100	<0.100	3.1	6.6	<0.100	17.4	18	12.3	32.3	46.6	56.2	71	158	213	283	305
Aromatics >EC35-EC44	mg/kg	<0.1	1510	-	2.47	1.21	<0.100	<0.100	0.418	3.26	5.5	5	4.1	11.4	7.44	13.3	9.24	20.2	35.6	92.2	107	94.4
Aromatics >EC40-EC44	mg/kg	<0.1	574	-	0.963	<0.100	<0.100	<0.100	0.105	1.43	3.3	1.86	1.13	5.03	1.73	3.94	1.95	5.91	10.6	28.2	37	30.5
Total Aromatics >EC12-EC44	mg/kg	<0.1	21200	-	4.74	5.38	2.7	<0.100	4.51	9.86	13.2	28.5	29.1	27.4	47.8	73.2	93.1	110	313	331	507	499
Total Aliphatics & Aromatics >C5-C44	mg/kg	<0.1	34600	-	8.67	9.26	9.3	10.5	13	19.2	28.2	28.9	29.1	32.1	76.5	79.4	129	135	339	376	573	643
Polyaromatic Hydrocarbons (PAHs)																						
Coronene	mg/kg	<0.2	6.55	-								<0.200	<0.200			0.266				0.393		
Naphthalene-d8 % recovery**	%		197	-	89.1	88.4	100	100	101	99.6	98.6	96.7	95.9	99.2	98.3	96.3	95.9	89.5	97.2	96.7	96.6	83.8
Acenaphthene-d10 % recovery**	%		195	-	79.7	87.8	97.8	92.6	93.3	94.3	90.3	94.2	96.2	94.4	94.2	95.5	85.6	85.1	90.5	92.7	86.8	88.4
Phenanthrene-d10 % recovery**	%		186	-	80.2	95.1	101	98.6	96.5	103	93.9	100	101	102	98.2	101	89	88.8	100	96	89.3	93
Chrysene-d12 % recovery**	%		170	-	78.1	90.1	89	92	88.7	95.4	97.3	86.6	94.8	101	85.3	91	88	98.6	99.2	88.4	72.1	91.9
Perylene-d12 % recovery**	%		177	-	77.4	88.8	85	87.9	89.1	92.4	101	84.2	93.9	94.3	76	89.3	91	91.2	97.4	89.2	70.2	87.3
Naphthalene	mg/kg	<0.009	2350	-	<0.009	<0.009	3.84	<0.009	<0.009	<0.009	3.84	0.0634	0.0174	<0.009	0.0252	0.0632	1.6	0.0741	0.295	0.288	0.307	0.833
Acenaphthylene	mg/kg	<0.012	565	-	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	0.682	0.0515	0.161	<0.012	0.0932	0.13	0.215	0.235	0.693	0.289	0.95	0.783
Acenaphthene	mg/kg	<0.008	142	-	0.022	<0.008	0.159	<0.008	<0.008	<0.008	0.141	0.023	0.0231	<0.008	0.0224	0.0403	0.178	0.0484	0.163	0.0221	0.29	0.243
Fluorene	mg/kg	<0.01	501	-	<0.010	<0.010	0.0217	<0.010	<0.010	<0.010	0.117	0.0444	0.213	<0.010	0.052	0.061	0.483	0.0739	0.457	0.		

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

					WS206	WS205	BH202	BH201	BH204	BH204	WS203	BH201	VW203A	WS203	WS205	BH204	BH203C	VP201	WS204	VW202	WS204	BH201
					4.20-4.30	2.30-2.40	3.00-	5.10-5.20	4.80-5.00	1.80-2.00	3.40-3.50	1.10-1.20	0.80-1.00	1.10-1.20	0.50-0.60	0.60-0.70	3.50-3.60	0.30-0.40	2.50-2.60	0.40-0.50	1.05-1.10	0.30-0.40
Test	Units	LOD	Max	L3 EQS	05/04/2019	05/04/2019	27/03/2019	29/03/2019	28/03/2019	28/03/2019	04/04/2019	25/03/2019	27/03/2019	26/03/2019	27/03/2019	27/03/2019	01/04/2019	25/03/2019	04/04/2019	26/03/2019	27/03/2019	25/03/2019
bis(2-Chloroethyl)ether	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
Azobenzene	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
4-Nitrophenol	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
4-Nitroaniline	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
4-Methylphenol	mg/kg	<0.1	341	-			<0.100				<0.100	<0.100			<0.100		0.168					
4-Chlorophenylphenylether	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
4-Chloroaniline	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
4-Chloro-3-methylphenol	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
4-Bromophenylphenylether	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
3-Nitroaniline	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
2-Nitrophenol	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
2-Nitroaniline	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
2-Methylphenol	mg/kg	<0.1	304	-			<0.100				<0.100	<0.100			<0.100		<0.100					
1,2,4-Trichlorobenzene	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
2-Chlorophenol	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
2,6-Dinitrotoluene	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
2,4-Dinitrotoluene	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
2,4-Dimethylphenol	mg/kg	<0.1	922	-			<0.100				<0.100	<0.100			<0.100		0.498					
2,4-Dichlorophenol	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
2,4,6-Trichlorophenol	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
2,4,5-Trichlorophenol	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
1,4-Dichlorobenzene	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
1,3-Dichlorobenzene	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
1,2-Dichlorobenzene	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
2-Chloronaphthalene	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
2-Methylnaphthalene	mg/kg	<0.1	323	-			0.515				0.997	<0.100			<0.100		0.184					
Acenaphthylene	mg/kg	<0.1	277	-			<0.100				0.156	<0.100			<0.100		0.356					
Acenaphthene	mg/kg	<0.1	105	-			<0.100				<0.100	<0.100			<0.100		0.152					
Anthracene	mg/kg	<0.1	258	-			<0.100				<0.100	<0.100			<0.100		0.366					
Benzo(a)anthracene	mg/kg	<0.1	260	-			<0.100				<0.100	0.276			0.155		0.441					
Benzo(b)fluoranthene	mg/kg	<0.1	175	-			<0.100				<0.100	0.435			0.282		0.417					
Benzo(k)fluoranthene	mg/kg	<0.1	172	-			<0.100				<0.100	0.145			<0.100		0.208					
Benzo(a)pyrene	mg/kg	<0.1	232	-			<0.100				<0.100	0.334			0.157		0.324					
Benzo(g,h,i)perylene	mg/kg	<0.1	149	-			<0.100				<0.100	0.29			0.135		0.203					
Chrysene	mg/kg	<0.1	219	-			<0.100				<0.100	0.232			0.139		0.35					
Fluoranthene	mg/kg	<0.1	747	-			<0.100				<0.100	0.406			0.264		1.17					
Fluorene	mg/kg	<0.1	212	-			<0.100				<0.100	<0.100			<0.100		0.419					
Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	175	-			<0.100				<0.100	0.319			0.197		0.254					
Phenanthrene	mg/kg	<0.1	890	-			<0.100				<0.100	0.189			<0.100		1.14					
Pyrene	mg/kg	<0.1	627	-			<0.100				<0.100	0.435			0.237		1.02					
Naphthalene	mg/kg	<0.1	1630	-			1.1				1.22	<0.100			<0.100		1.65					
Dibenzo(a,h)anthracene	mg/kg	<0.1	26	-			<0.100				<0.100	<0.100			<0.100		<0.100					
Bis(2-chloroisopropyl) ether	mg/kg	<0.1	5	-			<0.100				<0.100	<0.100			<0.100		<0.100					
Volatile Organic Compounds (VOCs)																						
Dibromofluoromethane**	%		166	-			112				123	119	108		109	108	106	106				101
Toluene-d8**	%		104	-			100				98.2	102	99.7		99.4	98.8	101	101				95.8
4-Bromofluorobenzene**	%		102	-			100				102	99.9	98.3		96.7	88.4	99.3	89.8				71.5
Dichlorodifluoromethane	mg/kg	<0.006	1.2	-			<0.060				<0.060	<0.060			<0.060		<0.060					
Chloromethane	mg/kg	<0.007	1.4	-			<0.070				<0.070	<0.070			<0.070							

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

					WS206	WS205	BH202	BH201	BH204	BH204	WS203	BH201	VW203A	WS203	WS205	BH204	BH203C	VP201	WS204	VW202	WS204	BH201
					4.20-4.30	2.30-2.40	3.00-	5.10-5.20	4.80-5.00	1.80-2.00	3.40-3.50	1.10-1.20	0.80-1.00	1.10-1.20	0.50-0.60	0.60-0.70	3.50-3.60	0.30-0.40	2.50-2.60	0.40-0.50	1.05-1.10	0.30-0.40
Test	Units	LOD	Max	L3 EQS	05/04/2019	05/04/2019	27/03/2019	29/03/2019	28/03/2019	28/03/2019	04/04/2019	25/03/2019	27/03/2019	26/03/2019	27/03/2019	27/03/2019	01/04/2019	25/03/2019	04/04/2019	26/03/2019	27/03/2019	25/03/2019
cis-1,3-Dichloropropene	mg/kg	<0.01	2	-			<0.100				<0.100	<0.100			<0.100		<0.100					
Toluene	mg/kg	<0.007	40.2	-	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070
trans-1,3-Dichloropropene	mg/kg	<0.01	2	-			<0.100				<0.100	<0.100			<0.100		<0.100					
1,1,2-Trichloroethane	mg/kg	<0.01	2	-			<0.100				<0.100	<0.100			<0.100		<0.100					
1,3-Dichloropropane	mg/kg	<0.007	1.4	-			<0.070				<0.070	<0.070			<0.070		<0.070					
Tetrachloroethene	mg/kg	<0.005	31.9	12.46			<0.050				<0.050	1.14			<0.050		<0.050					
Dibromochloromethane	mg/kg	<0.01	2	-			<0.100				<0.100	<0.100			<0.100		<0.100					
1,2-Dibromoethane	mg/kg	<0.01	2	-			<0.100				<0.100	<0.100			<0.100		<0.100					
Chlorobenzene	mg/kg	<0.005	1	-			<0.050				<0.050	<0.050			<0.050		<0.050					
1,1,1,2-Tetrachloroethane	mg/kg	<0.01	2	-			<0.100				<0.100	<0.100			<0.100		<0.100					
Ethylbenzene	mg/kg	<0.004	13.6	N/A	<0.040	<0.040	0.169	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.165	<0.040	<0.040	<0.040	<0.040	<0.040
p/m-Xylene	mg/kg	<0.01	88.5	-	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.211	<0.100	<0.100	<0.100	<0.100	<0.100	1.39	<0.100	<0.100	<0.100	<0.100	<0.100
o-Xylene	mg/kg	<0.01	40	-	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.754	<0.100	<0.100	<0.100	<0.100	<0.100
Total Xylenes (calculated)	mg/kg		128.5	N/A	<0.200	<0.200	<0.200	<0.200	<0.200	<0.200	<0.311	<0.200	<0.200	<0.200	<0.200	<0.200	<2.144	<0.200	<0.200	<0.200	<0.200	<0.200
Styrene	mg/kg	<0.01	2	-			<0.100				<0.100	<0.100			<0.100		<0.100					
Bromoform	mg/kg	<0.01	2	-			<0.100				<0.100	<0.100			<0.100		<0.100					
Isopropylbenzene	mg/kg	<0.005	2.83	-			<0.050				<0.050	<0.050			<0.050		<0.050					
1,1,2,2-Tetrachloroethane	mg/kg	<0.01	2	-			<0.100				<0.100	<0.100			<0.100		<0.100					
1,2,3-Trichloropropane	mg/kg	<0.016	3.2	-			<0.160				<0.160	<0.160			<0.160		<0.160					
Bromobenzene	mg/kg	<0.01	2	-			<0.100				<0.100	<0.100			<0.100		<0.100					
Propylbenzene	mg/kg	<0.01	6.33	-			<0.100				<0.100	<0.100			<0.100		<0.100					
2-Chlorotoluene	mg/kg	<0.009	1.8	-			<0.090				<0.090	<0.090			<0.090		<0.090					
1,3,5-Trimethylbenzene	mg/kg	<0.008	29.4	-			0.148				0.204	<0.080			<0.080		0.194					
4-Chlorotoluene	mg/kg	<0.01	2	-			<0.100				<0.100	<0.100			<0.100		<0.100					
tert-Butylbenzene	mg/kg	<0.014	2.8	-			<0.140				<0.140	<0.140			<0.140		<0.140					
1,2,4-Trimethylbenzene	mg/kg	<0.009	88.4	-			0.439				0.654	<0.090			<0.090		0.528					
sec-Butylbenzene	mg/kg	<0.01	2	-			<0.100				<0.100	<0.100			<0.100		<0.100					
4-Isopropyltoluene	mg/kg	<0.01	2	-			<0.100				<0.100	<0.100			<0.100		<0.100					
1,3-Dichlorobenzene	mg/kg	<0.008	1.6	-			<0.080				<0.080	<0.080			<0.080		<0.080					
1,4-Dichlorobenzene	mg/kg	<0.005	1	-			<0.050				<0.050	<0.050			<0.050		<0.050					
n-Butylbenzene	mg/kg	<0.011	2.2	-			<0.110				<0.110	<0.110			<0.110		<0.110					
1,2-Dichlorobenzene	mg/kg	<0.01	2	-			<0.100				<0.100	<0.100			<0.100		<0.100					
1,2-Dibromo-3-chloropropane	mg/kg	<0.014	2.8	-			<0.140				<0.140	<0.140			<0.140		<0.140					
Tert-amyl methyl ether	mg/kg	<0.01	2	-	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		<0.100	<0.100	<0.100	
1,2,4-Trichlorobenzene	mg/kg	<0.02	4	-			<0.200				<0.200	<0.200			<0.200		<0.200					
Hexachlorobutadiene	mg/kg	<0.02	4	-			<0.200				<0.200	<0.200			<0.200		<0.200					
Naphthalene	mg/kg	<0.013	699	-			4.62				7.87	<0.130			<0.130		9.32					
1,2,3-Trichlorobenzene	mg/kg	<0.02	4	-			<0.200				<0.200	<0.200			<0.200		<0.200					
Sum of Detected Xylenes	mg/kg	<0.2	0.2	-								<0.200						<0.200				<0.200
Sum of BTEX	mg/kg	<0.4	0.4	-								<0.400						<0.400				<0.400

	<0.000	Concentration below the LOD												
	0.000	Concentration in exceedance of the GAC												
	0.000	Concentration in exceedance of the L3 SSAC												
	N/A	Not applicable												
	LTT	Long travel time - risk negligible												

					WS201	BH203C	BH202	VW203	WS204	BH202	BH202	VW201A	WS203	WS204
					0.30-0.40	0.50-0.60	0.30-0.30	0.30-0.40	0.60-0.70	15.00-	6.30-	0.80-1.00	1.50-1.90	0.50-0.60
Test	Units	LOD	Max	L3 EQS	25/03/2019	26/03/2019	25/03/2019	26/03/2019	27/03/2019	27/03/2019	27/03/2019	05/04/2019	04/04/2019	27/03/2019
Sample Description														
Colour	No units		-	-	Dark Brown	White	Dark Brown	Dark Brown	Dark Brown	Grey	Black	Light Brown	-	-
Description	No units		-	-	Sand	Sandy Loam	Sand	Sand	Sand	N/A	Sand	Silty Clay Loam	-	-
Grain Size	No units		-	-	-	-	-	-	-	-	-	-	-	-
Inclusion 1)	No units		-	-	Stones	Brick	Stones	Vegetation	Stones	Vegetation	Stones	Stones	-	-
Inclusion 2)	No units		-	-	None	Stones	Vegetation	Stones	Vegetation	Stones	None	Crushed Brick	-	-
Moisture Content Ratio (% of as received sample)	%		-	-	16	12	11	20	9.7	21	13	15	-	-
Asbestos														
Asbestos Quantification - Gravimetric - %	%	<0.001	-	-		0.0108	<0.001	2.89						
Date of Analysis	No units		-	-	03/04/19	02/04/2019	03/04/19	02/04/2019					10/04/2019	05/04/2019
Analysed By	No units		-	-	Andrzej Ferlecki	Marcin Magdziarek	Andrzej Ferlecki	Marcin Magdziarek					Lucy Caroe	James Richards
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-	-		<0.001	<0.001	0.0988						
Additional Asbestos Components (Using TM048)	No units		-	-		Amosite detected.	None	None						
Analysts Comments	No units		-	-		Loose fibres in soil.	NC	NC						
Asbestos Quantification - Total - %	%	<0.001	-	-		0.0111	<0.001	2.99						
Chrysotile (White) Asbestos	No units		-	-	Not Detected	Not Detected	Detected	Detected					Not Detected	Detected
Amosite (Brown) Asbestos	No units		-	-	Not Detected	Not Detected	Not Detected	Not Detected					Not Detected	Not Detected
Crocidolite (Blue) Asbestos	No units		-	-	Not Detected	Detected	Not Detected	Not Detected					Not Detected	Not Detected
Fibrous Anthophyllite	No units		-	-	Not Detected	Not Detected	Not Detected	Not Detected					Not Detected	Not Detected
Fibrous Tremolite	No units		-	-	Not Detected	Not Detected	Not Detected	Not Detected					Not Detected	Not Detected
Fibrous Actinolite	No units		-	-	Not Detected	Not Detected	Not Detected	Not Detected					Not Detected	Not Detected
Non-Asbestos Fibre	No units		-	-	Not Detected	Not Detected	Not Detected	Not Detected					Not Detected	Not Detected
Comments	No units		-	-		Loose fibres in soil	loose fibres in soil	lining material typical of lagging						Soil containing ACM debris
Carbon														
Organic Carbon, Total	%	<0.2	-	-			9.39		5.34					
Fraction Organic Carbon (FOC)	No units	<0.002	-	-	0.0776	0.0687	0.0939	0.126	0.0534	0.002	<0.002	0.0906		
Soil Organic Matter (SOM)	%	<0.35	-	-										
Inorganics														
Water Soluble Sulphate as SO4 2:1 Extract	g/l	<0.004	3.31	-										
pH	pH Units	<1	10.1	-	7.8	7.69	8.08	8.03	7.48	9.02	8.65	8.07		
ANC @ pH 4	mol/kg	<0.03	2.77	-			0.15		0.15					
ANC @ pH 6	mol/kg	<0.03	0.113	-			0.0651		<0.030					
Nitrite as NO2, 2:1 water soluble	mg/kg	<0.1	2.12	-			0.82	0.69	0.1					
Ammoniacal N as NH4 in 2:1 extract BRE	g/l	<0.0003	0.157	-			0.00216	0.00241	0.00604					
Loss on Ignition	%	<0.7	11.6	-			11.6		8.16					
Sulphide, Easily liberated	mg/kg	<15	477	-			<15,000	<15,000	477					
Cyanide, Total	mg/kg	<1	1170	-										
Cyanide, Free	mg/kg	<1	10	0.441										
Exchangeable Ammonia as NH4	mg/kg	<15	5150	-										
Cyanide, Complex	mg/kg	<1	1170	-										
Exchangeable Ammonia as N	mg/kg	<12	4000	-										
Cyanide, Complex (low level)	mg/kg	<0.5	2390	-	217	147	45.3	432	476	<0.500	<0.500	5.35		
Metals - (Solids)														
Chromium, Hexavalent	mg/kg	<0.6	3	-	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600		
Boron, water soluble	mg/kg	<1	5.36	-	<1.000	<1.000	<1.000	1.16	1.15	<1.000	<1.000	<1.000		
Arsenic	mg/kg	<0.6	268	N/A	32.4	34.4	111	63.1	268	<0.600	5.22	24.9		
Barium	mg/kg	<0.6	862	-	595	199	280	108	89.1	13.4	19.4	119		
Beryllium	mg/kg	<0.01	2.85	-	1.38	0.435	1.29	0.459	1.91	0.0512	0.392	0.481		
Cadmium	mg/kg	<0.02	19.6	-	0.489	0.617	0.569	0.851	2.02	0.103	0.0871	0.264		
Chromium	mg/kg	<0.9	74	-	8.89	3.89	10.5	13.7	<0.900	<0.900	8.03	8.64		
Copper	mg/kg	<1.4	648	N/A	77.3	43.9	61.1	99	92	2.26	2.56	25		
Lead	mg/kg	<0.7	31000	-	209	327	1490	1920	31000	<0.700	5.16	103		
Mercury	mg/kg	<0.14	278	-	1.37	0.558	0.309	5.76	12.7	<0.140	<0.140	<0.140		
Nickel	mg/kg	<0.2	135	N/A	26	14.3	30.5	22.7	34.8	1.97	14.7	20.4		
Selenium	mg/kg	<1	46.4	-	<1.000	<1.000	<1.000	1.12	3.07	<1.000	<1.000	<1.000		
Vanadium	mg/kg	<0.2	119	-	32.1	18.9	52.3	29.6	35.1	1.4	19.7	33.2		
Zinc	mg/kg	<1.9	3260	LTT	148	225	166	490	358	12.7	27.8	93		
Metals - (Liquid)														
Chromium, Trivalent	mg/kg	<0.9	74	-										
Calcium	mg/kg	<210	224000	-		40200	64900	49700	78200					
Phenols														
Phenol	mg/kg	<0.01	90.5	N/A	<0.010	<0.010	<0.050	<0.010	<0.100	0.0127	<0.010	<0.010		
Cresols	mg/kg	<0.01	398	-	<0.010	<0.010	0.136	<0.010	<0.100	0.686	<0.010	<0.010		
Xylenols	mg/kg	<0.015	1150	-	<0.015	<0.015	0.113	<0.015	0.966	0.724	<0.015	<0.015		
2,3,5-Trimethylphenol	mg/kg	<0.01	156	-										
2-Isopropylphenol	mg/kg	<0.015	792	-										
Phenols, Total Detected monohydric	mg/kg	<0.035	2.39	-	<0.035	<0.035	0.249	<0.035	0.966	1.42	<0.035	<0.035		
Phenols, Total Detected 5 speciated	mg/kg	<0.06	2560	-										
TPH Criteria Working Group (TPH CWG)														
GRO Surrogate % recovery**	%		153	-	85.8	83.5	80.9	113	98.5					
GRO TOT (Moisture Corrected)	mg/kg	<0.044	190	-	0.249	0.126	7.75	0.292	190					
Methyl tertiary butyl ether (MTBE)	mg/kg	<0.005	0.01	-										

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

					WS201	BH203C	BH202	VW203	WS204	BH202	BH202	VW201A	WS203	WS204
					0.30-0.40	0.50-0.60	0.30-0.30	0.30-0.40	0.60-0.70	15.00-	6.30-	0.80-1.00	1.50-1.90	0.50-0.60
Test	Units	LOD	Max	L3 EQS	25/03/2019	26/03/2019	25/03/2019	26/03/2019	27/03/2019	27/03/2019	27/03/2019	05/04/2019	04/04/2019	27/03/2019
Benzene	mg/kg	<0.01	9.68	-										
Toluene	mg/kg	<0.002	11.3	-										
Ethylbenzene	mg/kg	<0.003	2.3	-										
m,p-Xylene	mg/kg	<0.006	12.7	-										
o-Xylene	mg/kg	<0.003	5.53	-										
sum of detected mpo xylene by GC	mg/kg	<0.009	18.2	-										
sum of detected BTEX by GC	mg/kg	<0.024	41.5	-										
Aliphatics >C5-C6	mg/kg	<0.01	1.63	-	0.019	<0.010	0.0316	0.0188	<0.200					
Aliphatics >C6-C8	mg/kg	<0.01	9.89	-	0.105	0.0228	0.172	0.0688	0.781					
Aliphatics >C8-C10	mg/kg	<0.01	22.3	-	0.0357	0.0239	1.21	0.0813	17.5					
Aliphatics >C10-C12	mg/kg	<0.01	95.8	-	0.0381	0.0319	3.31	0.0413	95.8					
Aliphatics >C12-C16	mg/kg	<0.1	4990	-	27.1	130	312	33.3	463					
Aliphatics >C16-C21	mg/kg	<0.1	5000	-	60.4		475							
Aliphatics >C16-C35	mg/kg	<0.1	616	-		353		616	456					
Aliphatics >C21-C35	mg/kg	<0.1	5330	-	81.6		624							
Aliphatics >C35-C44	mg/kg	<0.1	2030	-	9.8	15.6	90.7	288	13.9					
Total Aliphatics >C12-C44	mg/kg	<0.1	15700	-	179	1500	938	933						
Aromatics >EC5-EC7	mg/kg	<0.01	9.68	N/A	<0.010	<0.010	<0.010	<0.010	<0.200					
Aromatics >EC7-EC8	mg/kg	<0.01	11.3	-	<0.010	<0.010	<0.010	<0.010	<0.200					
Aromatics >EC8-EC10	mg/kg	<0.01	35.4	759.37	0.0238	0.016	0.808	0.0538	11.7					
Aromatics >EC10-EC12	mg/kg	<0.01	63.8	N/A	0.025	0.0217	2.21	0.0275	63.8					
Aromatics >EC12-EC16	mg/kg	<0.1	5800	N/A	26.4	187	271	37.8	858					
Aromatics >EC16-EC21	mg/kg	<0.1	6570	N/A	132	667	631	316	1380					
Aromatics >EC21-EC35	mg/kg	<0.1	9710	N/A	346	1710	1360	1810	2340					
Aromatics >EC35-EC44	mg/kg	<0.1	1510	-	93	394	360	1050	433					
Aromatics >EC40-EC44	mg/kg	<0.1	574	-	31.6	124	117	463	124					
Total Aromatics >EC12-EC44	mg/kg	<0.1	21200	-	597	2950	2620	3210	5010					
Total Aliphatics & Aromatics >C5-C44	mg/kg	<0.1	34600	-	776	3450	4130	4150	6130					
Polyaromatic Hydrocarbons (PAHs)														
Coronene	mg/kg	<0.2	6.55	-			4.61		6.55					
Naphthalene-d8 % recovery**	%		197	-	109	98.8	98	76.3	103	102	100	96.8		
Acenaphthene-d10 % recovery**	%		195	-	101	96.8	107	78.9	113	93.8	96.9	89.8		
Phenanthrene-d10 % recovery**	%		186	-	100	97.2	106	90.6	114	99.3	102	89.9		
Chrysene-d12 % recovery**	%		170	-	95.4	89.2	78.6	89.4	88.6	96.9	94.1	91.2		
Perylene-d12 % recovery**	%		177	-	101	89.6	79.4	74	96.8	96	86.1	95.5		
Naphthalene	mg/kg	<0.009	2350	-	0.291	0.433	2.96	0.278	3.51	0.441	0.0119	0.0606		
Acenaphthylene	mg/kg	<0.012	565	-	1.45	3.98	8.85	3.18	41.2	<0.012	<0.012	0.199		
Acenaphthene	mg/kg	<0.008	142	-	0.2	0.217	8.02	0.674	15.4	<0.008	0.0194	<0.008		
Fluorene	mg/kg	<0.01	501	-	0.498	0.68	7.42	1.21	54.1	0.0212	0.0209	<0.010		
Phenanthrene	mg/kg	<0.015	1180	-	6.12	5.65	20.6	17.9	164	0.0438	0.044	0.403		
Anthracene	mg/kg	<0.016	575	N/A	1.94	2.33	11.7	5.19	58.1	<0.016	0.0269	0.196		
Fluoranthene	mg/kg	<0.017	1330	N/A	15.8	23.7	47.4	41	176	<0.017	0.0791	2.83		
Pyrene	mg/kg	<0.015	1140	-	14.3	25.6	46.7	36.5	145	<0.015	0.0897	2.85		
Benz(a)anthracene	mg/kg	<0.014	394	-	7.23	14.6	17.6	18.4	57	<0.014	0.0285	1.48		
Chrysene	mg/kg	<0.01	363	-	6.48	11.6	13.4	13.9	48.4	<0.010	0.0212	1.21		
Benzo(b)fluoranthene	mg/kg	<0.015	472	-	9.7	37.4	17.2	34.7	63.7	<0.015	<0.015	2.48		
Benzo(k)fluoranthene	mg/kg	<0.014	211	-	3.33	12.4	7.91	10.7	23.7	<0.014	<0.014	1.23		
Benzo(a)pyrene	mg/kg	<0.015	382	LTT	8.83	27.7	21.8	21	50.3	<0.015	<0.015	2.86		
Indeno(1,2,3-cd)pyrene	mg/kg	<0.018	226	-	4.73	21.2	15.5	15.8	39.1	<0.018	<0.018	2.9		
Dibenzo(a,h)anthracene	mg/kg	<0.023	61.6	-	1.19	2.2	2.87	2.37	5.6	<0.023	<0.023	0.459		
Benzo(g,h,i)perylene	mg/kg	<0.024	249	-	5.78	22.1	19.4	18.1	33.3	<0.024	<0.024	3.04		
PAH ₁ Total Detected USEPA 16	mg/kg	<0.118	9300	-	87.9	212	269	241	979	0.506	0.342	22.2		
PAH sum of 4			1158	-	23.54	93.1	60.01	79.3	159.8	0.071	0.071	9.65		
Semi-Volatile Organic Compounds (SVOCs)														
Phenol	mg/kg	<0.1	107	-			<5.000		<2.000	0.15	<0.100	<0.200		
Pentachlorophenol	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
n-Nitroso-n-dipropylamine	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
Nitrobenzene	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
Isophorone	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
Hexachloroethane	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
Hexachlorocyclopentadiene	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
Hexachlorobutadiene	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
Hexachlorobenzene	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
n-Diethyl phthalate	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
Dimethyl phthalate	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
Diethyl phthalate	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
n-Dibutyl phthalate	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
Dibenzofuran	mg/kg	<0.1	181	-			<5.000		37.1	<0.100	<0.100	<0.200		
Carbazole	mg/kg	<0.1	99.8	-			<5.000		13.6	<0.100	<0.100	<0.200		
Butylbenzyl phthalate	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
bis(2-Ethylhexyl) phthalate	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
bis(2-Chloroethoxy)methane	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

					WS201	BH203C	BH202	VW203	WS204	BH202	BH202	VW201A	WS203	WS204
					0.30-0.40	0.50-0.60	0.30-0.30	0.30-0.40	0.60-0.70	15.00-	6.30-	0.80-1.00	1.50-1.90	0.50-0.60
Test	Units	LOD	Max	L3 EQS	25/03/2019	26/03/2019	25/03/2019	26/03/2019	27/03/2019	27/03/2019	27/03/2019	05/04/2019	04/04/2019	27/03/2019
bis(2-Chloroethyl)ether	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
Azobenzene	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
4-Nitrophenol	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
4-Nitroaniline	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
4-Methylphenol	mg/kg	<0.1	341	-			<5.000		<2.000	0.302	<0.100	<0.200		
4-Chlorophenylphenylether	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
4-Chloroaniline	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
4-Chloro-3-methylphenol	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
4-Bromophenylphenylether	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
3-Nitroaniline	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
2-Nitrophenol	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
2-Nitroaniline	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
2-Methylphenol	mg/kg	<0.1	304	-			<5.000		<2.000	0.519	<0.100	<0.200		
1,2,4-Trichlorobenzene	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
2-Chlorophenol	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
2,6-Dinitrotoluene	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
2,4-Dinitrotoluene	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
2,4-Dimethylphenol	mg/kg	<0.1	922	-			<5.000		<2.000	0.254	<0.100	<0.200		
2,4-Dichlorophenol	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
2,4,6-Trichlorophenol	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
2,4,5-Trichlorophenol	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
1,4-Dichlorobenzene	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
1,3-Dichlorobenzene	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
1,2-Dichlorobenzene	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
2-Chloronaphthalene	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
2-Methylnaphthalene	mg/kg	<0.1	323	-			<5.000		<2.000	<0.100	<0.100	<0.200		
Acenaphthylene	mg/kg	<0.1	277	-			13.3		45.5	<0.100	<0.100	0.526		
Acenaphthene	mg/kg	<0.1	105	-			5.67		13.1	<0.100	<0.100	<0.200		
Anthracene	mg/kg	<0.1	258	-			9.3		48	<0.100	<0.100	<0.200		
Benzo(a)anthracene	mg/kg	<0.1	260	-			23		48.9	<0.100	<0.100	3.49		
Benzo(b)fluoranthene	mg/kg	<0.1	175	-			33.4		54.2	<0.100	<0.100	11.5		
Benzo(k)fluoranthene	mg/kg	<0.1	172	-			12		24	<0.100	<0.100	4.26		
Benzo(a)pyrene	mg/kg	<0.1	232	-			26.5		37.5	<0.100	<0.100	9.13		
Benzo(g,h,i)perylene	mg/kg	<0.1	149	-			23		23.6	<0.100	<0.100	6.84		
Chrysene	mg/kg	<0.1	219	-			17.8		37.9	<0.100	<0.100	3.43		
Fluoranthene	mg/kg	<0.1	747	-			49.7		152	<0.100	<0.100	4.78		
Fluorene	mg/kg	<0.1	212	-			7.33		52	<0.100	<0.100	<0.200		
Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	175	-			25.9		36.9	<0.100	<0.100	10.8		
Phenanthrene	mg/kg	<0.1	890	-			30		145	<0.100	<0.100	<0.200		
Pyrene	mg/kg	<0.1	627	-			51.4		122	<0.100	<0.100	6.73		
Naphthalene	mg/kg	<0.1	1630	-			10.1		3.65	0.4	<0.100	<0.200		
Dibenzo(a,h)anthracene	mg/kg	<0.1	26	-			<5.000		2.23	<0.100	<0.100	0.789		
Bis(2-chloroisopropyl) ether	mg/kg	<0.1	5	-			<5.000		<2.000	<0.100	<0.100	<0.200		
Volatile Organic Compounds (VOCs)														
Dibromofluoromethane**	%		166	-	110		107		118	128	112	131		
Toluene-d8**	%		104	-	100		95.7		86	104	102	100		
4-Bromofluorobenzene**	%		102	-	89.8		81		76.2	99.1	98.1	94.6		
Dichlorodifluoromethane	mg/kg	<0.006	1.2	-			<0.060		<0.060	<0.060	<0.060	<0.060		
Chloromethane	mg/kg	<0.007	1.4	-			<0.070		<0.070	<0.070	<0.070	<0.070		
Vinyl Chloride	mg/kg	<0.006	1.2	-			<0.060		<0.060	<0.060	<0.060	<0.060		
Bromomethane	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
Chloroethane	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
Trichlorofluoromethane	mg/kg	<0.006	1.2	-			<0.060		<0.060	<0.060	<0.060	<0.060		
1,1-Dichloroethene	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
Carbon Disulphide	mg/kg	<0.007	4.67	-			<0.070		0.117	<0.070	<0.070	4.67		
Dichloromethane	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
Methyl Tertiary Butyl Ether	mg/kg	<0.01	2	-	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
trans-1,2-Dichloroethene	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
1,1-Dichloroethane	mg/kg	<0.008	1.6	-			<0.080		<0.080	<0.080	<0.080	<0.080		
cis-1,2-Dichloroethene	mg/kg	<0.006	1.2	-			<0.060		<0.060	<0.060	<0.060	<0.060		
2,2-Dichloropropane	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
Bromochloromethane	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
Chloroform	mg/kg	<0.008	1.6	-			<0.080		<0.080	<0.080	<0.080	<0.080		
1,1,1-Trichloroethane	mg/kg	<0.007	1.4	-			<0.070		<0.070	<0.070	<0.070	<0.070		
1,1-Dichloropropene	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
Carbontetrachloride	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
1,2-Dichloroethane	mg/kg	<0.005	1	-			<0.050		<0.050	<0.050	<0.050	<0.050		
Benzene	mg/kg	<0.009	16.4	16.35	<0.090	<0.090	<0.090	<0.090	<0.090	0.117	<0.090	<0.090		
Trichloroethene	mg/kg	<0.009	1.8	11.61			<0.090		<0.090	<0.090	<0.090	0.128		
1,2-Dichloropropane	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
Dibromomethane	mg/kg	<0.009	1.8	-			<0.090		<0.090	<0.090	<0.090	<0.090		
Bromodichloromethane	mg/kg	<0.007	1.4	-			<0.070		<0.070	<0.070	<0.070	<0.070		

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

					WS201	BH203C	BH202	VW203	WS204	BH202	BH202	VW201A	WS203	WS204
					0.30-0.40	0.50-0.60	0.30-0.30	0.30-0.40	0.60-0.70	15.00-	6.30-	0.80-1.00	1.50-1.90	0.50-0.60
Test	Units	LOD	Max	L3 EQS	25/03/2019	26/03/2019	25/03/2019	26/03/2019	27/03/2019	27/03/2019	27/03/2019	05/04/2019	04/04/2019	27/03/2019
cis-1,3-Dichloropropene	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
Toluene	mg/kg	<0.007	40.2	-	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070		
trans-1,3-Dichloropropene	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
1,1,2-Trichloroethane	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
1,3-Dichloropropane	mg/kg	<0.007	1.4	-			<0.070		<0.070	<0.070	<0.070	<0.070		
Tetrachloroethene	mg/kg	<0.005	31.9	12.46			<0.050		<0.050	<0.050	<0.050	31.9		
Dibromochloromethane	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
1,2-Dibromoethane	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
Chlorobenzene	mg/kg	<0.005	1	-			<0.050		<0.050	<0.050	<0.050	<0.050		
1,1,1,2-Tetrachloroethane	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
Ethylbenzene	mg/kg	<0.004	13.6	N/A	<0.040	<0.040	0.152	<0.040	0.269	<0.040	<0.040	<0.040		
p/m-Xylene	mg/kg	<0.01	88.5	-	<0.100	<0.100	<0.100	<0.100	0.461	<0.100	<0.100	<0.100		
o-Xylene	mg/kg	<0.01	40	-	<0.100	<0.100	<0.100	<0.100	0.407	<0.100	<0.100	<0.100		
Total Xylenes (calculated)	mg/kg		128.5	N/A	<0.200	<0.200	<0.200	<0.200	<0.868	<0.200	<0.200	<0.200	<0.000	<0.000
Styrene	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
Bromoform	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
Isopropylbenzene	mg/kg	<0.005	2.83	-			<0.050		0.117	<0.050	<0.050	<0.050		
1,1,2,2-Tetrachloroethane	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
1,2,3-Trichloropropane	mg/kg	<0.016	3.2	-			<0.160		<0.160	<0.160	<0.160	<0.160		
Bromobenzene	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
Propylbenzene	mg/kg	<0.01	6.33	-			<0.100		0.264	<0.100	<0.100	<0.100		
2-Chlorotoluene	mg/kg	<0.009	1.8	-			<0.090		<0.090	<0.090	<0.090	<0.090		
1,3,5-Trimethylbenzene	mg/kg	<0.008	29.4	-			<0.080		2.3	<0.080	<0.080	<0.080		
4-Chlorotoluene	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
tert-Butylbenzene	mg/kg	<0.014	2.8	-			<0.140		<0.140	<0.140	<0.140	<0.140		
1,2,4-Trimethylbenzene	mg/kg	<0.009	88.4	-			0.235		5.56	<0.090	<0.090	<0.090		
sec-Butylbenzene	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
4-Isopropyltoluene	mg/kg	<0.01	2	-			<0.100		0.673	<0.100	<0.100	<0.100		
1,3-Dichlorobenzene	mg/kg	<0.008	1.6	-			<0.080		<0.080	<0.080	<0.080	<0.080		
1,4-Dichlorobenzene	mg/kg	<0.005	1	-			<0.050		<0.050	<0.050	<0.050	<0.050		
n-Butylbenzene	mg/kg	<0.011	2.2	-			<0.110		0.637	<0.110	<0.110	<0.110		
1,2-Dichlorobenzene	mg/kg	<0.01	2	-			<0.100		<0.100	<0.100	<0.100	<0.100		
1,2-Dibromo-3-chloropropane	mg/kg	<0.014	2.8	-			<0.140		<0.140	<0.140	<0.140	<0.140		
Tert-amyl methyl ether	mg/kg	<0.01	2	-		<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100		
1,2,4-Trichlorobenzene	mg/kg	<0.02	4	-			<0.200		<0.200	<0.200	<0.200	<0.200		
Hexachlorobutadiene	mg/kg	<0.02	4	-			<0.200		<0.200	<0.200	<0.200	<0.200		
Naphthalene	mg/kg	<0.013	699	-			3.82		4.38	0.846	<0.130	<0.130		
1,2,3-Trichlorobenzene	mg/kg	<0.02	4	-			<0.200		<0.200	<0.200	<0.200	<0.200		
Sum of Detected Xylenes	mg/kg	<0.2	0.2	-	<0.200		<0.200							
Sum of BTEX	mg/kg	<0.4	0.4	-	<0.400		<0.400							

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

						BH104	BH105	BH106	BH107	BH102B	HP103	HP104A	TP102	TP103	TP104	TP105	TP106	TP103A
						1.30-	0.25-	1.10-	0.35-	1.00-	0.30-	0.70-	0.90-	0.80-	1.10-	1.70-	0.50-	0.40-
Test	Units	LOD	MAX	EQS	L3 SSAC	MG	MG	MG	MG	MG	MG	MG	MG	MG	MG	ALV	MG	MG
NRA - Leachant Volume	ml			-	-	980	980	980	980	980	980	980	980	980	980	980	980	980
Inorganics																		
NRA - Sulphate	µg/l	<2000	1570000	-	-	22900		1430000	111000	259000	1030000	45800	1490000	1310000	1570000	846000	11900	1400000
NRA - Ammoniacal Nitrogen as NH3	µg/l	<200	172000	-	-	<200.000		3530	<200.000	4670	477	976	301	5350	21000	172000	<200.000	<200.000
NRA - Cyanide, Total	µg/l	<50	4170	-	-	<50.000		<50.000	190	4170	113	509	838	520	137	<50.000	<50.000	645
NRA - Ammoniacal Nitrogen as NH4	µg/l	<300	183000	-	-	<300.000		3730	<300.000	4940	505	1030	319	5670	22200	183000	<300.000	<300.000
NRA - Cyanide, Free	µg/l	<50	250	1	-	<50.000		<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<250.000	<50.000	<50.000	<50.000	<50.000
NRA - Cyanide, Complex	µg/l	<50	4170	-	-	<50.000		<50.000	190	4170	113	509	838	520	137	<50.000	<50.000	645
Ammoniacal Nitrogen as N - Calculated	µg/l		142333	600	-	<233.333		2901.11	<233.333	3842.22	392.78	801.11	248.11	4410.00	17266.67	142333.33	<233.333	<233.333
free ammonia calculated			1498	600	-	<2.456		30.54	<2.456	40.45	4.13	8.43	2.61	46.42	181.77	1498.36	<2.456	<2.456
Filtered (Dissolved) Metals																		
NRA - Chromium, Hexavalent	µg/l	<30	30	3.4	-	<30.000		<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000
NRA - Chromium, Trivalent	µg/l	<30	30	4.3	-	<30.000		<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000
NRA - Mercury (diss.filt)	µg/l	<0.01	0.047	-	-	<0.010		<0.010	0.047	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0187	<0.010
NRA - Arsenic (diss.filt)	µg/l	<0.12	56.7	50	N/A	3.18		56.7	5.67	0.577	7.84	3.25	0.325	8.13	51.5	9.57	7.1	0.747
NRA - Barium (diss.filt)	µg/l	<0.03	46.7	-	-	6.35		17.7	30.8	21.5	46.7	22.8	11.1	19.4	4.87	13.9	3.49	28.2
NRA - Beryllium (diss.filt)	µg/l	<0.07	0.07	-	-	<0.070		<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070
NRA - Boron (diss.filt)	µg/l	<9.4	168	2000	-	34.4		<9.400	24.4	14.2	21.9	18.5	<9.400	30.4	168	12.4	<9.400	<9.400
NRA - Cadmium (diss.filt)	µg/l	<0.1	0.436	0.25	-	<0.100		<0.100	<0.100	<0.100	0.436	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
NRA - Chromium (diss.filt)	µg/l	<0.22	3.31	-	-	1.25		0.375	1.67	0.399	0.573	1.25	0.612	0.526	3.31	0.759	1.11	1.44
NRA - Copper (diss.filt)	µg/l	<0.85	21.7	7.33	N/A	3.26		9.08	21.7	1.51	14.4	1.07	9.46	6.3	11.6	8.02	3.2	14
NRA - Lead (diss.filt)	µg/l	<0.02	5.96	1.2	-	0.727		0.047	5.96	0.05	0.813	5.84	0.021	1.44	0.172	<0.020	1.44	2.25
NRA - Nickel (diss.filt)	µg/l	<0.15	17.8	8.03	N/A	0.963		11.8	5.69	2.65	17.8	2.36	16.7	9.44	5.15	10.9	<0.150	15.5
NRA - Selenium (diss.filt)	µg/l	<0.39	6.11	-	-	3.22		1.04	2.72	1.61	2.69	1.11	0.487	6.11	1.99	0.596	0.772	1.32
NRA - Vanadium (diss.filt)	µg/l	<0.24	9.23	-	-	3.15		0.71	1.71	0.299	1.46	0.758	0.712	1.07	5.72	1.44	9.23	0.531
NRA - Zinc (diss.filt)	µg/l	<0.41	29.1	22.64	LTT	<0.410		1.7	1.59	<0.410	29.1	0.438	2.97	0.895	2.59	0.618	3.04	4.64
Phenols																		
NRA - Phenol	µg/l	<2	290	7.7	N/A	<2.000		<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	290	<2.000	<2.000	<2.000	<2.000
NRA - Cresols	µg/l	<6	360	-	-	<6.000		<6.000	<6.000	<6.000	110	<6.000	<6.000	360	<6.000	<6.000	<6.000	<6.000
NRA - Xylenols	µg/l	<8	1610	-	-	<8.000		<8.000	<8.000	<8.000	1610	<8.000	<8.000	120	<8.000	10	<8.000	<8.000
NRA - 2,3,5-Trimethylphenol	µg/l	<3	10	-	-	<3.000		<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	10	<3.000	<3.000	<3.000	<3.000
NRA - 2-Isopropylphenol	µg/l	<6	2120	-	-	<6.000		<6.000	<6.000	<6.000	2120	<6.000	<6.000	40	<6.000	<6.000	<6.000	<6.000
NRA - Phenols, Total Detected 5 speciated	µg/l	<25	3840	-	-	<25.000		<25.000	<25.000	<25.000	3840	<25.000	<25.000	820	<25.000	<25.000	<25.000	<25.000
TPH Criteria Working Group (TPH CWG)																		
NRA - GRO Surrogate % recovery**	%		95	-	-	88		87	85	83	83	78	86	74	95	79	83	90
NRA - GRO >C5-C12	µg/l	<50	1860	-	-	<50.000		<50.000	219	<50.000	1860	916	<50.000	1080	<50.000	<50.000	<50.000	<50.000
NRA - Methyl tertiary butyl ether (MTBE)	µg/l	<3	3	-	-	<3.000		<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000
NRA - Benzene	µg/l	<7	7	-	-	<7.000		<7.000	<7.000	<7.000	<7.000	<7.000	<7.000	<7.000	<7.000	<7.000	<7.000	<7.000
NRA - Toluene	µg/l	<4	9	-	-	<4.000		<4.000	<4.000	<4.000	<4.000	<4.000	<4.000	9	<4.000	<4.000	<4.000	<4.000
NRA - Ethylbenzene	µg/l	<5	14	-	-	<5.000		<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	14	<5.000	<5.000	<5.000	<5.000
NRA - m,p-Xylene	µg/l	<8	22	-	-	<8.000		<8.000	<8.000	<8.000	<8.000	13	<8.000	22	<8.000	<8.000	<8.000	<8.000
NRA - o-Xylene	µg/l	<3	19	-	-	<3.000		<3.000	<3.000	<3.000	4	13	<3.000	19	<3.000	<3.000	<3.000	<3.000
NRA - Sum of detected Xylenes	µg/l	<11	41	-	-	<11.000		<11.000	<11.000	<11.000	<11.000	26	<11.000	41	<11.000	<11.000	<11.000	<11.000
NRA - Sum of detected BTEX	µg/l	<28	64	-	-	<28.000		<28.000	<28.000	<28.000	<28.000	<28.000	<28.000	64	<28.000	<28.000	<28.000	<28.000
NRA - Aliphatics >C5-C6	µg/l	<10	10	-	-	<10.000		<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
NRA - Aliphatics >C6-C8	µg/l	<10	25	-	-	<10.000		<10.000	<10.000	<10.000	<10.000	25	<10.000	11	<10.000	<10.000	<10.000	<10.000
NRA - Aliphatics >C8-C10	µg/l	<10	98	-	-	<10.000		<10.000	80	<10.000	95	98	<10.000	59	<10.000	<10.000	<10.000	<10.000
NRA - Aliphatics >C10-C12	µg/l	<10	1010	-	-	<10.000		<10.000	45	<10.000	1010	417	<10.000	541	<10.000	<10.000	<10.000	<10.000
NRA - Aliphatics >C12-C16 (aq)	µg/l	<10	23	-	-	<10.000		<10.000	<10.000	<10.000	<10.000	23	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
NRA - Aliphatics >C16-C21 (aq)	µg/l	<10	31	-	-	<10.000		<10.000	<10.000	<10.000	<10.000	31	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
NRA - Aliphatics >C21-C35 (aq)	µg/l	<10	342	-	-	<10.000		<10.000	<10.000	342	22	43	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
NRA - Total Aliphatics >C12-C35 (aq)	µg/l	<10	342	-	-	<10.000		<10.000	<10.000	342	22	97	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
NRA - Aromatics >EC5-EC7	µg/l	<10	10	10	N/A	<10.000		<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
NRA - Aromatics >EC7-EC8	µg/l	<10	10	74	-	<10.000		<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
NRA - Aromatics >EC8-EC10	µg/l	<10	94	20	27077	<10.000		<10.000	54	<10.000	74	92	<10.000	94	<10.000	<10.000	<10.000	<10.000
NRA - Aromatics >EC10-EC12	µg/l	<10	674	2	N/A	<10.000		<10.000	30	<10.000	674	278	<10.000	361	<10.000	<10.000	<10.000	<10.000
NRA - Aromatics >EC12-EC16 (aq)	µg/l	<10	3030	2	N/A	<10.000		<10.000	19	<10.000	3030	662	<10.000	635	<10.000	30	<10.000	14
NRA - Aromatics >EC16-EC21 (aq)	µg/l	<10	694	0.1	N/A	<10.000		<10.000	13	<10.000	694	275	<10.000	213	29	<10.000	<10.000	24
NRA - Aromatics >EC21-EC35 (aq)	µg/l	<10	77	0.00017	N/A	<10.000		<10.000	<10.000	<10.000	69	77	22	42	18	<10.000	<10.000	10
NRA - Total Aromatics >EC12-EC35 (aq)	µg/l	<10	3790	-	-	<10.000		<10.000	32	<10.000	3790	1010	22	890	47	30	<10.000	48
NRA - Total Aliphatics & Aromatics >C5-35 (aq)	µg/l	<10	5680	-	-	<10.000		<10.000	251	342	5680	2030	22	1970	49	58	<10.000	48
Polyaromatic Hydrocarbons (PAHs)																		
NRA - Naphthalene (aq)	µg/l	<0.1	322	2	-	<0.100		0.568	0.975	0.138	<1.000	<1.000	0.706	322	0.24	6.84	<0.100	<0.100
NRA - Acenaphthene (aq)	µg/l	<0.015	49.8	-	-	0.0273		0.15	1.51	0.478	19.3	15.8	<0.015	49.8	<0.015	<0.030	&	

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

						BH104	BH105	BH106	BH107	BH102B	HP103	HP104A	TP102	TP103	TP104	TP105	TP106	TP103A
						1.30-	0.25-	1.10-	0.35-	1.00-	0.30-	0.70-	0.90-	0.80-	1.10-	1.70-	0.50-	0.40-
Test	Units	LOD	MAX	EQS	L3 SSAC	MG	MG	MG	MG	MG	MG	MG	MG	MG	MG	ALV	MG	MG
NRA - Benzo(b)fluoranthene (aq)	µg/l	<0.023	0.23	-	-	<0.023		<0.023	0.0531	<0.023	<0.230	<0.230	<0.023	<0.230	<0.023	<0.046	<0.023	0.0645
NRA - Benzo(k)fluoranthene (aq)	µg/l	<0.027	0.27	-	-	<0.027		<0.027	<0.027	<0.027	<0.270	<0.270	<0.027	<0.270	<0.027	<0.054	<0.027	<0.027
NRA - Benzo(a)pyrene (aq)	µg/l	<0.009	0.201	0.022	LTT	<0.009		<0.009	0.0341	<0.009	0.107	0.201	<0.009	0.1	<0.009	<0.018	<0.009	0.0349
NRA - Dibenzo(a,h)anthracene (aq)	µg/l	<0.016	0.16	-	-	<0.016		<0.016	<0.016	<0.016	<0.160	<0.160	<0.016	<0.160	<0.016	<0.032	<0.016	<0.016
NRA - Benzo(g,h,i)perylene (aq)	µg/l	<0.016	0.183	-	-	<0.016		<0.016	0.0477	<0.016	<0.160	0.183	<0.016	<0.160	<0.016	<0.032	<0.016	0.0246
NRA - Indeno(1,2,3-cd)pyrene (aq)	µg/l	<0.014	0.14	-	-	<0.014		<0.014	0.0316	<0.014	<0.140	<0.140	<0.014	<0.140	<0.014	<0.028	<0.014	0.0178
NRA - PAH, Total Detected USEPA 16 (aq)	µg/l	<0.344	953	-	-	<0.344		2.51	4.68	2.22	263	37.5	0.961	953	0.594	7.01	<0.344	7.97
PAH sum of 4	µg/l		0.823	-	-	<0.080		<0.080	0.1594	<0.080	<0.800	0.823	<0.080	<0.800	<0.080	<0.160	<0.080	0.1339
Semi-Volatile Organic Compounds (SVOCs)																		
NRA - 1,2,4-Trichlorobenzene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 1,2-Dichlorobenzene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 1,3-Dichlorobenzene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 1,4-Dichlorobenzene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2,4,5-Trichlorophenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2,4,6-Trichlorophenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2,4-Dichlorophenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2,4-Dimethylphenol (aq)	µg/l	<1	93.6	-	-	<1.000		<1.000	<1.000	<1.000	93.6	1.25	<1.000	19.2	<1.000	4.02	<1.000	<1.000
NRA - 2,4-Dinitrotoluene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2,6-Dinitrotoluene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2-Chloronaphthalene (aq)	µg/l	<1	12.3	-	-	<1.000		<1.000	<1.000	<1.000	12.3	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2-Chlorophenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2-Methylnaphthalene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2-Methylphenol (aq)	µg/l	<1	102	-	-	<1.000		<1.000	<1.000	<1.000	102	<1.000	<1.000	52.5	<1.000	<2.000	<1.000	<1.000
NRA - 2-Nitroaniline (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2-Nitrophenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 3-Nitroaniline (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 4-Bromophenylphenylether (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 4-Chloro-3-methylphenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 4-Chloroaniline (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 4-Chlorophenylphenylether (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 4-Methylphenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 4-Nitroaniline (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 4-Nitrophenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Azobenzene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	2.41	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Acenaphthylene (aq)	µg/l	<1	96.8	-	-	<1.000		<1.000	<1.000	<1.000	39.2	4.91	<1.000	96.8	<1.000	<2.000	<1.000	<1.000
NRA - Acenaphthene (aq)	µg/l	<1	35.2	-	-	<1.000		<1.000	1.16	<1.000	17.8	7.3	<1.000	35.2	<1.000	<2.000	<1.000	<1.000
NRA - Anthracene (aq)	µg/l	<1	17.5	-	-	<1.000		<1.000	<1.000	<1.000	17.5	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - bis(2-Chloroethyl)ether (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - bis(2-Chloroethoxy)methane (aq)	µg/l	<1	25.5	-	-	<1.000		<1.000	<1.000	<1.000	25.5	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - bis(2-Ethylhexyl) phthalate (aq)	µg/l	<2	10	-	-	<2.000		<2.000	<2.000	<2.000	<10.000	<2.000	<2.000	<2.000	2.28	<4.000	<2.000	<2.000
NRA - Butylbenzyl phthalate (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Benzo(a)anthracene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Benzo(b)fluoranthene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Benzo(k)fluoranthene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Benzo(a)pyrene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Benzo(g,h,i)perylene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Carbazole (aq)	µg/l	<1	161	-	-	<1.000		<1.000	<1.000	<1.000	161	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Chrysene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Dibenzofuran (aq)	µg/l	<1	83.3	-	-	<1.000		<1.000	<1.000	<1.000	41.8	<1.000	<1.000	83.3	<1.000	<2.000	<1.000	<1.000
NRA - n-Dibutyl phthalate (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Diethyl phthalate (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Dibenzo(a,h)anthracene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Dimethyl phthalate (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - n-Dioctyl phthalate (aq)	µg/l	<5	25	-	-	<5.000		<5.000	<5.000	<5.000	<25.000	<5.000	<5.000	<5.000	<5.000	<10.000	<5.000	<5.000
NRA - Fluoranthene (aq)	µg/l	<1	17.9	-	-	<1.000		<1.000	<1.000	<1.000	10	1.42	<1.000	17.9	<1.000	<2.000	<1.000	2.53
NRA - Fluorene (aq)	µg/l	<1	67.6	-	-	<1.000		<1.000	<1.000	<1.000	53.4	<1.000	<1.000	67.6	<1.000	<2.000	<1.000	<1.000
NRA - Hexachlorobenzene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Hexachlorobutadiene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Pentachlorophenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000

	<0.000	Concentration below the LOD
	0.000	Concentration in exceedance of the GAC
	0.000	Concentration in exceedance of the L3 SSAC
	N/A	Not applicable
	LTT	Long travel time - risk negligible

						BH104	BH105	BH106	BH107	BH102B	HP103	HP104A	TP102	TP103	TP104	TP105	TP106	TP103A
						1.30-	0.25-	1.10-	0.35-	1.00-	0.30-	0.70-	0.90-	0.80-	1.10-	1.70-	0.50-	0.40-
Test	Units	LOD	MAX	EQS	L3 SSAC	MG	MG	MG	MG	MG	MG	MG	MG	MG	MG	ALV	MG	MG
NRA - 4-Bromofluorobenzene**	%		102	-	-	96.1		99.6	77.7	102	93	91.4	98.3	99.7	97	98.8	89.7	96.8
NRA - Dichlorodifluoromethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Chloromethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Vinyl chloride	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Bromomethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Chloroethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Trichlorofluoromethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - 1,1-Dichloroethene	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Carbon disulphide	µg/l	<1	61	-	-	<1.000		<1.000	1.3	1.5	<10.000	<1.000	61	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Dichloromethane	µg/l	<3	30	-	-	<3.000		<3.000	<3.000	<3.000	<30.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000
NRA - Methyl tertiary butyl ether (MTBE)	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - trans-1,2-Dichloroethene	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - 1,1-Dichloroethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - cis-1,2-Dichloroethene	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - 2,2-Dichloropropane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Bromochloromethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Chloroform	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - 1,1,1,1-Trichloroethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - 1,1-Dichloropropene	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Carbontetrachloride	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - 1,2-Dichloroethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Benzene	µg/l	<1	10	10	9484	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	3.07	<1.000	<1.000	<1.000	<1.000
NRA - Trichloroethene	µg/l	<1	10	10	6352	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - 1,2-Dichloropropane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Dibromomethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Bromodichloromethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - cis-1,3-Dichloropropene	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Toluene	µg/l	<1	10	74	-	<1.000		<1.000	<1.000	<1.000	<10.000	2.1	<1.000	7.24	<1.000	<1.000	<1.000	<1.000
NRA - trans-1,3-Dichloropropene	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - 1,1,2-Trichloroethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - 1,3-Dichloropropane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Tetrachloroethene	µg/l	<1	10	10	6352	<1.000		<1.000	<1.000	<1.000	<10.000	1.9	5.14	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Dibromochloromethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - 1,2-Dibromoethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Chlorobenzene	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - 1,1,1,2-Tetrachloroethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Ethylbenzene	µg/l	<1	10.5	20	N/A	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	10.5	<1.000	<1.000	<1.000	<1.000
NRA - m,p-Xylene	µg/l	<1	19.5	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	10.7	<1.000	19.5	<1.000	<1.000	<1.000	<1.000
NRA - o-Xylene	µg/l	<1	16.7	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	10.1	<1.000	16.7	<1.000	<1.000	<1.000	<1.000
Total xylenes	µg/l		36.2	30	N/A	<2.000		<2.000	<2.000	<2.000	<20.000	20.8	<2.000	36.2	<2.000	<2.000	<2.000	<2.000
NRA - Styrene	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Bromoform	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - Isopropylbenzene	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	1.39	<1.000	<1.000	<1.000	<1.000
NRA - 1,1,2,2-Tetrachloroethane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - 1,2,3-Trichloropropane	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000					

		<0.000	Concentration below the LOD												
		0.000	Concentration in exceedance of the GAC												
		0.000	Concentration in exceedance of the L3 SSAC												
		N/A	Not applicable												
		LTT	Long travel time - risk negligible												
						BH201	BH201	BH202	BH204	BH203C	VW202	VW203A	WS203	WS204	WS206
						1.10-1.20	5.10-5.20	0.30-0.30	0.60-0.70	2.20-2.30	0.40-0.50	0.80-1.00	3.40-3.50	0.60-0.70	4.20-4.30
						25/03/2019	29/03/2019	25/03/2019	27/03/2019	01/04/2019	26/03/2019	27/03/2019	04/04/2019	27/03/2019	05/04/2019
Test	Units	LOD	MAX	EQS	L3 SSAC	MG	RTG	MG	MG	ALV	MG	MG	ALV	MG	ALV
Waste Acceptance Criteria (WAC)															
CEN 2:1 - Temperature	°C		17.6	-	-	16.2	16.5	17.4	17.5	16.2	17.1	16.7	17.6	15.1	15.4
CEN 2:1 - pH	pH Units		10.36	-	-	7.84	8.29	10.36	8.05	8.61	8.51	7.87	8.59	7.31	7.66
CEN 2:1 - Conductivity @ 20 deg.C	µS/cm		2270	-	-	713	233	285	644	456	430	2270	606	2140	726
Inorganics															
CEN 2:1 - pH	pH Units	<1	10.18	-	-	8.26	8.18	10.18	8.26	8.6	8.43	7.95	8.5	7.97	8.26
CEN 2:1 - Ammoniacal Nitrogen as NH4	mg/l	<0.3	87.7	-	-	<0.300000	1.45	<0.300000	<0.300000	63.4	<0.300000	<0.300000	87.7	2.46	24.6
Ammoniacal Nitrogen as N - Calculated	mg/l		68.21111111	0.6	-	0.233	1.128	0.233	0.233	49.311	0.233	0.233	68.211	1.913	19.133
free ammonia (calculated)	mg/l		0.718064299	0.6	N/A	0.002	0.012	0.002	0.002	0.519	0.002	0.002	0.718	0.020	0.201
CEN 2:1 - Cyanide, Complex	mg/l	<0.05	8.15	-	-	0.34	<0.050000	8.15	0.494	0.095	0.5	0.622	0.14	1.09	0.57
CEN 2:1 - Sulphate (soluble) as S	mg/l	<1	513	-	-	95	1.9	22.8	71.7	17.6	7.33	513	22.3	473	75.3
Filtered (Dissolved) Metals															
CEN 2:1 - Chromium, Hexavalent	mg/l	<0.03	0.03	0.0034	-	<0.030000	<0.030000	<0.030000	<0.030000	<0.030000	<0.030000	<0.030000	<0.030000	<0.030000	<0.030000
CEN 2:1 - Mercury (diss.filt)	mg/l	<0.00001	0.0000269	0.00007	-	<0.000010	<0.000010	<0.000010	<0.000010	0.0000269	<0.000010	<0.000010	0.0000189	<0.000010	<0.000010
CEN 2:1 - Arsenic (diss.filt)	mg/l	<0.0005	0.192	0.05	N/A	0.00405	0.00166	0.0608	0.00197	0.0167	0.00537	0.0149	0.192	0.0306	0.00323
CEN 2:1 - Barium (diss.filt)	mg/l	<0.0002	0.055	-	-	0.0329	0.00919	0.0327	0.055	0.0175	0.0414	0.0271	0.0312	0.0546	0.053
CEN 2:1 - Beryllium (diss.filt)	mg/l	<0.0001	0.0001	-	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
CEN 2:1 - Boron (diss.filt)	mg/l	<0.01	0.191	2	-	0.0488	0.0229	0.0293	0.0352	0.191	0.02	0.0902	0.142	0.146	0.0314
CEN 2:1 - Cadmium (diss.filt)	mg/l	<0.00008	0.00037	0.00025	-	<0.000080	<0.000080	<0.000080	0.0000801	<0.000080	<0.000080	0.00037	<0.000080	<0.000080	<0.000080
CEN 2:1 - Chromium (diss.filt)	mg/l	<0.001	0.00731	-	-	<0.001000	<0.001000	0.00731	<0.001000	<0.001000	<0.001000	<0.001000	<0.001000	<0.001000	<0.001000
CEN 2:1 - Copper (diss.filt)	mg/l	<0.0003	0.0522	0.00733	N/A	0.00322	0.0014	0.0522	0.00448	0.00768	0.00158	0.00832	0.0069	0.00449	<0.000300
CEN 2:1 - Lead (diss.filt)	mg/l	<0.0002	0.0439	0.0012	-	0.000393	<0.000200	0.00523	0.000312	0.000877	0.000389	0.000758	0.00177	0.0439	<0.000200
CEN 2:1 - Nickel (diss.filt)	mg/l	<0.0004	0.0197	0.00803	N/A	0.000815	0.00144	0.00582	0.0028	0.00881	0.00141	0.00675	0.0184	0.0197	0.00246
CEN 2:1 - Selenium (diss.filt)	mg/l	<0.001	0.0556	-	-	0.00447	<0.001000	0.0082	0.00487	0.00449	0.00365	0.0109	0.0556	0.014	0.00782
CEN 2:1 - Vanadium (diss.filt)	mg/l	<0.001	0.0138	-	-	0.0015	<0.001000	0.0138	<0.001000	0.00128	0.00146	<0.001000	<0.001000	<0.001000	<0.001000
CEN 2:1 - Zinc (diss.filt)	mg/l	<0.001	0.021	0.02264	LTT	0.00446	0.00141	0.00238	0.00947	0.0118	0.00148	0.0168	0.00823	0.021	0.00764
Phenols															
CEN 2:1 - Phenol	mg/l	<0.002	0.01	0.0077	N/A	<0.002000	<0.002000	<0.002000	<0.002000	<0.002000	<0.002000	<0.002000	0.01	<0.002000	<0.002000
CEN 2:1 - Cresols	mg/l	<0.006	0.02	-	-	<0.006000	<0.006000	<0.006000	<0.006000	<0.006000	<0.006000	<0.006000	0.02	<0.006000	<0.006000
CEN 2:1 - Xylenols	mg/l	<0.008	0.03	-	-	<0.008000	<0.008000	<0.008000	<0.008000	<0.008000	<0.008000	<0.008000	0.03	<0.008000	<0.008000
CEN 2:1 - Phenols, Total Detected monohydric	mg/l	<0.016	0.06	-	-	<0.016000	<0.016000	<0.016000	<0.016000	<0.016000	<0.016000	<0.016000	0.06	<0.016000	<0.016000
TPH Criteria Working Group (TPH CWG)															
CEN 2:1 - GRO Surrogate % recovery**	%		117	-	-	82	116	46	72	116	110	117	88	92	74
CEN 2:1 - GRO >C5-C12	mg/l	<0.05	2.46	-	-	0.186	<0.050000	1.28	<0.050000	<0.050000	<0.050000	<0.050000	2.46	1.41	0.484
CEN 2:1 - Methyl tertiary butyl ether (MTBE)	mg/l	<0.003	0.003	-	-	<0.003000	<0.003000	<0.003000	<0.003000	<0.003000	<0.003000	<0.003000	<0.003000	<0.003000	<0.003000
CEN 2:1 - Benzene	mg/l	<0.007	0.007	-	-	<0.007000	<0.007000	<0.007000	<0.007000	<0.007000	<0.007000	<0.007000	<0.007000	<0.007000	0.007
CEN 2:1 - Toluene	mg/l	<0.004	0.004	-	-	<0.004000	<0.004000	0.004	<0.004000	<0.004000	<0.004000	<0.004000	<0.004000	<0.004000	<0.004000
CEN 2:1 - Ethylbenzene	mg/l	<0.005	0.028	-	-	<0.005000	<0.005000	0.028	<0.005000	<0.005000	<0.005000	<0.005000	0.015	0.01	0.006
CEN 2:1 - m,p-Xylene	mg/l	<0.008	0.054	-	-	<0.008000	<0.008000	0.008	<0.008000	<0.008000	<0.008000	<0.008000	0.054	0.018	0.008
CEN 2:1 - o-Xylene	mg/l	<0.003	0.03	-	-	<0.003000	<0.003000	0.009	<0.003000	<0.003000	<0.003000	<0.003000	0.03	0.016	0.016
CEN 2:1 - Sum of detected Xylenes	mg/l	<0.011	0.084	-	-	<0.011000	<0.011000	0.017	<0.011000	<0.011000	<0.011000	<0.011000	0.084	0.034	0.024
CEN 2:1 - Sum of detected BTEX	mg/l	<0.028	0.099	-	-	<0.028000	<0.028000	0.049	<0.028000	<0.028000	<0.028000	<0.028000	0.099	0.044	0.037
CEN 2:1 - Aliphatics >C5-C6	mg/l	<0.01	0.332	-	-	<0.010000	<0.010000	0.01	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	0.332
CEN 2:1 - Aliphatics >C6-C8	mg/l	<0.01	0.038	-	-	0.038	<0.010000	0.021	<0.010000	<0.010000	<0.010000	<0.010000	0.011	0.012	0.029
CEN 2:1 - Aliphatics >C8-C10	mg/l	<0.01	0.322	-	-	0.07	<0.010000	0.142	<0.010000	<0.010000	<0.010000	<0.010000	0.322	0.162	0.019
CEN 2:1 - Aliphatics >C10-C12	mg/l	<0.01	1.08	-	-	0.016	<0.010000	0.577	<0.010000	<0.010000	<0.010000	<0.010000	1.08	0.644	0.033
CEN 2:1 - Aliphatics >C12-C16 (aq)	mg/l	<0.01	0.02	-	-	<0.010000	<0.010000	<0.010000	<0.010000	<0.020000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000
CEN 2:1 - Aliphatics >C16-C21 (aq)	mg/l	<0.01	0.02	-	-	<0.010000	<0.010000	<0.010000	<0.010000	<0.020000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000
CEN 2:1 - Aliphatics >C21-C35 (aq)	mg/l	<0.01	0.02	-	-	<0.010000	<0.010000	<0.010000	<0.010000	<0.020000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000
CEN 2:1 - Total Aliphatics >C12-C35 (aq)	mg/l	<0.01	0.02	-	-	<0.010000	<0.010000	<0.010000	<0.010000	<0.020000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000
CEN 2:1 - Aromatics >EC5-EC7	mg/l	<0.01	0.01	0.01	N/A	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000
CEN 2:1 - Aromatics >EC7-EC8	mg/l	<0.01	0.01	0.074	-	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000
CEN 2:1 - Aromatics >EC8-EC10	mg/l	<0.01	0.314	0.02	27.077	0.047	<0.010000	0.139	<0.010000	<0.010000	<0.010000	<0.010000	0.314	0.152	0.042
CEN 2:1 - Aromatics >EC10-EC12	mg/l	<0.01	0.722	0.002	N/A	0.011	<0.010000	0.385	<0.010000	<0.010000	<0.010000	<0.010000	0.722	0.429	0.022
CEN 2:1 - Aromatics >EC12-EC16 (aq)	mg/l	<0.01	0.727	0.002	N/A	<0.010000	<0.010000	0.207	<0.010000	<0.020000	<0.010000	<0.010000	0.01	0.727	

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

						BH201	BH201	BH202	BH204	BH203C	VW202	VW203A	WS203	WS204	WS206
						1.10-1.20	5.10-5.20	0.30-0.30	0.60-0.70	2.20-2.30	0.40-0.50	0.80-1.00	3.40-3.50	0.60-0.70	4.20-4.30
						25/03/2019	29/03/2019	25/03/2019	27/03/2019	01/04/2019	26/03/2019	27/03/2019	04/04/2019	27/03/2019	05/04/2019
Test	Units	LOD	MAX	EQS	L3 SSAC	MG	RTG	MG	MG	ALV	MG	MG	ALV	MG	ALV
CEN 2:1 - Benzo(k)fluoranthene (aq)	mg/l	<0.000005	0.000186	-	-	<0.000005	<0.000005	0.000186	0.00000527	<0.000010	0.0000126	<0.000005	0.00000878	0.00017	<0.000005
CEN 2:1 - Benzo(a)pyrene (aq)	mg/l	<0.000002	0.000283	0.000022	LTT	<0.000002	<0.000002	0.000283	0.000005	<0.000004	0.0000178	<0.000002	0.00000628	0.000166	<0.000002
CEN 2:1 - Dibenzo(a,h)anthracene (aq)	mg/l	<0.000005	0.000251	-	-	<0.000005	<0.000005	0.000113	<0.000005	<0.000010	0.0000154	<0.000005	<0.000005	0.000251	<0.000005
CEN 2:1 - Benzo(g,h,i)perylene (aq)	mg/l	<0.000005	0.000309	-	-	<0.000005	<0.000005	0.000309	<0.000005	<0.000010	0.0000202	<0.000005	<0.000005	0.000192	<0.000005
CEN 2:1 - Indeno(1,2,3-cd)pyrene (aq)	mg/l	<0.000005	0.000207	-	-	<0.000005	<0.000005	0.000184	<0.000005	<0.000010	0.0000252	<0.000005	<0.000005	0.000207	<0.000005
CEN 2:1 - PAH, Total Detected USEPA 16 (aq)	mg/l	<0.000082	0.197	-	-	0.000347	0.00345	0.0761	0.000725	0.000185	0.000516	0.000751	0.0169	0.197	0.000397
PAH sum of 4 (calculated)	mg/l		0.001125	-	-	<0.000020	<0.000020	0.001125	0.00002647	0.00004	0.0000895	<0.000021	0.00004048	0.000755	<0.000020

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

						BH101	BH101	BH103A	BH103A	BH103A	BH201	BH203C	BH203C	BH204	BH204	BH101	BH101	BH104	BH104	BH104	BH201	BH103A	WS206
Reading						10/04/2019	10/02/2020	24/11/2015	15/12/2015	11/02/2020	10/02/2020	10/04/2019	11/02/2020	10/04/2019	11/02/2020	24/11/2015	15/12/2015	15/12/2015	24/11/2015	17/04/2019	10/04/2019	10/04/2019	10/02/2020
Test	Units	LOD	Total Max	EQS	L3 SSAC	MG	MG	AL/RTG	AL/RTG	AL/RTG	RTG	RTG	RTG	RTG	RTG	MG	MG	MG/AL/RTG	MG/AL/RTG	MG/AL/RTG	RTG	AL/RTG	MG
Inorganics																							
Nitrite as NO2	µg/l	<50	100	-	-			<50.000	<50.000							<50.000	59	<50.000	<50.000				
pH	pH Units	<1	8.3	-	-	7.82	8.11	7.59	7.93	7.96	8.19	8.05	8.23	8.3	7.77	8.05	8.09	7.48	7.13	7.25	7.76	8.05	8
Sulphate	µg/l	<2000	635000	-	-			174000	224000							16900	24600	358000	373000				
Sulphide	µg/l	<10	143	-	-			<10.000	11.9							<10.000	<10.000	<10.000	13.9				
Sulphate as %SO4	%	<0.0002	0.125	-	-	0.001	0.0009			0.00928	0.00857	0.00496	0.00503	0.00535	0.00706					0.0426	0.0111	0.0316	0.122
Ammoniacal Nitrogen as NH3	µg/l	<200	53700	-	-			15000	14600							1170	1020	47300	47400				
Cyanide, Total	µg/l	<50	2190	-	-	<50.000	<50.000	<50.000	50	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	78	83	103	105	150	190	210	310
Ammoniacal Nitrogen as NH4	µg/l	<300	56800	-	-	<300.000	<300.000	15800	15600	5880	6930	2020	1950	665	<300.000	1240	1080	50100	50300	35000	7350	21200	5280
Ammoniacal Nitrogen as N - Calculated	µg/l		44178	-	-	233.3	233.3	12288.9	12133.3	4573.3	5390.0	1571.1	1516.7	517.2	233.3	964.4	840.0	38966.7	39122.2	27222.2	5716.7	16488.9	4106.7
free ammonia (calculated)	µg/l		465	600	-	2.5	2.456320294	129.4	127.7	48.14387776	56.74099879	16.5	15.96608191	5.4	2.456320294	10.2	8.8	410.2	411.8	286.6	60.2	173.6	43.23123717
Cyanide, Free	µg/l	<50	50	1	4.987	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000
Cyanide, Complex	µg/l	<50	2180	-	-	<50.000	<50.000	<50.000	50	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	78	83	103	105	150	160	180	310
Nitrate as NO3	µg/l	<300	42400	-	-			<300.000	<300.000	572			33100		42400	<300.000	956	<300.000	<300.000				
Alkalinity, Total as CaCO3	µg/l	<2000	1630000	-	-	168000		190000	195000			344000		348000		270000	260000	645000	655000	1080000	347000	539000	
Chloride	µg/l	<2000	60700	-	-	4400	3500			36800	34800	44000	43400	47300	49300					40000	33700	60700	21900
Nitrate as N	µg/l	<67.7	8230	-	-	1190	1170				<67.700	6810		8230						<67.700	<67.700	3740	343
Cyanide, Total (low level)	µg/l	<5	4430	-	-																		
Cyanide, Free (low level)	µg/l	<2.5	80.3	1	4.987																		
Cyanide, Complex (low level)*	µg/l	<5	4350	-	-																		
Filtered (Dissolved) Metals																							
Iron, Ferric	µg/l	<50	22600	-	-	<50.000	<50.000	<50.000	<50.000	157	410	214	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	1500	170	223	369
Chromium, Hexavalent	µg/l	<30	30	3.4	-	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000
Chromium, Trivalent	µg/l	<30	30	4.3	-			<30.000	<30.000							<30.000	<30.000	<30.000	<30.000				
Mercury (diss.filt)	µg/l	<0.01	0.0196	0.07	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0179	<0.010	<0.010	<0.010
Arsenic (diss.filt)	µg/l	<0.12	69.3	50	N/A	<0.500	0.511	9.81	8.74	3.03	20	0.509	<0.500	<0.500	<0.500	1.67	1.36	26.8	2.7	68.5	11.1	2.1	1.11
Barium (diss.filt)	µg/l	<0.03	84.1	-	-	18.1	16.4	30.1	29.1	27.4	68.4	35.8	35.3	29.1	61.1	51.6	49.7	33.8	43.5	69.9	68.7	84.1	37.2
Beryllium (diss.filt)	µg/l	<0.07	0.1	-	-	<0.100	<0.100	<0.070	<0.070	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.070	<0.070	<0.070	<0.070	<0.100	<0.100	<0.100	<0.100
Iron (diss.filt)	µg/l	<19	34600	1000	LTT	20.6	<19.000	31.3	45.5	157	6860	214	44.6	20.5	<19.000	36.7	39.2	82.5	68.3	34600	8000	223	640
Boron (diss.filt)	µg/l	<9.4	397	2000	-	<10.000	<10.000	32.5	22	<10.000	147	115	101	123	123	34.4	117.8	353	384	296	149	24.7	140
Iron, Ferrous	µg/l	<100	33100	-	-	<100.000	<100.000	890	805	<100.000	6450	<100.000	<100.000	<100.000	<100.000	2100	1500	27400	20900	33100	7830	<100.000	271
Manganese II	µg/l	<200	1970	-	-			347	408							<200.000	750	651	558				
Cadmium (diss.filt)	µg/l	<0.1	0.1	2.25	-	<0.080	<0.080	<0.100	<0.100	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.100	<0.100	<0.100	<0.100	<0.080	<0.080	<0.080	<0.080
Chromium (diss.filt)	µg/l	<0.22	17.1	-	-	<1.000	1.04	2.51	2.12	6.84	<1.000	<1.000	17.1	<1.000	10.3	3.63	2.89	8.1	9.02	<1.000	<1.000	<1.000	13
Copper (diss.filt)	µg/l	<0.85	4.93	7.33	N/A	2.98	2.77	1.47	0.977	0.63	<0.300	<0.300	1.39	<0.300	1.01	<0.850	1.53	1.45	2.53	<0.300	0.631	<0.300	0.955
Lead (diss.filt)	µg/l	<0.02	14.9	3.35	-	<0.200	<0.200	0.033	<0.020	0.222	<0.200	0.949	1.65	<0.200	<0.200	<0.020	<0.020	<0.020	0.02	<0.200	0.67	<0.200	<0.200
Manganese (diss.filt)	µg/l	<0.04	3800	219.5	LTT	240	208									664	648	3380	3800				
Nickel (diss.filt)	µg/l	<0.15	21.3	8.03	N/A	0.999	0.817	2.13	2.21	0.771	1.22	2.48	1.91	4.27	1.94	4.16	21.3	5.27	6.26	2.88	1.36	5.89	5.89
Selenium (diss.filt)	µg/l	<0.39	5.12	-	-	1.41	1.51	0.97	<0.390	<1.000	<1.000	1.22	1.57	1.45	1.66	1.11	0.904	1.05	1.72	<1.000	<1.000	<1.000	2.13
Vanadium (diss.filt)	µg/l	<0.24	2.58	-	-	<1.000	<1.000	0.958	0.768	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	0.914	0.792	2.39	2.58	<1.000	<1.000	<1.000	<1.000
Zinc (diss.filt)	µg/l	<0.41	197	22.64	LTT	2.3	4.22	1.66	1.74	14	<1.000	4.59	6.38	4.28	2.39	2.32	1.21	2.97	2.69	1.31	3.83	197	6.25
Hardness, Total as CaCO3	µg/l		1530000	-	-		172000			219000	344000		314000		338000								1530000
Manganese (tot.unfilt)	µg/l		4270	-	-		17.8			226	631		174		60								1400
Phenols																							
Resorcinol (low level)	µg/l	<0.5	5	-	-		<0.500			<1.000	<5.000	<0.500	<0.500	<0.500						<0.500		<0.500	<0.500
Catechol (low level)	µg/l	<0.5	5	-	-		<0.500			<1.000	<5.000	<0.500	<0.500	<0.500						<0.500		<0.500	<0.500
Resorcinol	µg/l	<10	10	-	-	<10.000															<10.000		
Catechol	µg/l	<10	10	-	-	<10.000															<10.000		
Phenol (low level)	µg/l	<0.5	5.14	-	-	<0.500				5.14	<5.000	<0.500	<0.500	0.56						<0.500		0.7	<0.500
Cresols (low level)	µg/l	<0.5	16.1	-	-	<0.500				16.1	<5.000	<0.500	<0.500	<0.500						<0.500		<0.500	<0.500
Phenol	µg/l	<2	10	7.7	N/A	<2.000		<2.000	<2.000							<2.000	<2.000	<2.000	<2.000		<2.000		
Cresols	µg/l	<6	40	-	-	<6.000		<6.000	<6.000							<6.000	<6.000	<6.000	<6.000		<6.000		
Xylenols (low level)	µg/l	<0.5	14.7	-	-	<0.500				14.7	<5.000	0.96	0.81	<0.500						<0.500		<0.500	<0.500
1-Naphthol (low level)	µg/l	<0.5	5	-	-	<0.500				<1.000	<5.000	<0.500	<0.500	<0.500						<0.500		<0.500	<0.500
Xylenols	µg/l	<8	10	-	-	<8.000		<8.000	<8.000							<8.000	<8.000	<8.000	<8.000		<8.000		
1-Naphthol	µg/l	<10	10	-	-	<10.000															<10.000		
2,3,5-Trimethylphenol (low level)	µg/l	<0.5	5	-	-	<0.500				1.11	<5.000	<0.500	1.53	<0.500						<0.500		<0.500	<0.500
2,3,5-Trimethylphenol	µg/l	<3	3	-	-	<3.000		<3.000	<3.000							<3.000							

	<0.000	Concentration below the LOD																					
	0.000	Concentration in exceedance of the GAC																					
	0.000	Concentration in exceedance of the L3 SSAC																					
	N/A	Not applicable																					
	LTT	Long travel time - risk negligible																					
						BH101	BH101	BH103A	BH103A	BH103A	BH201	BH203C	BH203C	BH204	BH204	BH101	BH101	BH104	BH104	BH104	BH201	BH103A	WS206
Sum of detected BTEX	µg/l	<28	199	-	-			<28.000	<28.000							<28.000	<28.000	<28.000	<28.000				
Aliphatics >C5-C6	µg/l	<10	1920	-	-	43	46	<10.000	<10.000	<10.000	271	<10.000	<10.000	<10.000	<10.000	323	998	<10.000	<10.000	<10.000	286	<10.000	328
Aliphatics >C6-C8	µg/l	<10	52	-	-	38	14	<10.000	<10.000	<10.000	11	<10.000	<10.000	<10.000	<10.000	45	52	<10.000	<10.000	<10.000	11	<10.000	18
Aliphatics >C8-C10	µg/l	<10	121	-	-	121	76	<10.000	<10.000	<10.000	11	<10.000	<10.000	<10.000	<10.000	23	50	<10.000	<10.000	<10.000	<10.000	<10.000	44
Aliphatics >C10-C12	µg/l	<10	299	-	-	<10.000	<10.000	<10.000	<10.000	<10.000	15	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aliphatics >C12-C16 (aq)	µg/l	<10	42	-	-	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aliphatics >C16-C21 (aq)	µg/l	<10	100	-	-	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aliphatics >C21-C35 (aq)	µg/l	<10	893	-	-	<10.000	<10.000	20	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Total Aliphatics >C12-C35 (aq)	µg/l	<10	1010	-	-	<10.000	<10.000	20	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	37	<10.000	<10.000	<10.000
Aromatics >EC5-EC7	µg/l	<10	38	10	N/A	<10.000	<10.000	<10.000	<10.000	<10.000	13	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	11	<10.000	<10.000
Aromatics >EC7-EC8	µg/l	<10	21	74	-	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aromatics >EC8-EC10	µg/l	<10	235	20	145.5	81	51	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	17	34	<10.000	<10.000	<10.000	<10.000	<10.000	29
Aromatics >EC10-EC12	µg/l	<10	200	2	N/A	<10.000	<10.000	<10.000	<10.000	<10.000	10	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aromatics >EC12-EC16 (aq)	µg/l	<10	478	2	N/A	<10.000	<10.000	15	12	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aromatics >EC16-EC21 (aq)	µg/l	<10	134	0.1	N/A	<10.000	<10.000	<10.000	10	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aromatics >EC21-EC35 (aq)	µg/l	<10	115	0.022	N/A	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Total Aromatics >EC12-EC35 (aq)	µg/l	<10	569	-	-	<10.000	<10.000	15	22	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Total Aliphatics & Aromatics >C5-35 (aq)	µg/l	<10	3090	-	-	291	190	35	22	<10.000	340	<10.000	<10.000	<10.000	<10.000	425	1150	<10.000	37	<10.000	338	<10.000	424
Polyaromatic Hydrocarbons (PAHs)																							
Naphthalene (aq)	µg/l	<0.1	1	2	-	0.0269	0.0473	<0.100	<0.100	0.07	0.0328	0.0174	0.966	<0.010	<0.010	<0.100	<0.100	<0.100	<0.100	<0.010	0.0311	0.0306	0.011
Acenaphthene (aq)	µg/l	<0.015	13.7	-	-	<0.005	<0.005	1.84	2.14	0.545	0.152	<0.005	0.0717	<0.005	<0.005	<0.015	<0.015	<0.015	0.0172	<0.005	0.026	0.0345	0.00533
Acenaphthylene (aq)	µg/l	<0.011	20.1	-	-	<0.005	<0.005	0.147	0.208	0.0639	0.0541	<0.005	0.0109	<0.005	<0.011	<0.011	<0.011	<0.011	0.0156	<0.005	0.0225	0.00809	<0.005
Fluoranthene (aq)	µg/l	<0.017	3.45	0.12	N/A	<0.005	0.0143	0.432	0.603	0.468	0.0303	<0.005	0.0282	<0.005	0.0163	<0.017	<0.017	<0.017	0.0596	<0.005	0.0183	<0.005	0.0261
Anthracene (aq)	µg/l	<0.015	5.05	0.1	N/A	<0.005	<0.005	0.0338	0.0262	0.0242	0.00934	<0.005	0.00544	<0.005	<0.005	<0.015	<0.015	<0.015	<0.015	<0.005	<0.005	<0.005	0.00532
Phenanthrene (aq)	µg/l	<0.022	12.5	-	-	<0.005	0.00972	0.0237	<0.022	0.0161	0.0101	<0.005	0.0169	<0.005	0.00824	<0.022	<0.022	<0.022	0.0361	<0.005	<0.005	<0.005	0.00968
Fluorene (aq)	µg/l	<0.014	18	-	-	<0.005	<0.005	0.564	0.426	0.0274	0.0208	<0.005	0.0185	<0.005	<0.005	<0.014	<0.014	0.0153	0.0162	<0.005	0.00721	<0.005	<0.005
Chrysene (aq)	µg/l	<0.013	1.4	-	-	<0.005	0.00736	0.0203	0.0333	0.0214	0.0245	<0.005	0.0111	<0.005	0.0195	<0.013	<0.013	<0.013	0.025	<0.005	<0.005	<0.005	0.0183
Pyrene (aq)	µg/l	<0.015	4.15	-	-	<0.005	0.0164	0.211	0.235	0.282	0.0905	<0.005	0.0256	<0.005	0.0235	<0.015	<0.015	<0.015	0.0639	<0.005	0.0223	<0.005	0.0308
Benzo(a)anthracene (aq)	µg/l	<0.017	1.46	-	-	<0.005	0.00929	<0.017	0.0322	0.024	0.0239	<0.005	0.00626	<0.005	0.0188	0.032	<0.017	<0.017	<0.017	<0.005	<0.005	<0.005	0.0212
Benzo(b)fluoranthene (aq)	µg/l	<0.023	0.804	-	-	<0.005	0.0115	0.0313	0.0444	0.0231	0.0488	<0.005	0.0221	<0.005	0.0159	<0.023	<0.023	<0.023	0.0411	<0.005	0.0129	<0.005	0.037
Benzo(k)fluoranthene (aq)	µg/l	<0.027	0.386	-	-	<0.005	0.00678	<0.027	<0.027	0.0126	0.0219	<0.005	0.0132	<0.005	0.00708	<0.027	<0.027	<0.027	<0.027	<0.005	0.00526	<0.005	0.0149
Benzo(a)pyrene (aq)	µg/l	<0.009	1.09	0.022	LTT																		

	<0.000	Concentration below the LOD																					
	0.000	Concentration in exceedance of the GAC																					
	0.000	Concentration in exceedance of the L3 SSAC																					
	N/A	Not applicable																					
	LTT	Long travel time - risk negligible																					
						BH101	BH101	BH103A	BH103A	BH103A	BH201	BH203C	BH203C	BH204	BH204	BH101	BH101	BH104	BH104	BH104	BH201	BH103A	WS206
Benzo(g,h,i)perylene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Carbazole (aq)	µg/l	<1	4.83	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Chrysene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Dibenzofuran (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
n-Dibutyl phthalate (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Diethyl phthalate (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Dibenzo(a,h)anthracene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Dimethyl phthalate (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
n-Dioctyl phthalate (aq)	µg/l	<5	20	-	-	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000		<5.000	<5.000		<10.000	<5.000	<5.000	<5.000
Fluoranthene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Fluorene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Hexachlorobenzene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Hexachlorobutadiene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Pentachlorophenol (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Phenol (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
n-Nitroso-n-dipropylamine (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Hexachloroethane (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Nitrobenzene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Naphthalene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Isophorone (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Hexachlorocyclopentadiene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Phenanthrene (aq)	µg/l	<1	13.6	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Indeno(1,2,3-cd)pyrene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Pyrene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<2.000	<1.000	<1.000	<1.000
Volatile Organic Compounds (VOCs)																							
Dibromofluoromethane**	%		125	-	-	120	114	113	118	117	113	123	117	122	116		111	118		112	112	119	108
Toluene-d8**	%		112	-	-	102	107	98.6	100	106	98.8	104	108	103	112		102	100		100	101	103	98.7
4-Bromofluorobenzene**	%		105	-	-	96.8	99.4	99	101	97.9	101	102	104	101	97.7		100	99.7		96.4	99.6	102	97.5
Dichlorodifluoromethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
Chloromethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
Vinyl chloride	µg/l	<1	2750	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	192	<1.000	<1.000	<1.000	<1.000		1160	<1.000		<1.000	323	<1.000	31.7
Bromomethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
Chloroethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
Trichlorofluoromethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
1,1-Dichloroethene	µg/l	<1	4.9	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		4.9	<1.000		<1.000	<1.000	<1.000	<1.000
Carbon disulphide	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000									

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

						BH101	BH101	BH103A	BH103A	BH103A	BH201	BH203C	BH203C	BH204	BH204	BH101	BH101	BH104	BH104	BH104	BH201	BH103A	WS206
1,3,5-Trimethylbenzene	µg/l	<1	11.9	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
4-Chlorotoluene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
tert-Butylbenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
1,2,4-Trimethylbenzene	µg/l	<1	42.6	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
sec-Butylbenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
4-iso-Propyltoluene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
1,3-Dichlorobenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
n-Butylbenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
1,2-Dichlorobenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
1,2-Dibromo-3-chloropropane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
1,2,4-Trichlorobenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
Hexachlorobutadiene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
tert-Amyl methyl ether (TAME)	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
Naphthalene	µg/l	<1	38.6	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	2.07	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
1,2,3-Trichlorobenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
1,3,5-Trichlorobenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000		<1.000	<1.000	<1.000	<1.000
Sum of detected Xylenes	µg/l	<2	149	30	N/A	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000
Dissolved Gases																							
Methane, dissolved	µg/l	<1	418	-	-	<2.230	<2.200	8.37	<2.220	4.73	418	40.4	2.74	1.71	<2.210	302	365	82.3	62.5	58.2	361	18.8	6.18
Ethene, dissolved	µg/l	<1	753	-	-	<1.000	<1.000			<1.000	59.5	<1.000	<1.000	<1.000	<1.000					<1.000	96.4	<1.000	<1.000
Ethane, dissolved	µg/l	<1	6.94	-	-	<1.000	<1.000			<1.000	6.87	<1.000	<1.000	<1.000	<1.000					<1.000	5.8	<1.000	1.32
Carbon dioxide, dissolved	µg/l	<1300	136000	-	-	7860	8090	11800	12500	11100	20000	21700	22200	24200	32400	14800	20400	119000	111000	136000	25200	36900	63900
Propane, dissolved	µg/l	<1	3.36	-	-	<1.000	<1.000			<1.000	<1.000	<1.000	<1.000	<1.000	<1.000					<1.000	<1.000	<1.000	<1.000

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

						BH102B	BH104	BH102B	WS206	BH102B	BH102B	BH101	BH102B	BH103A	BH104	BH201	BH203C	BH204
Reading						24/11/2015	11/02/2020	15/12/2015	17/04/2019	10/04/2019	12/02/2020	30/09/2019	01/10/2019	01/10/2019	01/10/2019	30/09/2019	01/10/2019	01/10/2019
Test	Units	LOD	Total Max	EQS	L3 SSAC	AL/RTG	MG/AL/RTG	AL/RTG	MG	AL/RTG	AL/RTG	MG	AL/RTG	AL/RTG	MG/AL/RTG	RTG	RTG	RTG
Inorganics																		
Nitrite as NO2	µg/l	<50	100	-	-	<50.000		100										
pH	pH Units	<1	8.3	-	-	7.52	8.17	7.64	7.48	7.94	7.63	7.84	7.77	7.62	6.98	7.97	7.54	7.4
Sulphate	µg/l	<2000	635000	-	-	635000		522000										
Sulphide	µg/l	<10	143	-	-	121		143										
Sulphate as %SO4	%	<0.0002	0.125	-	-		0.0504		0.125	0.0668	0.0658							
Ammoniacal Nitrogen as NH3	µg/l	<200	53700	-	-	53700		32100										
Cyanide, Total	µg/l	<50	2190	-	-	352	370	400	695	1230	2190							
Ammoniacal Nitrogen as NH4	µg/l	<300	56800	-	-	56800	20100	33900	8250	15600	15900	<300.000	26700	7350	37700	7050	2910	<300.000
Ammoniacal Nitrogen as N - Calculated	µg/l		44178	-	-	44177.8	15633.3	26366.7	6416.7	12133.3	12366.7	233.3	20766.7	5716.7	29322.2	5483.3	2263.3	233.3
free ammonia (calculated)	µg/l		465	600	-	465.1	164.5734597	277.6	67.5	127.7	130.1849756	2.456320294	218.6125062	60.1798472	308.6775836	57.72352691	23.82630685	2.456320294
Cyanide, Free	µg/l	<50	50	1	4.987	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000							
Cyanide, Complex	µg/l	<50	2180	-	-	352	370	400	672	1200	2180							
Nitrate as NO3	µg/l	<300	42400	-	-	<300.000	919	<300.000		4460								
Alkalinity, Total as CaCO3	µg/l	<2000	1630000	-	-	400000		275000	1630000	849000								
Chloride	µg/l	<2000	60700	-	-		36600		43100	20800	10700	4700	17100	11600	45100	33200	40200	45800
Nitrate as N	µg/l	<67.7	8230	-	-				<67.700	1140		4320	2870	4930	<67.700	<67.700	2420	7360
Cyanide, Total (low level)	µg/l	<5	4430	-	-							79	4430	67.7	153	124	33.2	<5.000
Cyanide, Free (low level)	µg/l	<2.5	80.3	1	4.987							3.45	80.3	8.47	3.18	5.96	4.65	<2.500
Cyanide, Complex (low level)*	µg/l	<5	4350	-	-							75.6	4350	59.2	150	119	28.5	<5.000
Filtered (Dissolved) Metals																		
Iron, Ferric	µg/l	<50	22600	-	-	<50.000	1200	<50.000	716	1370	726	<50.000	1500	<50.000	22600	8330	<50.000	<50.000
Chromium, Hexavalent	µg/l	<30	30	3.4	-	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000
Chromium, Trivalent	µg/l	<30	30	4.3	-	<30.000		<30.000										
Mercury (diss.filt)	µg/l	<0.01	0.0196	0.07	-	<0.010	<0.010	<0.010	<0.010	<0.010	0.0196	<0.010	<0.010	<0.010	<0.010	0.0179	<0.010	<0.010
Arsenic (diss.filt)	µg/l	<0.12	69.3	50	N/A	21.6	26	12.1	2	5.2	3.22	<0.500	9.93	2.29	69.3	23.3	<0.500	<0.500
Barium (diss.filt)	µg/l	<0.03	84.1	-	-	38.5	43.9	26.7	83.5	31.5	29.4	26.6	50.4	37.6	79.2	74.3	34.9	70.5
Beryllium (diss.filt)	µg/l	<0.07	0.1	-	-	<0.070	<0.100	<0.070	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Iron (diss.filt)	µg/l	<19	34600	1000	LTT	317	18500	181	1430	1370	726	43.6	1500	28.6	22800	8450	34.8	21.8
Boron (diss.filt)	µg/l	<9.4	397	2000	-	133	271	96	119	96.9	78.6	17.4	184	20.4	397	142	108	132
Iron, Ferrous	µg/l	<100	33100	-	-	4800	17300	1290	714	<100.000	<100.000	<100.000	<100.000	<100.000	227	116	<100.000	<100.000
Manganese II	µg/l	<200	1970	-	-	417		1970										
Cadmium (diss.filt)	µg/l	<0.1	0.1	2.25	-	<0.100	<0.080	<0.100	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
Chromium (diss.filt)	µg/l	<0.22	17.1	-	-	3.57	<1.000	3.02	<1.000	<1.000	<1.000	9.02	1.29	<1.000	<1.000	1.16	<1.000	<1.000
Copper (diss.filt)	µg/l	<0.85	4.93	7.33	N/A	3.67	0.675	2.18	<0.300	4.93	1.44	3.62	1.38	3.24	<0.300	2.49	0.75	<0.300
Lead (diss.filt)	µg/l	<0.02	14.9	3.35	-	0.053	<0.200	<0.020	0.433	0.204	0.228	<0.200	<0.200	<0.200	0.445	14.9	<0.200	<0.200
Manganese (diss.filt)	µg/l	<0.04	3800	219.5	LTT	1430		1390										
Nickel (diss.filt)	µg/l	<0.15	21.3	8.03	N/A	10.8	2.97	6.95	4.75	3.48	4.19	1.72	5.59	1.45	2.19	1.76	1.69	1.75
Selenium (diss.filt)	µg/l	<0.39	5.12	-	-	5.12	1.19	2.73	3.04	1.56	2.31	1.93	4.06	<1.000	<1.000	<1.000	1.03	1.04
Vanadium (diss.filt)	µg/l	<0.24	2.58	-	-	1.72	<1.000	1.4	<1.000	<1.000	1.01	<1.000	1.73	<1.000	<1.000	<1.000	<1.000	<1.000
Zinc (diss.filt)	µg/l	<0.41	197	22.64	LTT	3.37	6.27	2.09	6.12	1.56	8.77	<1.000	2.64	31.3	2.17	6.9	1.22	1.1
Hardness, Total as CaCO3	µg/l		1530000	-	-		1040000				850000	260000	1000000	239000	895000	398000	354000	359000
Manganese (tot.unfilt)	µg/l		4270	-	-		3270				1130	4.09	1300	135	4270	734	128	17.4
Phenols																		
Resorcinol (low level)	µg/l	<0.5	5	-	-		<0.500		<0.500		<0.500							
Catechol (low level)	µg/l	<0.5	5	-	-		<0.500		<0.500		<0.500							
Resorcinol	µg/l	<10	10	-	-					<10.000		<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Catechol	µg/l	<10	10	-	-					<10.000		<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Phenol (low level)	µg/l	<0.5	5.14	-	-		<0.500		0.62		<0.500							
Cresols (low level)	µg/l	<0.5	16.1	-	-		<0.500		0.65	-		0.87						
Phenol	µg/l	<2	10	7.7	N/A	10		<2.000		<2.000		<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000
Cresols	µg/l	<6	40	-	-	40		20		<6.000		<6.000	10	<6.000	<6.000	<6.000	<6.000	<6.000
Xylenols (low level)	µg/l	<0.5	14.7	-	-		<0.500		<0.500		1.92							
1-Naphthol (low level)	µg/l	<0.5	5	-	-		<0.500		<0.500		<0.500							
Xylenols	µg/l	<8	10	-	-	<8.000		10		<8.000		<8.000	10	<8.000	<8.000	<8.000	<8.000	<8.000
1-Naphthol	µg/l	<10	10	-	-					<10.000		<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
2,3,5-Trimethylphenol (low level)	µg/l	<0.5	5	-	-		<0.500		<0.500		1.48							
2,3,5-Trimethylphenol	µg/l	<3	3	-	-	<3.000		<3.000		<3.000		<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000
2-Isopropylphenol (low level)	µg/l	<0.5	10	-	-	10	<0.500	<6.000	<0.500		<0.500							
2-Isopropylphenol	µg/l	<6	60	-	-	60		30		<6.000		<6.000	30	<6.000	<6.000	<6.000	<6.000	<6.000
Phenols, Total Detected 8 Speciated	µg/l	<45	50	-	-					<45.000		<45.000	50	<45.000	<45.000	<45.000	<45.000	<45.000
Phenols, Total Detected 5 speciated	µg/l	<25	0	-	-													
TPH Criteria Working Group (TPH CWG)																		
GRO Surrogate % recovery**	%		114	-	-	87	85	84	97	103	108	89	114	95	88	74	89	80
GRO >C5-C12	µg/l	<50	2080	-	-	855	<50.000	394	2080	55	78	151	<50.000	<50.000	<50.000	196	<50.000	<50.000
Methyl tertiary butyl ether (MTBE)	µg/l	<3	3	-	-	<3.000		<3.000										
Benzene	µg/l	<7	7	-	-	<7.000		<7.000										
Toluene	µg/l	<4	21	-	-	21		9										
Ethylbenzene	µg/l	<5	23	-	-	23		11										
m,p-Xylene	µg/l	<8	97	-	-	97		45										
o-Xylene	µg/l	<3	58	-	-	58		26										
Sum of detected Xylenes	µg/l	<11	155	-	-	155		71										

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

						BH102B	BH104	BH102B	WS206	BH102B	BH102B	BH101	BH102B	BH103A	BH104	BH201	BH203C	BH204
Sum of detected BTEX	µg/l	<28	199	-	-	199		91										
Aliphatics >C5-C6	µg/l	<10	1920	-	-	<10.000	<10.000	<10.000	1920	<10.000	<10.000	12	<10.000	<10.000	<10.000	153	<10.000	<10.000
Aliphatics >C6-C8	µg/l	<10	52	-	-	<10.000	<10.000	<10.000	24	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	11	<10.000	<10.000
Aliphatics >C8-C10	µg/l	<10	121	-	-	86	<10.000	53	27	<10.000	13	72	<10.000	<10.000	<10.000	11	<10.000	<10.000
Aliphatics >C10-C12	µg/l	<10	299	-	-	299	<10.000	121	12	14	26	<10.000	10	<10.000	<10.000	<10.000	<10.000	<10.000
Aliphatics >C12-C16 (aq)	µg/l	<10	42	-	-	42	<10.000	<10.000	17	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aliphatics >C16-C21 (aq)	µg/l	<10	100	-	-	23	<10.000	<10.000	100	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aliphatics >C21-C35 (aq)	µg/l	<10	893	-	-	42	<10.000	<10.000	893	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Total Aliphatics >C12-C35 (aq)	µg/l	<10	1010	-	-	107	<10.000	<10.000	1010	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aromatics >EC5-EC7	µg/l	<10	38	10	N/A	<10.000	<10.000	<10.000	38	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aromatics >EC7-EC8	µg/l	<10	21	74	-	21	<10.000	<10.000	19	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aromatics >EC8-EC10	µg/l	<10	235	20	145.5	235	<10.000	118	24	17	11	48	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aromatics >EC10-EC12	µg/l	<10	200	2	N/A	200	<10.000	80	<10.000	<10.000	18	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aromatics >EC12-EC16 (aq)	µg/l	<10	478	2	N/A	260	<10.000	478	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aromatics >EC16-EC21 (aq)	µg/l	<10	134	0.1	N/A	134	<10.000	75	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Aromatics >EC21-EC35 (aq)	µg/l	<10	115	0.022	N/A	115	<10.000	16	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Total Aromatics >EC12-EC35 (aq)	µg/l	<10	569	-	-	509	<10.000	569	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Total Aliphatics & Aromatics >C5-35 (aq)	µg/l	<10	3090	-	-	1470	<10.000	963	3090	55	79	150	42	<10.000	<10.000	196	<10.000	<10.000
Polyaromatic Hydrocarbons (PAHs)																		
Naphthalene (aq)	µg/l	<0.1	1	2	-	<1.000	0.0267	<0.100	<0.010	<0.010	0.0292	0.0192	0.116	<0.010	0.0695	0.0226	<0.010	<0.010
Acenaphthene (aq)	µg/l	<0.015	13.7	-	-	10.2	0.00981	13.7	<0.005	0.15	<0.005	0.0263	4.01	0.282	<0.025	0.0784	<0.005	<0.005
Acenaphthylene (aq)	µg/l	<0.011	20.1	-	-	13.3	<0.005	20.1	<0.005	0.0678	0.156	0.0275	2.97	0.0474	<0.025	0.0627	<0.005	<0.005
Fluoranthene (aq)	µg/l	<0.017	3.45	0.12	N/A	3.45	0.0118	1.02	0.116	0.0217	0.044	0.0451	0.485	0.246	<0.025	0.219	0.00863	<0.005
Anthracene (aq)	µg/l	<0.015	5.05	0.1	N/A	5.05	<0.005	1.76	0.0106	<0.005	0.0212	0.0315	0.0802	0.0109	<0.025	0.0442	<0.005	<0.005
Phenanthrene (aq)	µg/l	<0.022	12.5	-	-	12.5	0.0178	0.131	0.025	<0.005	0.0266	0.0343	0.0833	0.015	0.0388	0.0675	<0.005	<0.005
Fluorene (aq)	µg/l	<0.014	18	-	-	18	0.00602	11.1	<0.005	0.0229	<0.005	0.0307	0.181	<0.005	<0.025	0.0317	<0.005	<0.005
Chrysene (aq)	µg/l	<0.013	1.4	-	-	1.4	<0.005	0.11	0.0664	0.00509	0.0426	0.0376	0.169	0.0348	<0.025	0.167	<0.005	<0.005
Pyrene (aq)	µg/l	<0.015	4.15	-	-	4.15	0.0125	0.924	0.121	0.0218	0.0796	0.0441	0.491	0.126	<0.025	0.271	0.0133	<0.005
Benzo(a)anthracene (aq)	µg/l	<0.017	1.46	-	-	1.46	<0.005	0.15	0.0613	<0.005	0.0392	0.0276	0.145	0.0305	<0.025	0.152	<0.005	<0.005
Benzo(b)fluoranthene (aq)	µg/l	<0.023	0.804	-	-	0.804	<0.005	0.0651	0.205	0.0216	0.0744	0.0388	0.28	0.052	<0.025	0.477	<0.005	<0.005
Benzo(k)fluoranthene (aq)	µg/l	<0.027	0.386	-	-	0.386	<0.005	<0.027	0.0917	0.00723	0.0375	0.0316	0.132	0.0217	<0.025	0.183	<0.005	<0.005
Benzo(a)pyrene (aq)	µg/l	<0.009	1.09	0.022	LTT	1.09	<0.002	0.0599	0.136	0.023	0.0632	0.0307	0.189	0.0349	<0.010	0.365	<0.002	<0.002
Dibenzo(a,h)anthracene (aq)	µg/l	<0.016	0.16	-	-	<0.160	<0.005	<0.016	0.0216	<0.005	0.00841	0.0559	0.0553	<0.005	<0.025	0.0837	<0.005	<0.005
Benzo(g,h,i)perylene (aq)	µg/l	<0.016	0.546	-	-	0.546	<0.005	0.0261	0.152	<0.005	0.0651	0.0349	0.145	0.0434	<0.025	0.458	<0.005	<0.005
Indeno(1,2,3-cd)pyrene (aq)	µg/l	<0.014	0.518	-	-	0.518	<0.005	0.0159	0.138	0.00961	0.036	0.0282	0.152	0.0228	<0.025	0.336	<0.005	<0.005
PAH sum of 4 (calculated)	µg/l		2.254	-	-	2.254		0.1341	0.5867	0.04344								
PAH Total Detected USEPA 16 (aq)	µg/l	<0.344	73	-	-	73	0.0846	49.2	1.14	0.351	0.723	0.544	9.68	0.967	<0.410	3.02	<0.082	<0.082
Semi-Volatile Organic Compounds (SVOCs)																		
1,2,4-Trichlorobenzene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
1,2-Dichlorobenzene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
1,3-Dichlorobenzene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
1,4-Dichlorobenzene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
2,4,5-Trichlorophenol (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
2,4,6-Trichlorophenol (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
2,4-Dichlorophenol (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
2,4-Dimethylphenol (aq)	µg/l	<1	6.39	-	-	6.39	<1.000	1.99	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
2,4-Dinitrotoluene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
2,6-Dinitrotoluene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
2-Chloronaphthalene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
2-Chlorophenol (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
2-Methylnaphthalene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
2-Methylphenol (aq)	µg/l	<1	9.59	-	-	9.59	<1.000	1.14	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
2-Nitroaniline (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
2-Nitrophenol (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
3-Nitroaniline (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
4-Bromophenylphenylether (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
4-Chloro-3-methylphenol (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
4-Chloroaniline (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
4-Chlorophenylphenylether (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
4-Methylphenol (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
4-Nitroaniline (aq)	µg/l	<1	4</															

	<0.000	Concentration below the LOD
	0.000	Concentration in exceedance of the GAC
	0.000	Concentration in exceedance of the L3 SSAC
	N/A	Not applicable
	LTT	Long travel time - risk negligible

						BH102B	BH104	BH102B	WS206	BH102B	BH102B	BH101	BH102B	BH103A	BH104	BH201	BH203C	BH204
Benzo(g,h,i)perylene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Carbazole (aq)	µg/l	<1	4.83	-	-	4.83	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Chrysene (aq)	µg/l	<1	4	-	-	1.43	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Dibenzofuran (aq)	µg/l	<1	4	-	-	3.36	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
n-Dibutyl phthalate (aq)	µg/l	<1	4	-	-	1.02	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Diethyl phthalate (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Dibenzo(a,h)anthracene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Dimethyl phthalate (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
n-Dioctyl phthalate (aq)	µg/l	<5	20	-	-	<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	<10.000	<10.000	<10.000	<20.000	<10.000	<5.000	<5.000
Fluoranthene (aq)	µg/l	<1	4	-	-	3.18	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Fluorene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Hexachlorobenzene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Hexachlorobutadiene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Pentachlorophenol (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Phenol (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
n-Nitroso-n-dipropylamine (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Hexachloroethane (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Nitrobenzene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Naphthalene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Isophorone (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Hexachlorocyclopentadiene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Phenanthrene (aq)	µg/l	<1	13.6	-	-	13.6	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Indeno(1,2,3-cd)pyrene (aq)	µg/l	<1	4	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Pyrene (aq)	µg/l	<1	4	-	-	3.46	<1.000	<1.000	<1.000	<1.000	<1.000	<2.000	<2.000	<2.000	<4.000	<2.000	<1.000	<1.000
Volatile Organic Compounds (VOCs)																		
Dibromofluoromethane**	%		125	-	-	116	116	116	108	122	112	125	114	117	117	107	117	116
Toluene-d8**	%		112	-	-	96.2	98.3	100	98.4	102	109	104	102	102	102	102	102	102
4-Bromofluorobenzene**	%		105	-	-	101	98.2	105	95.6	101	97.7	99.7	98.8	98.8	100	98.7	98	98.3
Dichlorodifluoromethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Chloromethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Vinyl chloride	µg/l	<1	2750	-	-	<1.000	<1.000	<1.000	2750	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	206	<1.000	<1.000
Bromomethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Chloroethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Trichlorofluoromethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,1-Dichloroethene	µg/l	<1	4.9	-	-	<1.000	<1.000	<1.000	3.17	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Carbon disulphide	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Dichloromethane	µg/l	<3	3	-	-	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000
Methyl tertiary butyl ether (MTBE)	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
trans-1,2-Dichloroethene	µg/l	<1	14.3	-	-	<1.000	<1.000	<1.000	14.3	<1.000	<1.000	1.31	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,1-Dichloroethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
cis-1,2-Dichloroethene	µg/l	<1	5610	-	-	<1.000	<1.000	<1.000	5610	<1.000	<1.000	37.2	<1.000	<1.000	<1.000	861	<1.000	<1.000
2,2-Dichloropropane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Bromochloromethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Chloroform	µg/l	<1	1.44	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.03
1,1,1-Trichloroethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,1-Dichloropropene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Carbontetrachloride	µg/l	<1	2.33	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.67
1,2-Dichloroethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Benzene	µg/l	<1	45.2	10	50.9	4.78	<1.000	2.26	45.2	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	8.35	<1.000	<1.000
Trichloroethene	µg/l	<1	155	10	34.00	<1.000	<1.000	<1.000	42.8	<1.000	<1.000	8.15	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,2-Dichloropropane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Dibromomethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Bromodichloromethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
cis-1,3-Dichloropropene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Toluene	µg/l	<1	24.4	74	-	24.4	<1.000	9.46	21.8	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
trans-1,3-Dichloropropene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,1,2-Trichloroethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,3-Dichloropropane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Tetrachloroethene	µg/l	<1	956	10	34.00	<1.000	<1.000	<1.000	127	<1.000	<1.000	647	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Dibromochloromethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,2-Dibromoethane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Chlorobenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	&					

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	Not applicable
LTT	Long travel time - risk negligible

						BH102B	BH104	BH102B	WS206	BH102B	BH102B	BH101	BH102B	BH103A	BH104	BH201	BH203C	BH204
1,3,5-Trimethylbenzene	µg/l	<1	11.9	-	-	11.9	<1.000	4.82	<1.000	<1.000	<1.000	<1.000	1.71	<1.000	<1.000	<1.000	<1.000	<1.000
4-Chlorotoluene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
tert-Butylbenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,2,4-Trimethylbenzene	µg/l	<1	42.6	-	-	42.6	<1.000	14.2	<1.000	1.58	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
sec-Butylbenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
4-iso-Propyltoluene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,3-Dichlorobenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,4-Dichlorobenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
n-Butylbenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,2-Dichlorobenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,2-Dibromo-3-chloropropane	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,2,4-Trichlorobenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Hexachlorobutadiene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
tert-Amyl methyl ether (TAME)	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Naphthalene	µg/l	<1	38.6	-	-	38.6	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,2,3-Trichlorobenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,3,5-Trichlorobenzene	µg/l	<1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Sum of detected Xylenes	µg/l	<2	149	30	N/A	149.000	<2.000	56.000	4.01	7.8	<2.000	<2.000	7.03	<2.000	<2.000	<2.000	<2.000	<2.000
Dissolved Gases																		
Methane, dissolved	µg/l	<1	418	-	-	19	7.01	9.86	136	94.6	15.9	<2.180	8.47	2.35	43.9	113	1.19	1.85
Ethene, dissolved	µg/l	<1	753	-	-		<1.000		753	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	63.6	<1.000	<1.000
Ethane, dissolved	µg/l	<1	6.94	-	-		<1.000		6.94	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.22	<1.000	<1.000
Carbon dioxide, dissolved	µg/l	<1300	136000	-	-	31500	117000	24000	37400	29400	28900	12600	34400	14300	136000	23400	25100	23700
Propane, dissolved	µg/l	<1	3.36	-	-		<1.000		3.36	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH105	BH106	BH107	BH105	BH203C	TP102	TP105	BH105	VW201	TP106	BH103A	TP106	BH107	WS206	BH104	WS205	TP102	BH202
						9.20-	9.20-	8.20-	5.50-	2.20-2.30	2.20-	1.70-	2.40-	1.30-1.40	2.00-	2.00-	0.50-	3.90-	4.20-4.30	1.30-	2.30-2.40	1.80-	3.00-
Test	Units	LOD	Max	Count	L3 DWS	10/11/2015	13/11/2015	11/11/2015	09/11/2015	01/04/2019	06/11/2015	09/11/2015	10/11/2015	25/03/2019	10/11/2015	12/11/2015	10/11/2015	11/11/2015	05/04/2019	10/11/2015	05/04/2019	06/11/2015	27/03/2019
Sample Description																							
Colour	No units		-		-	White	White	Cream	Dark Brown	Dark Brown	Light Brown	Dark Brown	Beige	Dark Brown	Light Brown	Dark Brown	Dark Brown	Beige	Dark Brown	Light Brown	Dark Brown	Dark Brown	Dark Brown
Description	No units		-		-	Chalk	Chalk	Clay	Stone/Soil	Silty Clay Loam	Silty Clay	Silty Clay Loam	Clay Loam	Loamy Sand	Silty Clay	Silty Clay Loam	Sandy Silt Loam	Stone/Soil	N/A	Sandy Clay Loam	N/A	Silt Loam	Loamy Sand
Grain Size	No units		-		-	<0.063 mm	0.063 - 0.1 mm	0.063 - 0.1 mm	2 - 10 mm	-	0.063 - 0.1 mm	0.063 - 0.1 mm	0.063 - 0.1 mm	-	0.063 - 0.1 mm	0.1 - 2 mm	0.1 - 2 mm	2 - 10 mm	-	0.063 - 0.1 mm	-	0.063 - 0.1 mm	-
Inclusion 1)	No units		-		-	None	N/A	Stones	Stones	Vegetation	None	None	None	Vegetation	Stones	Stones	Brick	Stones	None	Stones	None	None	Vegetation
Inclusion 2)	No units		-		-	None	N/A	N/A	None	None	None	None	None	Stones	N/A	Vegetation	Stones	N/A	None	N/A	None	None	Stones
Moisture Content Ratio (% of as received sample)	%		-		-	22	20	23	7.7	29	28	29	31	22	26	27	17	24	41	15	30	30	36
Asbestos																							
Asbestos Quantification - Gravimetric - %	%	<0.001	-		-																		
Date of Analysis	No units		-		-					09/04/2019								17/11/2015					
Analysed By	No units		-		-					Barbara UrbanekWalsh					Andrzej Ferrecki		Simon Postlewhite						
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-		-																		
Additional Asbestos Components (Using TMO48)	No units		-		-																		
Analysts Comments	No units		-		-																		
Asbestos Quantification - Total - %	%	<0.001	-		-																		
Chrysotile (White) Asbestos	No units		-		-					Not Detected				Not Detected			Not Detected						
Amosite (Brown) Asbestos	No units		-		-					Not Detected				Not Detected			Not Detected						
Crocidolite (Blue) Asbestos	No units		-		-					Not Detected				Not Detected			Not Detected						
Fibrous Anthophyllite	No units		-		-					Not Detected				Not Detected			Not Detected						
Fibrous Tremolite	No units		-		-					Not Detected				Not Detected			Not Detected						
Fibrous Actinolite	No units		-		-					Not Detected				Not Detected			Not Detected						
Non-Asbestos Fibre	No units		-		-					Not Detected				Not Detected			Not Detected						
Comments	No units		-		-												0						
Carbon																							
Organic Carbon, Total	%	<0.2	-		-																		
Fraction Organic Carbon (FOC)	No units	<0.002	-		-					0.00796				0.0065					0.0109		0.00812		0.00409
Soil Organic Matter (SOM)	%	<0.35	-		-	<0.350	<0.350	<0.350	<0.350		0.765	1.56	0.86		2.33	1.1	1.37	1.56		2.26		4.07	
Inorganics																							
Water Soluble Sulphate as SO4 2:1 Extract	g/l	<0.004	3.31		-	0.042	0.0159	0.0166	0.0223		0.304	2.52	0.18		0.216	0.124	0.0305	0.0306		0.125		0.488	
pH	pH Units	<1	10.1		-	8.89	8.7	8.92	8.08	8.9	8.21	8.54	8.43	7.68	8.62	9.04	7.59	8.88	8.46	8.14	8.59	8.51	8.46
ANC @ pH 4	mol/kg	<0.03	2.77		-																		
ANC @ pH 6	mol/kg	<0.03	0.113		-																		
Nitrite as NO2 2:1 water soluble	mg/kg	<0.1	2.12		-					1.35				0.88							1.21		2.12
Ammoniacal N as NH4 in 2:1 extract BRE	g/l	<0.0003	0.157		-					0.0773				0.00262						0.0686		0.157	
Loss on ignition	%	<0.7	11.6		-																		
Sulphide, Easily liberated	mg/kg	<15	477		-					201				<15.000						156			26.8
Cyanide, Total	mg/kg	<1	1170	0	3658.023	<1.000	<1.000	<1.000	<1.000		289	1.47	155		<1.000	<1.000	<1.000	<1.000		2.24		56	
Cyanide, Free	mg/kg	<1	10		-	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000	<1.000		<1.000	<1.000	<1.000	<1.000		<1.000		<1.000	
Exchangeable Ammonia as NH4	mg/kg	<15	5150	23	207.850	<15.000	<15.000	<15.000	<15.000		<15.000	4330	257		517	1310	<15.000	<15.000		<15.000		137	
Cyanide, Complex	mg/kg	<1	1170		-	<1.000	<1.000	<1.000	<1.000		289	1.47	155		<1.000	<1.000	<1.000	<1.000		2.24		55.7	
Exchangeable Ammonia as N	mg/kg	<12	4000	0	-	<15.000	<15.000	<15.000	<15.000		<15.000	3370	200		402	1020	<15.000	<15.000		<15.000		107	
Cyanide, Complex (low level)	mg/kg	<0.5	2390		-					<0.500				<0.500					1.72		<0.500		17.8
Metals - (Solids)																							
Chromium, Hexavalent	mg/kg	<0.6	3		-	<0.600	<0.600	<0.600	<0.600	<0.600		<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600		<0.600
Boron, water soluble	mg/kg	<1	5.36		-	<1.000	<1.000	<1.000	<1.000	1.96	<1.000	<1.000	<1.000	<1.000	2.3	<1.000	<1.000	<1.000	<1.000	<1.000	1.29	2.69	<1.000
Arsenic	mg/kg	<0.6	268		N/A	<0.600	<0.600	1.33	7.13	30.9	4.51	6.51	4.98	16.4	7.24	11.1	15.4	3.97	18.9	15.3	3.38	8.09	13.7
Barium	mg/kg	<0.6	862		-	16.7	11.9	17.7	11	85.1	55.5	84.3	65.8	99.1	67.7	98.3	110	16.1	48	74.7	72.6	65.1	153
Beryllium	mg/kg	<0.01	2.85		-	0.0652	0.0208	0.036	0.438	0.637	0.716	0.964	0.774	0.644	0.723	0.821	0.739	0.194	0.589	0.872	0.582	1.17	0.655
Cadmium	mg/kg	<0.02	19.6		-	0.118	0.118	0.0959	0.185	0.247	0.335	0.392	0.357	0.398	0.28	1.24	0.363	0.0989	0.262	0.31	0.243	0.447	0.235
Chromium	mg/kg	<0.9	74		-	0.97	<0.900	<0.900	10	15	15	19.6	15.4	15.2	17.2	18.7	14.7	5.53	9.62	18.1	14.9	27.5	6.78
Copper	mg/kg	<1.4	648		-	<1.400	<1.400	1.42	3.31	137	5.08	8.21	5.02	17.7	20.5	6	63.5	2.25	14.8	32.8	8.01	16.4	15.6
Lead	mg/kg	<0.7	31000		-	<0.700	<0.700	<0.700	3.22	31.5	4.72	13.2	4.89	36.8	41.4	9.94	171	2.12	6.29	91.6	25.9	35.4	109
Mercury	mg/kg	<0.14	278		-	<0.140	<0.140	<0.140	<0.140	0.215	<0.140	<0.140	<0.140	<0.140	<0.140	<0.140	1.06	<0.140	<0.140	0.828	<0.140	<0.140	<0.140
Nickel	mg/kg	<0.2	135		N/A	1.44	1.46	8.72	14	18	17.4	20.9	17.2	28.4	16.6	22.8	21.1	7.72	22.4	19.9	17.4	24.2	35.6
Selenium	mg/kg	<1	46.4	0	N/A	<1.000	<1.000	<1.000	<1.000	1.36	<1.000	<1.000	<1.000	1.03	<1.000	<1.000	<1.000	1.14	2.94	<1.000	<1.000	<1.000	2.26
Vanadium	mg/kg	<0.2	119		-	1.98	1.16	2.22	30.3	18.6	19.1	23.4	19.1	39.4	23.8	30.9	32.4	11.6	35.8	34.3	22	39.4	28.5
Zinc	mg/kg	<1.9	3260		-	12.3	11.5	12.6	20.5	279	42.6	59.3	44.8	66.6	50.4	54	134	15.1	37	81.4	48.7	62.7	88
Metals - (Liquid)																							
Chromium, Trivalent	mg/kg	<0.9	74		-	0.97	<0.900	<0.900	10			19.6	15.4		17.2	18.7	14.7	5.53		18.1			
Calcium	mg/kg	<210	224000		-					176000				105000							139000		224000
Phenols																							
Phenol	mg/kg	<0.01	90.5		-	<0.010	<0.010	<0.010	<0.010	0.014	<0.010	0.0141	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0155
Cresols	mg/kg	<0.01	398		-	<0.010	<0.010	<0.010	<0.010	0.266	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0117	<0.010	<0.010	<0.010
Xylenols	mg/kg	<0.015	1150		-	<0.015	<0.015	<0.015	<0.015	0.168	<0.015	0.423	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
2,3,5-Trimethylphenol	mg/kg	<0.01	156		-	<0.010	<0.010	<0.010	<0.010		<0.010	0.31	<0.010		<0.010	<0.010	<0.010	<0.010		<0.010		<0.010	
2-Isopropylphenol	mg/kg	<0.015	792		-	<0.015	<0.015	<0.015	<0.015		<0.015	0.761	<0.015		<0.015	<0.015	<0.015	<0.015		<0.015		<0.015	
Phenols, Total Detected monohydric	mg/kg	<0.035	2.39		-					0.448				<0.035					<0.035		<0.035		<0.035
Phenols, Total Detected 5 speciated	mg/kg	<0.06	25																				

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH105	BH106	BH107	BH105	BH203C	TP102	TP105	BH105	VW201	TP106	BH103A	TP106	BH107	WS206	BH104	WS205	TP102	BH202
						9.20-	9.20-	8.20-	5.50-	2.20-2.30	2.20-	1.70-	2.40-	1.30-1.40	2.00-	2.00-	0.50-	3.90-	4.20-4.30	1.30-	2.30-2.40	1.80-	3.00-
Test	Units	LOD	Max	Count	L3 DWS	10/11/2015	13/11/2015	11/11/2015	09/11/2015	01/04/2019	06/11/2015	09/11/2015	10/11/2015	25/03/2019	10/11/2015	12/11/2015	10/11/2015	11/11/2015	05/04/2019	10/11/2015	05/04/2019	06/11/2015	27/03/2019
Benzene	mg/kg	<0.01	9.68		-	<0.010	<0.010	<0.010	<0.010		<0.010	0.0353	<0.010		<0.010	<0.010	<0.010	<0.010		<0.010		<0.010	
Toluene	mg/kg	<0.002	11.3		-	<0.002	<0.002	<0.002	<0.002		<0.002	<0.002	<0.002		<0.002	<0.002	<0.002	<0.002		<0.002		<0.002	
Ethylbenzene	mg/kg	<0.003	2.3		-	<0.003	<0.003	<0.003	<0.003		<0.003	0.00564	<0.003		<0.003	<0.003	<0.003	<0.003		<0.003		<0.003	
m,p-Xylene	mg/kg	<0.006	12.7		-	<0.006	<0.006	<0.006	<0.006		<0.006	0.0127	<0.006		<0.006	<0.006	<0.006	<0.006		<0.006		<0.006	
o-Xylene	mg/kg	<0.003	5.53		-	<0.003	<0.003	<0.003	<0.003		<0.003	0.0296	<0.003		<0.003	<0.003	<0.003	<0.003		<0.003		<0.003	
sum of detected mpo xylene by GC	mg/kg	<0.009	18.2		-	<0.009	<0.009	<0.009	<0.009		<0.009	0.0423	<0.009		<0.009	<0.009	<0.009	<0.009		<0.009		<0.009	
sum of detected BTEX by GC	mg/kg	<0.024	41.5		-	<0.024	<0.024	<0.024	<0.024		<0.024	0.0832	<0.024		<0.024	<0.024	<0.024	<0.024		<0.024		<0.024	
Aliphatics >C5-C6	mg/kg	<0.01	1.63		-	<0.010	<0.010	<0.010	<0.010	0.0252	<0.010	<0.010	<0.010	0.0141	<0.010	0.0685	<0.010	<0.010	1.09	<0.010	<0.010	0.0129	0.0248
Aliphatics >C6-C8	mg/kg	<0.01	9.89		-	<0.010	<0.010	<0.010	<0.010	0.0882	<0.010	<0.010	<0.010	0.479	<0.010	0.347	<0.010	<0.010	0.0992	<0.010	<0.010	0.0172	0.153
Aliphatics >C8-C10	mg/kg	<0.01	22.3		N/A	<0.010	<0.010	<0.010	<0.010	0.468	0.0111	0.0254	<0.010	0.0461	<0.010	0.893	<0.010	<0.010	0.139	<0.010	<0.010	0.0272	0.539
Aliphatics >C10-C12	mg/kg	<0.01	95.8		N/A	<0.010	<0.010	<0.010	<0.010	0.424	<0.010	0.0606	<0.010	0.0154	<0.010	1.06	<0.010	<0.010	0.145	<0.010	<0.010	0.0157	3.31
Aliphatics >C12-C16	mg/kg	<0.1	4990		-	<0.100	<0.100	<0.100	<0.100	0.174	0.664	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	1.36	<0.100	0.209	0.262	<0.100
Aliphatics >C16-C21	mg/kg	<0.1	5000		-	<0.100	<0.100	<0.100	<0.100		<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.528		<0.100		<0.100	
Aliphatics >C16-C35	mg/kg	<0.1	616		-					<0.100									<0.100		2.52		<0.100
Aliphatics >C21-C35	mg/kg	<0.1	5330		-	<0.100	<0.100	<0.100	<0.100		0.813	<0.100	2.25	<0.100	<0.100	<0.100	<0.100	4.14		<0.100		4.12	
Aliphatics >C35-C44	mg/kg	<0.1	2030		-	<0.100	<0.100	<0.100	0.345	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.776	0.352	<0.100	0.849	<0.100	<0.100
Total Aliphatics >C12-C44	mg/kg	<0.1	15700		-	<0.100	<0.100	<0.100	0.345	0.174	1.48	<0.100	2.25	<0.100	<0.100	<0.100	<0.100	5.44	2.18	<0.100	3.89	4.38	<0.100
Aromatics >EC5-EC7	mg/kg	<0.01	9.68		N/A	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0353	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0205	<0.010	<0.010	<0.010	<0.010
Aromatics >EC7-EC8	mg/kg	<0.01	<11.300		-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0616	<0.010	<0.010	<0.010	<0.010
Aromatics >EC8-EC10	mg/kg	<0.01	<35.400		5.57E+07	<0.010	<0.010	<0.010	<0.010	0.312	<0.010	0.0649	<0.010	0.0307	<0.010	0.596	<0.010	<0.010	0.0923	<0.010	<0.010	0.0186	0.36
Aromatics >EC10-EC12	mg/kg	<0.01	63.8		1.57E+06	<0.010	<0.010	<0.010	<0.010	0.283	<0.010	0.0409	<0.010	0.0102	<0.010	0.71	<0.010	<0.010	0.0975	<0.010	<0.010	0.01	2.21
Aromatics >EC12-EC16	mg/kg	<0.1	5800		N/A	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.525	<0.100	<0.100	<0.100	0.452	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	2.7
Aromatics >EC16-EC21	mg/kg	<0.1	6570		N/A	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.372	<0.100	0.253	<0.100	<0.100	0.74	1.29	<0.100	<0.100	<0.100
Aromatics >EC21-EC35	mg/kg	<0.1	9710		N/A	<0.100	<0.100	<0.100	<0.100	<0.100	0.626	1.34	1.58	2.95	2.49	<0.100	3.69	0.903	1.53	5.84	4.17	3.91	<0.100
Aromatics >EC35-EC44	mg/kg	<0.1	1510		-	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.525	<0.100	0.127	0.907	<0.100	2.47	1.63	1.21	0.875	<0.100
Aromatics >EC40-EC44	mg/kg	<0.1	574		-	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.725	<0.100	<0.100	0.35	<0.100	<0.100	<0.100	0.963	0.283	<0.100	<0.100	<0.100
Total Aromatics >EC12-EC44	mg/kg	<0.1	21200		-	<0.100	<0.100	<0.100	<0.100	<0.100	0.626	2.39	1.58	3.32	3.96	0.833	4.59	0.903	4.74	8.75	5.38	4.79	2.7
Total Aliphatics & Aromatics >C5-C44	mg/kg	<0.1	34600		-	<0.100	<0.100	<0.100	0.345	1.77	2.13	2.63	3.83	3.92	3.97	4.51	4.59	6.35	8.67	8.75	9.26	9.27	9.3
Polyaromatic Hydrocarbons (PAHs)																							
Coronene	mg/kg	<0.2	6.55		-																		
Naphthalene-d8 % recovery**	%		197		-	95.7	98.5	95.3	97.9	88.1	98.3	107	101	93.8	98.2	111	97.7	95.8	89.1	97.7	88.4	166	100
Acenaphthene-d10 % recovery**	%		195		-	99.7	95.4	92.2	93.7	84.4	95.1	103	101	92.1	96.2	109	103	92.5	79.7	95.4	87.8	159	97.8
Phenanthrene-d10 % recovery**	%		186		-	101	94.8	90.9	93.9	87	95.7	106	104	96.5	98.1	111	105	91.6	80.2	95.5			

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH105	BH106	BH107	BH105	BH203C	TP102	TP105	BH105	VW201	TP106	BH103A	TP106	BH107	WS206	BH104	WS205	TP102	BH202
						9.20-	9.20-	8.20-	5.50-	2.20-2.30	2.20-	1.70-	2.40-	1.30-1.40	2.00-	2.00-	0.50-	3.90-	4.20-4.30	1.30-	2.30-2.40	1.80-	3.00-
Test	Units	LOD	Max	Count	L3 DWS	10/11/2015	13/11/2015	11/11/2015	09/11/2015	01/04/2019	06/11/2015	09/11/2015	10/11/2015	25/03/2019	10/11/2015	12/11/2015	10/11/2015	11/11/2015	05/04/2019	10/11/2015	05/04/2019	06/11/2015	27/03/2019
bis(2-Chloroethyl)ether	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Azobenzene	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
4-Nitrophenol	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
4-Nitroaniline	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
4-Methylphenol	mg/kg	<0.1	341		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
4-Chlorophenylphenylether	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
4-Chloroaniline	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
4-Chloro-3-methylphenol	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
4-Bromophenylphenylether	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
3-Nitroaniline	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
2-Nitrophenol	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
2-Nitroaniline	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
2-Methylphenol	mg/kg	<0.1	304		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
1,2,4-Trichlorobenzene	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
2-Chlorophenol	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
2,6-Dinitrotoluene	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
2,4-Dinitrotoluene	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
2,4-Dimethylphenol	mg/kg	<0.1	922		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
2,4-Dichlorophenol	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
2,4,6-Trichlorophenol	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
2,4,5-Trichlorophenol	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
1,4-Dichlorobenzene	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
1,3-Dichlorobenzene	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
1,2-Dichlorobenzene	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
2-Chloronaphthalene	mg/kg	<0.1	5		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
2-Methylnaphthalene	mg/kg	<0.1	323		-				<0.100					<0.100	<0.100	<0.100						<0.100	0.515
Acenaphthylene	mg/kg	<0.1	277		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Acenaphthene	mg/kg	<0.1	105		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Anthracene	mg/kg	<0.1	258		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Benzo(a)anthracene	mg/kg	<0.1	260		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Benzo(b)fluoranthene	mg/kg	<0.1	175		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Benzo(k)fluoranthene	mg/kg	<0.1	172		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Benzo(a)pyrene	mg/kg	<0.1	232		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Benzo(g,h,i)perylene	mg/kg	<0.1	149		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Chrysene	mg/kg	<0.1	219		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Fluoranthene	mg/kg	<0.1	747		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Fluorene	mg/kg	<0.1	212		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	175		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Phenanthrene	mg/kg	<0.1	890		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Pyrene	mg/kg	<0.1	627		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Naphthalene	mg/kg	<0.1	1630		-				<0.100					<0.100	<0.100	<0.100						<0.100	1.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	26		-				<0.100					<0.100	<0.100	<0.100						<0.100	<0.100
Bis(2-chloroisopropyl) ether	mg/kg	<0.1	5		-									<0.100									<0.100
Volatile Organic Compounds (VOCs)																							
Dibromofluoromethane**	%		166		-				166					106	103	126						108	112
Toluene-d8**	%		104		-	104	104		97.8		101	96	103	102	97.7	103	101			102		90.5	100
4-Bromofluorobenzene**	%																						

<0.050	Concentration below the LOD
0.050	Concentration in exceedance of the GAC
0.050	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH105	BH106	BH107	BH105	BH203C	TP102	TP105	BH105	VW201	TP106	BH103A	TP106	BH107	WS206	BH104	WS205	TP102	BH202
						9.20-	9.20-	8.20-	5.50-	2.20-2.30	2.20-	1.70-	2.40-	1.30-1.40	2.00-	2.00-	0.50-	3.90-	4.20-4.30	1.30-	2.30-2.40	1.80-	3.00-
Test	Units	LOD	Max	Count	L3 DWS	10/11/2015	13/11/2015	11/11/2015	09/11/2015	01/04/2019	06/11/2015	09/11/2015	10/11/2015	25/03/2019	10/11/2015	12/11/2015	10/11/2015	11/11/2015	05/04/2019	10/11/2015	05/04/2019	06/11/2015	27/03/2019
cis-1,3-Dichloropropene	mg/kg	<0.01	2		-				<0.010					<0.100	<0.010	<0.010						<0.010	<0.100
Toluene	mg/kg	<0.007	40.2		-	<0.007	<0.007		0.0089	<0.070	<0.007	<0.007	<0.007	<0.070	<0.007	<0.007	<0.007		<0.070	<0.007	<0.070	<0.007	<0.070
trans-1,3-Dichloropropene	mg/kg	<0.01	2		-				<0.010					<0.100	<0.010	<0.010						<0.010	<0.100
1,1,2-Trichloroethane	mg/kg	<0.01	2		-				<0.010					<0.100	<0.010	<0.010						<0.010	<0.100
1,3-Dichloropropane	mg/kg	<0.007	1.4		-				<0.007					<0.070	<0.007	<0.007						<0.007	<0.070
Tetrachloroethene	mg/kg	<0.005	31.9	0	247.733				<0.005					1.8	<0.005	<0.005						<0.005	<0.050
Dibromochloromethane	mg/kg	<0.01	2		-				<0.010					<0.100	<0.010	<0.010						<0.010	<0.100
1,2-Dibromoethane	mg/kg	<0.01	2		-				<0.010					<0.100	<0.010	<0.010						<0.010	<0.100
Chlorobenzene	mg/kg	<0.005	1		-				<0.005					<0.050	<0.005	<0.005						<0.005	<0.050
1,1,1,2-Tetrachloroethane	mg/kg	<0.01	2		-				<0.010					<0.100	<0.010	<0.010						<0.010	<0.100
Ethylbenzene	mg/kg	<0.004	13.6		-	<0.004	<0.004		<0.004	<0.040	<0.004	<0.004	<0.004	<0.040	<0.004	<0.004	<0.004		<0.040	<0.004	<0.040	<0.004	0.169
p/m-Xylene	mg/kg	<0.01	88.5		-	<0.010	<0.010		<0.010	<0.100	<0.010	<0.010	<0.010	<0.100	<0.010	<0.010	<0.010		<0.100	<0.010	<0.100	<0.010	<0.100
o-Xylene	mg/kg	<0.01	40		-	<0.010	<0.010		<0.010	<0.100	<0.010	<0.010	<0.010	<0.100	<0.010	<0.010	<0.010		<0.100	<0.010	<0.100	<0.010	<0.100
Total Xylenes (calculated)	mg/kg		128.5		-	<0.020	<0.020	<0.000	<0.020	<0.200	<0.020	<0.020	<0.020	<0.200	<0.020	<0.020	<0.020	<0.020	<0.200	<0.020	<0.200	<0.020	<0.200
Styrene	mg/kg	<0.01	2		-				<0.010					<0.100	<0.010	<0.010						<0.010	<0.100
Bromoform	mg/kg	<0.01	2		-				<0.010					<0.100	<0.010	<0.010						<0.010	<0.100
Isopropylbenzene	mg/kg	<0.005	2.83		-				<0.005					<0.050	<0.005	<0.005						<0.005	<0.050
1,1,1,2,2-Tetrachloroethane	mg/kg	<0.01	2		-				<0.010					<0.100	<0.010	<0.010						<0.010	<0.100
1,2,3-Trichloropropane	mg/kg	<0.016	3.2		-				<0.016					<0.160	<0.016	<0.016						<0.016	<0.160
Bromobenzene	mg/kg	<0.01	2		-				<0.010					<0.100	<0.010	<0.010						<0.010	<0.100
Propylbenzene	mg/kg	<0.01	6.33		-				<0.010					<0.100	<0.010	<0.010						<0.010	<0.100
2-Chlorotoluene	mg/kg	<0.009	1.8		-				<0.009					<0.090	<0.009	<0.009						<0.009	<0.090
1,3,5-Trimethylbenzene	mg/kg	<0.008	29.4		-				<0.008					<0.080	<0.008	<0.008						<0.008	0.148
4-Chlorotoluene	mg/kg	<0.01	2		-				<0.010					<0.100	<0.010	<0.010						<0.010	<0.100
tert-Butylbenzene	mg/kg	<0.014	2.8		-				<0.014					<0.140	<0.014	<0.014						<0.014	<0.140
1,2,4-Trimethylbenzene	mg/kg	<0.009	88.4		-				<0.009					<0.090	<0.009	<0.009						<0.009	0.439
sec-Butylbenzene	mg/kg	<0.01	2		-				<0.010					<0.100	<0.010	<0.010						<0.010	<0.100
4-Isopropyltoluene	mg/kg	<0.01	2		-				<0.010					<0.100	<0.010	<0.010						<0.010	<0.100
1,3-Dichlorobenzene	mg/kg	<0.008	1.6		-				<0.008					<0.080	<0.008	<0.008						<0.008	<0.080
1,4-Dichlorobenzene	mg/kg	<0.005	1		-				<0.005					<0.050	<0.005	<0.005						<0.005	<0.050
n-Butylbenzene	mg/kg	<0.011	2.2		-				<0.011					<0.110	<0.011	<0.011						<0.011	<0.110
1,2-Dichlorobenzene	mg/kg	<0.01	2		-				<0.010					<0.100	<0.010	<0.010						<0.010	<0.100
1,2-Dibromo-3-chloropropane	mg/kg	<0.014	2.8		-				<0.014					<0.140	<0.014	<0.014						<0.014	<0.140
Tert-amyl methyl ether	mg/kg	<0.01	2		-				<0.010	<0.100				<0.100	<0.010	<0.010			<0.100		<0.100	<0.010	<0.100
1,2,4-Trichlorobenzene	mg/kg	<0.02	4		-				<0.020					<0.200	<0.020	<0.020						<0.020	<0.200
Hexachlorobutadiene	mg/kg	<0.02	4		-				<0.020					<0.200	<0.020	<0.020						<0.020	<0.200
Naphthalene	mg/kg	<0.013	699		-				<0.013					<0.130	<0.013	<0.013						<0.013	4.62
1,2,3-Trichlorobenzene	mg/kg	<0.02	4		-				<0.020					<0.200	<0.020	<0.020						<0.020	<0.200
Sum of Detected Xylenes	mg/kg	<0.2	0.2		-									<0.200									
Sum of BTEX	mg/kg	<0.4	0.4		-									<0.400									

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH201	BH101	BH204	BH204	BH107	TP102	WS203	BH201	VW203A	BH101	BH104	WS203	BH103A	BH106	BH105	BH104	BH102B	WS205
						5.10-5.20	8.20-	4.80-5.00	1.80-2.00	0.95-	0.90-	3.40-3.50	1.10-1.20	0.80-1.00	0.25-	4.40-	1.10-1.20	4.30-	1.70-	0.90-	1.90-	1.00-	0.50-0.60
Test	Units	LOD	Max	Count	L3 DWS	29/03/2019	05/11/2015	28/03/2019	28/03/2019	09/11/2015	06/11/2015	04/04/2019	25/03/2019	27/03/2019	03/11/2015	11/11/2015	26/03/2019	12/11/2015	13/11/2015	02/11/2015	11/11/2015	04/11/2015	27/03/2019
Sample Description																							
Colour	No units		-		-	Dark Brown	Beige	Light Brown	Dark Brown	Dark Brown	Light Brown	Dark Brown	Dark Brown	Dark Brown	Orange	Grey	Dark Brown	Light Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown
Description	No units		-		-	Silty Sand	Sandy Clay Loam	Sand	Silty Clay Loam	Sandy Silt Loam	Sandy Clay	Silty Clay Loam	Sandy Clay Loam	Loamy Sand	Sand	Sand	Sandy Loam	Stone/Soil	Silty Clay	Sandy Clay	Silty Clay Loam	Clay	Sandy Loam
Grain Size	No units		-		-	0.1 - 2 mm	-	-	-	0.1 - 2 mm	0.1 - 2 mm	-	-	-	0.1 - 2 mm	0.1 - 2 mm	-	2 - 10 mm	0.063 - 0.1 mm	0.1 - 2 mm	0.063 - 0.1 mm	<0.063 mm	-
Inclusion 1)	No units		-		-	Stones	Oil/Petroleum	Stones	Stones	Brick	Stones	None	Stones	Vegetation	Stones	Stones	Vegetation	Stones	Oil/Petroleum	Stones	Stones	Stones	Stones
Inclusion 2)	No units		-		-	None	Stones	None	None	N/A	None	None	None	Stones	N/A	None	Stones	N/A	Stones	Vegetation	Vegetation	None	Vegetation
Moisture Content Ratio (% of as received sample)	%		-		-	5.1	18	3.7	21	16	40	35	31	17	6.1	11	18	11	36	22	26	31	17
Asbestos																							
Asbestos Quantification - Gravimetric - %	%	<0.001	-		-									0.0348									
Date of Analysis	No units		-		-					16/11/2015			03/04/2019	04/04/2019	11/11/2015		02/04/2019			10/11/2015			05/04/2019
Analysed By	No units		-		-					Chris Swindells			Andrzej Ferfecki	Andrzej Ferfecki	Renata Hatos		Andrzej Ferfecki			Rebecca Rawlings			James Richards
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-		-									0.006									
Additional Asbestos Components (Using TM048)	No units		-		-									None									
Analysts Comments	No units		-		-								PCOM analysis showed fibres typical of Amphibole asbestos.										
Asbestos Quantification - Total - %	%	<0.001	-		-									0.0408									
Chrysotile (White) Asbestos	No units		-		-					Not Detected			Not Detected	Detected	Not Detected		Not Detected			Not Detected			Not Detected
Amosite (Brown) Asbestos	No units		-		-					Not Detected			Not Detected	Not Detected	Not Detected		Not Detected			Not Detected			Not Detected
Crocidolite (Blue) Asbestos	No units		-		-					Not Detected			Not Detected	Not Detected	Not Detected		Not Detected			Not Detected			Not Detected
Fibrous Anthophyllite	No units		-		-					Not Detected			Not Detected	Not Detected	Not Detected		Not Detected			Not Detected			Not Detected
Fibrous Tremolite	No units		-		-					Not Detected			Not Detected	Not Detected	Not Detected		Not Detected			Not Detected			Not Detected
Fibrous Actinolite	No units		-		-					Not Detected			Not Detected	Not Detected	Not Detected		Not Detected			Not Detected			Not Detected
Non-Asbestos Fibre	No units		-		-					Not Detected			Not Detected	Not Detected	Not Detected		Not Detected			Not Detected			Not Detected
Comments	No units		-		-					0				loose fibres in soil	0					0			
Carbon																							
Organic Carbon, Total	%	<0.2	-		-								1.88	0.746									
Fraction Organic Carbon (FOC)	No units	<0.002	-		-	<0.002		<0.002	0.00984			0.0086	0.0188	0.00746			0.0127						0.0464
Soil Organic Matter (SOM)	%	<0.35	-		-		<0.350			4.84	1.4				0.595	<0.350		<0.350	3.67	2.48	2.81	1.03	
Inorganics																							
Water Soluble Sulphate as SO4 2:1 Extract	g/l	<0.004	3.31		-		0.0511			0.182	1.53				0.175	0.0208		0.0579	1.47	0.131	0.133	1.38	
pH	pH Units	<1	10.1		-	8.23	8.96	8.6	8.14	7.85	7.8	9.22	8.4	7.66	10.1	8.64	7.44	8.17	8.56	8.01	8.22	8.21	7.77
ANC @ pH 4	mol/kg	<0.03	2.77		-								2.77	0.354									
ANC @ pH 6	mol/kg	<0.03	0.113		-								0.113	0.0306									
Nitrite as NO2, 2:1 water soluble	mg/kg	<0.1	2.12		-	<0.100						<0.100	0.54	0.5			0.35						
Ammoniacal N as NH4 in 2:1 extract BRE	g/l	<0.0003	0.157		-	0.00369						0.103	0.0016	0.00236			0.00317						
Loss on ignition	%	<0.7	11.6		-								7.72	2.53									
Sulphide, Easily liberated	mg/kg	<15	477		-	31.1						26.9	<15.000	<15.000			473						
Cyanide, Total	mg/kg	<1	1170	0	3658.023		<1.000			1.27	513				<1.000	<1.000		<1.000	<1.000	13.8	<1.000	1170	
Cyanide, Free	mg/kg	<1	10		-		<1.000			<1.000	<1.000				<1.000	<1.000		<1.000	<1.000	<1.000	<1.000	4.59	
Exchangeable Ammonia as NH4	mg/kg	<15	5150	23	207.850		67.9			29.4	39.1				<15.000	24.3		82	4260	<15.000	89	159	
Cyanide, Complex	mg/kg	<1	1170		-		<1.000			1.27	512				<1.000	<1.000		<1.000	<1.000	13.8	<1.000	1170	
Exchangeable Ammonia as N	mg/kg	<12	4000	0	-		52.8			22.9	30.4				<15.000	18.9		63.8	3310	<15.000	69.2	124	
Cyanide, Complex (low level)	mg/kg	<0.5	2390		-	<0.500		<0.500	<0.500			123	2.2	5.71			134						33.7
Metals - (Solids)																							
Chromium, Hexavalent	mg/kg	<0.6	3		-	<0.600	<3.000	<0.600	<0.600	<0.600		1.66	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600
Boron, water soluble	mg/kg	<1	5.36		-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.18	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	2.91	<1.000	2.17	1.09	<1.000
Arsenic	mg/kg	<0.6	268		N/A	26.2	12.6	9.51	3.82	16.6	6.01	33.1	27.5	15.8	24	4.07	18.8	4.12	20.9	12.4	6.12	4.34	27.8
Barium	mg/kg	<0.6	862		-	20.3	18.2	19.5	69.6	108	52.1	85.7	215	33	18.3	14.8.							

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH201	BH101	BH204	BH204	BH107	TP102	WS203	BH201	VW203A	BH101	BH104	WS203	BH103A	BH106	BH105	BH104	BH102B	WS205
						5.10-5.20	8.20-	4.80-5.00	1.80-2.00	0.95-	0.90-	3.40-3.50	1.10-1.20	0.80-1.00	0.25-	4.40-	1.10-1.20	4.30-	1.70-	0.90-	1.90-	1.00-	0.50-0.60
Test	Units	LOD	Max	Count	L3 DWS	29/03/2019	05/11/2015	28/03/2019	28/03/2019	09/11/2015	06/11/2015	04/04/2019	25/03/2019	27/03/2019	03/11/2015	11/11/2015	26/03/2019	12/11/2015	13/11/2015	02/11/2015	11/11/2015	04/11/2015	27/03/2019
Benzene	mg/kg	<0.01	9.68		-		0.282			<0.010	<0.010				<0.010	<0.010		<0.010	0.115	<0.010	<0.010	<0.010	
Toluene	mg/kg	<0.002	11.3		-		0.0303			0.00236	<0.002				<0.002	<0.002		<0.002	0.0377	<0.002	<0.002	<0.002	
Ethylbenzene	mg/kg	<0.003	2.3		-		0.11			<0.003	<0.003				<0.003	<0.003		<0.003	0.0251	<0.003	<0.003	<0.003	
m,p-Xylene	mg/kg	<0.006	12.7		-		0.203			<0.006	<0.006				<0.006	<0.006		<0.006	0.157	<0.006	<0.006	<0.006	
o-Xylene	mg/kg	<0.003	5.53		-		0.0992			<0.003	<0.003				<0.003	<0.003		<0.003	0.102	<0.003	<0.003	<0.003	
sum of detected mpo xylene by GC	mg/kg	<0.009	18.2		-		0.302			<0.009	<0.009				<0.009	<0.009		<0.009	0.259	<0.009	<0.009	<0.009	
sum of detected BTEX by GC	mg/kg	<0.024	41.5		-		0.724			<0.024	<0.024				<0.024	<0.024		<0.024	0.437	<0.024	<0.024	<0.024	
Aliphatics >C5-C6	mg/kg	<0.01	1.63		-	0.0137	<0.010	<0.010	<0.010	0.0106	0.0133	0.0231	0.0102	<0.010	<0.010	0.328	<0.010	0.342	0.0141	<0.010	0.586	<0.010	0.0288
Aliphatics >C6-C8	mg/kg	<0.01	9.89		-	0.0274	0.103	0.0374	0.0102	0.0189	0.0332	0.288	0.309	0.012	0.016	0.379	0.0146	0.418	0.0659	0.0116	0.807	0.0161	0.066
Aliphatics >C8-C10	mg/kg	<0.01	22.3		N/A	0.232	0.455	0.0311	<0.010	1.2	0.118	2.27	0.029	0.012	0.0373	0.669	0.022	0.593	0.334	0.0374	0.547	0.0409	0.212
Aliphatics >C10-C12	mg/kg	<0.01	95.8		N/A	0.247	0.8	0.0862	0.0114	0.53	0.0315	5.37	0.0102	0.0108	0.112	0.542	0.0232	0.65	0.675	<0.010	0.49	0.0701	0.344
Aliphatics >C12-C16	mg/kg	<0.1	4990		-	<0.100	0.171	4.54	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	1.31	<0.100	<0.100	<0.100	<0.100	0.568	0.425	<0.100	2.67
Aliphatics >C16-C21	mg/kg	<0.1	5000		-		<0.100			<0.100	<0.100		<0.100		3.48	2.72		3.55	<0.100	0.85	1.06	<0.100	
Aliphatics >C16-C35	mg/kg	<0.1	616		-	8.25		3.33	8.25			0.667		<0.100			3.46						22.8
Aliphatics >C21-C35	mg/kg	<0.1	5330		-		<0.100			<0.100	4.72		<0.100		4.89	18.1		19.2	8.34	5.22	4.48	1.1	
Aliphatics >C35-C44	mg/kg	<0.1	2030		-	0.726	<0.100	0.321	<0.100	<0.100	<0.100	1.05	<0.100	<0.100	0.674	6.73	1.11	6.09	0.664	<0.100	0.192	<0.100	2.17
Total Aliphatics >C12-C44	mg/kg	<0.1	15700		-	9.65	0.171	8.21	9.33	<0.100	4.72	1.94	<0.100	<0.100	10.4	27.5	4.57	28.8	9	6.64	6.15	1.1	27.6
Aromatics >EC5-EC7	mg/kg	<0.01	9.68		N/A	<0.010	0.282	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.115	<0.010	<0.010	<0.010	0.0432
Aromatics >EC7-EC8	mg/kg	<0.01	<11.300		-	<0.010	0.0303	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0377	<0.010	<0.010	<0.010	<0.010
Aromatics >EC8-EC10	mg/kg	<0.01	<35.400		5.57E+07	0.155	0.716	0.0208	<0.010	0.801	0.0797	1.51	0.0189	<0.010	0.0256	0.446	0.0146	0.396	0.507	0.0245	0.365	0.0277	0.142
Aromatics >EC10-EC12	mg/kg	<0.01	63.8		1.57E+06	0.165	0.534	0.0571	<0.010	0.353	0.0216	3.58	<0.010	<0.010	0.0746	0.362	0.0159	0.433	0.451	<0.010	0.327	0.0467	0.229
Aromatics >EC12-EC16	mg/kg	<0.1	5800		N/A	<0.100	2.57	0.12	<0.100	0.261	1.58	7.01	0.486	<0.100	1.18	<0.100	0.908	<0.100	5.9	0.952	2.22	2.89	1.73
Aromatics >EC16-EC21	mg/kg	<0.1	6570		N/A	<0.100	2.92	0.876	<0.100	2.76	1.98	0.691	5.66	6.92	3.37	<0.100	2.9	<0.100	1.23	5.51	14.1	16.3	6.36
Aromatics >EC21-EC35	mg/kg	<0.1	9710		N/A	<0.100	2.28	3.1	6.6	13	16.1	<0.100	17.4	18	12.4	0.536	12.3	1.29	18.2	21.7	29.7	40.6	32.3
Aromatics >EC35-EC44	mg/kg	<0.1	1510		-	<0.100	<0.100	0.418	3.26	3.72	2.2	5.5	5	4.1	3.54	0.997	11.4	<0.100	3.58	7.7	7.81	10.1	7.44
Aromatics >EC40-EC44	mg/kg	<0.1	574		-	<0.100	<0.100	0.105	1.43	1.44	0.39	3.3	1.86	1.13	1.3	0.61	5.03	<0.100	1.11	3.13	2.93	3.41	1.73
Total Aromatics >EC12-EC44	mg/kg	<0.1	21200		-	<0.100	7.78	4.51	9.86	19.7	21.8	13.2	28.5	29.1	20.4	1.53	27.4	1.29	28.9	35.9	53.9	69.9	47.8
Total Aliphatics & Aromatics >C5-C44	mg/kg	<0.1	34600		-	10.5	10.9	13	19.2	22.6	26.8	28.2	28.9	29.1	31.1	31.8	32.1	33	40.1	42.6	63.1	71.2	76.5
Polyaromatic Hydrocarbons (PAHs)																							
Coronene	mg/kg	<0.2	6.55		-								<0.200	<0.200									
Naphthalene-d8 % recovery**	%		197		-	100	83.5	101	99.6	96.4	110	98.6	96.7	95.9	83.7	101	99.2	105	90	101	116	110	98.3
Acenaphthene-d10 % recovery**	%		195		-	92.6	85.6	93.3	94.3	97.8	106	90.3	94.2	96.2	82.9	97.4	94.4	104	83.8	100	116	96.3	94.2
Phenanthrene-d10 % recovery**	%		186		-	98.6	87	96.5	103	99.5	106	93.9	100	101	82.8	99.9	102	106	81.9	100	115	88.4	98.2
Chrysene-d12 % recovery**	%		170		-	92	77.8	88.7	95.4	104	99.2	97.3	86.6	94.8	80.3	98.5	101	110	74.3	92.9	116	66.4	85.3
Perylene-d12 % recovery**	%		177		-	87.9	85.6	89.1	92.4	109	99.8	101	84.2	93.9	85.9	95.9	94.3	113					

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH201	BH101	BH204	BH204	BH107	TP102	WS203	BH201	VW203A	BH101	BH104	WS203	BH103A	BH106	BH105	BH104	BH102B	WS205
						5.10-5.20	8.20-	4.80-5.00	1.80-2.00	0.95-	0.90-	3.40-3.50	1.10-1.20	0.80-1.00	0.25-	4.40-	1.10-1.20	4.30-	1.70-	0.90-	1.90-	1.00-	0.50-0.60
Test	Units	LOD	Max	Count	L3 DWS	29/03/2019	05/11/2015	28/03/2019	28/03/2019	09/11/2015	06/11/2015	04/04/2019	25/03/2019	27/03/2019	03/11/2015	11/11/2015	26/03/2019	12/11/2015	13/11/2015	02/11/2015	11/11/2015	04/11/2015	27/03/2019
bis(2-Chloroethyl)ether	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
Azobenzene	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
4-Nitrophenol	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
4-Nitroaniline	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
4-Methylphenol	mg/kg	<0.1	341		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
4-Chlorophenylphenylether	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
4-Chloroaniline	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
4-Chloro-3-methylphenol	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
4-Bromophenylphenylether	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
3-Nitroaniline	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
2-Nitrophenol	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
2-Nitroaniline	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
2-Methylphenol	mg/kg	<0.1	304		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
1,2,4-Trichlorobenzene	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
2-Chlorophenol	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
2,6-Dinitrotoluene	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
2,4-Dinitrotoluene	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
2,4-Dimethylphenol	mg/kg	<0.1	922		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
2,4-Dichlorophenol	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
2,4,6-Trichlorophenol	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
2,4,5-Trichlorophenol	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
1,4-Dichlorobenzene	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
1,3-Dichlorobenzene	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
1,2-Dichlorobenzene	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
2-Chloronaphthalene	mg/kg	<0.1	5		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
2-Methylnaphthalene	mg/kg	<0.1	323		-		0.499					0.997	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
Acenaphthylene	mg/kg	<0.1	277		-		<0.100					0.156	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
Acenaphthene	mg/kg	<0.1	105		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
Anthracene	mg/kg	<0.1	258		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	0.19	<0.100
Benzo(a)anthracene	mg/kg	<0.1	260		-		<0.100					<0.100	0.276					<0.100		<0.100	<0.100	0.467	0.155
Benzo(b)fluoranthene	mg/kg	<0.1	175		-		<0.100					<0.100	0.435					<0.100		<0.100	<0.100	0.409	0.282
Benzo(k)fluoranthene	mg/kg	<0.1	172		-		<0.100					<0.100	0.145					<0.100		<0.100	<0.100	0.336	<0.100
Benzo(a)pyrene	mg/kg	<0.1	232		-		<0.100					<0.100	0.334					<0.100		0.129	<0.100	0.496	0.157
Benzo(g,h,i)perylene	mg/kg	<0.1	149		-		<0.100					<0.100	0.29					<0.100		<0.100	<0.100	0.277	0.135
Chrysene	mg/kg	<0.1	219		-		<0.100					<0.100	0.232					<0.100		0.129	<0.100	0.511	0.139
Fluoranthene	mg/kg	<0.1	747		-		<0.100					<0.100	0.406					<0.100		0.232	<0.100	1.04	0.264
Fluorene	mg/kg	<0.1	212		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	175		-		<0.100					<0.100	0.319					<0.100		<0.100	<0.100	0.336	0.197
Phenanthrene	mg/kg	<0.1	890		-		0.211					<0.100	0.189					<0.100		0.168	<0.100	0.336	<0.100
Pyrene	mg/kg	<0.1	627		-		<0.100					<0.100	0.435					<0.100		0.206	<0.100	0.905	0.237
Naphthalene	mg/kg	<0.1	1630		-		0.867					1.22	<0.100					<0.100		<0.100	<0.100	0.204	<0.100
Dibenzo(a,h)anthracene	mg/kg	<0.1	26		-		<0.100					<0.100	<0.100					<0.100		<0.100	<0.100	<0.100	<0.100
Bis(2-chloroisopropyl) ether	mg/kg	<0.1	5		-							<0.100	<0.100										<0.100
Volatile Organic Compounds (VOCs)																							
Dibromofluoromethane**	%		166		-		111					123	119	108				122		141	118	110	109
Toluene-d8**	%		104		-		101			94.6	99.8	98.2	102	99.7		101		104	98.9	99.3	102	97.3	99.4
4-Bromofluorobenzene**	%		102		-		91.3					102	99.9	98.3				91		97.9	75.8	85.2	96.7
Dichlorodifluoromethane	mg/kg	<0.006	1.2		-		<0.006					<0.060	<0.060					<0.006		<0.006	<0.006	<0.006	<0.060
Chloromethane	mg/kg	<0.007	1.4		-		<0.007					<0.070	<0.070					<0.007		<0.007	<0.007	<0.007	<0.070
Vinyl Chloride	mg/kg	<0.006	1.2	2	0.362		<0.006					<0.060	<0.060					<0.006		<0.006	<0.006	<0.006	<0.060
Bromomethane	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
Chloroethane	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
Trichlorofluoromethane	mg/kg	<0.006	1.2		-		<0.006					<0.060	<0.060					<0.006		<0.006	<0.006	<0.006	<0.060
1,1-Dichloroethene	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
Carbon Disulphide	mg/kg	<0.007	4.67		-		<0.007					<0.070	<0.070					0.0107		<0.007	<0.007	0.0112	<0.070
Dichloromethane	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
Methyl Tertiary Butyl Ether	mg/kg	<0.01	2		-	<0.100	<0.010	<0.100	<0.100			<0.100	<0.100	<0.100			<0.100	<0.010		<0.010	<0.010	<0.010	<0.100
trans-1,2-Dichloroethene	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
1,1-Dichloroethane	mg/kg	<0.008	1.6		-		<0.008					<0.080	<0.080					<0.008		<0.008	<0.008	<0.008	<0.080
cis-1,2-Dichloroethene	mg/kg	<0.006	1.2	0	124.249		<0.006					<0.060	<0.060					<0.006		<0.006	<0.006	<0.006	<0.060
2,2-Dichloropropane	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
Bromochloromethane	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH201	BH101	BH204	BH204	BH107	TP102	WS203	BH201	VW203A	BH101	BH104	WS203	BH103A	BH106	BH105	BH104	BH102B	WS205
						5.10-5.20	8.20-	4.80-5.00	1.80-2.00	0.95-	0.90-	3.40-3.50	1.10-1.20	0.80-1.00	0.25-	4.40-	1.10-1.20	4.30-	1.70-	0.90-	1.90-	1.00-	0.50-0.60
Test	Units	LOD	Max	Count	L3 DWS	29/03/2019	05/11/2015	28/03/2019	28/03/2019	09/11/2015	06/11/2015	04/04/2019	25/03/2019	27/03/2019	03/11/2015	11/11/2015	26/03/2019	12/11/2015	13/11/2015	02/11/2015	11/11/2015	04/11/2015	27/03/2019
cis-1,3-Dichloropropene	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
Toluene	mg/kg	<0.007	40.2		-	<0.070	0.0289	<0.070	<0.070	<0.007	0.0242	<0.070	<0.070	<0.070		<0.007	<0.070	<0.007	0.0214	<0.007	<0.007	<0.007	<0.070
trans-1,3-Dichloropropene	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
1,1,2-Trichloroethane	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
1,3-Dichloropropane	mg/kg	<0.007	1.4		-		<0.007					<0.070	<0.070					<0.007		<0.007	<0.007	<0.007	<0.070
Tetrachloroethene	mg/kg	<0.005	31.9	0	247.733		<0.005					<0.050	1.14					<0.005		0.323	<0.005	<0.005	<0.050
Dibromochloromethane	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
1,2-Dibromoethane	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
Chlorobenzene	mg/kg	<0.005	1		-		<0.005					<0.050	<0.050					<0.005		<0.005	<0.005	<0.005	<0.050
1,1,1,2-Tetrachloroethane	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
Ethylbenzene	mg/kg	<0.004	13.6		-	<0.040	0.0709	<0.040	<0.040	<0.004	<0.004	<0.040	<0.040	<0.040		<0.004	<0.040	<0.004	0.00945	<0.004	<0.004	<0.004	<0.040
p/m-Xylene	mg/kg	<0.01	88.5		-	<0.100	0.117	<0.100	<0.100	<0.010	<0.010	0.211	<0.100	<0.100		<0.010	<0.100	<0.010	0.0483	<0.010	<0.010	<0.010	<0.100
o-Xylene	mg/kg	<0.01	40		-	<0.100	0.0398	<0.100	<0.100	<0.010	<0.010	<0.100	<0.100	<0.100		<0.010	<0.100	<0.010	0.0289	<0.010	<0.010	<0.010	<0.100
Total Xylenes (calculated)	mg/kg		128.5		-	<0.200	<0.157	<0.200	<0.200	<0.020	<0.020	<0.311	<0.200	<0.200		<0.020	<0.200	<0.020	<0.077	<0.020	<0.020	<0.020	<0.200
Styrene	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
Bromoform	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
Isopropylbenzene	mg/kg	<0.005	2.83		-		<0.005					<0.050	<0.050					<0.005		<0.005	<0.005	<0.005	<0.050
1,1,2,2-Tetrachloroethane	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
1,2,3-Trichloropropane	mg/kg	<0.016	3.2		-		<0.016					<0.160	<0.160					<0.016		<0.016	<0.016	<0.016	<0.160
Bromobenzene	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
Propylbenzene	mg/kg	<0.01	6.33		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
2-Chlorotoluene	mg/kg	<0.009	1.8		-		<0.009					<0.090	<0.090					<0.009		<0.009	<0.009	<0.009	<0.090
1,3,5-Trimethylbenzene	mg/kg	<0.008	29.4		-		0.0189					0.204	<0.080					<0.008		<0.008	<0.008	<0.008	<0.080
4-Chlorotoluene	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
tert-Butylbenzene	mg/kg	<0.014	2.8		-		<0.014					<0.140	<0.140					<0.014		<0.014	<0.014	<0.014	<0.140
1,2,4-Trimethylbenzene	mg/kg	<0.009	88.4		-		0.071					0.654	<0.090					<0.009		<0.009	<0.009	<0.009	<0.090
sec-Butylbenzene	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
4-Isopropyltoluene	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
1,3-Dichlorobenzene	mg/kg	<0.008	1.6		-		<0.008					<0.080	<0.080					<0.008		<0.008	<0.008	<0.008	<0.080
1,4-Dichlorobenzene	mg/kg	<0.005	1		-		<0.005					<0.050	<0.050					<0.005		<0.005	<0.005	<0.005	<0.050
n-Butylbenzene	mg/kg	<0.011	2.2		-		<0.011					<0.110	<0.110					<0.011		<0.011	<0.011	<0.011	<0.110
1,2-Dichlorobenzene	mg/kg	<0.01	2		-		<0.010					<0.100	<0.100					<0.010		<0.010	<0.010	<0.010	<0.100
1,2-Dibromo-3-chloropropane	mg/kg	<0.014	2.8		-		<0.014					<0.140	<0.140					<0.014		<0.014	<0.014	<0.014	<0.140
Tert-amyl methyl ether	mg/kg	<0.01	2		-	<0.100	<0.010	<0.100	<0.100			<0.100	<0.100	<0.100			<0.100	<0.010		<0.010	<0.010	<0.010	<0.100
1,2,4-Trichlorobenzene	mg/kg	<0.02	4		-		<0.020					<0.200	<0.200					<0.020		<0.020	<0.020	<0.020	<0.200
Hexachlorobutadiene	mg/kg	<0.02	4		-		<0.020					<0.200	<0.200					<0.020		<0.020	<0.020	<0.020	<0.200
Naphthalene	mg/kg	<0.013	699		-		1.51					7.87	<0.130					<0.013		<0.013	<0.013	<0.013	<0.130
1,2,3-Trichlorobenzene	mg/kg	<0.02	4		-		<0.020					<0.200	<0.200					<0.020		<0.020	<0.020	<0.020	<0.200
Sum of Detected Xylenes	mg/kg	<0.2	0.2		-								<0.200										
Sum of BTEX	mg/kg	<0.4	0.4		-								<0.400										

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH106	BH204	TP104	BH203C	VP201	HP102	TT102	WS204	TP104	VW202	BH105	BH101	BH102	BH106	BH103A	BH104	WS204	BH107
						3.60-	0.60-0.70	2.00-	3.50-3.60	0.30-0.40	1.20-	0.70-	2.50-2.60	1.10-	0.40-0.50	0.25-	3.50-	0.80-	1.10-	0.40-	0.40-	1.05-1.10	0.35-
Test	Units	LOD	Max	Count	L3 DWS	13/11/2015	27/03/2019	10/11/2015	01/04/2019	25/03/2019	04/11/2015	05/11/2015	04/04/2019	10/11/2015	26/03/2019	02/11/2015	04/11/2015	02/11/2015	10/11/2015	10/11/2015	10/11/2015	27/03/2019	09/11/2015
Sample Description																							
Colour	No units		-		-	Dark Brown	Dark Brown	Black	Dark Brown	Dark Brown	Beige	Black	Dark Brown	Beige	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Yellow	Dark Brown	Dark Brown	Dark Brown	Dark Brown
Description	No units		-		-	Silty Clay	Sandy Loam	Silty Clay Loam	Sandy Loam	Loamy Sand	Sandy Clay Loam	Sandy Silt Loam	Loamy Sand	Sand	Sandy Loam	Loamy Sand	Sand	Sandy Clay Loam	Stone/Soil	Loamy Sand	Sand	Loamy Sand	Sandy Loam
Grain Size	No units		-		-	0.063 - 0.1 mm	-	<0.063 mm	-	-	0.1 - 2 mm	0.1 - 2 mm	-	0.1 - 2 mm	-	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	2 - 10 mm	0.1 - 2 mm	0.1 - 2 mm	-	0.1 - 2 mm
Inclusion 1)	No units		-		-	Oil/Petroleum	Vegetation	Stones	Stones	Vegetation	Brick	Brick	Stones	Stones	Vegetation	Vegetation	Stones	Stones	Stones	Brick	Crushed Brick	None	Stones
Inclusion 2)	No units		-		-	N/A	Stones	N/A	Vegetation	Stones	Stones	Stones	Brick	None	Stones	Stones	Oil/Petroleum	Vegetation	N/A	Stones	Stones	None	Vegetation
Moisture Content Ratio (% of as received sample)	%		-		-	45	9.7	42	29	17	12	21	14	17	16	17	13	25	11	25	22	13	18
Asbestos																							
Asbestos Quantification - Gravimetric - %	%	<0.001	-		-					<0.001		0.0012					0.0076		0.0015	0.0026			
Date of Analysis	No units		-		-		04/04/2019			03/04/2019	12/11/2015	11/11/2015	10/04/2019		02/04/2019	10/11/2015		10/11/2015		17/11/2015	17/11/2015	04/04/2019	16/11/2015
Analysed By	No units		-		-		Andrzej Ferfecki			Andrzej Ferfecki	Simon Postlewhite	Kevin Hughes	Lucy Caroe		Andrzej Ferfecki	Rebecca Rawlings		Simon Postlewhite		Simon Postlewhite	Simon Postlewhite	Andrzej Ferfecki	Chris Swindells
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-		-					<0.001		<0.001					0.0011		<0.001	<0.001			
Additional Asbestos Components (Using TMO48)	No units		-		-					None		Amosite						None		None	None		
Analysts Comments	No units		-		-					N/C		Loose fibres in soil						N/C		N/C	N/C		
Asbestos Quantification - Total - %	%	<0.001	-		-					<0.001		0.0012					0.0087		0.0015	0.0026			
Chrysotile (White) Asbestos	No units		-		-		Not Detected			Detected	Not Detected	Not Detected	Detected		Not Detected	Not Detected		Detected		Detected	Detected	Not Detected	Not Detected
Amosite (Brown) Asbestos	No units		-		-		Not Detected			Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected		Not Detected		Not Detected	Not Detected	Not Detected	Not Detected
Crocidolite (Blue) Asbestos	No units		-		-		Not Detected			Not Detected	Not Detected	Detected	Not Detected		Not Detected	Not Detected		Not Detected		Not Detected	Not Detected	Not Detected	Not Detected
Fibrous Anthophyllite	No units		-		-		Not Detected			Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected		Not Detected		Not Detected	Not Detected	Not Detected	Not Detected
Fibrous Tremolite	No units		-		-		Not Detected			Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected		Not Detected		Not Detected	Not Detected	Not Detected	Not Detected
Fibrous Actinolite	No units		-		-		Not Detected			Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected		Not Detected		Not Detected	Not Detected	Not Detected	Not Detected
Non-Asbestos Fibre	No units		-		-		Not Detected			Not Detected	Not Detected	Not Detected	Not Detected		Not Detected	Not Detected		Not Detected		Not Detected	Not Detected	Not Detected	Not Detected
Comments	No units		-		-					loose fibres in soil	0	Loose fibres in soil	Loose fibres in soil			0		Loose fibres in soil		Loose fibres in soil	Loose fibres in soil		0
Carbon																							
Organic Carbon, Total	%	<0.2	-		-		4.82								9.92								
Fraction Organic Carbon (FOC)	No units	<0.002	-		-		0.0482		0.0509	0.0416			0.0615		0.0992							0.0678	
Soil Organic Matter (SOM)	%	<0.35	-		-	6.59		7.84			4.19	12.1		0.848		11.3	1.14	35	0.547	32.6	21.7		14.6
Inorganics																							
Water Soluble Sulphate as SO4 2:1 Extract	g/l	<0.004	3.31		-	3.31		3.17			1.31	1.05		1.67		0.106	0.0188	1.33	1.57	1.52	0.0211		0.581
pH	pH Units	<1	10.1		-	8.23		8.06	8.19	7.7	7.63	8.61	7.22	8.82	8.39	7.96	8.63	8.02	7.96	7.97	7.8	7.61	7.86
ANC @ pH 4	mol/kg	<0.03	2.77		-		0.273								0.597								
ANC @ pH 6	mol/kg	<0.03	0.113		-		0.0789								0.0497								
Nitrite as NO2 2:1 water soluble	mg/kg	<0.1	2.12		-		0.62								0.45								
Ammoniacal N as NH4 in 2:1 extract BRE	g/l	<0.0003	0.157		-		0.00185								0.0027								
Loss on ignition	%	<0.7	11.6		-		4.44								5.28								
Sulphide, Easily liberated	mg/kg	<15	477		-		<15.000								<15.000								
Cyanide, Total	mg/kg	<1	1170	0	3658.023	<1.000		2.35			<1.000	137		5.09		67.5	3.67	116	<1.000	129	31.5		47.7
Cyanide, Free	mg/kg	<1	10		-	<1.000		<1.000			<1.000	<2.000		<1.000		4.51	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000
Exchangeable Ammonia as NH4	mg/kg	<15	5150	23	207.850	5150		4320			<15.000	22.6		1010		<15.000	<15.000	<15.000	256	<15.000	<15.000		<15.000
Cyanide, Complex	mg/kg	<1	1170		-	<1.000		2.11			<1.000	136		5.09		63	3.61	115	<1.000	129	31.5		47.5
Exchangeable Ammonia as N	mg/kg	<12	4000	0		4000		3360			<15.000	<15.000		782		<15.000	<15.000	<15.000	199	<15.000	<15.000		<15.000
Cyanide, Complex (low level)	mg/kg	<0.5	2390		-		83.7		13.1	108			312		16.6							2390	
Metals - (Solids)																							
Chromium, Hexavalent	mg/kg	<0.6	3		-	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600		0.726	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600
Boron, water soluble	mg/kg	<1	5.36		-	1	<1.000	5.36	3.51	<1.000	2.23	1.01	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.29	1.23
Arsenic	mg/kg	<0.6	268		N/A	5.19	19.2	116	18.8	117	20	28.5	21.4	67.2	31.6	48.5	16.4	94.7	225	50.2	91.4	94	50.1
Barium	mg/kg	<0.6	862		-	51.6	129	94.7	83	452	139	138	76	41.1	123	180	22.9	183	17.2	277	215	309	268
Beryllium	mg/kg	<0.01	2.85		-	0.556	0.928	0.938	0.517	0.525	1.6	0.988	0.43	0.553	0.765	1.17	0.596	0.874	0.118	1.79	1.63	1.72	1.46
Cadmium	mg/kg	<0.02	19.6		-	0.554	0.299	1.09	0.258	0.951	0.511	0.425	0.348	0.422	0.327	0.685	0.343	1.07	0.17	0.796	0.76	19.6	0.814
Chromium	mg/kg	<0.9	74		-	12.1	11.7	27.4	5.55	15.8	16.8	13.5	1.66	13.8	5.27	36	13.3	30.6	11.9	16.4	20.4	2.21	29
Copper	mg/kg	<1.4	648		-	7.29	42.4	51.2	86.5	51.3	54.9	45.4	26.4	9.33	51.2	95.2	4.29	191	5.6	128	152	64.9	174
Lead	mg/kg	<0.7	31000		-	3.69	205	107	50.7	380	180	304	145	28.4	653	462	19.8	468	7.87	4240	744	19700	851
Mercury	mg/kg	<0.14	278		-	<0.140	0.516	1.9	0.488	<0.140	1.11	0.933	0.341	<0.140	0.863	0.963	<0.140	2.33	<0.140	7.1	1.35	278	1.89
Nickel	mg/kg	<0.2	135		N/A	19.3	21.5	46.6	11.7	28.6	25.7	24	13.2	12.9	22.7	55.1	16	43.5	8.18	32.6	35.2	35.8	37.1
Selenium	mg/kg	<1	46.4	0	N/A	4.23	<1.000	1.15	2.46	<1.000	<1.000	<1.000	<1.000	<1.000	1.48	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	8.24	<1.000
Vanadium	mg/kg	<0.2	119		-	14	22.7	39.3	19.4	35.2	36	30.9	15.3	26.8	26.7	119	29.2	38.1	12.5	39.9	47.6	37.4	48.8
Zinc	mg/kg	<1.9	3260		-	43.8	390	199	93	1230	144	78.7	149	37.4	90.7	114	42.3	461	17.1	324	234	1150	222
Metals - (Liquid)																							
Chromium, Trivalent	mg/kg	<0.9	74		-	12.1		27.4			16.8			13.8		36	13.3	30.6	11.9	16.4	20.4		29
Calcium	mg/kg	<210	224000		-		78500								51700								
Phenols																							
Phenol	mg/kg	<0.01	90.5		-	0.344	<0.010	0.0865	<0.010	<0.010	<0.010	0.165	0.058	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cresols	mg/kg	<0.01	398		-	86.8	<0.010	1.12	0.672	<0.010	<0.010	0.686	0.151	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0115	0.0244
Xylenols	mg/kg	<0.015	1150		-	79.2	<0.015	6.4	1.48	<0.015	<0.015	0.762	0.244	0.024	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.061
2,3,5-Trimethylphenol	mg/kg	<0.01	156		-	<0.100		<0.010			<0.010	0.152		<0.010		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010		<0.010
2-Isopropylphenol	mg/kg	<0.015	792		-	24.6		7.32			<0.015	0.254		0.024		<0.015	<0.015	<0.015	<				

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH106	BH204	TP104	BH203C	VP201	HP102	TT102	WS204	TP104	VW202	BH105	BH101	BH102	BH106	BH103A	BH104	WS204	BH107	
						3.60-	0.60-0.70	2.00-	3.50-3.60	0.30-0.40	1.20-	0.70-	2.50-2.60	1.10-	0.40-0.50	0.25-	3.50-	0.80-	1.10-	0.40-	0.40-	1.05-1.10	0.35-	
Test	Units	LOD	Max	Count	L3 DWS	13/11/2015	27/03/2019	10/11/2015	01/04/2019	25/03/2019	04/11/2015	05/11/2015	04/04/2019	10/11/2015	26/03/2019	02/11/2015	04/11/2015	02/11/2015	10/11/2015	10/11/2015	10/11/2015	27/03/2019	09/11/2015	
Benzene	mg/kg	<0.01	9.68		-	0.878		0.33			<0.010	0.0279		<0.010		<0.010	<0.010	<0.010	<0.010	<0.010	0.0293	<0.010	<0.010	
Toluene	mg/kg	<0.002	11.3		-	0.335		0.0138			0.00678	0.00762		0.0024		0.0048	<0.002	0.00792	<0.002	0.016	0.00258		0.0146	
Ethylbenzene	mg/kg	<0.003	2.3		-	0.0869		0.138			<0.003	0.0102		<0.003		<0.003	0.0955	<0.003	<0.003	<0.003	0.00532	<0.003	<0.003	
m,p-Xylene	mg/kg	<0.006	12.7		-	0.393		0.368			<0.006	0.014		<0.006		<0.006	<0.006	<0.006	<0.006	<0.006	0.0253	<0.006	<0.006	
o-Xylene	mg/kg	<0.003	5.53		-	0.241		0.434			<0.003	0.00889		<0.003		<0.003	<0.003	<0.003	<0.003	<0.003	0.0226	<0.003	0.00366	
sum of detected mpo xylene by GC	mg/kg	<0.009	18.2		-	0.634		0.802			<0.009	0.0229		<0.009		<0.009	<0.009	<0.009	<0.009	<0.009	0.0479	<0.009	<0.009	
sum of detected BTEX by GC	mg/kg	<0.024	41.5		-	1.93		1.28			<0.024	0.0686		<0.024		<0.024	0.0955	<0.024	<0.024	<0.024	0.0985	<0.024	<0.024	
Aliphatics >C5-C6	mg/kg	<0.01	1.63		-	0.0272	<0.010	0.0311	0.0322	0.0288	<0.010	0.0178	0.0209	<0.010	<0.010	<0.010	0.0426	0.0119	<0.010	<0.010	0.0279	<0.010	0.0127	0.0268
Aliphatics >C6-C8	mg/kg	<0.01	9.89		-	0.272	0.0255	0.13	0.475	4.97	<0.010	0.0787	0.117	<0.010	0.036	0.0216	1.15	0.029	<0.010	0.165	0.0168	0.0495	0.0622	
Aliphatics >C8-C10	mg/kg	<0.01	22.3		N/A	0.252	0.0278	0.981	5.35	0.304	<0.010	0.166	0.198	<0.010	0.118	0.0684	3.64	0.0185	0.0181	0.335	0.0671	0.458	7.72	
Aliphatics >C10-C12	mg/kg	<0.01	95.8		N/A	0.378	0.03	1.36	2.37	0.066	<0.010	0.385	0.289	0.012	0.09	<0.010	4.59	0.125	0.0497	0.108	0.0735	2.61	2.65	
Aliphatics >C12-C16	mg/kg	<0.1	4990		-	<0.100	1.03	<0.100	0.969	1.26	<0.100	3	<0.100	3.97	3.5	1.2	51.6	34	1.35	3	6.38	25.9	8.11	
Aliphatics >C16-C21	mg/kg	<0.1	5000		-	1.44		3.19		8.52	4.1	4.98		101		10.1	173	84.7	0.609	15.4	21.1		26.6	
Aliphatics >C16-C35	mg/kg	<0.1	616		-		4.78		19.8				21		38.5							33.8		
Aliphatics >C21-C35	mg/kg	<0.1	5330		-	20.2		11.3		9.46	72.5	6.08		147		45	55.9	44.9	0.671	45.4	54		88.3	
Aliphatics >C35-C44	mg/kg	<0.1	2030		-	1.33	0.292	0.26	1.56	<0.100	9.18	3.85	4.44	2.3	2.89	4.57	1.63	2	<0.100	4.97	10.3	1.71	19.5	
Total Aliphatics >C12-C44	mg/kg	<0.1	15700		-	23	6.1	14.8	22.3	19.2	85.8	17.9	25.4	254	44.9	60.8	282	166	2.63	68.7	91.7	61.4	143	
Aromatics >EC5-EC7	mg/kg	<0.01	9.68		N/A	0.878	<0.010	0.33	<0.010	<0.010	<0.010	0.0279	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0293	<0.010	<0.010	
Aromatics >EC7-EC8	mg/kg	<0.01	<11.300		-	0.335	<0.010	0.0138	0.0938	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.016	<0.010	0.0146	
Aromatics >EC8-EC10	mg/kg	<0.01	<35.400		5.57E+07	0.887	0.0178	1.6	3.56	0.203	<0.010	0.144	0.132	<0.010	0.0792	0.0468	2.52	0.0185	0.0136	0.277	0.0516	0.306	5.15	
Aromatics >EC10-EC12	mg/kg	<0.01	63.8		1.57E+06	0.252	0.02	0.91	1.58	0.0432	<0.010	0.257	0.193	<0.010	0.06	<0.010	3.06	0.0832	0.0328	0.0718	0.049	1.74	1.77	
Aromatics >EC12-EC16	mg/kg	<0.1	5800		N/A	9.26	1.71	14.4	17.8	1.96	<0.100	20	19.3	0.818	1.88	23.5	20.1	27.4	17.8	4.67	10.8	21.6	13.8	
Aromatics >EC16-EC21	mg/kg	<0.1	6570		N/A	2.71	11.7	10.6	9.88	16.5	4.57	61.2	100	18.6	23.6	56.8	84	85.4	115	52.2	62.1	95	65.2	
Aromatics >EC21-EC35	mg/kg	<0.1	9710		N/A	31.3	46.6	37	56.2	71	33.5	84.2	158	71.3	213	206	37.1	169	286	314	315	283	310	
Aromatics >EC35-EC44	mg/kg	<0.1	1510		-	7.45	13.3	10.8	9.24	20.2	13.3	16.5	35.6	8.84	92.2	51.2	2.76	31.1	68.6	79.7	91.4	107	88.2	
Aromatics >EC40-EC44	mg/kg	<0.1	574		-	2.4	3.94	3.07	1.95	5.91	4.95	5.22	10.6	3.87	28.2	16.2	0.925	9.27	21.3	25.1	27.1	37	32.8	
Total Aromatics >EC12-EC44	mg/kg	<0.1	21200		-	50.7	73.2	72.8	93.1	110	51.4	182	313	99.5	331	337	144	313	488	451	479	507	478	
Total Aliphatics & Aromatics >C5-C44	mg/kg	<0.1	34600		-	77	79.4	93	129	135	137	201	339	354	376	398	441	479	491	521	571	573	638	
Polyaromatic Hydrocarbons (PAHs)																								
Coronene	mg/kg	<0.2	6.55		-		0.266								0.393									
Naphthalene-d8 % recovery**	%		197		-	197	96.3	121	95.9	89.5	93	110	97.2	94.5	96.7	106	83.5	86.5	95.6	128	106	96.6	94.4	
Acenaphthene-d10 % recovery**	%		195		-	195	95.5	124	85.6	85.1	92.7	113	90.5	92.9	92.7	108	83	86.7	93.2	131	107	86.8	96.9	
Phenanthrene-d10 % recovery**	%		186		-	186	101	121	89	88.8	94.6	113	100	93.8	96	107	84.9	85.8	93.3	127	110	89.3	97.7	
Chrysene-d12 % recovery**	%		170		-	170	91	120	88	98.6	92.3	114	99.2	95.6	88.4	108	81.8	85.8	87.1	119	109	72.1	109	
Perylene-d12 % recovery**	%		177		-	177	89.3	126	91	91.2	95.4	129	97.4	100	89.2	116	88.7	89.8	87.4	125	119	70.2	111	
Naphthalene	mg/kg	<0.009	2350		-	1.2																		

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH106	BH204	TP104	BH203C	VP201	HP102	TT102	WS204	TP104	VW202	BH105	BH101	BH102	BH106	BH103A	BH104	WS204	BH107
						3.60-	0.60-0.70	2.00-	3.50-3.60	0.30-0.40	1.20-	0.70-	2.50-2.60	1.10-	0.40-0.50	0.25-	3.50-	0.80-	1.10-	0.40-	0.40-	1.05-1.10	0.35-
Test	Units	LOD	Max	Count	L3 DWS	13/11/2015	27/03/2019	10/11/2015	01/04/2019	25/03/2019	04/11/2015	05/11/2015	04/04/2019	10/11/2015	26/03/2019	02/11/2015	04/11/2015	02/11/2015	10/11/2015	10/11/2015	10/11/2015	27/03/2019	09/11/2015
bis(2-Chloroethyl)ether	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
Azobenzene	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
4-Nitrophenol	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
4-Nitroaniline	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
4-Methylphenol	mg/kg	<0.1	341		-	<0.100			0.168							<0.100	<0.100	<1.000		<0.200			
4-Chlorophenylphenylether	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
4-Chloroaniline	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
4-Chloro-3-methylphenol	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
4-Bromophenylphenylether	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
3-Nitroaniline	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
2-Nitrophenol	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
2-Nitroaniline	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
2-Methylphenol	mg/kg	<0.1	304		-	50.8			<0.100							<0.100	<0.100	<1.000		<0.200			
1,2,4-Trichlorobenzene	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
2-Chlorophenol	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
2,6-Dinitrotoluene	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
2,4-Dinitrotoluene	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
2,4-Dimethylphenol	mg/kg	<0.1	922		-	9.47			0.498							<0.100	<0.100	<1.000		<0.200			
2,4-Dichlorophenol	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
2,4,6-Trichlorophenol	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
2,4,5-Trichlorophenol	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
1,4-Dichlorobenzene	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
1,3-Dichlorobenzene	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
1,2-Dichlorobenzene	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
2-Chloronaphthalene	mg/kg	<0.1	5		-	<0.100			<0.100							<0.100	<0.100	<1.000		<0.200			
2-Methylnaphthalene	mg/kg	<0.1	323		-	<0.100			0.184							<0.100	<0.100	3.59		0.544			
Acenaphthylene	mg/kg	<0.1	277		-	<0.100			0.356							0.852	<0.100	16.1		2.7			
Acenaphthene	mg/kg	<0.1	105		-	<0.100			0.152							0.216	<0.100	<1.000		1.06			
Anthracene	mg/kg	<0.1	258		-	<0.100			0.366							1.13	0.15	9.36		4.54			
Benzo(a)anthracene	mg/kg	<0.1	260		-	<0.100			0.441							6.26	0.178	16.6		23.5			
Benzo(b)fluoranthene	mg/kg	<0.1	175		-	<0.100			0.417							5.72	0.137	9.85		24.1			
Benzo(k)fluoranthene	mg/kg	<0.1	172		-	<0.100			0.208							5.32	<0.100	9.02		21.1			
Benzo(a)pyrene	mg/kg	<0.1	232		-	<0.100			0.324							7.28	0.146	13.7		30.4			
Benzo(g,h,i)perylene	mg/kg	<0.1	149		-	<0.100			0.203							5.44	<0.100	7.64		19.5			
Chrysene	mg/kg	<0.1	219		-	<0.100			0.35							5.9	0.173	15.5		21.5			
Fluoranthene	mg/kg	<0.1	747		-	<0.100			1.17							8.6	0.513	28		36.3			
Fluorene	mg/kg	<0.1	212		-	<0.100			0.419							0.168	0.215	2.3		1.02			
Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	175		-	<0.100			0.254							6.43	<0.100	9.19		24.2			
Phenanthrene	mg/kg	<0.1	890		-	<0.100			1.14							3.2	0.298	19.2		12.1			
Pyrene	mg/kg	<0.1	627		-	<0.100			1.02							8.34	0.471	30.1		33.3			
Naphthalene	mg/kg	<0.1	1630		-	0.53			1.65							0.312	<0.100	3.18		2.01			
Dibenzo(a,h)anthracene	mg/kg	<0.1	26		-	<0.100			<0.100							1.15	<0.100	2.1		3.83			
Bis(2-chloroisopropyl) ether	mg/kg	<0.1	5		-				<0.100														
Volatile Organic Compounds (VOCs)																							
Dibromofluoromethane**	%		166		-	108	108		106	106						114	118	119		107			
Toluene-d8**	%		104		-	102	98.8	88.7	101	101		98.9		101		97.4	97.9	94.4	100	103	96.2		87.6
4-Bromofluorobenzene**	%		102		-	84.1	88.4																

<0.050	Concentration below the LOD
0.050	Concentration in exceedance of the GAC
0.050	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH106	BH204	TP104	BH203C	VP201	HP102	TT102	WS204	TP104	VW202	BH105	BH101	BH102	BH106	BH103A	BH104	WS204	BH107
						3.60-	0.60-0.70	2.00-	3.50-3.60	0.30-0.40	1.20-	0.70-	2.50-2.60	1.10-	0.40-0.50	0.25-	3.50-	0.80-	1.10-	0.40-	0.40-	1.05-1.10	0.35-
Test	Units	LOD	Max	Count	L3 DWS	13/11/2015	27/03/2019	10/11/2015	01/04/2019	25/03/2019	04/11/2015	05/11/2015	04/04/2019	10/11/2015	26/03/2019	02/11/2015	04/11/2015	02/11/2015	10/11/2015	10/11/2015	10/11/2015	27/03/2019	09/11/2015
cis-1,3-Dichloropropene	mg/kg	<0.01	2		-	<0.100			<0.100							<0.100	<0.010	<0.100		<0.100			
Toluene	mg/kg	<0.007	40.2		-	0.2	<0.070	0.0135	<0.070	<0.070		<0.007	<0.070	<0.007	<0.070	<0.070	<0.007	<0.070	<0.007	0.144	<0.007	<0.070	0.0171
trans-1,3-Dichloropropene	mg/kg	<0.01	2		-	<0.100			<0.100							<0.100	<0.010	<0.100		<0.100			
1,1,2-Trichloroethane	mg/kg	<0.01	2		-	<0.100			<0.100							<0.100	<0.010	<0.100		<0.100			
1,3-Dichloropropane	mg/kg	<0.007	1.4		-	<0.070			<0.070							<0.070	<0.007	<0.070		<0.070			
Tetrachloroethene	mg/kg	<0.005	31.9	0	247.733	<0.050			<0.050							0.623	<0.005	<0.050		0.132			
Dibromochloromethane	mg/kg	<0.01	2		-	<0.100			<0.100							<0.100	<0.010	<0.100		<0.100			
1,2-Dibromoethane	mg/kg	<0.01	2		-	<0.100			<0.100							<0.100	<0.010	<0.100		<0.100			
Chlorobenzene	mg/kg	<0.005	1		-	<0.050			<0.050							<0.050	<0.005	<0.050		<0.050			
1,1,1,2-Tetrachloroethane	mg/kg	<0.01	2		-	<0.100			<0.100							<0.100	<0.010	<0.100		<0.100			
Ethylbenzene	mg/kg	<0.004	13.6		-	<0.040	<0.040	0.0977	0.165	<0.040		<0.004	<0.040	<0.004	<0.040	<0.040	0.0188	<0.040	<0.004	<0.040	<0.004	<0.040	<0.004
p/m-Xylene	mg/kg	<0.01	88.5		-	<0.100	<0.100	0.216	1.39	<0.100		<0.010	<0.100	<0.010	<0.100	<0.100	<0.010	<0.100	<0.010	<0.100	<0.010	<0.100	<0.010
o-Xylene	mg/kg	<0.01	40		-	<0.100	<0.100	0.271	0.754	<0.100		<0.010	<0.100	<0.010	<0.100	<0.100	<0.010	<0.100	<0.010	<0.100	<0.010	<0.100	<0.010
Total Xylenes (calculated)	mg/kg		128.5		-	<0.200	<0.200	<0.487	<2.144	<0.200	<0.000	<0.020	<0.200	<0.020	<0.200	<0.200	<0.020	<0.200	<0.020	<0.200	<0.020	<0.200	<0.020
Styrene	mg/kg	<0.01	2		-	<0.100			<0.100							<0.100	<0.010	<0.100		<0.100			
Bromoform	mg/kg	<0.01	2		-	<0.100			<0.100							<0.100	<0.010	<0.100		<0.100			
Isopropylbenzene	mg/kg	<0.005	2.83		-	<0.050			<0.050							<0.050	0.0118	<0.050		<0.050			
1,1,1,2-Tetrachloroethane	mg/kg	<0.01	2		-	<0.100			<0.100							<0.100	<0.010	<0.100		<0.100			
1,2,3-Trichloropropane	mg/kg	<0.016	3.2		-	<0.160			<0.160							<0.160	<0.016	<0.160		<0.160			
Bromobenzene	mg/kg	<0.01	2		-	<0.100			<0.100							<0.100	<0.010	<0.100		<0.100			
Propylbenzene	mg/kg	<0.01	6.33		-	<0.100			<0.100							<0.100	0.0122	<0.100		<0.100			
2-Chlorotoluene	mg/kg	<0.009	1.8		-	<0.090			<0.090							<0.090	<0.009	<0.090		<0.090			
1,3,5-Trimethylbenzene	mg/kg	<0.008	29.4		-	<0.080			0.194							<0.080	<0.008	<0.080		<0.080			
4-Chlorotoluene	mg/kg	<0.01	2		-	<0.100			<0.100							<0.100	<0.010	<0.100		<0.100			
tert-Butylbenzene	mg/kg	<0.014	2.8		-	<0.140			<0.140							<0.140	<0.014	<0.140		<0.140			
1,2,4-Trimethylbenzene	mg/kg	<0.009	88.4		-	<0.090			0.528							<0.090	0.0647	<0.090		<0.090			
sec-Butylbenzene	mg/kg	<0.01	2		-	<0.100			<0.100							<0.100	0.0141	<0.100		<0.100			
4-Isopropyltoluene	mg/kg	<0.01	2		-	<0.100			<0.100							<0.100	<0.010	<0.100		<0.100			
1,3-Dichlorobenzene	mg/kg	<0.008	1.6		-	<0.080			<0.080							<0.080	<0.008	<0.080		<0.080			
1,4-Dichlorobenzene	mg/kg	<0.005	1		-	<0.050			<0.050							<0.050	<0.005	<0.050		<0.050			
n-Butylbenzene	mg/kg	<0.011	2.2		-	<0.110			<0.110							<0.110	<0.011	<0.110		<0.110			
1,2-Dichlorobenzene	mg/kg	<0.01	2		-	<0.100			<0.100							<0.100	<0.010	<0.100		<0.100			
1,2-Dibromo-3-chloropropane	mg/kg	<0.014	2.8		-	<0.140			<0.140							<0.140	<0.014	<0.140		<0.140			
Tert-amyl methyl ether	mg/kg	<0.01	2		-	<0.100	<0.100		<0.100				<0.100		<0.100	<0.100	<0.010	<0.100		<0.100		<0.100	
1,2,4-Trichlorobenzene	mg/kg	<0.02	4		-	<0.200			<0.200							<0.200	<0.020	<0.200		<0.200			
Hexachlorobutadiene	mg/kg	<0.02	4		-	<0.200			<0.200							<0.200	<0.020	<0.200		<0.200			
Naphthalene	mg/kg	<0.013	699		-	<0.130			9.32							0.42	0.0552	0.359		<0.130			
1,2,3-Trichlorobenzene	mg/kg	<0.02	4		-	<0.200			<0.200							<0.200	<0.020	<0.200		<0.200			
Sum of Detected Xylenes	mg/kg	<0.2	0.2		-					<0.200													
Sum of BTEX	mg/kg	<0.4	0.4		-					<0.400													

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH201	WS201	BH102A	TP103	HP101A	TT101	TT101	HP101	TT101	HP102	TT102	HP104	BH102B	TP105	BH203C	TP103A	BH202	VW203
						0.30-0.40	0.30-0.40	0.40-	0.80-	0.20-	0.20-	1.00-	0.10-	0.50-	0.50-	0.35-	0.40-	0.30-	0.50-	0.50-0.60	0.40-	0.30-0.30	0.30-0.40
Test	Units	LOD	Max	Count	L3 DWS	25/03/2019	25/03/2019	03/11/2015	06/11/2015	03/11/2015	05/11/2015	05/11/2015	03/11/2015	05/11/2015	04/11/2015	05/11/2015	03/11/2015	04/11/2015	09/11/2015	26/03/2019	06/11/2015	25/03/2019	26/03/2019
Sample Description																							
Colour	No units		-		-	Dark Brown	Dark Brown	Dark Brown	Black	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Black	Dark Brown	Dark Brown	Dark Brown	Dark Brown	White	Dark Brown	Dark Brown	Dark Brown
Description	No units		-		-	Sandy Loam	Sand	Sand	Sandy Clay Loam	Loamy Sand	Sandy Clay Loam	Stone/Soil	Loamy Sand	Sandy Loam	Sand	Sand	Loamy Sand	Sandy Clay Loam	Sand	Sandy Loam	Sandy Clay Loam	Sand	Sand
Grain Size	No units		-		-	-	-	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	2 - 10 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	-	0.1 - 2 mm	-	-
Inclusion 1)	No units		-		-	Vegetation	Stones	Brick	N/A	Fibres	Glass & Stones	Stones	Vegetation	Stones	Brick	Brick	Vegetation	Brick	Stones	Brick	Brick	Stones	Vegetation
Inclusion 2)	No units		-		-	Stones	None	Stones	Stones	Stones	Vegetation	N/A	Stones	Vegetation	Stones	Concrete/Aggregate	Stones	Stones	None	Stones	Vegetation	Vegetation	Stones
Moisture Content Ratio (% of as received sample)	%		-		-	13	16	14	22	11	19	21	12	19	11	16	15	16	12	12	19	11	20
Asbestos																							
Asbestos Quantification - Gravimetric - %	%	<0.001	-		-					<0.001			2.89	0.0011		0.0023	0.0056	<0.001		0.0108		<0.001	2.89
Date of Analysis	No units		-		-	03/04/2019	03/04/2019	11/11/2015	11/11/2015	10/11/2015			10/11/2015	12/11/2015	12/11/2015	11/11/2015	10/11/2015	11/11/2015	16/11/2015	02/04/2019	11/11/2015	03/04/2019	02/04/2019
Analysed By	No units		-		-	Andrzej Ferfecki	Andrzej Ferfecki	Renata Hatos	Kevin Hughes	Rebecca Rawlings			Rebecca Rawlings	Simon Postlewhite	Simon Postlewhite	Kevin Hughes	Rebecca Rawlings	Renata Hatos	Chris Swindells	Marcin Magdziarek	Kevin Hughes	Andrzej Ferfecki	Marcin Magdziarek
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-		-					<0.001			0.0213	0.0011		<0.001	0.0017	<0.001		<0.001		<0.001	0.0988
Additional Asbestos Components (Using TMO48)	No units		-		-					None			None	Crocidolite		None	None	None		Amosite detected.		None	None
Analysts Comments	No units		-		-					N/C			N/C	Loose fibres in soil		N/C	N/C	N/C		Loose fibres in soil.		N/C	N/C
Asbestos Quantification - Total - %	%	<0.001	-		-					<0.001			2.91	0.0022		0.0031	0.0073	<0.001		0.0111		<0.001	2.99
Chrysotile (White) Asbestos	No units		-		-	Not Detected	Not Detected	Not Detected	Not Detected	Detected			Detected	Detected	Not Detected	Detected	Not Detected	Detected	Not Detected	Not Detected	Not Detected	Detected	Detected
Amosite (Brown) Asbestos	No units		-		-	Not Detected	Not Detected	Not Detected	Not Detected	Detected			Detected	Detected	Not Detected	Not Detected	Detected	Not Detected	Not Detected	Not Detected	Not Detected	Detected	Detected
Crocidolite (Blue) Asbestos	No units		-		-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected			Not Detected	Not Detected	Not Detected	Not Detected	Detected	Not Detected	Not Detected	Detected	Not Detected	Not Detected	Not Detected
Fibrous Anthophyllite	No units		-		-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected			Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Fibrous Tremolite	No units		-		-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected			Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Fibrous Actinolite	No units		-		-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected			Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Non-Asbestos Fibre	No units		-		-	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected			Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
Comments	No units		-		-			0	0	fres and fibre bundles in soil			Soil containing ACM det	0	0	Loose fibres in soil	Fibre bundles in soil	Loose fibres in soil.	0	Loose fibres in soil	0	loose fibres in soil	ining material typical
Carbon																							
Organic Carbon, Total	%	<0.2	-		-																	9.39	
Fraction Organic Carbon (FOC)	No units	<0.002	-		-	0.175	0.0776													0.0687		0.0939	0.126
Soil Organic Matter (SOM)	%	<0.35	-		-			10.4	12.8	2.67	9.74	10.1	7	17.2	38.4	11.3	9	13.2	2		9.9		
Inorganics																							
Water Soluble Sulphate as SO4 2:1 Extract	g/l	<0.004	3.31		-			1.49	1.53	0.0689	0.348	1.42	0.219	0.505	1.41	0.0498	0.224	1.45	1.52		1.49		
pH	pH Units	<1	10.1		-	7.91	7.8	7.47	8.05	8.19	8.26	9.05	8.2	7.79	7.7	8.63	8.11	8.77	7.65	7.69	7.25	8.08	8.03
ANC @ pH 4	mol/kg	<0.03	2.77		-																	0.15	
ANC @ pH 6	mol/kg	<0.03	0.113		-																	0.0651	
Nitrite as NO2 2:1 water soluble	mg/kg	<0.1	2.12		-	0.9																0.82	0.69
Ammoniacal N as NH4 in 2:1 extract BRE	g/l	<0.0003	0.157		-	0.00272																0.00216	0.00241
Loss on ignition	%	<0.7	11.6		-																	11.6	
Sulphide, Easily liberated	mg/kg	<15	477		-	21.7																<15.000	<15.000
Cyanide, Total	mg/kg	<1	1170	0	3658.023			56.5	295	106	28.8	<1.000	246	241	9.68	23.6	113	47.6	<1.000		173		
Cyanide, Free	mg/kg	<1	10		-			<1.000	<10.000	1.02	1.02	<1.000	1.12	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000		
Exchangeable Ammonia as NH4	mg/kg	<15	5150	23	207.850			<15.000	119	<15.000	<15.000	<15.000	<15.000	<15.000	<15.000	<15.000	<15.000	<15.000	<15.000		<15.000		
Cyanide, Complex	mg/kg	<1	1170		-			56.2	293	105	27.8	<1.000	245	241	9.64	23	112	47.4	<1.000		172		
Exchangeable Ammonia as N	mg/kg	<12	4000	0	-			<15.000	92.5	<15.000	<15.000	<15.000	<15.000	<15.000	<15.000	<15.000	<15.000	<15.000	<15.000		<15.000		
Cyanide, Complex (low level)	mg/kg	<0.5	2390		-	20.4	217													147		45.3	432
Metals - (Solids)																							
Chromium, Hexavalent	mg/kg	<0.6	3		-	<0.600	<0.600	<0.600		<0.600	<0.600	<0.600	<0.600	<0.600	<0.600		<0.600	<0.600	<0.600	<0.600		<0.600	<0.600
Boron, water soluble	mg/kg	<1	5.36		-	<1.000	<1.000	<1.000	1.58	1.6	<1.000	<1.000	1.16	<1.000	2.3	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.16
Arsenic	mg/kg	<0.6	268		N/A	262	32.4	33.1	35.7	15.1	22.1	30.1	36.1	57.6	28	20.3	38.8	34.9	78	34.4	50.6	111	63.1
Barium	mg/kg	<0.6	862		-	862	595	118	101	113	198	141	131	518	113	335	180	239	131	26.4	199	143	108
Beryllium	mg/kg	<0.01	2.85		-	0.784	1.38	0.9	1.2	1.27	1.02	1.13	2.85	0.726	2.36	1.15	2.06	1.07	0.449	0.435	1.36	1.29	0.459
Cadmium	mg/kg	<0.02	19.6		-	1.43	0.489	0.192	0.608	0.593	0.555	0.476	17.2	1.95	0.675	0.495	0.756	0.481	0.425	0.617	0.778	0.569	0.851
Chromium	mg/kg	<0.9	74		-	5.73	8.89	25.4	37.7	18.6	21.5	16.3	74	18.6	14.4	20.2	31.3	19.4	7.61	3.89	31.8	10.5	13.7
Copper	mg/kg	<1.4	648		-	83.3	77.3	62.5	45.1	293	52.1	55.6	648	63.4	186	71.7	193	77.5	8.89	43.9	99.7	61.1	99
Lead	mg/kg	<0.7	31000		-	1270	209	777	866	581	483	329	990	232	215	804	340	1250	34.8	327	1530	1490	1920
Mercury	mg/kg	<0.14	278		-	<0.140	1.37	0.452	7.68	4.55	0.42	0.365	2.9	0.33	0.867	0.637	12	0.894	0.292	0.558	<1.400	0.309	5.76
Nickel	mg/kg	<0.2	135		N/A	27.5	26	32.3	28.1	64.6	32.1	26.3	135	41.3	41.5	34.1	38.3	28.5	14.7	14.3	50.2	30.5	22.7
Selenium	mg/kg	<1	46.4	0	N/A	1.32	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<10.000	<1.000	1.12
Vanadium	mg/kg	<0.2	119		-	45.1	32.1	43.5	48.1	18.1	46	37.6	36.8	29.1	45.4	35.6	50	43.5	17.7	18.9	67	52.3	29.6
Zinc	mg/kg	<1.9	3260		-	484	148	172	112	1080	158	114	2660	790	165	193	215	157	50.4	225	150	166	490
Metals - (Liquid)																							
Chromium, Trivalent	mg/kg	<0.9	74		-			25.4		26.2	21.5	16.3	74	18.6	14.4		31.3	19.4	7.61				
Calcium	mg/kg	<210	224000		-	20400														40200		64900	49700
Phenols																							
Phenol	mg/kg	<0.01	90.5		-	<0.010	<0.010	<0.010	2.82	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.050	<0.050	<0.010
Cresols	mg/kg	<0.01	398		-	<0.010	<0.010	<0.010	2.37	<0.010	<0.010	<0.010	0.0226	0.0246	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.050	0.136	<0.010
Xylenols	mg/kg	<0.015	1150		-	<0.015	<0.015	<0.015	0.525	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.075	0.113	<0.015
2,3,5-Trimethylphenol	mg/kg	<0.01	156		-			&lt															

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH201	WS201	BH102A	TP103	HP101A	TT101	TT101	HP101	TT101	HP102	TT102	HP104	BH102B	TP105	BH203C	TP103A	BH202	VW203
						0.30-0.40	0.30-0.40	0.40-	0.80-	0.20-	0.20-	1.00-	0.10-	0.50-	0.50-	0.35-	0.40-	0.30-	0.50-	0.50-0.60	0.40-	0.30-0.30	0.30-0.40
Test	Units	LOD	Max	Count	L3 DWS	25/03/2019	25/03/2019	03/11/2015	06/11/2015	03/11/2015	05/11/2015	05/11/2015	03/11/2015	05/11/2015	04/11/2015	05/11/2015	03/11/2015	04/11/2015	09/11/2015	26/03/2019	06/11/2015	25/03/2019	26/03/2019
Benzene	mg/kg	<0.01	9.68		-			<0.010	0.468	<0.010	0.0172	<0.010	<0.010	0.0123	<0.010	<0.010	<0.010	<0.010	<0.010		<0.010		
Toluene	mg/kg	<0.002	11.3		-			0.0116	0.545	0.00339	0.00984	0.00252	0.00339	0.00492	0.00784	0.00595	0.0105	0.00714	<0.002		0.00248		
Ethylbenzene	mg/kg	<0.003	2.3		-			<0.003	0.709	<0.003	<0.003	<0.003	<0.003	0.00861	<0.003	<0.003	0.0211	<0.003	<0.003		<0.003		
m,p-Xylene	mg/kg	<0.006	12.7		-			0.0116	1.72	<0.006	<0.006	<0.006	<0.006	0.0123	<0.006	<0.006	0.0374	<0.006	<0.006		<0.006		
o-Xylene	mg/kg	<0.003	5.53		-			0.00928	1.05	<0.003	<0.003	<0.003	<0.003	0.00738	<0.003	0.00357	0.0363	0.00357	<0.003		<0.003		
sum of detected mpo xylene by GC	mg/kg	<0.009	18.2		-			0.0209	2.77	<0.009	<0.009	<0.009	<0.009	0.0197	<0.009	<0.009	0.0737	<0.009	<0.009		<0.009		
sum of detected BTEX by GC	mg/kg	<0.024	41.5		-			0.0325	4.49	<0.024	0.027	<0.024	<0.024	0.0455	<0.024	<0.024	0.105	<0.024	<0.024		<0.024		
Aliphatics >C5-C6	mg/kg	<0.01	1.63		-	0.0276	0.019	<0.010	0.0678	<0.010	<0.010	<0.010	<0.010	0.0135	<0.010	<0.010	0.0164	<0.010	<0.010	<0.010	<0.010	0.0316	0.0188
Aliphatics >C6-C8	mg/kg	<0.01	9.89		-	2.33	0.105	0.0174	0.682	0.0181	0.0234	0.0176	0.0181	0.0701	<0.010	0.0202	0.0854	0.0167	<0.010	0.0228	0.0112	0.172	0.0688
Aliphatics >C8-C10	mg/kg	<0.01	22.3		N/A	0.136	0.0357	0.0336	3.7	0.0136	0.048	0.0365	0.0113	0.121	<0.010	0.0333	0.433	0.0238	<0.010	0.0239	0.0533	1.21	0.0813
Aliphatics >C10-C12	mg/kg	<0.01	95.8		N/A	0.0173	0.0381	0.0418	11.2	0.0192	0.0517	0.058	0.0226	0.198	<0.010	0.0476	1.33	0.0345	<0.010	0.0319	0.0967	3.31	0.0413
Aliphatics >C12-C16	mg/kg	<0.1	4990		-	5.83	27.1	4.76	16.1	10.3	4.95	4.25	20	11.2	2.81	10.6	107	13.6	16.7	130	20	312	33.3
Aliphatics >C16-C21	mg/kg	<0.1	5000		-	11.7	60.4	23.4	24.2	145	14.7	25.2	174	26.6	7.11	24.8	309	55	8.25		46.5	475	
Aliphatics >C16-C35	mg/kg	<0.1	616		-															353			616
Aliphatics >C21-C35	mg/kg	<0.1	5330		-	114	81.6	56.2	38.7	279	33.2	220	324	49.7	21.7	45.3	378	95.5	7.11		75.9	624	
Aliphatics >C35-C44	mg/kg	<0.1	2030		-	10.4	9.8	10.5	<0.100	44.3	2.78	20.5	59.9	5.82	2.71	2.96	65.4	8.99	<0.100	15.6	4.69	90.7	288
Total Aliphatics >C12-C44	mg/kg	<0.1	15700		-	142	179	94.8	78.9	478	55.7	270	577	93.3	34.3	83.6	860	173	32.1	498	147	1500	938
Aromatics >EC5-EC7	mg/kg	<0.01	9.68		N/A	<0.010	<0.010	<0.010	0.468	<0.010	0.0172	<0.010	<0.010	0.0123	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Aromatics >EC7-EC8	mg/kg	<0.01	<11.300		-	<0.010	<0.010	0.0116	0.545	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0105	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Aromatics >EC8-EC10	mg/kg	<0.01	<35.400		5.57E+07	0.0909	0.0238	0.0464	5.94	0.0113	0.0369	0.029	0.0102	0.109	<0.010	0.0309	0.383	0.0274	<0.010	0.016	0.0397	0.808	0.0538
Aromatics >EC10-EC12	mg/kg	<0.01	63.8		1.57E+06	0.0115	0.025	0.0278	7.44	0.0124	0.0344	0.0391	0.0158	0.132	<0.010	0.0321	0.89	0.0238	<0.010	0.0217	0.0645	2.21	0.0275
Aromatics >EC12-EC16	mg/kg	<0.1	5800		N/A	14.9	26.4	16.7	116	14	30.8	21.2	13.5	112	24.9	59.6	200	46.6	119	187	90.9	271	37.8
Aromatics >EC16-EC21	mg/kg	<0.1	6570		N/A	84.7	132	181	375	109	382	261	117	478	374	466	470	624	1010	667	856	631	316
Aromatics >EC21-EC35	mg/kg	<0.1	9710		N/A	305	346	698	513	509	701	659	537	695	938	1280	1050	1710	1810	1710	2370	1360	1810
Aromatics >EC35-EC44	mg/kg	<0.1	1510		-	94.4	93	173	121	167	137	160	179	110	253	266	247	358	348	394	461	360	1050
Aromatics >EC40-EC44	mg/kg	<0.1	574		-	30.5	31.6	58.3	37.8	61.4	40	48	59.1	32.1	85	77.7	78.5	115	107	124	139	117	463
Total Aromatics >EC12-EC44	mg/kg	<0.1	21200		-	499	597	1070	1130	799	1250	1100	847	1400	1590	2070	1960	2740	3290	2950	3780	2620	3210
Total Aliphatics & Aromatics >C5-C44	mg/kg	<0.1	34600		-	643	776	1160	1230	1280	1310	1370	1420	1490	1620	2160	2820	2910	3320	3450	3930	4130	4150
Polyaromatic Hydrocarbons (PAHs)																							
Coronene	mg/kg	<0.2	6.55		-																	4.61	
Naphthalene-d8 % recovery**	%		197		-	83.8	109	85.5	114	93.1	92.3	92.9	93.7	94.3	92.8	95.3	96.8	80.5	95.8	98.8	104	98	76.3
Acenaphthene-d10 % recovery**	%		195		-	88.4	101	81.9	116	91.2	90.2	87	92.4	96	92.8	94.1	101	78.3	96.2	96.8	110	107	78.9
Phenanthrene-d10 % recovery**	%		186		-	93	100	81.8	116	92.4	90.2	89	93.1	94.8	94.7	98	101	76.1	98.3	97.2	112	106	90.6
Chrysene-d12 % recovery**	%		170		-	91.9	95.4	85.3	115	88.7	111	89.6	89.3	91.5	91.3	93.1	99.2	77.7	104	89.2	113	78.6	89.4
Perylene-d12 % recovery**	%		177		-	87.3	101	80.8	126	101	112	85.3	98.7	93	97.4	98.9	112	85.7	109	89.6	125	79.4	74
Naphthalene	mg/kg																						

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH201	WS201	BH102A	TP103	HP101A	TT101	TT101	HP101	TT101	HP102	TT102	HP104	BH102B	TP105	BH203C	TP103A	BH202	VW203
						0.30-0.40	0.30-0.40	0.40-	0.80-	0.20-	0.20-	1.00-	0.10-	0.50-	0.50-	0.35-	0.40-	0.30-	0.50-	0.50-0.60	0.40-	0.30-0.30	0.30-0.40
Test	Units	LOD	Max	Count	L3 DWS	25/03/2019	25/03/2019	03/11/2015	06/11/2015	03/11/2015	05/11/2015	05/11/2015	03/11/2015	05/11/2015	04/11/2015	05/11/2015	03/11/2015	04/11/2015	09/11/2015	26/03/2019	06/11/2015	25/03/2019	26/03/2019
bis(2-Chloroethyl)ether	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
Azobenzene	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
4-Nitrophenol	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
4-Nitroaniline	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
4-Methylphenol	mg/kg	<0.1	341		-			<0.200	2.43					<2.000			<1.000					<5.000	
4-Chlorophenylphenylether	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
4-Chloroaniline	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
4-Chloro-3-methylphenol	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
4-Bromophenylphenylether	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
3-Nitroaniline	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
2-Nitrophenol	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
2-Nitroaniline	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
2-Methylphenol	mg/kg	<0.1	304		-			<0.200	2.32					<2.000			<1.000					<5.000	
1,2,4-Trichlorobenzene	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
2-Chlorophenol	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
2,6-Dinitrotoluene	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
2,4-Dinitrotoluene	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
2,4-Dimethylphenol	mg/kg	<0.1	922		-			0.376	3.31					<2.000			<1.000					<5.000	
2,4-Dichlorophenol	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
2,4,6-Trichlorophenol	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
2,4,5-Trichlorophenol	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
1,4-Dichlorobenzene	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
1,3-Dichlorobenzene	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
1,2-Dichlorobenzene	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
2-Chloronaphthalene	mg/kg	<0.1	5		-			<0.200	<0.200					<2.000			<1.000					<5.000	
2-Methylnaphthalene	mg/kg	<0.1	323		-			0.383	1.22					3.16			2.45					<5.000	
Acenaphthylene	mg/kg	<0.1	277		-			6.32	10.5					27.1			8.06					13.3	
Acenaphthene	mg/kg	<0.1	105		-			0.468	3.13					45.7			2.39					5.67	
Anthracene	mg/kg	<0.1	258		-			11.5	10.3					121			7.29					9.3	
Benzo(a)anthracene	mg/kg	<0.1	260		-			41.7	15.9					174			23.2					23	
Benzo(b)fluoranthene	mg/kg	<0.1	175		-			36.1	10.5					115			18					33.4	
Benzo(k)fluoranthene	mg/kg	<0.1	172		-			33.2	10.4					113			15.9					12	
Benzo(a)pyrene	mg/kg	<0.1	232		-			44.2	14.3					152			23.3					26.5	
Benzo(g,h,i)perylene	mg/kg	<0.1	149		-			29.4	7.33					98.5			13.9					23	
Chrysene	mg/kg	<0.1	219		-			40.1	13.3					151			22.5					17.8	
Fluoranthene	mg/kg	<0.1	747		-			65.3	40					521			34.9					49.7	
Fluorene	mg/kg	<0.1	212		-			1.48	7.62					83			5.1					7.33	
Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	175		-			35.9	9.61					115			17.2					25.9	
Phenanthrene	mg/kg	<0.1	890		-			29.9	37					316			19.4					30	
Pyrene	mg/kg	<0.1	627		-			59.8	35.4					431			36.8					51.4	
Naphthalene	mg/kg	<0.1	1630		-			1.5	12.7					6.65			3.7					10.1	
Dibenzo(a,h)anthracene	mg/kg	<0.1	26		-			6.65	1.79					14.7			3.74					<5.000	
Bis(2-chloroisopropyl) ether	mg/kg	<0.1	5		-																	<5.000	
Volatile Organic Compounds (VOCs)																							
Dibromofluoromethane**	%		166		-	101	110	116	117					125			112					107	
Toluene-d8**	%		104		-	95.8	100	97.4	95.2	75.2			77.8	91.1		89	90.6		98.4		88.6	95.7	
4-Bromofluorobenzene**	%		102		-	71.5	89.8	88.3	82.7					79.6			76.3					81	
Dichlorodifluoromethane	mg/kg	<0.006	1.2		-			<0.060	<0.120					<0.060			<0.012					<0.060	
Chloromethane	mg/kg	<0.007	1.4		-			<0.070	<0.140					<0.070			<0.014					<0.070	
V																							

<0.050	Concentration below the LOD
0.050	Concentration in exceedance of the GAC
0.050	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH201	WS201	BH102A	TP103	HP101A	TT101	TT101	HP101	TT101	HP102	TT102	HP104	BH102B	TP105	BH203C	TP103A	BH202	VW203
						0.30-0.40	0.30-0.40	0.40-	0.80-	0.20-	0.20-	1.00-	0.10-	0.50-	0.50-	0.35-	0.40-	0.30-	0.50-	0.50-0.60	0.40-	0.30-0.30	0.30-0.40
Test	Units	LOD	Max	Count	L3 DWS	25/03/2019	25/03/2019	03/11/2015	06/11/2015	03/11/2015	05/11/2015	05/11/2015	03/11/2015	05/11/2015	04/11/2015	05/11/2015	03/11/2015	04/11/2015	09/11/2015	26/03/2019	06/11/2015	25/03/2019	26/03/2019
cis-1,3-Dichloropropene	mg/kg	<0.01	2		-			<0.100	<0.200					<0.100			<0.020					<0.100	
Toluene	mg/kg	<0.007	40.2		-	<0.070	<0.070	<0.070	0.284	<0.007			<0.007	<0.070		0.0148	<0.014		<0.007	<0.070	<0.007	<0.070	<0.070
trans-1,3-Dichloropropene	mg/kg	<0.01	2		-			<0.100	<0.200					<0.100			<0.020					<0.100	
1,1,2-Trichloroethane	mg/kg	<0.01	2		-			<0.100	<0.200					<0.100			<0.020					<0.100	
1,3-Dichloropropane	mg/kg	<0.007	1.4		-			<0.070	<0.140					<0.070			<0.014					<0.070	
Tetrachloroethene	mg/kg	<0.005	31.9	0	247.733			<0.050	<0.100					<0.050			0.0419					<0.050	
Dibromochloromethane	mg/kg	<0.01	2		-			<0.100	<0.200					<0.100			<0.020					<0.100	
1,2-Dibromoethane	mg/kg	<0.01	2		-			<0.100	<0.200					<0.100			<0.020					<0.100	
Chlorobenzene	mg/kg	<0.005	1		-			<0.050	<0.100					<0.050			<0.010					<0.050	
1,1,1,2-Tetrachloroethane	mg/kg	<0.01	2		-			<0.100	<0.200					<0.100			<0.020					<0.100	
Ethylbenzene	mg/kg	<0.004	13.6		-	<0.040	<0.040	<0.040	0.507	<0.004			<0.004	<0.040		<0.004	0.0126		<0.004	<0.040	<0.004	0.152	<0.040
p/m-Xylene	mg/kg	<0.01	88.5		-	<0.100	<0.100	<0.100	0.537	<0.010			<0.010	<0.100		<0.010	<0.020		<0.010	<0.100	<0.010	<0.100	<0.100
o-Xylene	mg/kg	<0.01	40		-	<0.100	<0.100	<0.100	0.503	<0.010			<0.010	<0.100		<0.010	<0.020		<0.010	<0.100	<0.010	<0.100	<0.100
Total Xylenes (calculated)	mg/kg		128.5		-	<0.200	<0.200	<0.200	<1.040	<0.020	<0.000	<0.000	<0.020	<0.200	<0.000	<0.020	<0.040	<0.000	<0.020	<0.200	<0.020	<0.200	<0.200
Styrene	mg/kg	<0.01	2		-			<0.100	<0.200					<0.100			<0.020					<0.100	
Bromoform	mg/kg	<0.01	2		-			<0.100	<0.200					<0.100			<0.020					<0.100	
Isopropylbenzene	mg/kg	<0.005	2.83		-			<0.050	<0.100					<0.050			<0.010					<0.050	
1,1,1,2,2-Tetrachloroethane	mg/kg	<0.01	2		-			<0.100	<0.200					<0.100			<0.020					<0.100	
1,2,3-Trichloropropane	mg/kg	<0.016	3.2		-			<0.160	<0.320					<0.160			<0.032					<0.160	
Bromobenzene	mg/kg	<0.01	2		-			<0.100	<0.200					<0.100			<0.020					<0.100	
Propylbenzene	mg/kg	<0.01	6.33		-			<0.100	<0.200					<0.100			<0.020					<0.100	
2-Chlorotoluene	mg/kg	<0.009	1.8		-			<0.090	<0.180					<0.090			<0.018					<0.090	
1,3,5-Trimethylbenzene	mg/kg	<0.008	29.4		-			<0.080	0.22					<0.080			0.0294					<0.080	
4-Chlorotoluene	mg/kg	<0.01	2		-			<0.100	<0.200					<0.100			<0.020					<0.100	
tert-Butylbenzene	mg/kg	<0.014	2.8		-			<0.140	<0.280					<0.140			<0.028					<0.140	
1,2,4-Trimethylbenzene	mg/kg	<0.009	88.4		-			<0.090	0.924					<0.090			0.0773					0.235	
sec-Butylbenzene	mg/kg	<0.01	2		-			<0.100	<0.200					<0.100			<0.020					<0.100	
4-Isopropyltoluene	mg/kg	<0.01	2		-			<0.100	<0.200					<0.100			<0.020					<0.100	
1,3-Dichlorobenzene	mg/kg	<0.008	1.6		-			<0.080	<0.160					<0.080			<0.016					<0.080	
1,4-Dichlorobenzene	mg/kg	<0.005	1		-			<0.050	<0.100					<0.050			<0.010					<0.050	
n-Butylbenzene	mg/kg	<0.011	2.2		-			<0.110	<0.220					<0.110			<0.022					<0.110	
1,2-Dichlorobenzene	mg/kg	<0.01	2		-			<0.100	<0.200					<0.100			<0.020					<0.100	
1,2-Dibromo-3-chloropropane	mg/kg	<0.014	2.8		-			<0.140	<0.280					<0.140			<0.028					<0.140	
Tert-amyl methyl ether	mg/kg	<0.01	2		-			<0.100	<0.200					<0.100			<0.020			<0.100		<0.100	<0.100
1,2,4-Trichlorobenzene	mg/kg	<0.02	4		-			<0.200	<0.400					<0.200			<0.040					<0.200	
Hexachlorobutadiene	mg/kg	<0.02	4		-			<0.200	<0.400					<0.200			<0.040					<0.200	
Naphthalene	mg/kg	<0.013	699		-			<0.130	37.4					<0.130			2.74					3.82	
1,2,3-Trichlorobenzene	mg/kg	<0.02	4		-			<0.200	<0.400					<0.200			<0.040					<0.200	
Sum of Detected Xylenes	mg/kg	<0.2	0.2		-	<0.200	<0.200															<0.200	
Sum of BTEX	mg/kg	<0.4	0.4		-	<0.400	<0.400															<0.400	

	<0.000	Concentration below the LOD
	0.000	Concentration in exceedance of the GAC
	0.000	Concentration in exceedance of the L3 SSAC
	N/A	not applicable
	LTT	Long Travel Time - risk negligible

						WS204	HP104A	BH103	HP103	BH103	BH202	BH202	VW201A	WS203	WS204
						0.60-0.70	0.70-	0.30-	0.30-	0.90-	15.00-	6.30-	0.80-1.00	1.50-1.90	0.50-0.60
Test	Units	LOD	Max	Count	L3 DWS	27/03/2019	03/11/2015	04/11/2015	02/11/2015	04/11/2015	27/03/2019	27/03/2019	05/04/2019	04/04/2019	27/03/2019
Sample Description															
Colour	No units		-		-	Dark Brown	Dark Brown	Dark Brown	Dark Brown	Black	Grey	Black	Light Brown	-	-
Description	No units		-		-	Sand	Loamy Sand	Sandy Clay	Loamy Sand	Silty Clay Loam	N/A	Sand	Silty Clay Loam	-	-
Grain Size	No units		-		-	-	0.1 - 2 mm	0.1 - 2 mm	0.1 - 2 mm	0.063 - 0.1 mm	-	-	-	-	-
Inclusion 1)	No units		-		-	Stones	Stones	Fibres	Vegetation	Oil/Petroleum	Vegetation	Stones	Stones	-	-
Inclusion 2)	No units		-		-	Vegetation	Vegetation	Stones	Stones	Fibres	Stones	None	Crushed Brick	-	-
Moisture Content Ratio (% of as received sample)	%		-		-	9.7	21	25	8.2	35	21	13	15	-	-
Asbestos															
Asbestos Quantification - Gravimetric - %	%	<0.001	-		-				<0.001	19.2					
Date of Analysis	No units		-		-		10/11/2015	12/11/2015	10/11/2015	16/11/2015				10/04/2019	05/04/2019
Analysed By	No units		-		-		Rebecca Rawlings	Simon Postlewhite	Rebecca Rawlings	Kevin Hughes				Lucy Caroe	James Richards
Asbestos Quantification - PCOM Evaluation - %	%	<0.001	-		-				<0.001	0.0378					
Additional Asbestos Components (Using TMO48)	No units		-		-				None	None					
Analysts Comments	No units		-		-				N/C	N/C					
Asbestos Quantification - Total - %	%	<0.001	-		-				<0.001	19.2					
Chrysotile (White) Asbestos	No units		-		-		Not Detected	Not Detected	Detected	Detected				Not Detected	Detected
Amosite (Brown) Asbestos	No units		-		-				Not Detected	Detected				Not Detected	Not Detected
Crocidolite (Blue) Asbestos	No units		-		-		Not Detected	Not Detected	Not Detected	Not Detected				Not Detected	Not Detected
Fibrous Anthophyllite	No units		-		-		Not Detected	Not Detected	Not Detected	Not Detected				Not Detected	Not Detected
Fibrous Tremolite	No units		-		-		Not Detected	Not Detected	Not Detected	Not Detected				Not Detected	Not Detected
Fibrous Actinolite	No units		-		-		Not Detected	Not Detected	Not Detected	Not Detected				Not Detected	Not Detected
Non-Asbestos Fibre	No units		-		-		Not Detected	Detected	Not Detected	Not Detected				Not Detected	Not Detected
Comments	No units		-		-	of lagging	0	0	Loose fibres in soil	ing ACM debris and loose fibres					Soil containing ACM debris
Carbon															
Organic Carbon, Total	%	<0.2	-		-	5.34									
Fraction Organic Carbon (FOC)	No units	<0.002	-		-	0.0534					0.002	<0.002	0.0906		
Soil Organic Matter (SOM)	%	<0.35	-		-		16.3	8.24	40.7	15.2					
Inorganics															
Water Soluble Sulphate as SO4 2:1 Extract	g/l	<0.004	3.31		-		0.124	0.614	1.47	0.676					
pH	pH Units	<1	10.1		-	7.48	7.14	9.67	7.6	10	9.02	8.65	8.07		
ANC @ pH 4	mol/kg	<0.03	2.77		-	0.15									
ANC @ pH 6	mol/kg	<0.03	0.113		-	<0.030									
Nitrite as NO2, 2:1 water soluble	mg/kg	<0.1	2.12		-	0.1									
Ammoniacal N as NH4 in 2:1 extract BRE	g/l	<0.0003	0.157		-	0.00604									
Loss on ignition	%	<0.7	11.6		-	8.16									
Sulphide, Easily liberated	mg/kg	<15	477		-	477									
Cyanide, Total	mg/kg	<1	1170	0	3658.023		29.3	<1.000	216	<1.000					
Cyanide, Free	mg/kg	<1	10		-		<1.000	<1.000	1.12	<1.000					
Exchangeable Ammonia as NH4	mg/kg	<15	5150	23	207.850		83.7	994	42.8	1470					
Cyanide, Complex	mg/kg	<1	1170		-		29	<1.000	215	<1.000					
Exchangeable Ammonia as N	mg/kg	<12	4000	0	-		65.1	773	33.3	1150					
Cyanide, Complex (low level)	mg/kg	<0.5	2390		-	476					<0.500	<0.500	5.35		
Metals - (Solids)															
Chromium, Hexavalent	mg/kg	<0.6	3		-	<0.600	1.31	<0.600	<0.600	<0.600	<0.600	<0.600	<0.600		
Boron, water soluble	mg/kg	<1	5.36		-	1.15	<1.000	2.77	<1.000	1.52	<1.000	<1.000	<1.000		
Arsenic	mg/kg	<0.6	268		N/A	268	17.2	14.7	146	33.2	<0.600	5.22	24.9		
Barium	mg/kg	<0.6	862		-	89.1	88.8	151	156	103	13.4	19.4	119		
Beryllium	mg/kg	<0.01	2.85		-	1.91	1.13	0.396	1.59	0.546	0.0512	0.392	0.481		
Cadmium	mg/kg	<0.02	19.6		-	2.02	0.326	1.75	3.55	3.16	0.103	0.0871	0.264		
Chromium	mg/kg	<0.9	74		-	<0.900	13.1	31.2	15	57.1	<0.900	8.03	8.64		
Copper	mg/kg	<1.4	648		-	92	26.8	41.8	203	92.7	2.26	2.56	25		
Lead	mg/kg	<0.7	31000		-	31000	2310	344	575	3150	<0.700	5.16	103		
Mercury	mg/kg	<0.14	278		-	12.7	0.334	12.1	7.66	21.1	<0.140	<0.140	<0.140		
Nickel	mg/kg	<0.2	135		N/A	34.8	19.4	53.8	64.9	43.7	1.97	14.7	20.4		
Selenium	mg/kg	<1	46.4	0	N/A	3.07	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		
Vanadium	mg/kg	<0.2	119		-	35.1	36.7	54.8	41.3	41.5	1.4	19.7	33.2		
Zinc	mg/kg	<1.9	3260		-	358	57.3	1170	460	3260	12.7	27.8	93		
Metals - (Liquid)															
Chromium, Trivalent	mg/kg	<0.9	74		-		11.8	31.2	15	57.1					
Calcium	mg/kg	<210	224000		-	78200									
Phenols															
Phenol	mg/kg	<0.01	90.5		-	<0.100	0.0756	90.5	<0.050	79.2	0.0127	<0.010	<0.010		
Cresols	mg/kg	<0.01	398		-	<0.100	0.252	398	3.51	386	0.686	<0.010	<0.010		
Xylenols	mg/kg	<0.015	1150		-	0.966	0.416	977	9.91	1150	0.724	<0.015	<0.015		
2,3,5-Trimethylphenol	mg/kg	<0.01	156		-		<0.010	105	3.37	156					
2-Isopropylphenol	mg/kg	<0.015	792		-		0.164	573	17.7	792					
Phenols, Total Detected monohydric	mg/kg	<0.035	2.39		-	0.966					1.42	<0.035	<0.035		
Phenols, Total Detected 5 speciated	mg/kg	<0.06	2560		-		0.907	2140	34.4	2560					
TPH Criteria Working Group (TPH CWG)															
GRO Surrogate % recovery**	%		153		-	98.5	29	39	12	22					
GRO TOT (Moisture Corrected)	mg/kg	<0.044	190		-	190	31.9	21.4	7.95	149					
Methyl tertiary butyl ether (MTBE)	mg/kg	<0.005	0.01		-		<0.005	<0.005	<0.005	<0.010					

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						WS204	HP104A	BH103	HP103	BH103	BH202	BH202	VW201A	WS203	WS204
						0.60-0.70	0.70-	0.30-	0.30-	0.90-	15.00-	6.30-	0.80-1.00	1.50-1.90	0.50-0.60
Test	Units	LOD	Max	Count	L3 DWS	27/03/2019	03/11/2015	04/11/2015	02/11/2015	04/11/2015	27/03/2019	27/03/2019	05/04/2019	04/04/2019	27/03/2019
Benzene	mg/kg	<0.01	9.68		-		<0.010	1.89	<0.010	9.68					
Toluene	mg/kg	<0.002	11.3		-		0.309	2.08	0.00653	11.3					
Ethylbenzene	mg/kg	<0.003	2.3		-		0.721	0.271	0.00436	2.3					
m,p-Xylene	mg/kg	<0.006	12.7		-		0.673	1.59	0.0414	12.7					
o-Xylene	mg/kg	<0.003	5.53		-		0.485	0.709	0.0261	5.53					
sum of detected mpo xylene by GC	mg/kg	<0.009	18.2		-		1.16	2.3	0.0675	18.2					
sum of detected BTEX by GC	mg/kg	<0.024	41.5		-		2.19	6.54	0.0784	41.5					
Aliphatics >C5-C6	mg/kg	<0.01	1.63		-	<0.200	0.134	0.126	0.0131	1.63					
Aliphatics >C6-C8	mg/kg	<0.01	9.89		-	0.781	1.52	0.737	0.0403	9.89					
Aliphatics >C8-C10	mg/kg	<0.01	22.3		N/A	17.5	6.08	2.28	0.584	22.3					
Aliphatics >C10-C12	mg/kg	<0.01	95.8		N/A	95.8	10.7	6.09	4.1	35.3					
Aliphatics >C12-C16	mg/kg	<0.1	4990		-	463	1580	1420	1440	4990					
Aliphatics >C16-C21	mg/kg	<0.1	5000		-		2790	2470	1300	5000					
Aliphatics >C16-C35	mg/kg	<0.1	616		-	456									
Aliphatics >C21-C35	mg/kg	<0.1	5330		-		2140	5330	1320	4790					
Aliphatics >C35-C44	mg/kg	<0.1	2030		-	13.9	195	2030	126	878					
Total Aliphatics >C12-C44	mg/kg	<0.1	15700		-	933	6700	11200	4190	15700					
Aromatics >EC5-EC7	mg/kg	<0.01	9.68		N/A	<0.200	<0.010	1.89	<0.010	9.68					
Aromatics >EC7-EC8	mg/kg	<0.01	<11.300		-	<0.200	0.309	2.08	<0.010	11.3					
Aromatics >EC8-EC10	mg/kg	<0.01	<35.400		5.57E+07	11.7	5.93	4.09	0.462	35.4					
Aromatics >EC10-EC12	mg/kg	<0.01	63.8		1.57E+06	63.8	7.16	4.06	2.74	23.6					
Aromatics >EC12-EC16	mg/kg	<0.1	5800		N/A	858	1100	1780	3490	5800					
Aromatics >EC16-EC21	mg/kg	<0.1	6570		N/A	1380	2090	2340	6570	5960					
Aromatics >EC21-EC35	mg/kg	<0.1	9710		N/A	2340	2580	3910	9710	5800					
Aromatics >EC35-EC44	mg/kg	<0.1	1510		-	433	387	1510	1440	1180					
Aromatics >EC40-EC44	mg/kg	<0.1	574		-	124	107	574	428	424					
Total Aromatics >EC12-EC44	mg/kg	<0.1	21200		-	5010	6170	9540	21200	18700					
Total Aliphatics & Aromatics >C5-C44	mg/kg	<0.1	34600		-	6130	12900	20800	25400	34600					
Polyaromatic Hydrocarbons (PAHs)															
Coronene	mg/kg	<0.2	6.55		-	6.55									
Naphthalene-d8 % recovery**	%		197		-	103	99.6	111	101	82.7	102	100	96.8		
Acenaphthene-d10 % recovery**	%		195		-	113	108	101	119	109	93.8	96.9	89.8		
Phenanthrene-d10 % recovery**	%		186		-	114	106	98.5	110	106	99.3	102	89.9		
Chrysene-d12 % recovery**	%		170		-	88.6	102	95.8	101	104	96.9	94.1	91.2		
Perylene-d12 % recovery**	%		177		-	96.8	116	93.1	109	100	96	86.1	95.5		
Naphthalene	mg/kg	<0.009	2350		-	3.51	31.2	2010	1510	2350	0.441	0.0119	0.0606		
Acenaphthylene	mg/kg	<0.012	565		-	41.2	54.1	185	565	237	<0.012	<0.012	0.199		
Acenaphthene	mg/kg	<0.008	142		-	15.4	20.4	131	131	142	<0.008	0.0194	<0.008		
Fluorene	mg/kg	<0.01	501		-	54.1	41	230	501	297	0.0212	0.0209	<0.010		
Phenanthrene	mg/kg	<0.015	1180		-	164	117	757	1180	939	0.0438	0.044	0.403		
Anthracene	mg/kg	<0.016	575		-	58.1	41.7	221	575	300	<0.016	0.0269	0.196		
Fluoranthene	mg/kg	<0.017	1330		-	176	111	439	1330	551	<0.017	0.0791	2.83		
Pyrene	mg/kg	<0.015	1140		-	145	98.6	337	1140	390	<0.015	0.0897	2.85		
Benz(a)anthracene	mg/kg	<0.014	394		-	57	47.6	109	394	124	<0.014	0.0285	1.48		
Chrysene	mg/kg	<0.01	363		-	48.4	35.6	81.1	363	90.2	<0.010	0.0212	1.21		
Benzo(b)fluoranthene	mg/kg	<0.015	472		-	63.7	55.3	99.6	472	128	<0.015	<0.015	2.48		
Benzo(k)fluoranthene	mg/kg	<0.014	211		-	23.7	17.6	30.6	211	39.1	<0.014	<0.014	1.23		
Benzo(a)pyrene	mg/kg	<0.015	382		LTT	50.3	48.4	73.7	382	91.3	<0.015	<0.015	2.86		
Indeno(1,2,3-cd)pyrene	mg/kg	<0.018	226		-	39.1	25.8	35.9	226	48.5	<0.018	<0.018	2.9		
Dibenzo(a,h)anthracene	mg/kg	<0.023	61.6		-	5.6	6.81	8.75	61.6	12	<0.023	<0.023	0.459		
Benzo(g,h,i)perylene	mg/kg	<0.024	249		-	33.3	29.4	40.6	249	53.6	<0.024	<0.024	3.04		
PAH, Total Detected USEPA 16	mg/kg	<0.118	9300		-	979	781	4790	9300	5790	0.506	0.342	22.2		
PAH sum of 4			1158		LTT	159.8	128.1	206.7	1158	269.2	<0.071	<0.071	9.65		
Semi-Volatile Organic Compounds (SVOCs)															
Phenol	mg/kg	<0.1	107		-	<2.000	<1.000	86.1	<4.000	107	0.15	<0.100	<0.200		
Pentachlorophenol	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
n-Nitroso-n-dipropylamine	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
Nitrobenzene	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
Isophorone	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
Hexachloroethane	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
Hexachlorocyclopentadiene	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
Hexachlorobutadiene	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
Hexachlorobenzene	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
n-Dioctyl phthalate	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
Dimethyl phthalate	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
Diethyl phthalate	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
n-Dibutyl phthalate	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
Dibenzofuran	mg/kg	<0.1	181		-	37.1	8.67	92.7	181	146	<0.100	<0.100	<0.200		
Carbazole	mg/kg	<0.1	99.8		-	13.6	1.89	36.9	99.8	34.9	<0.100	<0.100	<0.200		
Butylbenzyl phthalate	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
bis(2-Ethylhexyl) phthalate	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
bis(2-Chloroethoxy)methane	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						WS204	HP104A	BH103	HP103	BH103	BH202	BH202	VW201A	WS203	WS204
						0.60-0.70	0.70-	0.30-	0.30-	0.90-	15.00-	6.30-	0.80-1.00	1.50-1.90	0.50-0.60
Test	Units	LOD	Max	Count	L3 DWS	27/03/2019	03/11/2015	04/11/2015	02/11/2015	04/11/2015	27/03/2019	27/03/2019	05/04/2019	04/04/2019	27/03/2019
bis(2-Chloroethyl)ether	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
Azobenzene	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
4-Nitrophenol	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
4-Nitroaniline	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
4-Methylphenol	mg/kg	<0.1	341		-	<2.000	<1.000	251	<4.000	341	0.302	<0.100	<0.200		
4-Chlorophenylphenylether	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
4-Chloroaniline	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
4-Chloro-3-methylphenol	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
4-Bromophenylphenylether	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
3-Nitroaniline	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
2-Nitrophenol	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
2-Nitroaniline	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
2-Methylphenol	mg/kg	<0.1	304		-	<2.000	<1.000	240	<4.000	304	0.519	<0.100	<0.200		
1,2,4-Trichlorobenzene	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
2-Chlorophenol	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
2,6-Dinitrotoluene	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
2,4-Dinitrotoluene	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
2,4-Dimethylphenol	mg/kg	<0.1	922		-	<2.000	<1.000	639	14.7	922	0.254	<0.100	<0.200		
2,4-Dichlorophenol	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
2,4,6-Trichlorophenol	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
2,4,5-Trichlorophenol	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
1,4-Dichlorobenzene	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
1,3-Dichlorobenzene	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
1,2-Dichlorobenzene	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
2-Chloronaphthalene	mg/kg	<0.1	5		-	<2.000	<1.000	<4.000	<4.000	<5.000	<0.100	<0.100	<0.200		
2-Methylnaphthalene	mg/kg	<0.1	323		-	<2.000	35.6	189	307	323	<0.100	<0.100	<0.200		
Acenaphthylene	mg/kg	<0.1	277		-	45.5	15.9	102	277	185	<0.100	<0.100	0.526		
Acenaphthene	mg/kg	<0.1	105		-	13.1	16.3	91.7	56.6	105	<0.100	<0.100	<0.200		
Anthracene	mg/kg	<0.1	258		-	48	20.1	137	258	192	<0.100	<0.100	<0.200		
Benzo(a)anthracene	mg/kg	<0.1	260		-	48.9	13.4	95	260	89.3	<0.100	<0.100	3.49		
Benzo(b)fluoranthene	mg/kg	<0.1	175		-	54.2	8.88	56.6	175	60.4	<0.100	<0.100	11.5		
Benzo(k)fluoranthene	mg/kg	<0.1	172		-	24	7.98	57.7	172	52.2	<0.100	<0.100	4.26		
Benzo(a)pyrene	mg/kg	<0.1	232		-	37.5	14.9	72.5	232	68.9	<0.100	<0.100	9.13		
Benzo(g,h,i)perylene	mg/kg	<0.1	149		-	23.6	11.4	42.7	149	41.4	<0.100	<0.100	6.84		
Chrysene	mg/kg	<0.1	219		-	37.9	12.6	85.7	219	79.5	<0.100	<0.100	3.43		
Fluoranthene	mg/kg	<0.1	747		-	152	28.4	324	747	375	<0.100	<0.100	4.78		
Fluorene	mg/kg	<0.1	212		-	52	24.8	137	212	201	<0.100	<0.100	<0.200		
Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	175		-	36.9	12.7	54.4	175	52.8	<0.100	<0.100	10.8		
Phenanthrene	mg/kg	<0.1	890		-	145	57.1	448	890	632	<0.100	<0.100	<0.200		
Pyrene	mg/kg	<0.1	627		-	122	34.3	253	627	291	<0.100	<0.100	6.73		
Naphthalene	mg/kg	<0.1	1630		-	3.65	89.5	918	721	1630	0.4	<0.100	<0.200		
Dibenzo(a,h)anthracene	mg/kg	<0.1	26		-	2.23	2.14	8.68	26	<5.000	<0.100	<0.100	0.789		
Bis(2-chloroisopropyl) ether	mg/kg	<0.1	5		-	<2.000					<0.100	<0.100	<0.200		
Volatile Organic Compounds (VOCs)															
Dibromofluoromethane**	%		166		-	118	116	112	120	112	128	112	131		
Toluene-d8**	%		104		-	86	90.9	99.7	95	99.1	104	102	100		
4-Bromofluorobenzene**	%		102		-	76.2	80.7	95.1	83.2	94.7	99.1	98.1	94.6		
Dichlorodifluoromethane	mg/kg	<0.006	1.2		-	<0.060	<0.120	<1.200	<0.120	<1.200	<0.060	<0.060	<0.060		
Chloromethane	mg/kg	<0.007	1.4		-	<0.070	<0.140	<1.400	<0.140	<1.400	<0.070	<0.070	<0.070		
Vinyl Chloride	mg/kg	<0.006	1.2	2	0.362	<0.060	<0.120	<1.200	<0.120	<1.200	<0.060	<0.060	<0.060		
Bromomethane	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
Chloroethane	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
Trichlorofluoromethane	mg/kg	<0.006	1.2		-	<0.060	<0.120	<1.200	<0.120	<1.200	<0.060	<0.060	<0.060		
1,1-Dichloroethene	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
Carbon Disulphide	mg/kg	<0.007	4.67		-	0.117	<0.140	<1.400	<0.140	<1.400	<0.070	<0.070	4.67		
Dichloromethane	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
Methyl Tertiary Butyl Ether	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
trans-1,2-Dichloroethene	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
1,1-Dichloroethane	mg/kg	<0.008	1.6		-	<0.080	<0.160	<1.600	<0.160	<1.600	<0.080	<0.080	<0.080		
cis-1,2-Dichloroethene	mg/kg	<0.006	1.2	0	124.249	<0.060	<0.120	<1.200	<0.120	<1.200	<0.060	<0.060	<0.060		
2,2-Dichloropropane	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
Bromochloromethane	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
Chloroform	mg/kg	<0.008	1.6		-	<0.080	<0.160	<1.600	<0.160	<1.600	<0.080	<0.080	<0.080		
1,1,1-Trichloroethane	mg/kg	<0.007	1.4		-	<0.070	<0.140	<1.400	<0.140	<1.400	<0.070	<0.070	<0.070		
1,1-Dichloropropene	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
Carbontetrachloride	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
1,2-Dichloroethane	mg/kg	<0.005	1		-	<0.050	<0.100	<1.000	<0.100	<1.000	<0.050	<0.050	<0.050		
Benzene	mg/kg	<0.009	16.4	0	321.565	<0.090	<0.180	8.18	<0.180	16.4	0.117	<0.090	<0.090		
Trichloroethene	mg/kg	<0.009	1.8	0	36.093	<0.090	<0.180	<1.800	<0.180	<1.800	<0.090	<0.090	0.128		
1,2-Dichloropropane	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
Dibromomethane	mg/kg	<0.009	1.8		-	<0.090	<0.180	<1.800	<0.180	<1.800	<0.090	<0.090	<0.090		
Bromodichloromethane	mg/kg	<0.007	1.4		-	<0.070	<0.140	<1.400	<0.140	<1.400	<0.070	<0.070	<0.070		

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						WS204	HP104A	BH103	HP103	BH103	BH202	BH202	VW201A	WS203	WS204
						0.60-0.70	0.70-	0.30-	0.30-	0.90-	15.00-	6.30-	0.80-1.00	1.50-1.90	0.50-0.60
Test	Units	LOD	Max	Count	L3 DWS	27/03/2019	03/11/2015	04/11/2015	02/11/2015	04/11/2015	27/03/2019	27/03/2019	05/04/2019	04/04/2019	27/03/2019
cis-1,3-Dichloropropene	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
Toluene	mg/kg	<0.007	40.2		-	<0.070	0.446	10.7	<0.140	40.2	<0.070	<0.070	<0.070		
trans-1,3-Dichloropropene	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
1,1,2-Trichloroethane	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
1,3-Dichloropropane	mg/kg	<0.007	1.4		-	<0.070	<0.140	<1.400	<0.140	<1.400	<0.070	<0.070	<0.070		
Tetrachloroethene	mg/kg	<0.005	31.9	0	247.733	<0.050	0.225	<1.000	<0.100	4.77	<0.050	<0.050	31.9		
Dibromochloromethane	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
1,2-Dibromoethane	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
Chlorobenzene	mg/kg	<0.005	1		-	<0.050	<0.100	<1.000	<0.100	<1.000	<0.050	<0.050	<0.050		
1,1,1,2-Tetrachloroethane	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
Ethylbenzene	mg/kg	<0.004	13.6		-	0.269	1.39	2	<0.080	13.6	<0.040	<0.040	<0.040		
p/m-Xylene	mg/kg	<0.01	88.5		-	0.461	1.22	10.4	<0.200	88.5	<0.100	<0.100	<0.100		
o-Xylene	mg/kg	<0.01	40		-	0.407	0.955	4.56	<0.200	40	<0.100	<0.100	<0.100		
Total Xylenes (calculated)	mg/kg		128.5		-	<0.868	<2.175	<14.960	<0.400	<128.500	<0.200	<0.200	<0.200	<0.000	<0.000
Styrene	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	0.545	<2.000	<0.100	<0.100	<0.100		
Bromoform	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
Isopropylbenzene	mg/kg	<0.005	2.83		-	0.117	0.223	<1.000	<0.100	2.83	<0.050	<0.050	<0.050		
1,1,1,2,2-Tetrachloroethane	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
1,2,3-Trichloropropane	mg/kg	<0.016	3.2		-	<0.160	<0.320	<3.200	<0.320	<3.200	<0.160	<0.160	<0.160		
Bromobenzene	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
Propylbenzene	mg/kg	<0.01	6.33		-	0.264	0.258	<2.000	<0.200	6.33	<0.100	<0.100	<0.100		
2-Chlorotoluene	mg/kg	<0.009	1.8		-	<0.090	<0.180	<1.800	<0.180	<1.800	<0.090	<0.090	<0.090		
1,3,5-Trimethylbenzene	mg/kg	<0.008	29.4		-	2.3	1.85	3.02	0.486	29.4	<0.080	<0.080	<0.080		
4-Chlorotoluene	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
tert-Butylbenzene	mg/kg	<0.014	2.8		-	<0.140	<0.280	<2.800	<0.280	<2.800	<0.140	<0.140	<0.140		
1,2,4-Trimethylbenzene	mg/kg	<0.009	88.4		-	5.56	5.8	7.95	1.34	88.4	<0.090	<0.090	<0.090		
sec-Butylbenzene	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
4-Isopropyltoluene	mg/kg	<0.01	2		-	0.673	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
1,3-Dichlorobenzene	mg/kg	<0.008	1.6		-	<0.080	<0.160	<1.600	<0.160	<1.600	<0.080	<0.080	<0.080		
1,4-Dichlorobenzene	mg/kg	<0.005	1		-	<0.050	<0.100	<1.000	<0.100	<1.000	<0.050	<0.050	<0.050		
n-Butylbenzene	mg/kg	<0.011	2.2		-	0.637	<0.220	<2.200	<0.220	<2.200	<0.110	<0.110	<0.110		
1,2-Dichlorobenzene	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
1,2-Dibromo-3-chloropropane	mg/kg	<0.014	2.8		-	<0.140	<0.280	<2.800	<0.280	<2.800	<0.140	<0.140	<0.140		
Tert-amyl methyl ether	mg/kg	<0.01	2		-	<0.100	<0.200	<2.000	<0.200	<2.000	<0.100	<0.100	<0.100		
1,2,4-Trichlorobenzene	mg/kg	<0.02	4		-	<0.200	<0.400	<4.000	<0.400	<4.000	<0.200	<0.200	<0.200		
Hexachlorobutadiene	mg/kg	<0.02	4		-	<0.200	<0.400	<4.000	<0.400	<4.000	<0.200	<0.200	<0.200		
Naphthalene	mg/kg	<0.013	699		-	4.38	68.1	240	627	699	0.846	<0.130	<0.130		
1,2,3-Trichlorobenzene	mg/kg	<0.02	4		-	<0.200	<0.400	<4.000	<0.400	<4.000	<0.200	<0.200	<0.200		
Sum of Detected Xylenes	mg/kg	<0.2	0.2		-										
Sum of BTEX	mg/kg	<0.4	0.4		-										

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH104	BH105	BH106	BH107	BH102B	HP103	HP104A	TP102	TP103	TP104	TP105	TP106	TP103A
						1.30-	0.25-	1.10-	0.35-	1.00-	0.30-	0.70-	0.90-	0.80-	1.10-	1.70-	0.50-	0.40-
Test	Units	LOD	MAX	DWS	L3 SSAC	MG	MG	MG	MG	MG	MG	MG	MG	MG	MG	ALV	MG	MG
NRA - Leachant Volume	ml			-	-	980	980	980	980	980	980	980	980	980	980	980	980	980
Inorganics																		
NRA - Sulphate	µg/l	<2000	1570000	250000	N/A	22900		1430000	111000	259000	1030000	45800	1490000	1310000	1570000	846000	11900	1400000
NRA - Ammoniacal Nitrogen as NH3	µg/l	<200	172000	-	-	<200.000		3530	<200.000	4670	477	976	301	5350	21000	172000	<200.000	<200.000
NRA - Cyanide, Total	µg/l	<50	4170	50	7701050	<50.000		<50.000	190	4170	113	509	838	520	137	<50.000	<50.000	645
NRA - Ammoniacal Nitrogen as NH4	µg/l	<300	183000	500	654643	<300.000		3730	<300.000	4940	505	1030	319	5670	22200	183000	<300.000	<300.000
NRA - Cyanide, Free	µg/l	<50	250	-	-	<50.000		<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<250.000	<50.000	<50.000	<50.000	<50.000
NRA - Cyanide, Complex	µg/l	<50	4170	-	-	<50.000		<50.000	190	4170	113	509	838	520	137	<50.000	<50.000	645
Ammoniacal Nitrogen as N - Calculated	µg/l		142333	-	-	<233.333		2901.11	<233.333	3842.22	392.78	801.11	248.11	4410.00	17266.67	142333.33	<233.333	<233.333
free ammonia calculated			1498	-	-	<2.456		30.54	<2.456	40.45	4.13	8.43	2.61	46.42	181.77	1498.36	<2.456	<2.456
Filtered (Dissolved) Metals																		
NRA - Chromium, Hexavalent	µg/l	<30	30	-	-	<30.000		<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000
NRA - Chromium, Trivalent	µg/l	<30	30	-	-	<30.000		<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000
NRA - Mercury (diss.filt)	µg/l	<0.01	0.047	1	-	<0.010		<0.010	0.047	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0187	<0.010
NRA - Arsenic (diss.filt)	µg/l	<0.12	56.7	10	N/A	3.18		56.7	5.67	0.577	7.84	3.25	0.325	8.13	51.5	9.57	7.1	0.747
NRA - Barium (diss.filt)	µg/l	<0.03	46.7	700	-	6.35		17.7	30.8	21.5	46.7	22.8	11.1	19.4	4.87	13.9	3.49	28.2
NRA - Beryllium (diss.filt)	µg/l	<0.07	0.07	12	-	<0.070		<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070	<0.070
NRA - Boron (diss.filt)	µg/l	<9.4	168	1000	-	34.4		<9.400	24.4	14.2	21.9	18.5	<9.400	30.4	168	12.4	<9.400	<9.400
NRA - Cadmium (diss.filt)	µg/l	<0.1	0.436	5	-	<0.100		<0.100	<0.100	<0.100	0.436	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
NRA - Chromium (diss.filt)	µg/l	<0.22	3.31	50	-	1.25		0.375	1.67	0.399	0.573	1.25	0.612	0.526	3.31	0.759	1.11	1.44
NRA - Copper (diss.filt)	µg/l	<0.85	21.7	2000	-	3.26		9.08	21.7	1.51	14.4	1.07	9.46	6.3	11.6	8.02	3.2	14
NRA - Lead (diss.filt)	µg/l	<0.02	5.96	10	-	0.727		0.047	5.96	0.05	0.813	5.84	0.021	1.44	0.172	<0.020	1.44	2.25
NRA - Nickel (diss.filt)	µg/l	<0.15	17.8	20	-	0.963		11.8	5.69	2.65	17.8	2.36	16.7	9.44	5.15	10.9	<0.150	15.5
NRA - Selenium (diss.filt)	µg/l	<0.39	6.11	10	N/A	3.22		1.04	2.72	1.61	2.69	1.11	0.487	6.11	1.99	0.596	0.772	1.32
NRA - Vanadium (diss.filt)	µg/l	<0.24	9.23	-	-	3.15		0.71	1.71	0.299	1.46	0.758	0.712	1.07	5.72	1.44	9.23	0.531
NRA - Zinc (diss.filt)	µg/l	<0.41	29.1	-	-	<0.410		1.7	1.59	<0.410	29.1	0.438	2.97	0.895	2.59	0.618	3.04	4.64
Phenols																		
NRA - Phenol	µg/l	<2	290	-	-	<2.000		<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	290	<2.000	<2.000	<2.000	<2.000
NRA - Cresols	µg/l	<6	360	-	-	<6.000		<6.000	<6.000	<6.000	110	<6.000	<6.000	360	<6.000	<6.000	<6.000	<6.000
NRA - Xylenols	µg/l	<8	1610	-	-	<8.000		<8.000	<8.000	<8.000	1610	<8.000	<8.000	120	<8.000	10	<8.000	<8.000
NRA - 2,3,5-Trimethylphenol	µg/l	<3	10	-	-	<3.000		<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	10	<3.000	<3.000	<3.000	<3.000
NRA - 2-Isopropylphenol	µg/l	<6	2120	-	-	<6.000		<6.000	<6.000	<6.000	2120	<6.000	<6.000	40	<6.000	<6.000	<6.000	<6.000
NRA - Phenols, Total Detected 5 speciated	µg/l	<25	3840	-	-	<25.000		<25.000	<25.000	<25.000	3840	<25.000	<25.000	820	<25.000	<25.000	<25.000	<25.000
TPH Criteria Working Group (TPH CWG)																		
NRA - GRO Surrogate % recovery**	%		95	-	-	88		87	85	83	83	78	86	74	95	79	83	90
NRA - GRO >C5-C12	µg/l	<50	1860	-	-	<50.000		<50.000	219	<50.000	1860	916	<50.000	1080	<50.000	<50.000	<50.000	<50.000
NRA - Methyl tertiary butyl ether (MTBE)	µg/l	<3	3	-	-	<3.000		<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000	<3.000
NRA - Benzene	µg/l	<7	7	-	-	<7.000		<7.000	<7.000	<7.000	<7.000	<7.000	<7.000	<7.000	<7.000	<7.000	<7.000	<7.000
NRA - Toluene	µg/l	<4	9	-	-	<4.000		<4.000	<4.000	<4.000	<4.000	<4.000	<4.000	9	<4.000	<4.000	<4.000	<4.000
NRA - Ethylbenzene	µg/l	<5	14	-	-	<5.000		<5.000	<5.000	<5.000	<5.000	<5.000	<5.000	14	<5.000	<5.000	<5.000	<5.000
NRA - m,p-Xylene	µg/l	<8	22	-	-	<8.000		<8.000	<8.000	<8.000	<8.000	13	<8.000	22	<8.000	<8.000	<8.000	<8.000
NRA - o-Xylene	µg/l	<3	19	-	-	<3.000		<3.000	<3.000	<3.000	4	13	<3.000	19	<3.000	<3.000	<3.000	<3.000
NRA - Sum of detected Xylenes	µg/l	<11	41	-	-	<11.000		<11.000	<11.000	<11.000	<11.000	26	<11.000	41	<11.000	<11.000	<11.000	<11.000
NRA - Sum of detected BTEX	µg/l	<28	64	-	-	<28.000		<28.000	<28.000	<28.000	<28.000	<28.000	<28.000	64	<28.000	<28.000	<28.000	<28.000
NRA - Aliphatics >C5-C6	µg/l	<10	10	15000	-	<10.000		<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
NRA - Aliphatics >C6-C8	µg/l	<10	25	15000	-	<10.000		<10.000	<10.000	<10.000	<10.000	25	<10.000	11	<10.000	<10.000	<10.000	<10.000
NRA - Aliphatics >C8-C10	µg/l	<10	98	300	N/A	<10.000		<10.000	80	<10.000	95	98	<10.000	59	<10.000	<10.000	<10.000	<10.000
NRA - Aliphatics >C10-C12	µg/l	<10	1010	300	N/A	<10.000		<10.000	45	<10.000	1010	417	<10.000	541	<10.000	<10.000	<10.000	<10.000
NRA - Aliphatics >C12-C16 (aq)	µg/l	<10	23	300	-	<10.000		<10.000	<10.000	<10.000	<10.000	23	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
NRA - Aliphatics >C16-C21 (aq)	µg/l	<10	31	-	-	<10.000		<10.000	<10.000	<10.000	<10.000	31	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
NRA - Aliphatics >C21-C35 (aq)	µg/l	<10	342	-	-	<10.000		<10.000	<10.000	342	22	43	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
NRA - Total Aliphatics >C12-C35 (aq)	µg/l	<10	342	-	-	<10.000		<10.000	<10.000	342	22	97	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
NRA - Aromatics >EC5-EC7	µg/l	<10	10	1	N/A	<10.000		<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
NRA - Aromatics >EC7-EC8	µg/l	<10	10	300	-	<10.000		<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
NRA - Aromatics >EC8-EC10	µg/l	<10	94	300	1.98E+09	<10.000		<10.000	54	<10.000	74	92	<10.000	94	<10.000	<10.000	<10.000	<10.000
NRA - Aromatics >EC10-EC12	µg/l	<10	674	90	3.54E+07	<10.000		<10.000	30	<10.000	674	278	<10.000	361	<10.000	<10.000	<10.000	<10.000
NRA - Aromatics >EC12-EC16 (aq)	µg/l	<10	3030	90	N/A	<10.000		<10.000	19	<10.000	3030	662	<10.000	635	<10.000	30	<10.000	14
NRA - Aromatics >EC16-EC21 (aq)	µg/l	<10	694	90	N/A	<10.000		<10.000	13	<10.000	694	275	<10.000	213	29	<10.000	<10.000	24
NRA - Aromatics >EC21-EC35 (aq)	µg/l	<10	77	90	N/A	<10.000		<10.000	<10.000	<10.000	69	77	22	42	18	<10.000	<10.000	10
NRA - Total Aromatics >EC12-EC35 (aq)	µg/l	<10	3790	-	-	<10.000		<10.000	32	<10.000	3790	1010	22	890	47	30	<10.000	48
NRA - Total Aliphatics & Aromatics >C5-35 (aq)	µg/l	<10	5680	-	-	<10.000		<10.000	251	342	5680	2030	22	1970	49	58	<10.000	48
Polyaromatic Hydrocarbons (PAHs)																		
NRA - Naphthalene (aq)	µg/l	<0.1	322	-	-	<0.100		0.568	0.975	0.138	<1.000	<1.000	0.706	322	0.24	6.84	<0.100	<0.100
NRA - Acenaphthene (aq)	µg/l	<0.015	49.8	-	-	0.0273		0.15	1.51	0.478	19.3	15.8	<0.015	4				

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH104	BH105	BH106	BH107	BH102B	HP103	HP104A	TP102	TP103	TP104	TP105	TP106	TP103A
						1.30-	0.25-	1.10-	0.35-	1.00-	0.30-	0.70-	0.90-	0.80-	1.10-	1.70-	0.50-	0.40-
Test	Units	LOD	MAX	DWS	L3 SSAC	MG	MG	MG	MG	MG	MG	MG	MG	MG	MG	ALV	MG	MG
NRA - Benzo(b)fluoranthene (aq)	µg/l	<0.023	0.23	-	-	<0.023		<0.023	0.0531	<0.023	<0.230	<0.230	<0.023	<0.230	<0.023	<0.046	<0.023	0.0645
NRA - Benzo(k)fluoranthene (aq)	µg/l	<0.027	0.27	-	-	<0.027		<0.027	<0.027	<0.027	<0.270	<0.270	<0.027	<0.270	<0.027	<0.054	<0.027	<0.027
NRA - Benzo(a)pyrene (aq)	µg/l	<0.009	0.201	0.01	LTT	<0.009		<0.009	0.0341	<0.009	0.107	0.201	<0.009	0.1	<0.009	<0.018	<0.009	0.0349
NRA - Dibenzo(a,h)anthracene (aq)	µg/l	<0.016	0.16	-	-	<0.016		<0.016	<0.016	<0.016	<0.160	<0.160	<0.016	<0.160	<0.016	<0.032	<0.016	<0.016
NRA - Benzo(g,h,i)perylene (aq)	µg/l	<0.016	0.183	-	-	<0.016		<0.016	0.0477	<0.016	<0.160	0.183	<0.016	<0.160	<0.016	<0.032	<0.016	0.0246
NRA - Indeno(1,2,3-cd)pyrene (aq)	µg/l	<0.014	0.14	-	-	<0.014		<0.014	0.0316	<0.014	<0.140	<0.140	<0.014	<0.140	<0.014	<0.028	<0.014	0.0178
NRA - PAH, Total Detected USEPA 16 (aq)	µg/l	<0.344	953	-	-	<0.344		2.51	4.68	2.22	263	37.5	0.961	953	0.594	7.01	<0.344	7.97
PAH sum of 4	µg/l		0.823	0.1	LTT	<0.080		<0.080	0.1594	<0.080	<0.800	0.823	<0.080	<0.800	<0.080	<0.160	<0.080	0.1339
PCB's - (Solids)																		
NRA - PCB congener 28	µg/l	<0.015	0.015	-	-		<0.015						<0.015					
NRA - PCB congener 52	µg/l	<0.015	0.015	-	-		<0.015						<0.015					
NRA - PCB congener 101	µg/l	<0.015	0.015	-	-		<0.015						<0.015					
NRA - PCB congener 118	µg/l	<0.015	0.015	-	-		<0.015						<0.015					
NRA - PCB congener 138	µg/l	<0.015	0.015	-	-		<0.015						<0.015					
NRA - PCB congener 153	µg/l	<0.015	0.015	-	-		<0.015						<0.015					
NRA - PCB congener 180	µg/l	<0.015	0.015	-	-		<0.015						<0.015					
NRA - Sum of detected EC7 PCB's	µg/l	<0.105	0.105	-	-		<0.105						<0.105					
Semi-Volatile Organic Compounds (SVOCs)																		
NRA - 1,2,4-Trichlorobenzene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 1,2-Dichlorobenzene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 1,3-Dichlorobenzene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 1,4-Dichlorobenzene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2,4,5-Trichlorophenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2,4,6-Trichlorophenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2,4-Dichlorophenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2,4-Dimethylphenol (aq)	µg/l	<1	93.6	-	-	<1.000		<1.000	<1.000	<1.000	93.6	1.25	<1.000	19.2	<1.000	4.02	<1.000	<1.000
NRA - 2,4-Dinitrotoluene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2,6-Dinitrotoluene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2-Chloronaphthalene (aq)	µg/l	<1	12.3	-	-	<1.000		<1.000	<1.000	<1.000	12.3	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2-Chlorophenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2-Methylnaphthalene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2-Methylphenol (aq)	µg/l	<1	102	-	-	<1.000		<1.000	<1.000	<1.000	102	<1.000	<1.000	52.5	<1.000	<2.000	<1.000	<1.000
NRA - 2-Nitroaniline (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 2-Nitrophenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 3-Nitroaniline (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 4-Bromophenylphenylether (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 4-Chloro-3-methylphenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 4-Chloroaniline (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 4-Chlorophenylphenylether (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 4-Methylphenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 4-Nitroaniline (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - 4-Nitrophenol (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Azobenzene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	2.41	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Acenaphthylene (aq)	µg/l	<1	96.8	-	-	<1.000		<1.000	<1.000	<1.000	39.2	4.91	<1.000	96.8	<1.000	<2.000	<1.000	<1.000
NRA - Acenaphthene (aq)	µg/l	<1	35.2	-	-	<1.000		<1.000	1.16	<1.000	17.8	7.3	<1.000	35.2	<1.000	<2.000	<1.000	<1.000
NRA - Anthracene (aq)	µg/l	<1	17.5	-	-	<1.000		<1.000	<1.000	<1.000	17.5	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - bis(2-Chloroethyl)ether (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - bis(2-Chloroethoxy)methane (aq)	µg/l	<1	25.5	-	-	<1.000		<1.000	<1.000	<1.000	25.5	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - bis(2-Ethylhexyl) phthalate (aq)	µg/l	<2	10	-	-	<2.000		<2.000	<2.000	<2.000	<10.000	<2.000	<2.000	<2.000	2.28	<4.000	<2.000	<2.000
NRA - Butylbenzyl phthalate (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Benzo(a)anthracene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Benzo(b)fluoranthene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Benzo(k)fluoranthene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Benzo(a)pyrene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Benzo(g,h,i)perylene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Carbazole (aq)	µg/l	<1	161	-	-	<1.000		<1.000	<1.000	<1.000	161	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Chrysene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Dibenzofuran (aq)	µg/l	<1	83.3	-	-	<1.000		<1.000	<1.000	<1.000	41.8	<1.000	<1.000	83.3	<1.000	<2.000	<1.000	<1.000
NRA - n-Dibutyl phthalate (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Diethyl phthalate (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Dibenzo(a,h)anthracene (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - Dimethyl phthalate (aq)	µg/l	<1	5	-	-	<1.000		<1.000	<1.000	<1.000	<5.000	<1.000	<1.000	<1.000	<1.000	<2.000	<1.000	<1.000
NRA - n-Dioctyl phthalate (aq)	µg/l	<5	25	-	-	<5.000		<5.000	&lt									

	<0.000	Concentration below the LOD
	0.000	Concentration in exceedance of the GAC
	0.000	Concentration in exceedance of the L3 SSAC
	N/A	not applicable
	LTT	Long Travel Time - risk negligible

[illegible]

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH104	BH105	BH106	BH107	BH102B	HP103	HP104A	TP102	TP103	TP104	TP105	TP106	TP103A
						1.30-	0.25-	1.10-	0.35-	1.00-	0.30-	0.70-	0.90-	0.80-	1.10-	1.70-	0.50-	0.40-
Test	Units	LOD	MAX	DWS	L3 SSAC	MG	MG	MG	MG	MG	MG	MG	MG	MG	MG	ALV	MG	MG
NRA - 1,2,3-Trichlorobenzene	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
NRA - 1,3,5-Trichlorobenzene	µg/l	<1	10	-	-	<1.000		<1.000	<1.000	<1.000	<10.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH201	BH201	BH202	BH204	BH203C	VW202	VW203A	WS203	WS204	WS206
						1.10-1.20	5.10-5.20	0.30-0.30	0.60-0.70	2.20-2.30	0.40-0.50	0.80-1.00	3.40-3.50	0.60-0.70	4.20-4.30
Reading Gasholder No. 4						25/03/2019	29/03/2019	25/03/2019	27/03/2019	01/04/2019	26/03/2019	27/03/2019	04/04/2019	27/03/2019	05/04/2019
Test	Units	LOD	MAX	DWS	L3 SSAC	MG	RTG	MG	MG	ALV	MG	MG	ALV	MG	ALV
Waste Acceptance Criteria (WAC)															
CEN 2:1 - Temperature	°C		17.6	-	-	16.2	16.5	17.4	17.5	16.2	17.1	16.7	17.6	15.1	15.4
CEN 2:1 - pH	pH Units		10.36	-	-	7.84	8.29	10.36	8.05	8.61	8.51	7.87	8.59	7.31	7.66
CEN 2:1 - Conductivity @ 20 deg.C	µS/cm		2270	-	-	713	233	285	644	456	430	2270	606	2140	726
Inorganics															
CEN 2:1 - pH	pH Units	<1	10.18	-	-	8.26	8.18	10.18	8.26	8.6	8.43	7.95	8.5	7.97	8.26
CEN 2:1 - Ammoniacal Nitrogen as NH ₄	mg/l	<0.3	87.7	0.5	654.643	<0.300000	1.45	<0.300000	<0.300000	63.4	<0.300000	<0.300000	87.7	2.46	24.6
Ammoniacal Nitrogen as N - Calculated	mg/l		68.21	0.5	-	0.233	1.128	0.233	0.233	49.311	0.233	0.233	68.211	1.913	19.133
Free ammonia (calculated)	mg/l		0.72	-	-	0.002	0.012	0.002	0.002	0.519	0.002	0.002	0.718	0.020	0.201
CEN 2:1 - Cyanide, Complex	mg/l	<0.05	8.15	-	-	0.34	<0.050000	8.15	0.494	0.095	0.5	0.622	0.14	1.09	0.57
CEN 2:1 - Sulphate (soluble) as S	mg/l	<1	513	250	-	95	1.9	22.8	71.7	17.6	7.33	513	22.3	473	75.3
Filtered (Dissolved) Metals															
CEN 2:1 - Chromium, Hexavalent	mg/l	<0.03	0.03	-	-	<0.030000	<0.030000	<0.030000	<0.030000	<0.030000	<0.030000	<0.030000	<0.030000	<0.030000	<0.030000
CEN 2:1 - Mercury (diss.filt)	mg/l	<0.00001	0.0000269	-	-	<0.000010	<0.000010	<0.000010	<0.000010	0.0000269	<0.000010	<0.000010	0.0000189	<0.000010	<0.000010
CEN 2:1 - Arsenic (diss.filt)	mg/l	<0.0005	0.192	0.01	N/A	0.00405	0.00166	0.0608	0.00197	0.0167	0.00537	0.0149	0.192	0.0306	0.00323
CEN 2:1 - Barium (diss.filt)	mg/l	<0.0002	0.055	0.7	-	0.0329	0.00919	0.0327	0.055	0.0175	0.0414	0.0271	0.0312	0.0546	0.053
CEN 2:1 - Beryllium (diss.filt)	mg/l	<0.0001	0.0001	0.012	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
CEN 2:1 - Boron (diss.filt)	mg/l	<0.01	0.191	1	-	0.0488	0.0229	0.0293	0.0352	0.191	0.02	0.0902	0.142	0.146	0.0314
CEN 2:1 - Cadmium (diss.filt)	mg/l	<0.00008	0.00037	0.005	-	<0.000080	<0.000080	<0.000080	0.0000801	<0.000080	<0.000080	0.00037	<0.000080	<0.000080	<0.000080
CEN 2:1 - Chromium (diss.filt)	mg/l	<0.001	0.00731	0.05	-	<0.001000	<0.001000	0.00731	<0.001000	<0.001000	<0.001000	<0.001000	<0.001000	<0.001000	<0.001000
CEN 2:1 - Copper (diss.filt)	mg/l	<0.0003	0.0522	2	-	0.00322	0.0014	0.0522	0.00448	0.00768	0.00158	0.00832	0.0069	0.00449	<0.000300
CEN 2:1 - Lead (diss.filt)	mg/l	<0.0002	0.0439	0.01	-	0.000393	<0.000200	0.00523	0.000312	0.000877	0.000389	0.000758	0.00177	0.0439	<0.000200
CEN 2:1 - Nickel (diss.filt)	mg/l	<0.0004	0.0197	0.02	-	0.000815	0.00144	0.00582	0.0028	0.00881	0.00141	0.00675	0.0184	0.0197	0.00246
CEN 2:1 - Selenium (diss.filt)	mg/l	<0.001	0.0556	0.01	N/A	0.00447	<0.001000	0.0082	0.00487	0.00449	0.00365	0.0109	0.0556	0.014	0.00782
CEN 2:1 - Vanadium (diss.filt)	mg/l	<0.001	0.0138	-	-	0.0015	<0.001000	0.0138	<0.001000	0.00128	0.00146	<0.001000	<0.001000	<0.001000	<0.001000
CEN 2:1 - Zinc (diss.filt)	mg/l	<0.001	0.021	-	-	0.00446	0.00141	0.00238	0.00947	0.0118	0.00148	0.0168	0.00823	0.021	0.00764
Phenols															
CEN 2:1 - Phenol	mg/l	<0.002	0.01	-	-	<0.002000	<0.002000	<0.002000	<0.002000	<0.002000	<0.002000	<0.002000	0.01	<0.002000	<0.002000
CEN 2:1 - Cresols	mg/l	<0.006	0.02	-	-	<0.006000	<0.006000	<0.006000	<0.006000	<0.006000	<0.006000	<0.006000	0.02	<0.006000	<0.006000
CEN 2:1 - Xylenols	mg/l	<0.008	0.03	-	-	<0.008000	<0.008000	<0.008000	<0.008000	<0.008000	<0.008000	<0.008000	0.03	<0.008000	<0.008000
CEN 2:1 - Phenols, Total Detected monohydric	mg/l	<0.016	0.06	-	-	<0.016000	<0.016000	<0.016000	<0.016000	<0.016000	<0.016000	<0.016000	0.06	<0.016000	<0.016000
TPH Criteria Working Group (TPH CWG)															
CEN 2:1 - GRO Surrogate % recovery**	%		117	-	-	82	116	46	72	116	110	117	88	92	74
CEN 2:1 - GRO >C5-C12	mg/l	<0.05	2.46	-	-	0.186	<0.050000	1.28	<0.050000	<0.050000	<0.050000	<0.050000	2.46	1.41	0.484
CEN 2:1 - Methyl tertiary butyl ether (MTBE)	mg/l	<0.003	0.003	-	-	<0.003000	<0.003000	<0.003000	<0.003000	<0.003000	<0.003000	<0.003000	<0.003000	<0.003000	<0.003000
CEN 2:1 - Benzene	mg/l	<0.007	0.007	0.001	-	<0.007000	<0.007000	<0.007000	<0.007000	<0.007000	<0.007000	<0.007000	<0.007000	<0.007000	0.007
CEN 2:1 - Toluene	mg/l	<0.004	0.004	0.7	-	<0.004000	<0.004000	0.004	<0.004000	<0.004000	<0.004000	<0.004000	<0.004000	<0.004000	<0.004000
CEN 2:1 - Ethylbenzene	mg/l	<0.005	0.028	0.3	-	<0.005000	<0.005000	0.028	<0.005000	<0.005000	<0.005000	<0.005000	0.015	0.01	0.006
CEN 2:1 - m,p-Xylene	mg/l	<0.008	0.054	-	-	<0.008000	<0.008000	0.008	<0.008000	<0.008000	<0.008000	<0.008000	0.054	0.018	0.008
CEN 2:1 - o-Xylene	mg/l	<0.003	0.03	-	-	<0.003000	<0.003000	0.009	<0.003000	<0.003000	<0.003000	<0.003000	0.03	0.016	0.016
CEN 2:1 - Sum of detected Xylenes	mg/l	<0.011	0.084	0.5	-	<0.011000	<0.011000	0.017	<0.011000	<0.011000	<0.011000	<0.011000	0.084	0.034	0.024
CEN 2:1 - Sum of detected BTEX	mg/l	<0.028	0.099	-	-	<0.028000	<0.028000	0.049	<0.028000	<0.028000	<0.028000	<0.028000	0.099	0.044	0.037
CEN 2:1 - Aliphatics >C5-C6	mg/l	<0.01	0.332	15	-	<0.010000	<0.010000	0.01	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	0.332
CEN 2:1 - Aliphatics >C6-C8	mg/l	<0.01	0.038	15	-	0.038	<0.010000	0.021	<0.010000	<0.010000	<0.010000	<0.010000	0.011	0.012	0.029
CEN 2:1 - Aliphatics >C8-C10	mg/l	<0.01	0.322	0.3	N/A	0.07	<0.010000	0.142	<0.010000	<0.010000	<0.010000	<0.010000	0.322	0.162	0.019
CEN 2:1 - Aliphatics >C10-C12	mg/l	<0.01	1.08	0.3	N/A	0.016	<0.010000	0.577	<0.010000	<0.010000	<0.010000	<0.010000	1.08	0.644	0.033
CEN 2:1 - Aliphatics >C12-C16 (aq)	mg/l	<0.01	0.02	0.3	-	<0.010000	<0.010000	<0.010000	<0.010000	<0.020000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000
CEN 2:1 - Aliphatics >C16-C21 (aq)	mg/l	<0.01	0.02	-	-	<0.010000	<0.010000	<0.010000	<0.010000	<0.020000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000
CEN 2:1 - Aliphatics >C21-C35 (aq)	mg/l	<0.01	0.02	-	-	<0.010000	<0.010000	<0.010000	<0.010000	<0.020000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000
CEN 2:1 - Total Aliphatics >C12-C35 (aq)	mg/l	<0.01	0.02	-	-	<0.010000	<0.010000	<0.010000	<0.010000	<0.020000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000
CEN 2:1 - Aromatics >EC5-EC7	mg/l	<0.01	0.01	0.001	N/A	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000
CEN 2:1 - Aromatics >EC7-EC8	mg/l	<0.01	0.01	0.7	-	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000	<0.010000
CEN 2:1 - Aromatics >EC8-EC10	mg/l	<0.01	0.314	0.5	1.98E+06	0.047	<0.010000	0.139	<0.010000	<0.010000	<0.010000	<0.010000	0.314	0.152	0.042
CEN 2:1 - Aromatics >EC10-EC12	mg/l	<0.01	0.722	0.09	3.54E+04	0.011	<0.010000	0.385	<0.010000	<0.010000	<0.010000	<0.010000	0.722	0.429	0.022
CEN 2:1 - Aromatics >EC12-EC16 (aq)	mg/l	<0.01	0.727	0.09	N/A	<0.010000	<0.010000	0.207	<0.010000	<0.020000	<0.010000	<0.010000	0.01	0.727	<0.010000
CEN 2:1 - Aromatics >EC16-EC21 (aq)	mg/l	<0.01	0.821	0.09	N/A	<0.010000	<0.010000	0.124	0.821	<0.020000	<0.010000	<0.010000	<0.010000	0.302	<0.010000
CEN 2:1 - Aromatics >EC21-EC35 (aq)	mg/l	<0.01	513	0.09	N/A	<0.010000	<0.010000	0.029	513	<0.020000	<0.010000	<0.010000	<0.010000	0.04	<0.010000
CEN 2:1 - Total Aromatics >EC12-EC35 (aq)	mg/l	<0.01	513	-	-	<0.010000	<0.010000	0.36	513	<0.020000	<0.010000	<0.010000	0.01	1.07	<0.010000
CEN 2:1 - Total Aliphatics & Aromatics >C5-35 (aq)	mg/l	<0.01	513	-	-	0.186	<0.010000	1.64	513	<0.020000	0.03	<0.010000	2.47	2.48	0.484
Polyaromatic Hydrocarbons (PAHs)															
CEN 2:1 - Naphthalene (aq)	mg/l	<0.00001	0.0517	-	-	<0.000010	0.00277	0.0517	0.0000137	0.0000225	0.0000428	0.0000501	0.0142	0.0173	0.0000268
CEN 2:1 - Acenaphthene (aq)	mg/l	<0.000005	0.0138	-	-	0.0000184	0.0000266	<0.000005	<0.000005	0.00000609	0.0000145	0.0000273	0.0138	0.000117	
CEN 2:1 - Acenaphthylene (aq)	mg/l	<0.000005	0.0659	-	-	<0.000005	0.0000292	<0.000005	<0.000005	<0.000010	0.00000824	0.0000206	0.00193	0.0659	0.0000239
CEN 2:1 - Fluoranthene (aq)	mg/l	<0.000005	0.00827	-	-	0.000011	0.0000647	0.0037	0.0000201	0.0000391	0.000126	0.0000795	0.00827	0.0000607	
CEN 2:1 - Anthracene (aq)	mg/l	<0.000005	0.00894	-	-	0									

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

						BH201	BH201	BH202	BH204	BH203C	VW202	VW203A	WS203	WS204	WS206
						1.10-1.20	5.10-5.20	0.30-0.30	0.60-0.70	2.20-2.30	0.40-0.50	0.80-1.00	3.40-3.50	0.60-0.70	4.20-4.30
Reading Gasholder No. 4						25/03/2019	29/03/2019	25/03/2019	27/03/2019	01/04/2019	26/03/2019	27/03/2019	04/04/2019	27/03/2019	05/04/2019
Test	Units	LOD	MAX	DWS	L3 SSAC	MG	RTG	MG	MG	ALV	MG	MG	ALV	MG	ALV
CEN 2:1 - Benzo(k)fluoranthene (aq)	mg/l	<0.000005	0.000186	-	-	<0.000005	<0.000005	0.000186	0.00000527	<0.000010	0.0000126	<0.000005	0.00000878	0.00017	<0.000005
CEN 2:1 - Benzo(a)pyrene (aq)	mg/l	<0.000002	0.000283	0.00001	LTT	<0.000002	<0.000002	0.000283	0.000005	<0.000004	0.0000178	<0.000002	0.00000628	0.000166	<0.000002
CEN 2:1 - Dibenzo(a,h)anthracene (aq)	mg/l	<0.000005	0.000251	-	-	<0.000005	<0.000005	0.000113	<0.000005	<0.000010	0.0000154	<0.000005	<0.000005	0.000251	<0.000005
CEN 2:1 - Benzo(g,h,i)perylene (aq)	mg/l	<0.000005	0.000309	-	-	<0.000005	<0.000005	0.000309	<0.000005	<0.000010	0.0000202	<0.000005	<0.000005	0.000192	<0.000005
CEN 2:1 - Indeno(1,2,3-cd)pyrene (aq)	mg/l	<0.000005	0.000207	-	-	<0.000005	<0.000005	0.000184	<0.000005	<0.000010	0.0000252	<0.000005	<0.000005	0.000207	<0.000005
CEN 2:1 - PAH, Total Detected USEPA 16 (aq)	mg/l	<0.000082	0.197	-	-	0.000347	0.00345	0.0761	0.000725	0.000185	0.000516	0.000751	0.0169	0.197	0.000397
PAH sum of 4 (calculated)	mg/l		0.001125	0.0001	LTT	<0.000020	<0.000020	0.001125	0.00002647	0.00004	0.0000895	<0.000021	0.00004048	0.000755	<0.000020

	<0.000	Concentration below the LOD																					
	0.000	Concentration in exceedance of the GAC																					
	0.000	Concentration in exceedance of the L3 SSAC																					
	N/A	not applicable																					
	LTT	Long Travel Time - risk negligible																					

	<0.000	Concentration below the LOD																						
	0.000	Concentration in exceedance of the GAC																						
	0.000	Concentration in exceedance of the L3 SSAC																						
	N/A	not applicable																						
	LTT	Long Travel Time - risk negligible																						
								BH101	BH101	BH103A	BH103A	BH103A	BH105	BH105	BH106	BH106	BH106	BH106	BH107	BH107	BH107	BH107	BH201	BH203C
Reading								10/04/2019	10/02/2020	24/11/2015	15/12/2015	11/02/2020	24/11/2015	15/12/2015	24/11/2015	15/12/2015	15/04/2019	11/02/2020	24/11/2015	15/12/2015	15/04/2019	11/02/2020	10/02/2020	10/04/2019
Test	Units	LOD	Total Max	Max in Chalk	DWS	L3 DWS	MG	MG	AL/RTG	AL/RTG	AL/RTG	Chalk	Chalk	Chalk	Chalk	Chalk	Chalk	Chalk	Chalk	Chalk	Chalk	Chalk	RTG	RTG
1,3-Dichlorobenzene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000	<1.000		<1.000	<1.000	<1.000	<1.000	<1.000
1,4-Dichlorobenzene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000	<1.000		<1.000	<1.000	<1.000	<1.000	<1.000
n-Butylbenzene	µg/l	<1	3.94	3.94	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000	<1.000		<1.000	<1.000	<1.000	<1.000	<1.000
1,2-Dichlorobenzene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000	<1.000		<1.000	<1.000	<1.000	<1.000	<1.000
1,2-Dibromo-3-chloropropane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000	<1.000		<1.000	<1.000	<1.000	<1.000	<1.000
1,2,4-Trichlorobenzene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000	<1.000		<1.000	<1.000	<1.000	<1.000	<1.000
Hexachlorobutadiene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000	<1.000		<1.000	<1.000	<1.000	<1.000	<1.000
tert-Amyl methyl ether (TAME)	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000	<1.000		<1.000	<1.000	<1.000	<1.000	<1.000
Naphthalene	µg/l	<1	4060	4060	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000	<1.000		<1.000	<1.000	<1.000	<1.000	<1.000
1,2,3-Trichlorobenzene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000	<1.000		<1.000	<1.000	<1.000	<1.000	<1.000
1,3,5-Trichlorobenzene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000		<1.000	<1.000	<1.000		<1.000	<1.000	<1.000	<1.000	<1.000
Sum of detected Xylenes	µg/l	<2	1000	1000	500	-	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000
Dissolved Gases																								
Methane, dissolved	µg/l	<1	11800	11800	-	-	<2.230	<2.200	8.37	<2.220	4.73	21.5	36	25.4	11.4	21	<2.220	<2.220	2.82	1.27	<2.210	418	40.4	
Ethene, dissolved	µg/l	<1	753	19.4	-	-	<1.000	<1.000			<1.000					<1.000	<1.000			<1.000	<1.000	59.5	<1.000	
Ethane, dissolved	µg/l	<1	29.4	29.4	-	-	<1.000	<1.000			<1.000					<1.000	<1.000			<1.000	<1.000	6.87	<1.000	
Carbon dioxide, dissolved	µg/l	<1300	174000	174000	-	-	7860	8090	11800	12500	11100	18100	17400	32200	28000	39600	33900	18900	22600	26700	28500	20000	21700	
Propane, dissolved	µg/l	<1	9.04	9.04	-	-	<1.000	<1.000			<1.000					<1.000	<1.000			<1.000	<1.000	<1.000	<1.000	

	<0.000	Concentration below the LOD																				
	0.000	Concentration in exceedance of the GAC																				
	0.000	Concentration in exceedance of the L3 SSAC																				
	N/A	not applicable																				
	LTT	Long Travel Time - risk negligible																				
Reading							BH203C	BH204	BH204	BH101	BH101	BH105	BH104	BH104	BH104	BH105A	BH201	BH302A	BH103A	WS206	BH102B	BH104
Test	Units	LOD	Total Max	Max in Chalk	DWS	L3 DWS	11/02/2020	10/04/2019	11/02/2020	24/11/2015	15/12/2015	11/02/2020	15/12/2015	24/11/2015	17/04/2019	10/04/2019	10/04/2019	10/02/2020	10/04/2019	10/02/2020	24/11/2015	11/02/2020
							RTG	RTG	RTG	MG	MG	Chalk	MG/AL/RTG	MG/AL/RTG	MG/AL/RTG	Chalk	RTG	Chalk	AL/RTG	MG	AL/RTG	MG/AL/RTG
Inorganics																						
Nitrite as NO2	µg/l	<50	2360	2360	500	N/A				<50.000	59		<50.000	<50.000							<50.000	
pH	pH Units	<1	8.35	8.35	-	-	8.23	8.3	7.77	8.05	8.09	7.68	7.48	7.13	7.25	7.78	7.76	7.76	8.05	8	7.52	8.17
Sulphate	µg/l	<2000	635000	317000	250000	-				16900	24600		358000	373000							635000	
Sulphide	µg/l	<10	143	81.3	-	-				<10.000	<10.000		<10.000	13.9							121	
Sulphate as %SO4	%	<0.0002	0.125	0.019	0.025	-	0.00503	0.00535	0.00706			0.0123			0.0426	0.0141	0.0111	0.00671	0.0316	0.122		0.0504
Ammoniacal Nitrogen as NH3	µg/l	<200	53700	40800	-	-				1170	1020		47300	47400							53700	
Cyanide, Total	µg/l	<50	2190	2160	50	698850	<50.000	<50.000	<50.000	78	83	90	103	105	150	150	190	200	210	310	352	370
Ammoniacal Nitrogen as NH4	µg/l	<300	179000	179000	500	47511	1950	665	<300.000	1240	1080	6830	50100	50300	35000	6760	7350	53600	21200	5280	56800	20100
Cyanide, Free	µg/l	<50	50	50	-	-	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000
Cyanide, Total (low level)	µg/l	<5	4430	456	50	698850																
Cyanide, Free (low level)	µg/l	<2.5	80.3	28.5	-	4.98																
Cyanide, Complex (low level)*	µg/l	<5	4350	427	-	-																
Filtered (Dissolved) Metals																						
Iron, Ferric	µg/l	<50	22600	1300	-	-	<50.000	<50.000	<50.000	<50.000	<50.000	410	<50.000	<50.000	1500	270	170	95	223	369	<50.000	1200
Chromium, Hexavalent	µg/l	<30	30	30	-	-	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000
Chromium, Trivalent	µg/l	<30	30	30	-	-				<30.000	<30.000		<30.000	<30.000							<30.000	
Mercury (diss.filt)	µg/l	<0.01	0.0196	0.013	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0179	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Arsenic (diss.filt)	µg/l	<0.12	69.3	26.4	10	N/A	<0.500	<0.500	<0.500	1.67	1.36	15.7	26.8	2.7	68.5	10.4	11.1	8.98	2.1	1.11	21.6	26
Barium (diss.filt)	µg/l	<0.03	159	159	700	-	35.3	62.1	61.1	51.6	49.7	85.7	33.8	43.5	69.9	66.6	68.7	51.6	84.1	37.2	38.5	43.9
Beryllium (diss.filt)	µg/l	<0.07	0.1	0.1	12	-	<0.100	<0.100	<0.100	<0.070	<0.070	<0.100	<0.070	<0.070	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.070	<0.100
Iron (diss.filt)	µg/l	<19	34600	8550	200	LTT	44.6	20.5	<19.000	36.7	39.2	8550	82.5	68.3	34600	7500	8000	372	223	640	317	18500
Boron (diss.filt)	µg/l	<9.4	397	217	1000	-	101	123	123	34.4	17.8	123	353	384	296	145	149	74.6	24.7	140	133	271
Iron, Ferrous	µg/l	<100	33100	8140	-	-	<100.000	<100.000	<100.000	2100	1500	8140	27400	20900	33100	7230	7830	277	<100.000	271	4800	17300
Manganese II	µg/l	<200	1970	591	-	-				<200.000	750		651	558							417	
Cadmium (diss.filt)	µg/l	<0.1	0.1	0.1	5	-	<0.080	<0.080	<0.080	<0.100	<0.100	<0.080	<0.100	<0.100	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.100	<0.080
Chromium (diss.filt)	µg/l	<0.22	17.1	4.15	50	-	17.1	<1.000	10.3	3.63	2.89	<1.000	8.1	9.02	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	13	3.57
Copper (diss.filt)	µg/l	<0.85	4.93	2.03	2000	-	1.39	<0.300	1.01	<0.850	1.53	0.528	1.45	2.53	<0.300	0.572	0.631	<0.300	<0.300	0.955	3.67	0.675
Lead (diss.filt)	µg/l	<0.02	14.9	1.26	10	N/A	1.65	<0.200	<0.200	<0.020	<0.020	0.293	<0.020	0.02	<0.200	0.634	0.67	1.26	<0.200	<0.200	0.053	<0.200
Manganese (diss.filt)	µg/l	<0.04	3800	693	50	LTT				664	648		3380	3800							1430	
Nickel (diss.filt)	µg/l	<0.15	27.9	27.9	20	N/A	1.91	4.27	1.94	4.16	21.3	1.3	5.27	6.26	2.88	1.73	1.36	4.05	5.89	5.89	10.8	2.97
Selenium (diss.filt)	µg/l	<0.39	23.5	23.5	10	N/A	1.57	1.45	1.66	1.11	0.904	<1.000	1.05	1.72	<1.000	<1.000	<1.000	1.38	<1.000	2.13	5.12	1.19
Vanadium (diss.filt)	µg/l	<0.24	8.18	8.18	-	-	<1.000	<1.000	<1.000	0.914	0.792	<1.000	2.39	2.58	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.72	<1.000
Zinc (diss.filt)	µg/l	<0.41	197	31.4	-	-	6.38	4.28	2.39	2.32	1.21	9.15	2.97	2.69	1.31	15.5	3.83	2.06	197	6.25	3.37	6.27
Hardness, Total as CaCO3	µg/l		1530000	430000	-	-	314000		338000			399000					260000		1530000			1040000
Manganese (tot.unfilt)	µg/l		4270	3690	-	-	174		60			872					132		1400			3270
Phenols																						
Resorcinol (low level)	µg/l	<0.5	5	5	-	-	<0.500	<0.500							<0.500			<5.000	<0.500	<0.500		<0.500
Catechol (low level)	µg/l	<0.5	5	5	-	-	<0.500	<0.500							<0.500			<5.000	<0.500	<0.500		

	<0.000	Concentration below the LOD																				
	0.000	Concentration in exceedance of the GAC																				
	0.000	Concentration in exceedance of the L3 SSAC																				
	N/A	not applicable																				
	LTT	Long Travel Time - risk negligble																				

	<0.000	Concentration below the LOD																				
	0.000	Concentration in exceedance of the GAC																				
	0.000	Concentration in exceedance of the L3 SSAC																				
	N/A	not applicable																				
	LTT	Long Travel Time - risk negligible																				
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	<0.000	Concentration below the LOD																				
	0.000	Concentration in exceedance of the GAC																				
	0.000	Concentration in exceedance of the L3 SSAC																				
	N/A	not applicable																				
	LTT	Long Travel Time - risk negligible																				

	<0.000	Concentration below the LOD																				
	0.000	Concentration in exceedance of the GAC																				
	0.000	Concentration in exceedance of the L3 SSAC																				
	N/A	not applicable																				
	LTT	Long Travel Time - risk negligible																				
							BH102B	BH303	BH301	WS206	BH102B	BH202	BH202D	BH102B	BH101	BH102B	BH103A	BH104	BH106	BH107	BH201	BH203C
Reading							15/12/2015	11/02/2020	10/02/2020	17/04/2019	10/04/2019	10/02/2020	20/06/2019	12/02/2020	30/09/2019	01/10/2019	01/10/2019	01/10/2019	01/10/2019	01/10/2019	30/09/2019	01/10/2019
Test	Units	LOD	Total Max	Max in Chalk	DWS	L3 DWS	AL/RTG	Chalk	Chalk	MG	AL/RTG	Chalk	Chalk	AL/RTG	MG	AL/RTG	AL/RTG	MG/AL/RTG	Chalk	Chalk	RTG	RTG
Inorganics																						
Nitrite as NO2	µg/l	<50	2360	2360	500	N/A	100															
pH	pH Units	<1	8.35	8.35	-	-	7.64	8.04	8.35	7.48	7.94	7.69	7.44	7.63	7.84	7.77	7.62	6.98	7.4	7.47	7.97	7.54
Sulphate	µg/l	<2000	635000	317000	250000	-	522000															
Sulphide	µg/l	<10	143	81.3	-	-	143															
Sulphate as %SO4	%	<0.0002	0.125	0.019	0.025	-		0.00703	0.00089	0.125	0.0668	0.00526	0.00408	0.0658								
Ammoniacal Nitrogen as NH3	µg/l	<200	53700	40800	-	-	32100															
Cyanide, Total	µg/l	<50	2190	2160	50	698850	400	460	500	695	1230	1450	2160	2190								
Ammoniacal Nitrogen as NH4	µg/l	<300	179000	179000	500	47511	33900	1280	64900	8250	15600	130000	179000	15900	<300.000	26700	7350	37700	11200	<300.000	7050	2910
Cyanide, Free	µg/l	<50	50	50	-	-	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000	<50.000								
Cyanide, Total (low level)	µg/l	<5	4430	456	50	698850									79	4430	67.7	153	39.1	<5.000	124	33.2
Cyanide, Free (low level)	µg/l	<2.5	80.3	28.5	-	4.98									3.45	80.3	8.47	3.18	2.89	<2.500	5.96	4.65
Cyanide, Complex (low level)*	µg/l	<5	4350	427	-	-									75.6	4350	59.2	150	36.2	<5.000	119	28.5
Filtered (Dissolved) Metals																						
Iron, Ferric	µg/l	<50	22600	1300	-	-	<50.000	247	<50.000	716	1370	1030	1300	726	<50.000	1500	<50.000	22600	<50.000	<50.000	8330	<50.000
Chromium, Hexavalent	µg/l	<30	30	30	-	-	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000	<30.000
Chromium, Trivalent	µg/l	<30	30	30	-	-	<30.000															
Mercury (diss.filt)	µg/l	<0.01	0.0196	0.013	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0196	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0179	<0.010
Arsenic (diss.filt)	µg/l	<0.12	69.3	26.4	10	N/A	12.1	1.11	7.51	2	5.2	9.39	14.5	3.22	<0.500	9.93	2.29	69.3	0.54	<0.500	23.3	<0.500
Barium (diss.filt)	µg/l	<0.03	159	159	700	-	26.7	39.1	94.9	83.5	31.5	41.5	67.2	29.4	26.6	50.4	37.6	79.2	39.7	42.3	74.3	34.9
Beryllium (diss.filt)	µg/l	<0.07	0.1	0.1	12	-	<0.070	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Iron (diss.filt)	µg/l	<19	34600	8550	200	LTT	181	247	284	1430	1370	2370	6470	726	43.6	1500	28.6	22800	30.4	<19.000	8450	34.8
Boron (diss.filt)	µg/l	<9.4	397	217	1000	-	96	116	107	119	96.9	142	217	78.6	17.4	184	20.4	397	184	156	142	108
Iron, Ferrous	µg/l	<100	33100	8140	-	-	1290	<100.000	300	714	<100.000	1340	5170	<100.000	<100.000	<100.000	<100.000	227	<100.000	<100.000	116	<100.000
Manganese II	µg/l	<200	1970	591	-	-	1970															
Cadmium (diss.filt)	µg/l	<0.1	0.1	0.1	5	-	<0.100	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
Chromium (diss.filt)	µg/l	<0.22	17.1	4.15	50	-	3.02	1.36	1	<1.000	<1.000	2.01	3.35	<1.000	9.02	1.29	<1.000	<1.000	<1.000	2.36	1.16	<1.000
Copper (diss.filt)	µg/l	<0.85	4.93	2.03	2000	-	2.18	1.37	<0.300	<0.300	4.93	<0.300	<0.300	1.44	3.62	1.38	3.24	<0.300	0.752	0.453	2.49	0.75
Lead (diss.filt)	µg/l	<0.02	14.9	1.26	10	N/A	<0.020	<0.200	<0.200	0.433	0.204	<0.200	0.259	0.228	<0.200	<0.200	<0.200	0.445	<0.200	<0.200	14.9	<0.200
Manganese (diss.filt)	µg/l	<0.04	3800	693	50	LTT	1390															
Nickel (diss.filt)	µg/l	<0.15	27.9	27.9	20	N/A	6.95	6.61	12.8	4.75	3.48	1.36	2.8	4.19	1.72	5.59	1.45	2.19	23.7	2.15	1.76	1.69
Selenium (diss.filt)	µg/l	<0.39	23.5	23.5	10	N/A	2.73	1.5	3.27	3.04	1.56	<1.000	<1.000	2.31	1.93	4.06	<1.000	<1.000	<1.000	1.2	<1.000	1.03
Vanadium (diss.filt)	µg/l	<0.24	8.18	8.18	-	-	1.4	<1.000	8.18	<1.000	<1.000	2.07	4.55	1.01	<1.000	1.73	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Zinc (diss.filt)	µg/l	<0.41	197	31.4	-	-	2.09	7.06	1.83	6.12	1.56	<1.000	5.05	8.77	<1.000	2.64	31.3	2.17	4.28	<1.000	6.9	1.22
Hardness, Total as CaCO3	µg/l		1530000	430000	-	-		291000	116000			329000		850000	260000	1000000	239000	895000	430000	391000	398000	354000
Manganese (tot.unfilt)	µg/l		4270	3690	-	-		141	126			1270		1130	4.09	1300	135	4270	485	<1.000	734	128
Phenols																						
Resorcinol (low level)	µg/l	<0.5	5	5	-	-				<0.500		<5.000	<5.000	<0.500								
Catechol (low level)	µg/l	<0.5	5	5	-	-				<0.500		<5.000	<5.000	<0.500								
Resorcinol	µg/l	<10	320	320	-	-		50			<10.000				<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000
Catechol	µg/l	<10	270	270	-	-		10			<10.000				<10.000	<10.000						

	<0.000	Concentration below the LOD																				
	0.000	Concentration in exceedance of the GAC																				
	0.000	Concentration in exceedance of the L3 SSAC																				
	N/A	not applicable																				
	LTT	Long Travel Time - risk negligible																				

	<0.000	Concentration below the LOD																					
	0.000	Concentration in exceedance of the GAC																					
	0.000	Concentration in exceedance of the L3 SSAC																					
	N/A	not applicable																					
	LTT	Long Travel Time - risk negligible																					
								BH102B	BH303	BH301	WS206	BH102B	BH202	BH202D	BH102B	BH101	BH102B	BH103A	BH104	BH106	BH107	BH201	BH203C
Reading								15/12/2015	11/02/2020	10/02/2020	17/04/2019	10/04/2019	10/02/2020	20/06/2019	12/02/2020	30/09/2019	01/10/2019	01/10/2019	01/10/2019	01/10/2019	01/10/2019	30/09/2019	01/10/2019
Test	Units	LOD	Total Max	Max in Chalk	DWS	L3 DWS		AL/RTG	Chalk	Chalk	MG	AL/RTG	Chalk	Chalk	AL/RTG	MG	AL/RTG	AL/RTG	MG/AL/RTG	Chalk	Chalk	RTG	RTG
1,3-Dichlorobenzene	µg/l	<1	1	1	-	-		<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,4-Dichlorobenzene	µg/l	<1	1	1	-	-		<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
n-Butylbenzene	µg/l	<1	3.94	3.94	-	-		<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,2-Dichlorobenzene	µg/l	<1	1	1	-	-		<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,2-Dibromo-3-chloropropane	µg/l	<1	1	1	-	-		<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,2,4-Trichlorobenzene	µg/l	<1	1	1	-	-		<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Hexachlorobutadiene	µg/l	<1	1	1	-	-		<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
tert-Amyl methyl ether (TAME)	µg/l	<1	1	1	-	-		<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Naphthalene	µg/l	<1	4060	4060	-	-		<1.000	<1.000	80.9	<1.000	<1.000	122	283	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,2,3-Trichlorobenzene	µg/l	<1	1	1	-	-		<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
1,3,5-Trichlorobenzene	µg/l	<1	1	1	-	-		<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000
Sum of detected Xylenes	µg/l	<2	1000	1000	500	-		56.000	<2.000	31.2	4.01	7.8	111	442	<2.000	<2.000	7.03	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000
Dissolved Gases																							
Methane, dissolved	µg/l	<1	11800	11800	-	-		9.86	<2.220	9050	136	94.6	7670	11800	15.9	<2.180	8.47	2.35	43.9	14.5	1.28	113	1.19
Ethene, dissolved	µg/l	<1	753	19.4	-	-			<1.000	<19.100	753	<1.000	<19.100	<19.400	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	63.6	<1.000
Ethane, dissolved	µg/l	<1	29.4	29.4	-	-			<1.000	<20.500	6.94	<1.000	29.4	27.8	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	1.22	<1.000
Carbon dioxide, dissolved	µg/l	<1300	174000	174000	-	-		24000	25600	49500	37400	29400	116000	174000	28900	12600	34400	14300	136000	33900	25100	23400	25100
Propane, dissolved	µg/l	<1	9.04	9.04	-	-			<1.000	2.56	3.36	<1.000	5.94	3.97	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000	<1.000

	<0.000	Concentration below the LOD								
	0.000	Concentration in exceedance of the GAC								
	0.000	Concentration in exceedance of the L3 SSAC								
	N/A	not applicable								
	LTT	Long Travel Time - risk negligible								
							BH204	BH301	BH302A	BH303
Reading							01/10/2019	01/10/2019	01/10/2019	01/10/2019
Test	Units	LOD	Total Max	Max in Chalk	DWS	L3 DWS	RTG	Chalk	Chalk	Chalk
Inorganics										
Nitrite as NO2	µg/l	<50	2360	2360	500	N/A				
pH	pH Units	<1	8.35	8.35	-	-	7.4	8.07	7.69	7.46
Sulphate	µg/l	<2000	635000	317000	250000	-				
Sulphide	µg/l	<10	143	81.3	-	-				
Sulphate as %SO4	%	<0.0002	0.125	0.019	0.025	-				
Ammoniacal Nitrogen as NH3	µg/l	<200	53700	40800	-	-				
Cyanide, Total	µg/l	<50	2190	2160	50	698850				
Ammoniacal Nitrogen as NH4	µg/l	<300	179000	179000	500	47511	<300.000	11400	134000	1070
Cyanide, Free	µg/l	<50	50	50	-	-				
Cyanide, Total (low level)	µg/l	<5	4430	456	50	698850	<5.000	276	456	27.3
Cyanide, Free (low level)	µg/l	<2.5	80.3	28.5	-	4.98	<2.500	<2.500	28.5	<2.500
Cyanide, Complex (low level)*	µg/l	<5	4350	427	-	-	<5.000	274	427	26.1
Filtered (Dissolved) Metals										
Iron, Ferric	µg/l	<50	22600	1300	-	-	<50.000	<50.000	146	<50.000
Chromium, Hexavalent	µg/l	<30	30	30	-	-	<30.000	<30.000	<30.000	<30.000
Chromium, Trivalent	µg/l	<30	30	30	-	-				
Mercury (diss.filt)	µg/l	<0.01	0.0196	0.013	-	-	<0.010	<0.010	0.013	<0.010
Arsenic (diss.filt)	µg/l	<0.12	69.3	26.4	10	N/A	<0.500	4.54	26.4	<0.500
Barium (diss.filt)	µg/l	<0.03	159	159	700	-	70.5	50.3	84.2	41.5
Beryllium (diss.filt)	µg/l	<0.07	0.1	0.1	12	-	<0.100	<0.100	<0.100	<0.100
Iron (diss.filt)	µg/l	<19	34600	8550	200	LTT	21.8	21.6	487	<19.000
Boron (diss.filt)	µg/l	<9.4	397	217	1000	-	132	63.9	77.4	127
Iron, Ferrous	µg/l	<100	33100	8140	-	-	<100.000	<100.000	341	<100.000
Manganese II	µg/l	<200	1970	591	-	-				
Cadmium (diss.filt)	µg/l	<0.1	0.1	0.1	5	-	<0.080	<0.080	<0.080	<0.080
Chromium (diss.filt)	µg/l	<0.22	17.1	4.15	50	-	<1.000	<1.000	<1.000	<1.000
Copper (diss.filt)	µg/l	<0.85	4.93	2.03	2000	-	<0.300	<0.300	<0.300	<0.300
Lead (diss.filt)	µg/l	<0.02	14.9	1.26	10	N/A	<0.200	<0.200	<0.200	<0.200
Manganese (diss.filt)	µg/l	<0.04	3800	693	50	LTT				
Nickel (diss.filt)	µg/l	<0.15	27.9	27.9	20	N/A	1.75	6.2	22.9	10.7
Selenium (diss.filt)	µg/l	<0.39	23.5	23.5	10	N/A	1.04	23.5	6.96	<1.000
Vanadium (diss.filt)	µg/l	<0.24	8.18	8.18	-	-	<1.000	<1.000	4	<1.000
Zinc (diss.filt)	µg/l	<0.41	197	31.4	-	-	1.1	31.4	1.7	5.12
Hardness, Total as CaCO3	µg/l		1530000	430000	-	-	359000	176000	231000	383000
Manganese (tot.unfilt)	µg/l		4270	3690	-	-	17.4	3690	638	290
Phenols										
Resorcinol (low level)	µg/l	<0.5	5	5	-	-				
Catechol (low level)	µg/l	<0.5	5	5	-	-				
Resorcinol	µg/l	<10	320	320	-	-	<10.000	<10.000	320	<10.000
Catechol	µg/l	<10	270	270	-	-	<10.000	<10.000	270	<10.000
Phenol (low level)	µg/l	<0.5	13.3	13.3	-	-				
Cresols (low level)	µg/l	<0.5	69.9	69.9	-	-				
Phenol	µg/l	<2	3050	3050	-	-	<2.000	<2.000	3050	<2.000
Cresols	µg/l	<6	2360	2360	-	-	<6.000	10	2360	<6.000
Xylenols (low level)	µg/l	<0.5	170	170	-	-				
1-Naphthol (low level)	µg/l	<0.5	5	5	-	-				
Xylenols	µg/l	<8	1990	1990	-	-	<8.000	60	1990	<8.000
1-Naphthol	µg/l	<10	30	30	-	-	<10.000	<10.000	30	<10.000
2,3,5-Trimethylphenol (low level)	µg/l	<0.5	50.2	50.2	-	-				
2,3,5-Trimethylphenol	µg/l	<3	240	240	-	-	<3.000	<3.000	240	<3.000
2-Isopropylphenol (low level)	µg/l	<0.5	33.8	33.8	-	-				
2-Isopropylphenol	µg/l	<6	1020	1020	-	-	<6.000	<6.000	1020	<6.000
Phenols, Total Detected 8 Speciated	µg/l	<45	70	70	-	-	<45.000	70		<45.000
Phenols, Total Detected 5 speciated	µg/l	<25	0	0	-	-				
TPH Criteria Working Group (TPH CWG)										
GRO Surrogate % recovery**	%		114	112	-	-	80	75	85	93
GRO >C5-C12	µg/l	<50	7130	7130	-	-	<50.000	5280	4980	<50.000
Methyl tertiary butyl ether (MTBE)	µg/l	<3	3	3	-	-				
Benzene	µg/l	<7	7	7	-	-				
Toluene	µg/l	<4	21	4	-	-				
Ethylbenzene	µg/l	<5	23	5	-	-				
m,p-Xylene	µg/l	<8	97	8	-	-				
o-Xylene	µg/l	<3	58	3	-	-				
Sum of detected Xylenes	µg/l	<11	155	11	-	-				
Sum of detected BTEX	µg/l	<28	199	28	-	-				
Aliphatics >C5-C6	µg/l	<10	1920	27	15000	-	<10.000	<10.000	26	<10.000
Aliphatics >C6-C8	µg/l	<10	105	105	15000	-	<10.000	61	105	<10.000
Aliphatics >C8-C10	µg/l	<10	840	840	300	N/A	<10.000	337	181	<10.000
Aliphatics >C10-C12	µg/l	<10	2570	2570	300	N/A	<10.000	1840	575	<10.000
Aliphatics >C12-C16 (aq)	µg/l	<10	111	111	300	-	<10.000	111	<10.000	<10.000
Aliphatics >C16-C21 (aq)	µg/l	<10	180	180	-	-	<10.000	100	<10.000	<10.000
Aliphatics >C21-C35 (aq)	µg/l	<10	893	781	-	-	<10.000	322	<10.000	<10.000

	<0.000	Concentration below the LOD								
	0.000	Concentration in exceedance of the GAC								
	0.000	Concentration in exceedance of the L3 SSAC								
	N/A	not applicable								
	LTT	Long Travel Time - risk negligible								

							BH204	BH301	BH302A	BH303
Reading							01/10/2019	01/10/2019	01/10/2019	01/10/2019
Test	Units	LOD	Total Max	Max in Chalk	DWS	L3 DWS	RTG	Chalk	Chalk	Chalk
Total Aliphatics >C12-C35 (aq)	µg/l	<10	1010	961	-	-	<10.000	533	<10.000	<10.000
Aromatics >EC5-EC7	µg/l	<10	2140	2140	1	N/A	<10.000	417	2140	<10.000
Aromatics >EC7-EC8	µg/l	<10	1010	1010	700	-	<10.000	492	1010	<10.000
Aromatics >EC8-EC10	µg/l	<10	1070	1070	500	2.05E+08	<10.000	892	564	<10.000
Aromatics >EC10-EC12	µg/l	<10	1710	1710	90	3.34E+06	<10.000	1230	383	<10.000
Aromatics >EC12-EC16 (aq)	µg/l	<10	875	875	90	N/A	<10.000	875	293	<10.000
Aromatics >EC16-EC21 (aq)	µg/l	<10	347	347	90	N/A	<10.000	347	78	<10.000
Aromatics >EC21-EC35 (aq)	µg/l	<10	351	351	90	N/A	<10.000	351	48	<10.000
Total Aromatics >EC12-EC35 (aq)	µg/l	<10	1570	1570	-	-	<10.000	1570	419	<10.000
Total Aliphatics & Aromatics >C5-35 (aq)	µg/l	<10	7520	7520	-	-	<10.000	7380	5400	18
Polyaromatic Hydrocarbons (PAHs)										
Naphthalene (aq)	µg/l	<0.1	2650	2650	-	-	<0.010	2650	10.4	<0.010
Acenaphthene (aq)	µg/l	<0.015	32.3	32.3	-	-	<0.005	11.9	4.47	<0.005
Acenaphthylene (aq)	µg/l	<0.011	20.1	2.85	-	-	<0.005	2.85	0.953	0.0941
Fluoranthene (aq)	µg/l	<0.017	6.8	6.8	-	-	<0.005	6.8	0.875	<0.005
Anthracene (aq)	µg/l	<0.015	6.06	6.06	-	-	<0.005	6.06	1.47	<0.005
Phenanthrene (aq)	µg/l	<0.022	21.4	21.4	-	-	<0.005	21.4	4.85	<0.005
Fluorene (aq)	µg/l	<0.014	18	17.9	-	-	<0.005	17.9	3.26	<0.005
Chrysene (aq)	µg/l	<0.013	1.4	0.5	-	-	<0.005	<0.500	0.291	<0.005
Pyrene (aq)	µg/l	<0.015	7.03	7.03	-	-	<0.005	7.03	1.11	0.0373
Benzo(a)anthracene (aq)	µg/l	<0.017	1.46	0.5	-	-	<0.005	<0.500	0.353	<0.005
Benzo(b)fluoranthene (aq)	µg/l	<0.023	0.804	0.701	-	-	<0.005	<0.500	0.121	<0.005
Benzo(k)fluoranthene (aq)	µg/l	<0.027	0.5	0.5	-	-	<0.005	<0.500	0.0513	<0.005
Benzo(a)pyrene (aq)	µg/l	<0.009	1.09	0.53	0.01	LTT	<0.002	<0.200	0.15	<0.002
Dibenzo(a,h)anthracene (aq)	µg/l	<0.016	0.5	0.5	-	-	<0.005	<0.500	<0.005	<0.005
Benzo(g,h,i)perylene (aq)	µg/l	<0.016	0.546	0.5	-	-	<0.005	<0.500	0.0782	<0.005
Indeno(1,2,3-cd)pyrene (aq)	µg/l	<0.014	0.518	0.5	-	-	<0.005	<0.500	0.0426	<0.005
PAH sum of 4 (calculated)	µg/l		2.254	1.653	0.1	LTT	<0.020	<2.000	0.2931	<0.020
PAH, Total Detected USEPA 16 (aq)	µg/l	<0.344	2720	2720	-	-	<0.082	2720	28.5	0.131
Semi-Volatile Organic Compounds (SVOCs)										
1,2,4-Trichlorobenzene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
1,2-Dichlorobenzene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
1,3-Dichlorobenzene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
1,4-Dichlorobenzene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
2,4,5-Trichlorophenol (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
2,4,6-Trichlorophenol (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
2,4-Dichlorophenol (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
2,4-Dimethylphenol (aq)	µg/l	<1	22.5	22.5	-	-	<1.000	22.5	<10.000	<1.000
2,4-Dinitrotoluene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
2,6-Dinitrotoluene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
2-Chloronaphthalene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
2-Chlorophenol (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
2-Methylnaphthalene (aq)	µg/l	<1	265	265	-	-	<1.000	265	23.8	<1.000
2-Methylphenol (aq)	µg/l	<1	1030	1030	-	-	<1.000	29.9	1030	<1.000
2-Nitroaniline (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
2-Nitrophenol (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
3-Nitroaniline (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
4-Bromophenylphenylether (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
4-Chloro-3-methylphenol (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
4-Chloroaniline (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
4-Chlorophenylphenylether (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
4-Methylphenol (aq)	µg/l	<1	524	524	-	-	<1.000	<20.000	524	<1.000
4-Nitroaniline (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
4-Nitrophenol (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Azobenzene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Acenaphthylene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Acenaphthene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Anthracene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
bis(2-Chloroethoxy)ether (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
bis(2-Chloroethoxy)methane (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
bis(2-Ethylhexyl) phthalate (aq)	µg/l	<2	40	40	-	-	<2.000	<40.000	<20.000	<2.000
Butylbenzyl phthalate (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Benzo(a)anthracene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Benzo(b)fluoranthene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Benzo(k)fluoranthene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Benzo(a)pyrene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Benzo(g,h,i)perylene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Carbazole (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Chrysene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Dibenzofuran (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
n-Dibutyl phthalate (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Diethyl phthalate (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Dibenzo(a,h)anthracene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000

	<0.000	Concentration below the LOD								
	0.000	Concentration in exceedance of the GAC								
	0.000	Concentration in exceedance of the L3 SSAC								
	N/A	not applicable								
	LTT	Long Travel Time - risk negligible								
							BH204	BH301	BH302A	BH303
Reading							01/10/2019	01/10/2019	01/10/2019	01/10/2019
Test	Units	LOD	Total Max	Max in Chalk	DWS	L3 DWS	RTG	Chalk	Chalk	Chalk
Dimethyl phthalate (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
n-Dioctyl phthalate (aq)	µg/l	<5	100	100	-	-	<5.000	<100.000	<50.000	<5.000
Fluoranthene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Fluorene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Hexachlorobenzene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Hexachlorobutadiene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Pentachlorophenol (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Phenol (aq)	µg/l	<1	783	783	-	-	<1.000	<20.000	783	<1.000
n-Nitroso-n-dipropylamine (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Hexachloroethane (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Nitrobenzene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Naphthalene (aq)	µg/l	<1	2110	2110	-	-	<1.000	2110	13.9	<1.000
Isophorone (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Hexachlorocyclopentadiene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Phenanthrene (aq)	µg/l	<1	36.6	36.6	-	-	<1.000	36.6	<10.000	<1.000
Indeno(1,2,3-cd)pyrene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Pyrene (aq)	µg/l	<1	20	20	-	-	<1.000	<20.000	<10.000	<1.000
Volatile Organic Compounds (VOCs)										
Dibromofluoromethane**	%		129	129	-	-	116	106	108	116
Toluene-d8**	%		112	109	-	-	102	99.1	103	101
4-Bromofluorobenzene**	%		106	106	-	-	98.3	98.3	104	98.7
Dichlorodifluoromethane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Chloromethane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Vinyl chloride	µg/l	<1	2750	26.4	0.5	33.900	<1.000	<1.000	3.34	<1.000
Bromomethane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Chloroethane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Trichlorofluoromethane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
1,1-Dichloroethene	µg/l	<1	4.9	1	-	-	<1.000	<1.000	<1.000	<1.000
Carbon disulphide	µg/l	<1	3.51	3.51	-	-	<1.000	<1.000	3.51	<1.000
Dichloromethane	µg/l	<3	3	3	-	-	<3.000	<3.000	<3.000	<3.000
Methyl tertiary butyl ether (MTBE)	µg/l	<1	1	1	15	-	<1.000	<1.000	<1.000	<1.000
trans-1,2-Dichloroethene	µg/l	<1	14.3	1	50	-	<1.000	<1.000	<1.000	<1.000
1,1-Dichloroethane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
cis-1,2-Dichloroethene	µg/l	<1	5610	47.6	50	3392.00	<1.000	<1.000	12.2	<1.000
2,2-Dichloropropane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Bromochloromethane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Chloroform	µg/l	<1	2.85	2.85	-	-	1.03	<1.000	<1.000	1
1,1,1-Trichloroethane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
1,1-Dichloropropene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Carbontetrachloride	µg/l	<1	3.59	3.59	-	-	1.67	<1.000	<1.000	1.13
1,2-Dichloroethane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Benzene	µg/l	<1	2890	2890	1	17063.445	<1.000	721	2890	3.45
Trichloroethene	µg/l	<1	155	2	10	1465.53	<1.000	<1.000	<1.000	<1.000
1,2-Dichloropropane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Dibromomethane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Bromodichloromethane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
cis-1,3-Dichloropropene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Toluene	µg/l	<1	1310	1310	700	-	<1.000	819	1310	6.47
trans-1,3-Dichloropropene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
1,1,2-Trichloroethane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
1,3-Dichloropropane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Tetrachloroethene	µg/l	<1	956	6.33	10	10277.32	<1.000	<1.000	<1.000	<1.000
Dibromochloromethane	µg/l	<1	1.4	1.4	-	-	<1.000	1.4	<1.000	<1.000
1,2-Dibromoethane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Chlorobenzene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
1,1,1,2-Tetrachloroethane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Ethylbenzene	µg/l	<1	185	185	300	-	<1.000	127	86	1.25
m,p-Xylene	µg/l	<1	622	622	-	-	<1.000	622	310	2.1
o-Xylene	µg/l	<1	380	380	-	-	<1.000	380	198	1.56
Styrene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Bromoform	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Isopropylbenzene	µg/l	<1	16.4	16.4	-	-	<1.000	7.73	3.75	<1.000
1,1,2,2-Tetrachloroethane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
1,2,3-Trichloropropane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Bromobenzene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Propylbenzene	µg/l	<1	10.5	10.5	-	-	<1.000	10.5	2.85	<1.000
2-Chlorotoluene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
1,3,5-Trimethylbenzene	µg/l	<1	109	109	-	-	<1.000	66.6	14.4	<1.000
4-Chlorotoluene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
tert-Butylbenzene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
1,2,4-Trimethylbenzene	µg/l	<1	348	348	-	-	<1.000	228	53.7	<1.000
sec-Butylbenzene	µg/l	<1	1.24	1.24	-	-	<1.000	<1.000	<1.000	<1.000
4-Iso-Propyltoluene	µg/l	<1	11.4	11.4	-	-	<1.000	7.9	4.45	<1.000

<0.000	Concentration below the LOD
0.000	Concentration in exceedance of the GAC
0.000	Concentration in exceedance of the L3 SSAC
N/A	not applicable
LTT	Long Travel Time - risk negligible

							BH204	BH301	BH302A	BH303
Reading							01/10/2019	01/10/2019	01/10/2019	01/10/2019
Test	Units	LOD	Total Max	Max in Chalk	DWS	L3 DWS	RTG	Chalk	Chalk	Chalk
1,3-Dichlorobenzene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
1,4-Dichlorobenzene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
n-Butylbenzene	µg/l	<1	3.94	3.94	-	-	<1.000	3.94	<1.000	<1.000
1,2-Dichlorobenzene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
1,2-Dibromo-3-chloropropane	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
1,2,4-Trichlorobenzene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Hexachlorobutadiene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
tert-Amyl methyl ether (TAME)	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Naphthalene	µg/l	<1	4060	4060	-	-	<1.000	4060	743	<1.000
1,2,3-Trichlorobenzene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
1,3,5-Trichlorobenzene	µg/l	<1	1	1	-	-	<1.000	<1.000	<1.000	<1.000
Sum of detected Xylenes	µg/l	<2	1000	1000	500	-	<2.000	1000	508	3.66
Dissolved Gases										
Methane, dissolved	µg/l	<1	11800	11800	-	-	1.85	419	4620	6.3
Ethene, dissolved	µg/l	<1	753	19.4	-	-	<1.000	<1.000	<19.100	<1.000
Ethane, dissolved	µg/l	<1	29.4	29.4	-	-	<1.000	1.17	<20.500	<1.000
Carbon dioxide, dissolved	µg/l	<1300	174000	174000	-	-	23700	19200	47900	31000
Propane, dissolved	µg/l	<1	9.04	9.04	-	-	<1.000	<1.000	9.04	<1.000

Appendix E

P20 WORKSHEETS





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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Tetrachloroethene		
Target Concentration (C _T)	0.01	mg/l	Origin of C _T : DWS

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.

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 Tetrachloroethene
0.01 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity θ_w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy g
Air filled soil porosity θ_a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy g
Bulk density of soil zone material ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy g
Henry's Law constant H	1.77E-02	dimensionless	34

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient. The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Variable	Value	Unit	Source of parameter value
Soil water partition coefficient K_d		l/kg	

Entry for non-polar organic chemicals (option)

Variable	Value	Unit	Source of parameter value
Fraction of organic carbon (in soil) f_{oc}	1.75E-02	fraction	geomean of 25 analysis of uncontaminated unsaturated zone soil
Organic carbon partition coefficient K_{oc}	9.49E+01	l/kg	34

Entry for ionic organic chemicals (option)

Variable	Value	Unit	Source of parameter value
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	

Variable	Value	Unit	Source of parameter value
Soil water partition coefficient used in Level Assessment K_d	1.66E+00	l/kg	Calculated value

Level 1 Remedial Target

Level 1 Remedial Target	1.96E-02	mg/kg	(for comparison with soil analyses)
or	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration

C_T

Tetrachloroethene
0.01

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

1.13E-04
2.50E+03

m/d
m²

s (SU718741)). Assuming 40% Evapotranspiration and
by 50 m based on area of site with observed contaminant

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

5.00E+01
3.00E+01
7.00E+00
2.00E-03
5.00E+01
0.00E+00

m
m
m/d
fraction
m
mg/l

proximate based on contaminated area and a NE GW direction
Assume thickness of effective permeable Chalk.
g tests carried out on two boreholes on Chalk (See 2019)
nt value within 5 monitoring rounds between April 2019
proximate based on contaminated area and a NE GW direction

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

0.00E+00
Calculate

m
m

Calculated Parameters

Dilution Factor

DF

1.51E+01

Level 2 Remedial Target

1.51E-01

mg/l

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

or

2.96E-01

mg/kg

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: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Tetrachloroethene		from Level 1
Target Concentration	C _T	0.01	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		from Level 2

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

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

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

Variable	Value	Unit	Source of parameter value
Enter source concentration			
Enter soil concentration	31.9	mg/kg	Soil concentration as mg/kg
Half life for degradation of contaminant in water	t _{1/2}	7.20E+02	days
Calculated decay rate	λ	9.63E-04	days ⁻¹
Width of plume in aquifer at source	Sz	5.00E+01	m
Plume thickness in aquifer at source	Sy	5.69E+00	m
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³
Effective porosity of aquifer	n	2.00E-01	fraction
Hydraulic gradient	i	2.14E-03	fraction
Hydraulic conductivity of saturated aquifer	K	7.00E+00	m/d
Distance to compliance point	x	4.00E+02	m
Distance (lateral) to compliance point perpendicular to flow direction	z		m
Distance (depth) to compliance point perpendicular to flow direction	y		m
Time since pollutant entered groundwater	t	9.99E+99	days
Parameters values determined from options			
Partition coefficient	Kd	1.90E-01	l/kg
Longitudinal dispersivity	ax	40.000	m
Transverse dispersivity	az	12.000	m
Vertical dispersivity	ay	0.400	m

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	7.50E-02 m/d
Retardation factor	Rf	2.87E+00
Decay rate used	λ	3.35E-04 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.14E-03
Rate of contaminant flow due to retardation	u	2.61E-02 m/d
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	1.20E-03
Attenuation factor (C ₀ /C _{eq})	AF	8.36E+02
Calculated soil leachate concentration	Co	1.63E+01 mg/l

Remedial Targets

Level 3 Remedial Target	1.26E+02	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or		This assumes Level 1 Remedial Target is based on Target Concentration.
	2.48E+02	mg/kg	For comparison with measured soil concentration. This
Distance to compliance point	400	m	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	1.20E-03	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 Kd l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc} 2.00E-03 fractionOrganic carbon partition coefficient K_{oc} 9.49E+01 l/kgSorption coefficient for related species K_{oc,n} l/kgSorption 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 Kd 1.90E-01 l/kg

Mean bulk density of Chalk at thames and Chilterns area (BGS The physical properties of major aquifers in England and W.

Conservative value based on geomean value

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax 4.00E+01 4.00E+01 8.36E+00 m

Transverse dispersivity az 1.20E+01 0.00E+00 8.36E-01 m

Vertical dispersivity ay 4.00E-01 4.00E-01 8.36E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, az = ax/10, ay = ax/100 are assumed

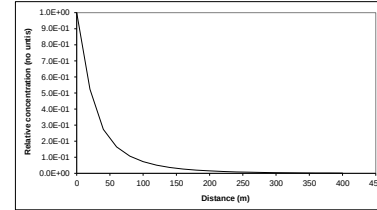
Note

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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	1.08E+00
20.0	5.23E-01	5.63E-01
40.0	2.74E-01	2.95E-01
60.0	1.65E-01	1.77E-01
80.0	1.07E-01	1.15E-01
100.0	7.29E-02	7.85E-02
120.0	5.13E-02	5.52E-02
140.0	3.69E-02	3.98E-02
160.0	2.70E-02	2.91E-02
180.0	2.01E-02	2.16E-02
200.0	1.51E-02	1.63E-02
220.0	1.14E-02	1.23E-02
240.0	8.73E-03	9.40E-03
260.0	6.71E-03	7.23E-03
280.0	5.18E-03	5.58E-03
300.0	4.02E-03	4.33E-03
320.0	3.14E-03	3.38E-03
340.0	2.45E-03	2.64E-03
360.0	1.93E-03	2.07E-03
380.0	1.52E-03	1.63E-03
400.0	1.20E-03	1.29E-03

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Tetrachloroethene	from Level 1
Target Concentration	C _r	1.00E-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	9.56E-01	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	7.20E+02	days	Based on site data
Calculated decay rate	λ	9.63E-04	days ⁻¹	79
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.89E+00	m	See Appendix C
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable C
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³	Mean bulk density of Chalk at Thames and Chilterns area
Effective porosity of aquifer	n	2.00E-01	fraction	Conservative value based on geomean value of total porosity in the Chalk at Thames and Chilterns area of 38.8 (BGS The physical properties of major aquifers in England and Wales, pg 24)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	7.00E+00	m/d	Based on 12 slug tests carried out on two
Distance to compliance point	x	4.00E+02	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	1.90E-01	l/kg	see options
Longitudinal dispersivity	ax	4.00E+01	m	see options
Transverse dispersivity	az	1.20E+01	m	see options
Vertical dispersivity	ay	4.00E-01	m	see options

Calculated Parameters

Groundwater flow velocity	v	7.00E-02	m/d
Retardation factor	Rf	2.87E+00	fraction
Decay rate used	λ	3.36E-04	d ⁻¹
Rate of contaminant flow due to retardation	u	2.44E-02	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	9.30E-04	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	1.03E+03	

Remedial Targets

Remedial Target	1.03E+01	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	400	m	
Concentration of contaminant at compliance point	C _{1D} /C ₀	9.30E-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.

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

Calculate for non-polar organic chemicals

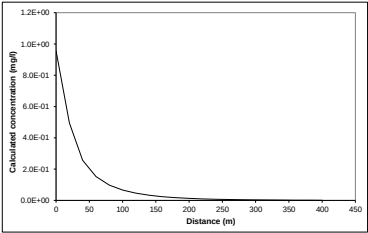
Entry if specify partition coefficient (option)	Kd		l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc	2.00E-03	fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc	9.49E+01	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		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
Soil water partition coefficient	Kd	1.90E-01	l/kg

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

User defined values for dispersivity

Enter value	Calc value	Xu & Eckstein	m
4.00E+01	4.00E+01	9.38E+00	m
1.20E+01	4.00E+01	9.38E+01	m
4.00E-01	4.00E-01	9.38E-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)^{2.434}; 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.

(BGS The physical properties of major aquifers in England and Wales, pg 24)

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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Distance	Concentration
	mg/l
0	9.6E-01
20.0	4.95E-01
40.0	2.56E-01
60.0	1.53E-01
80.0	9.81E-02
100.0	6.62E-02
120.0	4.61E-02
140.0	3.28E-02
160.0	2.38E-02
180.0	1.75E-02
200.0	1.30E-02
220.0	9.76E-03
240.0	7.38E-03
260.0	5.61E-03
280.0	4.29E-03
300.0	3.30E-03
320.0	2.54E-03
340.0	1.97E-03
360.0	1.53E-03
380.0	1.19E-03
400.0	9.30E-04



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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Trichloroethene		
Target Concentration (C_T)	0.01 mg/l	Origin of C_T :	DWS

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.

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 Trichloroethene
0.01 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity θ_w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy g
Air filled soil porosity θ_a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy g
Bulk density of soil zone material ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy g
Henry's Law constant H	4.35E-01	dimensionless	33

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.
The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

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}	1.75E-02	fraction	geomean of 25 analysis of uncontaminated unsaturated zone soil
Organic carbon partition coefficient K_{oc}	8.70E+01	l/kg	34

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	1.52E+00	l/kg	Calculated value
---	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	1.83E-02	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration

C_T

Trichloroethene
0.01

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

1.13E-04
2.50E+03

m/d
m²

s (SU718741)). Assuming 40% Evapotranspiration and
by 50 m based on area of site with observed contaminant

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

5.00E+01
3.00E+01
7.00E+00
2.00E-03
5.00E+01
0.00E+00

m
m
m/d
fraction
m
mg/l

Approximate based on contaminated area and a NE GW direction
Assume thickness of effective permeable Chalk.
g tests carried out on two boreholes on Chalk (See 2019)
at value within 5 monitoring rounds between April 2019
Approximate based on contaminated area and a NE GW direction

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
0.00E+00

m
m

Calculated Parameters

Dilution Factor

DF

1.51E+01

Level 2 Remedial Target

1.51E-01

mg/l

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

or
2.76E-01
mg/kg
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: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Trichloroethene		from Level 1
Target Concentration	C _T	0.01	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		from Level 2

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

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

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

Variable	Value	Unit	Source of parameter value
Enter source concentration			
Enter soil concentration	1.8	mg/kg	Soil concentration as mg/kg
Half life for degradation of contaminant in water	t _{1/2}	days	79
Calculated decay rate	λ	days ⁻¹	calculated
Width of plume in aquifer at source	Sz	m	from Level 2
Plume thickness in aquifer at source	Sy	m	from Level 2
Bulk density of aquifer materials	ρ	g/cm ³	Mean bulk density of Chalk at thames and Chilterns area (BGS The physical properties of major aquifers in England and W.
Effective porosity of aquifer	n	fraction	Conservative value based on geomean value
Hydraulic gradient	i	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	m/d	from Level 2
Distance to compliance point	x	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	m	default condition
Time since pollutant entered groundwater	t	days	time variant options only
Parameters values determined from options			
Partition coefficient	Kd	l/kg	see options
Longitudinal dispersivity	ax	m	see options
Transverse dispersivity	az	m	see options
Vertical dispersivity	ay	m	see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	7.50E-02 m/d
Retardation factor	Rf	2.71E+00 fraction
Decay rate used	λ	1.55E-04 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.14E-03 fraction
Rate of contaminant flow due to retardation	u	2.76E-02 m/d
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	7.65E-03 fraction
Attenuation factor (C ₀ /C _{eq})	AF	1.31E+02 fraction
Calculated soil leachate concentration	Co	9.89E-01 mg/l

Remedial Targets

Level 3 Remedial Target	1.97E+01	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or		This assumes Level 1 Remedial Target is based on Target Concentration.
	3.61E+01	mg/kg	For comparison with measured soil concentration. This
Distance to compliance point	400	m	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	7.65E-03 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 Kd l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc} 2.00E-03 fractionOrganic carbon partition coefficient K_{oc} 8.70E+01 l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species K_{oc,n} l/kgSorption 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 Kd 1.74E-01 l/kg

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax 4.00E+01 4.00E+01 8.36E+00 m

Transverse dispersivity az 1.20E+01 0.00E+00 8.32E-01 m

Vertical dispersivity ay 4.00E-01 4.00E-01 8.35E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀x)^{0.414}, az = ax/10, ay = ax/100 are assumed

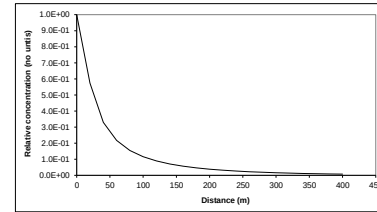
Note

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

From calculation sheet

Distance	Relative concentration	Concentration mg/l
	(No units)	
0	1.0E+00	6.52E-02
20.0	5.74E-01	3.74E-02
40.0	3.30E-01	2.15E-02
60.0	2.17E-01	1.42E-02
80.0	1.55E-01	1.01E-02
100.0	1.16E-01	7.55E-03
120.0	8.95E-02	5.83E-03
140.0	7.07E-02	4.61E-03
160.0	5.68E-02	3.70E-03
180.0	4.63E-02	3.02E-03
200.0	3.82E-02	2.49E-03
220.0	3.17E-02	2.07E-03
240.0	2.66E-02	1.73E-03
260.0	2.24E-02	1.46E-03
280.0	1.90E-02	1.24E-03
300.0	1.62E-02	1.06E-03
320.0	1.38E-02	9.02E-04
340.0	1.19E-02	7.74E-04
360.0	1.02E-02	6.67E-04
380.0	8.84E-03	5.76E-04
400.0	7.65E-03	4.99E-04

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Trichloroethene	from Level 1
Target Concentration	C _r 1.00E-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	1.55E-01	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	1.65E+03	days	Based on site data
Calculated decay rate	λ	4.19E-04	days ⁻¹	79
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.89E+00	m	See Appendix C
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable C
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³	Mean bulk density of Chalk at Thames and Chilterns area
Effective porosity of aquifer	n	2.00E-01	fraction	Conservative value based on geomean value of total porosity in the Chalk at Thames and Chilterns area of 38.8 (BGS The physical properties of major aquifers in England and Wales, pg 24)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	7.00E+00	m/d	Based on 12 slug tests carried out on two
Distance to compliance point	x	4.00E+02	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	1.74E-01	l/kg	see options
Longitudinal dispersivity	ax	4.00E+01	m	see options
Transverse dispersivity	az	1.20E+01	m	see options
Vertical dispersivity	ay	4.00E-01	m	see options

Calculated Parameters

Groundwater flow velocity	v	7.00E-02	m/d
Retardation factor	Rf	2.71E+00	fraction
Decay rate used	λ	1.55E-04	d ⁻¹
Rate of contaminant flow due to retardation	u	2.58E-02	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	1.06E-03	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	1.47E+02	

Remedial Targets

Remedial Target	1.47E+00	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	400	m	
Concentration of contaminant at compliance point	C _{1D} /C ₀	1.06E-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.

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

Calculate for non-polar organic chemicals

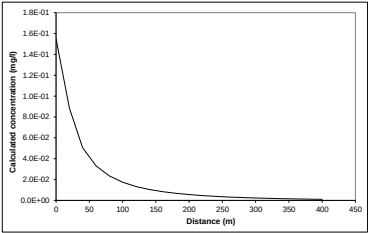
Entry if specify partition coefficient (option)	Kd	1.74E-01	l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc	2.00E-03	fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc	8.70E+01	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		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)

User defined values for dispersivity

Enter value	Calc value	Xu & Eckstein	m
4.00E+01	4.00E+01	6.38E+00	m
1.20E+01	4.00E+01	6.38E+01	m
4.00E-01	4.00E-01	6.38E-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)^{2.434}; 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.

(BGS The physical properties of major aquifers in England and Wales, pg 24)

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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Distance	Concentration
0	1.6E-01
20.0	8.85E-02
40.0	5.05E-02
60.0	3.31E-02
80.0	2.35E-02
100.0	1.75E-02
120.0	1.34E-02
140.0	1.05E-02
160.0	8.41E-03
180.0	6.82E-03
200.0	5.59E-03
220.0	4.62E-03
240.0	3.85E-03
260.0	3.23E-03
280.0	2.72E-03
300.0	2.30E-03
320.0	1.96E-03
340.0	1.67E-03
360.0	1.43E-03
380.0	1.23E-03
400.0	1.06E-03



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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	cis1-2 dichloroethene		
Target Concentration (C _T)	0.05	mg/l	Origin of C _T : DWS

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.

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

cis1-2 dichloroethene
0.05 mg/l

Input Parameters

Standard entry

Water filled soil porosity θ_w 4.80E-01 fraction
Air filled soil porosity θ_a 2.00E-02 fraction
Bulk density of soil zone material ρ 1.60E+00 g/cm³
Henry's Law constant H 2.71E-02 dimensionless

R&D Technical Report P13 Made Ground of sandy gr
R&D Technical Report P13 Made Ground of sandy gr
R&D Technical Report P13 Made Ground of sandy gr
34

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient. The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Soil water partition coefficient K_d

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil) f_{oc} 1.75E-02 fraction
Organic carbon partition coefficient K_{oc} 1.32E+02 l/kg

geomean of 25 analysis of uncontaminated unsaturated zone soil
34

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 2.31E+00 l/kg Calculated value

Level 1 Remedial Target

Level 1 Remedial Target	1.31E-01	mg/kg	(for comparison with soil analyses)
	or		
	0.05	mg/l	(for comparison with leachate test results)

Site being assessed: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant Target concentration C_T **cis1-2 dichloroethene** from Level 1
0.05 mg/l 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	1.13E-04	m/d	s (SU718741)). Assuming 40% Evapotranspiration and
Area of contaminant source	A	2.50E+03	m ²	by 50 m based on area of site with observed contaminant value within 5 monitoring rounds between April 2019
Entry for groundwater flow below site				
Length of contaminant source in direction of groundwater flow	L	5.00E+01	m	proximate based on contaminated area and a NE GW direction
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable Chalk.
Hydraulic Conductivity of aquifer in which dilution occurs	K	7.00E+00	m/d	g tests carried out on two boreholes on Chalk (See 2019)
Hydraulic gradient of water table	i	2.00E-03	fraction	at value within 5 monitoring rounds between April 2019
Width of contaminant source perpendicular to groundwater flow	w	5.00E+01	m	proximate based on contaminated area and a NE GW direction
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l	
Define mixing zone depth by specifying or calculating depth (using pull down list)		Calculate		
Enter mixing zone thickness	Mz	0.00E+00	m	
Calculated mixing zone thickness	Mz		m	

Calculated Parameters

Dilution Factor	DF	1.51E+01		
Level 2 Remedial Target		7.55E-01 or 1.97E+00	mg/l or 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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		cis1,2 dichloroethene		from Level 1
Target Concentration	C _r	0.05	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		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 dissolved pollutants only

Variable	Value	Unit	Source of parameter value
Enter source concentration			
Enter soil concentration	1.2	mg/kg	Soil concentration as mg/kg
Half life for degradation of contaminant in water	t _{1/2}	2.88E+03	days
Calculated decay rate	λ	2.41E-04	days ⁻¹
Width of plume in aquifer at source	Sz	5.00E+01	m
Plume thickness in aquifer at source	Sy	5.69E+00	m
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³
Effective porosity of aquifer	n	2.00E-01	fraction
Hydraulic gradient	i	2.14E-03	fraction
Hydraulic conductivity of saturated aquifer	K	7.00E+00	m/d
Distance to compliance point	x	4.00E+02	m
Distance (lateral) to compliance point perpendicular to flow direction	z		m
Distance (depth) to compliance point perpendicular to flow direction	y		m
Time since pollutant entered groundwater	t	9.99E+99	days
Parameters values determined from options			
Partition coefficient	Kd	2.64E-01	l/kg
Longitudinal dispersivity	ax	40.000	m
Transverse dispersivity	az	12.000	m
Vertical dispersivity	ay	0.400	m

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	7.50E-02 m/d
Retardation factor	Rf	3.60E+00
Decay rate used	λ	6.70E-05 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.14E-03
Rate of contaminant flow due to retardation	u	2.08E-02 m/d
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	1.59E-02
Attenuation factor (C ₀ /C _{eq})	AF	6.30E+01
Calculated soil leachate concentration	Co	4.60E-01 mg/l

Remedial Targets

Level 3 Remedial Target	4.76E+01	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or	1.24E+02	This assumes Level 1 Remedial Target is based on Target Concentration.
Distance to compliance point	400	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 _{eq} /C ₀	1.59E-02	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 Kd

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc}Organic carbon partition coefficient K_{oc}Sorption coefficient for related species K_{oc,n}

pH value pH

Acid dissociation constant pKa

Fraction of organic carbon in aquifer f_{oc}

Soil water partition coefficient Kd

Mean bulk density of Chalk at thames and Chilterns area (BGS The physical properties of major aquifers in England and W.

Conservative value based on geomean value

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax

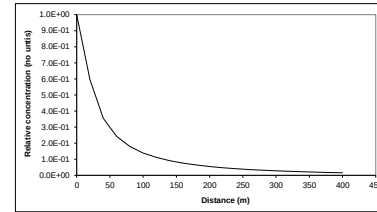
Transverse dispersivity az

Vertical dispersivity ay

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, 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⁻, SO₄²⁻ 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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	3.04E-02
20.0	5.95E-01	1.81E-02
40.0	3.55E-01	1.08E-02
60.0	2.43E-01	7.38E-03
80.0	1.79E-01	5.46E-03
100.0	1.39E-01	4.23E-03
120.0	1.11E-01	3.39E-03
140.0	9.12E-02	2.78E-03
160.0	7.61E-02	2.32E-03
180.0	6.43E-02	1.96E-03
200.0	5.50E-02	1.67E-03
220.0	4.74E-02	1.44E-03
240.0	4.12E-02	1.25E-03
260.0	3.60E-02	1.10E-03
280.0	3.17E-02	9.64E-04
300.0	2.80E-02	8.51E-04
320.0	2.48E-02	7.55E-04
340.0	2.21E-02	6.72E-04
360.0	1.97E-02	6.00E-04
380.0	1.77E-02	5.38E-04
400.0	1.59E-02	4.83E-04

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		cis1-2 dichloroethene	From Level 1
Target Concentration	C _r	5.00E-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
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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	5.61E+00	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	2.88E+03	days	Based on site data
Calculated decay rate	λ	2.41E-04	days ⁻¹	79
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.89E+00	m	See Appendix C
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable C
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³	Mean bulk density of Chalk at Thames and Chilterns area
Effective porosity of aquifer	n	2.00E-01	fraction	Conservative value based on geomechanical data
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	7.00E+00	m/d	Based on 12 slug tests carried out on two
Distance to compliance point	x	4.00E+02	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	2.64E-01	l/kg	see options
Longitudinal dispersivity	ax	4.00E+01	m	see options
Transverse dispersivity	az	1.20E+01	m	see options
Vertical dispersivity	ay	4.00E-01	m	see options

Calculated Parameters

Groundwater flow velocity	v	7.00E-02	m/d
Retardation factor	Rf	3.60E+00	fraction
Decay rate used	λ	6.70E-05	d ⁻¹
Rate of contaminant flow due to retardation	u	1.94E-02	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	8.27E-02	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	6.78E+01	

Remedial Targets

Remedial Target	3.39E+00	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	400	m	
Concentration of contaminant at compliance point	C _{1D} /C ₀	8.27E-02	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

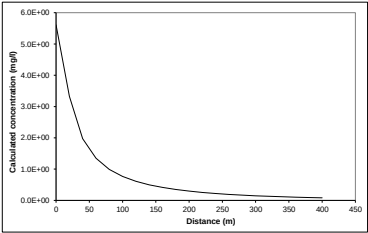
Entry if specify partition coefficient (option)	Kd		l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc	2.00E-03	fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc	1.32E+02	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		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
Soil water partition coefficient	Kd	2.64E-01	l/kg

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

User defined values for dispersivity

Enter value	Calc value	Xu & Eckstein	m
4.00E+01	4.00E+01	6.38E+00	m
1.20E+01	4.00E+01	6.38E+01	m
4.00E-01	4.00E-01	6.38E-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)^{2.434}; 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.

(BGS The physical properties of major aquifers in England and Wales, pg 24)

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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks	From calculation sheet
Distance	Concentration
	mg/l
0	5.6E+00
20.0	3.33E+00
40.0	1.97E+00
60.0	1.35E+00
80.0	9.91E-01
100.0	7.66E-01
120.0	6.11E-01
140.0	4.99E-01
160.0	4.14E-01
180.0	3.49E-01
200.0	2.97E-01
220.0	2.55E-01
240.0	2.21E-01
260.0	1.93E-01
280.0	1.69E-01
300.0	1.49E-01
320.0	1.31E-01
340.0	1.16E-01
360.0	1.04E-01
380.0	9.24E-02
400.0	8.27E-02



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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Vinyl chloride		
Target Concentration (C_T)	0.0005	mg/l	Origin of C_T : DWS

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.

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	Vinyl chloride
Target concentration	0.0005 mg/l

Input Parameters Variable Value Unit Source of parameter value

Standard entry

Water filled soil porosity	θ_w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy g
Air filled soil porosity	θ_a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy g
Bulk density of soil zone material	ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy g
Henry's Law constant	H	3.58E+00	dimensionless	34

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient. The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd		l/kg	
----------------------------------	----	--	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	foc	1.75E-02	fraction	geomean of 25 analysis of uncontaminated unsaturated zone soil
Organic carbon partition coefficient	Koc	2.37E+01	l/kg	36

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	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment Kd 4.15E-01 l/kg Calculated value

Level 1 Remedial Target

Level 1 Remedial Target	3.80E-04	mg/kg	(for comparison with soil analyses)
	or		
	0.0005	mg/l	(for comparison with leachate test results)

Site being assessed: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration

C_T

Vinyl chloride
0.0005

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

1.13E-04
2.50E+03

m/d
m²

s (SU718741)). Assuming 40% Evapotranspiration and
by 50 m based on area of site with observed contaminant

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

5.00E+01
3.00E+01
7.00E+00
2.00E-03
5.00E+01
0.00E+00

m
m
m/d
fraction
m
mg/l

proximate based on contaminated area and a NE GW direction
Assume thickness of effective permeable Chalk.
g tests carried out on two boreholes on Chalk (See 2019)
nt value within 5 monitoring rounds between April 2019
proximate based on contaminated area and a NE GW direction

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
0.00E+00

m
m

Calculated Parameters

Dilution Factor

DF

1.51E+01

Level 2 Remedial Target

7.55E-03

mg/l

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

or

5.74E-03

mg/kg

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: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Vinyl chloride		from Level 1
Target Concentration	C _T	0.0095	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		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 dissolved pollutants only

Variable	Value	Unit	Source of parameter value
Enter source concentration			
Enter soil concentration	1.2	mg/kg	Soil concentration as mg/kg
Half life for degradation of contaminant in water	t _{1/2}	2.88E+03	days
Calculated decay rate	λ	2.41E-04	days ⁻¹
Width of plume in aquifer at source	Sz	5.00E+01	m
Plume thickness in aquifer at source	Sy	5.69E+00	m
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³
Effective porosity of aquifer	n	2.00E-01	fraction
Hydraulic gradient	i	2.14E-03	fraction
Hydraulic conductivity of saturated aquifer	K	7.00E+00	m/d
Distance to compliance point	x	4.00E+02	m
Distance (lateral) to compliance point perpendicular to flow direction	z		m
Distance (depth) to compliance point perpendicular to flow direction	y		m
Time since pollutant entered groundwater	t	9.99E+99	days
Parameters values determined from options			
Partition coefficient	Kd	4.75E-02	l/kg
Longitudinal dispersivity	ax	40.000	m
Transverse dispersivity	az	12.000	m
Vertical dispersivity	ay	0.400	m

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	7.50E-02 m/d
Retardation factor	Rf	1.47E+00
Decay rate used	λ	1.64E-04 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.14E-03
Rate of contaminant flow due to retardation	u	5.11E-02 m/d
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	1.59E-02
Attenuation factor (C ₀ /C _{CP})	AF	6.30E+01
Calculated soil leachate concentration	Co	1.58E+00 mg/l

Remedial Targets

Level 3 Remedial Target	4.76E-01	mg/l	For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentration.	
Ogata Banks	or			
	3.62E-01	mg/kg	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.	
Distance to compliance point	400	m		
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	1.59E-02	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 Kd

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc}Organic carbon partition coefficient K_{oc}Sorption coefficient for related species K_{oc,n}Sorption coefficient for ionised species K_{oc,i}

pH value pH

Acid dissociation constant pKa

Fraction of organic carbon in aquifer f_{oc}

Soil water partition coefficient Kd

Mean bulk density of Chalk at thames and Chilterns area (BGS The physical properties of major aquifers in England and W.

Conservative value based on geomean value

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

User defined values for dispersivity

Enter value

Calc value

Xu & Eckstein

Longitudinal dispersivity ax

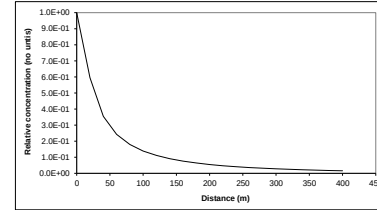
Transverse dispersivity az

Vertical dispersivity ay

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, 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⁻, SO₄²⁻ 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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	1.05E-01
20.0	5.95E-01	6.22E-02
40.0	3.55E-01	3.71E-02
60.0	2.43E-01	2.54E-02
80.0	1.79E-01	1.87E-02
100.0	1.39E-01	1.45E-02
120.0	1.11E-01	1.16E-02
140.0	9.12E-02	9.53E-03
160.0	7.61E-02	7.95E-03
180.0	6.43E-02	6.72E-03
200.0	5.50E-02	5.75E-03
220.0	4.74E-02	4.95E-03
240.0	4.12E-02	4.30E-03
260.0	3.60E-02	3.76E-03
280.0	3.17E-02	3.31E-03
300.0	2.80E-02	2.92E-03
320.0	2.48E-02	2.59E-03
340.0	2.21E-02	2.31E-03
360.0	1.97E-02	2.06E-03
380.0	1.77E-02	1.85E-03
400.0	1.59E-02	1.66E-03

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Vinyl chloride	from Level 1
Target Concentration	5.00E-04	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	2.75E+00	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	2.88E+03	days	Based on site data
Calculated decay rate	λ	2.41E-04	days ⁻¹	79
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.89E+00	m	See Appendix C
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable C
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³	Mean bulk density of Chalk at Thames and Chilterns area
Effective porosity of aquifer	n	2.00E-01	fraction	Conservative value based on geomechanical data
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	7.00E+00	m/d	Based on 12 slug tests carried out on two
Distance to compliance point	x	4.00E+02	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	4.75E-02	l/kg	see options
Longitudinal dispersivity	ax	4.00E+01	m	see options
Transverse dispersivity	ay	1.20E+01	m	see options
Vertical dispersivity	az	4.00E-01	m	see options

Calculated Parameters

Groundwater flow velocity	v	7.00E-02	m/d
Retardation factor	Rf	1.47E+00	fraction
Decay rate used	λ	1.64E-04	d ⁻¹
Rate of contaminant flow due to retardation	u	4.77E-02	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	4.05E-02	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	6.78E+01	

Remedial Targets

Remedial Target	3.39E-02	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	400	m	
Concentration of contaminant at compliance point after	C _{1D} /C ₀	4.05E-02	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.

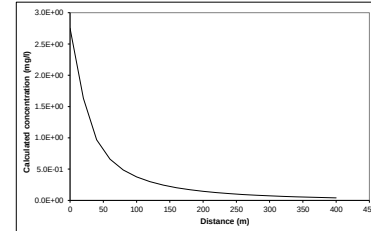
Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)	Kd		l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc	2.00E-03	fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc	2.37E+01	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		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
Soil water partition coefficient	Kd	4.75E-02	l/kg

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

User defined values for dispersivity			
typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020	Enter value	Calc value	Xu & Eckstein
Based on 12 slug tests carried out on two	4.00E+01	4.00E+01	6.38E+00
EA guidance Principal Aquifer	1.20E+01	4.00E+01	6.38E+01
default condition	4.00E-01	4.00E-01	6.38E-02
default condition			
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) ^{2.434} ; 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.

(BGS The physical properties of major aquifers in England and Wales, pg 24)

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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks		
From calculation sheet		
Distance	Concentration	
	mg/l	
0	2.8E+00	
20.0	1.63E+00	
40.0	9.68E-01	
60.0	6.60E-01	
80.0	4.86E-01	
100.0	3.75E-01	
120.0	2.99E-01	
140.0	2.45E-01	
160.0	2.03E-01	
180.0	1.71E-01	
200.0	1.46E-01	
220.0	1.25E-01	
240.0	1.08E-01	
260.0	9.44E-02	
280.0	8.27E-02	
300.0	7.28E-02	
320.0	6.43E-02	
340.0	5.70E-02	
360.0	5.08E-02	
380.0	4.53E-02	
400.0	4.05E-02	



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.

© Environment Agency, 2006. (Produced by the Environment Agency's Science Group)

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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Liability: The Environment Agency does not promise that the worksheet will provide any particular facilities or functions. You must ensure that the worksheet meets your needs and you remain solely responsible for the competent use of the worksheet. You are entirely responsible for the consequences of any use of the worksheet and the Agency provides no warranty about the fitness for purpose or performance of any part of the worksheet. We do not promise that the media will always be free from defects, computer viruses, software locks or other similar code or that the operation of the worksheet will be uninterrupted or error free. You should carry out all necessary virus checks prior to installing on your computing system.

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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Benzene		
Target Concentration (C_T)	0.001	mg/l	Origin of C_T : DWS

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.

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	Benzene
Target concentration	0.001 mg/l

Input Parameters

Standard entry

Water filled soil porosity	θ_w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy gr
Air filled soil porosity	θ_a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy gr
Bulk density of soil zone material	ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy gr
Henry's Law constant	H	2.25E-01	dimensionless	83

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.
The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd		l/kg	
----------------------------------	----	--	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	foc	1.75E-02	fraction	geomean of 25 analysis of uncontaminated unsaturated zone soil
Organic carbon partition coefficient	Koc	8.12E+01	l/kg	83

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	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	Kd	1.42E+00	l/kg	Calculated value
---	----	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	1.72E-03	mg/kg	(for comparison with soil analyses)
	or		
	0.001	mg/l	(for comparison with leachate test results)

Site being assessed:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration

C_T

Benzene
0.001 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

1.13E-04
2.50E+03

m/d
m²

s (SU718741)). Assuming 40% Evapotranspiration and
by 50 m based on area of site with observed contaminant

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

5.00E+01
3.00E+01
7.00E+00
2.00E-03
5.00E+01
0.00E+00

m
m
m/d
fraction
m
mg/l

proximate based on contaminated area and a NE GW direction
Assume thickness of effective permeable Chalk.
g tests carried out on two boreholes on Chalk (See 2019)
nt value within 5 monitoring rounds between April 2019
proximate based on contaminated area and a NE GW direction

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

0.00E+00
Calculate

m
m

Calculated Parameters

Dilution Factor

DF

1.51E+01

Level 2 Remedial Target

1.51E-02 mg/l
or
2.60E-02 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: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Benzene		from Level 1
Target Concentration	C _T	0.001	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		from Level 2

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

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

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

Variable	Value	Unit	Source of parameter value
Enter source concentration			
Enter soil concentration	16.4	mg/kg	Soil concentration as mg/kg
Half life for degradation of contaminant in water	t _{1/2}	3.50E+02	days
Calculated decay rate	λ	1.98E-03	days ⁻¹
Width of plume in aquifer at source	Sz	5.00E+01	m
Plume thickness in aquifer at source	Sy	5.69E+00	m
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³
Effective porosity of aquifer	n	2.00E-01	fraction
Hydraulic gradient	i	2.14E-03	fraction
Hydraulic conductivity of saturated aquifer	K	7.00E+00	m/d
Distance to compliance point	x	4.00E+02	m
Distance (lateral) to compliance point perpendicular to flow direction	z		m
Distance (depth) to compliance point perpendicular to flow direction	y		m
Time since pollutant entered groundwater	t	9.99E+99	days
Parameters values determined from options			
Partition coefficient	Kd	1.62E-01	l/kg
Longitudinal dispersivity	ax	40.000	m
Transverse dispersivity	az	12.000	m
Vertical dispersivity	ay	0.400	m

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	7.50E-02 m/d
Retardation factor	Rf	2.60E+00
Decay rate used	λ	7.62E-04 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.14E-03
Rate of contaminant flow due to retardation	u	2.88E-02 m/d
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	8.10E-05
Attenuation factor (C ₀ /C _{CP})	AF	1.23E+04
Calculated soil leachate concentration	Co	9.51E+00 mg/l

Remedial Targets

Level 3 Remedial Target	1.87E+02	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or		This assumes Level 1 Remedial Target is based on Target Concentration.
	3.22E+02	mg/kg	For comparison with measured soil concentration. This
Distance to compliance point	400	m	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	8.10E-05	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 Kd l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc} 2.00E-03 fractionOrganic carbon partition coefficient K_{oc} 8.12E+01 l/kgSorption coefficient for related species K_{oc,n} l/kgSorption 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 Kd 1.62E-01 l/kg

Mean bulk density of Chalk at thames and Chilterns area (BGS The physical properties of major aquifers in England and W.

Conservative value based on geomean value

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax 4.00E+01 4.00E+01 8.36E+00 m

Transverse dispersivity az 1.20E+01 0.00E+00 8.32E-01 m

Vertical dispersivity ay 4.00E-01 4.00E-01 4.39E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{2.41+4}, az = ax/10, ay = ax/100 are assumed

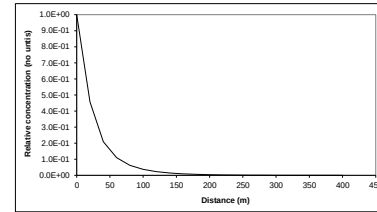
Note

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⁻, SO₄²⁻ 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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	6.30E-01
20.0	4.57E-01	2.88E-01
40.0	2.09E-01	1.32E-01
60.0	1.10E-01	6.92E-02
80.0	6.24E-02	3.93E-02
100.0	3.72E-02	2.34E-02
120.0	2.29E-02	1.44E-02
140.0	1.44E-02	9.06E-03
160.0	9.21E-03	5.80E-03
180.0	5.98E-03	3.77E-03
200.0	3.93E-03	2.47E-03
220.0	2.60E-03	1.64E-03
240.0	1.74E-03	1.09E-03
260.0	1.17E-03	7.34E-04
280.0	7.87E-04	4.96E-04
300.0	5.34E-04	3.36E-04
320.0	3.64E-04	2.29E-04
340.0	2.49E-04	1.57E-04
360.0	1.71E-04	1.07E-04
380.0	1.17E-04	7.39E-05
400.0	8.10E-05	5.10E-05

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Benzene	from Level 1
Target Concentration	C _r 1.00E-03	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	7.12E-01	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	3.50E+02	days	Based on site data
Calculated decay rate	λ	1.98E-03	days ⁻¹	77
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.89E+00	m	See Appendix C
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable C
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³	Mean bulk density of Chalk at Thames and Chilterns are
Effective porosity of aquifer	n	2.00E-01	fraction	Conservative value based on geomean value of total porosity in the Chalk at Thames and Chilterns area of 38.8 (BGS The physical properties of major aquifers in England and Wales, pg 24)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	7.00E+00	m/d	Based on 12 slug tests carried out on two
Distance to compliance point	x	4.00E+02	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	1.62E-01	l/kg	see options
Longitudinal dispersivity	ax	4.00E+01	m	see options
Transverse dispersivity	az	1.20E+01	m	see options
Vertical dispersivity	ay	4.00E-01	m	see options

Calculated Parameters

Groundwater flow velocity	v	7.00E-02	m/d
Retardation factor	Rf	2.60E+00	fraction
Decay rate used	λ	7.62E-04	d ⁻¹
Rate of contaminant flow due to retardation	u	2.69E-02	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	4.17E-05	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	1.71E+04	

Remedial Targets

Remedial Target	1.71E+01	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	400	m	
Concentration of contaminant at compliance point	C _{1D} /C ₀	4.17E-05	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

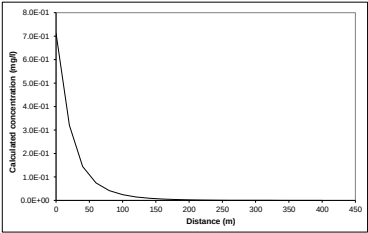
Entry if specify partition coefficient (option)	Kd		l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc	2.00E-03	fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc	8.12E+01	l/kg
Entry for ionic organic chemicals (option)	K _{oc,n}		l/kg
Sorption coefficient for related species	K _{oc,i}		l/kg
Sorption coefficient for ionised species	pH		
pH value	pKa		
acid dissociation constant	foc		fraction
Fraction of organic carbon in aquifer	Kd	1.62E-01	l/kg
Soil water partition coefficient			

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

User defined values for dispersivity

Enter value	Calc value	Xu & Eckstein	m
4.00E+01	4.00E+01	6.38E+00	m
1.20E+01	4.00E+00	6.38E-01	m
4.00E-01	4.00E-01	6.38E-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)^{2.434}; 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.

(BGS The physical properties of major aquifers in England and Wales, pg 24)

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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks	From calculation sheet
Distance	Concentration
	mg/l
0	7.1E-01
20.0	3.20E-01
40.0	1.44E-01
60.0	7.46E-02
80.0	4.17E-02
100.0	2.44E-02
120.0	1.48E-02
140.0	9.15E-03
160.0	5.76E-03
180.0	3.68E-03
200.0	2.38E-03
220.0	1.55E-03
240.0	1.02E-03
260.0	6.73E-04
280.0	4.47E-04
300.0	2.98E-04
320.0	2.00E-04
340.0	1.35E-04
360.0	9.08E-05
380.0	6.15E-05
400.0	4.17E-05



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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	PAH Sum 4 (benzo(k)fluoranthene)		
Target Concentration (C _T)	0.0001	mg/l	Origin of C _T : DWS

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.

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 PAH Sum 4 (benzo(k)fluoranthene) 0.0001 mg/l

Input Parameters

Standard entry

Water filled soil porosity θ_w 4.80E-01 fraction
Air filled soil porosity θ_a 2.00E-02 fraction
Bulk density of soil zone material ρ 1.60E+00 g/cm³
Henry's Law constant H 6.46E-06 dimensionless

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R&D Technical Report P13 Made Ground of sandy gr
R&D Technical Report P13 Made Ground of sandy gr
83

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient. The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Soil water partition coefficient K_d

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil) f_{oc} 1.75E-02 fraction
Organic carbon partition coefficient K_{oc} 1.21E+05 l/kg

geomean of 25 analysis of uncontaminated unsaturated zone soil
83

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 2.12E+03 l/kg Calculated value

Level 1 Remedial Target

Level 1 Remedial Target	2.12E-01	mg/kg	(for comparison with soil analyses)
	or		
	0.0001	mg/l	(for comparison with leachate test results)

Site being assessed: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration C_T PAH Sum 4 (benzo(k)fluoranthene) from Level 1
0.0001 mg/l 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	1.13E-04	m/d	s (SU718741)). Assuming 40% Evapotranspiration and
Area of contaminant source	A	2.50E+03	m ²	by 50 m based on area of site with observed contaminant
Entry for groundwater flow below site				
Length of contaminant source in direction of groundwater flow	L	5.00E+01	m	proximate based on contaminated area and a NE GW direction
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable Chalk.
Hydraulic Conductivity of aquifer in which dilution occurs	K	7.00E+00	m/d	g tests carried out on two boreholes on Chalk (See 2019)
Hydraulic gradient of water table	i	2.00E-03	fraction	at value within 5 monitoring rounds between April 2019
Width of contaminant source perpendicular to groundwater flow	w	5.00E+01	m	proximate based on contaminated area and a NE GW direction
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l	
Define mixing zone depth by specifying or calculating depth (using pull down list)		Calculate		
Enter mixing zone thickness	Mz	0.00E+00	m	
Calculated mixing zone thickness	Mz		m	

Calculated Parameters

Dilution Factor	DF	1.51E+01		
Level 2 Remedial Target		1.51E-03 or 3.20E+00	mg/l or 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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters

Contaminant	PAH Sum 4 (benzo(k)fluorant	from Level 1
Target Concentration	0.0001	from Level 1
Dilution Factor	1.51E+01	from Level 2

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

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

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

Variable	Value	Unit	Source of parameter value
Soil concentration as mg/kg			
Enter source concentration			
Enter soil concentration	1158	mg/kg	
Half life for degradation of contaminant in water	4.27E+03	days	78
Calculated decay rate	1.62E-04	days ⁻¹	calculated
Width of plume in aquifer at source	5.00E+01	m	from Level 2
Plume thickness in aquifer at source	5.69E+00	m	from Level 2
Bulk density of aquifer materials	1.97E+00	g/cm ³	Mean bulk density of Chalk at Thames and Chilterns area (BGS The physical properties of major aquifers in England and W.
Effective porosity of aquifer	2.00E-01	fraction	Conservative value based on geomean value
Hydraulic gradient	2.14E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	7.00E+00	m/d	from Level 2
Distance to compliance point	4.00E+02	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction		m	default condition
Distance (depth) to compliance point perpendicular to flow direction		m	default condition
Time since pollutant entered groundwater	9.99E+99	days	time variant options only
Parameters values determined from options			
Partition coefficient	2.42E+02	l/kg	see options
Longitudinal dispersivity	40.000	m	see options
Transverse dispersivity	12.000	m	see options
Vertical dispersivity	0.400	m	see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	7.50E-02	m/d
Retardation factor	2.38E+03	fraction
Decay rate used	6.81E-08	d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	2.14E-03	fraction
Rate of contaminant flow due to retardation	3.14E-05	m/d
Ratio of Compliance Point to Source Concentration	2.26E-02	fraction
Attenuation factor (C ₀ /C _{eq})	4.43E+01	fraction
Calculated soil leachate concentration	5.47E-01	mg/l

Remedial Targets

Level 3 Remedial Target	6.70E-02	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or	mg/kg	This assumes Level 1 Remedial Target is based on Target Concentration.
Distance to compliance point	400	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 _{eq} /C ₀	2.26E-02	fraction

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 Kd l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc} 2.00E-03 fractionOrganic carbon partition coefficient K_{oc} 1.21E+05 l/kgSorption coefficient for related species K_{oc,n} l/kgSorption 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 Kd 2.42E+02 l/kg

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax 4.00E+01 4.00E+01 6.36E+00 m

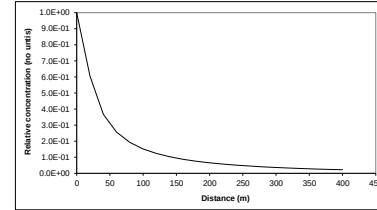
Transverse dispersivity az 1.20E+01 0.00E+00 6.32E-01 m

Vertical dispersivity ay 4.00E-01 4.00E-01 4.39E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, 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⁻, SO₄²⁻ 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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	3.62E-02
20.0	6.06E-01	2.19E-02
40.0	3.67E-01	1.33E-02
60.0	2.56E-01	9.26E-03
80.0	1.92E-01	6.97E-03
100.0	1.52E-01	5.50E-03
120.0	1.24E-01	4.48E-03
140.0	1.03E-01	3.74E-03
160.0	8.76E-02	3.17E-03
180.0	7.53E-02	2.73E-03
200.0	6.55E-02	2.37E-03
220.0	5.75E-02	2.08E-03
240.0	5.09E-02	1.84E-03
260.0	4.53E-02	1.64E-03
280.0	4.05E-02	1.47E-03
300.0	3.64E-02	1.32E-03
320.0	3.29E-02	1.18E-03
340.0	2.98E-02	1.08E-03
360.0	2.71E-02	9.80E-04
380.0	2.47E-02	8.93E-04
400.0	2.26E-02	8.16E-04

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	PAH Sum 4 (benzo(k)fluorant)	from Level 1
Target Concentration	C _r 1.00E-04	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	2.25E-03	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	4.27E+03	days	Based on site data
Calculated decay rate	λ	1.62E-04	days ⁻¹	78
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.89E+00	m	See Appendix C
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable C
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³	Mean bulk density of Chalk at Thames and Chilterns area
Effective porosity of aquifer	n	2.00E-01	fraction	Conservative value based on geomean value of total porosity in the Chalk at Thames and Chilterns area
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	7.00E+00	m/d	Based on 12 slug tests carried out on two
Distance to compliance point	x	4.00E+02	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	2.42E+02	l/kg	see options
Longitudinal dispersivity	ax	4.00E+01	m	see options
Transverse dispersivity	az	1.20E+01	m	see options
Vertical dispersivity	ay	4.00E-01	m	see options

Calculated Parameters

Groundwater flow velocity	v	7.00E-02	m/d
Retardation factor	Rf	2.38E+03	fraction
Decay rate used	λ	6.81E-08	d ⁻¹
Rate of contaminant flow due to retardation	u	2.94E-05	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	4.81E-05	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	4.87E+01	

Remedial Targets

Remedial Target	4.67E-03	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	400	m	
Concentration of contaminant at compliance point after	C _{1D} /C ₀	4.81E-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

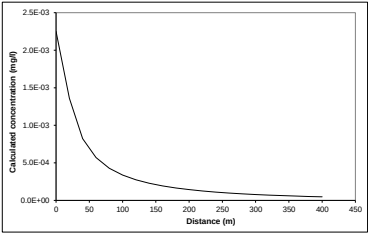
Entry if specify partition coefficient (option)	Kd		l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc	2.00E-03	fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc	1.21E+05	l/kg
Entry for ionic organic chemicals (option)	K _{oc,n}		l/kg
Sorption coefficient for related species	K _{oc,i}		l/kg
Sorption coefficient for ionised species	pH		
pH value	pKa		
acid dissociation constant	foc		fraction
Fraction of organic carbon in aquifer	Kd	2.42E+02	l/kg
Soil water partition coefficient			

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

User defined values for dispersivity

Enter value	Calc value	Xu & Eckstein	m
4.00E+01	4.00E+01	6.38E+00	m
1.20E+01	4.00E+01	6.38E+01	m
4.00E-01	4.00E-01	6.38E-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)^{2.434}; 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.

The physical properties of major aquifers in England and Wales, pg 24)

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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks		
From calculation sheet		
Distance	Concentration	mg/l
0	2.3E-03	
20.0	1.36E-03	
40.0	8.22E-04	
60.0	5.71E-04	
80.0	4.28E-04	
100.0	3.37E-04	
120.0	2.74E-04	
140.0	2.28E-04	
160.0	1.93E-04	
180.0	1.66E-04	
200.0	1.44E-04	
220.0	1.26E-04	
240.0	1.11E-04	
260.0	9.84E-05	
280.0	8.78E-05	
300.0	7.87E-05	
320.0	7.09E-05	
340.0	6.41E-05	
360.0	5.81E-05	
380.0	5.28E-05	
400.0	4.81E-05	



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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Benzo(a)pyrene		
Target Concentration (C _T)	0.00001 mg/l	Origin of C _T :	DWS

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.

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 Benzo(a)pyrene
0.00001 mg/l

Input Parameters Variable Value Unit Source of parameter value

Standard entry

Water filled soil porosity θ_w 4.80E-01 fraction R&D Technical Report P13 Made Ground of sandy gr
Air filled soil porosity θ_a 2.00E-02 fraction R&D Technical Report P13 Made Ground of sandy gr
Bulk density of soil zone material ρ 1.60E+00 g/cm³ R&D Technical Report P13 Made Ground of sandy gr
Henry's Law constant H 1.86E-05 dimensionless 83

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.
The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Soil water partition coefficient K_d I/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil) f_{oc} 1.75E-02 fraction geomean of 25 analysis of uncontaminated unsaturated zone soil
Organic carbon partition coefficient K_{oc} 1.31E+05 I/kg 83

Entry for ionic organic chemicals (option)

Sorption coefficient for neutral species $K_{oc,n}$ I/kg
Sorption coefficient for ionised species $K_{oc,i}$ I/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 2.29E+03 I/kg Calculated value

Level 1 Remedial Target

Level 1 Remedial Target	2.29E-02	mg/kg	(for comparison with soil analyses)
	or		
	0.00001	mg/l	(for comparison with leachate test results)

Site being assessed: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant Target concentration C_T Benzo(a)pyrene 0.00001 mg/l

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	1.13E-04	m/d	s (SU718741)). Assuming 40% Evapotranspiration and
Area of contaminant source	A	2.50E+03	m ²	by 50 m based on area of site with observed contaminant value within 5 monitoring rounds between April 2019
Entry for groundwater flow below site				
Length of contaminant source in direction of groundwater flow	L	5.00E+01	m	proximate based on contaminated area and a NE GW direction
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable Chalk.
Hydraulic Conductivity of aquifer in which dilution occurs	K	7.00E+00	m/d	g tests carried out on two boreholes on Chalk (See 2019)
Hydraulic gradient of water table	i	2.00E-03	fraction	at value within 5 monitoring rounds between April 2019
Width of contaminant source perpendicular to groundwater flow	w	5.00E+01	m	proximate based on contaminated area and a NE GW direction
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l	
Define mixing zone depth by specifying or calculating depth (using pull down list)		Calculate		
Enter mixing zone thickness	Mz	0.00E+00	m	
Calculated mixing zone thickness	Mz		m	

Calculated Parameters

Dilution Factor	DF	1.51E+01		
Level 2 Remedial Target		1.51E-04	mg/l	For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentration
		or		
		3.46E-01	mg/kg	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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Benzo(a)pyrene		from Level 1
Target Concentration	C _T	0.00001	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		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 dissolved pollutants only

Variable	Value	Unit	Source of parameter value
Enter source concentration			
Enter soil concentration	382	mg/kg	Soil concentration as mg/kg
Half life for degradation of contaminant in water	t _{1/2}	days	78
Calculated decay rate	λ	days ⁻¹	calculated
Width of plume in aquifer at source	Sz	m	from Level 2
Plume thickness in aquifer at source	Sy	m	from Level 2
Bulk density of aquifer materials	ρ	g/cm ³	Mean bulk density of Chalk at thames and Chilterns area (BGS The physical properties of major aquifers in England and W.
Effective porosity of aquifer	n	fraction	Conservative value based on geomean value
Hydraulic gradient	i	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	m/d	from Level 2
Distance to compliance point	x	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	m	default condition
Time since pollutant entered groundwater	t	days	time variant options only
Parameters values determined from options			
Partition coefficient	Kd	l/kg	see options
Longitudinal dispersivity	ax	m	see options
Transverse dispersivity	az	m	see options
Vertical dispersivity	ay	m	see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	7.50E-02 m/d
Retardation factor	Rf	2.58E+03 fraction
Decay rate used	λ	5.97E-08 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.14E-03 fraction
Rate of contaminant flow due to retardation	u	2.90E-05 m/d
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	2.34E-02 fraction
Attenuation factor (C ₀ /C _{eq})	AF	4.27E+01 fraction
Calculated soil leachate concentration	Co	1.67E-01 mg/l

Remedial Targets

Level 3 Remedial Target	6.45E-03	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or	mg/kg	This assumes Level 1 Remedial Target is based on Target Concentration.
Distance to compliance point	400	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 _{eq} /C ₀	2.34E-02 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 Kd l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc} 2.00E-03 fractionOrganic carbon partition coefficient K_{oc} 1.31E+05 l/kgSorption coefficient for related species K_{oc,n} l/kgSorption 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 Kd 2.62E+02 l/kg

Mean bulk density of Chalk at thames and Chilterns area (BGS The physical properties of major aquifers in England and W.

Conservative value based on geomean value

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax 4.00E+01 4.00E+01 4.36E+00 m

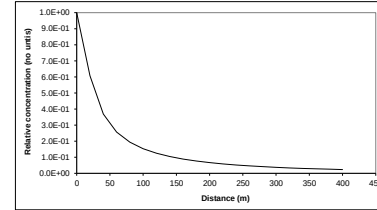
Transverse dispersivity az 1.20E+01 0.00E+00 8.32E-01 m

Vertical dispersivity ay 4.00E-01 4.00E-01 4.36E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, 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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	1.10E-02
20.0	6.07E-01	6.70E-03
40.0	3.69E-01	4.07E-03
60.0	2.57E-01	2.84E-03
80.0	1.94E-01	2.14E-03
100.0	1.53E-01	1.69E-03
120.0	1.25E-01	1.38E-03
140.0	1.05E-01	1.15E-03
160.0	8.89E-02	9.81E-04
180.0	7.67E-02	8.45E-04
200.0	6.68E-02	7.37E-04
220.0	5.87E-02	6.48E-04
240.0	5.20E-02	5.74E-04
260.0	4.64E-02	5.12E-04
280.0	4.16E-02	4.59E-04
300.0	3.75E-02	4.13E-04
320.0	3.39E-02	3.74E-04
340.0	3.08E-02	3.39E-04
360.0	2.80E-02	3.09E-04
380.0	2.56E-02	2.82E-04
400.0	2.34E-02	2.58E-04

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Benzo(a)pyrene	from Level 1
Target Concentration	C _r 1.00E-05	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	1.09E-03	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	4.50E+03	days	Based on site data
Calculated decay rate	λ	1.54E-04	days ⁻¹	78
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.89E+00	m	See Appendix C
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable C
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³	Mean bulk density of Chalk at Thames and Chilterns area
Effective porosity of aquifer	n	2.00E-01	fraction	Conservative value based on geomean value of total porosity in the Chalk at Thames and Chilterns area of 38.8 (BGS The physical properties of major aquifers in England and Wales, pg 24)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	7.00E+00	m/d	Based on 12 slug tests carried out on two
Distance to compliance point	x	4.00E+02	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	2.62E+02	l/kg	see options
Longitudinal dispersivity	ax	4.00E+01	m	see options
Transverse dispersivity	az	1.20E+01	m	see options
Vertical dispersivity	ay	4.00E-01	m	see options

Calculated Parameters

Groundwater flow velocity	v	7.00E-02	m/d
Retardation factor	Rf	2.58E+03	fraction
Decay rate used	λ	5.97E-08	d ⁻¹
Rate of contaminant flow due to retardation	u	2.71E-05	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	2.43E-05	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	4.49E+01	

Remedial Targets

Remedial Target	4.49E-04	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	400	m	
Concentration of contaminant at compliance point after	C _{1D} /C ₀ 2.43E-05	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

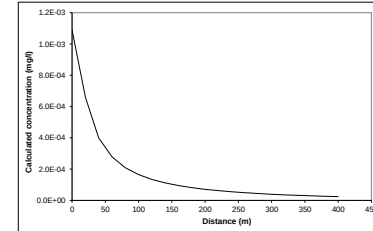
Entry if specify partition coefficient (option)	Kd		l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc	2.00E-03	fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc	1.31E+05	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		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
Soil water partition coefficient	Kd	2.62E+02	l/kg

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

User defined values for dispersivity

Enter value	Calc value	Xu & Eckstein	m
4.00E+01	4.00E+01	6.38E+00	m
1.20E+01	4.00E+00	6.38E+01	m
4.00E-01	4.00E-01	6.38E-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)^{2.434}; 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.

(BGS The physical properties of major aquifers in England and Wales, pg 24)

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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks	
From calculation sheet	
Distance	Concentration
	mg/l
0	1.1E-03
20.0	6.60E-04
40.0	4.00E-04
60.0	2.78E-04
80.0	2.09E-04
100.0	1.65E-04
120.0	1.34E-04
140.0	1.12E-04
160.0	9.50E-05
180.0	8.17E-05
200.0	7.10E-05
220.0	6.23E-05
240.0	5.50E-05
260.0	4.90E-05
280.0	4.38E-05
300.0	3.93E-05
320.0	3.55E-05
340.0	3.21E-05
360.0	2.92E-05
380.0	2.66E-05
400.0	2.43E-05



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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Aromatics >C10-C12 (TPHCWG)		
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.

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 Aromatics >C10-C12 (TPHCW) 0.09 mg/l

Input Parameters

Standard entry

Water filled soil porosity θ_w 4.80E-01 fraction
Air filled soil porosity θ_a 2.00E-02 fraction
Bulk density of soil zone material ρ 1.60E+00 g/cm³
Henry's Law constant H 1.40E-01 dimensionless

R&D Technical Report P13 Made Ground of sandy gr
R&D Technical Report P13 Made Ground of sandy gr
R&D Technical Report P13 Made Ground of sandy gr
83

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient. The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Soil water partition coefficient K_d

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil) f_{oc} 1.75E-02 fraction
Organic carbon partition coefficient K_{oc} 2.51E+03 l/kg

geomean of 25 analysis of uncontaminated unsaturated zone soil
83

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 4.39E+01 l/kg Calculated value

Level 1 Remedial Target

Level 1 Remedial Target	3.98E+00	mg/kg	(for comparison with soil analyses)
	or		
	0.09	mg/l	(for comparison with leachate test results)

Site being assessed: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant Target concentration C_T Aromatics >C10-C12 (TPHCW) from Level 1
0.09 mg/l 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	1.13E-04	m/d	s (SU718741)). Assuming 40% Evapotranspiration and
Area of contaminant source	A	2.50E+03	m ²	by 50 m based on area of site with observed contaminant value within 5 monitoring rounds between April 2019
Entry for groundwater flow below site				
Length of contaminant source in direction of groundwater flow	L	5.00E+01	m	proximate based on contaminated area and a NE GW direction
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable Chalk.
Hydraulic Conductivity of aquifer in which dilution occurs	K	7.00E+00	m/d	g tests carried out on two boreholes on Chalk (See 2019)
Hydraulic gradient of water table	i	2.00E-03	fraction	at value within 5 monitoring rounds between April 2019
Width of contaminant source perpendicular to groundwater flow	w	5.00E+01	m	proximate based on contaminated area and a NE GW direction
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l	
Define mixing zone depth by specifying or calculating depth (using pull down list)		Calculate		
Enter mixing zone thickness	Mz	0.00E+00	m	
Calculated mixing zone thickness	Mz		m	

Calculated Parameters

Dilution Factor	DF	1.51E+01		
Level 2 Remedial Target		1.36E+00 or 6.01E+01	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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Aromatics >C10-C12 (TPHC)		from Level 1
Target Concentration	C _T	0.09	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		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 dissolved pollutants only

Variable	Value	Unit	Source of parameter value
Enter source concentration			Soil concentration as mg/kg
Enter soil concentration	63.8	mg/kg	
Half life for degradation of contaminant in water	t _{1/2}	days	77
Calculated decay rate	λ	days ⁻¹	calculated
Width of plume in aquifer at source	Sz	m	from Level 2
Plume thickness in aquifer at source	Sy	m	from Level 2
Bulk density of aquifer materials	ρ	g/cm ³	Mean bulk density of Chalk at thames and Chilterns area (BGS The physical properties of major aquifers in England and W.
Effective porosity of aquifer	n	fraction	Conservative value based on geomean value
Hydraulic gradient	i	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	m/d	from Level 2
Distance to compliance point	x	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	m	default condition
Time since pollutant entered groundwater	t	days	time variant options only
Parameters values determined from options			
Partition coefficient	Kd	l/kg	see options
Longitudinal dispersivity	ax	m	see options
Transverse dispersivity	az	m	see options
Vertical dispersivity	ay	m	see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	7.50E-02 m/d
Retardation factor	Rf	5.05E+01 fraction
Decay rate used	λ	4.58E-05 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.14E-03 fraction
Rate of contaminant flow due to retardation	u	1.49E-03 m/d
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	3.84E-05 fraction
Attenuation factor (C ₀ /C _{CP})	AF	2.60E+04 fraction
Calculated soil leachate concentration	C ₀	1.44E+00 mg/l

Remedial Targets

Level 3 Remedial Target		3.54E+04	mg/l	For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentration.
Ogata Banks		or		
		1.57E+06	mg/kg	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point		400	m	
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	3.84E-05	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 Kd l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc} 2.00E-03 fractionOrganic carbon partition coefficient K_{oc} 2.51E+03 l/kgSorption coefficient for related species K_{oc,n} l/kgSorption 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 Kd 5.02E+00 l/kg

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax 4.00E+01 4.00E+01 8.38E+00 m

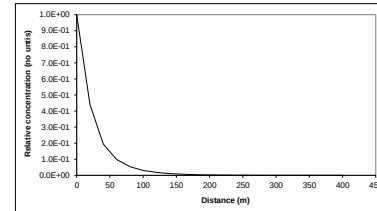
Transverse dispersivity az 1.20E+01 0.0E+00 8.32E-01 m

Vertical dispersivity ay 4.00E-01 4.00E-01 8.35E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, 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⁻, SO₄²⁻ 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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	9.55E-02
20.0	4.41E-01	4.21E-02
40.0	1.94E-01	1.85E-02
60.0	9.83E-02	9.38E-03
80.0	5.38E-02	5.13E-03
100.0	3.08E-02	2.94E-03
120.0	1.83E-02	1.74E-03
140.0	1.11E-02	1.06E-03
160.0	6.84E-03	6.53E-04
180.0	4.28E-03	4.08E-04
200.0	2.70E-03	2.58E-04
220.0	1.73E-03	1.65E-04
240.0	1.11E-03	1.06E-04
260.0	7.18E-04	6.85E-05
280.0	4.67E-04	4.46E-05
300.0	3.05E-04	2.91E-05
320.0	2.00E-04	1.91E-05
340.0	1.32E-04	1.26E-05
360.0	8.72E-05	8.32E-06
380.0	5.78E-05	5.52E-06
400.0	3.84E-05	3.67E-06

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2



Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Variable	Value	Unit	Source
Target Concentration	C _r	Aromatics >C10-C12 (TPHCW) 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	1.71E+00	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	3.00E+02	days	Based on site data
Calculated decay rate	λ	2.31E-03	days ⁻¹	77
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.89E+00	m	See Appendix C
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable C
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³	Mean bulk density of Chalk at Thames and Chilterns area
Effective porosity of aquifer	n	2.00E-01	fraction	Conservative value based on geomechanical value of total porosity in the Chalk at Thames and Chilterns area of 38.8 (BGS The physical properties of major aquifers in England and Wales, pg 24)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	7.00E+00	m/d	Based on 12 slug tests carried out on two
Distance to compliance point	x	4.00E+02	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	5.02E+00	l/kg	see options
Longitudinal dispersivity	ax	4.00E+01	m	see options
Transverse dispersivity	ay	1.20E+01	m	see options
Vertical dispersivity	az	4.00E-01	m	see options

Calculated Parameters

Groundwater flow velocity	v	7.00E-02	m/d
Retardation factor	Rf	5.05E+01	fraction
Decay rate used	λ	4.58E-05	d ⁻¹
Rate of contaminant flow due to retardation	u	1.39E-03	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	4.61E-05	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	3.71E+04	

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

Calculate for non-polar organic chemicals

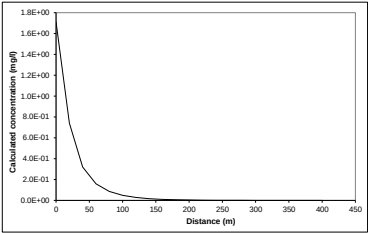
Entry if specify partition coefficient (option)	Kd		l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc	2.00E-03	fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc	2.51E+03	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		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
Soil water partition coefficient	Kd	5.02E+00	l/kg

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

User defined values for dispersivity

Enter value	Calc value	Xu & Eckstein	m
4.00E+01	4.00E+01	6.38E+00	m
1.20E+01	4.00E+01	6.38E+01	m
4.00E-01	4.00E-01	6.38E-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)^{2.434}; 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.

(BGS The physical properties of major aquifers in England and Wales, pg 24)

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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks	From calculation sheet
Distance	Concentration
	mg/l
0	1.7E+00
20.0	7.40E-01
40.0	3.20E-01
60.0	1.59E-01
80.0	8.56E-02
100.0	4.83E-02
120.0	2.81E-02
140.0	1.67E-02
160.0	1.01E-02
180.0	6.24E-03
200.0	3.87E-03
220.0	2.43E-03
240.0	1.53E-03
260.0	9.75E-04
280.0	6.23E-04
300.0	4.00E-04
320.0	2.58E-04
340.0	1.67E-04
360.0	1.08E-04
380.0	7.06E-05
400.0	4.61E-05

Remedial Targets

Remedial Target	3.34E+03	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	400	m	
Concentration of contaminant at compliance point	C _{1D} /C ₀	4.61E-05	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.



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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Aromatics >C8-C10 (TPHCWG)		
Target Concentration (C _T)	0.5	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.

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 Aromatics >C8-C10 (TPHCWG)
0.5 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity θ_w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy g
Air filled soil porosity θ_a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy g
Bulk density of soil zone material ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy g
Henry's Law constant H	4.80E-01	dimensionless	83

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient. The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Variable	Value	Unit	Source of parameter value
Soil water partition coefficient K_d		l/kg	

Entry for non-polar organic chemicals (option)

Variable	Value	Unit	Source of parameter value
Fraction of organic carbon (in soil) f_{oc}	1.75E-02	fraction	geomean of 25 analysis of uncontaminated unsaturated zone soil
Organic carbon partition coefficient K_{oc}	1.59E+03	l/kg	83

Entry for ionic organic chemicals (option)

Variable	Value	Unit	Source of parameter value
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	

Variable	Value	Unit	Source of parameter value
Soil water partition coefficient used in Level Assessment K_d	2.77E+01	l/kg	Calculated value

Level 1 Remedial Target

Level 1 Remedial Target	1.40E+01	mg/kg	(for comparison with soil analyses)
	or		
	0.5	mg/l	(for comparison with leachate test results)

Site being assessed:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant Target concentration C_T Aromatics >C8-C10 (TPHCW) 0.5 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	1.13E-04	m/d	s (SU718741)). Assuming 40% Evapotranspiration and
Area of contaminant source	A	2.50E+03	m ²	by 50 m based on area of site with observed contaminant value within 5 monitoring rounds between April 2019
Entry for groundwater flow below site				
Length of contaminant source in direction of groundwater flow	L	5.00E+01	m	proximate based on contaminated area and a NE GW direction
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable Chalk.
Hydraulic Conductivity of aquifer in which dilution occurs	K	7.00E+00	m/d	g tests carried out on two boreholes on Chalk (See 2019)
Hydraulic gradient of water table	i	2.00E-03	fraction	at value within 5 monitoring rounds between April 2019
Width of contaminant source perpendicular to groundwater flow	w	5.00E+01	m	proximate based on contaminated area and a NE GW direction
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l	
Define mixing zone depth by specifying or calculating depth (using pull down list)		Calculate		
Enter mixing zone thickness	Mz	0.00E+00	m	
Calculated mixing zone thickness	Mz		m	

Calculated Parameters

Dilution Factor	DF	1.51E+01		
Level 2 Remedial Target		7.55E+00 or 2.12E+02	mg/l or 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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Aromatics >C8-C10 (TPHCW)		from Level 1
Target Concentration	C _T	0.5	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		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 dissolved pollutants only

Variable	Value	Unit	Source of parameter value
Enter source concentration			
Enter soil concentration	35.4	mg/kg	
Half life for degradation of contaminant in water	t _{1/2}	2.00E+02	days
Calculated decay rate	λ	3.47E-03	days ⁻¹
Width of plume in aquifer at source	Sz	5.00E+01	m
Plume thickness in aquifer at source	Sy	5.69E+00	m
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³
Effective porosity of aquifer	n	2.00E-01	fraction
Hydraulic gradient	i	2.14E-03	fraction
Hydraulic conductivity of saturated aquifer	K	7.00E+00	m/d
Distance to compliance point	x	4.00E+02	m
Distance (lateral) to compliance point perpendicular to flow direction	z		m
Distance (depth) to compliance point perpendicular to flow direction	y		m
Time since pollutant entered groundwater	t	9.99E+99	days
Parameters values determined from options			
Partition coefficient	Kd	3.17E+00	l/kg
Longitudinal dispersivity	ax	40.000	m
Transverse dispersivity	az	12.000	m
Vertical dispersivity	ay	0.400	m

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	7.50E-02 m/d
Retardation factor	Rf	3.22E+01
Decay rate used	λ	1.08E-04 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.14E-03
Rate of contaminant flow due to retardation	u	2.33E-03 m/d
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	3.81E-06
Attenuation factor (C ₀ /C _{eq})	AF	2.63E+05
Calculated soil leachate concentration	Co	1.26E+00 mg/l

Remedial Targets

Level 3 Remedial Target		1.98E+06	mg/l	For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentration.
Ogata Banks		or		
		5.57E+07	mg/kg	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point		400	m	
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	3.81E-06	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 Kd

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc}Organic carbon partition coefficient K_{oc}Sorption coefficient for related species K_{oc,n}Sorption coefficient for ionised species K_{oc,i}

pH value pH

Acid dissociation constant pKa

Fraction of organic carbon in aquifer f_{oc}

Soil water partition coefficient Kd

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax

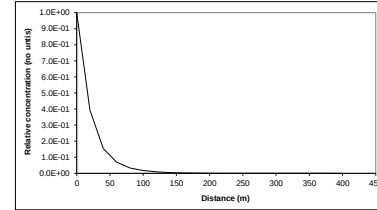
Transverse dispersivity az

Vertical dispersivity ay

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, 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⁻, SO₄²⁻ 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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	8.36E-02
20.0	3.92E-01	3.28E-02
40.0	1.54E-01	1.29E-02
60.0	6.95E-02	5.81E-03
80.0	3.39E-02	2.83E-03
100.0	1.73E-02	1.45E-03
120.0	9.13E-03	7.63E-04
140.0	4.93E-03	4.12E-04
160.0	2.71E-03	2.27E-04
180.0	1.51E-03	1.26E-04
200.0	8.51E-04	7.11E-05
220.0	4.84E-04	4.04E-05
240.0	2.77E-04	2.32E-05
260.0	1.60E-04	1.34E-05
280.0	9.26E-05	7.74E-06
300.0	5.39E-05	4.50E-06
320.0	3.15E-05	2.63E-06
340.0	1.85E-05	1.55E-06
360.0	1.09E-05	9.10E-07
380.0	6.43E-06	5.37E-07
400.0	3.81E-06	3.18E-07

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Variable	Value	Unit	Source
Target Concentration	C _r	5.00E-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	1.07E+00	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	2.00E+02	days	Based on site data
Calculated decay rate	λ	3.47E-03	days ⁻¹	77
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.89E+00	m	See Appendix C
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable C
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³	Mean bulk density of Chalk at Thames and Chilterns area
Effective porosity of aquifer	n	2.00E-01	fraction	Conservative value based on geomechanical data
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	7.00E+00	m/d	Based on 12 slug tests carried out on two
Distance to compliance point	x	4.00E+02	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Partition coefficient	Kd	3.17E+00	l/kg	see options
Longitudinal dispersivity	ax	4.00E+01	m	see options
Transverse dispersivity	az	1.20E+01	m	see options
Vertical dispersivity	ay	4.00E-01	m	see options

Calculated Parameters

Groundwater flow velocity	v	7.00E-02	m/d
Retardation factor	Rf	3.22E+01	fraction
Decay rate used	λ	1.08E-04	d ⁻¹
Rate of contaminant flow due to retardation	u	2.17E-03	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	2.61E-06	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	4.10E+05	

Remedial Targets

Remedial Target	2.05E+05	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	400	m	
Concentration of contaminant at compliance point after	C _{1D} /C ₀	2.61E-06	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)

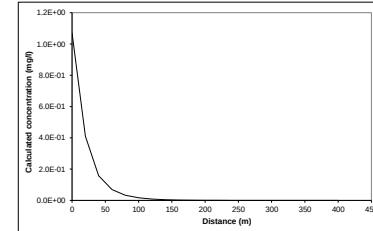
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)	Kd		l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc	2.00E-03	fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc	1.59E+03	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		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
Soil water partition coefficient	Kd	3.17E+00	l/kg

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

User defined values for dispersivity			
m of total porosity in the Chalk at Thames and Chilterns area of 38.8 (BGS) The physical properties of major aquifers between April 2019 and Feb 2020			
		Enter value	Calc value Xu & Eckstein
Longitudinal dispersivity	ax	4.00E+01	4.00E+01 8.35E+00
Transverse dispersivity	az	1.20E+01	4.00E+01 8.35E+01
Vertical dispersivity	ay	4.00E-01	4.00E-01 8.35E-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(log₁₀X)^{2.434}; 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.

(BGS The physical properties of major aquifers in England and Wales, pg 24)

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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks	From calculation sheet
Distance	Concentration
	mg/l
0	1.1E+00
20.0	4.11E-01
40.0	1.58E-01
60.0	6.95E-02
80.0	3.31E-02
100.0	1.66E-02
120.0	8.55E-03
140.0	4.52E-03
160.0	2.43E-03
180.0	1.32E-03
200.0	7.29E-04
220.0	4.05E-04
240.0	2.27E-04
260.0	1.28E-04
280.0	7.25E-05
300.0	4.13E-05
320.0	2.36E-05
340.0	1.35E-05
360.0	7.80E-06
380.0	4.50E-06
400.0	2.61E-06



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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Manganese		
Target Concentration (C_T)	0.05	mg/l	Origin of C_T : DWS

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.

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

User specified value for partition coefficient

Contaminant	Manganese
Target concentration	0.05 mg/l

Input Parameters

Standard entry

Water filled soil porosity	θ_w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy g
Air filled soil porosity	θ_a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy g
Bulk density of soil zone material	ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy g
Henry's Law constant	H	0.00E+00	dimensionless	0

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.
The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	6.50E+02	l/kg	3.40E+01
----------------------------------	----	----------	------	----------

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	

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	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	Kd	6.50E+02	l/kg	Specified value
---	----	----------	------	-----------------

Level 1 Remedial Target

Level 1 Remedial Target	3.25E+01	mg/kg	(for comparison with soil analyses)
	or		
	0.05	mg/l	(for comparison with leachate test results)

Site being assessed:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration

C_T

Manganese
0.05

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

1.13E-04
2.50E+03

m/d
m²

s (SU718741)). Assuming 40% Evapotranspiration and
by 50 m based on area of site with observed contaminant

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

5.00E+01
3.00E+01
7.00E+00
2.00E-03
5.00E+01
0.00E+00

m
m
m/d
fraction
m
mg/l

proximate based on contaminated area and a NE GW direction
Assume thickness of effective permeable Chalk.
g tests carried out on two boreholes on Chalk (See 2019)
nt value within 5 monitoring rounds between April 2019
proximate based on contaminated area and a NE GW direction

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
0.00E+00

m
m

Calculated Parameters

Dilution Factor

DF

1.51E+01

Level 2 Remedial Target

7.55E-01

mg/l

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

or
4.91E+02
mg/kg
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: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Manganese		from Level 1
Target Concentration	C _T	0.05	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		from Level 2

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

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

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

Variable	Value	Unit	Source of parameter value
Enter source concentration			Soil concentration as mg/kg
Enter soil concentration	0.001	mg/kg	
Half life for degradation of contaminant in water	t _{1/2}	days	0
Calculated decay rate	λ	days ⁻¹	calculated
Width of plume in aquifer at source	Sz	m	from Level 2
Plume thickness in aquifer at source	Sy	m	from Level 2
Bulk density of aquifer materials	ρ	g/cm ³	Mean bulk density of Chalk at thames and Chilterns area (BGS The physical properties of major aquifers in England and W.
Effective porosity of aquifer	n	fraction	Conservative value based on geomean value
Hydraulic gradient	i	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	m/d	from Level 2
Distance to compliance point	x	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	m	default condition
Time since pollutant entered groundwater	t	days	time variant options only
Parameters values determined from options			
Partition coefficient	Kd	l/kg	see options
Longitudinal dispersivity	ax	m	see options
Transverse dispersivity	az	m	see options
Vertical dispersivity	ay	m	see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	7.50E-02 m/d
Retardation factor	Rf	6.40E+03 fraction
Decay rate used	λ	1.20E-104 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.14E-03 fraction
Rate of contaminant flow due to retardation	u	1.17E-05 m/d
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	5.03E-02 fraction
Attenuation factor (C ₀ /C _{eq})	AF	1.99E+01 fraction
Calculated soil leachate concentration	Co	1.54E-06 mg/l

Remedial Targets

Level 3 Remedial Target		1.50E+01	mg/l	For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentration.
Ogata Banks		or		
		9.77E+03	mg/kg	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point		400	m	
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	5.03E-02	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)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd 6.50E+02 l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer foc fraction

Organic carbon partition coefficient Koc l/kg

Sorption coefficient for related species K_{oc,n} l/kg

pH value pH l/kg

Acid dissociation constant pKa fraction

Fraction of organic carbon in aquifer foc fraction

Soil water partition coefficient Kd 6.50E+02 l/kg

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax 4.00E+01 4.00E+01 6.36E+00 m

Transverse dispersivity az 1.20E+01 0.00E+00 6.36E-01 m

Vertical dispersivity ay 4.00E-01 4.00E-01 6.36E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, az = ax/10, ay = ax/100 are assumed

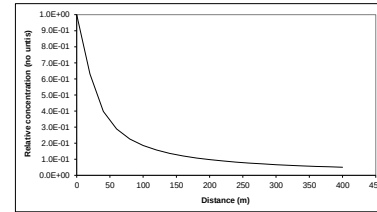
Note

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⁻, SO₄²⁻ 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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	1.02E-07
20.0	6.31E-01	6.42E-08
40.0	3.98E-01	4.05E-08
60.0	2.88E-01	2.94E-08
80.0	2.26E-01	2.30E-08
100.0	1.86E-01	1.89E-08
120.0	1.57E-01	1.60E-08
140.0	1.37E-01	1.39E-08
160.0	1.21E-01	1.23E-08
180.0	1.08E-01	1.10E-08
200.0	9.79E-02	9.96E-09
220.0	8.94E-02	9.10E-09
240.0	8.23E-02	8.38E-09
260.0	7.62E-02	7.76E-09
280.0	7.10E-02	7.23E-09
300.0	6.64E-02	6.76E-09
320.0	6.24E-02	6.36E-09
340.0	5.89E-02	5.99E-09
360.0	5.57E-02	5.67E-09
380.0	5.29E-02	5.38E-09
400.0	5.03E-02	5.12E-09

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Manganese	from Level 1
Target Concentration	C _r 5.00E-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	3.80E+00	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	9.00E+99	days	Based on site data
Calculated decay rate	λ	7.70E-101	days ⁻¹	0
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.89E+00	m	See Appendix C
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable C
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³	Mean bulk density of Chalk at Thames and Chilterns area
Effective porosity of aquifer	n	2.00E-01	fraction	Conservative value based on geomean value of total porosity in the Chalk at Thames and Chilterns area of 38.8 (BGS The physical properties of major aquifers in England and Wales, pg 24)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	7.00E+00	m/d	Based on 12 slug tests carried out on two
Distance to compliance point	x	4.00E+02	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	6.50E+02	l/kg	see options
Longitudinal dispersivity	ax	4.00E+01	m	see options
Transverse dispersivity	az	1.20E+01	m	see options
Vertical dispersivity	ay	4.00E-01	m	see options

Calculated Parameters

Groundwater flow velocity	v	7.00E-02	m/d
Retardation factor	Rf	6.40E+03	fraction
Decay rate used	λ	1.20E-104	d ⁻¹
Rate of contaminant flow due to retardation	u	1.09E-05	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	1.91E-01	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	1.99E+01	

Remedial Targets

Remedial Target	9.94E-01	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	400	m	
Concentration of contaminant at compliance point	C _{1D} /C ₀ 1.91E-01	mg/l	Ogata Banks
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)

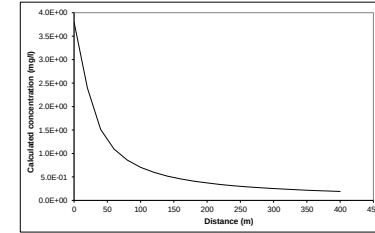
User specified value for partition coefficient

Entry if specify partition coefficient (option)	Kd	6.50E+02	l/kg
Soil water partition coefficient	foc		fraction
Entry for non-polar organic chemicals (option)	Koc		l/kg
Fraction of organic carbon in aquifer	K _{oc,n}		l/kg
Organic carbon partition coefficient	K _{oc,i}		l/kg
Entry for ionic organic chemicals (option)	pH		
Sorption coefficient for related species	pKa		
Sorption coefficient for ionised species	foc		fraction
pH value	Kd	6.50E+02	l/kg
acid dissociation constant			
Fraction of organic carbon in aquifer			

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

Enter value	Calc value	Xu & Eckstein	m
4.00E+01	4.00E+01	6.38E+00	m
1.20E+01	4.00E+01	6.38E+01	m
4.00E-01	4.00E-01	6.38E-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)^{2.434}; 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.

(BGS The physical properties of major aquifers in England and Wales, pg 24)

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
	mg/l
0	3.8E+00
20.0	2.40E+00
40.0	1.51E+00
60.0	1.10E+00
80.0	8.58E-01
100.0	7.05E-01
120.0	5.98E-01
140.0	5.19E-01
160.0	4.59E-01
180.0	4.11E-01
200.0	3.72E-01
220.0	3.40E-01
240.0	3.13E-01
260.0	2.90E-01
280.0	2.70E-01
300.0	2.52E-01
320.0	2.37E-01
340.0	2.24E-01
360.0	2.12E-01
380.0	2.01E-01
400.0	1.91E-01

Site being assessed:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx



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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Iron		
Target Concentration (C _T)	0.2	mg/l	Origin of C _T : DWS

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.

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

User specified value for partition coefficient

Contaminant	Iron
Target concentration	0.2 mg/l

Input Parameters

Standard entry

Water filled soil porosity	θ_w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy g
Air filled soil porosity	θ_a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy g
Bulk density of soil zone material	ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy g
Henry's Law constant	H	0.00E+00	dimensionless	0

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.
The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	2.50E+02	l/kg	3.40E+01
----------------------------------	----	----------	------	----------

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	

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	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment	Kd	2.50E+02	l/kg	Specified value
---	----	----------	------	-----------------

Level 1 Remedial Target

Level 1 Remedial Target	5.01E+01	mg/kg	(for comparison with soil analyses)
	or		
	0.2	mg/l	(for comparison with leachate test results)

Site being assessed:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration

C_T

Iron
0.2 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

1.13E-04
2.50E+03

m/d
m²

s (SU718741)). Assuming 40% Evapotranspiration and
by 50 m based on area of site with observed contaminant

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

5.00E+01
3.00E+01
7.00E+00
2.00E-03
5.00E+01
0.00E+00

m
m
m/d
fraction
m
mg/l

proximate based on contaminated area and a NE GW direction
Assume thickness of effective permeable Chalk.
g tests carried out on two boreholes on Chalk (See 2019)
nt value within 5 monitoring rounds between April 2019
proximate based on contaminated area and a NE GW direction

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

0.00E+00
Calculate

m
m

Calculated Parameters

Dilution Factor

DF

1.51E+01

Level 2 Remedial Target

3.02E+00

mg/l

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

or
7.56E+02 mg/kg
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: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Iron		from Level 1
Target Concentration	C _T	0.2	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		from Level 2

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

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

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

Variable	Value	Unit	Source of parameter value
Enter source concentration			
Enter soil concentration	0.001	mg/kg	Soil concentration as mg/kg
Half life for degradation of contaminant in water	t _{1/2}	days	0
Calculated decay rate	λ	days ⁻¹	calculated
Width of plume in aquifer at source	Sz	m	from Level 2
Plume thickness in aquifer at source	Sy	m	from Level 2
Bulk density of aquifer materials	ρ	g/cm ³	Mean bulk density of Chalk at thames and Chilterns area (BGS The physical properties of major aquifers in England and W.
Effective porosity of aquifer	n	fraction	Conservative value based on geomean value
Hydraulic gradient	i	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	m/d	from Level 2
Distance to compliance point	x	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	m	default condition
Time since pollutant entered groundwater	t	days	time variant options only
Parameters values determined from options			
Partition coefficient	Kd	l/kg	see options
Longitudinal dispersivity	ax	m	see options
Transverse dispersivity	az	m	see options
Vertical dispersivity	ay	m	see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	7.50E-02 m/d
Retardation factor	Rf	2.46E+03 fraction
Decay rate used	λ	3.13E-104 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.14E-03 fraction
Rate of contaminant flow due to retardation	u	3.04E-05 m/d
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	5.03E-02 fraction
Attenuation factor (C ₀ /C _{eq})	AF	1.99E+01 fraction
Calculated soil leachate concentration	Co	4.00E-06 mg/l

Remedial Targets

Level 3 Remedial Target	6.01E+01	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.50E+04	mg/kg	For comparison with measured soil concentration. This
Distance to compliance point	400	m	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	5.03E-02	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)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient Kd 2.50E+02 l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc} fractionOrganic carbon partition coefficient K_{oc} l/kgSorption coefficient for related species K_{oc,n} l/kg

pH value pH l/kg

Acid dissociation constant pKa

Fraction of organic carbon in aquifer f_{oc} fraction

Soil water partition coefficient Kd 2.50E+02 l/kg

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax 4.00E+01 4.00E+01 4.36E+00 m

Transverse dispersivity az 1.20E+01 0.00E+00 8.32E-01 m

Vertical dispersivity ay 4.00E-01 4.00E-01 4.36E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, az = ax/10, ay = ax/100 are assumed

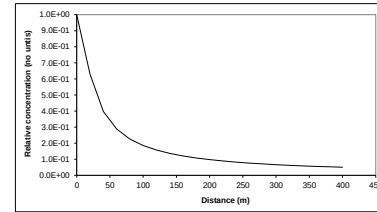
Note

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⁻, SO₄²⁻ 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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	2.64E-07
20.0	6.31E-01	1.67E-07
40.0	3.98E-01	1.05E-07
60.0	2.88E-01	7.63E-08
80.0	2.26E-01	5.97E-08
100.0	1.86E-01	4.91E-08
120.0	1.57E-01	4.16E-08
140.0	1.37E-01	3.61E-08
160.0	1.21E-01	3.19E-08
180.0	1.08E-01	2.86E-08
200.0	9.79E-02	2.59E-08
220.0	8.94E-02	2.36E-08
240.0	8.23E-02	2.18E-08
260.0	7.62E-02	2.02E-08
280.0	7.10E-02	1.88E-08
300.0	6.64E-02	1.76E-08
320.0	6.24E-02	1.65E-08
340.0	5.89E-02	1.56E-08
360.0	5.57E-02	1.47E-08
380.0	5.29E-02	1.40E-08
400.0	5.03E-02	1.33E-08

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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	#####
Version:	x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Iron	from Level 1
Target Concentration	C _r 2.00E-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	3.46E+01	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	9.00E+99	days	Based on site data
Calculated decay rate	λ	7.70E-101	days ⁻¹	0
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.89E+00	m	See Appendix C
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable C
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³	Mean bulk density of Chalk at Thames and Chilterns are
Effective porosity of aquifer	n	2.00E-01	fraction	Conservative value based on geomean value of total porosity in the Chalk at Thames and Chilterns area of 38.8 (BGS The physical properties of major aquifers in England and Wales, pg 24)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	7.00E+00	m/d	Based on 12 slug tests carried out on two
Distance to compliance point	x	4.00E+02	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	2.50E+02	l/kg	see options
Longitudinal dispersivity	ax	4.00E+01	m	see options
Transverse dispersivity	az	1.20E+01	m	see options
Vertical dispersivity	ay	4.00E-01	m	see options

Calculated Parameters

Groundwater flow velocity	v	7.00E-02	m/d
Retardation factor	Rf	2.46E+03	fraction
Decay rate used	λ	3.13E-104	d ⁻¹
Rate of contaminant flow due to retardation	u	2.84E-05	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	1.74E+00	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	1.99E+01	

Remedial Targets

Remedial Target	3.88E+00	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	400	m	
Concentration of contaminant at compliance point after	C _{1D} /C ₀ 1.74E+00	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)

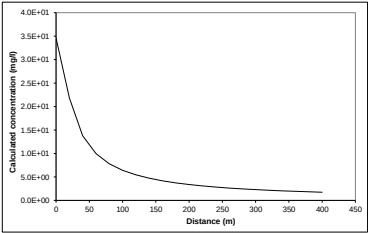
User specified value for partition coefficient

Entry if specify partition coefficient (option)	Kd	2.50E+02	l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc		fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		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
Soil water partition coefficient	Kd	2.50E+02	l/kg

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

User defined values for dispersivity			
Enter value	Calc value	Xu & Eckstein	m
4.00E+01	4.00E+01	6.38E+00	m
1.20E+01	4.00E+00	6.38E-01	m
4.00E-01	4.00E-01	6.38E-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)^{2.434}; 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.

(BGS The physical properties of major aquifers in England and Wales, pg 24)

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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks		
From calculation sheet		
Distance	Concentration	mg/l
0		3.5E+01
20.0		2.18E+01
40.0		1.38E+01
60.0		9.98E+00
80.0		7.82E+00
100.0		6.42E+00
120.0		5.44E+00
140.0		4.73E+00
160.0		4.18E+00
180.0		3.74E+00
200.0		3.39E+00
220.0		3.09E+00
240.0		2.85E+00
260.0		2.64E+00
280.0		2.46E+00
300.0		2.30E+00
320.0		2.16E+00
340.0		2.04E+00
360.0		1.93E+00
380.0		1.83E+00
400.0		1.74E+00



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.

© Environment Agency, 2006. (Produced by the Environment Agency's Science Group)

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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Total Cyanide		
Target Concentration (C_T)	0.05 mg/l	Origin of C_T :	DWS

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.

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	Total Cyanide
Target concentration	C _T 0.05 mg/l

Input Parameters

Standard entry

Water filled soil porosity	θ _w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy gr
Air filled soil porosity	θ _a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy gr
Bulk density of soil zone material	ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy gr
Henry's Law constant	H	4.18E-11	dimensionless	0

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient. The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

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}	1.75E-02	fraction	geomean of 25 analysis of uncontaminated unsaturated zone soil
Organic carbon partition coefficient	K _{oc}	1.00E+01	l/kg	80

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	1.75E-01	l/kg	Calculated value
---	----------------	----------	------	------------------

Level 1 Remedial Target

Level 1 Remedial Target	2.38E-02	mg/kg	(for comparison with soil analyses)
	or		
	0.05	mg/l	(for comparison with leachate test results)

Site being assessed:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration

C_T

Total Cyanide
0.05

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

1.13E-04
2.50E+03

m/d
m²

s (SU718741)). Assuming 40% Evapotranspiration and
by 50 m based on area of site with observed contaminant

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

5.00E+01
3.00E+01
7.00E+00
2.00E-03
5.00E+01
0.00E+00

m
m
m/d
fraction
m
mg/l

Approximate based on contaminated area and a NE GW direction
Assume thickness of effective permeable Chalk.
g tests carried out on two boreholes on Chalk (See 2019)
at value within 5 monitoring rounds between April 2019
Approximate based on contaminated area and a NE GW direction

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

0.00E+00
Calculate

m
m

Calculated Parameters

Dilution Factor

DF

1.51E+01

Level 2 Remedial Target

7.55E-01

mg/l

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

or

3.59E-01

mg/kg

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: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Total Cyanide		from Level 1
Target Concentration	C _T	0.05	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		from Level 2

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

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

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

Variable	Value	Unit	Source of parameter value
Enter source concentration			
Enter soil concentration	1170	mg/kg	Soil concentration as mg/kg
Half life for degradation of contaminant in water	t _{1/2}	days	80
Calculated decay rate	λ	days ⁻¹	calculated
Width of plume in aquifer at source	Sz	m	from Level 2
Plume thickness in aquifer at source	Sy	m	from Level 2
Bulk density of aquifer materials	ρ	g/cm ³	Mean bulk density of Chalk at thames and Chilterns area (BGS The physical properties of major aquifers in England and W.
Effective porosity of aquifer	n	fraction	Conservative value based on geomean value
Hydraulic gradient	i	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	m/d	from Level 2
Distance to compliance point	x	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	m	default condition
Time since pollutant entered groundwater	t	days	time variant options only
Parameters values determined from options			
Partition coefficient	Kd	l/kg	see options
Longitudinal dispersivity	ax	m	see options
Transverse dispersivity	az	m	see options
Vertical dispersivity	ay	m	see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	7.50E-02 m/d
Retardation factor	Rf	1.20E+00 fraction
Decay rate used	λ	1.59E-03 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.14E-03 fraction
Rate of contaminant flow due to retardation	u	6.26E-02 m/d
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	9.81E-05 fraction
Attenuation factor (C ₀ /C _{CP})	AF	1.02E+04 fraction
Calculated soil leachate concentration	Co	2.46E+03 mg/l

Remedial Targets

Level 3 Remedial Target	7.70E+03	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or		This assumes Level 1 Remedial Target is based on Target Concentration.
	3.66E+03	mg/kg	For comparison with measured soil concentration. This
Distance to compliance point	400	m	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	9.81E-05	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 Kd l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc} 2.00E-03 fractionOrganic carbon partition coefficient K_{oc} 1.00E+01 l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species K_{oc,n} l/kgSorption 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 Kd 2.00E-02 l/kg

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax 4.00E+01 4.00E+01 8.36E+00 m

Transverse dispersivity az 1.20E+01 0.00E+00 8.32E-01 m

Vertical dispersivity ay 4.00E-01 1.07E-01 8.35E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, az = ax/10, ay = ax/100 are assumed

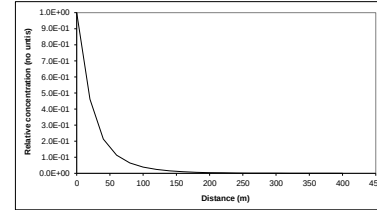
Note

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⁻, SO₄²⁻ 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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	1.63E+02
20.0	4.62E-01	7.53E+01
40.0	2.13E-01	3.48E+01
60.0	1.13E-01	1.84E+01
80.0	6.48E-02	1.06E+01
100.0	3.90E-02	6.36E+00
120.0	2.42E-02	3.95E+00
140.0	1.54E-02	2.51E+00
160.0	9.95E-03	1.62E+00
180.0	6.52E-03	1.06E+00
200.0	4.32E-03	7.05E+00
220.0	2.89E-03	4.71E+01
240.0	1.95E-03	3.18E-01
260.0	1.32E-03	2.15E-01
280.0	9.00E-04	1.47E-01
300.0	6.17E-04	1.01E-01
320.0	4.24E-04	6.92E-02
340.0	2.93E-04	4.77E-02
360.0	2.03E-04	3.31E-02
380.0	1.41E-04	2.30E-02
400.0	9.81E-05	1.60E-02

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Total Cyanide	from Level 1
Target Concentration	C _r 5.00E-02	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	2.16E+00	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	3.65E+02	days	Based on site data
Calculated decay rate	λ	1.90E-03	days ⁻¹	80
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.89E+00	m	See Appendix C
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable C
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³	Mean bulk density of Chalk at Thames and Chilterns area
Effective porosity of aquifer	n	2.00E-01	fraction	Conservative value based on geomean value of total porosity in the Chalk at Thames and Chilterns area of 38.8 (BGS The physical properties of major aquifers in England and Wales, pg 24)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	7.00E+00	m/d	Based on 12 slug tests carried out on two
Distance to compliance point	x	4.00E+02	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	2.00E-02	l/kg	see options
Longitudinal dispersivity	ax	4.00E+01	m	see options
Transverse dispersivity	az	1.20E+01	m	see options
Vertical dispersivity	ay	4.00E-01	m	see options

Calculated Parameters

Groundwater flow velocity	v	7.00E-02	m/d
Retardation factor	Rf	1.20E+00	fraction
Decay rate used	λ	1.59E-03	d ⁻¹
Rate of contaminant flow due to retardation	u	5.85E-02	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	1.55E-04	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	1.40E+04	

Remedial Targets

Remedial Target	6.99E+02	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	400	m	
Concentration of contaminant at compliance point after	C _{1D} /C ₀ 1.55E-04	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)

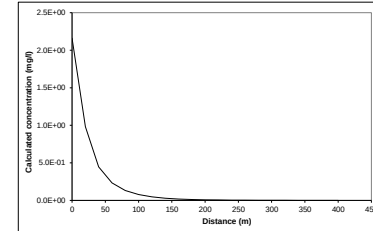
Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)	Kd		l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc	2.00E-03	fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc	1.00E+01	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		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
Soil water partition coefficient	Kd	2.00E-02	l/kg

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

User defined values for dispersivity				
Average of total porosity in the Chalk at Thames and Chilterns area of 38.8 (BGS The physical properties of major aquifers between April 2019 and Feb 2020)				
Longitudinal dispersivity	ax	Enter value 4.00E+01	Calc value 4.00E+01	Xu & Eckstein 8.35E+00
Transverse dispersivity	az	1.20E+01	4.00E+00	8.35E-01
Vertical dispersivity	ay	4.00E-01	4.00E-01	8.35E-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(log₁₀X)^{2.434}; 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.

(BGS The physical properties of major aquifers in England and Wales, pg 24)

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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks	From calculation sheet
Distance	Concentration
	mg/l
0	2.2E+00
20.0	9.82E-01
40.0	4.46E-01
60.0	2.33E-01
80.0	1.32E-01
100.0	7.78E-02
120.0	4.76E-02
140.0	2.98E-02
160.0	1.89E-02
180.0	1.22E-02
200.0	7.97E-03
220.0	5.25E-03
240.0	3.48E-03
260.0	2.32E-03
280.0	1.56E-03
300.0	1.05E-03
320.0	7.12E-04
340.0	4.84E-04
360.0	3.30E-04
380.0	2.25E-04
400.0	1.55E-04



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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Total Ammonium		
Target Concentration (C_T)	0.5 mg/l	Origin of C_T :	DWS

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.

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	Total Ammonium
Target concentration	C _T 0.5 mg/l

Input Parameters

Standard entry

Water filled soil porosity	θ _w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy g
Air filled soil porosity	θ _a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy g
Bulk density of soil zone material	ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy g
Henry's Law constant	H	7.81E-05	dimensionless	81

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient. The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

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}	1.75E-02	fraction	geomean of 25 analysis of uncontaminated unsaturated zone soil
Organic carbon partition coefficient	K _{oc}	1.00E+00	l/kg	81

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	1.75E-02	l/kg	Calculated value
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Level 1 Remedial Target

Level 1 Remedial Target	1.59E-01	mg/kg	(for comparison with soil analyses)
	or		
	0.5	mg/l	(for comparison with leachate test results)

Site being assessed:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration

C_T

Total Ammonium
0.5

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

1.13E-04
2.50E+03

m/d
m²

s (SU718741)). Assuming 40% Evapotranspiration and
by 50 m based on area of site with observed contaminant

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

5.00E+01
3.00E+01
7.00E+00
2.00E-03
5.00E+01
0.00E+00

m
m
m/d
fraction
m
mg/l

Approximate based on contaminated area and a NE GW direction
Assume thickness of effective permeable Chalk.
g tests carried out on two boreholes on Chalk (See 2019)
at value within 5 monitoring rounds between April 2019
Approximate based on contaminated area and a NE GW direction

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

0.00E+00
Calculate

m
m

Calculated Parameters

Dilution Factor

DF

1.51E+01

Level 2 Remedial Target

7.55E+00

mg/l

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

or

2.40E+00

mg/kg

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: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Total Ammonium		from Level 1
Target Concentration	C _T	0.5	mg/l	from Level 1
Dilution Factor	DF	1.51E+01		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 dissolved pollutants only

Variable	Value	Unit	Source of parameter value
Enter source concentration			Soil concentration as mg/kg
Enter soil concentration	5150	mg/kg	
Half life for degradation of contaminant in water	t _{1/2}	days	81
Calculated decay rate	λ	days ⁻¹	calculated
Width of plume in aquifer at source	Sz	m	from Level 2
Plume thickness in aquifer at source	Sy	m	from Level 2
Bulk density of aquifer materials	ρ	g/cm ³	Mean bulk density of Chalk at thames and Chilterns area (BGS The physical properties of major aquifers in England and W.
Effective porosity of aquifer	n	fraction	Conservative value based on geomean value
Hydraulic gradient	i	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	m/d	from Level 2
Distance to compliance point	x	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	m	default condition
Time since pollutant entered groundwater	t	days	time variant options only
Parameters values determined from options			
Partition coefficient	Kd	l/kg	see options
Longitudinal dispersivity	ax	m	see options
Transverse dispersivity	az	m	see options
Vertical dispersivity	ay	m	see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	7.50E-02 m/d
Retardation factor	Rf	1.02E+00 fraction
Decay rate used	λ	3.10E-04 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.14E-03 fraction
Rate of contaminant flow due to retardation	u	7.35E-02 m/d
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	1.15E-02 fraction
Attenuation factor (C ₀ /C _{eq})	AF	8.67E+01 fraction
Calculated soil leachate concentration	Co	1.62E+04 mg/l

Remedial Targets

Level 3 Remedial Target	6.55E+02	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or	mg/kg	This assumes Level 1 Remedial Target is based on Target Concentration.
Distance to compliance point	400	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 _{eq} /C ₀	1.15E-02 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 Kd l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc} 2.00E-03 fractionOrganic carbon partition coefficient K_{oc} 1.00E+00 l/kgSorption coefficient for related species K_{oc,n} l/kgSorption 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 Kd 2.00E-03 l/kg

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax 4.00E+01 4.00E+01 8.38E+00 m

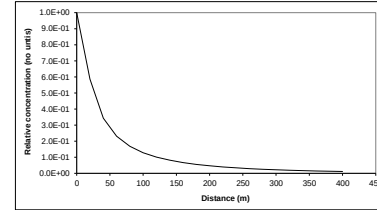
Transverse dispersivity az 1.20E+01 0.00E+00 8.32E-01 m

Vertical dispersivity ay 4.00E-01 4.00E-01 8.35E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, 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⁻, SO₄²⁻ 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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	1.07E+03
20.0	5.86E-01	6.29E+02
40.0	3.43E-01	3.69E+02
60.0	2.31E-01	2.48E+02
80.0	1.68E-01	1.81E+02
100.0	1.28E-01	1.38E+02
120.0	1.01E-01	1.09E+02
140.0	8.16E-02	8.76E+01
160.0	6.70E-02	7.19E+01
180.0	5.57E-02	5.98E+01
200.0	4.69E-02	5.03E+01
220.0	3.98E-02	4.27E+01
240.0	3.40E-02	3.65E+01
260.0	2.93E-02	3.14E+01
280.0	2.53E-02	2.72E+01
300.0	2.20E-02	2.37E+01
320.0	1.92E-02	2.08E+01
340.0	1.68E-02	1.81E+01
360.0	1.48E-02	1.59E+01
380.0	1.31E-02	1.40E+01
400.0	1.15E-02	1.24E+01

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Total Ammonium	from Level 1
Target Concentration	5.00E-01	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	4.42E+01	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	2.19E+03	days	Based on site data
Calculated decay rate	λ	3.17E-04	days ⁻¹	8t
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.89E+00	m	See Appendix C
Saturated aquifer thickness	da	3.00E+01	m	Assume thickness of effective permeable C
Bulk density of aquifer materials	ρ	1.97E+00	g/cm ³	Mean bulk density of Chalk at Thames and Chilterns are
Effective porosity of aquifer	n	2.00E-01	fraction	Conservative value based on geomean value of total porosity in the Chalk at Thames and Chilterns area of 38.8 (BGS The physical properties of major aquifers in England and Wales, pg 24)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	7.00E+00	m/d	Based on 12 slug tests carried out on two
Distance to compliance point	x	4.00E+02	m	EA guidance Principal Aquifer
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	2.00E-03	l/kg	see options
Longitudinal dispersivity	ax	4.00E+01	m	see options
Transverse dispersivity	az	1.20E+01	m	see options
Vertical dispersivity	ay	4.00E-01	m	see options

Calculated Parameters

Groundwater flow velocity	v	7.00E-02	m/d
Retardation factor	Rf	1.02E+00	fraction
Decay rate used	λ	3.10E-04	d ⁻¹
Rate of contaminant flow due to retardation	u	6.86E-02	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	4.65E-01	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	9.50E+01	

Remedial Targets

Remedial Target	4.75E+01	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	400	m	
Concentration of contaminant at compliance point after	C _{1D} /C ₀	4.65E-01	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

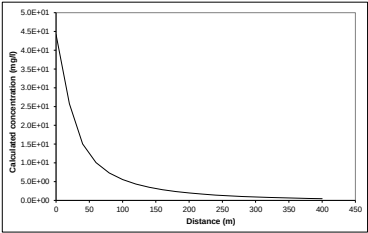
Entry if specify partition coefficient (option)	Kd		l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc	2.00E-03	fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc	1.00E+00	l/kg
Entry for ionic organic chemicals (option)	K _{oc,n}		l/kg
Sorption coefficient for related species	K _{oc,i}		l/kg
Sorption coefficient for ionised species	pH		
pH value	pKa		
acid dissociation constant	foc		fraction
Fraction of organic carbon in aquifer			
Soil water partition coefficient	Kd	2.00E-03	l/kg

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

User defined values for dispersivity

Enter value	Calc value	Xu & Eckstein	m
4.00E+01	4.00E+01	6.38E+00	m
1.20E+01	4.00E+01	6.38E+01	m
4.00E-01	4.00E-01	6.38E-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)^{2.434}; 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.

(BGS The physical properties of major aquifers in England and Wales, pg 24)

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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Distance	Concentration
	mg/l
0	4.4E+01
20.0	2.58E+01
40.0	1.50E+01
60.0	1.01E+01
80.0	7.30E+00
100.0	5.54E+00
120.0	4.35E+00
140.0	3.49E+00
160.0	2.85E+00
180.0	2.36E+00
200.0	1.98E+00
220.0	1.67E+00
240.0	1.42E+00
260.0	1.22E+00
280.0	1.05E+00
300.0	9.08E-01
320.0	7.89E-01
340.0	6.88E-01
360.0	6.02E-01
380.0	5.28E-01
400.0	4.65E-01



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.

© Environment Agency, 2006. (Produced by the Environment Agency's Science Group)

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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Aromatics >C8-C10 (TPHCWG)		
Target Concentration (C _T)	0.02	mg/l	Origin of C _T : EQS

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.

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 Aromatics >C8-C10 (TPHCWG)
0.02 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity θ_w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy g
Air filled soil porosity θ_a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy g
Bulk density of soil zone material ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy g
Henry's Law constant H	4.80E-01	dimensionless	83

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.
The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Variable	Value	Unit	Source of parameter value
Soil water partition coefficient K_d		l/kg	

Entry for non-polar organic chemicals (option)

Variable	Value	Unit	Source of parameter value
Fraction of organic carbon (in soil) f_{oc}	1.75E-02	fraction	geomean of 25 analysis of uncontaminated unsaturated zone soil
Organic carbon partition coefficient K_{oc}	1.59E+03	l/kg	83

Entry for ionic organic chemicals (option)

Variable	Value	Unit	Source of parameter value
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	

Variable	Value	Unit	Source of parameter value
Soil water partition coefficient used in Level Assessment K_d	2.77E+01	l/kg	Calculated value

Level 1 Remedial Target

Level 1 Remedial Target	5.61E-01	mg/kg	(for comparison with soil analyses)
or	0.02	mg/l	(for comparison with leachate test results)

Site being assessed:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant Target concentration C_T Aromatics >C8-C10 (TPHCW) 0.02 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	1.13E-04	m/d	s (SU718741)). Assuming 40% Evapotranspiration and
Area of contaminant source	A	2.50E+03	m ²	by 50 m based on area of site with observed contaminant value within 5 monitoring rounds between April 2019
Entry for groundwater flow below site				
Length of contaminant source in direction of groundwater flow	L	5.00E+01	m	ervative based on contaminated area and a NE GW direction
Saturated aquifer thickness	da	5.00E+00	m	Thickness of RTG based on Logs
Hydraulic Conductivity of aquifer in which dilution occurs	K	1.05E+02	m/d	s carried out on two boreholes screened in the RTG (S
Hydraulic gradient of water table	i	2.00E-03	fraction	nt value within 5 monitoring rounds between April 2019
Width of contaminant source perpendicular to groundwater flow	w	5.00E+01	m	ervative based on contaminated area and a NE GW direction
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l	
Define mixing zone depth by specifying or calculating depth (using pull down list)		Calculate		
Enter mixing zone thickness	Mz	0.00E+00	m	
Calculated mixing zone thickness	Mz		m	

Calculated Parameters

Dilution Factor	DF	1.87E+02		
Level 2 Remedial Target		3.74E+00 or 1.05E+02	mg/l or 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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Aromatics >C8-C10 (TPHCW)		from Level 1
Target Concentration	C _T	0.02	mg/l	from Level 1
Dilution Factor	DF	1.87E+02		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 dissolved pollutants only

Variable	Value	Unit	Source of parameter value
Enter source concentration			
Enter soil concentration	35.4	mg/kg	Soil concentration as mg/kg
Half life for degradation of contaminant in water	t _{1/2}	2.00E+02	days
Calculated decay rate	λ	3.47E-03	days ⁻¹
Width of plume in aquifer at source	Sz	5.00E+01	m
Plume thickness in aquifer at source	Sy	5.00E+00	m
Bulk density of aquifer materials	ρ	1.77E+00	g/cm ³
Effective porosity of aquifer	n	2.40E-01	fraction
Hydraulic gradient	i	2.01E-03	fraction
Hydraulic conductivity of saturated aquifer	K	1.05E+02	m/d
Distance to compliance point	x	2.40E+02	m
Distance (lateral) to compliance point perpendicular to flow direction	z		m
Distance (depth) to compliance point perpendicular to flow direction	y		m
Time since pollutant entered groundwater	t	9.99E+99	days
Parameters values determined from options			
Partition coefficient	Kd	1.26E+01	l/kg
Longitudinal dispersivity	ax	24.000	m
Transverse dispersivity	az	7.200	m
Vertical dispersivity	av	0.000	m

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	8.80E-01
Retardation factor	Rf	9.41E+01
Decay rate used	λ	3.68E-05
Hydraulic gradient used in aquifer flow down-gradient	i	2.01E-03
Rate of contaminant flow due to retardation	u	9.35E-03
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	1.38E-01
Attenuation factor (C ₀ /C _{eq})	AF	7.25E+00
Calculated soil leachate concentration	C ₀	1.26E+00

Remedial Targets

Level 3 Remedial Target	2.71E+01	mg/l	For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentration.
Ogata Banks	or		
	7.59E+02	mg/kg	For comparison with measured soil concentration. This assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Distance to compliance point	240	m	
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	1.38E-01	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 Kd

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc}Organic carbon partition coefficient K_{oc}Sorption coefficient for related species K_{oc,n}Sorption coefficient for ionised species K_{oc,i}

pH value pH

Acid dissociation constant pKa

Fraction of organic carbon in aquifer f_{oc}

Soil water partition coefficient Kd

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax

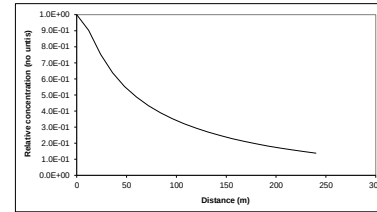
Transverse dispersivity az

Vertical dispersivity ay

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{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⁻, SO₄²⁻ 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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	6.76E-03
12.0	9.03E-01	6.10E-03
24.0	7.53E-01	5.09E-03
36.0	6.39E-01	4.32E-03
48.0	5.53E-01	3.74E-03
60.0	4.87E-01	3.29E-03
72.0	4.33E-01	2.93E-03
84.0	3.89E-01	2.63E-03
96.0	3.52E-01	2.38E-03
108.0	3.20E-01	2.16E-03
120.0	2.93E-01	1.98E-03
132.0	2.69E-01	1.82E-03
144.0	2.47E-01	1.67E-03
156.0	2.28E-01	1.54E-03
168.0	2.11E-01	1.43E-03
180.0	1.96E-01	1.33E-03
192.0	1.82E-01	1.23E-03
204.0	1.70E-01	1.15E-03
216.0	1.58E-01	1.07E-03
228.0	1.48E-01	9.98E-04
240.0	1.38E-01	9.32E-04

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Variable	Value	Unit	Source
Target Concentration	C _r	Aromatics >C8-C10 (TPHCW)	mg/l	from Level 1
		2.00E-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
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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	2.35E-01	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	2.00E+02	days	Based on site data
Calculated decay rate	λ	3.47E-03	days ⁻¹	77
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.00E+00	m	See Appendix C
Saturated aquifer thickness	da	5.00E+00	m	Thickness of RTG based on Logs
Bulk density of aquifer materials	ρ	1.77E+00	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	n	2.40E-01	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	1.05E+02	m/d	Based on 10 slug tests carried out on two
Distance to compliance point	x	2.40E+02	m	Longitudinal dispersivity
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	Transverse dispersivity
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	Vertical dispersivity
Time since pollutant entered groundwater	t	9.99E+99	days	Note values of dispersivity must be > 0
Parameters values determined from options				For calculated value, assumes ax = 0.1 * x, az = 0.01 * x, ay = 0.001 * x
Partition coefficient	Kd	1.26E+01	l/kg	Xu & Eckstein (1995) report ax = 0.83(log ₁₀ X) ^{2.434} ; az = ax/10, ay = ax/100 are assumed
Longitudinal dispersivity	ax	2.40E+01	m	see options
Transverse dispersivity	az	7.20E+00	m	see options
Vertical dispersivity	ay	9.00E-99	m	see options

Calculated Parameters

Groundwater flow velocity	v	8.75E-01	m/d
Retardation factor	Rf	9.41E+01	fraction
Decay rate used	λ	3.68E-05	d ⁻¹
Rate of contaminant flow due to retardation	u	9.30E-03	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	3.23E-02	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	7.28E+00	

Remedial Targets

Remedial Target	1.46E-01	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	240	m	
Concentration of contaminant at compliance point after	C _{1D} /C ₀	3.23E-02	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

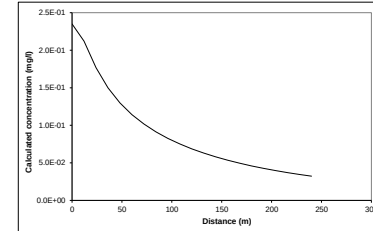
Entry if specify partition coefficient (option)	Kd		l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc	7.96E-03	fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc	1.59E+03	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		l/kg
Sorption coefficient for ionised species	K _{oc,i}		l/kg
pH value	pKa		
acid dissociation constant	foc		fraction
Fraction of organic carbon in aquifer			
Soil water partition coefficient	Kd	1.26E+01	l/kg

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

User defined values for dispersivity

Enter value	Calc value	Xu & Eckstein	m
2.40E+01	2.40E+01	6.73E-02	m
7.20E+00	7.20E+00	6.73E-01	m
9.00E-99	2.40E-01	6.73E-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)^{2.434}; 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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks From calculation sheet

Distance	Concentration
	mg/l
0	2.4E-01
12.0	2.12E-01
24.0	1.77E-01
36.0	1.50E-01
48.0	1.30E-01
60.0	1.14E-01
72.0	1.02E-01
84.0	9.13E-02
96.0	8.26E-02
108.0	7.51E-02
120.0	6.87E-02
132.0	6.30E-02
144.0	5.80E-02
156.0	5.35E-02
168.0	4.95E-02
180.0	4.59E-02
192.0	4.27E-02
204.0	3.97E-02
216.0	3.70E-02
228.0	3.46E-02
240.0	3.23E-02



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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Tetrachloroethene		
Target Concentration (C_T)	0.01	mg/l	Origin of C_T : EQS

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.

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 Tetrachloroethene
0.01 mg/l

Input Parameters

Standard entry

Variable	Value	Unit	Source of parameter value
Water filled soil porosity θ_w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy g
Air filled soil porosity θ_a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy g
Bulk density of soil zone material ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy g
Henry's Law constant H	1.77E-02	dimensionless	34

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient. The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Variable	Value	Unit	Source of parameter value
Soil water partition coefficient K_d		l/kg	

Entry for non-polar organic chemicals (option)

Variable	Value	Unit	Source of parameter value
Fraction of organic carbon (in soil) f_{oc}	1.75E-02	fraction	geomean of 25 analysis of uncontaminated unsaturated zone soil
Organic carbon partition coefficient K_{oc}	9.49E+01	l/kg	34

Entry for ionic organic chemicals (option)

Variable	Value	Unit	Source of parameter value
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	

Variable	Value	Unit	Source of parameter value
Soil water partition coefficient used in Level Assessment K_d	1.66E+00	l/kg	Calculated value

Level 1 Remedial Target

Level 1 Remedial Target	1.96E-02	mg/kg	(for comparison with soil analyses)
or	0.01	mg/l	(for comparison with leachate test results)

Site being assessed:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration
 C_T

Tetrachloroethene
0.01
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	1.13E-04	m/d	s (SU718741)). Assuming 40% Evapotranspiration and
Area of contaminant source	A	2.50E+03	m ²	by 50 m based on area of site with observed contaminant
Entry for groundwater flow below site				
Length of contaminant source in direction of groundwater flow	L	5.00E+01	m	ervative based on contaminated area and a NE GW direction
Saturated aquifer thickness	da	5.00E+00	m	Thickness of RTG based on Logs
Hydraulic Conductivity of aquifer in which dilution occurs	K	1.05E+02	m/d	s carried out on two boreholes screened in the RTG (S
Hydraulic gradient of water table	i	2.00E-03	fraction	nt value within 5 monitoring rounds between April 2019
Width of contaminant source perpendicular to groundwater flow	w	5.00E+01	m	ervative based on contaminated area and a NE GW direction
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l	
Define mixing zone depth by specifying or calculating depth (using pull down list)		Calculate		
Enter mixing zone thickness	Mz	0.00E+00	m	
Calculated mixing zone thickness	Mz		m	

Calculated Parameters

Dilution Factor	DF	1.87E+02		
Level 2 Remedial Target		1.87E+00 or 3.66E+00	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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Tetrachloroethene		from Level 1
Target Concentration	C _T	0.01	mg/l	from Level 1
Dilution Factor	DF	1.87E+02		from Level 2

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

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

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

Variable	Value	Unit	Source of parameter value
Soil concentration as mg/kg			
Enter source concentration			
Enter soil concentration	31.9	mg/kg	
Half life for degradation of contaminant in water	t _{1/2}	days	79
Calculated decay rate	λ	days ⁻¹	calculated
Width of plume in aquifer at source	Sz	m	from Level 2
Plume thickness in aquifer at source	Sy	m	from Level 2
Bulk density of aquifer materials	ρ	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	n	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	i	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	m/d	from Level 2
Distance to compliance point	x	m	River Thames to the northeast
Distance (lateral) to compliance point perpendicular to flow direction	z	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	m	default condition
Time since pollutant entered groundwater	t	days	time variant options only
Parameters values determined from options			
Partition coefficient	Kd	l/kg	see options
Longitudinal dispersivity	ax	m	see options
Transverse dispersivity	az	m	see options
Vertical dispersivity	ay	m	see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	8.80E-01 m/d
Retardation factor	Rf	6.57E+00 fraction
Decay rate used	λ	6.38E-05 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.01E-03 fraction
Rate of contaminant flow due to retardation	u	1.34E-01 m/d
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	2.94E-01 fraction
Attenuation factor (C ₀ /C _{eq})	AF	3.40E+00 fraction
Calculated soil leachate concentration	Co	1.63E+01 mg/l

Remedial Targets

Level 3 Remedial Target	6.35E+00	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.25E+01	mg/kg	For comparison with measured soil concentration. This
Distance to compliance point	240	m	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	2.94E-01 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 Kd l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc} 7.96E-03 fractionOrganic carbon partition coefficient K_{oc} 9.49E+01 l/kgSorption coefficient for related species K_{oc,n} l/kgSorption 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 Kd 7.56E-01 l/kg

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

User defined values for dispersivity

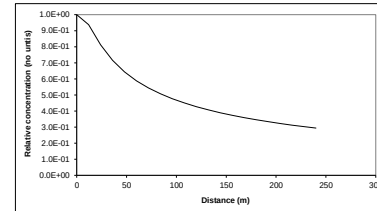
	Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	ax	2.40E+01	3.40E+01	6.78E+00 m
Transverse dispersivity	az	7.20E+00	4.00E+00	6.73E-01 m
Vertical dispersivity	ay	9.00E-99	4.47E-01	6.73E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, 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⁻, SO₄²⁻ 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

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	8.71E-02
12.0	9.37E-01	8.16E-02
24.0	8.12E-01	7.07E-02
36.0	7.16E-01	6.23E-02
48.0	6.44E-01	5.60E-02
60.0	5.88E-01	5.12E-02
72.0	5.44E-01	4.73E-02
84.0	5.07E-01	4.42E-02
96.0	4.77E-01	4.15E-02
108.0	4.50E-01	3.92E-02
120.0	4.28E-01	3.72E-02
132.0	4.07E-01	3.55E-02
144.0	3.90E-01	3.39E-02
156.0	3.74E-01	3.25E-02
168.0	3.59E-01	3.13E-02
180.0	3.46E-01	3.01E-02
192.0	3.34E-01	2.91E-02
204.0	3.23E-01	2.81E-02
216.0	3.13E-01	2.72E-02
228.0	3.03E-01	2.64E-02
240.0	2.94E-01	2.56E-02

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: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: #####
Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant		Tetrachloroethene	from Level 1
Target Concentration	C _r	1.00E-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
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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	9.56E-01	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	1.65E+03	days	Based on site data
Calculated decay rate	λ	4.19E-04	days ⁻¹	79
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.00E+00	m	See Appendix C
Saturated aquifer thickness	da	5.00E+00	m	Thickness of RTG based on Logs
Bulk density of aquifer materials	ρ	1.77E+00	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	n	2.40E-01	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	1.05E+02	m/d	Based on 10 slug tests carried out on two
Distance to compliance point	x	2.40E+02	m	River Thames to the northeast
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	7.56E-01	l/kg	see options
Longitudinal dispersivity	ax	2.40E+01	m	see options
Transverse dispersivity	az	7.20E+00	m	see options
Vertical dispersivity	ay	9.00E-99	m	see options

Calculated Parameters

Groundwater flow velocity	v	8.75E-01	m/d
Retardation factor	Rf	6.57E+00	fraction
Decay rate used	λ	6.38E-05	d ⁻¹
Rate of contaminant flow due to retardation	u	1.33E-01	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	2.81E-01	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	3.40E+00	

Remedial Targets

Remedial Target	3.40E-02	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	240	m	
Concentration of contaminant at compliance point	C _{1D} /C ₀	2.81E-01	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

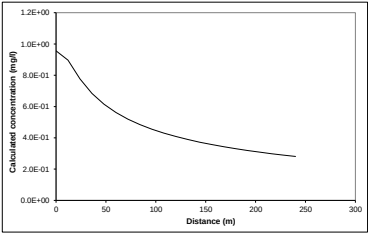
Entry if specify partition coefficient (option)	Kd		l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc	7.96E-03	fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc	9.49E+01	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		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
Soil water partition coefficient	Kd	7.56E-01	l/kg

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

User defined values for dispersivity

Enter value	Calc value	Xu & Eckstein	m
2.40E+01	2.40E+01	6.73E+00	m
7.20E+00	7.20E+00	6.73E+01	m
9.00E-99	2.40E-01	6.73E-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)^{2.434}; 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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks	
From calculation sheet	
Distance	Concentration
	mg/l
0	9.6E-01
12.0	8.96E-01
24.0	7.76E-01
36.0	6.84E-01
48.0	6.15E-01
60.0	5.62E-01
72.0	5.20E-01
84.0	4.85E-01
96.0	4.56E-01
108.0	4.30E-01
120.0	4.09E-01
132.0	3.89E-01
144.0	3.72E-01
156.0	3.57E-01
168.0	3.43E-01
180.0	3.31E-01
192.0	3.19E-01
204.0	3.08E-01
216.0	2.99E-01
228.0	2.90E-01
240.0	2.81E-01



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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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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Trichloroethene		
Target Concentration (C_T)	0.01 mg/l	Origin of C_T :	EQS

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.

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

Trichloroethene
0.01 mg/l

Input Parameters

Standard entry

Water filled soil porosity θ_w 4.80E-01 fraction
Air filled soil porosity θ_a 2.00E-02 fraction
Bulk density of soil zone material ρ 1.60E+00 g/cm³
Henry's Law constant H 4.35E-01 dimensionless

R&D Technical Report P13 Made Ground of sandy gr
R&D Technical Report P13 Made Ground of sandy gr
R&D Technical Report P13 Made Ground of sandy gr
33

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient. The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Soil water partition coefficient K_d

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil) f_{oc} 1.75E-02 fraction
Organic carbon partition coefficient K_{oc} 8.70E+01 l/kg

geomean of 25 analysis of uncontaminated unsaturated zone soil
34

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 1.52E+00 l/kg Calculated value

Level 1 Remedial Target

Level 1 Remedial Target	1.83E-02	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration C_T **Trichloroethene** from Level 1
0.01 mg/l 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	1.13E-04	m/d	s (SU718741)). Assuming 40% Evapotranspiration and
Area of contaminant source	A	2.50E+03	m ²	by 50 m based on area of site with observed contaminant value within 5 monitoring rounds between April 2019
Entry for groundwater flow below site				
Length of contaminant source in direction of groundwater flow	L	5.00E+01	m	ervative based on contaminated area and a NE GW direction
Saturated aquifer thickness	da	5.00E+00	m	Thickness of RTG based on Logs
Hydraulic Conductivity of aquifer in which dilution occurs	K	1.05E+02	m/d	s carried out on two boreholes screened in the RTG (S
Hydraulic gradient of water table	i	2.00E-03	fraction	nt value within 5 monitoring rounds between April 2019
Width of contaminant source perpendicular to groundwater flow	w	5.00E+01	m	ervative based on contaminated area and a NE GW direction
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l	
Define mixing zone depth by specifying or calculating depth (using pull down list)		Calculate		
Enter mixing zone thickness	Mz	0.00E+00	m	
Calculated mixing zone thickness	Mz		m	

Calculated Parameters

Dilution Factor	DF	1.87E+02		
Level 2 Remedial Target		1.87E+00 or 3.42E+00	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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Trichloroethene		from Level 1
Target Concentration	C _T	0.01	mg/l	from Level 1
Dilution Factor	DF	1.87E+02		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 dissolved pollutants only

Variable	Value	Unit	Source of parameter value
Soil concentration as mg/kg			
Enter source concentration			
Enter soil concentration	1.8	mg/kg	
Half life for degradation of contaminant in water	t _{1/2}	days	79
Calculated decay rate	λ	days ⁻¹	calculated
Width of plume in aquifer at source	Sz	m	from Level 2
Plume thickness in aquifer at source	Sy	m	from Level 2
Bulk density of aquifer materials	ρ	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	n	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	i	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	m/d	from Level 2
Distance to compliance point	x	m	River Thames to the northeast
Distance (lateral) to compliance point perpendicular to flow direction	z	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	m	default condition
Time since pollutant entered groundwater	t	days	time variant options only
Parameters values determined from options			
Partition coefficient	Kd	l/kg	see options
Longitudinal dispersivity	ax	m	see options
Transverse dispersivity	az	m	see options
Vertical dispersivity	ay	m	see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	8.80E-01 m/d
Retardation factor	Rf	6.11E+00 fraction
Decay rate used	λ	6.86E-05 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.01E-03 fraction
Rate of contaminant flow due to retardation	u	1.44E-01 m/d
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	2.94E-01 fraction
Attenuation factor (C ₀ /C _{eq})	AF	3.40E+00 fraction
Calculated soil leachate concentration	Co	9.89E-01 mg/l

Remedial Targets

Level 3 Remedial Target	6.35E+00	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.16E+01	mg/kg	For comparison with measured soil concentration. This
Distance to compliance point	240	m	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	2.94E-01 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 Kd l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc} 7.96E-03 fractionOrganic carbon partition coefficient K_{oc} 8.70E+01 l/kgSorption coefficient for related species K_{oc,n} l/kgSorption 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 Kd 6.93E-01 l/kg

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax 2.40E+01 2.40E+01 6.78E+00 m

Transverse dispersivity az 7.20E+00 7.20E+00 6.73E-01 m

Vertical dispersivity ay 9.00E-99 9.00E-99 6.73E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, az = ax/10, ay = ax/100 are assumed

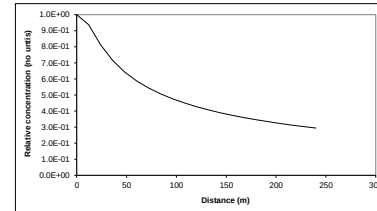
Note

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⁻, SO₄²⁻ 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

From calculation sheet

Distance	Relative concentration	Concentration mg/l
	(No units)	
0	1.0E+00	5.27E-03
12.0	9.37E-01	4.94E-03
24.0	8.12E-01	4.28E-03
36.0	7.16E-01	3.77E-03
48.0	6.44E-01	3.39E-03
60.0	5.88E-01	3.10E-03
72.0	5.44E-01	2.87E-03
84.0	5.07E-01	2.67E-03
96.0	4.77E-01	2.51E-03
108.0	4.50E-01	2.37E-03
120.0	4.28E-01	2.25E-03
132.0	4.07E-01	2.15E-03
144.0	3.90E-01	2.05E-03
156.0	3.74E-01	1.97E-03
168.0	3.59E-01	1.89E-03
180.0	3.46E-01	1.82E-03
192.0	3.34E-01	1.76E-03
204.0	3.23E-01	1.70E-03
216.0	3.13E-01	1.65E-03
228.0	3.03E-01	1.60E-03
240.0	2.94E-01	1.55E-03

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Trichloroethene	from Level 1
Target Concentration	C _r 1.00E-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	1.55E-01	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	1.65E+03	days	Based on site data
Calculated decay rate	λ	4.19E-04	days ⁻¹	79
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.00E+00	m	See Appendix C
Saturated aquifer thickness	da	5.00E+00	m	Thickness of RTG based on Logs
Bulk density of aquifer materials	ρ	1.77E+00	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	n	2.40E-01	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	1.05E+02	m/d	Based on 10 slug tests carried out on two
Distance to compliance point	x	2.40E+02	m	River Thames to the northeast
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Partition coefficient	Kd	6.93E-01	l/kg	see options
Longitudinal dispersivity	ax	2.40E+01	m	see options
Transverse dispersivity	az	7.20E+00	m	see options
Vertical dispersivity	ay	9.00E-99	m	see options

Calculated Parameters

Groundwater flow velocity	v	8.75E-01	m/d
Retardation factor	Rf	6.11E+00	fraction
Decay rate used	λ	6.86E-05	d ⁻¹
Rate of contaminant flow due to retardation	u	1.43E-01	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	4.56E-02	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	3.40E+00	

Remedial Targets

Remedial Target	3.40E-02	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	240	m	
Concentration of contaminant at compliance point	C _{1D} /C ₀	4.56E-02	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

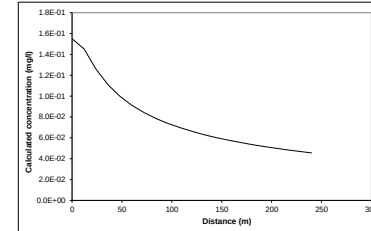
Entry if specify partition coefficient (option)	Kd		l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc	7.96E-03	fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc	8.70E+01	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		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
Soil water partition coefficient	Kd	6.93E-01	l/kg

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

User defined values for dispersivity

Enter value	Calc value	Xu & Eckstein	m
2.40E+01	2.40E+01	6.73E-01	m
7.20E+00	7.20E+00	6.73E-01	m
9.00E-99	2.40E-01	6.73E-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)^{2.434}; 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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance	Concentration
	mg/l
0	1.6E-01
12.0	1.45E-01
24.0	1.26E-01
36.0	1.11E-01
48.0	9.97E-02
60.0	9.11E-02
72.0	8.43E-02
84.0	7.86E-02
96.0	7.39E-02
108.0	6.98E-02
120.0	6.63E-02
132.0	6.31E-02
144.0	6.04E-02
156.0	5.79E-02
168.0	5.56E-02
180.0	5.36E-02
192.0	5.17E-02
204.0	5.00E-02
216.0	4.84E-02
228.0	4.69E-02
240.0	4.56E-02



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.

© Environment Agency, 2006. (Produced by the Environment Agency's Science Group)

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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Benzene		
Target Concentration (C_T)	0.01	mg/l	Origin of C_T : EQS

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.

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	Benzene
Target concentration	0.01 mg/l

Input Parameters

Standard entry

Water filled soil porosity	θ_w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy gr
Air filled soil porosity	θ_a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy gr
Bulk density of soil zone material	ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy gr
Henry's Law constant	H	2.25E-01	dimensionless	83

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient. The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd		l/kg	
----------------------------------	----	--	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	foc	1.75E-02	fraction	geomean of 25 analysis of uncontaminated unsaturated zone soil
Organic carbon partition coefficient	Koc	8.12E+01	l/kg	83

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	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment Kd 1.42E+00 l/kg Calculated value

Level 1 Remedial Target

Level 1 Remedial Target	1.72E-02	mg/kg	(for comparison with soil analyses)
	or		
	0.01	mg/l	(for comparison with leachate test results)

Site being assessed: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration

C_T

Benzene
0.01

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

1.13E-04
2.50E+03

m/d
m²

s (SU718741)). Assuming 40% Evapotranspiration and
by 50 m based on area of site with observed contaminant

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

5.00E+01
5.00E+00
1.05E+02
2.00E-03
5.00E+01
0.00E+00

m
m
m/d
fraction
m
mg/l

ervative based on contaminated area and a NE GW direction
Thickness of RTG based on Logs
s carried out on two boreholes screened in the RTG (S
nt value within 5 monitoring rounds between April 2019
ervative based on contaminated area and a NE GW direction

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
0.00E+00

m
m

Calculated Parameters

Dilution Factor

DF

1.87E+02

Level 2 Remedial Target

1.87E+00
or
3.22E+00

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: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Benzene		from Level 1
Target Concentration	C _T	0.01	mg/l	from Level 1
Dilution Factor	DF	1.87E+02		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 dissolved pollutants only

Variable	Value	Unit	Source of parameter value
Soil concentration as mg/kg			
Enter source concentration			
Enter soil concentration	16.4	mg/kg	
Half life for degradation of contaminant in water	3.50E+02	days	77
Calculated decay rate	1.98E-03	days ⁻¹	calculated
Width of plume in aquifer at source	5.00E+01	m	from Level 2
Plume thickness in aquifer at source	5.00E+00	m	from Level 2
Bulk density of aquifer materials	1.77E+00	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	2.40E-01	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	2.01E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	1.05E+02	m/d	from Level 2
Distance to compliance point	2.40E+02	m	River Thames to the northeast
Distance (lateral) to compliance point perpendicular to flow direction		m	default condition
Distance (depth) to compliance point perpendicular to flow direction		m	default condition
Time since pollutant entered groundwater	9.99E+99	days	time variant options only
Parameters values determined from options			
Partition coefficient	K _d	6.47E-01	l/kg see options
Longitudinal dispersivity	ax	24.000	m see options
Transverse dispersivity	az	7.200	m see options
Vertical dispersivity	av	0.000	m see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	8.80E-01	m/d
Retardation factor	5.77E+00	fraction
Decay rate used	3.43E-04	d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	2.01E-03	fraction
Rate of contaminant flow due to retardation	1.52E-01	m/d
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	1.97E-01
Attenuation factor (C ₀ /C _{CP})	AF	5.08E+00
Calculated soil leachate concentration	Co	9.51E+00

Remedial Targets

Level 3 Remedial Target	9.48E+00	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.63E+01	mg/kg	For comparison with measured soil concentration. This
Distance to compliance point	240	m	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	1.97E-01	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

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc}Organic carbon partition coefficient K_{oc}Sorption coefficient for related species K_{oc,n}Sorption coefficient for ionised species K_{oc,i}

pH value pH

Acid dissociation constant pK_aFraction of organic carbon in aquifer f_{oc}Soil water partition coefficient K_d

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax

Transverse dispersivity az

Vertical dispersivity ay

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, az = ax/10, ay = ax/100 are assumed

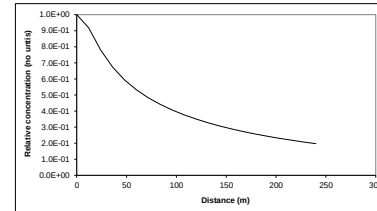
Note

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⁻, SO₄²⁻ 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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	5.08E-02
12.0	9.19E-01	4.68E-02
24.0	7.80E-01	3.97E-02
36.0	6.74E-01	3.43E-02
48.0	5.94E-01	3.02E-02
60.0	5.32E-01	2.71E-02
72.0	4.82E-01	2.45E-02
84.0	4.41E-01	2.24E-02
96.0	4.06E-01	2.07E-02
108.0	3.76E-01	1.91E-02
120.0	3.50E-01	1.78E-02
132.0	3.27E-01	1.66E-02
144.0	3.06E-01	1.56E-02
156.0	2.88E-01	1.47E-02
168.0	2.71E-01	1.38E-02
180.0	2.56E-01	1.30E-02
192.0	2.42E-01	1.23E-02
204.0	2.30E-01	1.17E-02
216.0	2.18E-01	1.11E-02
228.0	2.07E-01	1.05E-02
240.0	1.97E-01	1.00E-02

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Benzene	from Level 1
Target Concentration	C _r 1.00E-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
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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	4.52E-02	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	3.50E+02	days	Based on site data
Calculated decay rate	λ	1.98E-03	days ⁻¹	77
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.00E+00	m	See Appendix C
Saturated aquifer thickness	da	5.00E+00	m	Thickness of RTG based on Logs
Bulk density of aquifer materials	ρ	1.77E+00	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	n	2.40E-01	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	1.05E+02	m/d	Based on 10 slug tests carried out on two
Distance to compliance point	x	2.40E+02	m	River Thames to the northeast
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	6.47E-01	l/kg	see options
Longitudinal dispersivity	ax	2.40E+01	m	see options
Transverse dispersivity	az	7.20E+00	m	see options
Vertical dispersivity	ay	9.00E-99	m	see options

Calculated Parameters

Groundwater flow velocity	v	8.75E-01	m/d
Retardation factor	Rf	5.77E+00	fraction
Decay rate used	λ	3.43E-04	d ⁻¹
Rate of contaminant flow due to retardation	u	1.52E-01	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	8.88E-03	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	5.09E+00	

Remedial Targets

Remedial Target	5.09E-02	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	240	m	
Concentration of contaminant at compliance point	C _{1D} /C ₀	8.88E-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.

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

Calculate for non-polar organic chemicals

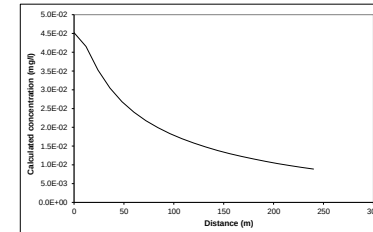
Entry if specify partition coefficient (option)	Kd		l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc	7.96E-03	fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc	8.12E+01	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		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
Soil water partition coefficient	Kd	6.47E-01	l/kg

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

User defined values for dispersivity

Enter value	Calc value	Xu & Eckstein	m
2.40E+01	2.40E+01	6.73E+00	m
7.20E+00	7.20E+00	6.73E+01	m
9.00E-99	2.40E-01	6.73E-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)^{2.434}; 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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: 00/00/0000

Version: x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks

From calculation sheet

Distance Concentration

	mg/l
0	4.5E-02
12.0	4.15E-02
24.0	3.53E-02
36.0	3.04E-02
48.0	2.68E-02
60.0	2.40E-02
72.0	2.18E-02
84.0	1.99E-02
96.0	1.83E-02
108.0	1.70E-02
120.0	1.58E-02
132.0	1.48E-02
144.0	1.38E-02
156.0	1.30E-02
168.0	1.22E-02
180.0	1.16E-02
192.0	1.09E-02
204.0	1.04E-02
216.0	9.83E-03
228.0	9.34E-03
240.0	8.88E-03



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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Benzo(a)pyrene		
Target Concentration (C_T)	0.000022 mg/l	Origin of C_T :	EQS

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.

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

Benzo(a)pyrene
0.000022 mg/l

Input Parameters

Standard entry

Water filled soil porosity θ_w 4.80E-01 fraction
Air filled soil porosity θ_a 2.00E-02 fraction
Bulk density of soil zone material ρ 1.60E+00 g/cm³
Henry's Law constant H 1.86E-05 dimensionless

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R&D Technical Report P13 Made Ground of sandy gr
R&D Technical Report P13 Made Ground of sandy gr
83

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient. The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Soil water partition coefficient K_d

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil) f_{oc} 1.75E-02 fraction
Organic carbon partition coefficient K_{oc} 1.31E+05 l/kg

geomean of 25 analysis of uncontaminated unsaturated zone soil
83

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 2.29E+03 l/kg Calculated value

Level 1 Remedial Target

Level 1 Remedial Target	5.04E-02	mg/kg	(for comparison with soil analyses)
	or		
	0.000022	mg/l	(for comparison with leachate test results)

Site being assessed: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration C_T Benzo(a)pyrene 0.000022 mg/l

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	1.13E-04	m/d	s (SU718741)). Assuming 40% Evapotranspiration and
Area of contaminant source	A	2.50E+03	m ²	by 50 m based on area of site with observed contaminant
Entry for groundwater flow below site				
Length of contaminant source in direction of groundwater flow	L	5.00E+01	m	ervative based on contaminated area and a NE GW direction
Saturated aquifer thickness	da	5.00E+00	m	Thickness of RTG based on Logs
Hydraulic Conductivity of aquifer in which dilution occurs	K	1.05E+02	m/d	s carried out on two boreholes screened in the RTG (S
Hydraulic gradient of water table	i	2.00E-03	fraction	nt value within 5 monitoring rounds between April 2019
Width of contaminant source perpendicular to groundwater flow	w	5.00E+01	m	ervative based on contaminated area and a NE GW direction
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l	
Define mixing zone depth by specifying or calculating depth (using pull down list)		Calculate		
Enter mixing zone thickness	Mz	0.00E+00	m	
Calculated mixing zone thickness	Mz		m	

Calculated Parameters

Dilution Factor	DF	1.87E+02		
Level 2 Remedial Target		4.11E-03	mg/l	For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentration
		or		
		9.42E+00	mg/kg	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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Benzo(a)pyrene		from Level 1
Target Concentration	C _T	0.00022	mg/l	from Level 1
Dilution Factor	DF	1.87E+02		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 dissolved pollutants only

Variable	Value	Unit	Source of parameter value
Soil concentration as mg/kg			
Enter source concentration			
Enter soil concentration	382	mg/kg	
Half life for degradation of contaminant in water	t _{1/2}	days	78
Calculated decay rate	λ	days ⁻¹	calculated
Width of plume in aquifer at source	Sz	m	from Level 2
Plume thickness in aquifer at source	Sy	m	from Level 2
Bulk density of aquifer materials	ρ	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	n	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	i	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	m/d	from Level 2
Distance to compliance point	x	m	River Thames to the northeast
Distance (lateral) to compliance point perpendicular to flow direction	z	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	m	default condition
Time since pollutant entered groundwater	t	days	time variant options only
Parameters values determined from options			
Partition coefficient	Kd	l/kg	see options
Longitudinal dispersivity	ax	m	see options
Transverse dispersivity	az	m	see options
Vertical dispersivity	ay	m	see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	8.80E-01 m/d
Retardation factor	Rf	7.70E+03 fraction
Decay rate used	λ	2.00E-08 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.01E-03 fraction
Rate of contaminant flow due to retardation	u	1.14E-04 m/d
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	3.16E-01 fraction
Attenuation factor (C ₀ /C _{CP})	AF	3.17E+00 fraction
Calculated soil leachate concentration	Co	1.67E-01 mg/l

Remedial Targets

Level 3 Remedial Target	1.30E-02	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or	mg/kg	This assumes Level 1 Remedial Target is based on Target Concentration.
Distance to compliance point	240	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 _{CP} /C ₀	3.16E-01	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 Kd l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer f_{oc} 7.96E-03 fractionOrganic carbon partition coefficient K_{oc} 1.31E+05 l/kgSorption coefficient for related species K_{oc,n} l/kgSorption 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 Kd 1.04E+03 l/kg

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax 2.40E+01 2.40E+01 6.78E+00 m

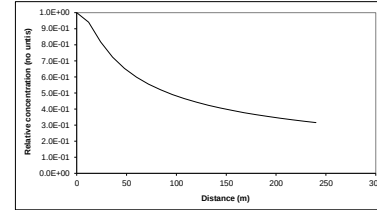
Transverse dispersivity az 7.20E+00 7.20E+00 6.73E-01 m

Vertical dispersivity ay 9.00E-99 9.00E-99 6.73E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀x)^{0.414}, 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⁻, SO₄²⁻ 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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	8.92E-04
12.0	9.41E-01	8.39E-04
24.0	8.18E-01	7.29E-04
36.0	7.23E-01	6.45E-04
48.0	6.53E-01	5.82E-04
60.0	5.99E-01	5.34E-04
72.0	5.55E-01	4.95E-04
84.0	5.20E-01	4.64E-04
96.0	4.90E-01	4.37E-04
108.0	4.65E-01	4.15E-04
120.0	4.43E-01	3.95E-04
132.0	4.24E-01	3.78E-04
144.0	4.07E-01	3.63E-04
156.0	3.91E-01	3.49E-04
168.0	3.78E-01	3.37E-04
180.0	3.65E-01	3.25E-04
192.0	3.54E-01	3.15E-04
204.0	3.43E-01	3.06E-04
216.0	3.33E-01	2.97E-04
228.0	3.24E-01	2.89E-04
240.0	3.16E-01	2.82E-04

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Benzo(a)pyrene	from Level 1
Target Concentration	C _r 2.20E-05	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	1.09E-03	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	4.50E+03	days	Based on site data
Calculated decay rate	λ	1.54E-04	days ⁻¹	78
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.00E+00	m	See Appendix C
Saturated aquifer thickness	da	5.00E+00	m	Thickness of RTG based on Logs
Bulk density of aquifer materials	ρ	1.77E+00	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	n	2.40E-01	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	1.05E+02	m/d	Based on 10 slug tests carried out on two
Distance to compliance point	x	2.40E+02	m	River Thames to the northeast
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Partition coefficient	Kd	1.04E+03	l/kg	see options
Longitudinal dispersivity	ax	2.40E+01	m	see options
Transverse dispersivity	az	7.20E+00	m	see options
Vertical dispersivity	ay	9.00E-99	m	see options

Calculated Parameters

Groundwater flow velocity	v	8.75E-01	m/d
Retardation factor	Rf	7.70E+03	fraction
Decay rate used	λ	2.00E-08	d ⁻¹
Rate of contaminant flow due to retardation	u	1.14E-04	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	3.44E-04	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	3.17E+00	

Remedial Targets

Remedial Target	6.97E-05	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	240	m	
Concentration of contaminant at compliance point	C _{1D} /C ₀	3.44E-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.

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

Kd

foc

Koc

K_{oc,n}K_{oc,i}

pH

pKa

foc

Kd

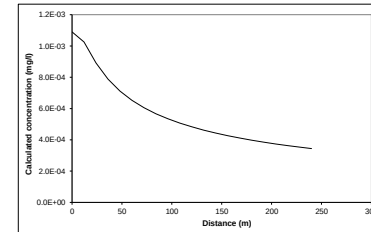
Define dispersivity (click brown cell and use pull down list)

User defined values for dispersivity

Enter value	Calc value	Xu & Eckstein	m
2.40E+01	2.40E+01	6.73E-02	m
7.20E+00	7.20E+00	6.73E-01	m
9.00E-99	2.40E-01	6.73E-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)^{2.434}; 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

mg/l

0 1.1E-03

12.0 1.03E-03

24.0 8.91E-04

36.0 7.88E-04

48.0 7.12E-04

60.0 6.53E-04

72.0 6.05E-04

84.0 5.67E-04

96.0 5.34E-04

108.0 5.07E-04

120.0 4.83E-04

132.0 4.62E-04

144.0 4.43E-04

156.0 4.26E-04

168.0 4.11E-04

180.0 3.98E-04

192.0 3.85E-04

204.0 3.74E-04

216.0 3.63E-04

228.0 3.53E-04

240.0 3.44E-04

Site being assessed: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: 00000000

Version: x.xx



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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Zinc		
Target Concentration (C_T)	0.02264	mg/l	Origin of C_T : Bio EQS

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.

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

User specified value for partition coefficient

Contaminant	Zinc
Target concentration	0.02264 mg/l

Input Parameters

Standard entry

Water filled soil porosity	θ_w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy g
Air filled soil porosity	θ_a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy g
Bulk density of soil zone material	ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy g
Henry's Law constant	H	0.00E+00	dimensionless	0

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient. The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	5.00E+02	l/kg	6.50E+01
----------------------------------	----	----------	------	----------

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	

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	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment Kd 5.00E+02 l/kg Specified value

Level 1 Remedial Target

Level 1 Remedial Target	1.13E+01	mg/kg	(for comparison with soil analyses)
	or		
	0.02264	mg/l	(for comparison with leachate test results)

Site being assessed: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration

C_T

Zinc
0.02264 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)

Standard entry

Input Parameters

Variable

Value

Unit

Source of parameter value

Infiltration
Area of contaminant source

Inf
A

1.13E-04
2.50E+03

m/d
m²

s (SU718741)). Assuming 40% Evapotranspiration and
by 50 m based on area of site with observed contaminant

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

5.00E+01
5.00E+00
1.05E+02
2.00E-03
5.00E+01
0.00E+00

m
m
m/d
fraction
m
mg/l

ervative based on contaminated area and a NE GW direction
Thickness of RTG based on Logs
s carried out on two boreholes screened in the RTG (S
nt value within 5 monitoring rounds between April 2019
ervative based on contaminated area and a NE GW direction

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

0.00E+00
Calculate

m
m

Calculated Parameters

Dilution Factor

DF

1.87E+02

Level 2 Remedial Target

4.23E+00

mg/l

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

or

2.12E+03

mg/kg

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: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Zinc		from Level 1
Target Concentration	C _T	0.02264	mg/l	from Level 1
Dilution Factor	DF	1.87E+02		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 dissolved pollutants only

Variable	Value	Unit	Source of parameter value
Enter source concentration			
Enter soil concentration	3260	mg/kg	Soil concentration as mg/kg
Half life for degradation of contaminant in water	t _{1/2}	9.00E+99	days
Calculated decay rate	λ	7.70E-101	days ⁻¹
Width of plume in aquifer at source	Sz	5.00E+01	m
Plume thickness in aquifer at source	Sy	5.00E+00	m
Bulk density of aquifer materials	ρ	1.77E+00	g/cm ³
Effective porosity of aquifer	n	2.40E-01	fraction
Hydraulic gradient	i	2.01E-03	fraction
Hydraulic conductivity of saturated aquifer	K	1.05E+02	m/d
Distance to compliance point	x	2.40E+02	m
Distance (lateral) to compliance point perpendicular to flow direction	z		m
Distance (depth) to compliance point perpendicular to flow direction	y		m
Time since pollutant entered groundwater	t	9.99E+99	days
Parameters values determined from options			
Partition coefficient	Kd	5.00E+02	l/kg
Longitudinal dispersivity	ax	24.000	m
Transverse dispersivity	az	7.200	m
Vertical dispersivity	ay	0.000	m

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	8.80E-01
Retardation factor	Rf	3.69E+03
Decay rate used	λ	2.09E-104
Hydraulic gradient used in aquifer flow down-gradient	i	2.01E-03
Rate of contaminant flow due to retardation	u	2.39E-04
Ratio of Compliance Point to Source Concentration	C _{ED} /C ₀	3.29E-01
Attenuation factor (C ₀ /C _{ED})	AF	3.04E+00
Calculated soil leachate concentration	Co	6.52E+00

Remedial Targets

Level 3 Remedial Target	1.28E+01	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or		This assumes Level 1 Remedial Target is based on Target Concentration.
	6.43E+03	mg/kg	For comparison with measured soil concentration. This
Distance to compliance point	240	m	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{ED} /C ₀	3.29E-01	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)
User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient

Kd

5.00E+02

l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer

foc

fraction

Organic carbon partition coefficient

Koc

l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species

K_{oc,n}

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

Soil water partition coefficient

Kd

5.00E+02

l/kg

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

User defined values for dispersivity

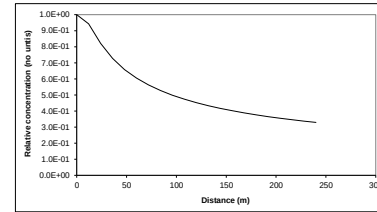
	Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	ax	2.40E+01	2.40E+01	6.78E+00
Transverse dispersivity	az	7.20E+00	7.20E+00	6.73E-01
Vertical dispersivity	ay	9.00E-99	4.47E-01	6.73E-02

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, 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⁻, SO₄²⁻ 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

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	3.49E-02
12.0	9.43E-01	3.29E-02
24.0	8.21E-01	2.86E-02
36.0	7.28E-01	2.54E-02
48.0	6.58E-01	2.30E-02
60.0	6.05E-01	2.11E-02
72.0	5.62E-01	1.96E-02
84.0	5.28E-01	1.84E-02
96.0	4.99E-01	1.74E-02
108.0	4.74E-01	1.65E-02
120.0	4.52E-01	1.58E-02
132.0	4.34E-01	1.51E-02
144.0	4.17E-01	1.45E-02
156.0	4.02E-01	1.40E-02
168.0	3.89E-01	1.36E-02
180.0	3.77E-01	1.31E-02
192.0	3.66E-01	1.27E-02
204.0	3.55E-01	1.24E-02
216.0	3.46E-01	1.21E-02
228.0	3.37E-01	1.18E-02
240.0	3.29E-01	1.15E-02

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: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: #####
Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Zinc	from Level 1
Target Concentration	C _r 2.26E-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
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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	1.97E-01	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	9.00E+99	days	Based on site data
Calculated decay rate	λ	7.70E-101	days ⁻¹	
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.00E+00	m	See Appendix C
Saturated aquifer thickness	da	5.00E+00	m	Thickness of RTG based on Logs
Bulk density of aquifer materials	ρ	1.77E+00	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	n	2.40E-01	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	1.05E+02	m/d	Based on 10 slug tests carried out on two
Distance to compliance point	x	2.40E+02	m	River Thames to the northeast
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Partition coefficient	Kd	5.00E+02	l/kg	see options
Longitudinal dispersivity	ax	2.40E+01	m	see options
Transverse dispersivity	az	7.20E+00	m	see options
Vertical dispersivity	ay	9.00E-99	m	see options

Calculated Parameters

Groundwater flow velocity	v	8.75E-01	m/d
Retardation factor	Rf	3.69E+03	fraction
Decay rate used	λ	2.09E-104	d ⁻¹
Rate of contaminant flow due to retardation	u	2.37E-04	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	6.49E-02	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	3.04E+00	

Remedial Targets

Remedial Target	6.87E-02	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	240	m	
Concentration of contaminant at compliance point	C _{1D} /C ₀	6.49E-02	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)

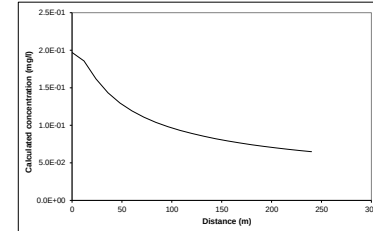
User specified value for partition coefficient

Entry if specify partition coefficient (option)	Kd	5.00E+02	l/kg
Soil water partition coefficient	foc		fraction
Entry for non-polar organic chemicals (option)	Koc		l/kg
Fraction of organic carbon in aquifer	K _{oc,n}		l/kg
Organic carbon partition coefficient	K _{oc,l}		l/kg
Entry for ionic organic chemicals (option)	pH		
Sorption coefficient for related species	pKa		
Sorption coefficient for ionised species	foc		fraction
acid dissociation constant	Kd	5.00E+02	l/kg
Fraction of organic carbon in aquifer			

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

User defined values for dispersivity	Enter value	Calc value	Xu & Eckstein	m
	2.40E+01	2.40E+01	6.73E-01	m
	7.20E+00	7.20E+00	6.73E-01	m
	9.00E-99	2.40E-01	6.73E-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)^{2.434}; 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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks	From calculation sheet
Distance	Concentration
	mg/l
0	2.0E-01
12.0	1.86E-01
24.0	1.62E-01
36.0	1.43E-01
48.0	1.30E-01
60.0	1.19E-01
72.0	1.11E-01
84.0	1.04E-01
96.0	9.82E-02
108.0	9.34E-02
120.0	8.91E-02
132.0	8.54E-02
144.0	8.21E-02
156.0	7.92E-02
168.0	7.66E-02
180.0	7.42E-02
192.0	7.20E-02
204.0	7.00E-02
216.0	6.82E-02
228.0	6.65E-02
240.0	6.49E-02



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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Manganese		
Target Concentration (C_T)	0.2195	mg/l	Origin of C_T : Bio EQS

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.

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

User specified value for partition coefficient

Contaminant	Manganese
Target concentration	0.2195 mg/l

Input Parameters

Standard entry

Water filled soil porosity	θ_w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy g
Air filled soil porosity	θ_a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy g
Bulk density of soil zone material	ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy g
Henry's Law constant	H	0.00E+00	dimensionless	0

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient. The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	6.50E+02	l/kg	3.40E+01
----------------------------------	----	----------	------	----------

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	foc		fraction	
Organic carbon partition coefficient	Koc		l/kg	

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	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment Kd 6.50E+02 l/kg Specified value

Level 1 Remedial Target

Level 1 Remedial Target	1.43E+02	mg/kg	(for comparison with soil analyses)
	or		
	0.2195	mg/l	(for comparison with leachate test results)

Site being assessed: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant Target concentration C_T **Manganese** from Level 1
0.2195 mg/l 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	1.13E-04	m/d	s (SU718741)). Assuming 40% Evapotranspiration and by 50 m based on area of site with observed contaminant
Area of contaminant source	A	2.50E+03	m ²	
Entry for groundwater flow below site				
Length of contaminant source in direction of groundwater flow	L	5.00E+01	m	ervative based on contaminated area and a NE GW direction Thickness of RTG based on Logs s carried out on two boreholes screened in the RTG (S nt value within 5 monitoring rounds between April 2019 ervative based on contaminated area and a NE GW direction
Saturated aquifer thickness	da	5.00E+00	m	
Hydraulic Conductivity of aquifer in which dilution occurs	K	1.05E+02	m/d	
Hydraulic gradient of water table	i	2.00E-03	fraction	
Width of contaminant source perpendicular to groundwater flow	w	5.00E+01	m	
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	0.00E+00	m	
Calculated mixing zone thickness	Mz		m	

Calculated Parameters

Dilution Factor	DF	1.87E+02		
Level 2 Remedial Target		4.10E+01	mg/l	For comparison with measured pore water concentration. This assumes Level 1 Remedial Target is based on Target Concentration
		2.67E+04	mg/kg	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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Manganese		from Level 1
Target Concentration	C _T	0.2195	mg/l	from Level 1
Dilution Factor	DF	1.87E+02		from Level 2

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

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

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

Variable	Value	Unit	Source of parameter value
Soil concentration as mg/kg			
Enter source concentration	0.001	mg/kg	
Half life for degradation of contaminant in water	t _{1/2}	days	0
Calculated decay rate	λ	days ⁻¹	calculated
Width of plume in aquifer at source	Sz	m	from Level 2
Plume thickness in aquifer at source	Sy	m	from Level 2
Bulk density of aquifer materials	ρ	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	n	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	i	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	m/d	from Level 2
Distance to compliance point	x	m	River Thames to the northeast
Distance (lateral) to compliance point perpendicular to flow direction	z	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	m	default condition
Time since pollutant entered groundwater	t	days	time variant options only
Parameters values determined from options			
Partition coefficient	Kd	l/kg	see options
Longitudinal dispersivity	ax	m	see options
Transverse dispersivity	az	m	see options
Vertical dispersivity	ay	m	see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	8.80E-01 m/d
Retardation factor	Rf	4.79E+03
Decay rate used	λ	1.61E-104 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.01E-03
Rate of contaminant flow due to retardation	u	1.83E-04 m/d
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	3.29E-01
Attenuation factor (C ₀ /C _{CP})	AF	3.04E+00
Calculated soil leachate concentration	Co	1.54E-06 mg/l

Remedial Targets

Level 3 Remedial Target	1.25E+02	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or		This assumes Level 1 Remedial Target is based on Target Concentration.
	8.10E+04	mg/kg	For comparison with measured soil concentration. This
Distance to compliance point	240	m	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	3.29E-01	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)
User specified value for partition coefficient

Entry if specify partition coefficient (option)		
Soil water partition coefficient	Kd	6.50E+02 l/kg
Entry for non-polar organic chemicals (option)		
Fraction of organic carbon in aquifer	foc	fraction
Organic carbon partition coefficient	Koc	l/kg
Entry for ionic organic chemicals (option)		
Sorption coefficient for related species	K _{oc,n}	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
Soil water partition coefficient	Kd	6.50E+02 l/kg

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

User defined values for dispersivity

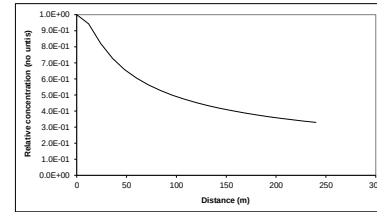
	Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	ax	2.40E+01	4.0E+01	6.78E+00 m
Transverse dispersivity	az	7.20E+00	4.0E+00	6.73E-01 m
Vertical dispersivity	ay	9.00E-99	4.4E-01	6.73E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, 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⁻, SO₄²⁻ 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

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	8.23E-09
12.0	9.43E-01	7.76E-09
24.0	8.21E-01	6.76E-09
36.0	7.28E-01	5.99E-09
48.0	6.58E-01	5.42E-09
60.0	6.05E-01	4.98E-09
72.0	5.62E-01	4.63E-09
84.0	5.28E-01	4.34E-09
96.0	4.99E-01	4.10E-09
108.0	4.74E-01	3.90E-09
120.0	4.52E-01	3.72E-09
132.0	4.34E-01	3.57E-09
144.0	4.17E-01	3.43E-09
156.0	4.02E-01	3.31E-09
168.0	3.89E-01	3.20E-09
180.0	3.77E-01	3.10E-09
192.0	3.66E-01	3.01E-09
204.0	3.55E-01	2.92E-09
216.0	3.46E-01	2.85E-09
228.0	3.37E-01	2.78E-09
240.0	3.29E-01	2.71E-09

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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	#####
Version:	x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Manganese	from Level 1
Target Concentration	C _r 2.20E-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	3.80E+00	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	9.00E+99	days	Based on site data
Calculated decay rate	λ	7.70E-101	days ⁻¹	
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.00E+00	m	See Appendix C
Saturated aquifer thickness	da	5.00E+00	m	Thickness of RTG based on Logs
Bulk density of aquifer materials	ρ	1.77E+00	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	n	2.40E-01	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	1.05E+02	m/d	Based on 10 slug tests carried out on two
Distance to compliance point	x	2.40E+02	m	River Thames to the northeast
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Partition coefficient	Kd	6.50E+02	l/kg	see options
Longitudinal dispersivity	ax	2.40E+01	m	see options
Transverse dispersivity	az	7.20E+00	m	see options
Vertical dispersivity	ay	9.00E-99	m	see options

Calculated Parameters

Groundwater flow velocity	v	8.75E-01	m/d
Retardation factor	Rf	4.79E+03	fraction
Decay rate used	λ	1.61E-104	d ⁻¹
Rate of contaminant flow due to retardation	u	1.82E-04	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	1.25E+00	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	3.04E+00	

Remedial Targets

Remedial Target	6.66E-01	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	240	m	
Concentration of contaminant at compliance point after	C _{1D} /C ₀ 1.25E+00	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)

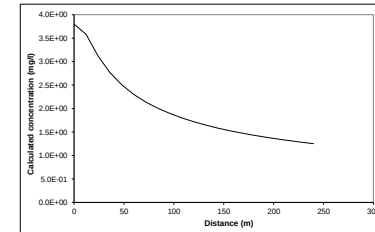
User specified value for partition coefficient

Entry if specify partition coefficient (option)	Kd	6.50E+02	l/kg
Soil water partition coefficient			
Entry for non-polar organic chemicals (option)	foc		fraction
Fraction of organic carbon in aquifer			
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	K _{oc,n}		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
Soil water partition coefficient	Kd	6.50E+02	l/kg

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

User defined values for dispersivity			
Enter value	Calc value	Xu & Eckstein	m
2.40E+01	2.40E+01	6.73E-01	m
7.20E+00	7.20E+00	6.73E-01	m
9.00E-99	2.40E-01	6.73E-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)^{2.434}; 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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks	From calculation sheet
Distance	Concentration
	mg/l
0	3.8E+00
12.0	3.58E+00
24.0	3.12E+00
36.0	2.77E+00
48.0	2.50E+00
60.0	2.30E+00
72.0	2.14E+00
84.0	2.01E+00
96.0	1.89E+00
108.0	1.80E+00
120.0	1.72E+00
132.0	1.65E+00
144.0	1.58E+00
156.0	1.53E+00
168.0	1.48E+00
180.0	1.43E+00
192.0	1.39E+00
204.0	1.35E+00
216.0	1.31E+00
228.0	1.28E+00
240.0	1.25E+00



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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Iron		
Target Concentration (C_T)	1	mg/l	Origin of C_T : EQS

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.

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

User specified value for partition coefficient

Contaminant	Iron
Target concentration	C _T 1 mg/l

Input Parameters

Standard entry

Water filled soil porosity	θ _w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy g
Air filled soil porosity	θ _a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy g
Bulk density of soil zone material	ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy g
Henry's Law constant	H	0.00E+00	dimensionless	0

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient.
The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Soil water partition coefficient	K _d	2.50E+02	l/kg	3.40E+01
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Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	f _{oc}		fraction	
Organic carbon partition coefficient	K _{oc}		l/kg	

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	2.50E+02	l/kg	Specified value
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Level 1 Remedial Target

Level 1 Remedial Target	2.50E+02	mg/kg	(for comparison with soil analyses)
	or		
	1	mg/l	(for comparison with leachate test results)

Site being assessed:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant Target concentration C_T Iron 1 mg/l

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	1.13E-04	m/d	s (SU718741)). Assuming 40% Evapotranspiration and
Area of contaminant source	A	2.50E+03	m ²	by 50 m based on area of site with observed contaminant value within 5 monitoring rounds between April 2019
Entry for groundwater flow below site				
Length of contaminant source in direction of groundwater flow	L	5.00E+01	m	ervative based on contaminated area and a NE GW direction
Saturated aquifer thickness	da	5.00E+00	m	Thickness of RTG based on Logs
Hydraulic Conductivity of aquifer in which dilution occurs	K	1.05E+02	m/d	s carried out on two boreholes screened in the RTG (S
Hydraulic gradient of water table	i	2.00E-03	fraction	nt value within 5 monitoring rounds between April 2019
Width of contaminant source perpendicular to groundwater flow	w	5.00E+01	m	ervative based on contaminated area and a NE GW direction
Background concentration of contaminant in groundwater beneath site	Cu	0.00E+00	mg/l	
Define mixing zone depth by specifying or calculating depth (using pull down list)		Calculate		
Enter mixing zone thickness	Mz	0.00E+00	m	
Calculated mixing zone thickness	Mz		m	

Calculated Parameters

Dilution Factor	DF	1.87E+02		
Level 2 Remedial Target		1.87E+02 or 4.68E+04	mg/l or 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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	05-Aug-21
Version:	x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Iron		from Level 1
Target Concentration	C _T	1	mg/l	from Level 1
Dilution Factor	DF	1.87E+02		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 dissolved pollutants only

Variable	Value	Unit	Source of parameter value
Enter source concentration			
Enter soil concentration	0.001	mg/kg	Soil concentration as mg/kg
Half life for degradation of contaminant in water	t _{1/2}	days	0
Calculated decay rate	λ	days ⁻¹	calculated
Width of plume in aquifer at source	Sz	m	from Level 2
Plume thickness in aquifer at source	Sy	m	from Level 2
Bulk density of aquifer materials	ρ	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	n	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	i	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	K	m/d	from Level 2
Distance to compliance point	x	m	River Thames to the northeast
Distance (lateral) to compliance point perpendicular to flow direction	z	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	m	default condition
Time since pollutant entered groundwater	t	days	time variant options only
Parameters values determined from options			
Partition coefficient	Kd	l/kg	see options
Longitudinal dispersivity	ax	m	see options
Transverse dispersivity	az	m	see options
Vertical dispersivity	ay	m	see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters	Variable	Value	Unit
Groundwater flow velocity	v	8.80E-01	m/d
Retardation factor	Rf	1.84E+03	fraction
Decay rate used	λ	4.17E-104	d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.01E-03	fraction
Rate of contaminant flow due to retardation	u	4.77E-04	m/d
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	3.29E-01	fraction
Attenuation factor (C ₀ /C _{CP})	AF	3.04E+00	fraction
Calculated soil leachate concentration	Co	4.00E-06	mg/l

Remedial Targets

Level 3 Remedial Target	5.67E+02	mg/l	For comparison with measured pore water concentration.
Ogata Banks	or		This assumes Level 1 Remedial Target is based on Target Concentration.
	1.42E+05	mg/kg	For comparison with measured soil concentration. This
Distance to compliance point	240	m	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{CP} /C ₀	3.29E-01	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)
User specified value for partition coefficient

Entry if specify partition coefficient (option)		
Soil water partition coefficient	Kd	2.50E+02 l/kg
Entry for non-polar organic chemicals (option)		
Fraction of organic carbon in aquifer	foc	fraction
Organic carbon partition coefficient	Koc	l/kg
Entry for ionic organic chemicals (option)		
Sorption coefficient for related species	K _{oc,n}	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
Soil water partition coefficient	Kd	2.50E+02 l/kg

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

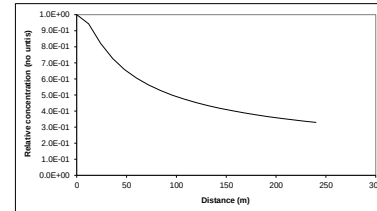
Longitudinal dispersivity	ax	2.40E+01	4.00E+01	6.78E+00	m
Transverse dispersivity	az	7.20E+00	4.00E+00	6.78E+01	m
Vertical dispersivity	ay	9.00E-99	4.00E+01	6.78E+02	m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ay)^{0.414}, 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⁻, SO₄²⁻ 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

Distance	Relative concentration (No units)	Concentration mg/l
0	1.0E+00	2.14E-08
12.0	9.43E-01	2.02E-08
24.0	8.21E-01	1.76E-08
36.0	7.28E-01	1.56E-08
48.0	6.58E-01	1.41E-08
60.0	6.05E-01	1.29E-08
72.0	5.62E-01	1.20E-08
84.0	5.28E-01	1.13E-08
96.0	4.99E-01	1.07E-08
108.0	4.74E-01	1.01E-08
120.0	4.52E-01	9.67E-09
132.0	4.34E-01	9.27E-09
144.0	4.17E-01	8.92E-09
156.0	4.02E-01	8.60E-09
168.0	3.89E-01	8.31E-09
180.0	3.77E-01	8.05E-09
192.0	3.66E-01	7.82E-09
204.0	3.55E-01	7.60E-09
216.0	3.46E-01	7.40E-09
228.0	3.37E-01	7.21E-09
240.0	3.29E-01	7.04E-09

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: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: #####
Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Iron	from Level 1
Target Concentration	C _r 1.00E+00	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	3.46E+01	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	9.00E+99	days	Based on site data
Calculated decay rate	λ	7.70E-101	days ⁻¹	0
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.00E+00	m	See Appendix C
Saturated aquifer thickness	da	5.00E+00	m	Thickness of RTG based on Logs
Bulk density of aquifer materials	ρ	1.77E+00	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	n	2.40E-01	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	1.05E+02	m/d	Based on 10 slug tests carried out on two
Distance to compliance point	x	2.40E+02	m	River Thames to the northeast
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Partition coefficient	Kd	2.50E+02	l/kg	see options
Longitudinal dispersivity	ax	2.40E+01	m	see options
Transverse dispersivity	az	7.20E+00	m	see options
Vertical dispersivity	ay	9.00E-99	m	see options

Calculated Parameters

Groundwater flow velocity	v	8.75E-01	m/d
Retardation factor	Rf	1.84E+03	fraction
Decay rate used	λ	4.18E-104	d ⁻¹
Rate of contaminant flow due to retardation	u	4.74E-04	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	1.14E+01	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	3.04E+00	

Remedial Targets

Remedial Target	3.04E+00	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	240	m	
Concentration of contaminant at compliance point after	C _{1D} /C ₀	1.14E+01	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)

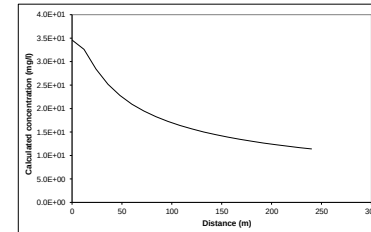
User specified value for partition coefficient

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

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

User defined values for dispersivity	Enter value	Calc value	Xu & Eckstein	m
	2.40E+01	2.40E+01	6.73E+00	m
	7.20E+00	7.20E+00	6.73E+01	m
	9.00E-99	2.40E-01	6.73E-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)^{2.434}; 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	mg/l
0		3.5E+01
12.0		3.26E+01
24.0		2.84E+01
36.0		2.52E+01
48.0		2.28E+01
60.0		2.09E+01
72.0		1.95E+01
84.0		1.83E+01
96.0		1.73E+01
108.0		1.64E+01
120.0		1.57E+01
132.0		1.50E+01
144.0		1.44E+01
156.0		1.39E+01
168.0		1.35E+01
180.0		1.30E+01
192.0		1.26E+01
204.0		1.23E+01
216.0		1.20E+01
228.0		1.17E+01
240.0		1.14E+01

Site being assessed:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx



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.

© Environment Agency, 2006. (Produced by the Environment Agency's Science Group)

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:	Gas Holder Site, Reading		
Site Address:	Reading		
Completed by:	Ana Jimenez		
Date:	05-Aug-21	Version:	x.xx
Contaminant	Free Cyanide		
Target Concentration (C_T)	0.001 mg/l	Origin of C_T :	EQS

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.

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	Free Cyanide
Target concentration	0.001 mg/l

Input Parameters

Standard entry

Water filled soil porosity	θ_w	4.80E-01	fraction	R&D Technical Report P13 Made Ground of sandy gr
Air filled soil porosity	θ_a	2.00E-02	fraction	R&D Technical Report P13 Made Ground of sandy gr
Bulk density of soil zone material	ρ	1.60E+00	g/cm ³	R&D Technical Report P13 Made Ground of sandy gr
Henry's Law constant	H	4.18E-11	dimensionless	0

This sheet calculates the Level 1 remedial target for soils(mg/kg) based on a selected target concentration and theoretical calculation of soil water partitioning. Three options are included for determining the partition coefficient. The measured soil concentration as mg/kg should be compared with the Level 1 remedial target to determine the need for further action.

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd		l/kg	
----------------------------------	----	--	------	--

Entry for non-polar organic chemicals (option)

Fraction of organic carbon (in soil)	foc	1.75E-02	fraction	geomean of 25 analysis of uncontaminated unsaturated zone soil
Organic carbon partition coefficient	Koc	1.00E+01	l/kg	80

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	pKa			
Fraction of organic carbon (in soil)	foc		fraction	

Soil water partition coefficient used in Level Assessment Kd 1.75E-01 l/kg Calculated value

Level 1 Remedial Target

Level 1 Remedial Target	4.75E-04	mg/kg	(for comparison with soil analyses)
	or		
	0.001	mg/l	(for comparison with leachate test results)

Site being assessed: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2



Level 2 - Soil

Contaminant
Target concentration

C_T

Free Cyanide
0.001

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

1.13E-04
2.50E+03

m/d
m²

s (SU718741)). Assuming 40% Evapotranspiration and
by 50 m based on area of site with observed contaminant

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

5.00E+01
5.00E+00
1.05E+02
2.00E-03
5.00E+01
0.00E+00

m
m
m/d
fraction
m
mg/l

ervative based on contaminated area and a NE GW direction
Thickness of RTG based on Logs
s carried out on two boreholes screened in the RTG (S
nt value within 5 monitoring rounds between April 2019
ervative based on contaminated area and a NE GW direction

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

0.00E+00
Calculate

m
m

Calculated Parameters

Dilution Factor

DF

1.87E+02

Level 2 Remedial Target

1.87E-01
or
8.87E-02

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: Gas Holder Site, Reading
Completed by: Ana Jimenez
Date: 05-Aug-21
Version: x.xx

Remedial Targets Worksheet , Release 3.2

Level 3 - Soil

See Note



Input Parameters	Variable	Value	Unit	Source
Contaminant		Free Cyanide		from Level 1
Target Concentration	C _T	0.001	mg/l	from Level 1
Dilution Factor	DF	1.87E+02		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 dissolved pollutants only

Variable	Value	Unit	Source of parameter value
Soil concentration as mg/kg			
Enter source concentration			
Enter soil concentration	1.12	mg/kg	
Half life for degradation of contaminant in water	3.65E+02	days	
Calculated decay rate	1.90E-03	days ⁻¹	calculated
Width of plume in aquifer at source	5.00E+01	m	from Level 2
Plume thickness in aquifer at source	5.00E+00	m	from Level 2
Bulk density of aquifer materials	1.77E+00	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	2.40E-01	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	2.01E-03	fraction	from Level 2 (adjusted)
Hydraulic conductivity of saturated aquifer	1.05E+02	m/d	from Level 2
Distance to compliance point	2.40E+02	m	River Thames to the northeast
Distance (lateral) to compliance point perpendicular to flow direction		m	default condition
Distance (depth) to compliance point perpendicular to flow direction		m	default condition
Time since pollutant entered groundwater	9.99E+99	days	time variant options only
Parameters values determined from options			
Partition coefficient	K _d	7.96E-02	l/kg see options
Longitudinal dispersivity	ax	24.000	m see options
Transverse dispersivity	az	7.200	m see options
Vertical dispersivity	ay	0.000	m see options

Parameter values should be checked against Level 1 and 2

Calculated Parameters

Variable	Value	Unit
Groundwater flow velocity	v	8.80E-01 m/d
Retardation factor	R _f	1.59E+00 fraction
Decay rate used	λ	1.20E-03 d ⁻¹
Hydraulic gradient used in aquifer flow down-gradient	i	2.01E-03 fraction
Rate of contaminant flow due to retardation	u	5.54E-01 m/d
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	2.01E-01 fraction
Attenuation factor (C ₀ /C _{eq})	AF	4.97E+00 fraction
Calculated soil leachate concentration	Co	2.36E+00 mg/l

Remedial Targets

Level 3 Remedial Target	9.29E-01	mg/l	For comparison with measured pore water concentration.
Ogata Banks			This assumes Level 1 Remedial Target is based on Target Concentration.
	4.41E-01	mg/kg	For comparison with measured soil concentration. This
Distance to compliance point	240	m	assumes Level 1 Remedial Target calculated from soil-water partitioning equation.
Ratio of Compliance Point to Source Concentration	C _{eq} /C ₀	2.01E-01	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} 7.96E-03 fractionOrganic carbon partition coefficient K_{oc} 1.00E+01 l/kgSorption coefficient for related species K_{oc,n} l/kgSorption coefficient for ionised species K_{oc,i} l/kg

pH value pH

Acid dissociation constant pK_aFraction of organic carbon in aquifer f_{oc} fractionSoil water partition coefficient K_d 7.96E-02 l/kg

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

User defined values for dispersivity

Enter value Calc value Xu & Eckstein

Longitudinal dispersivity ax 2.40E+01 2.40E+01 6.78E+00 m

Transverse dispersivity az 7.20E+00 7.20E+00 6.73E-01 m

Vertical dispersivity ay 9.00E-99 9.00E-99 6.73E-02 m

Note values of dispersivity must be > 0

Xu & Eckstein (1995) report ax = 0.83(log₁₀ax)^{0.414}, az = ax/10, ay = ax/100 are assumed

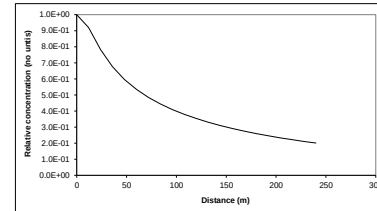
Note

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⁻, SO₄²⁻ 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

From calculation sheet

Distance	Relative concentration	Concentration
	(No units)	mg/l
0	1.0E+00	1.26E-02
12.0	9.20E-01	1.16E-02
24.0	7.82E-01	9.87E-03
36.0	6.76E-01	8.53E-03
48.0	5.96E-01	7.53E-03
60.0	5.35E-01	6.75E-03
72.0	4.85E-01	6.12E-03
84.0	4.44E-01	5.60E-03
96.0	4.09E-01	5.17E-03
108.0	3.79E-01	4.79E-03
120.0	3.53E-01	4.46E-03
132.0	3.31E-01	4.17E-03
144.0	3.10E-01	3.91E-03
156.0	2.92E-01	3.68E-03
168.0	2.75E-01	3.47E-03
180.0	2.60E-01	3.28E-03
192.0	2.46E-01	3.11E-03
204.0	2.34E-01	2.95E-03
216.0	2.22E-01	2.80E-03
228.0	2.11E-01	2.66E-03
240.0	2.01E-01	2.54E-03

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: Gas Holder Site, Reading

Completed by: Ana Jimenez

Date: #####

Version: x.xx

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

Contaminant	Free Cyanide	from Level 1
Target Concentration	C _r 1.00E-03	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	8.03E-02	mg/l	Source of parameter value
Half life for degradation of contaminant in water	t _{1/2}	3.65E+02	days	Based on site data
Calculated decay rate	λ	1.90E-03	days ⁻¹	80
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.00E+01	m	See Appendix C
Plume thickness at source	Sy	5.00E+00	m	See Appendix C
Saturated aquifer thickness	da	5.00E+00	m	Thickness of RTG based on Logs
Bulk density of aquifer materials	ρ	1.77E+00	g/cm ³	Average of gravel literature values (Consim help)
Effective porosity of aquifer	n	2.40E-01	fraction	medium gravels (Brady & Kunkel, 2003)
Hydraulic gradient	i	2.00E-03	fraction	typical gradient value within 5 monitoring rounds between April 2019 and Feb 2020
Hydraulic conductivity of aquifer	K	1.05E+02	m/d	Based on 10 slug tests carried out on two
Distance to compliance point	x	2.40E+02	m	River Thames to the northeast
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	default condition
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	default condition
Time since pollutant entered groundwater	t	9.99E+99	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	7.96E-02	l/kg	see options
Longitudinal dispersivity	ax	2.40E+01	m	see options
Transverse dispersivity	az	7.20E+00	m	see options
Vertical dispersivity	ay	9.00E-99	m	see options

Calculated Parameters

Groundwater flow velocity	v	8.75E-01	m/d
Retardation factor	Rf	1.59E+00	fraction
Decay rate used	λ	1.20E-03	d ⁻¹
Rate of contaminant flow due to retardation	u	5.51E-01	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C _{1D}	1.61E-02	mg/l
Attenuation factor (one way vertical dispersion, COICED)	AF	4.99E+00	

Remedial Targets

Remedial Target	4.99E-03	mg/l	For comparison with measured groundwater concentration.
Ogata Banks			
Distance to compliance point	240	m	
Concentration of contaminant at compliance point after	C _{1D} /C ₀ 1.61E-02	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

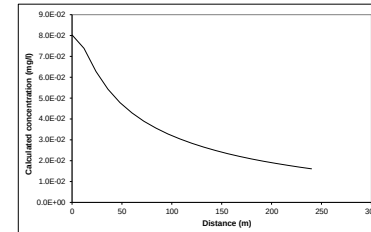
Entry if specify partition coefficient (option)	Kd	l/kg
Soil water partition coefficient		
Entry for non-polar organic chemicals (option)	foc	7.96E-03 fraction
Fraction of organic carbon in aquifer		
Organic carbon partition coefficient	Koc	1.00E+01 l/kg
Entry for ionic organic chemicals (option)		
Sorption coefficient for related species	K _{oc,n}	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
Soil water partition coefficient	Kd	7.96E-02 l/kg

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

User defined values for dispersivity

Enter value	Calc value	Xu & Eckstein	m
2.40E+01	2.40E+01	6.73E+00	m
7.20E+00	7.20E+00	6.73E+01	m
9.00E-99	2.40E-01	6.73E-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)^{2.434}; 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:	Gas Holder Site, Reading
Completed by:	Ana Jimenez
Date:	00/00/0000
Version:	x.xx

Calculated concentrations for distance-concentration graph

Ogata Banks	From calculation sheet
Distance	Concentration
	mg/l
0	8.0E-02
12.0	7.39E-02
24.0	6.28E-02
36.0	5.42E-02
48.0	4.79E-02
60.0	4.29E-02
72.0	3.89E-02
84.0	3.56E-02
96.0	3.28E-02
108.0	3.04E-02
120.0	2.83E-02
132.0	2.65E-02
144.0	2.49E-02
156.0	2.34E-02
168.0	2.21E-02
180.0	2.08E-02
192.0	1.97E-02
204.0	1.87E-02
216.0	1.78E-02
228.0	1.69E-02
240.0	1.61E-02



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