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Comprehensive Environmental Site Assessment - Further Investigation

Shell Hitchin

NPS: 10019011



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Shell UK Oil Products Ltd.

Prepared by:
URS Infrastructure &
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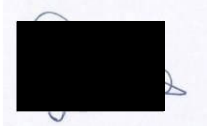
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EXECUTIVE SUMMARY

URS Infrastructure & Environment UK Limited (URS) has undertaken an Environmental Site Assessment (ESA) of the Shell Hitchin located at Bedford Road, Hitchin, Hertfordshire, SG5 2TY to ascertain environmental conditions of the site. The specific purpose of this investigation was to undertake further assessment of the potentially complete pollutant linkages to Controlled Waters receptors identified in previous site investigations.

The scope of work included the installation of two groundwater monitoring wells (BH105A and BH106A) to depths of 9 metres (m) below ground level (bgl) into the underlying, Zig Zag Chalk formation, classified by the Environment Agency (EA) as a Principal Aquifer and the installation of one borehole (BH102A) to a depth of 14.4m bgl into the superficial deposits. During the intrusive works, the Zig Zag chalk formation was encountered at a depth of 6.3m bgl in BH105A located in the western corner of the site; at 2.8m bgl in BH106A located approximately 7m west of the pump islands in the western area of the site and at a depth of 14.5m bgl at BH102A located on the eastern boundary of the site.

A groundwater gauging and monitoring event was undertaken at the site in February 2012 where new monitoring wells (BH102A, BH105A and BH106A installed into deep drift or the Chalk) and existing monitoring wells (BH101, BH102 and BH103 installed into the drift deposits) were purged and sampled. Groundwater was encountered in all boreholes and ranged from 6.42 to 7.18m bgl with an inferred flow to the southeast in the direction of the River Hiz located approximately 850m east of the site.

A second groundwater monitoring event (GME) was undertaken at the site between December 2012 and January 2013 which included three gauging rounds and a sampling event to confirm groundwater levels and concentrations following heavy rainfall. Dataloggers were installed into BH101 and BH106A on 19th December 2012 for a 6 week period to monitor fluctuations in water levels. Groundwater was encountered in all on-site monitoring wells and ranged from 5.69 to 7.62m bgl during all three gauging rounds, approximately 0.5m higher than recorded in the October 2011 and February 2012 GME. Inferred groundwater direction was found to be towards east of the site.

The Controlled Waters receptors for the site are the underlying Zig Zag Chalk (Principal Aquifer) and the Superficial Deposits. Although the site is underlain by superficial deposits of the Lowestoft Formation which are described by the EA as unproductive strata, the formation is shown on the 1:50,000 geological map to be underlain and surrounded by Glaciofluvial Deposits (classified as a Secondary-A aquifer). It has been assumed that the boreholes are installed in the more sensitive Secondary-A aquifer as the vertical and horizontal extent of the Lowestoft Till and Glaciofluvial Deposit units within the permeable drift are not known. The site is close to the edge of a significant buried valley feature with drift deposits reaching up to 80m in thickness within 1km to the north-west, north and north-east of the site.

The site is not located within a Source Protection Zone. There are no reported licensed groundwater abstractions within 1km of the site and no reported private groundwater abstractions within 2km of the site. The closest surface water feature is the Bearton Pond located approximately 200 m north of the site. The River Hiz is located approximately 850m east of the site, the River Oughton is located 1km north of the site and the River Purwell is located approximately 1.2km north-east of the site.

No phase separate hydrocarbons (PSH) or visual evidence of soil staining were identified at the site, however mild hydrocarbon odours were noted on groundwater samples collected from BH102.

Generic screening of soil, groundwater and vapour results identified potential risks to controlled waters at Stage 2 assessment. No significant risks to human health were identified.

URS conducted a Controlled Waters Detailed Quantitative Risk Assessment (DQRA) to assess the significance of identified potential pollutant linkages from soil and groundwater monitoring from both the December 2011 and February 2012 investigations and January 2013 GME. The potential pollutant linkages modelled as part of the DQRA are presented below.

Modelled Pollutant Linkages			
Assessment	Source	Pathway(s)	Receptor
Chalk Model – Horizontal and Vertical Migration into the Chalk Principal Aquifer			
CW Pollutant Linkage No. 1	Impacted Soils (above URS Stage 2 CW GAC)	- Partitioning between soil and pore water - Infiltration of impacted pore water down to the saturated zone assuming drift absent - Dilution of impacted pore water within the saturated zone - Horizontal migration of impacted groundwater	Groundwater within the Zig Zag Chalk Formation bedrock (Principal aquifer).
CW Pollutant Linkage No. 2	Impacted groundwater (above URS Stage 2 CW GAC)	- Horizontal migration of impacted groundwater. - Vertical migration of impacted groundwater.	
Drift Deposits Model – Horizontal Migration within the Drift Deposits Secondary-A Aquifer			
CW Pollutant Linkage No. 3	Impacted Soils (above URS Stage 2 CW GAC)	- Partitioning between soil and pore water - Infiltration of impacted pore water down to the saturated zone (water table) - Dilution of impacted pore water within the saturated zone - Horizontal migration of impacted groundwater	Groundwater within the drift deposits (Secondary-A aquifer)
CW Pollutant Linkage No. 4	Impacted groundwater (above URS Stage 2 CW GAC)	- Horizontal migration of impacted groundwater. - Vertical migration of impacted groundwater.	

The principal conclusions of the Controlled Waters DQRA are summarised below:

Model 1: Groundwater in the Chalk

Of the COPC groups assessed, soil concentrations of naphthalene and fluoranthene were simulated to present a theoretical risk to the Principal aquifer at a 50m compliance point considering a 3.6m mixing zone. At 95% confidence the simulated CWHI for naphthalene and fluoranthene were 15.2 and 3.54 respectively.

If additional dilution is considered within a 10m mixing zone, the hazard indices of the simulated concentrations decrease proportionally, indicating a marginal risk of naphthalene exceeding the GAC at 50m, and no risk of fluoranthene exceeding the withdrawn EEC MAC.

No other risks were simulated from vertical migration of soil sources to the underlying Principal Chalk aquifer at a 50m compliance point.

No significant risks were identified from concentrations of COPC in groundwater to the underlying Principal Chalk aquifer at a 50m compliance point.

Model 2: Groundwater in the Drift Deposits

No significant risks were identified from concentrations of chemicals of potential concern (COPC) in soil to the drift deposits Secondary-A aquifer.

Of the COPC groups assessed, groundwater concentrations of benzene were simulated to present a theoretical risk at the 50m compliance point protective of the Secondary-A aquifer at a 95% confidence level with a CWHI of 12.0. At the 50th percentile ('most likely'), the model did not simulate a risk from concentrations of benzene at the 50m compliance point with an HI of 0.371. No risks were simulated from benzene at the 100m compliance point.

Given the low exploitation potential of the aquifer, an extended compliance point of 100m is considered appropriate. As no risks are simulated at the 95th percentile (worst case) at the extended compliance point, or at the 50th percentile ('most likely'), at the 50m compliance point, from a conservative DQRA, the theoretical risks simulated by the model are considered unlikely to pose a significant risk to controlled waters in the drift.

1. INTRODUCTION

URS Infrastructure & Environment UK Limited (URS) has undertaken a Comprehensive Environmental Site Assessment (ESA) of Shell Hitchin located at Bedford Road, Hitchin, Hertfordshire, SG5 2TY at the request of Shell UK Oil Products Ltd. (Shell). The information contained herein is in accordance with Shell's requirements for a Comprehensive ESA report.

1.1. Objectives

The objective of this Phase II ESA report is to collect data to refine the current conceptual site model (CSM) for the site. The aim of this ESA is to:

- Assess the hydrogeological characteristics of the site;
- Assess the extent, magnitude and nature of impact, if any;
- Refine the conceptual site model (CSM); and
- Produce a combined Environmental Site Assessment (ESA) and Detailed Quantitative Risk Assessment (DQRA) Report.

The specific objective of this Phase II ESA report is to undertake further assessment of the site to obtain additional site specific information, to fill data gaps and revise the detailed qualitative risk assessment undertaken in the initial Comprehensive ESA (**Reference 3**). Specifically the data gaps include:

- Groundwater flow direction across the site;
- Groundwater gradient;
- Site specific hydraulic conductivity of the Zig Zag Chalk Formation;
- Depth to the Zig Zag Chalk Formation on the eastern side of the site;
- Vertical extent of hydrocarbon impacts in the vicinity of BH102; and
- Relationship and connectivity of the overlying Lowestoft and Pleistocene glaciofluvial deposits with the underlying Zig Zag Chalk (Principal aquifer).

1.2. Scope of Work

The Scope of Work for this ESA includes:

Preliminary Works

- Submission of a Management of Business Interference (MBI) form to the nominated site contacts.
- Review of the URS Phase 1 Investigation and Comprehensive ESA Reports (**Reference 2 & 3**).

Phase 2 Activities

- Underground utility plans were obtained and on-site service clearance was undertaken during the initial stage of investigation.
- Clearance of three locations by vacuum excavation (vacex) at the site to 1.2m bgl, at 150% diameter of the proposed borehole.
- Further advancement of a two boreholes (BH102A and BH106A) in the vicinity of existing BH102 and BH106 to assess the depth to chalk and vertical extent of groundwater impact to a depth of 14.4m bgl .
- Over-drill of existing monitoring well BH105 and advancement into the Zig Zag Chalk formation to depths of 8.5m bgl.
- Installation of three (3) groundwater monitoring wells (BH102A BH105A and BH106A).
- Decommissioning of BH106 by over-drilling and grouting.
- Levelling of groundwater wells.
- Collection of soil samples from targeted locations to evaluate the presence of potential impact.
- Collection of groundwater samples from six (6) monitoring wells during February 2012 and January 2013.
- Monitoring of groundwater levels from new and existing wells during February 2012, December 2012 and January 2013.
- Hydraulic conductivity testing of three (3) groundwater monitoring wells (BH102A, BH105A and BH106A).
- Installation of dataloggers into BH101 and BH106A for a 6 week period to monitoring fluctuations in groundwater levels.

- Assessment of the magnitude, type and extent of Chemicals of Potential Concern (COPC) present through the performance of laboratory and/or on-site analysis of soil, groundwater and vapour for various chemical indicators associated with operation as a petrol filling station.
- Screening of analytical results against Generic Assessment Criteria (GAC) to determine the requirement for a DQRA.

Detailed Quantitative Risk Assessment (DQRA)

- Assessment of the significance of identified potential Pollutant Linkages.
- Completion and submission of this ESA report.

2. BACKGROUND INFORMATION

2.1. Site Identification Details

Table A: Site Information	
Site Name	Shell Hitchin
Network Planning System ID	10019011
Site Address	Shell Hitchin, Bedford Road, Hitchin, Hertfordshire, SG5 2TY Figure 1 provides a site location map.
Grid Reference (Easting, Northing)	517920, 229840
Approximate Site Area	1,500m ² (calculated by Envirocheck). Figure 2 provides a summary plan of the site layout.
Freehold/Leasehold	URS understands the site is owned by Shell.
Land Use Zoning	Continued Petroleum Use (CPU)
Surrounding Land Use	North: A tyre dealership is situated approximately 5m north of the site beyond an access road. A three storey apartment block with surrounding garden lies approximately 30m north of the site. South: A hotel lies approximately 5m south of the site beyond a small car parking area. Residential properties are situated approximately 30m south of the site. East: The site is bounded to the east by the A550 Bedford Road. Hitchin Town FC football ground is approximately 20m east of the site. West: The site is bounded to the west by a garage and car park. Residential properties with gardens lie approximately 20m west the site.

2.2. Chronology of Activities

Table B: Chronology of Activities		
Activity	Date	Summary
Previous site investigations and/or remediation	Not applicable	Previous investigations and projects at the site to date include the following: • GeoDelft Tier 1 soil gas survey, May 1999 • URS Phase 1 Environmental Site Assessment, September 2011 • URS Phase 2 Environmental Site Assessment, December 2011
<u>Review of Historical Reports by GeoDelft (Reference 1)</u> A GeoDelft Tier 1 report identified no historical known pollution incidents at the site. Concentrations of VOC <50ppm were recorded at the site. Minimal impact was identified at the site. <u>Review of URS Phase 1 Environmental Site Assessment Report (Reference 2)</u> A Phase 1 Investigation was undertaken by URS in September 2011 and included an initial desk based investigation and site walkover to provide information on the environmental site setting. An initial conceptual site model and Preliminary Risk Assessment (PRA) was undertaken. The preliminary risk assessment identified a number of potential pollutant linkages, summarised as follows: Human Health • Migration of hydrocarbon vapours from potentially impacted shallow soils and/or groundwater to on-site workers within the shop area and off-site workers to the north and east of the site. • Permeation of hydrocarbons from potentially impacted soil into plastic water supply pipes followed by ingestion by on-site shop staff. Controlled Waters • Vertical migration of COPC from potentially impacted shallow soils into perched water and/or the shallow groundwater within the shallow Drift Deposits that border the site (Secondary A Aquifer), and potentially deeper groundwater in the underlying Zig Zag Chalk Formation (Principal Aquifer). • Migration of COPC from potentially impacted shallow soils into perched water and/or the shallow groundwater followed by lateral migration to Surface Waters (Bearton Pond located 200m north of the site, The River Hiz located approximately 850m east of the site, the River Oughton located 1km north of the site and the River Purwell located approximately 1.2km north-east of the site). <u>Review of URS Comprehensive Environmental Site Assessment Report (Reference 3)</u> A comprehensive investigation was undertaken by URS in December 2011. Intrusive works included the drilling and installation of 5 monitoring wells into the superficial deposits and 3 vapour wells at the site. A DQRA was carried out on available soil, groundwater and vapour data. The principal conclusions were:		

Table B: Chronology of Activities

- No significant risks to human health (on site workers or off-site residents) were identified
- Potentially unacceptable risks to groundwater in the underlying superficial deposits were identified from reported concentrations of benzene, TPH Aromatics <C₅-C₇ and naphthalene in groundwater at a 50m compliance point. The 50m compliance point was selected based on the hazardous classification of these substances, the presence of the Principal Aquifer beneath the superficial deposits and the uncertainty in groundwater flow direction and gradient.
- Potentially unacceptable risks to groundwater in the underlying Chalk Principal aquifer were identified from reported concentrations of benzene at a 50m compliance point however this assessment was based on a number of assumptions in the absence of site specific data.

2.3. Site Equipment – Storage Tank Summary

Table C: Summary of On-site Fuel Tank / Compartments							
Tank number or identification	Tank / Compartment 1	Tank / Compartment 2	Tank / Compartment 3	Tank / Compartment 4	Tank / Compartment 5	Tank / Compartment 6	Tank / Compartment 7
Tank type (b)	Single walled Dual Chamber	Single walled Dual Chamber	Single walled	Single walled	Single walled Dual Chamber	Single walled	Single walled Dual Chamber
Tank size (a, b) (litres)	13,190	13,190	26,190	26,190	12,363	26,190	12,121
Product stored (a)	V-Power UL	V-Power Diesel	Unleaded	Diesel	Unleaded	Unleaded	V-Power UL
Status (a)	In use	In use	In use	In use	In use	In use	In use
Date of installation (b)	1970	1970	1970	1970	1970	1970	1970
Removal date or abandonment date	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Relative level (RL) of tank base (c)	Assumed to be 4.5 m bgl	Assumed to be 4.5 m bgl	Assumed to be 4.5 m bgl	Assumed to be 4.5 m bgl	Assumed to be 4.5 m bgl	Assumed to be 4.5 m bgl	Assumed to be 4.5 m bgl

NOTES:

a - Information from site inspection

b - Information from petroleum officer's report

c - Estimate based upon tank size

3. FIELD WORK

3.1. Summary of Field Work

Table D: Summary of Fieldwork	
Date of Field Work	Field work was undertaken between 13 th February and 27 th February 2012 and 19 th December 2012 and 29 th January 2013
Site Activities	Field works included the following key tasks: - Excavation/drilling of 2 boreholes (BH102A and BH106A) and overdrilling of 1 borehole (BH105A) followed by the installation of 3 groundwater monitoring wells by Tor Drilling Ltd; - Decommissioning of monitoring well BH106 that was initially installed above the chalk and found to be dry; - Environmental soil sampling; - Two groundwater monitoring events (February 2012 and January 2013); and - Hydraulic conductivity testing.
Service Clearance	Prior to commencing works all excavation locations were pre-cleared for the potential presence of subsurface utilities by Glover GB. Utility and as-built plans were reviewed and a site-wide robust underground utilities subscan was conducted, utilising a cable avoidance tool with generator (CAT & genny) and Ground Penetrating Radar (GPR). Each bore was then cleared by URS subcontractor Tor Drilling Ltd (Tor) by vacuum excavation to 150% of auger diameter and to a depth of no less than 1.2m below ground level (bgl) prior to mechanical drilling.
Borehole Drilling Methodology	Tor, on subcontract to, and supervised by URS advanced the boreholes using a Hollow Stem Auger (HSA) methodology. Each well was installed using 50-millimetre (mm) diameter, 1mm-slotted, flush-threaded high-density polyethylene (HDPE) well screen and finished with a sufficient length of compatible HDPE riser. The annulus surrounding each well was filled with clean, washed gravel to a minimum of 0.2m (groundwater monitoring wells) or 0.15m (vapour wells) above the top of the screened interval, and topped with a layer of activated bentonite to act as a seal. Each well was finished in a protective well vault placed flush to surface and set in a concrete pad. URS personnel logged and screened all soil arising during excavation. The borehole logs are presented in Appendix B, and photographs taken during drilling are presented in Appendix C.
Borehole Location Rationale	Two boreholes were excavated to depths of 14.4m bgl (BH102A) and 8.7m bgl (BH106A) prior to the installation of a groundwater monitoring wells. One borehole (BH105) was overdrilled to a depth of 9.0m bgl prior to the installation of a monitoring well. Drilling locations were designed to evaluate the soil, groundwater and soil vapour conditions associated with the target locations described below. The monitoring well locations are illustrated on Figure 2.

Table D: Summary of Fieldwork

	Borehole ID	Target Location	Completion Depth (m bgl)	Monitoring Well (y/n)
	BH102A	Located on the eastern boundary of the site, approximately 7m from the pump islands and 1m from BH102	14.4	Y
	BH105A (formerly BH105)	Located in the western area of the site, approximately 5m west of the off-set fill points.	8.5	Y
	BH106A	Located in the north-west corner of the site approximately 3m from the shop.	8.5	Y
Soil Sampling	In total 5 soil samples, were collected during the site investigation programme. In general, soil samples were taken from each borehole based on potential field evidence of impact for laboratory analysis. Soil analytical results are presented in Appendix A . The location and depth of each soil sample is highlighted on the drilling logs provided in Appendix B .			
Surveying	The elevation of the groundwater monitoring standpipes has been surveyed to metres above Ordnance Datum (mAOD) by URS subcontractor Interlock Surveys Ltd.			
Groundwater Elevation Monitoring	On 27th February 2012, 19th December 2012, 11th January 2013, and 29th January 2012, URS field personnel measured liquid levels in all monitoring wells associated with the site using an interface probe (IP), which is capable of distinguishing Phase Separated Hydrocarbons (PSH) from water. The IP was cleaned by washing with a non-phosphate soap solution and rinsing with deionised water before each measuring event. Liquid levels were measured to the nearest 0.01m from the top of each well casing, so that they could be directly compared to a common datum. Measurements made in the field included depth to water, depth to PSH (if present), and depth to the base of each well. On 27 February 2012, depth to groundwater ranged from 6.42m bgl in BH102A to 7.18m bgl in BH103. Groundwater was inferred to flow to the southeast of the site in the direction of the River Hiz located approximately 850m east and down gradient of the site. On 19th December 2012, depth to groundwater ranged from 5.94m bgl in BH102A to 7.05m bgl in BH101. Groundwater was inferred to flow to the east of the site in the direction of the River Hiz located approximately 850m east and down gradient of the site. On 11th January 2013, depth to groundwater ranged from 5.69m bgl in BH102A to 6.87m bgl in BH101. Groundwater was inferred to flow to the east of the site in the direction of the River Hiz located approximately 850m east and down gradient of the site. On 29th January 2013, depth to groundwater ranged from 5.80 bgl in BH102A to 6.92m bgl in BH102. Groundwater was inferred to flow to the east of the site in the direction of the River Hiz located approximately 850m east and down gradient of the site. PSH were not encountered in any well during the four gauging events. Liquid level data collected in February 2012, December 2012 and January 2013 are summarised in Table 1, Appendix A. The groundwater levels for the four gauging event are illustrated on Figures 3a – 3d.			

Table D: Summary of Fieldwork	
Groundwater Sampling	The groundwater wells were sampled on 27 th February 2012 and 11 th January 2013. Wells were purged and sampled using a low-flow sampling method incorporating a flow through cell and dedicated tubing. During well purging activities, water was periodically monitored for temperature, pH, conductivity, dissolved oxygen (DO), and oxidation/reduction potential (ORP or Redox) using a water quality meter to determine when representative formation waters were being encountered. Following sufficient recharge, groundwater samples were collected. All groundwater samples were collected into laboratory supplied, glass containers, labelled, and placed on ice.
Field Quality Control Sampling	The following field quality control samples were collected as part of this ESA: • 2 trip blanks (1 groundwater sample per GME); • 2 field duplicates (1 groundwater sample per GME)
Hydraulic Conductivity Testing	On 27 th February 2012, rising and falling head tests using a slug were conducted in wells BH102A, BH105A and BH106A within the Lowestoft Formation and Chalk. The data were interpreted using the Bouwer Rice method. Hydraulic conductivity data are presented in Appendix I .
Dataloggers	Dataloggers were installed in BH101 and BH106A on the 19 th December 2012 to monitor fluctuations in the groundwater levels at the site. The data showed the levels to range from 6.831 to 6.577m bgl in BH103 and 6.124 to 5.785m bgl in BH106A. Datalogger information is presented in Appendix I .
Hydraulic Gradient	Based on the 27 th February 2012 gauging event a hydraulic gradient of 0.005 has been calculated for the wells installed in the Zig Zag Chalk, and BH102A installed in drift immediately above the Chalk. Based on the 19 th December 2012 gauging event a hydraulic gradient of 0.0045 has been calculated for the wells installed in the Zig Zag Chalk, and BH102A installed in drift immediately above the Chalk. Based on the 11 th January 2013 gauging event a hydraulic gradient of 0.004 has been calculated for the wells installed in the Zig Zag Chalk, and BH102A installed in drift immediately above the Chalk. Based on the 29 th January 2013 gauging event a hydraulic gradient of 0.0042 has been calculated for the wells installed in the Zig Zag Chalk, and BH102A installed in drift immediately above the Chalk.

3.2. Field Screening Results / Observations

Table E: Field Screening	
Soil Observations	During excavation of boreholes, soil vapour screening of arisings using a field-calibrated photo-ionisation detector (PID) equipped with a 10.6 electron-volt (eV) lamp was undertaken. PID readings were documented and are presented in the borehole logs provided in Appendix B . PID readings was recorded at <10 ppm in all boreholes across the site with the exception of BH102A where readings of 3987 was reported at the top of the groundwater table at 7.2m bgl. A hydrocarbon odour was noted at this location.
Groundwater Observations	Mild hydrocarbon odours were noted from groundwater sampled from BH102 during the February 2012 and January 2013 GMEs.
Phase Separate Hydrocarbons (PSH)	PSH were not detected during any of the four gauging rounds at the site.
Field Groundwater Quality Parameters	Details of field groundwater quality parameters are presented in Appendix A. During the February 2012 groundwater monitoring event (GME) the following were noted: • Dissolved oxygen concentrations range from 0.37 to 6.65 milligrams per litre (mg/L) • Redox potential of groundwater ranged from -124.6 to 83.6 millivolts (mV) indicating oxidising/aerobic conditions; • Electrical conductivity of groundwater ranged from 846 to 2,882 microsiemens per centimetre ($\mu\text{S}/\text{cm}$); • Groundwater pH ranged from 6.63 to 6.93; • Groundwater temperature ranged from 12.61 to 12.82°C. During the January 2013 groundwater monitoring event (GME) the following were noted: • Dissolved oxygen concentrations range from 2.78 to 21.9 milligrams per litre (mg/L) • Redox potential of groundwater ranged from 31.4 to 336.1 millivolts (mV) indicating oxidising/aerobic conditions; • Electrical conductivity of groundwater ranged from 578 to 1,093 microsiemens per centimetre ($\mu\text{S}/\text{cm}$); • Groundwater pH ranged from 5.83 to 7.07; • Groundwater temperature ranged from 11.89 to 13.09°C.

3.3. Hydrogeological Information

Table F: Hydrogeological Information	
Made Ground and Superficial Geology	The site consists of made ground underlain by drift and then the Zig Zag Chalk. The site is shown to be underlain by the Lowestoft Formation, which forms an extensive sheet of chalky till, together with outwash sands and gravels, silts and clays. The till is characterised by its chalk and flint content. The EA website classifies the superficial Lowestoft formation as Unproductive Strata. These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. The site lies on the boundary of the Glaciofluvial deposits which is located approximately 25m of the west of the site. The EA website classifies the superficial Glaciofluvial Deposits as a Secondary-A Aquifer. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.
Solid Geology	The Bedrock Geology of the site is reported to be the Zig Zag Chalk Formation. This consists of mostly firm, pale grey to off-white blocky chalk with a lower part characterised by rhythmic alternations of marls and marly chalks with firm white chalk. Thin gritty, silty chalk beds act as markers in the sequence. The thickness is typically 35–50 m bgl. The EA Website classifies the Zig Zag Chalk Formation as a Principal aquifer. These are layers of rock or drift deposits that have high inter-granular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer. The site is reported by BGS (Hitchin Sheet 221) to lie on the border of a buried sediment-filled channel that reaches depths of 100m deep in the centre of the channel. In the buried channel the Chalk has been eroded and the drift sequence is underlain by the Gault Formation. The Gault Formation comprises pale to dark grey or blue-grey clay or mudstone, glauconitic in part, with a sandy base. Discrete bands of phosphatic nodules (commonly preserving fossils), some pyrite and calcareous nodules. During intrusive works in September 2011 and February 2012, Chalk was encountered at a depth of 5.4m bgl at boreholes BH105 and BH106 located in the western area of the site and at 14.2m bgl at BH102A located in the eastern area of site.
Groundwater	The site is not located within a Source Protection Zone and there are no reported licensed or private groundwater abstractions within 1km of the site. SPZ's are present 2km west, 2km south and 4km to the east of the site. There are four current groundwater abstractions between 1 and 2km from the site: Pilkington Farms 1.4km west of the site is licensed to abstract groundwater from chalk sourced from a well and borehole. Abstraction is currently unspecified but previous permit was for Household Water Supply: Drinking, Cooking, Sanitary, Washing; (Small Garden). Status: Perpetuity.

Table F: Hydrogeological Information

	• Environment Agency 1.7km south of the site is licensed to abstract groundwater from a well for Environmental use: Remedial/Wetland Support: Transfer Between Sources. Status: Not Supplied. • DPH Parker 2km north west of the site is licensed to abstract groundwater from chalk for General Farming and Domestic use. Status: Perpetuity. • Veolia Water Central Limited 2km west of the site are licensed to abstract groundwater from chalk for Public Water Supply: Potable Water Supply – Direct. Status: Perpetuity. License was previously held by Three Valleys Water Plc. It has been confirmed by North Hertfordshire District Council that there are no reported private water abstractions within 2km of the site.
Surface Water Features	The closest surface water feature is the Bearton Pond Located approximately 200 m north of the site. The River Hiz is located approximately 850m east of the site, the River Oughton is located 1km north of the site and the River Purwell is located approximately 1.2km north-east of the site. There is one active and one historical surface water abstraction identified within 1km of the site. • William Ransom and Sons between 835m and 1.1km south from the site, licensed to abstract water from the River Hiz for cooling. Status: Current. • G W Russell & Son 720m south east of the site, licensed to abstract water from the River Hiz for cooling. Status: Revoked. There are a further 4 additional current surface water abstractions between 1km and 2km from the site.

3.4. Preliminary Conceptual Site Model

Following review of the available data regarding site history, environmental setting, and proposed future use, a preliminary CSM was developed, as presented in Table G below. The CSM illustrates the potential sources, pathways and receptors for the evaluation of potential risk at the site.

Table G: Human Health			
Source	Pathway	Receptor	Likelihood of Potentially Significant Pollutant Linkage
Potentially impacted shallow soils / groundwater from the site and identified potential off-site sources (AST and Garage)	Vapours - Migration of hydrocarbon vapours through made ground to above ground buildings	On-site shop staff	Unlikely – vapour data collected in the December Comp ESA (Ref.2) was not reported above the Stage 2 GAC
		Off-site workers in garages adjacent to the west and 5m north of the site and hotel 5m south of the site	
		Occupants in residential properties adjacent the southern site boundary, 30m to the north of the site and 20m to the west of the site	
	Particulate - Ingestion, inhalation, dermal contact, with soil particulates	Visiting contractors excavating ground	Unlikely – The use of personal protective equipment by contractors excavating ground would break the pathway between source and receptor. As the majority of the site is covered in hardstanding it is unlikely visitors and shop workers would come into contact with impacted soil.
		On-site employees of the retail petroleum shop and site visitors	
	Permeation of hydrocarbon substances through plastic potable water supply pipes	On-site shop staff (ingestion of drinking water on-site)	Unlikely – Potable water samples collected in 2011 showed no impact and significantly impacted soils have not been encountered at the site.

Table H: Controlled Waters			
Source	Pathway	Receptor	Pollutant Linkage
Potentially impacted soils / groundwater from the site and identified potential off-site sources	Leaching - Migration of COPC from soils into groundwater.	Groundwater within The Zig Zag Chalk Formation (Bedrock) Principal Aquifer and Superficial Deposits that border the site boundary.	Potential Linkage
	Migration of impacted perched water into shallow and deeper groundwater.		Potential Linkage
	Leaching - Migration of COPC from soils into shallow groundwater, followed by migration to surface water	Bearton Pond Located approximately 200 m north of the site. The River Hiz is located approximately 850m east of the site, the River Oughton located 1km north of the site and the River Purwell located approximately 1.2km north-east of the site.	Unlikely (Bearton Pond) – groundwater flow has been calculated to the east of the site, Bearton Pond is cross gradient of the site.
	Migration of impacted perched water into shallow groundwater, followed by migration to surface water		Unlikely (River Oughton, Purwell and Hiz) - based on distance of the river from the site.

4. LABORATORY ANALYTICAL RESULTS

4.1. Analytical Schedules & QA/QC

Table I: Analytical Information			
Analytical Laboratory	Analytical samples were analysed by Alcontrol Laboratories of Chester. Copies of the Chain of Custodies (COCs) and laboratory certificates are presented in Appendix D and E respectively.		
Analytical Schedule	The following schedule of analysis was completed for this ESA, Appendix E provides the results and details of the analytical methodology		
	Analysis	Number of soil samples	Number of groundwater samples
	Total Petroleum Hydrocarbon (TPH) Health Risk Assessment Fractions	5	12
	Polycyclic Aromatic Hydrocarbons (PAHs)	5	12
	Benzene, toluene, ethylbenzene, xylenes (BTEX), TPH, 6 Fuel Oxygenates (methyl tertiary butyl ether (MtBE), tert-butyl ethyl ether (ETBE), di-isopropyl ether (DIPE), tert butanol (TBA), tert-amyl methyl ether (TAME), Ethanol)	5	12
	Heavy metals	5	n/a
Field Quality Control Sampling	The analytical data have been reviewed for quality assurance and control purposes (QA/QC), and the results of these reviews are documented on the data validation forms included in Appendix F. Holding times for soil samples exceeded the seven day holding time by one day for one samples collected. The relative percentage difference (RPD) between detected concentrations in the groundwater duplicate sample (DUP01) and its parent (BH102) were within acceptable limits. In general, the data are considered appropriate for reporting.		
Laboratory Quality Control Sampling	Results of laboratory quality control sampling suggest that the results obtained are suitable for use for this ESA.		

5. STAGE 2 GENERIC QUANTITATIVE RISK ASSESSMENT

5.1. Introduction

The risk based methodology adopted in this report is based upon the UK DEFRA and EA "best practice" in regard to the assessment of contaminated land. An overview of the methodologies adopted as part of this assessment is provided in URS Technical Document 'Shell UK Controlled Waters & Human Health Risk Assessment Method'¹. The approach taken reflects that promoted in CLR11² and R&D Publication 66³ and the supporting guidance referenced within them.

5.1.1. On-site Scenario

URS has screened the soil, groundwater and vapour data collected in September and October 2011 against URS generic assessment criteria (GAC) for:

- Human Health: Continued Petroleum Use (CPU), protective of on-site petroleum workers.
- Controlled waters receptors (protective of the Chalk Principal aquifer and Secondary A aquifer underlying the site).

The human health CPU GAC are derived assuming vapour only pathways are viable, and that there is no risk of exposure to soil impact via direct contact pathways including dermal contact and dust inhalation/ingestion as the site is fully covered in hardstanding/building footprint. From the URS site walkover the site was found to be covered in 100% hard standing and the human health CPU assessing vapour inhalation pathways only are therefore considered appropriate to use.

The URS human health GAC were derived assuming soils beneath the site typically contained 0.58% total organic carbon (TOC). Values for TOC in unsaturated soil samples collected from the site by URS ranged from 0.2% to 2.09% with an average of 0.73%, which is greater than that used in the derivation of the GAC. Consequently, the human health screening criteria are conservative when applied to the site and may over-estimate potential risks to the identified human health receptors.

The reported analyte concentrations in soil and groundwater samples that exceed the GAC are highlighted in **Appendix H, Tables 1 to 4**.

¹ URS Technical Document – 'Shell UK Controlled Waters & Human Health Risk Assessment Method', Dated September 2010, Ref: Issue 1.

² Model Procedures for the Management of Land Contamination, Contaminated Land Report (CLR) 11, Environment Agency & DEFRA, Dated September 2004.

³ Guidance for the Safe Development of Housing on Land Affected by Contamination, R&D Publication 66: 2008 (Volume 1), NHBC and the Environment Agency 2008.

5.1.2. Off-site Scenario

The land use in the vicinity of the site which is potentially more sensitive than the on-site CPU scenario is considered to be the low density residential houses with gardens located approximately 20m west of the site and Firs Hotel located approximately 5m from the southern site boundary.

URS has screened the soil, groundwater and vapour data collected in September and October 2011 against URS generic assessment criteria (GAC) for:

- Human Health receptors: High Density Residential (HDR) GAC protective of off-site residents to the west of the site and live-in hotel staff in Firs Hotel to the south of the site.
- Controlled waters receptors (protective of the Chalk Principal aquifer and Secondary A aquifer underlying the site).

The human health HDR GAC are derived assuming vapour only pathways are viable, and that there is no risk of exposure to soil impact via direct contact pathways including dermal contact and dust inhalation/ingestion as the site is fully covered in hardstanding/building footprint. It is assumed that soil sources only extend to the site boundary. From the URS site walkover the site was found to be covered in 100% hard standing and the human health HDR GAC assessing vapour inhalation pathways only are therefore considered appropriate to use.

The URS human health HDR GAC were derived assuming soils beneath the site typically contained 0.58% total organic carbon (TOC). Values for TOC in unsaturated soil samples collected from the site by URS ranged from 0.2% to 2.09% with an average of 0.73%, which is greater than that used in the derivation of the GAC. Consequently, the human health screening criteria are conservative when applied to the site and may over-estimate potential risks to the identified human health receptors.

The reported analyte concentrations in soil and groundwater samples that exceed the GAC are highlighted in **Appendix H, Tables 1 to 4**.

5.2. Soil Analytical Results

Soil results are screened against GAC in **Appendix H - Table 1 and 2**. The GAC selected for comparison with soil analytical results are the following:

- Human Health: Continued Petroleum Use (CPU) protective of on-site workers.
- Human Health: High Density Residential GAC protective of off-site residents to the north and west of the site and live-in hotel staff in Firs Hotel to the south of the site.
- Controlled Waters: Drinking Water Standards (DWS) protective of the Chalk Principal aquifer and Secondary A aquifer underlying the site

The following soil results are deemed to be potentially significant for the stated objective of this ESA:

Human Health – CPU protective of on-site workers

No Soil Concentrations were reported above the CPU GAC protective of on-site workers in any of the soil samples collected and analysed during the September 2011 and February 2012 intrusive works.

Human Health – HDR GAC protective of off-site residents

Naphthalene concentrations were reported in excess of the Stage 2 HDR GAC in shallow soil samples collected from BH105 and BH106 during the September 2011 drilling works. BH105 exceeded the GAC by a factor of 5.1, BH106 exceeded by a factor of 7.1.

Controlled Waters

It should be noted that the laboratory reporting limits for cadmium, hexavalent chromium, mercury, several PAH compounds, DIPE, MTBE, TBE, and aromatic TPH >C6-C7 exceeded the respective controlled waters GAC. This does not significantly affect interpretation of the data because the controlled waters GAC are conservative and the GAC are generally within one order of magnitude of the laboratory reporting limits.

- Concentrations of 11 or more PAH compounds were detected in excess of the GAC derived to be protective of controlled waters in three of the soil samples analysed from September 2011. Greatest exceedances were found in a shallow soil sample collected from BH105 which failed the GAC by over three orders of magnitude.
- Concentrations of 4 or more metals were detected in excess of the controlled waters GAC in three of the soil samples analysed from September 2011.
- Reported soil concentrations of benzene exceeded the controlled waters GAC in a shallow soil sample collected in September 2011 from BH105 at 0.6m bgl.
- Multiple TPH bands in soils exceeded the controlled waters GAC in 10 soil samples collected in September 2011 and in 5 soil samples collected in February 2012.

5.3. Groundwater Analytical Results

Groundwater results collected during the October 2011, February 2012 and January 2013 monitoring events are screened against GAC in **Appendix H – Tables 3 and 4**. The assessment criteria selected for comparison with soil analytical results are the following:

- Human Health: Continued Petroleum Use (CPU) protective of on-site workers.
- Human Health: High Density Residential GAC protective of off-site residents to the north and west of the site and live-in hotel staff in Firs Hotel to the south of the site.

- Controlled Waters: Drinking Water Standards (DWS) protective of the Chalk Principal aquifer and Secondary A aquifer underlying the site.

Human Health – CPU protective of on-site workers

Based on the generic screening, reported groundwater concentrations from the October 2011, February 2012 and January 2013 groundwater monitoring rounds did not exceed the CPU human health GAC protective of on-site workers.

Human Health – HDR GAC protective of off-site residents

Two groundwater samples collected and analysed from BH102 in October 2011 and February 2012 located approximately 7m from the pump islands exceeded the human health HDR GAC for Benzene by a factor of 1.3 and 1.0. The samples also had reported TPH Hazard Indices (HI) of 3.1 and 3.2 respectively which exceeded the Stage 2 target value of 1. A sample collected from BH102 in January 2013 also exceeded the TPH HI by a factor of 4.59.

Controlled Waters

- Concentrations of benzene, ethylbenzene and xylenes were reported in excess of the Stage 2 controlled waters GAC from samples collected and analysed from BH102 in October 2011, February 2012 and January 2013.
- Naphthalene was reported at concentrations of 175µg/l, 289µg/l and 560 µg/l from groundwater samples collected from BH102 in October 2011, February 2012 and January 2013 which exceeded the DWS of 1µg/l.
- Multiple TPH bands exceeded the Stage 2 controlled waters GAC in three sample collected and analysed from BH102 in October 2011, February 2012 and January 2013.
- Concentrations of COPC in BH102 varied across the three sampling rounds, although for the majority of COPCs the maximum concentrations were detected in the January 2013 sampling round. As groundwater levels were approximately 0.5m higher in January 2013 than earlier GME the increases may relate to remobilisation of COPC from a smear zone.
- Benzene (and equivalent TPH aromatic C5 – C7) concentrations in BH102 did not increase in January 2013 with concentration in January 2013 substantially lower than those measured in earlier October 2011 and Feb 2012 GME. Benzene was not reported above the laboratory detection limit in any of the other on-site monitoring wells in all three sampling events at the site.

5.4. Further Assessment of Risks to Human Health

The COPC which exceeded controlled waters GAC have been further assessed in the DQRA presented in Section 7 of this report.

Reported concentrations of naphthalene from soil samples collected from BH105 at 0.5m and BH106 at 0.6m bgl have not been assessed further for potential human health risks to off-site residents for the following reasons:

- 1) The primary exposure pathway for risks to off-site residents from naphthalene in shallow soils is via vapour migration and subsequent inhalation. The nearest residents to the site are located approximately 5m from the southern boundary of the site in a hotel. The soil impacts identified at BH105 and BH106 are located approximately 20m and 35m respectively north of these off-site residents. The potential attenuation of vapours over a minimum compliance point distance of 20m has also not been included within the generic assessment. This would be expected to result in significant vapour attenuation and resultant significant decrease in potential risk.
- 2) The data from on-site vapour wells (VP101 to VP103) in the December Comprehensive ESA (Ref. 2) are three orders of magnitude lower than the soil vapour GAC. The results from VP103 provide an indication of the degree to which the soil GAC overestimates vapour intrusion risk at this particular site.
- 3) The site-specific TOC values were higher than the TOC values used to generate the URS human health GAC (0.58%). As such, vapours theoretically partitioning from soils would be expected to be lower than predicted for GAC.

Reported concentrations of benzene and TPH from groundwater samples collected and analysed from BH102 have not been assessed further for potential human health risks to off-site residents for the following reasons:

- 1) The groundwater GAC were derived assuming a depth to the groundwater table of 1.0m bgl. The geometric mean depth to groundwater measured by URS in January 2013 was 6.20m bgl. As such, the CSM assumed for the GAC is likely to overestimate potential risks relative actual conditions present at the site. A greater unsaturated zone thickness will typically allow a greater degradation of vapours and ground gas oxygen concentrations appear indicative of such degradation conditions.
- 2) The primary exposure pathway for risks to off-site residents from benzene and TPH in groundwater is via vapour migration and subsequent inhalation. The average depth to groundwater at the site is 6.20m bgl. The nearest residents to the site are located approximately 5m from the southern boundary of the site in the Firs Hotel. The groundwater impacts identified at BH102 are located approximately 25m north of these off-site residents. The potential attenuation of vapours over a minimum compliance point distance of 25m has also not been included within the generic assessment. This would be expected to result in significant vapour attenuation and resultant significant decrease in potential risk.
- 3) The data from on-site vapour wells (VP101 to VP103) are three orders of magnitude lower than the soil vapour GAC. The results from VP102, located 12m south of BH102, provides an indication of the degree to which the groundwater

GAC overestimate vapour intrusion risk at this particular site. Furthermore, the soil and groundwater GAC assume no degradation. Ground gas results show oxygen above the critical 5% and hence biodegradation is likely to be occurring at the site.

- 4) The site-specific TOC values were higher than the TOC values used to generate the URS human health GAC (0.58%). As such, vapours theoretically partitioning from soils would be expected to be lower than predicted for GAC.

6. CONCEPTUAL SITE MODEL

6.1. Introduction

The CSM presented in this section is based on the preliminary CSM described in the URS Phase 1 Site Investigation and on observations made during the URS site investigation activities.

For a risk from a given source to be considered plausible, a mechanism (or 'pathway') must be present by which COPC can reach a given receptor. Such complete Source ⇒ Pathway ⇒ Receptor (SPR) exposure mechanisms are commonly termed 'pollutant linkages'.

The CSM presented in Sections 6.2 and 6.3 below is intended as a means of identifying and describing the potential pollutant linkages at the site. Potentially *significant* pollutant linkages will be listed in Section 6.4 and will be investigated further as part of the Stage 3 DQRA.

6.2. Human Health CSM

Sources, pathways and receptors relevant to the Stage 3 human health (HH) DQRA receptors are summarised in Table J below:

Table J: Overview of HH Sources, Pathways and Receptors		
Potential Source(s)	Potential Pathway(s)	Potential Receptor(s)
No soil or groundwater source identified at Stage 2.	Inhalation of vapours (indoor and outdoor)	On site workers during future construction

Key observations with regard to viable pollutant linkages at the subject site are as follows:

- Areas of exposed soils were not identified at the subject site. Therefore, assuming continued use as a CPU and retention of the current layout, exposure to COPC via dermal contact, dust and/or ingestion is considered unlikely.

Reported concentrations of COPC in soils and groundwater were not reported above the Stage 2 CPU or Residential GAC. As such, Stage 3 HH DQRA modelling was not undertaken.

6.3. Controlled Waters CSM

Sources, pathways and receptors relevant to the Stage 3 controlled waters (CW) DQRA are summarised in Table K below and presented on Figure 4.

Table K: Overview of CW Sources, Pathways & Receptors

Potential Source(s)	Potential Pathway(s)	Potential Receptor(s)
Impacted Soils (above URS Stage 2 CW GAC) Impacted Groundwater (above URS Stage 2 CW GAC)	• Partitioning between soil and pore water; • Infiltration of impacted pore water down to the saturated zone (water table); • Dilution of impacted pore water within the saturated zone; and • Horizontal migration of impacted groundwater.	• Zig Zag Chalk (Principal aquifer) • Superficial Deposits (Secondary A aquifer)

6.3.1. Source Areas

Potential source areas assessed as part of the Stage 3 CW DQRA are as follows:

- Soil Source 1 – Multiple TPH fractions were reported at concentrations above their respective Stage 2 CW GAC in soil samples collected from across the site analysed for these parameters. Therefore a site-wide 35m x 33m source area has conservatively been assumed for Soil Source 1.
- Soil Source 2 – PAH compounds and heavy metals (arsenic, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, tin, and zinc) were reported at concentrations above their respective Stage 2 CW GAC in soil samples collected from BH101, BH103 BH105, and BH106. A 25m x 30m source zone has been assumed.
- Soil Source 3 – benzene was reported at concentrations in excess of its respective Stage 2 CW GAC in one soil sample collected and analysed from BH105 which is located north of the tank farm. Given the distance to adjacent borings where these COPC were not reported within shallow or deep soils above the Stage 2 CW GAC, a 10m by 10m source zone has been assumed for Soil Source 3.
- Groundwater Source 1 – reported concentrations of BTEX, naphthalene and TPH bands exceeded the Stage 2 controlled waters GAC at BH102. Given the distance to adjacent borings where these COPC were not reported within groundwater above the Stage 2 CW GAC, a 10m by 10m source zone has been assumed for Soil Source 2.

For the majority of COPC the maximum reported concentrations were from the most recent groundwater sampling event in January 2013 and these have therefore been used as source concentrations for the model. For benzene (and equivalent TPH aromatic C5 – C7) concentrations were substantially lower in January 2013, so for these COPC the geomean of the results from October 2011, February 2012 and January 2013 were used as source concentrations for the model.

6.3.2. Pathways

Migration pathways that are considered viable at the site are listed for each of the models in sections 6.3.5 and 6.3.6 below.

6.3.3. Receptors

The principal controlled waters receptor for the site is considered to be the underlying Zig Zag Chalk Principal aquifer. Groundwater within the superficial deposits is also considered to be a secondary receptor and has been modelled separately. The surface water features in the vicinity of the site which consist Bearton Pond approximately 200m north and cross gradient of the site, the River Hiz, located approximately 850m east of the site and the River Oughton and River Purwell, located greater than 1km north/north-east of the site, and not considered as potential receptors based on their distance from the site.

Potential risks to groundwater underlying the site have been further assessed using two separate models:

- Model 1: Groundwater in the Chalk - Primary Receptor
- Model 2: Groundwater in the Drift Deposits – Secondary Receptor

Details of the key parameters and their rationale used in each model are summarised below.

6.3.4. Sensitivity Analysis

URS CW DQRA is run using a model which has probabilistic inputs similar to those used in ConSim. A probabilistic assessment enables the risk assessor to incorporate an element of uncertainty in the parameter values used and also provides the output of the assessment at various confidence limits. For each parameter a range of values can be inputted which reflect not only the best estimate value but also the minimum and maximum values considered likely to be present based on either site or literature data. The model is then run 1000 times, with values chosen from within the range for each parameter on each run. A range of simulated concentrations at the receptor is provided. The 50th %ile simulated concentrations represent the concentrations simulated in 50% of the runs, and depending on the parameter ranges used, is often similar to that derived using solely best estimate values. The 95th %ile simulated concentrations represent the concentrations simulated in 95% of the 1000 runs, and represent a conservative worst case.

Although the model simulates concentrations at various timeslices the steady state concentrations have been assessed as no depletion of the sources has been considered.

6.3.5. Model 1: Groundwater in the Chalk

Local flow in the Chalk Principal aquifer in the area has been inferred towards the east towards the River Hiz which feeds into the River Purwell. The 1:50,000 geological map indicates that the increasingly thick drift sequence may be directly underlain by the Gault Clay, with the Lower Chalk absent, within 300m of the west of the site, and within 1km to the north and north east.

Groundwater flowing laterally in the Chalk in the area of the site is therefore likely to discharge laterally to the drift sequence, as the top of the Chalk becomes increasingly deeper, for example the groundwater in the Chalk on site is assumed to flow eastwards with a gradient of approximately 0.005 at approximately 6.2m bgl however the depth to the Chalk increases from 5.4m bgl in the western area of the site to 14.2m bgl at BH102A located in the eastern area of site.

Groundwater in the underlying Zig Zag Chalk formation has been selected as the primary compliance point for this assessment and has been modelled assuming that impacted pore water from soils and groundwater could migrate into the Principal aquifer at a rate equal to infiltration, followed by horizontal migration within the aquifer. A Compliance Point of 50m has been selected to model the potential risks from hazardous substances to groundwater. This assessment is considered appropriate for soils, as it effectively assumes that impacted soils directly overlie the Chalk, and disregards any dilution and attenuation in the drift.

It should be noted that impacted groundwater was only encountered within the superficial deposits at BH102. COPC in groundwater sampled from the deeper drift at BH102A located 3m west of BH102 was not reported above the laboratory detection limit. Groundwater in the drift at BH102 and the deeper drift at location BH102A is separated by a 1.3m clay band. Although this is the only well which extended to this depth, the presence of a vertical gradient between these two wells suggests that either this clay is widespread, or that further dilution would occur in the drift before groundwater migrated to the Chalk if the clay was absent.

As Clay was not encountered in the western area of the site where Chalk was logged as high as 2.8m bgl in BH106A, the model assumes that no clay layer is present at the site, and assumes that impacted groundwater from the drift could migrate into the Principal aquifer at a rate equal to infiltration. The rate of groundwater flow in the Chalk has then been estimated to allow a dilution factor to be calculated appropriate to impacted groundwater migrating from the drift into the Chalk and being diluted by the greater volume of flow in the major aquifer.

Key Uncertainties

Conservative assumptions have been made about the groundwater flow in the Chalk, with an assumed hydraulic gradient of 0.005 estimated from Hydrogeological map (Cambridge to Maidenhead) and calculated from groundwater beneath the site, and an assumed effective thickness of 10m. A smaller mixing zone thickness of 3.6m, has also been considered based on the size of the site and the hydraulic properties of the Chalk. Hydraulic conductivity has been set at 8.5m/day based on site specific conductivity tests within the Chalk at BH105A (7.5 m/d) and discussion with the EA. The rate at which impacted groundwater from the drift could migrate into the Principal aquifer is not known but has been assumed to equal infiltration.

Modelled Pathways

Migration pathways that have been modelled for the Chalk include:

- Leaching of COPC from unsaturated soils beneath the site into the pore water;
- Infiltration of impacted pore water directly into the Chalk (assuming that drift is absent) and dilution within the saturated zone in the Chalk followed by horizontal migration within the Chalk aquifer;
- Vertical migration of impacted groundwater in the drift into the underlying Chalk formation, dilution within the groundwater in the Chalk, followed by horizontal migration within the Chalk aquifer.

The key parameters input into the chalk model are summarised in Table L below:

Table L – Summary of Key Parameters used in the Chalk Model					
Parameter	Units	Best Estimate Value Modelled	Minimum Value Modelled (5%)	Maximum Value Modelled (95%)	Source / Comment
Horizontal Hydraulic Conductivity of Chalk Aquifer	m/d	8.5	4.3	17.0	Estimated from slug test data from the Chalk in BH105A and discussion with the EA.
Hydraulic Gradient of Chalk Aquifer	-	0.005	0.0025	0.0075	Estimated from Hydrogeological map (Cambridge to Maidenhead) and on-site data
Mixing Zone in Chalk	m	10 and 3.6	-	-	Mixing zone assumed to be 10m in thickness, based on the 10m change in elevation of the Chalk surface across the site. A smaller mixing zone thickness of 3.6m, has also been considered based on the size of the site and the hydraulic properties of the Chalk.
Groundwater flow in chalk per unit width	m²/a	156 and 56.8	-	-	Based on deterministic calculation using best estimate parameters above.
Assumed vertical flow from drift into Chalk for 10m source per unit width	m²/a	0.58	-	-	Based on infiltration rate of 10% of 584 mm/a
Dilution factor for the 10m long source groundwater source	-	268.5 (10m mixing zone) and 98.4 (3.6m mixing zone)			Based on deterministic calculation using best estimate parameters above and different mixing zone thicknesses.

Table L – Summary of Key Parameters used in the Chalk Model

Parameter	Units	Best Estimate Value Modelled	Minimum Value Modelled (5%)	Maximum Value Modelled (95%)	Source / Comment
Organic Carbon in Chalk Aquifer	%	0.05	0.02	0.12	R&D Technical Report P2-228/TR
Aerobicity	-	Aerobic Conditions	-	-	Aerobic degradation rates selected based on site specific data.
Screening Criteria	-	DWS			Protective of the Chalk Principal Aquifer
Compliance	-	50 m			50m Compliance selected for Hazardous Substances in a Principal Aquifer.

6.3.6. Model 2 - Groundwater in the Drift Deposits

Groundwater in the superficial deposits underlying the site has been selected as the secondary compliance point for this assessment. The superficial deposits of the Lowestoft Formation have been described by the EA as unproductive strata. However, the Lowestoft Formation is shown on the 1:50,000 geological map to be underlain and surrounded by Glaciofluvial Deposits (classified as a Secondary-A aquifer), which outcrop within 25m of the west of the site. For the purpose of this assessment it has been conservatively assumed that the wells installed in the drift are installed in a Secondary-A aquifer, as the vertical and horizontal extent of the Lowestoft Formation and Glaciofluvial Deposits is not known.

The site is close to the edge of a significant buried valley feature with drift deposits reaching up to 80m in thickness within 1km to the north-west, north and north-east of the site.

Although the drift deposits are considered a controlled waters receptor, there are physical constraints on the ability to use the groundwater resource. The exploitation potential of the drift deposits beneath the site is considered likely to be low for the following reasons:

- Field tests indicate the drift deposits below the site are only slowly permeable (refer to **Appendix I**, hydraulic conductivity ranges between 0.15 m/d to 1.91 m/d);
- There are no reported licensed groundwater abstractions within 1km of the site and no reported private groundwater abstractions within 2km of the site. The nearest surface water abstraction is located 835m south of the site; and

- The down-gradient area is a residential area with mains water supply.

An arbitrary Compliance Point of 50m in the drift deposits has been selected to be protective of the Secondary-A aquifer, however due to the low exploitation of the aquifer an extended compliance point of 100m has also been considered in the assessment to provide an indication of potential risks to the wider aquifer.

Modelled Pathways

Migration pathways that are considered viable at site include:

- Leaching of COPC from unsaturated soils beneath the site into the pore water;
- Infiltration of impacted pore water to the water table and dilution within the saturated zone; and
- Horizontal migration of impacted groundwater within the superficial deposits, which directly underlies the site.

The key parameters input into the drift deposits model are summarised in Table M below:

Table M – Summary of Key Parameters used in the Horizontal Drift Deposits Model					
Parameter	Units	Best Estimate Value Modelled	Minimum Value Modelled (5%)	Maximum Value Modelled (95%)	Source / Comment
Organic Carbon in Unsaturated Zone	%	0.73	0.37	1.10	Geomean of 13 samples from BH101, BH102, BH103, BH105, BH106 & VP101 - 103.
Organic Carbon in Saturated Zone	%	0.2	0.1	0.3	Site specific TOC results taken from soil samples from BH102A collected at 13.2m and 13.6m bgl in saturated zone.
Depth to Groundwater / Soil Source Thickness	m	6.20	3.10	12.40	Average depth to groundwater measured between December 2012 and January 2013 at the site. Soil source assumed to extend to groundwater level
Saturated Aquifer thickness	m	3	2.25 m	3.75 m	3m thickness based on BH102A where groundwater was encountered at 7m bgl and CLAY was encountered at 10m bgl.

Table M – Summary of Key Parameters used in the Horizontal Drift Deposits Model					
Parameter	Units	Best Estimate Value Modelled	Minimum Value Modelled (5%)	Maximum Value Modelled (95%)	Source / Comment
Hydraulic Conductivity of Aquifer	m/day	0.38	0.08	1.9	Calculated from the mean of slug test data from BH101, BH102, BH102A, BH103.(Refer to Appendix I for details)
Hydraulic Gradient	m/m	0.0075	0.0038	0.0113	A gradient of 0.005 has been calculated for the site from monitoring wells screened in the Chalk and drift deposits in continuity with the Chalk. The gradient in the drift will be higher but cannot be measured with the current on site network. A gradient of 0.0075 has been assumed based on likely gradient over catchment to river.
Porosity of Aquifer	%	0.2	0.1	0.3	Calculated based on porosity values from Fetter 1986
Aerobicity	-	Aerobic Conditions	-	-	Aerobic degradation rates selected based on site specific data.
Screening Criteria	-	DWS	-	-	Protective of the Chalk Principal Aquifer
Modelled Compliance Point	m	50	50	250	50m Compliance selected for Hazardous Substances, 250m for non-hazardous substances

6.3.7. Summary of Viable Pollutant Linkages

Potentially viable Controlled Waters pollutant linkages modelled as part of this assessment are summarised in Table N below:

Table N – Modelled CW Sources, Pathways and Receptors			
Assessment	Source	Pathway(s)	Receptor
Chalk Model – Horizontal and Vertical Migration into the Chalk Principal Aquifer (50m)			
CW Pollutant Linkage No. 3	Impacted Soils (above URS Stage 2 CW GAC)	• Partitioning between soil and pore water • Infiltration of impacted pore water down to the saturated zone assuming drift absent • Dilution of impacted pore water within the saturated zone • Horizontal migration of impacted groundwater	• Groundwater within the Zig Zag Chalk Formation bedrock (Principal aquifer).
CW Pollutant Linkage No. 4	Impacted groundwater (above URS Stage 2 CW GAC)	• Dilution of impacted drift groundwater within the saturated zone • Horizontal migration of impacted groundwater.	
Drift Deposits Model – Horizontal Migration within the Drift Deposits Secondary-A Aquifer (50m)			
CW Pollutant Linkage No. 1	Impacted Soils (above URS Stage 2 CW GAC)	• Partitioning between soil and pore water • Infiltration of impacted pore water down to the saturated zone (water table) • Dilution of impacted pore water within the saturated zone • Horizontal migration of impacted groundwater	• Groundwater within the drift deposits (Secondary-A aquifer)
CW Pollutant Linkage No. 2	Impacted groundwater (above URS Stage 2 CW GAC)	• Horizontal migration of impacted groundwater.	

Results from the Stage 3 assessment of the sources detailed above are presented in Section 7.2. Stage 3 CW DQRA model parameters and rationale are provided in Tables N and O and in **Appendix G**.

7. STAGE 3 DQRA

7.1. Introduction

The principal controlled waters receptor for the site is considered to be the underlying Zig Zag Chalk Principal Aquifer. Groundwater within the superficial deposits is also considered to be a secondary receptor and has been modelled separately.

Results of the Stage 3 CW DQRA are presented and discussed below.

Outputs from the Stage 3 CW model are presented in **Appendix G**. Soil and groundwater data are presented with the applicable SSAC in **Appendix A Tables 2 - 4**.

7.2. Stage 3 Controlled Waters DQRA Results

Table O: Summary of Stage 3 CW DQRA Results at 50m Compliance Point							
Linkage No.	Source	Receptor	Metals	BTEX	Oxy- genates*	PAH	TPH
CW Pollutant Linkage No. 1	Impacted Soils (above URS Stage 2 CW GAC)	Principal aquifer (Chalk)	x	x	x	✓	x
CW Pollutant Linkage No. 2	Impacted Groundwater (above URS Stage 2 CW GAC)	Principal aquifer (Chalk)	x	x	x	x	x
CW Pollutant Linkage No. 3	Impacted Soils (above URS Stage 2 CW GAC)	Secondary A aquifer (superficial deposits)	x	x	x	x	x
CW Pollutant Linkage No. 4	Impacted Groundwater (above URS Stage 2 CW GAC)	Secondary A aquifer (superficial deposits)	x	✓	x	x	x

Note

* - Includes MtBE, ETBE, DIPE, TBA, TAME and Ethanol.

N/A - not modelled as no risks generated at Stage 2

x - Significant risk not identified.

✓ - Potentially significant risk identified.

The following COPC and/or COPC groups were simulated by the Stage 3 CW DQRA model to present a theoretical risk to the identified CW receptors:

7.3. Model 1. Groundwater in the Chalk

7.3.1. Soil

Of the COPC groups assessed, naphthalene and fluoranthene were simulated to present a theoretical risk to the Principal aquifer at a 50m compliance point considering a 3.6m mixing zone. However it is noted that current UK drinking standards have not been published for either of these COPCs, and that a conservatively large source size has been assumed.

At 95% confidence the simulated concentration for naphthalene at the 50m compliance point was calculated as 15.2ug/l which exceeds the GAC which has adopted the Irish IGTV of 1ug/l. Simulated concentrations of naphthalene at a 100m compliance point exceeded the GAC with a marginal HI of 3.45.

At 95% confidence the simulated concentration for fluoranthene at the 50m compliance point was calculated as 0.7ug/l, which exceeds the now withdrawn EEC MAC 180 of 0.2µg/l.

If additional dilution is considered within a 10m mixing zone, the hazard indices of the simulated concentrations decrease proportionally, indicating a marginal risk of naphthalene exceeding the GAC at 50m, and no risk of fluoranthene exceeding the withdrawn EEC MAC.

No other risks were simulated from vertical migration of soil sources to the underlying Principal Chalk aquifer at a 50m compliance point.

7.3.2. Groundwater

Based on a 10m assumed mixing zone thickness the simulated concentrations of COPC in groundwater in the Chalk after dilution only marginally exceed the GAC, with Hazard Indices of 2.87 for benzene, 4.63 for xylene and 2.09 for naphthalene. Simulated concentrations at 50m are below the GAC.

Based on a 3.6m assumed mixing zone thickness, the simulated concentrations of COPC in groundwater in the Chalk after dilution do exceed the GAC. Hazard Indices of 7.8 for benzene, 12.6 for xylene and 5.7 for naphthalene were calculated. A 3.6m assumed mixing zone thickness may be more appropriate thickness for the limited extent of impact on the site, although it is noted that the upper metres of the Chalk encountered in the investigation were heavily weathered and the hydraulic parameters in Table K may therefore be over conservative.

The DQRA was then run using the 3.6m mixing zone diluted concentrations to simulate concentrations for these COPC at the 50m compliance point appropriate for hazardous COPC. The simulated concentration at 50m for benzene was approximately equal to the DWS with a concentration of 1.01µg/l,

7.4. Model 2. Groundwater in the Drift Deposits

7.4.1. Soil

Of the COPC groups assessed, cobalt was simulated to present a theoretical risk to the Secondary-A aquifer at a 50m compliance point.

Cobalt was simulated to exceed its respective Water Target Values (WTVs) after 1,000 years following the start of the simulation with a Controlled Waters Hazard Index (CWHI)

of 7.83. On the basis of travel time, cobalt is not considered to represent a significant risk. It should be noted that with respect to simulated controlled waters exceedances for heavy metals, the model typically over estimates leaching of inorganics from soil.

7.4.2. Groundwater

Of the COPC groups assessed, groundwater concentrations of benzene⁴ from BH102 were simulated to present a theoretical risk at the 50m compliance point protective of the Secondary-A aquifer at a 95% confidence level. Exceedances are simulated to occur within two years at the 50m compliance point, with steady state concentrations within ten years. At 95% confidence the CWHI at the 50m compliance point at steady state was calculated at 12.0. At the 50th percentile ('most likely'), the model did not simulate a risk from concentrations of benzene at the 50m compliance point with an HI of 0.371. Simulated concentrations of benzene (including C₅-C₇ aromatics) at a 100m compliance point did not exceed the WTV with an HI of 0.766.

It has been assumed that the aquifer is aerobic based on the geology, depth to groundwater, ferrous iron, nitrate and sulphate concentrations and field groundwater measurements.

Although the drift deposits are considered a controlled waters receptor, there are physical constraints on the ability to use the groundwater resource. The exploitation potential of the drift deposits beneath the site is considered likely to be low because:

- Field tests indicate the drift deposits below the site are only slowly permeable (ranges between 0.15 m/d to 1.91 m/d);
- There are no reported licensed groundwater abstractions with 1km of the site and no reported private groundwater abstractions within 2km of the site; and
- The down-gradient area is a residential area with mains water supply.

Given the low exploitation potential of the aquifer, an extended compliance point of 100m is considered appropriate. As no risks are simulated at the 95th percentile (worst case) at the extended compliance point, or at the 50th percentile ('most likely'), at the 50m compliance point, from a conservative DQRA, the theoretical risks simulated by the model are considered unlikely to pose a significant risk to controlled waters in the drift.

Outputs from the Stage 3 CW DQRA model including CWHI and SSAC are presented in **Appendix G**.

7.5. Remedial Targets

Soil remedial targets for known and currently un-known potentially impacted ground at the site have been derived from Model 1: Groundwater in the Chalk. This is considered

⁴ Also includes TPH aromatics <C5-C7 (benzene) exceedances in the model output.

appropriate for soils, as it effectively assumes that any impacted soils directly overlie the Chalk, and disregards any dilution and attenuation in the drift.

Remedial targets for groundwater in the Chalk and groundwater in the drift deposits are summarised below.

Remedial target values for the site are summarised in Table P below.

Table P - Remedial Targets at a 50m compliance point			
Determinand	Soil (mg/kg)	Groundwater in Chalk (µg/l) assuming a 3.6m mixing zone with a calculated dilution factor of 98.4	Groundwater in drift (µg/l)
Benzene	1.21E-01	7.47E+02	6.37E+01
Toluene	7.73E+01	>Sol	>Sol
Ethylbenzene	7.62E+01	>Sol	>Sol
Xylenes	1.33E+02	>Sol	>Sol
TPH (>EC5-7) aromatic	-	7.43E+03	6.69E+2
TPH (>EC7-8) aromatic	-	>Sol	>Sol
TPH (>EC8-10) aromatic	>Sat	>Sol	>Sol
TPH (>EC10-12) aromatic	2.46E+02	>Sol	>Sol
TPH (>EC12-16) aromatic	>Sat	>Sol	>Sol
TPH (>EC16-21) aromatic	>Sat	>Sol	>Sol
TPH (>EC21-35) aromatic	>Sat	>Sol	>Sol
TPH (>EC5-6) aliphatic	>Sat	>Sol	>Sol
TPH (>EC6-8) aliphatic	>Sat	>Sol	>Sol
TPH (>EC8-10) aliphatic	>Sat	>Sol	>Sol
TPH (>EC10-12) aliphatic	>Sat	>Sol	>Sol
TPH (>EC12-16) aliphatic	>Sat	>Sol	>Sol
TPH (>EC16-21) aliphatic	>Sat	>Sol	>Sol
TPH (>EC21-35) aliphatic	>Sat	>Sol	>Sol
Acenaphthene	>Sat	>Sol	>Sol
Acenaphthylene	1.66E+01	1.60E+04	>Sol
Anthracene	>Sat	>Sol	>Sol
Benzo(a)anthracene	>Sat	>Sol	>Sol
Benzo(a)pyrene	>Sat	>Sol	>Sol
Benzo(b)fluoranthene	>Sat	>Sol	>Sol
Benzo(g,h,i)perylene	>Sat	>Sol	>Sol
Benzo(k)fluoranthene	>Sat	>Sol	>Sol
Chrysene	>Sat	>Sol	>Sol
Dibenzo(a,h)anthracene	>Sat	-	-
Fluoranthene	7.99E+00	>Sol	>Sol
Fluorene	>Sat	>Sol	>Sol
Indeno[1,2,3-cd]pyrene	>Sat	>Sol	>Sol
Naphthalene	2.80E-01	8.74E+02	1.12E+03
Phenanthrene	>Sat	>Sol	>Sol
Pyrene	>Sat	>Sol	>Sol

7.6. Summary of DQRA

7.6.1. Model 1: Groundwater in the Chalk

Of the COPC groups assessed, soil concentrations of naphthalene and fluoranthene were simulated to present a theoretical risk to the Principal aquifer at a 50m compliance point considering a 3.6m mixing zone. At 95% confidence the simulated CWHI for naphthalene and fluoranthene were 15.2 and 3.54 respectively.

If additional dilution is considered within a 10m mixing zone, the hazard indices of the simulated concentrations decrease proportionally, indicating a marginal risk of naphthalene exceeding the IGV at 50m, and no risk of fluoranthene exceeding the withdrawn EEC MAC.

No other risks were simulated from vertical migration of soil sources to the underlying Principal Chalk aquifer at a 50m compliance point.

Based on a 3.6m assumed mixing zone thickness and a 50m compliance point simulated concentration of benzene in groundwater were approximately equal to the DWS with a concentration of 1.01 µg/l. This is not considered significant.

Based on a 10m assumed mixing zone thickness the simulated concentrations at a 50m compliance point are below the GAC.

7.6.2. Model 2: Groundwater in the Drift Deposits

No significant risks were identified from concentrations of COPC in soil to the drift deposits Secondary-A aquifer.

Of the COPC groups assessed, groundwater concentrations of benzene were simulated to present a theoretical risk at the 50m compliance point protective of the Secondary-A aquifer at a 95% confidence level with a CWHI of 12.0. At the 50th percentile ('most likely'), the model did not simulate a risk from concentrations of benzene at the 50m compliance point with an HI of 0.371. No risks were simulated from benzene at the 100m compliance point.

Given the low exploitation potential of the aquifer, an extended compliance point of 100m is considered appropriate. As no risks are simulated at the 95th percentile (worst case) at the extended compliance point, or at the 50th percentile ('most likely'), at the 50m compliance point, from a conservative DQRA, the theoretical risks simulated by the model are considered unlikely to pose a significant risk to controlled waters in the drift.

8. CONCLUSIONS

URS has undertaken an additional investigation and revised ESA and DQRA for Shell Hitchin to further assess the potentially complete pollutant linkages to Controlled Waters receptors identified in previous site investigations.

The principal conclusions of the ESA and Controlled Waters DQRA completed for both December 2011 and February 2012 investigations and January GME are summarised below:

No significant risks to human health for on site workers or off-site residents were identified as part of the investigation.

The principal controlled waters receptor for the site is considered to be the underlying Zig Zag Chalk Principal aquifer. Groundwater within the superficial deposits is also considered to be a secondary receptor and has been modelled separately. Potential risks to groundwater underlying the site have been further assessed using two separate models:

- Model 1: Groundwater in the Chalk - Primary Receptor
- Model 2: Groundwater in the Drift Deposits – Secondary Receptor

Model 1: Groundwater in the Chalk

Of the COPC groups assessed, soil concentrations of naphthalene and fluoranthene were simulated to present a theoretical risk to the Principal aquifer at a 50m compliance point considering a 3.6m mixing zone. At 95% confidence the simulated CWHI for naphthalene and fluoranthene were 15.2 and 3.54 respectively.

If additional dilution is considered within a 10m mixing zone, the hazard indices of the simulated concentrations decrease proportionally, indicating a marginal risk of naphthalene exceeding the GAC at 50m, and no risk of fluoranthene exceeding the withdrawn EEC MAC.

No other risks were simulated from vertical migration of soil sources to the underlying Principal Chalk aquifer at a 50m compliance point.

No significant risks were identified from concentrations of COPC in groundwater to the underlying Principal Chalk aquifer at a 50m compliance point.

Model 2: Groundwater in the Drift Deposits

No significant risks were identified from concentrations of COPC in soil to the drift deposits Secondary-A aquifer.

Of the COPC groups assessed, groundwater concentrations of benzene were simulated to present a theoretical risk at the 50m compliance point protective of the Secondary-A aquifer at a 95% confidence level with a CWHI of 12.0. At the 50th percentile ('most

likely'), the model did not simulate a risk from concentrations of benzene at the 50m compliance point with an HI of 0.371. No risks were simulated from benzene at the 100m compliance point.

Given the low exploitation potential of the aquifer, an extended compliance point of 100m is considered appropriate. As no risks are simulated at the 95th percentile (worst case) at the extended compliance point, or at the 50th percentile ('most likely'), at the 50m compliance point, from a conservative DQRA, the theoretical risks simulated by the model are considered unlikely to pose a significant risk to controlled waters in the drift.

9. REFERENCES

- Reference 1** GeoDelft. Tier 1 Report: Soil Gas Survey – Shell Hitchin. May 1999. C1402.SG474.8008
- Reference 2** URS, Phase 1 Environmental Site Investigation - Shell Hitchin. October 2011. R46370079-001 Final
- Reference 3** URS, Comprehensive Environmental Site Assessment - Shell Hitchin. January 2012. R46370079-002 Final Draft

Figures

Figure 1 – Site Location Map

Figure 2 – Site Features Plan

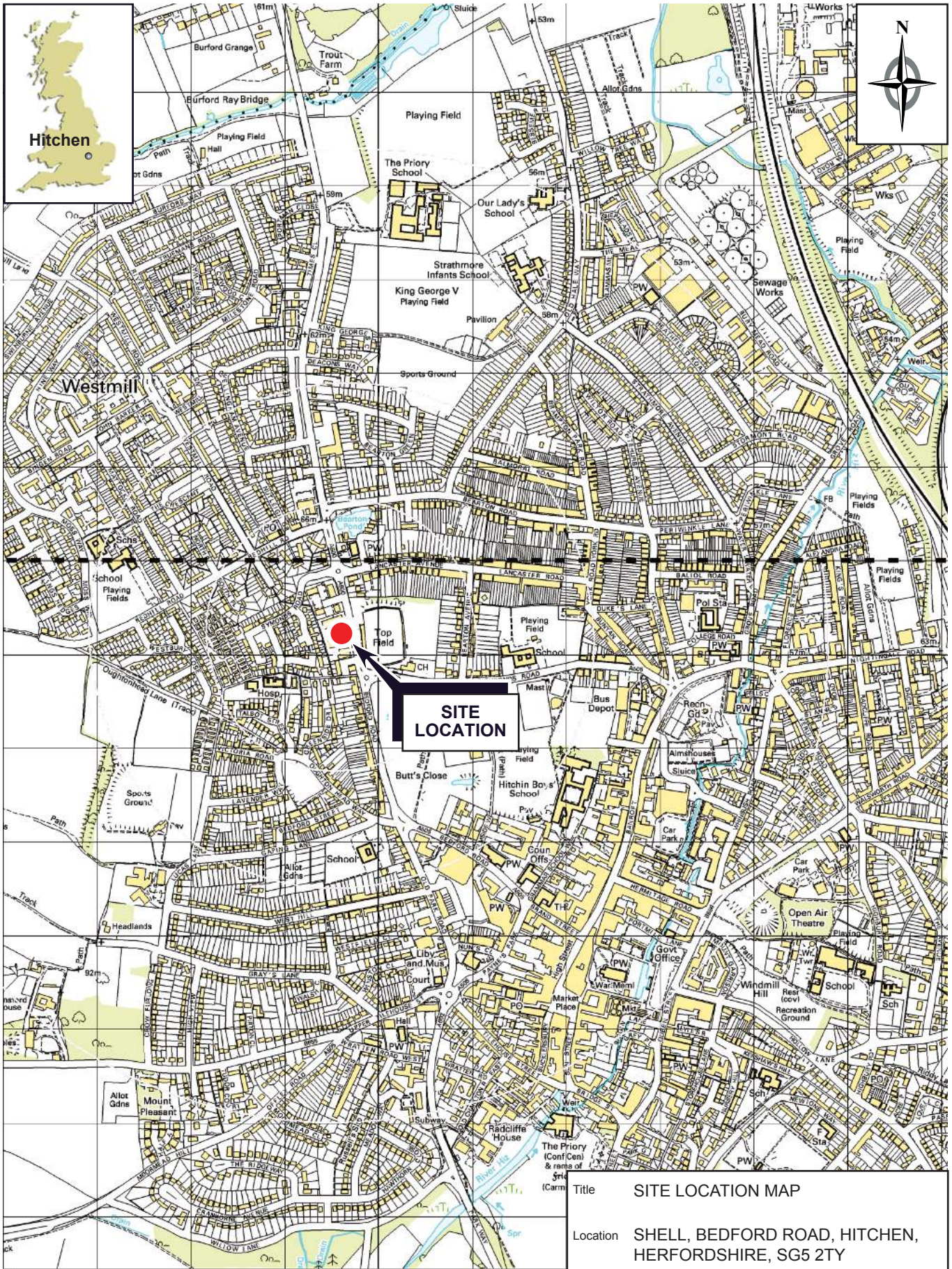
Figure 3a – Potentiometric Surface Map – February 2012

Figure 3b – Potentiometric Surface Map – 19th December 2012

Figure 3c – Potentiometric Surface Map – 11th January 2013

Figure 3d - Potentiometric Surface Map – 29th January 2013

Figure 4 – Conceptual Site Model



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Title SITE LOCATION MAP

Location SHELL, BEDFORD ROAD, HITCHEN, HERFORDSHIRE, SG5 2TY

Client SHELL UK OIL PRODUCTS LTD

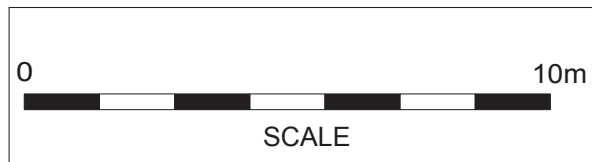
URS

App'd: BS	Drawn: BS	TI Ch'kd: LCH	Drg.Size: A4
Status: DRAFT	Ref: BS/LON/LCH/CFD		
Scale: AS SHOWN	Job No: 46370079		
Date: SEPT 2011	FIGURE 1		



KEY

- SITE BOUNDARY
- BOREHOLE LOCATION
- BOREHOLE LOCATION (REFUSALS)
- VAPOUR WELL LOCATION
- DECOMMISSIONED BOREHOLE LOCATION



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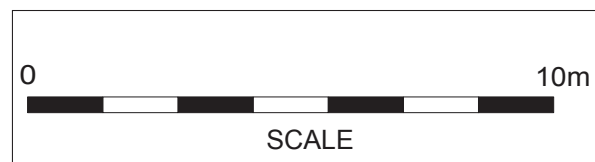
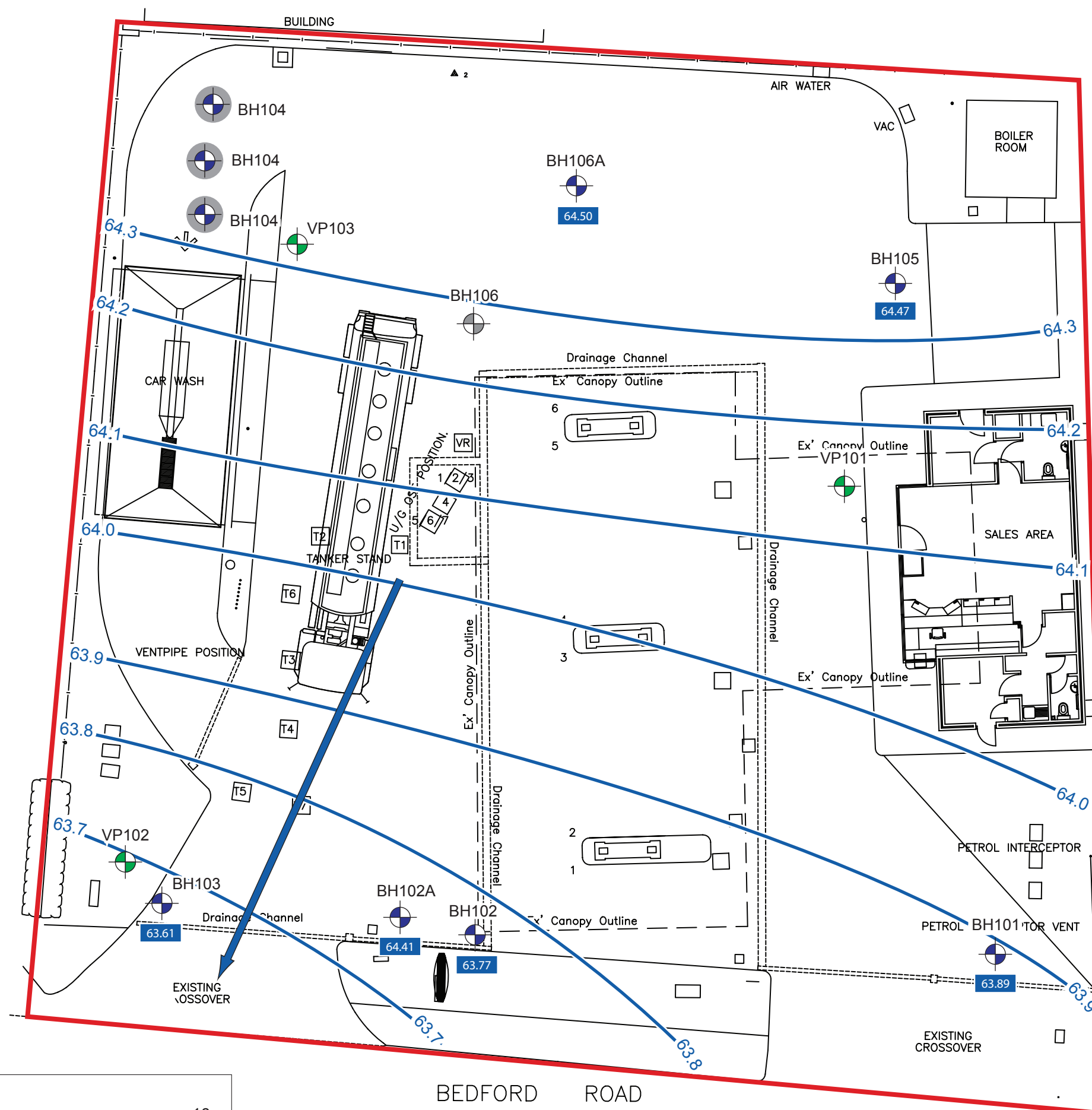
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FIGURE 2 - SITE FEATURES & BOREHOLE LOCATION
PLAN

DRAWN LCH	TRACED LCH	CHECKED BS	APPROVED BS	DATE OCT 2011
SCALE NTS	DRG NO. 46370079 / FIGURE 2			REV.



KEY

- SITE BOUNDARY
- BOREHOLE LOCATION
- BOREHOLE LOCATION (REFUSALS)
- VAPOUR WELL LOCATION
- 64.3 POTENTIOMETRIC CONTOUR
- POTENTIOMETRIC GROUNDWATER FLOW DIRECTION
- 64.47 POTENTIOMETRIC GROUNDWATER LEVEL
- DECOMMISSIONED BOREHOLE LOCATION



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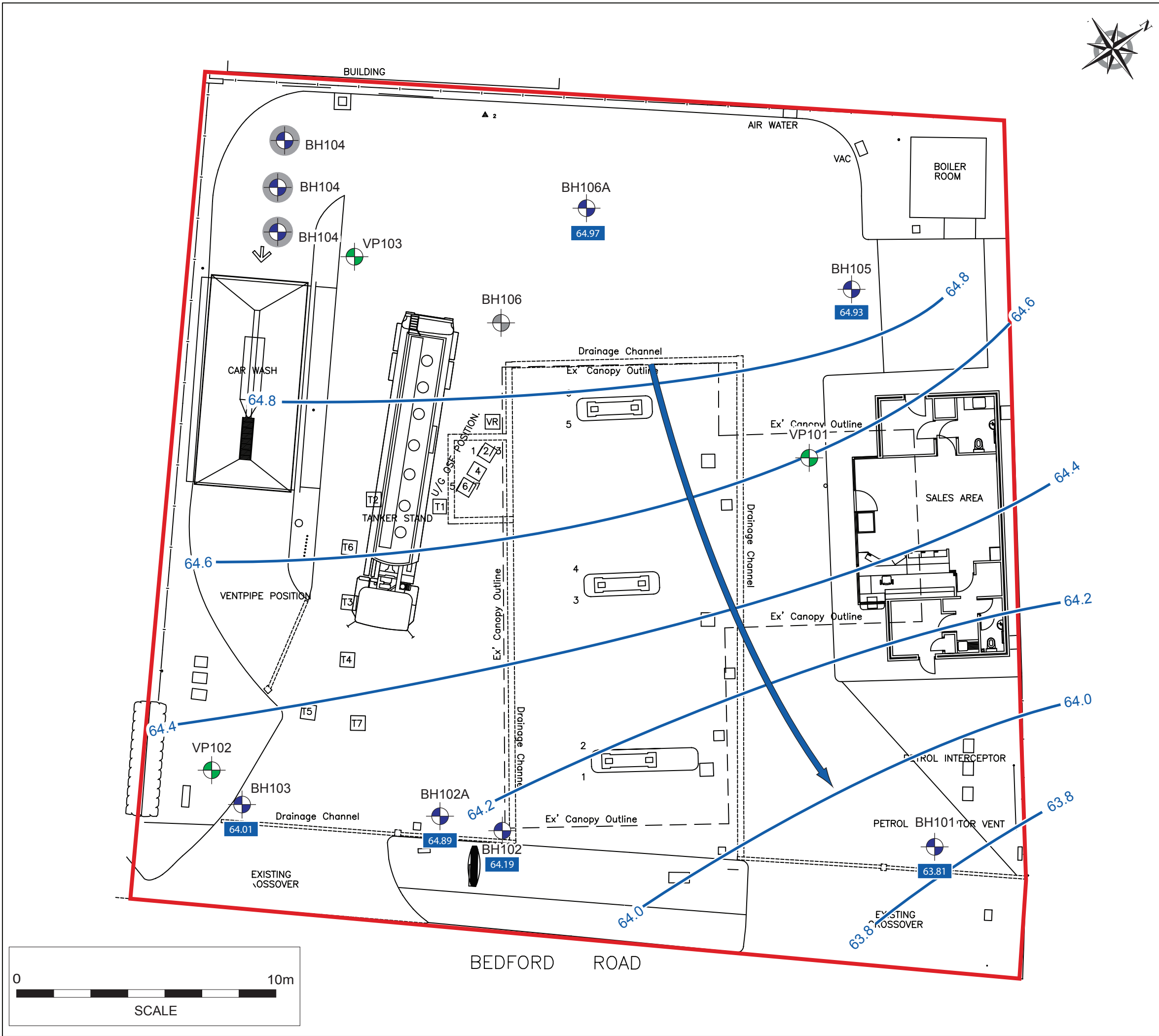
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DRAWING TITLE
FIGURE 3A - POTENTIOMETRIC SURFACE MAP -
FEBRUARY 2012

DRAWN LCS	TRACED LCS	CHECKED KM	APPROVED KM	DATE JAN 2013
SCALE NTS	DRG NO. 46370079 / FIGURE 3			REV.



- KEY
- SITE BOUNDARY
 - BOREHOLE LOCATION
 - BOREHOLE LOCATION (REFUSALS)
 - VAPOUR WELL LOCATION
 - POTENTIOMETRIC CONTOUR
 - POTENTIOMETRIC GROUNDWATER FLOW DIRECTION
 - POTENTIOMETRIC GROUNDWATER LEVEL
 - DECOMMISSIONED BOREHOLE LOCATION

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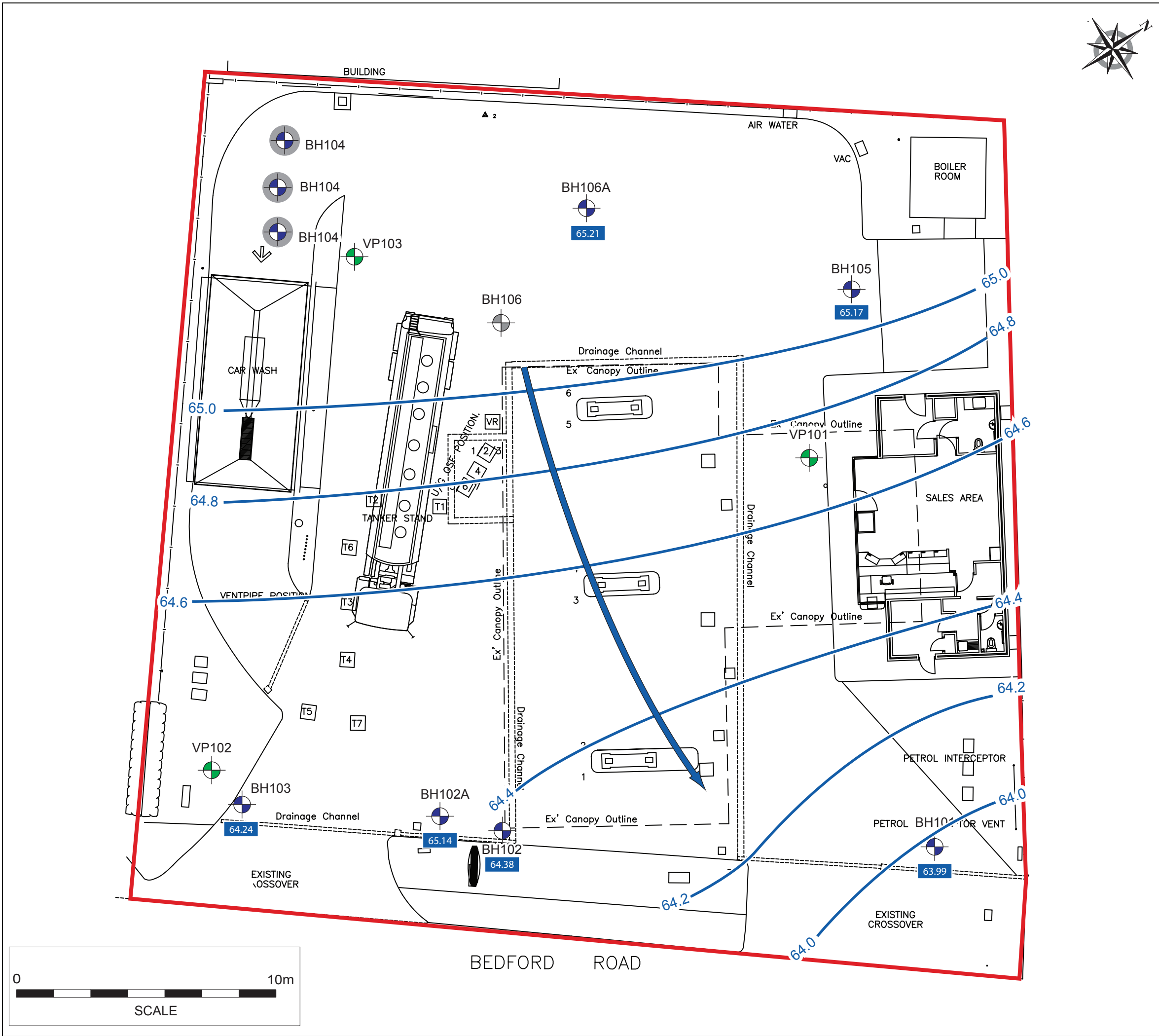
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DRAWING TITLE
FIGURE 3B - POTENTIOMETRIC SURFACE MAP -
DECEMBER 2012

DRAWN LCS	TRACED LCS	CHECKED KM	APPROVED KM	DATE JAN 2013
SCALE NTS	DRG NO. 46370079 / FIGURE 3B			REV.



- KEY
- SITE BOUNDARY
 - BOREHOLE LOCATION
 - BOREHOLE LOCATION (REFUSALS)
 - VAPOUR WELL LOCATION
 - POTENTIOMETRIC CONTOUR
 - POTENTIOMETRIC GROUNDWATER FLOW DIRECTION
 - POTENTIOMETRIC GROUNDWATER LEVEL
 - DECOMMISSIONED BOREHOLE LOCATION

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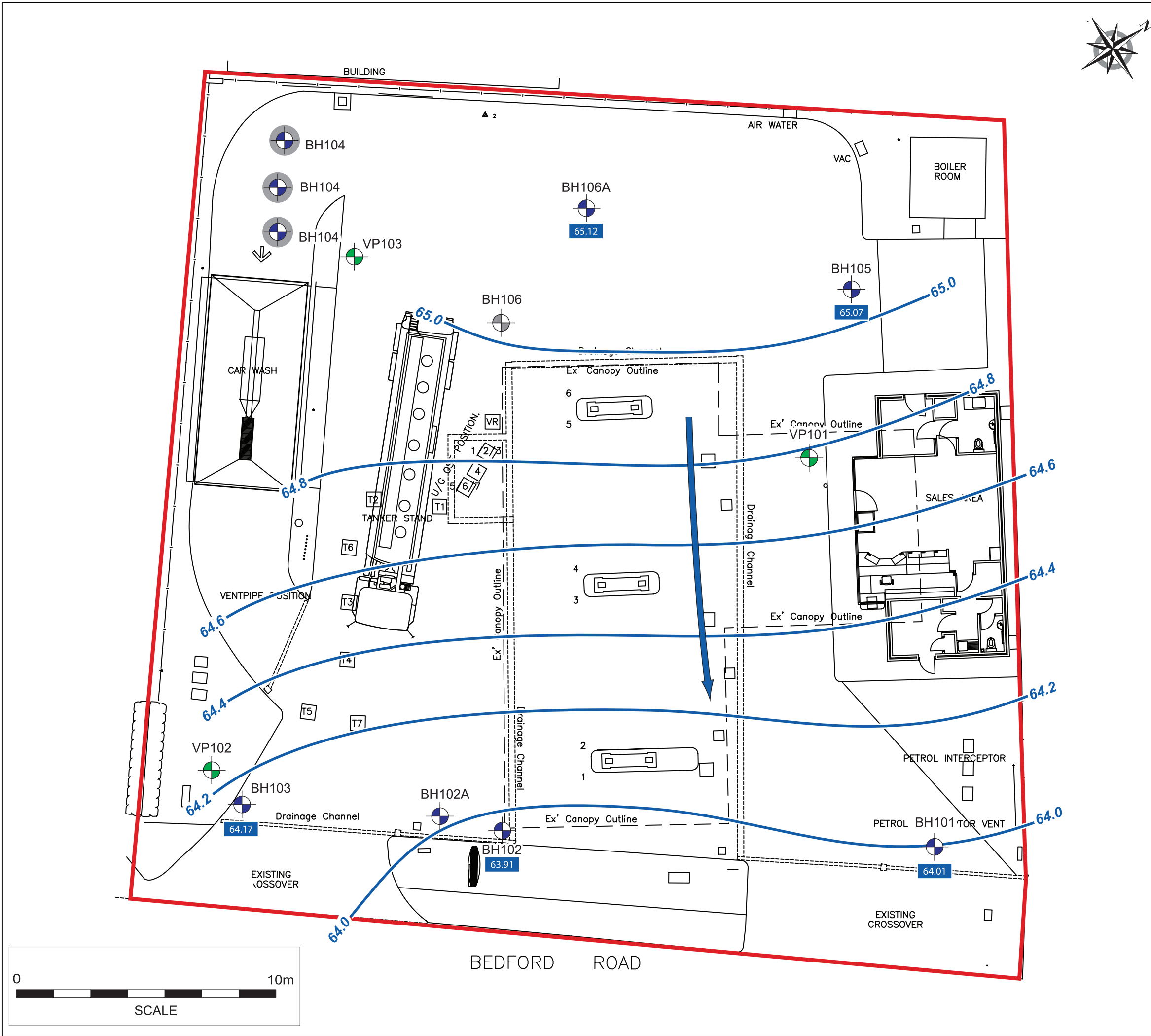
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DRAWING TITLE
FIGURE 3C - POTENTIOMETRIC SURFACE MAP -
JAN 2013

DRAWN LCS	TRACED LCS	CHECKED KM	APPROVED KM	DATE JAN 2013
SCALE NTS	DRG NO. 46370079 / FIGURE 3C			REV.



- KEY
- SITE BOUNDARY
 - BOREHOLE LOCATION
 - BOREHOLE LOCATION (REFUSALS)
 - VAPOUR WELL LOCATION
 - POTENTIOMETRIC CONTOUR
 - POTENTIOMETRIC GROUNDWATER FLOW DIRECTION
 - POTENTIOMETRIC GROUNDWATER LEVEL
 - DECOMMISSIONED BOREHOLE LOCATION

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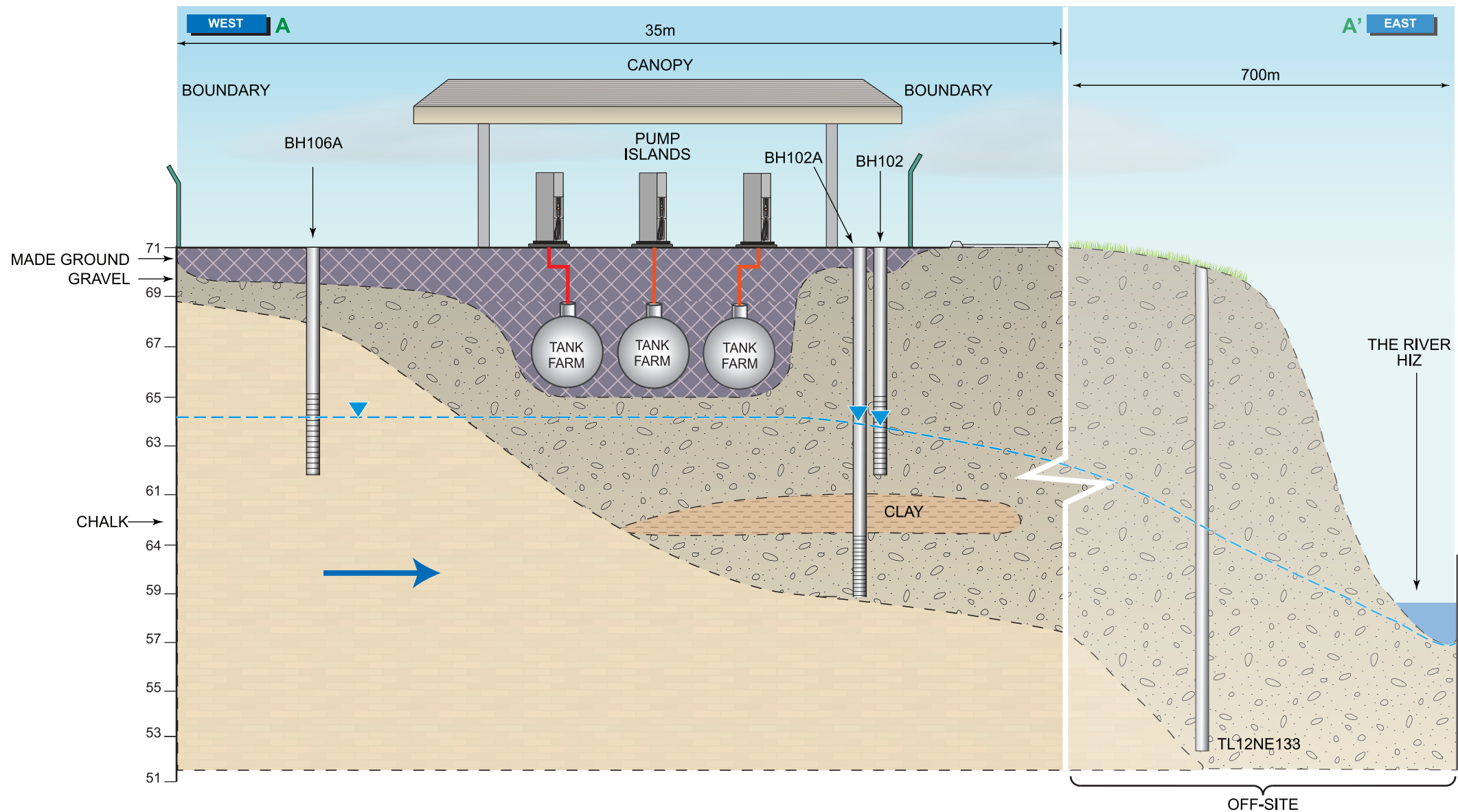
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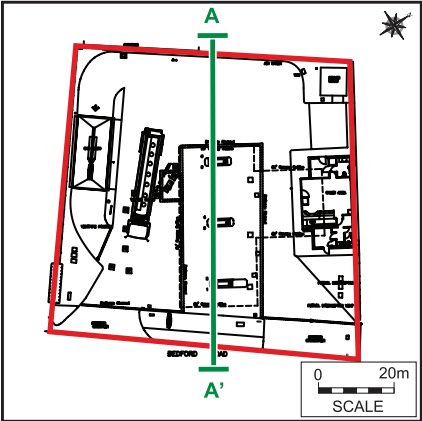
PROJECT
SHELL, BEDFORD ROAD, HITCHEN,
HERFORDSHIRE, SG5 2TY

DRAWING TITLE
FIGURE 3D - POTENTIOMETRIC SURFACE MAP -
JAN 2013

DRAWN LCS/SQ	TRACED LCS	CHECKED JW	APPROVED KM	DATE FEB 2013
SCALE NTS	DRG NO. 46370079 / FIGURE 3D			REV.



NOTES



AREA OF POTENTIAL CONCERN

- On-site**
Historical
- Historical use of the site as a petrol filling station since 1970.
 - Leaking and joints were noted during an inspection of the pumps and pipework by the Petroleum Officer in October 1986.
 - A leak on pump 8/9 noted by the Petroleum Officer in January 1991.
- Current**
- Operational underground storage tanks (URSSW understands there are no historic / decommissioned storage tanks on-site).
 - Accidental releases to ground from off-set fill points, located to the south of the forecourt.
 - Accidental releases to ground from dispenser pumps: 3 car fuel islands under the canopy and cracks in concrete surface of the forecourt.
 - Accidental releases from fuel lines: Present between the tanks, offset fill points and fuel islands.
 - Site interceptors (main forecourt interceptor located at the north east of the site, and interceptor associated with the car wash at the south of the site) and associated drainage lines.
 - Drainage from the car wash.
- Off-site**
Historical
- An Aboveground Storage Tank (AST) associated with a warehouse is shown approximately 30m north of the site boundary.
 - Garage (later shown as depot) approximately 5m north of the site boundary.
- Current**
- Garage adjacent to the site boundary at the west of the site.
 - Tyre Centre/Garage approximately 5m north of the site boundary.

CHEMICALS OF POTENTIAL CONCERN

- Historical**
- Metals – arsenic, boron, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium and zinc.
 - VOCs
- Current**
- TPH - Petroleum hydrocarbons.
 - BTEX- Benzene, toluene, ethylbenzene and xylenes.
 - Petroleum Additives- Methyl tertiary butyl ether (MTBE) and tertiary amyl methyl ether (TAME).
 - PAHs- Polycyclic aromatic hydrocarbons.
 - Metals – arsenic, boron, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium and zinc.

POTENTIAL PATHWAYS

- Human Health**
- Vapours – Migration of vapours through made ground to above ground buildings.
 - Particulate – Ingestion, inhalation, dermal contact, with soil particulates.
 - Permeation – Migration of hydrocarbon substances through plastic potable water supply pipes.
- Controlled waters - Groundwater in the Chalk**
- Leaching of COPC from unsaturated soils beneath the site into the pore water;
 - Infiltration of impacted pore water directly into the Chalk (assuming that drift is absent) and dilution within the saturated zone in the Chalk followed by horizontal migration within the Chalk aquifer;
 - Vertical migration of impacted groundwater in the drift into the underlying Chalk formation, dilution within the groundwater in the Chalk, followed by horizontal migration within the Chalk aquifer.
- Controlled waters - Groundwater in the Drift**
- Leaching of COPC from unsaturated soils beneath the site into the pore water;
 - Infiltration of impacted pore water to the water table and dilution within the saturated zone; and
 - Horizontal migration of impacted groundwater within the superficial deposits, which directly underlies the site.

POTENTIAL RECEPTORS

- Human Health**
- Shop staff.
 - The general public and visiting staff (such as contractors, including those conducting excavation works).
 - Workers in the garage adjacent to the east of the site, tyre centre approximately 5m north of the site and workers and guests at the Fir Hotel approximately 5m south of the site.
 - Occupants of residential properties approximately 30m north and south of the site and 20m to the west of the site
- Controlled Waters**
- Groundwater within the Superficial Deposits on-site (Potentially a Secondary A Aquifer).
 - Groundwater within the Zig Zag Chalk Formation (Principal Aquifer).

POTENTIALLY COMPLETE POLLUTANT LINKAGES:

- Human Health**
- No significant risks to human health identified at the site.
- Controlled Waters**
- Potentially impacted shallow soils / groundwater, followed by vertical migration into the shallow groundwater within the shallow Drift Deposits that border the site, and potentially deeper groundwater in the underlying Zig Zag Chalk Formation Principal Aquifer

DESCRIPTION	DRAWN	DESIGNED	CHECKED	APPROVED	DATE
STATUS					
FINAL					
CONSULTING ENGINEERS					
URS					
URS Infrastructure & Environment UK LTD, St George's House, 2nd Floor 5 St George's Road, Wimbledon, London SW19 4DR Tel :020 8944 3300 Fax: 020 8944 3301					
CLIENT					
SHELL UK OIL PRODUCTS LIMITED					
PROJECT					
SHELL, BEDFORD ROAD, HITCHEN, HERFORDSHIRE, SG5 2TY					
DRAWING TITLE					
Conceptual Site Model – Figure 4					
DRAWN LCH/SQ	DESIGNED JT	CHECKED JT	APPROVED JT	DATE FEB 2013	
SCALE NTS	DRG No. 46370079/FIGURE 4			REV.	

Appendix A - Tables

Table 1 – Groundwater Elevations and Quality Measurements

Table 2 – Soil Analytical Results with Stage 3 SSAC (Model 1; Groundwater in the Chalk)

Table 3 – Groundwater Analytical Results with Stage 3 SSAC (Model 1; Groundwater in the Chalk)

Table 4 – Groundwater Analytical Results with Stage 3 SSAC (Model 2; Groundwater in the Drift)

TABLE 1
GROUNDWATER ELEVATIONS AND QUALITY MEASUREMENTS

Site	Shell Hitchin
Sample Round	ALL
Sample Date	October 2011, February 2012, January 2013

Borehole	Screened Section	Depth to base (mb TOC)	Depth to product (mb TOC)	Depth to water (mb TOC)	Borehole elevation (m AOD)	Groundwater elevation (m AOD)	Sample Date	Purge Volume (l)	pH	Temperature (°C)	Conductivity (mS/cm)	ORP (mV)	ORP (mV) Corrected	Dissolved Oxygen (mg/L)	Comments
BH101	7.5 - 9.0	8.72	-	7.615	70.860	63.245	12/10/2011	3	6.6	15.8	0.99	-105.7	111.3	2.07	Orange, turbid with slight odour and sheen
								4	6.62	15.9	0.96	-109.4	107.6	1.95	
								5.5	6.6	15	0.92	-107.5	109.5	3.37	
		9	6.59	15.1		0.927	-104.3	112.7	3.63	Initially orange/turbid turning to clear/colourless. NVO.					
		3	6.63	12.61		2.837	83.6	300.6	4.12						
		6	6.64	12.74		2.882	68.0	285	4.11						
		8.8	-	6.873		63.987	11/01/2013	9	6.64	12.78	2.750	69.5	286.5	3.8	Clear. NVO.
								4	5.86	12.92	1.084	97.2	314.2	6.54	
								8	5.83	12.98	1.089	113.9	330.9	6.73	
		8.71	-	7.052		63.808	19/12/2012	12	5.9	12.98	1.093	119.1	336.1	6.8	
8.75	-	6.874	63.986	29/01/2013											
BH102	7.5 - 9.0	8.04	-	7.320	70.830	63.510	12/10/2011	2	6.51	15.10	0.827	-115.6	101.4	0.89	Orange, turbid with odour. Slow recharge (DUP02)
								3.5	6.63	15.10	0.809	-125.2	91.8	0.70	
								5.5	6.76	15.10	0.778	-129.4	87.6	0.58	
		6.5	6.77	15.80		0.791	-134.7	82.3	0.58	Slightly turbid, clear after 4L. Poor recharge so pumped slowly, mild HC odour when sampling. (DUP01).					
		2	6.71	12.43		1.246	-124.6	92.4	0.57						
		4	6.85	12.13		1.225	-86.4	130.6	0.37						
		7.9	-	6.446		64.384	11/01/2013	6	6.86	11.98	1.212	-76.8	140.2	0.48	Grey/brown, turbid, hydrocarbon odour.
								3	6.20	12.76	0.719	-175.2	41.8	3.89	
								6	6.68	12.88	0.679	-182.2	34.8	2.78	
		7.85	-	6.639		64.191	19/12/2012	9	6.93	12.91	0.65	-185.6	31.4	3.18	
7.93	-	6.919	63.911	29/01/2013											
BH102A	11.5 - 13.5	13.29	-	6.417	70.830	64.413	27/02/2012	10	6.85	12.25	0.965	35.2	252.2	4.10	50L pumped via hand using Waterra tubing and hand pump, very silty and high volume of sediment removed. 30 L then pumped using Peristaltic, mild turbidity, slightly brown. NVO.
								20	6.83	12.21	0.953	40.6	257.6	5.05	
								30	6.82	12.25	0.95	43.5	260.5	4.69	
		13.52	-	5.69		65.140	11/01/2013	14	7.04	10.94	0.578	-50.8	166.2	17.25	Bailed. Turbid, mild hydrocarbon odour
								28	7.02	12.09	0.589	-14	203	17.12	
								42	7.07	11.89	0.593	4.4	221.4	21.90	
		13.27	-	5.94		64.890	19/12/2012								
13.36	-	5.796	65.034	29/01/2013											
BH103	7.5 - 9.0	8.40	-	7.460	70.780	63.320	12/10/2011	2	6.34	14.60	0.581	-20.6	196.4	6.30	Orange colour, very slow recharge. NVO
								5	6.55	14.60	0.581	-24.7	192.3	5.24	
								7	6.54	14.60	0.581	-77.1	139.9	5.11	
		8.35	-	7.179		63.601	27/02/2012	2.5	6.93	12.32	0.849	43.8	260.8	6.65	Clear. NVO.
								5	6.89	12.35	0.846	45.1	262.1	6.01	
								7.5	6.87	12.35	0.848	46.5	263.5	5.47	
		8.33	-	6.55		64.230	11/01/2013	3	6.87	12.80	0.643	19.3	236.3	14.56	Clear. NVO.
								6	6.95	12.89	0.637	23.1	240.1	15.23	
								9	6.97	12.92	0.629	26.7	243.7	15.67	
		8.33	-	6.784		63.996	19/12/2012								
8.36	-	6.616	64.164	29/01/2013											
BH105	3.3 - 5.3	5.23	-	5.210	71.030	65.820	12/10/2011	-	-	-	-	-	-	-	Borehole was reported as dry.
BH105A	6.5 - 8.5	8.42	-	6.572	71.030	64.458	27/02/2012	3	6.7	12.7	1.173	57.6	274.6	2.67	Clear. NVO.
								6	6.66	12.74	1.172	55.6	272.6	2.4	
								9	6.66	12.72	1.171	56.5	273.5	2.42	
		8.43	-	5.873		65.157	11/01/2013	5	5.47	12.92	0.768	33.5	250.5	4.3	Clear. NVO.
								10	5.75	12.93	0.771	41	258	4.36	
								15	6.36	12.94	0.775	47.2	264.2	4.31	
8.38	-	6.109	64.921	19/12/2012											
8.35	-	5.966	65.064	29/01/2013											
BH106	3.0 - 5.0	4.66	-	DRY	70.980	DRY	12/10/2011	-	-	-	-	-	-	-	Borehole was reported with insufficient water to sample.
BH106A	6.5 - 8.5	8.26	-	6.547	71.050	64.503	27/02/2012	3	6.84	12.8	1.089	54.1	271.1	41.70	Turbid (light brown), becoming clear (colourless). Slightly cloudy while sampling.
								6	6.84	12.82	1.083	51.8	268.8	40.00	
								9	6.83	12.76	1.085	51.5	268.5	40.70	
		8.26	-	5.844		65.206	11/01/2013	5	6.08	12.79	0.591	17.4	234.4	6.20	
								10	6.43	13.06	0.597	27.2	244.2	6.49	
								15	6.23	13.09	0.601	30.8	247.8	6.26	
		8.24	-	6.077		64.973	19/12/2012								
8.26	-	5.934	65.116	29/01/2013											

Legend

°C - degrees celsius
L - Litres
m AOD - metres Above Ordinance Datum
NVO - no visible or olfactory evidence of impact

mb TOC - metres below Top of Casing
mg/L - milligrams per litre
mS - milli siemens
mV - milli volts

ORP - Oxidation Reduction Potential
pH - potential of Hydrogen (dimensionless)

Notes

Borehole elevations were measured to mAOD by URS subcontractor Glover GB.

TABLE 2
SOIL ANALYTICAL DATA with HDR and CW SSAC

Stage2 Human Health GAC	Human Health High Density Residential
Stage2 Controlled Waters GAC	Soil SSAC (Model 1: Groundwater in the Chalk)
Sample Round	All Data
Site	Hitchin

					BH101		BH102		BH103		BH105		BH106		UP101	VP102	VP103	BH102A			BH106A	
					0.8	5.4	0.8	2.7	1	3.2	0.6	4.1	0.5	3.9	0.6	0.4	0.7	13.2	13.6	5.7	1.5	5
Chem Class	Analyte	HH	CW	Units	27/09/2011	03/10/2011	27/09/2011	30/09/2011	27/09/2011	29/09/2011	27/09/2011	29/09/2011	28/09/2011	04/10/2011	28/09/2011	27/09/2011	26/09/2011	16/02/2012	16/02/2012	16/02/2012	14/02/2012	14/02/2012
BTEX	BENZENE	0.0928	0.121	mg/kg	ND	ND	ND	ND	ND	ND	0.00222	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	TOLUENE	>Sat	77.3	µg/l	ND	ND	NT	NT	ND	ND	1.34	ND	ND	NT	NT	NT	NT	ND	ND	ND	ND	ND
	ETHYLBENZENE	60.1	76.2	mg/kg	ND	ND	ND	ND	ND	ND	0.00792	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	M_P_XYLENE	19.7	133	mg/kg	ND	ND	ND	ND	ND	ND	0.0163	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	O_XYLENE	21.1	133	mg/kg	ND	ND	ND	ND	ND	ND	0.0139	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METALTOT	TOTAL ARSENIC	NP	145	mg/kg	19.6	NT	NT	NT	21.9	NT	21.2	NT	13.9	NT	NT	NT	NT	NT	NT	NT	NT	NT
	TOTAL BORON	NP	291	mg/kg	10.4	NT	NT	NT	10.7	NT	13.6	NT	9.31	NT	NT	NT	NT	NT	NT	NT	NT	NT
	TOTAL CADMIUM	NP	14.4	mg/kg	0.751	NT	NT	NT	0.875	NT	0.779	NT	0.367	NT	NT	NT	NT	NT	NT	NT	NT	NT
	TOTAL CHROMIUM	NP	67900	mg/kg	31.1	NT	NT	NT	22.9	NT	22	NT	17.5	NT	NT	NT	NT	NT	NT	NT	NT	NT
	TOTAL COBALT	NP	14.3	mg/kg	10.5	NT	NT	NT	7.58	NT	6.19	NT	5.63	NT	NT	NT	NT	NT	NT	NT	NT	NT
	TOTAL COPPER	NP	5780	mg/kg	18	NT	NT	NT	15	NT	106	NT	13.8	NT	NT	NT	NT	NT	NT	NT	NT	NT
	TOTAL HEXAVALENT_CHROMIUM	NP	-	mg/kg	ND	NT	NT	NT	ND	NT	ND	NT	ND	NT	NT	NT	NT	NT	NT	NT	NT	NT
	TOTAL LEAD	NP	>Sat	mg/kg	15.2	NT	NT	NT	24	NT	128	NT	37.1	NT	NT	NT	NT	NT	NT	NT	NT	NT
	TOTAL MERCURY	NP	-	mg/kg	ND	NT	NT	NT	ND	NT	ND	NT	ND	NT	NT	NT	NT	NT	NT	NT	NT	NT
	TOTAL MOLYBDENUM	NP	11.6	mg/kg	0.217	NT	NT	NT	ND	NT	0.294	NT	ND	NT	NT	NT	NT	NT	NT	NT	NT	NT
	TOTAL NICKEL	NP	291	mg/kg	37.5	NT	NT	NT	25.4	NT	25.3	NT	17.1	NT	NT	NT	NT	NT	NT	NT	NT	NT
	TOTAL SELENIUM	NP	-	mg/kg	ND	NT	NT	NT	ND	NT	ND	NT	ND	NT	NT	NT	NT	NT	NT	NT	NT	NT
	TOTAL TIN	NP	>Sat	mg/kg	ND	NT	NT	NT	0.817	NT	12.2	NT	0.89	NT	NT	NT	NT	NT	NT	NT	NT	NT
	TOTAL ZINC	NP	5500	mg/kg	81.3	NT	NT	NT	230	NT	200	NT	85.9	NT	NT	NT	NT	NT	NT	NT	NT	NT
MISC	Total Organic Carbon	(blank)	(blank)	%	0.371	0.438	0.334	ND	0.746	0.288	2.09	ND	0.702	ND	1.23	0.766	1.87	ND	ND	ND	ND	ND
PAH	Acenaphthene	>Sat	>Sat	mg/kg	0.179	NT	NT	NT	0.0115	NT	5.89	NT	20.9	NT	NT	NT	NT	ND	ND	ND	ND	ND
	Acenaphthylene	>Sat	16.6	mg/kg	ND	NT	NT	NT	0.0609	NT	1.76	NT	1.29	NT	NT	NT	NT	ND	ND	ND	ND	ND
	Anthracene	>Sat	>Sat	mg/kg	0.09	NT	NT	NT	0.0667	NT	11.8	NT	17.8	NT	NT	NT	NT	ND	ND	ND	ND	ND
	BENZO_A_ ANTHRACENE	>Sat	>Sat	mg/kg	0.0883	NT	NT	NT	0.432	NT	23.4	NT	14.8	NT	NT	NT	NT	ND	ND	ND	ND	ND
	BENZO_A_PYRENE	>Sat	>Sat	mg/kg	0.077	NT	NT	NT	0.554	NT	23.9	NT	13.6	NT	NT	NT	NT	ND	ND	ND	ND	ND
	BENZO_B_FLUORANTHENE	>Sat	>Sat	mg/kg	0.0938	NT	NT	NT	0.79	NT	26.7	NT	16.2	NT	NT	NT	NT	ND	ND	ND	ND	ND
	BENZO_G_H_I_PERYLENE	>Sat	>Sat	mg/kg	0.0489	NT	NT	NT	0.467	NT	13.7	NT	6.88	NT	NT	NT	NT	ND	ND	ND	ND	ND
	BENZO_K_FLUORANTHENE	>Sat	>Sat	mg/kg	0.0426	NT	NT	NT	0.339	NT	9.62	NT	5.79	NT	NT	NT	NT	ND	ND	ND	ND	ND
	Chrysene	>Sat	>Sat	mg/kg	0.0748	NT	NT	NT	0.481	NT	17.3	NT	12.4	NT	NT	NT	NT	ND	ND	ND	ND	ND
	DIBENZ_A_H_ ANTHRACENE	>Sat	>Sat	mg/kg	ND	NT	NT	NT	0.0957	NT	3.44	NT	1.86	NT	NT	NT	NT	ND	ND	ND	ND	ND
	Fluoranthene	>Sat	7.99	mg/kg	0.211	NT	NT	NT	0.851	NT	55.6	NT	53.9	NT	NT	NT	NT	ND	ND	ND	ND	ND
	Fluorene	>Sat	>Sat	mg/kg	0.127	NT	NT	NT	0.0129	NT	6.7	NT	17.7	NT	NT	NT	NT	ND	ND	ND	ND	ND
	INDENO_1_2_3_CD_PYRENE	>Sat	>Sat	mg/kg	0.0398	NT	NT	NT	0.358	NT	11.7	NT	5.78	NT	NT	NT	NT	ND	ND	ND	ND	ND
	Naphthalene	0.599	0.28	mg/kg	ND	NT	NT	NT	0.0201	NT	3.08	NT	4.2	NT	NT	NT	NT	ND	ND	ND	ND	ND
	Phenanthrene	>Sat	>Sat	mg/kg	0.298	NT	NT	NT	0.241	NT	35.6	NT	62.7	NT	NT	NT	NT	ND	ND	ND	ND	ND
	Pyrene	>Sat	>Sat	mg/kg	0.168	NT	NT	NT	0.735	NT	46.5	NT	41.8	NT	NT	NT	NT	ND	ND	ND	ND	ND
	TOTAL_PAH	(blank)	-	mg/kg	1.54	NT	NT	NT	5.52	NT	297	NT	297	NT	NT	NT	NT	ND	ND	ND	ND	ND
RISKTPH	RISK_TPH_C6_C7_AROM	92	-	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	RISK_TPH_C7_C8_AROM	222	-	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	RISK_TPH_C8_C10_AROM	12.9	>Sat	mg/kg	ND	ND	ND	ND	ND	ND	0.311	ND	0.252	ND	ND	ND	0.0285	0.0167	ND	ND	ND	ND
	RISK_TPH_C10_C12_AROM	70.6	246	mg/kg	0.0131	ND	ND	ND	ND	ND	0.301	ND	0.365	ND	ND	ND	0.0161	0.0107	ND	ND	ND	ND
	RISK_TPH_C12_C16_AROM	>Sat	>Sat	mg/kg	8.16	7.32	9.82	3.51	1.6	19.8	52.4	ND	16.5	2.92	3.6	1.41	36.7	1.61	3.63	0.993	42.5	56.7
	RISK_TPH_C16_C21_AROM	>Sat	>Sat	mg/kg	12.8	4.9	10.1	1.73	5.68	101	271	ND	65	2.58	35.7	2.27	115	ND	ND	ND	8.56	7.43
	RISK_TPH_C21_C35_AROM	>Sat	>Sat	mg/kg	32.1	7.07	43.8	0.692	28.1	175	641	ND	183	6.11	146	18.4	616	ND	ND	ND	ND	ND
	RISK_TPH_C5_C6_ALI	14	>Sat	mg/kg	ND	ND	ND	ND	ND	ND	0.0203	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	RISK_TPH_C6_C8_ALI	30.7	>Sat	mg/kg	0.0107	ND	ND	ND	ND	ND	0.148	ND	0.052	ND	ND	ND	ND	ND	ND	ND	ND	ND
	RISK_TPH_C8_C10_ALI	7.46	>Sat	mg/kg	0.0107	ND	ND	ND	ND	ND	0.357	ND	0.378	ND	ND	ND	0.0422	0.0155	ND	ND	ND	ND
	RISK_TPH_C10_C12_ALI	36.4	>Sat	mg/kg	0.019	ND	ND	ND	ND	ND	0.451	ND	0.547	ND	ND	ND	0.0248	0.0167	ND	ND	ND	ND
	RISK_TPH_C12_C16_ALI	>Sat	>Sat	mg/kg	7.25	17.6	23.3	6.66	2.48	77.7	24.5	7.29	8.93	2.57	8.07	2.46	13.8	18.6	40.7	8.37	61.6	76.4
	RISK_TPH_C16_C21_ALI	>Sat	>Sat	mg/kg	5.31	7	11.9	6.37	2.87	223	44.1	5.6	21.6	2.15	15.8	2.73	27.3	5.48	5.49	4.95	7.82	9.73
	RISK_TPH_C21_C35_ALI	>Sat	>Sat	mg/kg	12.3	7.79	38.4	1.08	12.5	303	411	ND	125	6.64	117	16.1	359	ND	ND	ND	ND	ND
	RISK_TPH_C35_C44_ALI	>Sat	>Sat	mg/kg	3.13	1.42	17.6	ND	2.43	86.8	160	ND	83.9	1.49	72.7	3.53	438	ND	ND	ND	ND	ND
	TPH_STAGE2_HI	1	-	ratio	0.038874	0.0712508	0.0933111	0.0301831	0.0617843	0.1081551	0.2406315	0.028008	0.1447994	0.016138	0.0360549	0.0138464	0.1030854	0.0684712	0.086151084	0.0325799	0.1351167	0.1528949
VOC	DIPE	1.52	0.00484	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	ETHANOL	(blank)	0.584	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	MTBE	23.5	0.00302	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	TAME	0.738	0.00517	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	TBA	111	0.00164	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	ETBE	2.31	0.00507	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MISC_CEN21	PH	(blank)	(blank)	pH Units	8.64	8.43	NT	NT	8.6	8.46	9.18	8.61	9.71	6.84	NT	NT	NT	NT	NT	NT	NT	NT
	CONDUCTIVITY	(blank)	(blank)	µS/cm	400	756	NT	NT	415	227	466	274	468	190	NT	NT	NT	NT	NT	NT	NT	NT

XX	Exceeds Human Health & Controlled Waters
>XX	Exceeds Human Health Criteria
XX	Exceeds Controlled Waters Criteria

CSM / Assumptions:
Soil 1% SOM (0.58% TOC)
Soil properties for "sand"
Commercial site area 0.5ha
Soil gas ingress rates calculated by model
Infinite groundwater source at 1m.bgl for groundwater GAC
High density residential assume vapour exposure pathways only
CPU scenario modified from modelled commercial scenario by:
Building dimensions (l x w x h): 14m x 6.5m x 2.4m
Differential pressure: 2.6 pascals
Only vapour exposure pathways considered viable
Derived November 2010 using Human7.1 Issue9. MTF.

ND: Not detected above MDL
HH: Human Health
GAC: Generic Assessment Criteria
(blank): No criteria
NP: No pathway
>Sat: Unacceptable risk not achieved due to calculated saturation of vapour pathway
NT: Not tested

TABLE 3
GROUNDWATER ANALYTICAL DATA WITH HDR GAC and CW SSAC (MODEL 1: Groundwater in the Chalk)

Stage2 Human Health	Human Health High Density Residential
Stage 3 Controlled Waters	CW SSAC - Model 1: Groundwater in the Chalk assuming a 3.6m mixing zone with a calculated dilution factor of 98.4
Sample Round	ALL
Site	Hitchin

						BH101			BH102			BH102A		BH103			BH105	BH105A		BH106A			
						12/10/2011	27/02/2012	22/01/2013	12/10/2011	27/02/2012	22/01/2013	27/02/2012	22/01/2013	27/02/2012	22/01/2013	12/10/2011	27/02/2012	11/01/2013	12/10/2011	27/02/2012	11/01/2013	27/02/2012	11/01/2013
Chem Class	Analyte	HH	CW	MDL	Units	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
BTEX	BENZENE	1100	747	1	µg/l	ND	ND	ND	ND	1460	1100	282	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	TOLUENE	>Sat	>Sol	1	µg/l	ND	ND	ND	ND	465	150	241	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	ETHYLBENZENE	173000	>Sol	1	µg/l	ND	ND	ND	ND	2350	3600	3760	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	M P XYLENE	51600	>Sol	1	µg/l	ND	ND	ND	ND	6480	9330	12400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	O XYLENE	62100	>Sol	1	µg/l	ND	ND	ND	ND	2460	4380	4500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
PAH	Acenaphthene	>Sat	>Sol	0.015	µg/l	ND	ND	ND	ND	0.193	2.35	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	
	ACENAPHTHYLENE	>Sat	16000	0.011	µg/l	ND	ND	ND	ND	0.0456	0.753	ND	ND	ND	ND	ND	NT	ND	ND	ND	0.0125	ND	
	Anthracene	>Sat	>Sol	0.015	µg/l	ND	ND	ND	ND	0.0315	1.43	ND	ND	ND	ND	ND	NT	ND	ND	ND	0.0234	ND	
	BENZO A ANTHRACENE	>Sat	>Sol	0.017	µg/l	ND	ND	ND	ND	ND	0.495	ND	ND	ND	ND	ND	NT	0.0343	ND	0.0679	ND	ND	
	BENZO A PYRENE	>Sat	>Sol	0.009	µg/l	ND	ND	ND	ND	ND	0.359	ND	ND	ND	ND	ND	NT	0.04	ND	0.0397	ND	ND	
	BENZO B FLUORANTHENE	>Sat	>Sol	0.023	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	0.0322	ND	0.0372	ND	ND	
	BENZO G H I PERYLENE	>Sat	>Sol	0.016	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	0.0175	ND	0.0233	ND	ND	
	BENZO K FLUORANTHENE	>Sat	>Sol	0.027	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	0.0431	ND	0.0408	ND	ND	
	CHRYSENE	>Sat	>Sol	0.013	µg/l	ND	ND	ND	ND	ND	0.639	ND	ND	ND	ND	ND	NT	0.029	ND	0.0567	ND	ND	
	DIBENZ A H ANTHRACENE	>Sat	>Sol	0.016	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	
	FLUORANTHENE	>Sat	>Sol	0.017	µg/l	ND	ND	ND	ND	ND	0.0162	1.21	ND	ND	ND	ND	NT	0.0634	ND	0.19	ND	ND	
	FLUORENE	>Sat	>Sol	0.014	µg/l	ND	ND	ND	0.205	0.387	5.51	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	
	INDENO 1 2 3 CD PYRENE	>Sat	>Sol	0.014	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	0.0183	ND	0.0216	ND	ND	
	NAPHTHALENE	640	874	0.1	µg/l	ND	0.168	ND	175	289	560	ND	ND	ND	0.143	ND	NT	ND	ND	ND	ND	ND	
	PHENANTHRENE	>Sat	>Sol	0.022	µg/l	ND	ND	ND	ND	0.146	7.34	ND	ND	ND	ND	ND	NT	ND	ND	ND	0.0295	ND	
	Pyrene	>Sat	>Sol	0.015	µg/l	ND	ND	0.0165	ND	0.0234	2.11	ND	0.0165	ND	ND	ND	NT	0.0718	ND	0.138	ND	ND	
VOC	DIPE	25300	120	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	ETBE	34600	40	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	ETHANOL	(blank)	1100000	50	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	MTBE	331000	30	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	TAME	11700	140	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	TBA	628000	40	10	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
RISKTPH	RISK TPH C6 C7 AROM	1090000	7430	10	µg/l	ND	ND	ND	1210	731	176	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	RISK TPH C7 C8 AROM	>Sat	>Sol	10	µg/l	17	ND	ND	392	131	148	ND	ND	14	ND	ND	ND	ND	ND	ND	ND	ND	
	RISK TPH C8 C10 AROM	9830	>Sol	10	µg/l	12	ND	ND	13300	14500	19600	ND	ND	12	ND	ND	ND	ND	ND	ND	ND	ND	
	RISK TPH C10 C12 AROM	>Sat	>Sol	10	µg/l	ND	ND	ND	1010	934	4820	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	RISK TPH C12 C16 AROM	>Sat	>Sol	10	µg/l	ND	ND	ND	143	306	2120	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	
	RISK TPH C16 C21 AROM	>Sat	>Sol	10	µg/l	ND	ND	ND	ND	17	617	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	
	RISK TPH C21 C35 AROM	>Sat	>Sol	10	µg/l	ND	ND	ND	ND	ND	307	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	
	RISK TPH C5 C6 ALI	10300	>Sol	10	µg/l	ND	ND	ND	308	646	1510	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	RISK TPH C6 C8 ALI	>Sat	>Sol	10	µg/l	ND	ND	ND	697	1430	6350	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	RISK TPH C8 C10 ALI	302	>Sol	10	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	RISK TPH C10 C12 ALI	>Sat	>Sol	10	µg/l	ND	ND	ND	1510	1400	7230	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	RISK TPH C12 C16 ALI	>Sat	>Sol	10	µg/l	ND	ND	ND	ND	1400	1950	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	
	RISK TPH C16 C21 ALI	>Sat	>Sol	10	µg/l	ND	ND	ND	ND	ND	762	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	
	RISK TPH C21 C35 ALI	>Sat	>Sol	10	µg/l	ND	ND	ND	ND	ND	766	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND	ND	
	TPH_STAGE2_HI	1	(blank)	10	ratio	0.0986376	0.0046095	0.0984283	3.1001248	3.1800256	4.5861068	0.0046095	0.0984283	0.0986376	0.0046095	0.0984283	0.0041197	0.0046095	0.0984283	0.0046095	0.0984283	0.0046095	0.0984283

XX	Exceeds Human Health & Controlled Waters
X	Exceeds Human Health Criteria
XX	Exceeds Controlled Waters Criteria

CSM / Assumptions:
Soil 1% SOM (0.58% TOC)
Soil properties for "sand"
Commercial site area 0.5ha
Soil gas ingress rates calculated by model
Infinite groundwater source at 1m.bgl for groundwater GAC
High density residential assume vapour exposure pathways only
CPU scenario modified from modelled commercial scenario by:
Building dimensions (l x w x h): 14m x 6.5m x 2.4m
Differential pressure: 2.6 pascals
Only vapour exposure pathways considered viable
Derived November 2010 using Human7.1 Issue9. MTF.

TABLE 4
GROUNDWATER ANALYTICAL DATA WITH HDR GAC and CW SSAC (Model 2: Groundwater in the Drift Deposits)

Stage2 Human Health	Human Health High Density Residential
Stage 3 Controlled Waters	CW SSAC Model 2: Groundwater in the Drift
Sample Round	ALL
Site	Hitchin

						BH101			BH102			BH102A		BH103			BH105	BH105A		BH106A	
						12/10/2011	27/02/2012	22/01/2013	12/10/2011	27/02/2012	22/01/2013	27/02/2012	22/01/2013	12/10/2011	27/02/2012	11/01/2013	12/10/2011	27/02/2012	11/01/2013	27/02/2012	11/01/2013
Chem Class	Analyte	HH	CW	MDL	Units	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
BTEX	BENZENE	1100	63.7	1	µg/l	ND	ND	ND	1460	1100	282	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	TOLUENE	>Sat	>Sol	1	µg/l	ND	ND	ND	465	150	241	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	ETHYLBENZENE	173000	>Sol	1	µg/l	ND	ND	ND	2350	3600	3760	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	M P_XYLENE	51600	>Sol	1	µg/l	ND	ND	ND	6480	9330	12400	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	O_XYLENE	62100	>Sol	1	µg/l	ND	ND	ND	2460	4380	4500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PAH	Acenaphthene	>Sat	>Sol	0.015	µg/l	ND	ND	ND	ND	0.193	2.35	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND
	ACENAPHTHYLENE	>Sat	>Sol	0.011	µg/l	ND	ND	ND	ND	0.0456	0.753	ND	ND	ND	ND	ND	NT	ND	ND	0.0125	ND
	Anthracene	>Sat	>Sol	0.015	µg/l	ND	ND	ND	ND	0.0315	1.43	ND	ND	ND	ND	ND	NT	ND	ND	0.0234	ND
	BENZO_A_ ANTHRACENE	>Sat	>Sol	0.017	µg/l	ND	ND	ND	ND	ND	0.495	ND	ND	ND	ND	ND	NT	0.0343	ND	0.0679	ND
	BENZO_A PYRENE	>Sat	>Sol	0.009	µg/l	ND	ND	ND	ND	ND	0.359	ND	ND	ND	ND	ND	NT	0.04	ND	0.0397	ND
	BENZO_B FLUORANTHENE	>Sat	>Sol	0.023	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	0.0322	ND	0.0372	ND
	BENZO_G_H_I PERYLENE	>Sat	>Sol	0.016	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	0.0175	ND	0.0233	ND
	BENZO_K FLUORANTHENE	>Sat	>Sol	0.027	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	0.0431	ND	0.0408	ND
	CHRYSENE	>Sat	>Sol	0.013	µg/l	ND	ND	ND	ND	ND	0.639	ND	ND	ND	ND	ND	NT	0.029	ND	0.0567	ND
	DIBENZ_A_H_ ANTHRACENE	>Sat	>Sol	0.016	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND
	FLUORANTHENE	>Sat	>Sol	0.017	µg/l	ND	ND	ND	ND	0.0182	1.21	ND	ND	ND	ND	ND	NT	0.0634	ND	0.19	ND
	FLUORENE	>Sat	>Sol	0.014	µg/l	ND	ND	ND	0.205	0.387	5.51	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND
	INDENO_1_2_3_CD PYRENE	>Sat	>Sol	0.014	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NT	0.0183	ND	0.0216	ND
	NAPHTHALENE	640	1120	0.1	µg/l	ND	0.168	ND	175	289	560	ND	ND	ND	0.143	ND	NT	ND	ND	ND	ND
	PHENANTHRENE	>Sat	>Sol	0.022	µg/l	ND	ND	ND	ND	0.146	7.34	ND	ND	ND	ND	ND	NT	ND	ND	0.0295	ND
	Pyrene	>Sat	>Sol	0.015	µg/l	ND	ND	0.0165	ND	0.0234	2.11	ND	0.0165	ND	ND	ND	NT	0.0718	ND	0.138	ND
VOC	DIPE	25300	120	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	ETBE	34600	40	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	ETHANOL	(blank)	1100000	50	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	MTBE	331000	30	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	TAME	11700	140	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	TBA	628000	40	10	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
RISKTPH	RISK TPH C6 C7 AROM	1090000	669	10	µg/l	ND	ND	ND	1210	731	176	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	RISK TPH C7 C8 AROM	>Sat	>Sol	10	µg/l	17	ND	ND	392	131	148	ND	ND	14	ND	ND	ND	ND	ND	ND	ND
	RISK TPH C8 C10 AROM	9830	>Sol	10	µg/l	12	ND	ND	13300	14500	19600	ND	ND	12	ND	ND	ND	ND	ND	ND	ND
	RISK TPH C10 C12 AROM	>Sat	>Sol	10	µg/l	ND	ND	ND	1010	934	4820	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	RISK TPH C12 C16 AROM	>Sat	>Sol	10	µg/l	ND	ND	ND	143	306	2120	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND
	RISK TPH C16 C21 AROM	>Sat	>Sol	10	µg/l	ND	ND	ND	ND	17	617	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND
	RISK TPH C21 C35 AROM	>Sat	>Sol	10	µg/l	ND	ND	ND	ND	ND	307	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND
	RISK TPH C5 C6 ALI	10300	>Sol	10	µg/l	ND	ND	ND	308	646	1510	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	RISK TPH C6 C8 ALI	>Sat	>Sol	10	µg/l	ND	ND	ND	697	1430	6350	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	RISK TPH C8 C10 ALI	302	>Sol	10	µg/l	ND	ND	ND	3220	3250	9340	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	RISK TPH C10 C12 ALI	>Sat	>Sol	10	µg/l	ND	ND	ND	1510	1400	7230	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	RISK TPH C12 C16 ALI	>Sat	>Sol	10	µg/l	ND	ND	ND	ND	ND	1950	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND
	RISK TPH C16 C21 ALI	>Sat	>Sol	10	µg/l	ND	ND	ND	ND	ND	762	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND
	RISK TPH C21 C35 ALI	>Sat	>Sol	10	µg/l	ND	ND	ND	ND	ND	766	ND	ND	ND	ND	ND	NT	ND	ND	ND	ND
	TPH_STAGE2_HI	1	(blank)	10	ratio	0.0986376	0.0046095	0.0984283	3.1001248	3.1800256	4.5861068	0.0046095	0.0984283	0.0986376	0.0046095	0.0984283	0.0041197	0.0046095	0.0984283	0.0046095	0.0984283

XX	Exceeds Human Health & Controlled Waters
XX	Exceeds Human Health Criteria
XX	Exceeds Controlled Waters Criteria

CSM / Assumptions:
Soil 1% SOM (0.58% TOC)
Soil properties for "sand"
Commercial site area 0.5ha
Soil gas ingress rates calculated by model
Infinite groundwater source at 1m.bgl for groundwater GAC
High density residential assume vapour exposure pathways only
CPU scenario modified from modelled commercial scenario by:
Building dimensions (l x w x h): 14m x 6.5m x 2.4m
Differential pressure: 2.6 pascals
Only vapour exposure pathways considered viable
Derived November 2010 using Human7.1 Issue9. MTF.

Appendix B - Borehole Logs

EXPLORATORY HOLE LOG

Project Name and Site Location Shell Hitchin			Client Shell UK Oil Products Ltd		BOREHOLE No BH102A
Job No 46370079	Date Start Date 13-02-12 End Date 16-02-12	Ground Level (m) 70.83	Co-Ordinates () E 517,936.67 N 229,836.99		
Contractor Tor Drilling Ltd		Method / Plant Used Vacuum Extraction and Comacchio GEO 250			Sheet 1 of 2

Depth		Sample / Test Details	PID (ppm)	Water	STRATA				Installation / Backfill
					Legend	Depth (Thickness)	DESCRIPTION	COMMENTS	
						0.20	Concrete		
70.5			0.9			0.50	MADE GROUND: Light orange-brown silty gravelly sand. Sand is fine. Gravel is fine to coarse rounded to subangular chalk and flint.	Dry. NVO.	
0.5			0.6					Dry. NVO.	
70.0						0.90	MADE GROUND: Light orange-brown very gravelly sandy silt. Sand is fine. Gravel is fine to coarse rounded to subangular chalk, flint and brick.	Dry. NVO.	
1.0			0.7						
69.5									
1.5									
69.0			<0.1			(1.70)	Orange-brown silty SAND. Sand is fine to medium. Gravelly and slightly silty from 1.1m bgl.		
2.0									
68.5									
2.5						2.60	Silty and not gravelly from 2.1m bgl.		
68.0			<0.1						
3.0									
67.5			0.2			(1.65)	Light brown and orange-brown slightly gravelly SAND. Sand is coarse. Gravel is fine rounded to subrounded natural stone and chalk. Not gravelly from 2.9m bgl.	Dry. NVO.	
3.5							Medium-grained sand from 3.4m bgl.		
67.0									
4.0									
66.5			<0.1			4.25	Orange-brown only from 4.15m bgl.		
4.5			0.3			4.50	Firm orange-brown SILT.	Wet. NVO.	
66.0			<0.1				Dark grey-black from 4.45m bgl.	Organic odour from 4.45m bgl.	
5.0						(1.20)	Orange-brown silty SAND and GRAVEL. Sand is fine to medium. Gravel is fine to coarse rounded to subrounded flint.	Dry. NVO.	
65.5									
5.5									
65.0						5.70			
6.0			0.2			(0.50)	Orange-brown and light brown slightly silty SAND. Sand is fine.	Dry. NVO.	
64.5			8.8			6.20			
6.5							Firm brown very sandy SILT. Sand is fine.	Wet. Slight hydrocarbon odour.	
64.0			1089			(1.00)	Also orange-brown in colour from 6.7m bgl.	Strong hydrocarbon odour from 6.6m bgl.	
7.0									
63.5			3987			7.20			
7.5			228				Brown-grey silty SAND. Sand is medium to coarse.	Moist. Strong hydrocarbon odour.	
63.0			85.5					Slight hydrocarbon odour from 7.4m bgl.	
8.0			26.1					Stained dark grey from 7.5 to 7.9m bgl.	
62.5						(2.10)		NVO from 7.9m bgl.	
8.5			5.2				Occasional fine subrounded chalk gravel from 8.5m bgl.		
62.0									
9.0						9.30			

WELL INSTALLATION DETAILS  Cement seal riser  Bentonite seal riser  Filter pack screen  Bentonite/Grout Mix  Filter pack riser  Bentonite: Bottom of hole/well SAMPLE TYPE DETAILS  Environmental Sample		LEGEND  Concrete  Silty Sand  Silt  Sandy Silt  Gravelly Silt  Groundwater Table  Made Ground  Gravelly Sand  SAND & GRAVEL with silt  Clay  NVO - No Visual or Olfactory Evidence of Contamination  Water Strike bgl = Below Ground Level		GENERAL REMARKS Vacuum extraction to 1.2m bgl. Hollow stem from 1.2 to 14.4m bgl. Installed as monitoring well with 50mm OD HDPE, 1mm slotted from 11.5m bgl to 13.6m bgl. 3-6mm gravel filter pack. Groundwater strike unclear during drilling. Groundwater at 7m bgl after 20 mins. NVO = No visual or olfactory evidence of impact. m bgl = metres below ground level. Borehole backfilled with bentonite to top of chalk.
	Logged By	BSS	Approved By	BKS

EXPLORATORY HOLE LOG

Project Name and Site Location Shell Hitchin			Client Shell UK Oil Products Ltd		BOREHOLE No BH102A
Job No 46370079	Date Start Date 13-02-12 End Date 16-02-12	Ground Level (m) 70.83	Co-Ordinates () E 517,936.67 N 229,836.99		
Contractor Tor Drilling Ltd		Method / Plant Used Vacuum Extraction and Comacchio GEO 250			Sheet 2 of 2

Depth	Sample / Test Details	PID (ppm)	Water	STRATA			
				Legend	Depth (Thickness)	DESCRIPTION	COMMENTS
9.5		0.8		x x x	9.70	Firm orange-brown sandy SILT. Sand is fine to medium.	Wet. NVO.
61.0		0.2		x x x	9.80	Orange-brown slightly silty SAND. Sand is fine to medium.	Wet. NVO.
10.0		0.5		x x x	10.00	Firm orange-brown sandy SILT. Sand is fine to medium.	Wet. NVO.
60.5						Stiff brown and orange-brown CLAY.	Dry. NVO.
10.5					(1.30)		
60.0							
11.0							
59.5		<0.1		x o x	11.30	Firm to stiff orange-brown gravelly SILT. Gravel is medium to coarse rounded to subrounded flint.	Moist. NVO.
11.5				x o x			
59.0				x o x			
12.0		<0.1		x o x	(1.60)	Sandy (medium to coarse-grained) with fine to coarse subrounded to angular gravel of weak chalk from 11.9m bgl.	
58.5				x o x		Very sandy and no flint gravel from 12.0m bgl.	
12.5				x o x			
58.0				x o x	12.90		
13.0		<0.1		x o x	13.20	Orange-brown very silty SAND. Sand is medium to coarse.	Moist. NVO.
57.5	BH102A_13.2	<0.1		x o x	13.30	Dark orange-brown SAND. Sand is medium to coarse.	Wet. NVO.
13.5				x o x	13.60	Soft orange-brown gravelly SILT. Gravel is fine to medium rounded to subrounded flint.	Wet. NVO.
57.0	BH102A_13.6-14.0	<0.1		x o x		Structureless CHALK composed of stiff white SILT.	Dry. NVO.
14.0				x o x	(0.60)		
56.5				x o x	14.20	Weak medium density white CHALK.	Dry. NVO.
				x o x	14.40	Borehole terminated at 14.4m bgl. Refusal on chalk.	

WELL INSTALLATION DETAILS		LEGEND		GENERAL REMARKS
 Cement seal riser	 Bentonite/Grout Mix	 Concrete	 Made Ground	
 Bentonite seal riser	 Filter pack riser	 Silty Sand	 Gravelly Sand	
 Filter pack screen	 Bentonite: Bottom of hole/well	 Silt	 SAND & GRAVEL with silt	
SAMPLE TYPE DETAILS		 Sandy Silt	 Clay	
 Environmental Sample		 Gravelly Silt	 NVO - No Visual or Olfactory Evidence of Contamination	
		 Groundwater Table	 Water Strike	
		bgl = Below Ground Level		
		Logged By	BSS	
		Approved By		
		BKS		

EXPLORATORY HOLE LOG

Project Name and Site Location Shell Hitchin			Client Shell UK Oil Products Ltd		BOREHOLE No BH105A
Job No 46370079	Date Start Date 15-02-12 End Date 15-02-12	Ground Level (m) 71.04	Co-Ordinates () E 517,908.32 N 229,847.40		
Contractor Tor Drilling Ltd		Method / Plant Used Vacuum Extraction and Comacchio GEO 250			Sheet 1 of 1

Depth	Sample / Test Details	PID (ppm)	Water	STRATA				
				Legend	Depth (Thickness)	DESCRIPTION	COMMENTS	Installation / Backfill
						Previous install (BH105)	Overdrilled BH105.	
0.5								
1.0								
1.5								
2.0								
2.5								
3.0								
3.5								
4.0								
4.5								
5.0								
5.5								
6.0								
6.5	BH105A_6.5	<0.1			6.30	Cream weak medium density CHALK. Discontinuities closed and extremely closely spaced. Stained brown and orange-brown along discontinuity surfaces.	Dry. NVO.	
7.0					6.70		Dry. NVO.	
7.5		<0.1				Structureless cream CHALK comprised of stiff slightly gravelly SILT. Gravel is fine to medium subrounded to subangular very weak low density cream chalk. Discontinuities closed and extremely closely spaced. Occasional orange-brown staining.		
8.0					(2.30)			
8.5		<0.1				Blocky from 8.2m bgl.		
9.0		<0.1			9.00	Borehole terminated at 9.0m bgl. Target depth reached.		

WELL INSTALLATION DETAILS				LEGEND		GENERAL REMARKS
Cement seal riser	Bentonite/Grout Mix	Bentonite seal riser	Filter pack riser	Chalk		
Filter pack screen	Hole Collapse	SAMPLE TYPE DETAILS				Vacuum extraction to 1.2m bgl. Hollow stem from 1.2 to 9.0m bgl. Installed as monitoring well with 50mm OD HDPE, 1mm slotted from 6.5m bgl to 8.5m bgl. 3-6mm gravel filter pack. Groundwater strike unclear during drilling. Groundwater at 7.00m bgl after 20 mins. NVO = No visual or olfactory evidence of impact. m bgl = metres below ground level.
Environmental Sample				Groundwater Table Water Strike bgl = Below Ground Level	NVO - No Visual or Olfactory Evidence of Contamination	
				Logged By	BSS	Approved By
						BKS

EXPLORATORY HOLE LOG

Project Name and Site Location Shell Hitchin			Client Shell UK Oil Products Ltd		BOREHOLE No BH106A
Job No 46370079	Date Start Date 14-02-12 End Date 14-02-12	Ground Level (m) 71.05	Co-Ordinates () E 517,907.63 N 229,830.01		
Contractor Tor Drilling Ltd		Method / Plant Used Vacuum Extraction and Comacchio GEO 250			Sheet 1 of 1

Depth	Sample / Test Details	PID (ppm)	Water	STRATA			Installation / Backfill
				Legend	Depth (Thickness)	DESCRIPTION	
71.0					0.22	Concrete	
0.5					0.40		
70.5	BH106A_0.7	<0.1			0.75	MADE GROUND: Brown clayey sandy gravel. Sand is fine to medium. Gravel is fine to coarse subangular to subrounded brick and concrete.	Moist. NVO. Dry. NVO.
1.0		<0.1			1.00		Dry. NVO.
70.0		<0.1			1.20	MADE GROUND: Dark grey-brown slightly clayey sand and gravel. Sand is fine to medium. Gravel is fine to coarse concrete and brick.	Dry. NVO.
1.5		<0.1			1.50		Wet. NVO.
69.5	BH106A_1.5-2.0	<0.1				MADE GROUND: Light grey slightly silty sand and gravel. Sand is fine to medium. Gravel is fine to coarse subrounded to subangular brick and chalk.	Dry. NVO
2.0		<0.1			(1.30)	Orange-brown very silty SAND. Sand is fine.	
2.5						Soft orange-brown SILT.	
69.0		<0.1			2.80	Firm to stiff orange-brown gravelly SILT. Gravel is fine to medium rounded flint.	Moist. NVO.
3.0		<0.1				With low density chalk gravel from 2.1m bgl.	
3.5						Structureless CHALK comprised of firm white SILT. Discontinuities closed and extremely closely spaced. Stiff from 3.2m bgl.	
4.0		<0.1			(2.10)		
4.5							
66.5					4.90		
5.0	BH106A_5.0	<0.1				Structureless white CHALK comprised of stiff slightly gravelly SILT. Gravel is medium to coarse subrounded to subangular very weak low density white chalk. Discontinuities closed and extremely closely spaced. Occasional light orange-brown staining from 5.3m bgl. Cream in colour from 5.4m bgl.	Moist. NVO.
5.5		<0.1					
6.0		<0.1					
6.5		<0.1					
7.0		<0.1			(3.80)		
7.5		<0.1					
8.0		<0.1					
8.5		<0.1			8.70		
						Borehole terminated at 8.7m bgl. Target depth reached.	

WELL INSTALLATION DETAILS		LEGEND	GENERAL REMARKS
Cement seal riser Bentonite seal riser Filter pack screen Environmental Sample	Bentonite/Grout Mix Filter pack riser Filter Pack: Bottom of hole		
SAMPLE TYPE DETAILS		Concrete Silty Sand Gravelly Silt Made Ground Silt Chalk Groundwater Table Water Strike NVO - No Visual or Olfactory Evidence of Contamination bgl = Below Ground Level	Vacuum extraction to 1.2m bgl. Hollow stem from 1.2 to 8.7m bgl. Installed as monitoring well with 50mm OD HDPE, 1mm slotted from 5.3m bgl to 8.3m bgl. 3-6mm gravel filter pack. NVO = No visual or olfactory evidence of impact. m bgl = metres below ground level.
Logged By		BSS	Approved By BKS

EXPLORATORY HOLE LOG

Project Name and Site Location Shell Hitchin			Client Shell UK Oil Products Ltd		BOREHOLE No BH106B
Job No 46370079	Date Start Date 13-02-12 End Date 13-02-12		Ground Level (m)	Co-Ordinates ()	
Contractor Tor Drilling Ltd			Method / Plant Used Vacuum Extraction		Sheet 1 of 1

Depth	Sample / Test Details	PID (ppm)	Water	STRATA			
				Legend	Depth (Thickness)	DESCRIPTION	COMMENTS
					(0.23) 0.23	Concrete.	
		<0.1			(0.07) 0.30	MADE GROUND: Light brown silty sand and gravel. Sand is fine. Gravel is fine to coarse brick, tarmac and natural stone.	Wet (perched water). NVO.
					(0.20) 0.50	Tarmac.	
0.5		1.4			(0.10) 0.60	MADE GROUND: Dark grey sandy clayey gravel. Sand is fine. Gravel is coarse and cobble sized brick.	Wet (perched water). NVO.
		1			(0.10) 0.70	MADE GROUND: Dark grey-brown clayey sandy gravel. Gravel is medium to coarse subangular to subrounded brick and tarmac.	Wet (perched water). NVO.
						Borehole terminated at 0.7m bgl. Refusal on concrete obstruction.	

WELL INSTALLATION DETAILS		LEGEND		GENERAL REMARKS	
 Backfilled with on-site soils.		 Concrete  Tarmac  Made Ground  Groundwater Table  Water Strike NVO - No Visual or Olfactory Evidence of Contamination bgl = Below Ground Level		Vacuum extraction to 0.7m bgl. . NVO = No visual or olfactory evidence of impact. m bgl = metres below ground level.	
SAMPLE TYPE DETAILS					
		Logged By	BSS	Approved By	BKS

EXPLORATORY HOLE LOG

Project Name and Site Location Shell Hitchin				Client Shell UK Oil Products Ltd				BOREHOLE No BH106C	
Job No 46370079		Date Start Date 15-02-12 End Date 15-02-12		Ground Level (m)		Co-Ordinates ()		Sheet 1 of 1	
Contractor Tor Drilling Ltd				Method / Plant Used Vacuum Extraction					

Depth	Sample / Test Details	PID (ppm)	Water	STRATA				
				Legend	Depth (Thickness)	DESCRIPTION	COMMENTS	Installation / Backfill
0.4	BH106C_0.6	0.4	Water		(0.20)	Concrete		
					0.20			
					(0.10)	MADE GROUND: Bricks and concrete cobbles.	Wet (perched water). NVO	
					0.30			
0.5	BH106C_0.6	<0.1	Water		(0.05)	MADE GROUND: Dark brown clayey slightly sandy gravel. Sand is fine. Gravel is fine to coarse subangular to subrounded brick, concrete and natural stone.	Wet (perched water). NVO	
					0.35	MADE GROUND: Light grey very gravelly sandy SILT. Sand is fine to medium. Gravel is fine to coarse rounded to angular brick, concrete and chalk.	Moist. NVO.	
					(0.45)			
					0.80	Borehole terminated at 0.8m bgl. Refusal on concrete obstruction.		

WELL INSTALLATION DETAILS  Backfilled with on-site soils.		LEGEND  Concrete  Made Ground  Groundwater Table  Water Strike bgl = Below Ground Level		GENERAL REMARKS Vacuum extraction to 0.8m bgl. NVO = No visual or olfactory evidence of impact. m bgl = metres below ground level.
SAMPLE TYPE DETAILS  Environmental Sample				

Logged By BSS		Approved By BKS	
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Monitoring Well Log

Project Name and Site Location Shell Hitchin		Client Shell UK Oil Products Ltd		BOREHOLE No BH101
Job No 46370079	Date Start Date 27-09-11 End Date 27-09-11	Ground Level (m)	Co-Ordinates ()	
Contractor Glover		Method / Plant Used Vacex and Hollow Stem Auger		Sheet 1 of 2

Depth BGL	Sample / Test Details	PID (ppm)	Water	STRATA			
				Legend	Depth (Thickness)	DESCRIPTION	COMMENTS
0.30	BH101_0.8	<0.1			0.30	Concrete and rebar	
0.50					0.50	MADE GROUND: Tarmac and bricks	NVO
0.70					(0.70)	Dark grey/brown sandy slightly gravelly SILT. Gravels are subrounded to subangular of flint and chalk.	Minor black staining, NVO
1.20					1.20	Dark brown slightly sandy SILT with 1-3cm bands of chalk and occasional gravels.	Dry, NVO
1.80	BH101_5.4	<0.1			(1.80)	Dark brown/dark grey slightly sandy firm CLAY with occasional chalk gravels.	Dry, NVO
3.00					3.00		
3.20					(3.20)		
6.20					6.20		
6.80		0.4			(0.80)	Orange sandy SILT.	Dry, NVO
7.00					7.00	Orange/yellow grey medium to coarse SAND with occasional chalk gravels.	Wet, NVO

Backfill Cement seal riser Bentonite seal riser Filter pack riser Filter pack screen	Sample Details Environmental Sample	Legend Concrete Gravelly Sandy Silt Silt Groundwater Table Made Ground Sandy gravelly CLAY Gravelly Sand Groundwater Strike	GENERAL REMARKS m bgl = metres below ground level NVO = No visual or olfactory evidence of impact. Cleared by vacuum excavation to 2m bgl.
Logged By JT		Approved By BS	

Monitoring Well Log

Project Name and Site Location Shell Hitchin			Client Shell UK Oil Products Ltd		BOREHOLE No BH101
Job No 46370079	Date Start Date 27-09-11 End Date 27-09-11	Ground Level (m)	Co-Ordinates ()		
Contractor Glover			Method / Plant Used Vacex and Hollow Stem Auger		Sheet 2 of 2

Depth BGL	Sample / Test Details	PID (ppm)	Water	STRATA			
				Legend	Depth (Thickness)	DESCRIPTION	COMMENTS
8.5		5.2			(2.00)	Orange/yellow grey medium to coarse SAND with occasional chalk gravels. (continued)	Wet, NVO (continued)
9.0		0.3			9.00	EOH at 9.0m bgl	

Backfill ☐ Cement seal riser ☐ Bentonite seal riser ☐ Filter pack riser ☐ Filter pack screen	Sample Details ☒ Environmental Sample	Legend Concrete Made Ground Gravelly Sandy Silt Sandy gravelly CLAY Silt Gravelly Sand Groundwater Table Groundwater Strike	GENERAL REMARKS m bgl = metres below ground level NVO = No visual or olfactory evidence of impact. Cleared by vacuum excavation to 2m bgl.
		Logged By JT	Approved By BS

Monitoring Well Log

Project Name and Site Location Shell Hitchin		Client Shell UK Oil Products Ltd		BOREHOLE No BH102
Job No 46370079	Date Start Date 27-09-11 End Date 27-09-11	Ground Level (m)	Co-Ordinates ()	
Contractor Glover		Method / Plant Used Vacex and Hollow Stem Auger		Sheet 1 of 2

Depth BGL	Sample / Test Details	PID (ppm)	Water	STRATA			Instrument / Backfill
				Legend	Depth (Thickness)	DESCRIPTION	
0.5	BH102_0.8	<0.1			0.30	Concrete and rebar	
0.5					(0.60)	Orange/brown silty slightly gravelly SAND. Contains fragments of sub-rounded to subangular flint and chalk.	NVO
1.0		0.4			0.90	Orange/grey silty SAND. Sand is fine to medium.	Dry, NVO
1.5	BH102_2.7				(1.80)		
2.0		1.1					
2.5					2.70		
3.0		0.8			(1.30)	Orange/brown coarse SAND with rare gravels.	Dry, NVO
4.0		1.7			4.00	Orange/grey banded SAND. Sand is fine to medium	Dry, NVO
4.5					(1.20)		
5.0		2.1			5.20		
5.5					(0.80)	Dark orange/brown slightly silty SAND and GRAVELS. Sand is fine to coarse, gravel is subrounded to subangular of flint and chalk.	Dry, NVO
6.0		419			6.00	Yellow/orange/grey very silty SAND.	Dry, NVO
6.5					(0.50)		
6.5					6.50	Grey sandy SILT.	Dry, NVO
7.0		1207			(0.60)		
7.0					7.10	Orange/grey very silty SAND.	Wet, NVO
7.5							
8.0							

Backfill Cement seal riser Bentonite seal riser Filter pack riser Filter pack screen	Sample Details Environmental Sample	Legend Concrete Silty Sand Sandy Gravel Gravelly Sand Sand Sandy Silt Groundwater Table Groundwater Strike	GENERAL REMARKS m bgl = metres below ground level NVO = No visual or olfactory evidence of impact.
Logged By JT		Approved By BS	



Monitoring Well Log

Project Name and Site Location Shell Hitchin		Client Shell UK Oil Products Ltd		BOREHOLE No BH102
Job No 46370079	Date Start Date 27-09-11 End Date 27-09-11	Ground Level (m)	Co-Ordinates ()	
Contractor Glover		Method / Plant Used Vacex and Hollow Stem Auger		

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Backfill		Sample Details		Legend		GENERAL REMARKS m bgl = metres below ground level NVO = No visual or olfactory evidence of impact.	
	Cement seal riser		Environmental Sample	Concrete	Gravelly Sand		
	Bentonite seal riser			Silty Sand	Sand		
	Filter pack riser			Sandy Gravel	Sandy Silt		
	Filter pack screen			Groundwater Table	Groundwater Strike		
				Logged By	JT	Approved By	BS

JRS ENVIRONMENTAL TRIAL PIT LOG 21/09/07 HITCHIN LOGS SEPT 2011.GPJ AGS3 ALL.GDT 17/10/11

Monitoring Well Log

Project Name and Site Location Shell Hitchin			Client Shell UK Oil Products Ltd		BOREHOLE No BH103
Job No 46370079	Date Start Date 27-09-11 End Date 29-09-11	Ground Level (m)	Co-Ordinates ()		
Contractor Glover		Method / Plant Used Vacex and Hollow Stem Auger			Sheet 1 of 2

Depth BGL	Sample / Test Details	PID (ppm)	Water	STRATA			Instrument / Backfill
				Legend	Depth (Thickness)	DESCRIPTION	
0.30					0.30	Concrete and rebar	
0.5		<0.1			(0.80)	MADE GROUND: Brown sandy gavels. Gravels are brick, clinker and concrete.	
1.0	BH103_1.0	<0.1			1.10		
1.5		0.4				Orange/brown fine to medium SAND.	
2.0	BH103_1.8 N=18 BH103_2.0	<0.1			(1.40)		
2.5					2.50		
3.0		0.7				Dark orange/brown SAND and GRAVELS. Sand is fine to coarse, gravel is subangular to angular of chalk.	
3.5	BH103_3.2				(2.00)		
4.0	BH103_3.6 N=23 BH103_4.0	0.9			4.50		
4.5					(0.50)	Orange/brown silty SAND.	
5.0		0.3			5.00		
5.5	BH103_5.4 N=41				(0.40)	Orange/grey/brown sandy SILT.	
6.0	BH103_6.0	0.2			5.40		
6.5					(0.60)	Orange/brown SAND and GRAVELS. Gravel is chalk and flint.	
7.0		1.6			6.00		
7.5	BH103_7.2 N=15				(3.00)	Orange/grey brown sandy SILT.	
8.0						Becoming wet at 7.1m bgl	

Backfill		Sample Details		Legend		GENERAL REMARKS
Cement seal riser	Bentonite seal riser	Environmental Sample	Standard Penetration Test	Concrete	Made Ground	
Filter pack riser	Filter pack screen	Small Disturbed Sample		Sand	Gravelly Sand	m bgl = metres below ground level NVO = No visual or olfactory evidence of impact.
				Silty Sand	Sandy Silt	
				Groundwater Table	Groundwater Strike	
Logged By			JT		Approved By	BS



Monitoring Well Log

Project Name and Site Location Shell Hitchin		Client Shell UK Oil Products Ltd		BOREHOLE No BH103
Job No 46370079	Date Start Date 27-09-11 End Date 29-09-11	Ground Level (m)	Co-Ordinates ()	
Contractor Glover		Method / Plant Used Vacex and Hollow Stem Auger		

Depth BGL		Sample / Test Details	PID (ppm)	Water	STRATA				
					Legend	Depth (Thickness)	DESCRIPTION	COMMENTS	Instrument / Backfill
8.5			3.7		x x x x x x x x x x x x x x x x x x x x	9.00	Orange/grey brown sandy SILT. <i>(continued)</i>	Dry, NVO <i>(continued)</i>	
9.0							EOH at 9.0m bgl		

Backfill  Cement seal riser  Bentonite seal riser  Filter pack riser  Filter pack screen		Sample Details  Environmental Sample  Standard Penetration Test  Small Disturbed Sample	Legend  Concrete  Sand  Silty Sand  Groundwater Table  Made Ground  Gravelly Sand  Sandy Silt  Groundwater Strike		GENERAL REMARKS m bgl = metres below ground level NVO = No visual or olfactory evidence of impact.
		Logged By	JT	Approved By	BS

JRS ENVIRONMENTAL TRIAL PIT LOG 21/09/07 HITCHIN LOGS SEPT 2011.GPJ AGS3_ALL.GDT 17/10/11

Monitoring Well Log

Project Name and Site Location Shell Hitchin			Client Shell UK Oil Products Ltd		BOREHOLE No BH105
Job No 46370079	Date Start Date 26-09-11 End Date 29-09-11		Ground Level (m)	Co-Ordinates ()	
Contractor Glover			Method / Plant Used Vacex and Hollow Stem Auger		Sheet 1 of 1

Depth BGL	Sample / Test Details	PID (ppm)	Water	STRATA			
				Legend	Depth (Thickness)	DESCRIPTION	COMMENTS
0.5	BH105_0.6	1.7			0.30	Concrete	
					0.50	Tarmac	
1.0		0.9			(0.40) 0.90	MADE GROUND: Dark brown gravels of fragments of brick, clinker, wood and concrete cobbles.	Wet from Vacex, NVO
1.5	BH105_4.1	<0.1			(0.90)	MADE GROUND: Dark brown sandy gravels.	Wet from Vacex, NVO
2.0		0.3			1.80	Light orange/grey silty SAND. Sand is fine to medium.	Dry, NVO
2.5							
3.0		<0.1			(2.40)		
3.5							
4.0	BH105_4.1	<0.1			4.20	Orange/light grey sandy SILT.	Dry, NVO
4.5						Becoming wet at 4.5m bgl	Wet, NVO
5.0		<0.1			(1.60)		
5.5					5.80		
6.0		<0.1			(0.50) 6.30	CHALK	Wet, NVO
						EOH at 6.3m bgl	

Backfill		Sample Details		Legend		GENERAL REMARKS
	Cement seal riser		Environmental Sample		Concrete	
	Bentonite seal riser				Tarmac	m bgl = metres below ground level NVO = No visual or olfactory evidence of impact.
	Filter pack riser				Made Ground	
	Filter pack screen				Silty Sand	
	Bentonite: Bottom of hole/well				Sandy Silt	
					Chalk	
					Groundwater Table	
					Groundwater Strike	
		Logged By		JT		Approved By
						BS

Monitoring Well Log

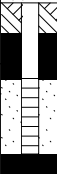
Project Name and Site Location Shell Hitchin			Client Shell UK Oil Products Ltd		BOREHOLE No BH106
Job No 46370079	Date Start Date 28-09-11 End Date 04-10-11	Ground Level (m)	Co-Ordinates ()		
Contractor Glover		Method / Plant Used Vacex and Hollow Stem Auger			Sheet 1 of 1

Depth BGL	Sample / Test Details	PID (ppm)	Water	STRATA			
				Legend	Depth (Thickness)	DESCRIPTION	COMMENTS
0.5	BH106_0.5	1.2			(0.40) 0.40 0.50	Concrete and rebar	
1.0		0.9			(0.70) 1.20	Bricks and tarmac MADE GROUND: Black and grey/brpwm silty slightly sandy gravel. Gravels are brick and concrete fragments.	NVO Black staining, NVO
1.5						Orange/brown silty SAND. Becoming wet from 1.4 to 2.0m bgl	Dry, NVO Wet, NVO
2.0	BH106 1.8 N=22 BH106_2.0	0.2					Dry, NVO
2.5							
3.0		0.4					
3.5	BH106 3.6 N=19				(4.20)	Becoming wet from 3.5m bgl	Wet, NVO
4.0	BH106 3.9 BH106_4.0	0.1					
4.5							
5.0		<0.1					
5.5	BH106 5.4 N=31				5.40	CHALK with small amounts of orange silty sand.	Wet, NVO
6.0	BH106_6.0	<0.1			(0.60) 6.00	CHALK	
6.5					(1.20)		
7.0		<0.1			7.20	EOH at 7.2m bgl	

Backfill		Sample Details		Legend		GENERAL REMARKS
Cement seal riser	Bentonite seal riser	Environmental Sample	Standard Penetration Test	Concrete	Made Ground	
Filter pack riser	Filter pack screen	Small Disturbed Sample		Silty Sand	Chalk	m bgl = metres below ground level NVO = No visual or olfactory evidence of impact.
Bentonite: Bottom of hole/well				Groundwater Table	Groundwater Strike	
		Logged By JT		Approved By BS		

Monitoring Well Log

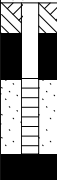
Project Name and Site Location Shell Hitchin			Client Shell UK Oil Products Ltd		BOREHOLE No VP101
Job No 46370079	Date Start Date 29-09-11 End Date 29-09-11	Ground Level (m)	Co-Ordinates ()		
Contractor Glover			Method / Plant Used Vacex		Sheet 1 of 1

Depth BGL	Sample / Test Details	PID (ppm)	Water	STRATA				Instrument / Backfill
				Legend	Depth (Thickness)	DESCRIPTION	COMMENTS	
0.5 1.0					(0.40) 0.40	Concrete and rebar		
					0.60	MADE GROUND: Light brown silty sands and gravels of fragments of brick, concrete and clinker.	NVO	
					(0.60)	Light grey/brown sandy SILT with occasional gravels.	NVO	
					1.20	End of vapour well at 1.2m bgl		

Backfill  Cement seal riser  Bentonite seal riser  Filter pack screen  Bentonite: Bottom of hole/well	Sample Details	Legend  Concrete  Gravelly Silt  Made Ground  Groundwater Table  Groundwater Strike	GENERAL REMARKS m bgl = metres below ground level NVO = No visual or olfactory evidence of impact.
Logged By JT		Approved By BS	

Monitoring Well Log

Project Name and Site Location Shell Hitchin		Client Shell UK Oil Products Ltd		BOREHOLE No VP102
Job No 46370079	Date Start Date 27-09-11 End Date 27-09-11	Ground Level (m)	Co-Ordinates ()	
Contractor Glover		Method / Plant Used Vacex		Sheet 1 of 1

Depth BGL	Sample / Test Details	PID (ppm)	Water	STRATA				Instrument / Backfill
				Legend	Depth (Thickness)	DESCRIPTION	COMMENTS	
0.5	VP102_0.4	<0.1			0.20	Grass and topsoil with roots		
					(0.40) 0.60	MADE GROUND: Brown silty slightly gravelly sand. Gravels are fine to medium of brick and concrete fragments.	Minor black staining, NVO	
					0.80	Tarmac and bricks		
					(0.40) 1.20	Orange/brown silty sandy CLAY.	Minor black staining, NVO	
1.0		<0.1				End of vapour well at 1.2m bgl		

Backfill  Cement seal riser  Bentonite seal riser  Filter pack screen  Bentonite: Bottom of hole/well	Sample Details  Environmental Sample	Legend  Topsoil  Tarmac  Groundwater Table  Made Ground  Sandy Silt/Clay  Groundwater Strike	GENERAL REMARKS m bgl = metres below ground level NVO = No visual or olfactory evidence of impact.
Logged By JT		Approved By BS	

Monitoring Well Log

Project Name and Site Location Shell Hitchin			Client Shell UK Oil Products Ltd		BOREHOLE No VP103
Job No 46370079	Date Start Date 29-09-11 End Date 29-09-11	Ground Level (m)	Co-Ordinates ()		
Contractor Glover		Method / Plant Used Vacex		Sheet 1 of 1	

Depth BGL		Sample / Test Details	PID (ppm)	Water	STRATA			
					Legend	Depth (Thick- ness)	DESCRIPTION	COMMENTS
0.5		VP103_0.7	1.2		0.30	Concrete		
					0.40	Tarmac		
					(0.40)	MADE GROUND: Orange/brown gravels. Gravels are subangular to angular of brick, clinker and concrete cobbles with some tree roots.	Wet from Vacex, NVO	
					0.80			
1.0			1.4		1.00	MADE GROUND: Red bricks and cobbles.	Wet from Vacex, NVO	
						End of vapour well at 1.0m bgl		

Backfill		Sample Details		Legend		GENERAL REMARKS	
	Cement seal riser		Environmental Sample		Concrete		Tarmac
	Bentonite seal riser				Made Ground		Gravelly Sand
	Filter pack screen						
					Groundwater Table		Groundwater Strike
				Logged By JT		Approved By BS	

Appendix C - Photographs

Client Name: Shell UK Oil Products	Site Location: Shell Hitchin	Project No. 46370079
--	-------------------------------------	--------------------------------

Photo No. 1 & 2	Date: February 2012		
Description: Vacex set up at BH102A Drill Rig Set up at BH105A		 	
Photo No. 3,4,5,& 6	Date: February 2012		
Description: Drift Deposits encountered at BH102A: Soil arising from 1.2m to 4.2m bgl. Soil arising from 4.2m to 5.7m bgl. Soil arising from 5.7m to 7.2m bgl. Soil arising from 7.2m to 11.3m bgl.		   	

Client Name: Shell UK Oil Products	Site Location: Shell Hitchin	Project No. 46370079
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Photo No. 7 & 8	Date: February 2012		
Description: Zig Zag Chalk encountered at BH102A: Soil arising from 11.7m to 13.2m bgl. Soil arising from 13.2m to 14.2m bgl.			
Photo No. 9, 10, 11 & 12	Date: February 2012		
Description: Zig Zag Chalk encountered at BH106A: Soil arising from 2.7m to 4.2m bgl. Soil arising from 5.7m to 6.2m bgl. Soil arising from 6.2m to 7.2m bgl. Soil arising from 7.2m to 8.7m bgl.			
			

Appendix D - Chain Of Custodies (COCs)



Alcontrol Laboratories

Units 7 - 8 Hawarden Business Park, Manor Road (Off Manor Lane), Hawarden, Deeside, CH5 3US
 email: chester.schedulers@alcontrol.com
 Tel : 01244 528 700 Couriers: 0845 1241715

Client: URS
 Address: 551 Georges Road
 Wimbledon
 SW19 4DR
 Tel: Fax: 0208 9443300
 Location [PROJ_NAME]: Shell Hithin
 Project Code [PROJ_ID]: 46370079
 Email: ben.schultz@urs.com

Date Samples Despatched: 4/12/12
 Sampler: B SHORT
 Quotation - yes/no
 Quotation Number:
 Job Continuation - yes / no
 Continuation of ALcontrol job:
 Only one project per sheet please.

[SAMP_DATE]	Sample Ref. ID [HOLE_ID]	Depth in metres (top) [SAMP_TOP]	Depth in metres (base) [SAMP_BASE]	AGS Sample Type [SAMP_TYPE]	Client Sample Ref [SAMP_REF]	Sample Preservation Y/N	(S)oil or (W)ater (specify if other)	(E)ffluent, (Sew)wage, (Sa)lline	Suite Name/Analysis Required	Turnaround - please tick	Report format	Samplers Signature
13/12/12	BH106C	0.6							02 HOLD	7 day turnaround 5 day turnaround ☒ 4 day turnaround 3 day turnaround Other (please specify) Date required by:	Standard Cross Tab NG AGS Equis Other (please specify)	BS
14/12/12	BH106A	0.7							02 HOLD			BS
14/12/12	DJAC1								02 HOLD			BS

Will samples be scheduled in @mis? Yes / No KNOWN HAZARDS / Additional Instructions / overseas samples Please ensure water matrices are clearly identified for correct MCERTS accreditation.	P.O. Number	Invoice address if different from above:
	NB. - Results will not be issued without a P.O number Date Received: Time: Signature: ALcontrol Job No.	



Alcontrol Laboratories

Units 7 - 8 Hawarden Business Park, Manor Road (Off Manor Lane), Hawarden, Deeside, CH5 3US
email: chester.schedulers@alcontrol.com
Tel : 01244 528 700 Counters: 0845 1241715

Client: URS
Address: 5 St Georges Rd
Wimbledon
SW19 4DR
Tel: 0208 944 3300
Location [PROJ_NAME]: Shell Hatchery
Project Code [PROJ_ID]: A6320079
Email: BEN.SCHULTZ@URS.COM
Contact Name: BEN SCHULTZ

Date Samples Dispatched:	15/02/12
Sampler :	B. SHORT
Quotation - yes/no	
Quotation Number:	
Job Continuation - yes / no	
Continuation of ALcontrol job:	

Only one project per sheet please.

Date of Sampling [SAMP_DATE]	Sample Ref. ID [HOLE_ID]	Depth in metres (top) [SAMP_TOP]	Depth in metres (base) [SAMP_BASE]	AGS Sample Type [SAMP_TYPE]	Client Sample Ref [SAMP_REF]	Sample Preservation Y/N	(S)oil or (W)ater (specify if other)	(E)ffluent, (Sew)wage, (Sa)lline	Suite Name/Analysis Required	Turnaround - please tick	Report format	Samplers Signature
02/12	BH106A	1.5	2.0						AGS 0.7 AGS 1.0 AGS 1.4 AGS 1.6	☒ 7 day turnaround ☐ 5 day turnaround ☐ 4 day turnaround ☐ 3 day turnaround ☐ Other (please specify) Date required by :	Standard Cross Tab NG AGS Equis Other (please specify)	B5
02/12	BH106A	5.0										B5
02/12	BH105A	6.5							20 HCL D			B5

@mis: Save time and
also your wallet. mis.com

Will samples be scheduled in @mis? Yes / No

KNOWN HAZARDS / Additional Instructions / overseas samples

Please ensure water matrices are clearly identified for correct MCERTS accreditation.

P.O. Number

NB. - Results will not be issued without a PO number

Date Received:

Signature: _____

ALcontrol Job No.

Appendix E - Laboratory Analytical Results



URS Corporation Limited
St. George's House
2nd Floor
5 St. George's Road
Wimbledon
Greater London
SW19 4DR

Attention: Ben Schultz

CERTIFICATE OF ANALYSIS

Date: 27 February 2012
Customer: H_URS_WIM
Sample Delivery Group (SDG): 120218-36
Your Reference: 46370079
Location: Shell Hitchin
Report No: 172112

We received 4 samples on Saturday February 18, 2012 and 4 of these samples were scheduled for analysis which was completed on Monday February 27, 2012. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager





SDG:	120218-36	Location:	Shell Hitchin	Order Number:	
Job:	H_URS_WIM-108	Customer:	URS Corporation Limited	Report Number:	172112
Client Reference:	46370079	Attention:	Ben Schultz	Superseded Report:	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
5194606	BH102A		13.20	16/02/2012
5194607	BH102A		13.60 - 14.00	16/02/2012
5194604	BH102A		5.70 - 6.10	16/02/2012
5194608	TRIP BLANK			16/02/2012

Only received samples which have had analysis scheduled will be shown on the following pages.



CERTIFICATE OF ANALYSIS

Validated

SDG:	120218-36	Location:	Shell Hitchin	Order Number:	
Job:	H_URS_WIM-108	Customer:	URS Corporation Limited	Report Number:	172112
Client Reference:	46370079	Attention:	Ben Schultz	Superseded Report:	

LIQUID Results Legend X Test N No Determination Possible	Lab Sample No(s)		5194608
	Customer Sample Reference		TRIP BLANK
	AGS Reference		
	Depth (m)		
	Container		Vial (ALE297)
VOC MS (W)	All	NDPs: 0 Tests: 1	X



SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 172112
Superseded Report:

SOLID**Results Legend**

Test

No Determination
Possible**Lab Sample No(s)**5194604
5194606
5194607**Customer
Sample Reference**BH102A
BH102A
BH102A**AGS Reference****Depth (m)**5.70 - 6.10
13.20
13.60 - 14.00**Container**250g Amber Jar (AL
60g VOC (ALE215)
250g Amber Jar (AL
60g VOC (ALE215)
250g Amber Jar (AL
60g VOC (ALE215)

EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 3	X	X	X			
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 3	X	X	X			
GRO by GC-FID (S)	All	NDPs: 0 Tests: 3		X	X	X		
Oxygenates (S)	All	NDPs: 0 Tests: 3		X	X	X		
PAH by GCMS	All	NDPs: 0 Tests: 3	X	X	X			
Sample description	All	NDPs: 0 Tests: 3	X	X	X			
Total Organic Carbon	All	NDPs: 0 Tests: 3	X	X	X			
VOC MS (S)	All	NDPs: 0 Tests: 3	X	X	X			



SDG:	120218-36	Location:	Shell Hitchin	Order Number:	
Job:	H_URS_WIM-108	Customer:	URS Corporation Limited	Report Number:	172112
Client Reference:	46370079	Attention:	Ben Schultz	Superseded Report:	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm
Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2		
5194604	BH102A	5.70 - 6.10	Light Brown	Sand	0.1 - 2 mm	None	None		
5194606	BH102A	13.20	Light Brown	Silty Sand	0.1 - 2 mm	None	None		
5194607	BH102A	13.60 - 14.00	Cream	Silt	0.063 - 0.1 mm	None	None		

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Order Number:
Report Number: 172112
Superseded Report:

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Order Number:
Report Number: 172112
Superseded Report:

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Order Number:
Report Number: 172112
Superseded Report:

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Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Order Number:
Report Number: 172112
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[illegible]

Order Number:
Report Number: 172112
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Order Number:
Report Number: 172112
Superseded Report:

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Order Number:
Report Number: 172112
Superseded Report:

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SDG:	120218-36	Location:	Shell Hitchin	Order Number:	
Job:	H_URS_WIM-108	Customer:	URS Corporation Limited	Report Number:	172112
Client Reference:	46370079	Attention:	Ben Schultz	Superseded Report:	

Notification of Deviating Samples

Sample Number	Customer Sample Ref.	Depth (m)	Matrix	Test Name	Component Name	Comment
5210486	BH102A	13.20	SOLID	GRO by GC-FID (S)	GRO Surrogate % recovery**	Matrix interference

Note : Test results may be compromised



SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 172112
Superseded Report:

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample ¹	Surrogate Corrected
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM116	Modified: US EPA Method 8260, 8120, 8020, 624, 610 & 602	Determination of Volatile Organic Compounds by Headspace / GC-MS		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM208	Modified: US EPA Method 8260b & 624	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM288		Determination of Oxygenates in Soils by Headspace/GC-MS		

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.



SDG:	120218-36	Location:	Shell Hitchin	Order Number:	
Job:	H_URS_WIM-108	Customer:	URS Corporation Limited	Report Number:	172112
Client Reference:	46370079	Attention:	Ben Schultz	Superseded Report:	

Test Completion Dates

Lab Sample No(s)	5194604	5194606	5194607	5194608
Customer Sample Ref.	BH102A	BH102A	BH102A	TRIP BLANK
AGS Ref.				
Depth	5.70 - 6.10	13.20	13.60 - 14.00	
Type	SOLID	SOLID	SOLID	LIQUID

EPH CWG (Aliphatic) GC (S)	27-Feb-2012	27-Feb-2012	27-Feb-2012	
EPH CWG (Aromatic) GC (S)	27-Feb-2012	27-Feb-2012	27-Feb-2012	
GRO by GC-FID (S)	23-Feb-2012	23-Feb-2012	23-Feb-2012	
Oxygenates (S)	23-Feb-2012	23-Feb-2012	23-Feb-2012	
PAH by GCMS	24-Feb-2012	24-Feb-2012	24-Feb-2012	
Sample description	22-Feb-2012	22-Feb-2012	22-Feb-2012	
Total Organic Carbon	24-Feb-2012	24-Feb-2012	24-Feb-2012	
VOC MS (S)	23-Feb-2012	23-Feb-2012	23-Feb-2012	
VOC MS (W)				22-Feb-2012



SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 172112
Superseded Report:

ASSOCIATED AQC DATA

EPH CWG (Aliphatic) GC (S)

Component	Method Code	QC 57	QC 54
Total Aliphatics >C12-C35	TM173	83.75 68.60 : 100.41	81.46 63.33 : 106.07

EPH CWG (Aromatic) GC (S)

Component	Method Code	QC 57	QC 54
Total Aromatics >EC12-EC35	TM173	97.33 60.37 : 122.36	92.67 67.63 : 106.82

GRO by GC-FID (S)

Component	Method Code	QC 52	QC 56
Benzene by GC (Moisture Corrected)	TM089	91.5 71.62 : 122.71	109.0 80.15 : 118.91
Ethylbenzene by GC (Moisture Corrected)	TM089	92.0 70.69 : 122.64	106.5 79.83 : 118.16
m & p Xylene by GC (Moisture Corrected)	TM089	91.25 69.15 : 125.16	105.5 77.43 : 115.19
MTBE GC-FID (Moisture Corrected)	TM089	88.0 79.00 : 121.00	105.5 80.54 : 120.94
o Xylene by GC (Moisture Corrected)	TM089	90.0 70.21 : 124.53	104.0 80.90 : 117.77
QC	TM089	100.17 78.42 : 129.82	101.51 77.71 : 108.77
Toluene by GC (Moisture Corrected)	TM089	92.0 79.00 : 121.00	108.0 81.82 : 117.25

Oxygenates (S)

Component	Method Code	QC 50
Benzene raw	TM288	95.5 77.94 : 128.84
Diisopropyl ether raw	TM288	99.5 78.68 : 128.65
Ethanol raw	TM288	73.0 56.39 : 148.67
Ethylbenzene raw	TM288	97.0 85.32 : 126.10
o-Xylene raw	TM288	91.25 79.38 : 117.63
p/m-Xylene raw	TM288	93.38 86.29 : 121.95
tert Butanol raw	TM288	110.5 75.64 : 168.91
tert-amyl methyl ether raw	TM288	98.5 71.22 : 127.95



CERTIFICATE OF ANALYSIS

SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 172112
Superseded Report:

Oxygenates (S)

		QC 50
tert-butyl ethyl ether raw	TM288	98.0 64.00 : 136.00
tert-butyl methyl ether raw	TM288	100.75 83.50 : 129.91
Toluene raw	TM288	90.25 75.97 : 110.53

PAH by GCMS

Component	Method Code	QC 50
Acenaphthene	TM218	83.0 78.38 : 107.88
Acenaphthylene	TM218	76.5 69.53 : 98.96
Anthracene	TM218	78.0 70.02 : 108.14
Benz(a)anthracene	TM218	87.0 75.52 : 122.57
Benzo(a)pyrene	TM218	88.5 81.94 : 122.53
Benzo(b)fluoranthene	TM218	88.0 86.08 : 119.90
Benzo(ghi)perylene	TM218	87.5 74.07 : 119.02
Benzo(k)fluoranthene	TM218	88.5 86.13 : 115.27
Chrysene	TM218	87.0 75.35 : 119.13
Dibenzo(ah)anthracene	TM218	89.0 72.56 : 120.05
Fluoranthene	TM218	80.0 75.41 : 112.08
Fluorene	TM218	82.5 79.26 : 109.59
Indeno(123cd)pyrene	TM218	88.5 71.54 : 119.37
Naphthalene	TM218	80.5 76.45 : 106.42
Phenanthrene	TM218	80.0 74.28 : 110.55
Pyrene	TM218	79.5 76.12 : 112.08

Total Organic Carbon

Component	Method Code	QC 56	QC 52
Total Organic Carbon	TM132	100.0 89.28 : 110.72	104.59 89.28 : 110.72

VOC MS (S)



SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 172112
Superseded Report:

VOC MS (S)

Component	Method Code	QC 59
1,1,1,2-tetrachloroethane	TM116	98.8 86.16 : 121.72
1,1,1-Trichloroethane	TM116	116.2 85.09 : 125.10
1,1,2-Trichloroethane	TM116	116.0 98.00 : 135.46
1,1-Dichloroethane	TM116	124.6 85.89 : 132.78
1,2-Dichloroethane	TM116	126.6 89.80 : 135.21
1,4-Dichlorobenzene	TM116	106.0 86.85 : 121.85
2-Chlorotoluene	TM116	121.4 89.30 : 154.24
4-Chlorotoluene	TM116	117.2 89.25 : 148.67
Benzene	TM116	114.2 90.00 : 123.49
Carbon Disulphide	TM116	104.2 70.58 : 125.46
Carbontetrachloride	TM116	101.4 85.17 : 120.25
Chlorobenzene	TM116	102.0 89.06 : 121.18
Chloroform	TM116	122.2 87.09 : 129.96
Chloromethane	TM116	123.6 73.44 : 175.23
Cis-1,2-Dichloroethene	TM116	115.0 79.66 : 120.66
Dibromomethane	TM116	96.8 79.31 : 116.60
Dichloromethane	TM116	121.6 85.23 : 135.44
Ethylbenzene	TM116	103.4 70.86 : 132.33
Hexachlorobutadiene	TM116	101.2 58.81 : 216.52
Isopropylbenzene	TM116	92.6 66.12 : 105.73
Naphthalene	TM116	100.6 90.69 : 135.27
o-Xylene	TM116	100.0 77.66 : 112.05
p/m-Xylene	TM116	99.2 87.70 : 116.30
Sec-Butylbenzene	TM116	103.8 54.08 : 128.43
Tetrachloroethene	TM116	102.4 78.08 : 139.93
Toluene	TM116	106.2 65.92 : 140.08



SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 172112
Superseded Report:

VOC MS (S)

		QC 59
Trichloroethene	TM116	110.0 88.19 : 119.96
Trichlorofluoromethane	TM116	118.2 86.00 : 127.38
Vinyl Chloride	TM116	114.6 54.01 : 136.23

VOC MS (W)

Component	Method Code	QC 53
1,1,1,2-Tetrachloroethane	TM208	113.0 83.92 : 121.71
1,1,1-Trichloroethane	TM208	107.0 82.89 : 127.03
1,1-Dichloroethane	TM208	113.0 84.06 : 128.53
1,2-Dichloroethane	TM208	114.0 76.92 : 137.00
2-Chlorotoluene	TM208	111.5 84.65 : 118.91
4-Chlorotoluene	TM208	112.5 85.47 : 119.58
Benzene	TM208	114.5 75.59 : 136.08
Bromomethane	TM208	116.5 75.78 : 148.00
Carbontetrachloride	TM208	108.5 80.59 : 133.93
Chlorobenzene	TM208	117.0 80.31 : 128.02
Chloroform	TM208	115.0 83.42 : 132.37
Chloromethane	TM208	117.5 71.27 : 130.07
Cis-1,2-Dichloroethene	TM208	113.5 79.85 : 133.15
Dichloromethane	TM208	117.5 75.54 : 141.85
Ethylbenzene	TM208	111.0 79.89 : 124.59
Hexachlorobutadiene	TM208	118.0 55.77 : 158.25
o-Xylene	TM208	115.0 74.49 : 131.29
p/m-Xylene	TM208	110.25 79.11 : 123.92
Tert-butyl methyl ether	TM208	96.0 72.42 : 136.24
Tetrachloroethene	TM208	110.5 74.98 : 135.52
Toluene	TM208	111.0 80.34 : 126.47
Trichloroethene	TM208	110.0 80.68 : 127.52



SDG:	120218-36	Location:	Shell Hitchin	Order Number:	
Job:	H_URS_WIM-108	Customer:	URS Corporation Limited	Report Number:	172112
Client Reference:	46370079	Attention:	Ben Schultz	Superseded Report:	

VOC MS (W)

		QC 53
Vinyl Chloride	TM208	100.5 67.05 : 124.84

The above information details the reference name of the analytical quality control sample (AQC) that has been run with the samples contained in this report for the different methods of analysis.

The figure detailed is the percentage recovery result for the AQC.

The subscript numbers below are the percentage recovery lower control limit (LCL) and the upper control limit (UCL). The percentage recovery result for the AQC should be between these limits to be statistically in control.



SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 172112
Superseded Report:

Chromatogram

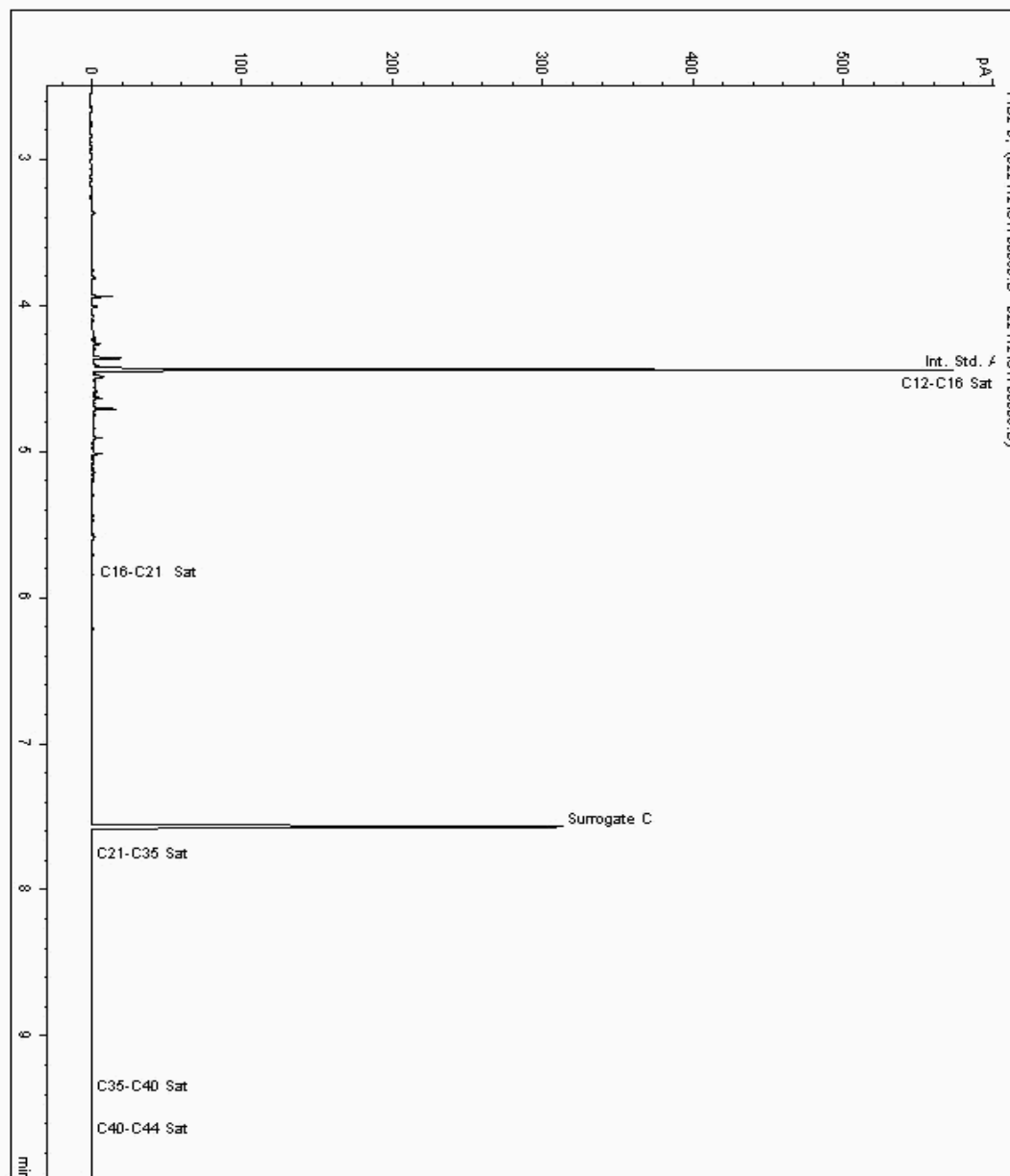
Analysis: EPH CWG (Aliphatic) GC (S)

Sample No : 5222614
Sample ID : BH102A

Depth : 13.20

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 5088904-5222614
Date Acquired : 25/02/2012 11:09:08 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.985





SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 172112
Superseded Report:

Chromatogram

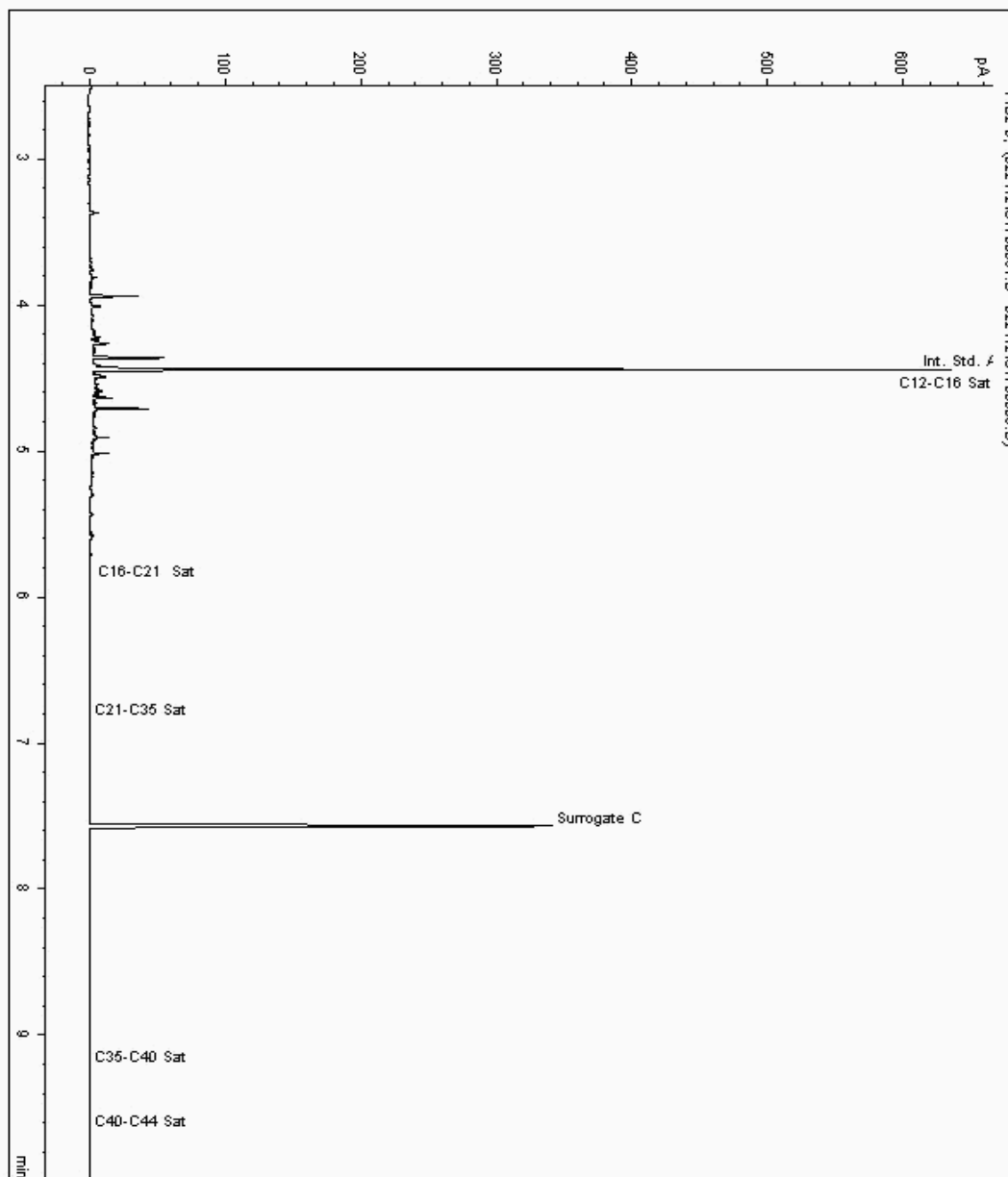
Analysis: EPH CWG (Aliphatic) GC (S)

Sample No : 5222687
Sample ID : BH102A

Depth : 13.60 - 14.00

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 5088914-5222687
Date Acquired : 25/02/2012 11:29:10 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 1.000





CERTIFICATE OF ANALYSIS

SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 172112
Superseded Report:

Chromatogram

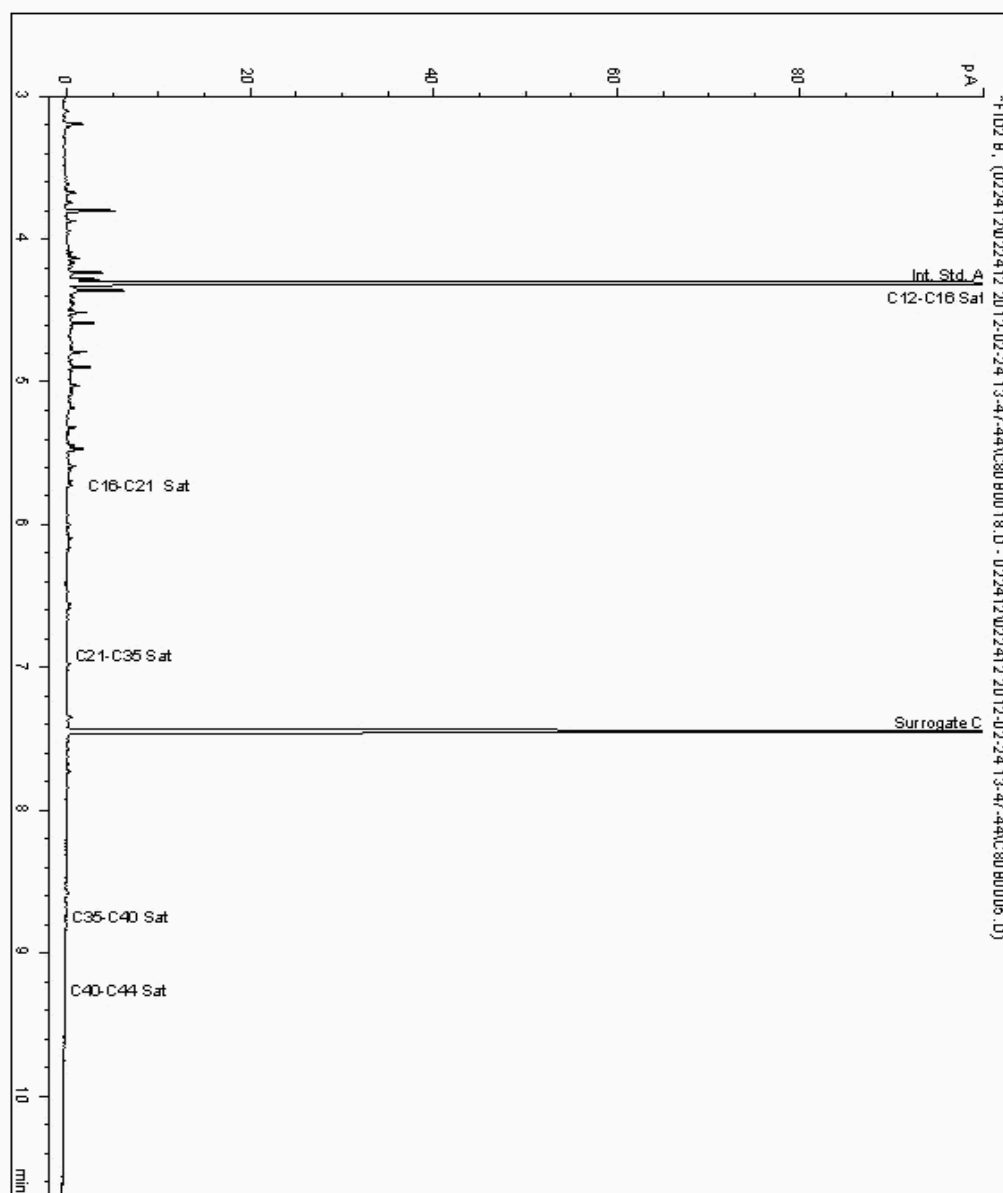
Analysis: EPH CWG (Aliphatic) GC (S)

Sample No : 5223104
Sample ID : BH102A

Depth : 5.70 - 6.10

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 5088894-5223104
Date Acquired : 24/02/12 20:59:13
Units : ppb
Dilution :
CF : 1
Multiplier : 0.978





CERTIFICATE OF ANALYSIS

SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 172112
Superseded Report:

Chromatogram

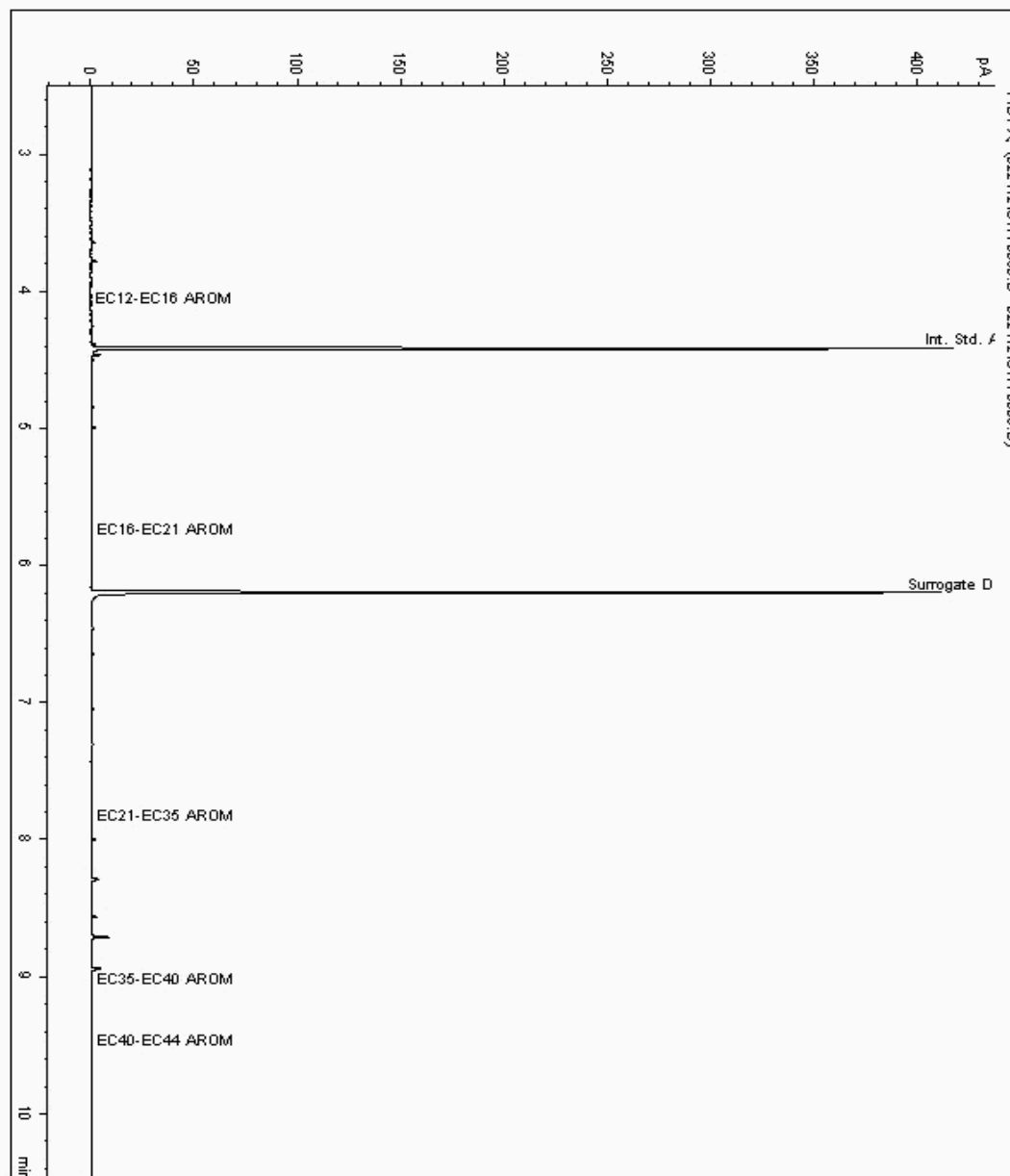
Analysis: EPH CWG (Aromatic) GC (S)

Sample No : 5222614
Sample ID : BH102A

Depth : 13.20

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 5088905-5222614
Date Acquired : 25/02/2012 11:09:08 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.985





SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 172112
Superseded Report:

Chromatogram

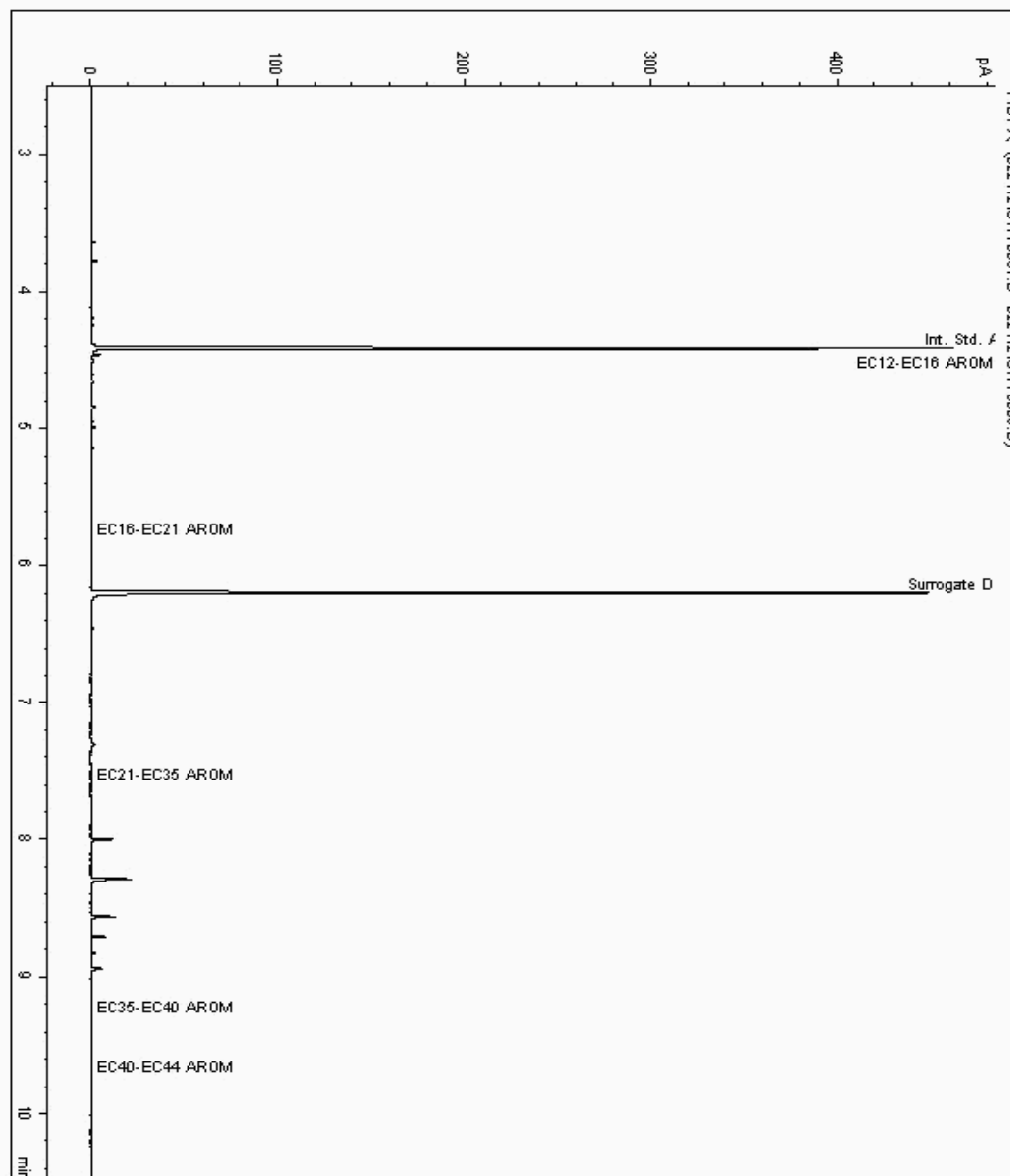
Analysis: EPH CWG (Aromatic) GC (S)

Sample No : 5222687
Sample ID : BH102A

Depth : 13.60 - 14.00

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 5088915-5222687
Date Acquired : 25/02/2012 11:29:10 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 1.000





SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 172112
Superseded Report:

Chromatogram

Analysis: EPH CWG (Aromatic) GC (S)

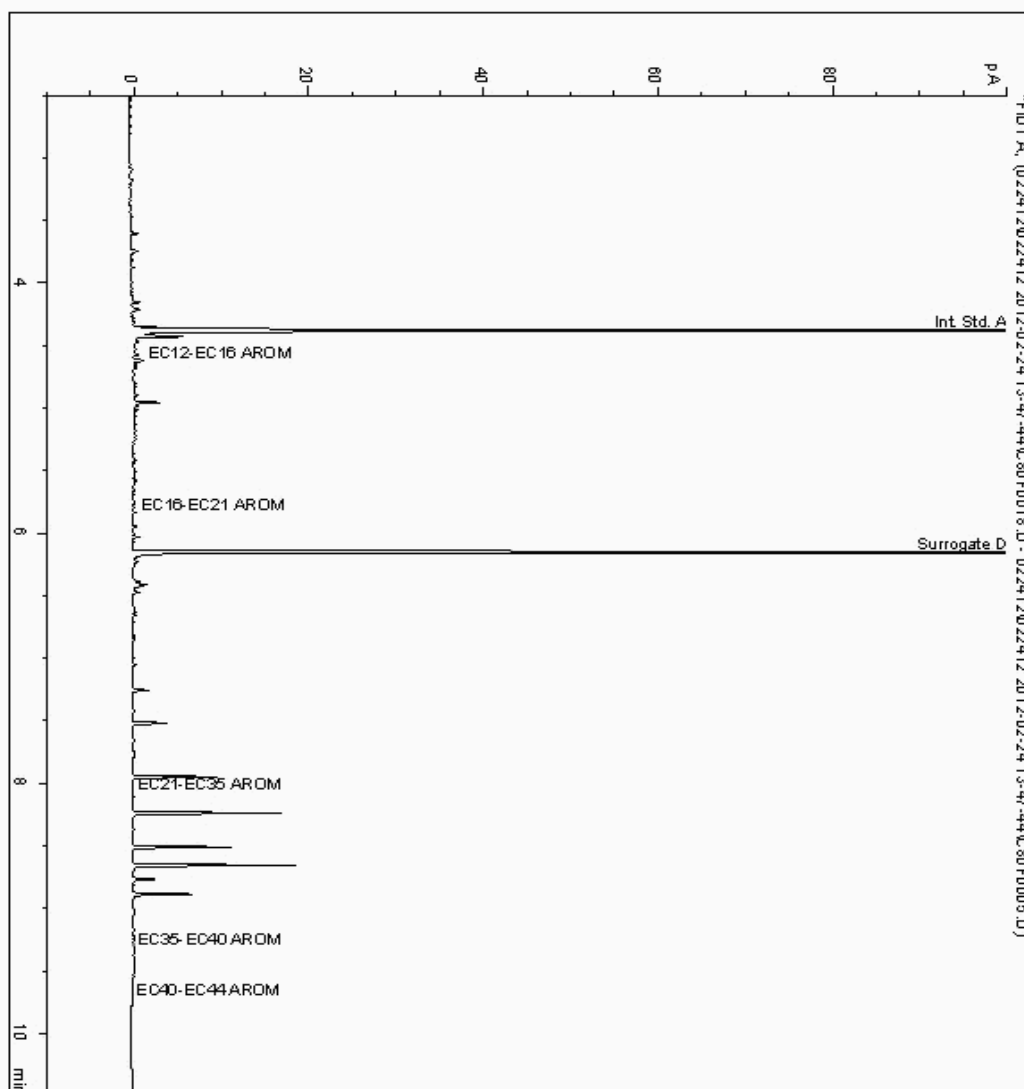
Sample No : 5223104
Sample ID : BH102A

Depth : 5.70 - 6.10

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 5088895-5223104
Date Acquired : 24/02/12 20:59:13
Units : ppb
Dilution :
CF : 1
Multiplier : 0.978

#	Compound Name	Main Peak Area	Amount
1	Int. Std. A	373.9	48.900
2	EC12-EC16 AROM	8.7	0.993
3	EC16-EC21 AROM	0.0	0.000
4	Surrogate D	367.2	40.857
5	EC21-EC35 AROM	0.0	0.000
6	EC35-EC40 AROM	0.0	0.000
7	EC40-EC44 AROM	0.0	0.000
Total Peak Area		749.7	





SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

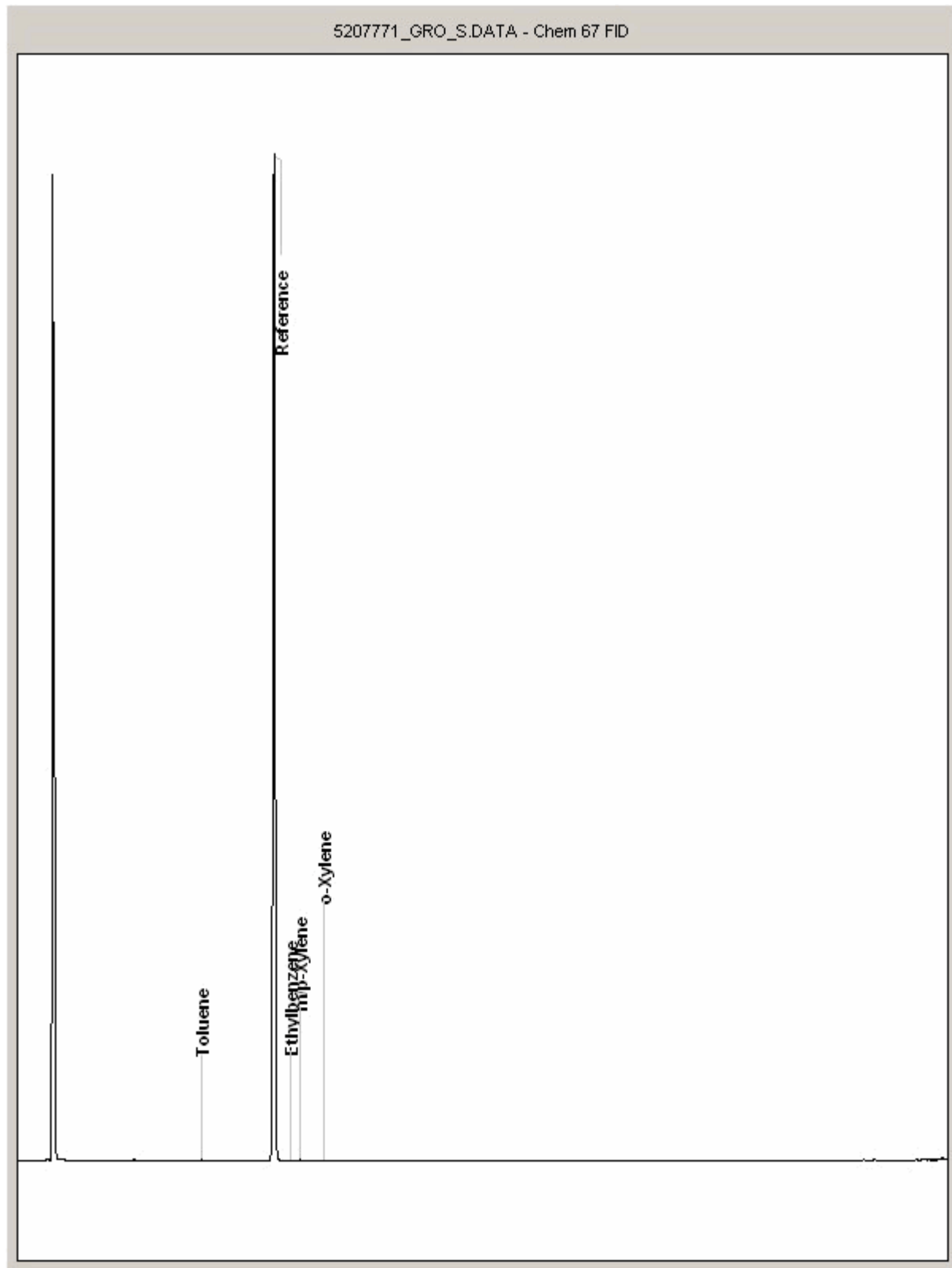
Order Number:
Report Number: 172112
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 5207771
Sample ID : BH102A

Depth : 5.70 - 6.10





SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

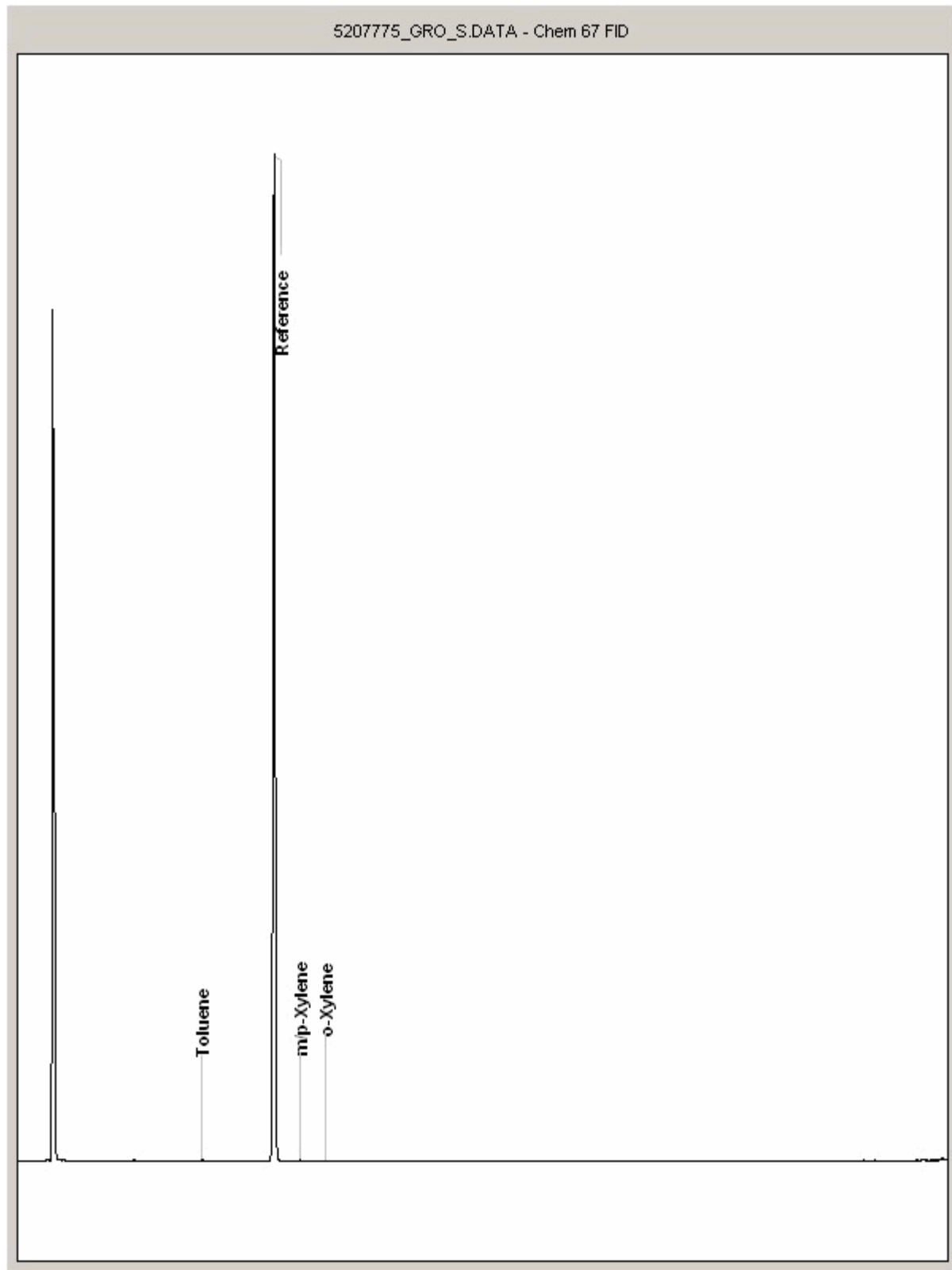
Order Number:
Report Number: 172112
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 5207775
Sample ID : BH102A

Depth : 13.60 - 14.00





SDG: 120218-36
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

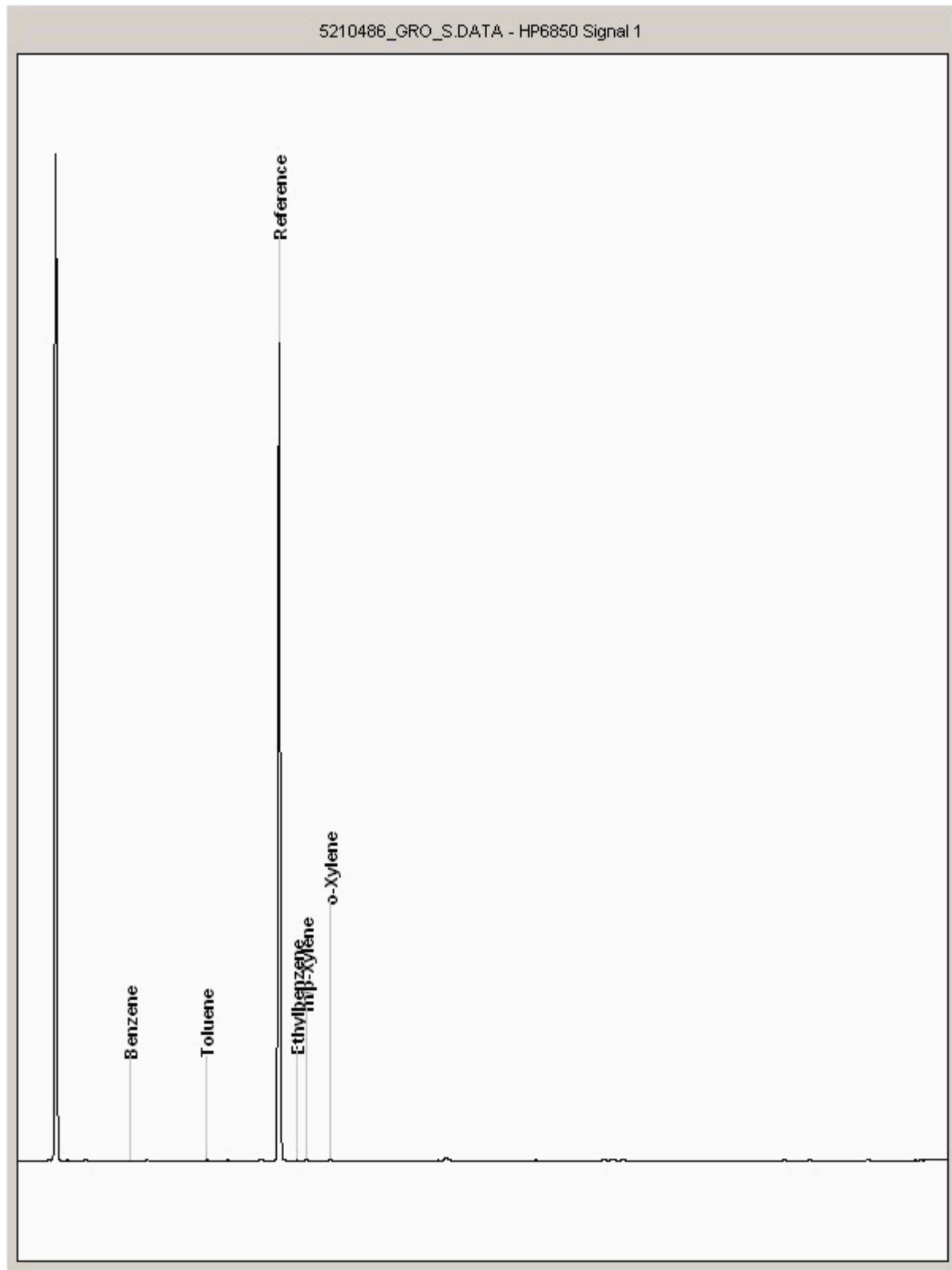
Order Number:
Report Number: 172112
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (S)

Sample No : 5210486
Sample ID : BH102A

Depth : 13.20





CERTIFICATE OF ANALYSIS

SDG:	120218-36	Location:	Shell Hitchin	Order Number:	
Job:	H_URS_WIM-108	Customer:	URS Corporation Limited	Report Number:	172112
Client Reference:	46370079	Attention:	Ben Schultz	Superseded Report:	

Appendix

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

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 2 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

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

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

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

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

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

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

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

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

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

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

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

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

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

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

SOLID MATRICES EXTRACTION SUMMARY				
ANALYSIS	D&C OR WET	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
SOLVENTEXTRACTABLE MATTER	D&C	DCM	SOX THERM	GRAVIMETRIC
CYCLOHEXANE EXT. MATTER	D&C	CYCLOHEXANE	SOX THERM	GRAVIMETRIC
ELEMENTAL SULPHUR	D&C	DCM	SOX THERM	HPLC
PHENOLS BY GCMS	WET	DCM	SOX THERM	GC-MS
HERBICIDES	D&C	HEXANE/ACETONE	SOX THERM	GC-MS
PESTICIDES	D&C	HEXANE/ACETONE	SOX THERM	GC-MS
EPH (DRO)	D&C	HEXANE/ACETONE	END OVER END	GC-FID
EPH (MIN OIL)	D&C	HEXANE/ACETONE	END OVER END	GC-FID
EPH (CLEANED UP)	D&C	HEXANE/ACETONE	END OVER END	GC-FID
EPH CWGBY GC	D&C	HEXANE/ACETONE	END OVER END	GC-FID
PCBAROCLOR 1254/PCB CON	D&C	HEXANE/ACETONE	END OVER END	GC-MS
POLYAROMATIC HYDROCARBONS (MS)	WET	HEXANE/ACETONE	MICROWAVE TM218.	GC-MS
>C6-C40	WET	HEXANE/ACETONE	SHAKER	GC-FID
POLYAROMATIC HYDROCARBONS RAPID GC	WET	HEXANE/ACETONE	SHAKER	GC-FID
SEMI VOLATILE ORGANIC COMPOUNDS	WET	DOM/ACETONE	SONICATE	GC-MS

LIQUID MATRICES EXTRACTION SUMMARY			
ANALYSIS	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
PAHMS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-MS
EPH	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-FID
EPH CWG	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-FID
MINERAL OIL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-FID
PCB7 CONGENERS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-MS
PCBAROCLOR 1254	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC-MS
SVOC	DCM	LIQUID/LIQUID SHAKE	GC-MS
FREESULPHUR	DCM	SOLID PHASE EXTRACTION	HPLC
PESTOCPOPP	DCM	LIQUID/LIQUID SHAKE	GC-MS
TRIAZINE HERBS	DCM	LIQUID/LIQUID SHAKE	GC-MS
PHENOLS MS	ACETONE	SOLID PHASE EXTRACTION	GC-MS
TPH by INFRARED (IR)	TCE	STIRRED EXTRACTION (STIR-BAR)	IR
MINERAL OIL by IR	TCE	STIRRED EXTRACTION (STIR-BAR)	IR
GLYCOLS	NONE	DIRECT INJECTION	GC-FID

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials or those identified as potentially asbestos containing during sample description which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Visual Estimation Of Fibre Content

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

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

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



URS Corporation Limited
St. George's House
2nd Floor
5 St. George's Road
Wimbledon
Greater London
SW19 4DR

Attention: Ben Schultz

CERTIFICATE OF ANALYSIS

Date: 05 March 2012
Customer: H_URS_WIM
Sample Delivery Group (SDG): 120228-13
Your Reference: 46370079
Location: Shell Hitchin
Report No: 173041

We received 9 samples on Tuesday February 28, 2012 and 9 of these samples were scheduled for analysis which was completed on Monday March 05, 2012. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager





SDG:	120228-13	Location:	Shell Hitchin	Order Number:	
Job:	H_URS_WIM-108	Customer:	URS Corporation Limited	Report Number:	173041
Client Reference:	46370079	Attention:	Ben Schultz	Superseded Report:	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
5239901	BH101			27/02/2012
5239883	BH102			27/02/2012
5239888	BH102A			27/02/2012
5239890	BH103			27/02/2012
5239898	BH105A			27/02/2012
5239896	BH106A			27/02/2012
5239887	DUP01			27/02/2012
5239895	EQUIPMENT BLANK			27/02/2012
5239894	TRIP BLANK			27/02/2012

Only received samples which have had analysis scheduled will be shown on the following pages.



SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

LIQUID**Results Legend**

Test

No Determination
Possible**Lab Sample No(s)****Customer
Sample Reference****AGS Reference****Depth (m)****Container**

			5239896	BH106A			Vial /AL E297
			5239898	BH105A			1l green glass bottle
			5239890	BH103			Vial /AL E297
			5239888	BH102A			1l green glass bottle
			5239883	BH102			Vial /AL E297
			5239901	BH101			1l green glass bottle
			5239887	DUP01			Vial /AL E297
			5239894	TRIP BLANK			1l green glass bottle
			5239895	EQUIPMENT BLANK			Vial /AL E297
							1l green glass bottle
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 8	X	X	X	X	X
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 8	X	X	X	X	X
GRO by GC-FID (W)	All	NDPs: 0 Tests: 8	X	X	X	X	X
Oxygenates (W)	All	NDPs: 0 Tests: 8	X	X	X	X	X
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 8	X	X	X	X	X
VOC MS (W)	All	NDPs: 0 Tests: 9	X	X	X	X	X

Order Number:
Report Number: 173041
Superseded Report:

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Order Number:
Report Number: 173041
Superseded Report:

Page 5 of 45

Order Number:
Report Number: 173041
Superseded Report:

Page 6 of 45

Order Number:
Report Number: 173041
Superseded Report:

Page 7 of 45

Order Number:
Report Number: 173041
Superseded Report:

Page 8 of 45

Order Number:
Report Number: 173041
Superseded Report:

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CERTIFICATE OF ANALYSIS

SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

GRO by GC-FID (W)

[illegible]

Order Number:
Report Number: 173041
Superseded Report:

Page 11 of 45

CERTIFICATE OF ANALYSIS

SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

PAH Spec MS - Aqueous (W)

[illegible]

Order Number:
Report Number: 173041
Superseded Report:

Page 13 of 45

CERTIFICATE OF ANALYSIS

SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

VOC MS (W)

[illegible]

CERTIFICATE OF ANALYSIS

SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

VOC MS (W)

[illegible]



SDG:	120228-13	Location:	Shell Hitchin	Order Number:	
Job:	H_URS_WIM-108	Customer:	URS Corporation Limited	Report Number:	173041
Client Reference:	46370079	Attention:	Ben Schultz	Superseded Report:	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample ¹	Surrogate Corrected
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM208	Modified: US EPA Method 8260b & 624	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM289		Determination of Oxygenates in Waters by Headspace/GC-MS		

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.



CERTIFICATE OF ANALYSIS

Validated

SDG:	120228-13	Location:	Shell Hitchin	Order Number:	
Job:	H_URS_WIM-108	Customer:	URS Corporation Limited	Report Number:	173041
Client Reference:	46370079	Attention:	Ben Schultz	Superseded Report:	

Test Completion Dates

Lab Sample No(s)	5239901	5239883	5239890	5239888	5239898	5239896	5239887	5239895	5239894
Customer Sample Ref.	BH101	BH102	BH103	BH102A	BH105A	BH106A	DUP01	EQUIPMENT BLANK	TRIP BLANK
AGS Ref.									
Depth									
Type	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
EPH CWG (Aliphatic) Aqueous GC (W)	02-Mar-2012	02-Mar-2012	02-Mar-2012	02-Mar-2012	02-Mar-2012	02-Mar-2012	02-Mar-2012	02-Mar-2012	
EPH CWG (Aromatic) Aqueous GC (W)	02-Mar-2012	02-Mar-2012	02-Mar-2012	02-Mar-2012	02-Mar-2012	02-Mar-2012	02-Mar-2012	02-Mar-2012	
GRO by GC-FID (W)	29-Feb-2012	29-Feb-2012	29-Feb-2012	29-Feb-2012	29-Feb-2012	29-Feb-2012	29-Feb-2012	29-Feb-2012	
Oxygenates (W)	29-Feb-2012	29-Feb-2012	29-Feb-2012	29-Feb-2012	29-Feb-2012	29-Feb-2012	29-Feb-2012	29-Feb-2012	
PAH Spec MS - Aqueous (W)	02-Mar-2012	05-Mar-2012	05-Mar-2012	05-Mar-2012	05-Mar-2012	05-Mar-2012	05-Mar-2012	05-Mar-2012	
TPH CWG (W)	02-Mar-2012	02-Mar-2012	02-Mar-2012	02-Mar-2012	02-Mar-2012	02-Mar-2012	02-Mar-2012	02-Mar-2012	
VOC MS (W)	29-Feb-2012	01-Mar-2012	29-Feb-2012	29-Feb-2012	29-Feb-2012	29-Feb-2012	01-Mar-2012	29-Feb-2012	29-Feb-2012



SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

ASSOCIATED AQC DATA

EPH CWG (Aliphatic) Aqueous GC (W)

Component	Method Code	QC 54
Total Aliphatics >C12-C35	TM174	90.83 80.02 : 103.41

EPH CWG (Aromatic) Aqueous GC (W)

Component	Method Code	QC 57
Total Aromatics >EC12-EC35	TM174	100.0 81.29 : 109.00

GRO by GC-FID (W)

Component	Method Code	QC 59
Benzene by GC	TM245	97.5 71.13 : 126.23
Ethylbenzene by GC	TM245	98.0 69.26 : 125.64
m & p Xylene by GC	TM245	97.25 68.13 : 125.17
MTBE GC-FID	TM245	97.5 72.11 : 125.43
o Xylene by GC	TM245	98.5 70.52 : 120.41
QC	TM245	96.36 66.93 : 117.51
Toluene by GC	TM245	97.5 72.37 : 125.80

Oxygenates (W)

Component	Method Code	QC 57
Benzene	TM289	95.5 79.73 : 131.69
Diisopropyl ether	TM289	97.5 72.91 : 124.47
Ethanol	TM289	83.2 60.84 : 141.13
Ethylbenzene	TM289	94.5 76.16 : 122.57
o-Xylene	TM289	95.5 77.08 : 124.38
p/m-Xylene	TM289	95.75 82.78 : 120.00
tert Butanol	TM289	84.0 70.51 : 143.48
tert-amyl methyl ether	TM289	96.0 78.92 : 124.29



CERTIFICATE OF ANALYSIS

SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Oxygenates (W)

		QC 57
tert-butyl ethyl ether	TM289	96.0 78.17 : 124.34
tert-butyl methyl ether	TM289	97.5 78.27 : 127.85
Toluene	TM289	95.0 79.08 : 122.51

PAH Spec MS - Aqueous (W)

Component	Method Code	QC 58	QC 54	QC 54
Acenaphthene by GCMS	TM178	97.0 89.14 : 107.15	98.5 89.14 : 107.15	101.0 89.24 : 105.49
Acenaphthylene by GCMS	TM178	104.5 79.43 : 110.70	98.0 79.43 : 110.70	103.5 77.71 : 112.87
Anthracene by GCMS	TM178	90.5 85.28 : 104.91	96.5 85.28 : 104.91	96.0 84.95 : 105.41
Benz(a)anthracene by GCMS	TM178	91.5 76.69 : 110.97	95.5 76.69 : 110.97	88.5 81.03 : 108.36
Benzo(a)pyrene by GCMS	TM178	101.0 82.57 : 113.60	97.5 82.57 : 113.60	101.5 86.69 : 118.58
Benzo(b)fluoranthene by GCMS	TM178	95.5 87.25 : 114.25	97.0 87.25 : 114.25	98.0 87.25 : 114.25
Benzo(ghi)perylene by GCMS	TM178	90.5 82.05 : 112.05	97.0 82.05 : 112.05	96.0 82.05 : 112.05
Benzo(k)fluoranthene by GCMS	TM178	102.5 87.20 : 122.40	97.0 87.20 : 122.40	114.0 87.20 : 122.40
Chrysene by GCMS	TM178	96.5 89.30 : 108.42	96.5 89.30 : 108.42	100.0 83.22 : 112.82
Dibenzo(ah)anthracene by GCMS	TM178	86.5 72.40 : 118.55	102.5 72.40 : 118.55	90.0 72.40 : 118.55
Fluoranthene by GCMS	TM178	93.0 88.44 : 107.61	100.5 88.44 : 107.61	97.5 87.00 : 105.75
Fluorene by GCMS	TM178	95.0 89.91 : 108.00	97.5 89.91 : 108.00	99.5 83.12 : 110.71
Indeno(123cd)pyrene by GCMS	TM178	92.5 82.25 : 114.75	102.0 82.25 : 114.75	93.0 82.25 : 114.75
Naphthalene by GCMS	TM178	98.0 82.31 : 110.89	101.0 82.31 : 110.89	99.5 89.22 : 108.21
Phenanthrene by GCMS	TM178	99.0 84.10 : 107.63	97.0 84.10 : 107.63	102.5 86.79 : 108.29
Pyrene by GCMS	TM178	97.0 88.25 : 107.26	104.0 88.25 : 107.26	99.5 84.55 : 108.55

VOC MS (W)

Component	Method Code	QC 53	QC 50	QC 56
1,1,1,2-Tetrachloroethane	TM208	94.0 86.47 : 123.48	100.0 85.60 : 129.18	94.5 85.60 : 129.18
1,1,1-Trichloroethane	TM208	96.0 84.58 : 123.50	101.0 83.85 : 123.10	98.0 83.85 : 123.10
1,1-Dichloroethane	TM208	100.5 85.03 : 127.99	104.0 82.87 : 126.33	102.0 82.87 : 126.33
1,2-Dichloroethane	TM208	97.5 83.41 : 142.43	93.0 83.09 : 130.94	95.5 83.09 : 130.94



CERTIFICATE OF ANALYSIS

SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

VOC MS (W)

		QC 53	QC 50	QC 56
2-Chlorotoluene	TM208	97.0 83.27 : 124.81	101.5 82.75 : 124.73	94.5 82.75 : 124.73
4-Chlorotoluene	TM208	101.0 84.29 : 124.70	101.0 86.75 : 129.37	94.0 86.75 : 129.37
Benzene	TM208	102.0 86.11 : 127.43	105.0 83.55 : 126.49	102.5 83.55 : 126.49
Bromomethane	TM208	96.5 78.98 : 129.87	102.5 76.88 : 128.80	99.0 76.88 : 128.80
Carbontetrachloride	TM208	99.0 86.30 : 125.39	99.5 84.57 : 127.22	98.0 84.57 : 127.22
Chlorobenzene	TM208	100.5 87.08 : 121.66	103.0 85.63 : 124.57	96.0 85.63 : 124.57
Chloroform	TM208	96.0 86.30 : 130.22	98.0 84.11 : 125.26	97.5 84.11 : 125.26
Chloromethane	TM208	76.5 54.61 : 156.60	117.5 53.01 : 144.16	118.0 53.01 : 144.16
Cis-1,2-Dichloroethene	TM208	93.0 82.98 : 124.07	100.0 81.65 : 120.44	98.0 81.65 : 120.44
Dichloromethane	TM208	94.0 81.74 : 127.88	100.5 79.31 : 122.56	100.0 79.31 : 122.56
Ethylbenzene	TM208	95.0 80.29 : 125.75	98.5 82.87 : 118.68	93.0 82.87 : 118.68
Hexachlorobutadiene	TM208	91.5 74.78 : 134.63	100.5 77.25 : 128.02	93.0 77.25 : 128.02
o-Xylene	TM208	94.5 83.08 : 123.04	99.5 82.79 : 121.93	94.5 82.79 : 121.93
p/m-Xylene	TM208	95.75 85.38 : 120.33	98.75 80.96 : 122.17	93.5 80.96 : 122.17
Tert-butyl methyl ether	TM208	83.0 72.01 : 124.40	97.5 69.07 : 119.88	91.0 69.07 : 119.88
Tetrachloroethene	TM208	96.5 82.62 : 128.11	100.5 88.02 : 123.47	96.5 88.02 : 123.47
Toluene	TM208	96.5 85.43 : 121.75	101.0 84.35 : 124.90	97.0 84.35 : 124.90
Trichloroethene	TM208	94.5 85.42 : 122.53	100.0 85.11 : 127.08	96.5 85.11 : 127.08
Vinyl Chloride	TM208	99.0 62.68 : 118.07	107.5 69.53 : 110.98	106.0 69.53 : 110.98

The above information details the reference name of the analytical quality control sample (AQC) that has been run with the samples contained in this report for the different methods of analysis.

The figure detailed is the percentage recovery result for the AQC.

The subscript numbers below are the percentage recovery lower control limit (LCL) and the upper control limit (UCL). The percentage recovery result for the AQC should be between these limits to be statistically in control.



SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

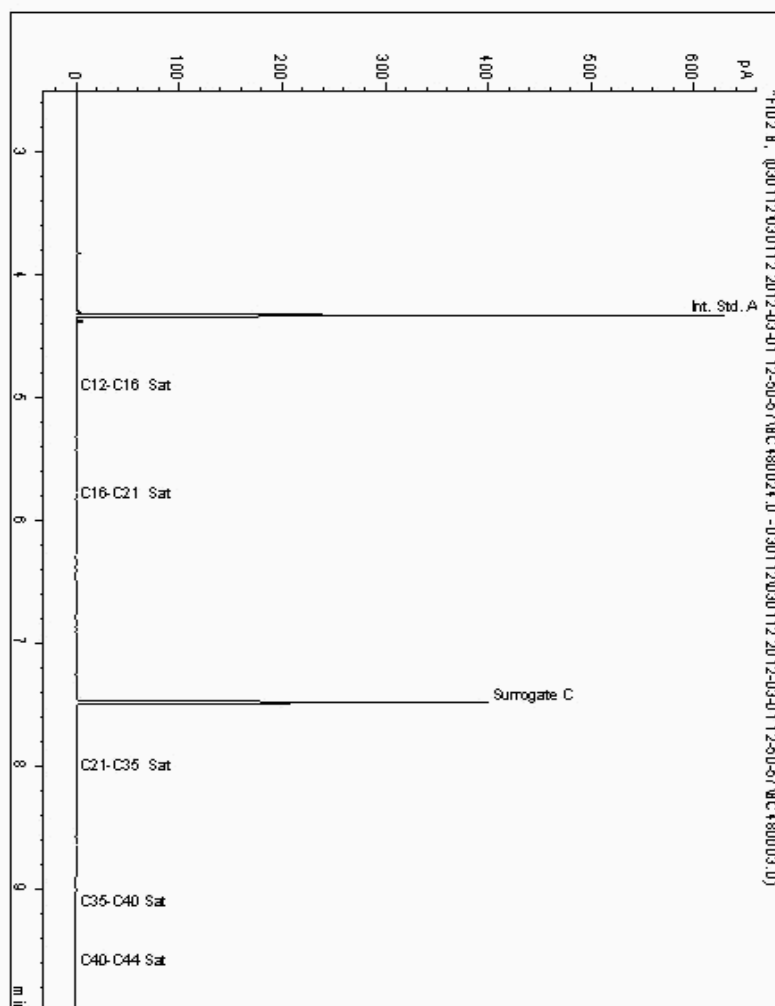
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 5242612
Sample ID : BH102A

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 5133931-5242612
Date Acquired : 01/03/12 20:03:15
Units : ppb
Dilution :
CF : 1
Multiplier : 0.009





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

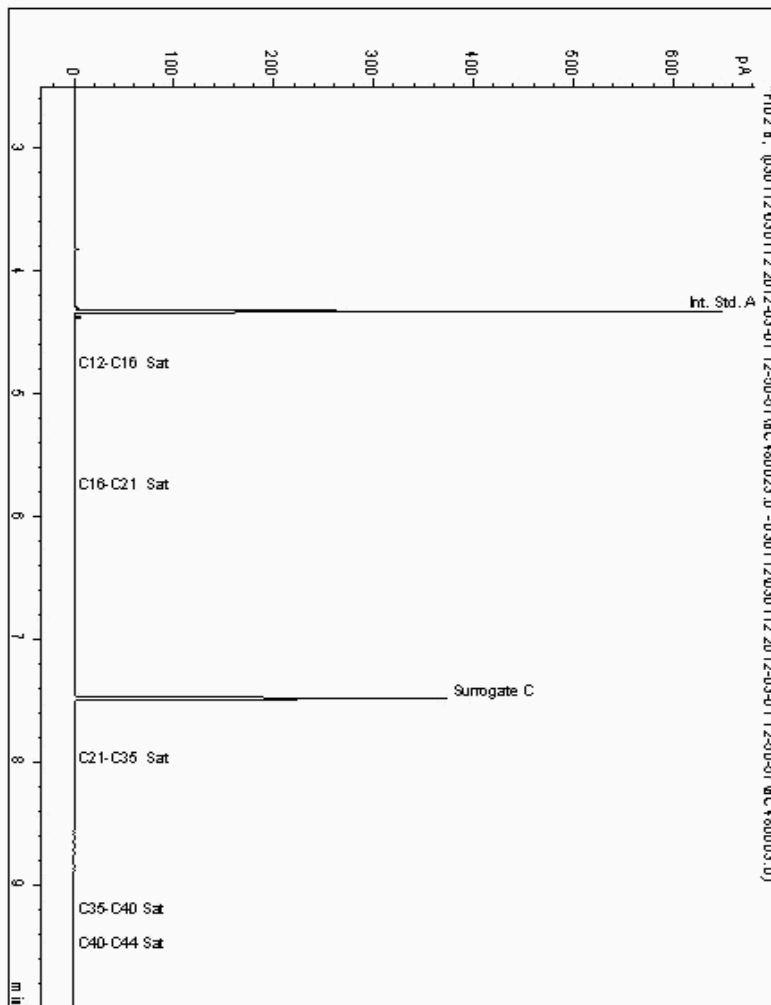
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 5242677
Sample ID : BH101

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 5134005-5242677
Date Acquired : 01/03/12 19:44:06
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

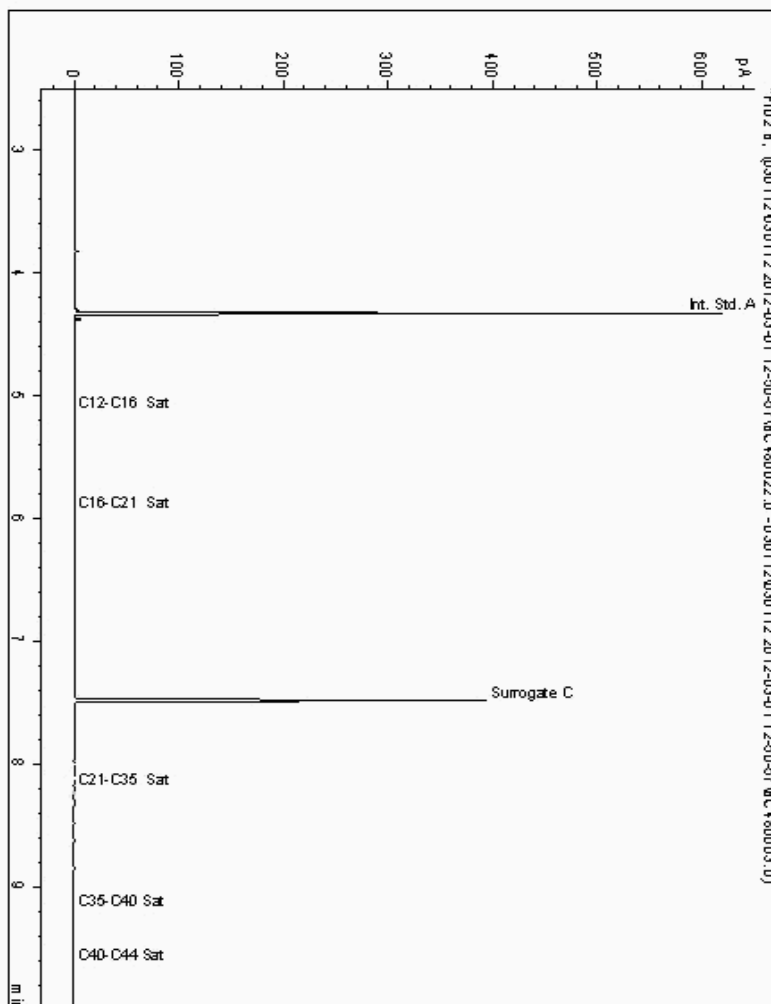
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 5242703
Sample ID : EQUIPMENT BLANK

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 5133967-5242703
Date Acquired : 01/03/12 19:25:04
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

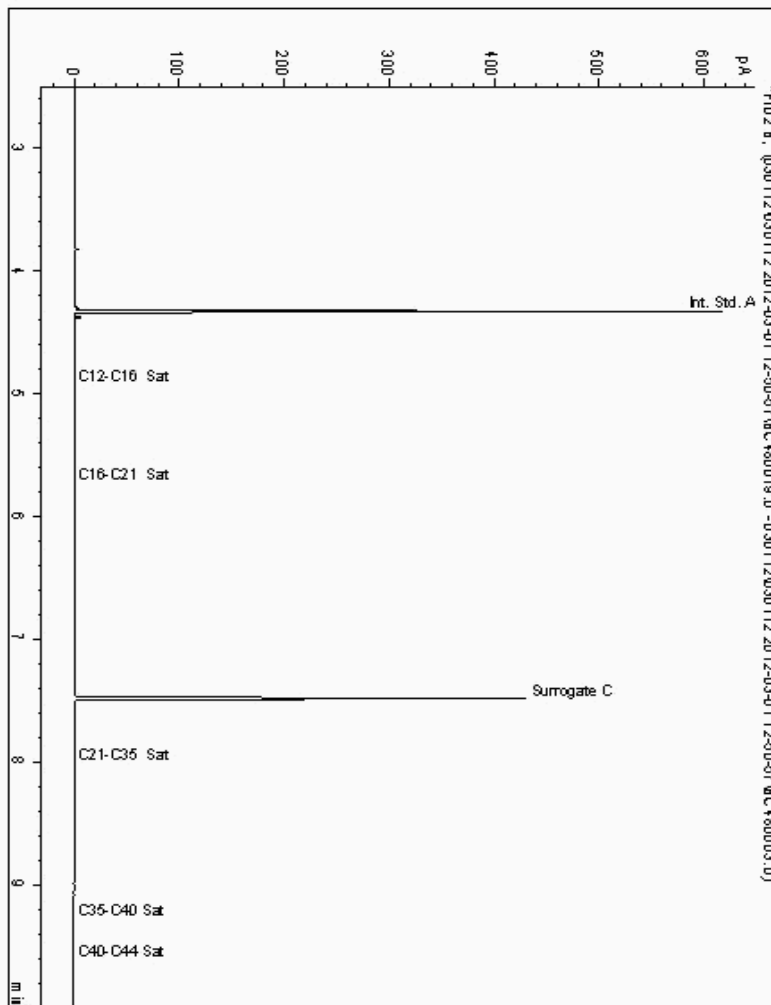
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 5242731
Sample ID : BH105A

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 5133995-5242731
Date Acquired : 01/03/12 18:28:05
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

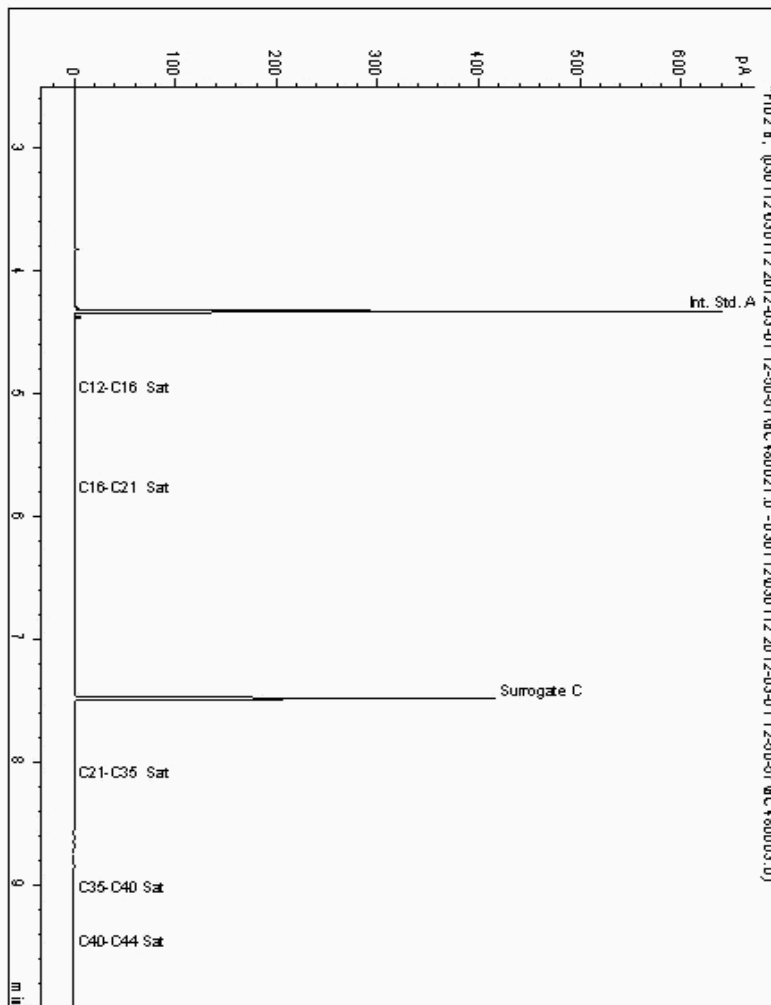
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 5242800
Sample ID : BH106A

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 5133982-5242800
Date Acquired : 01/03/12 19:06:04
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

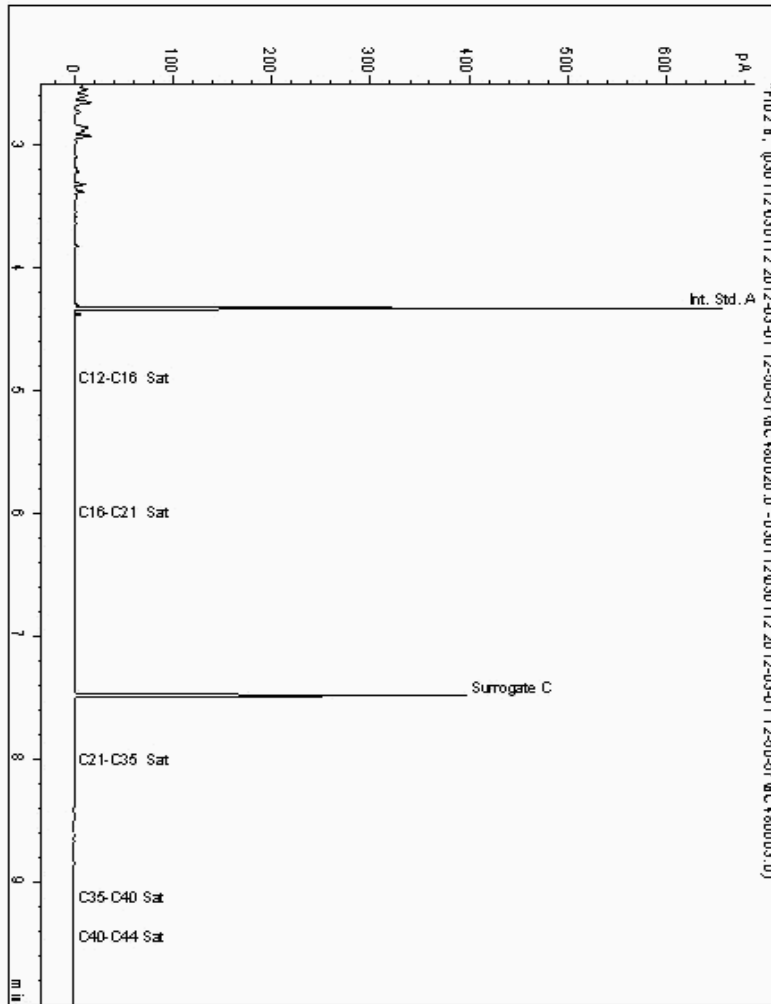
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 5242884
Sample ID : DUP01

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 5133907-5242884
Date Acquired : 01/03/12 18:46:59
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

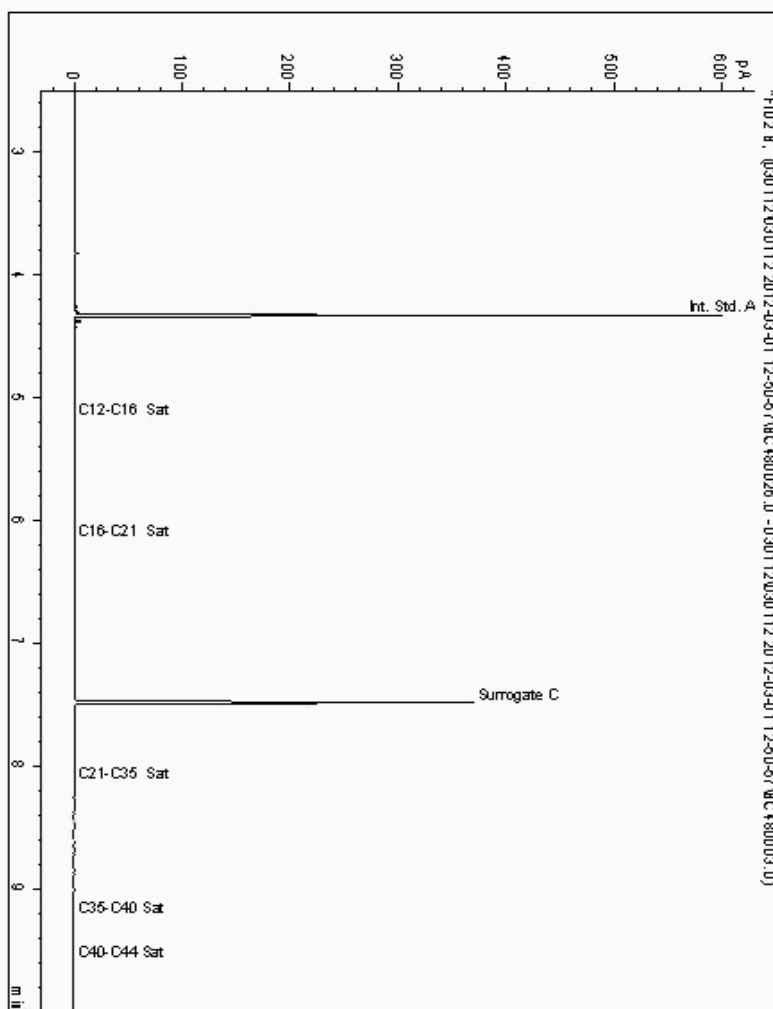
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 5242988
Sample ID : BH103

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 5133941-5242988
Date Acquired : 01/03/12 20:41:23
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

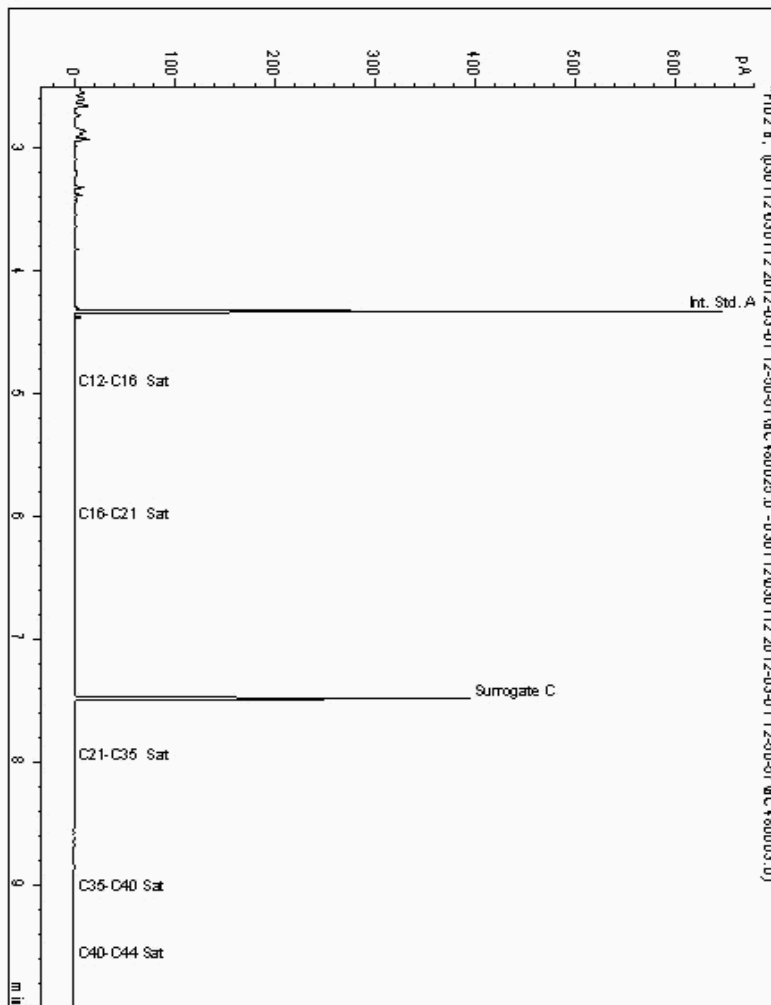
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 5243002
Sample ID : BH102

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 5133885-5243002
Date Acquired : 01/03/12 20:22:18
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

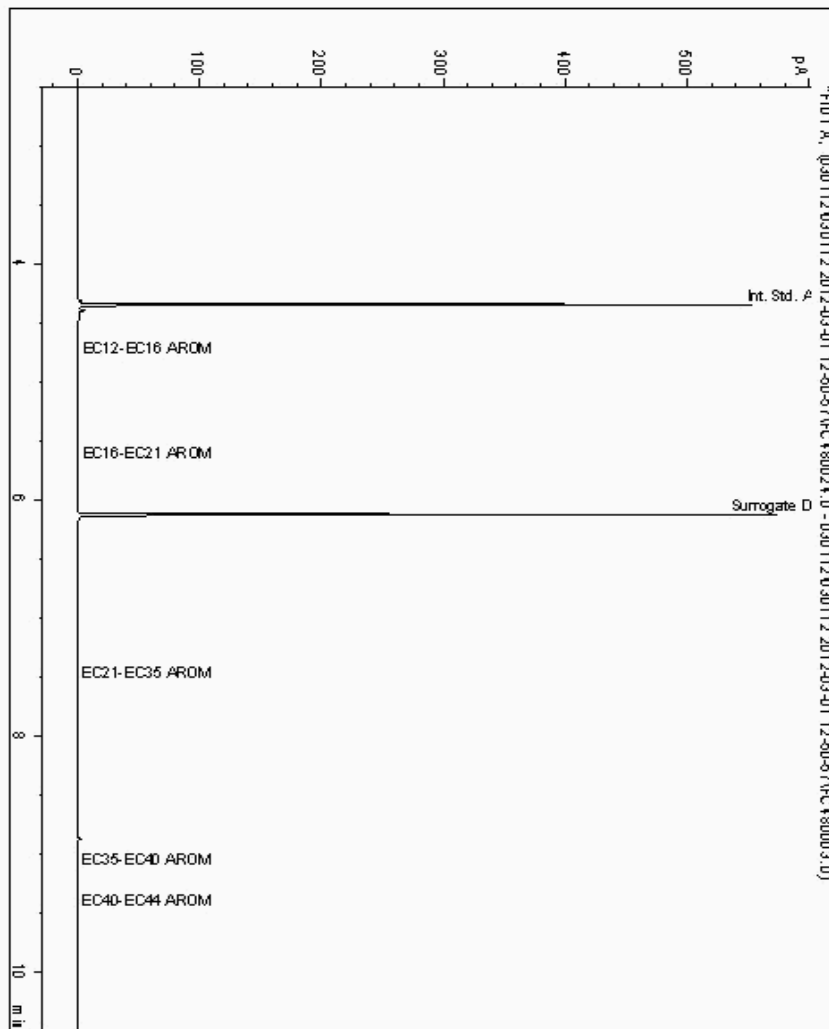
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 5242612
Sample ID : BH102A

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 5133932-5242612
Date Acquired : 01/03/12 20:03:15
Units :
Dilution :
CF : 1
Multiplier : 0.009





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

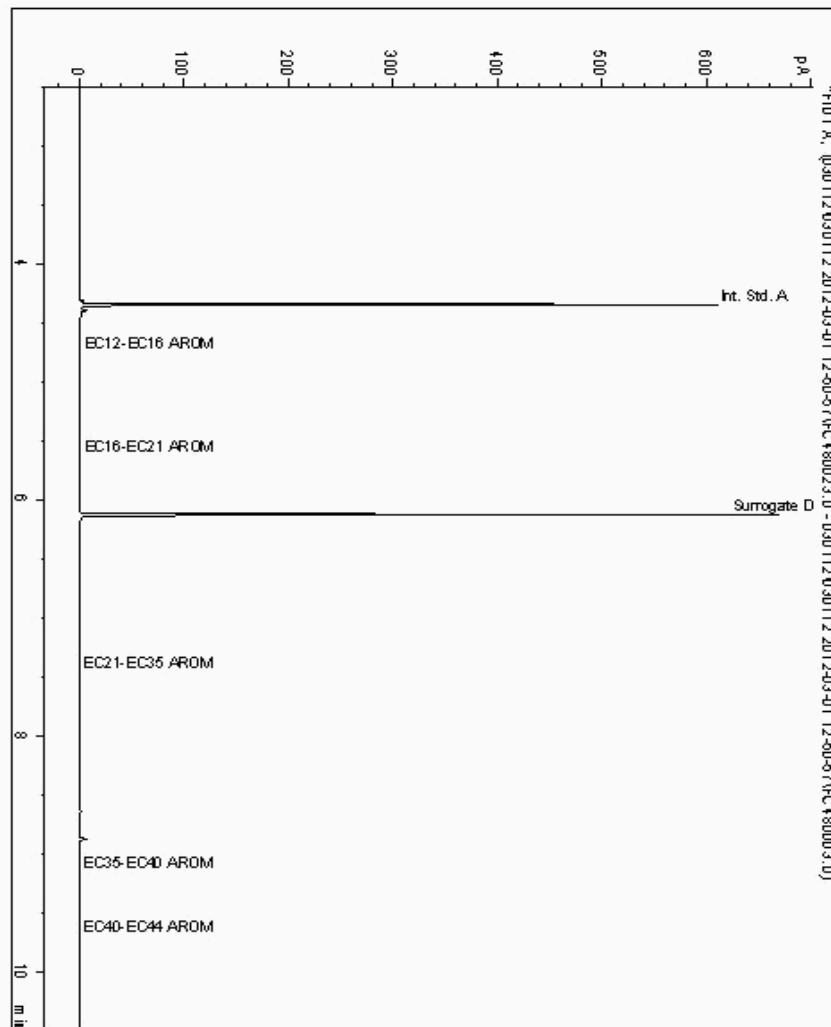
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 5242677
Sample ID : BH101

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 5134006-5242677
Date Acquired : 01/03/12 19:44:07
Units :
Dilution :
CF : 1
Multiplier : 0.008





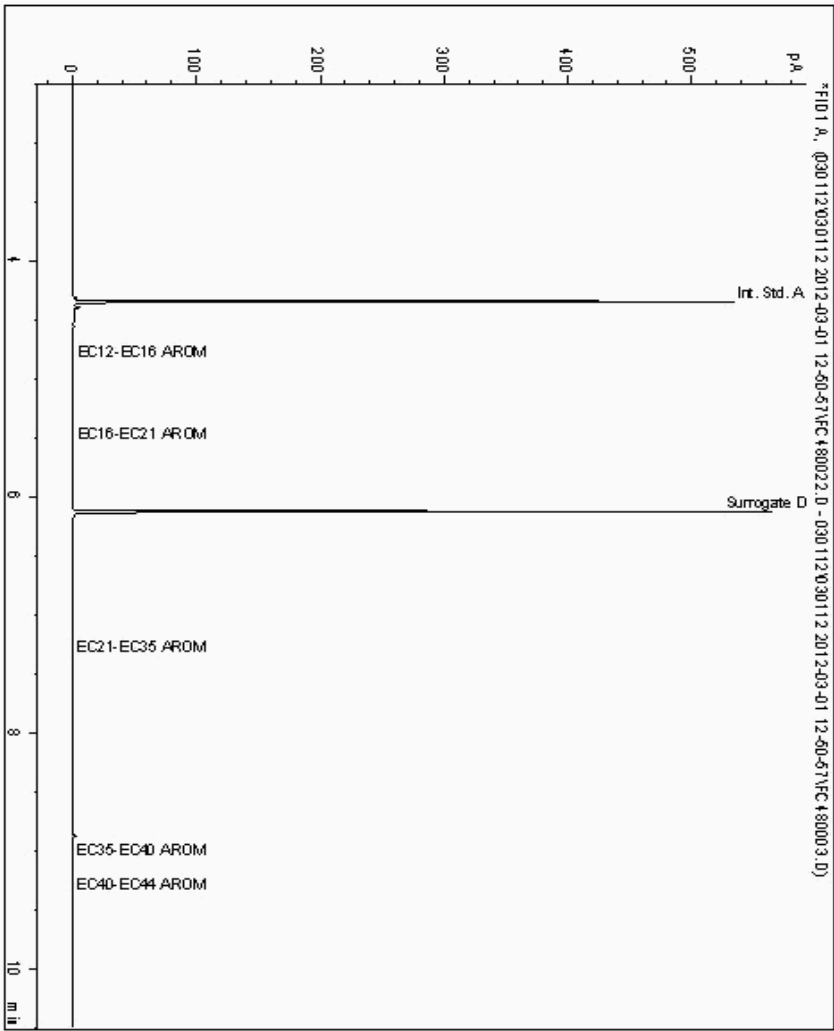
SDG:	120228-13	Location:	Shell Hitchin	Order Number:	
Job:	H_URS_WIM-108	Customer:	URS Corporation Limited	Report Number:	173041
Client Reference:	46370079	Attention:	Ben Schultz	Superseded Report:	

Chromatogram

Analysis:	EPH CWG (Aromatic) Aqueous GC (W)	Sample No :	5242703	Depth :	
		Sample ID :	EQUIPMENT BLANK		

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 5133968-5242703
Date Acquired : 01/03/12 19:25:05
Units :
Dilution :
CF : 1
Multiplier : 0.008





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

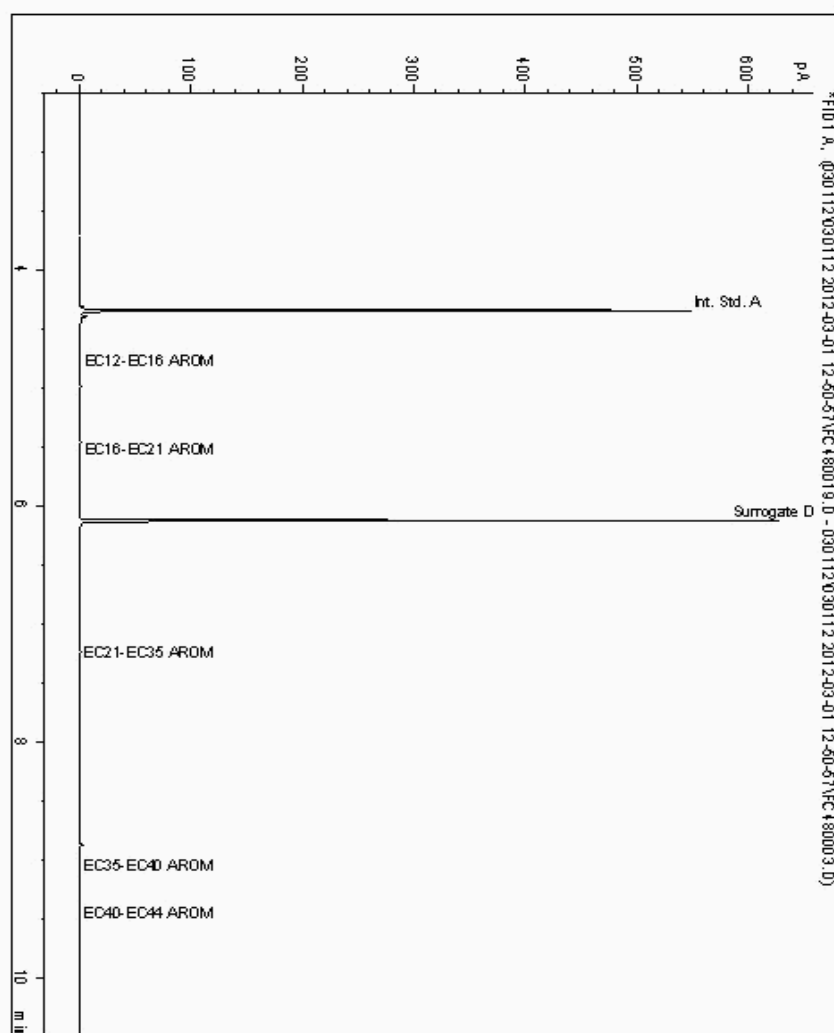
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 5242731
Sample ID : BH105A

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 5133996-5242731
Date Acquired : 01/03/12 18:28:05
Units :
Dilution :
CF : 1
Multiplier : 0.008





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

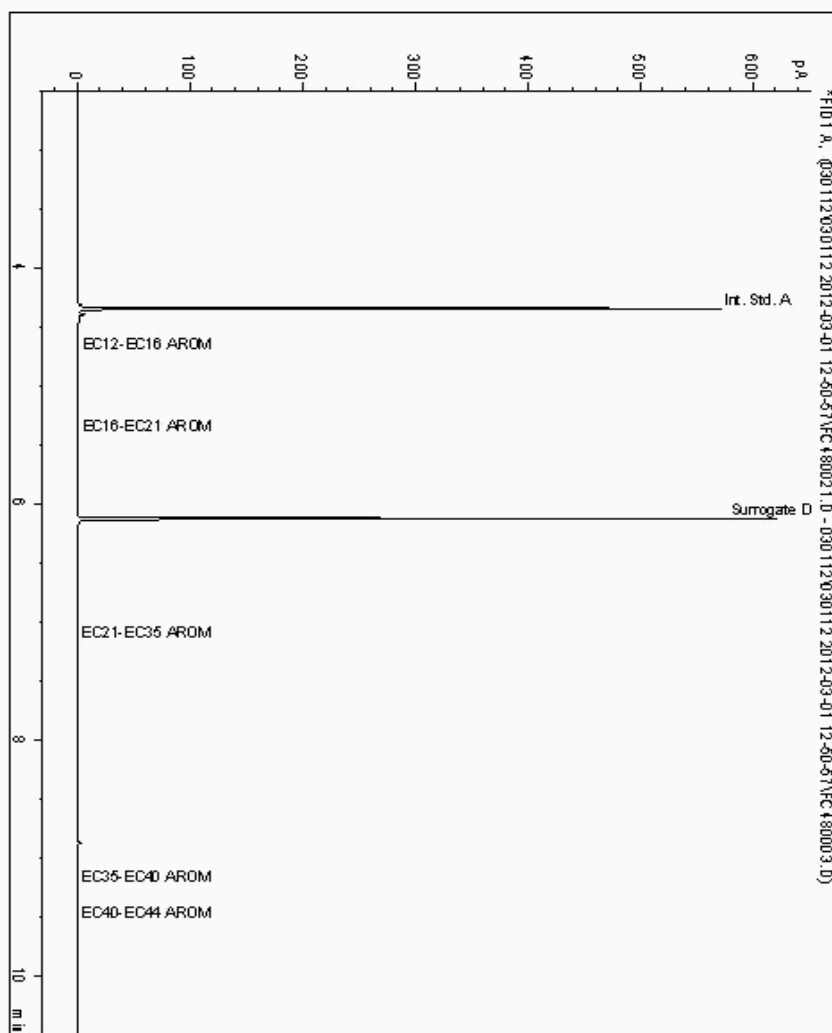
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 5242800
Sample ID : BH106A

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 5133983-5242800
Date Acquired : 01/03/12 19:06:05
Units :
Dilution :
CF : 1
Multiplier : 0.008





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

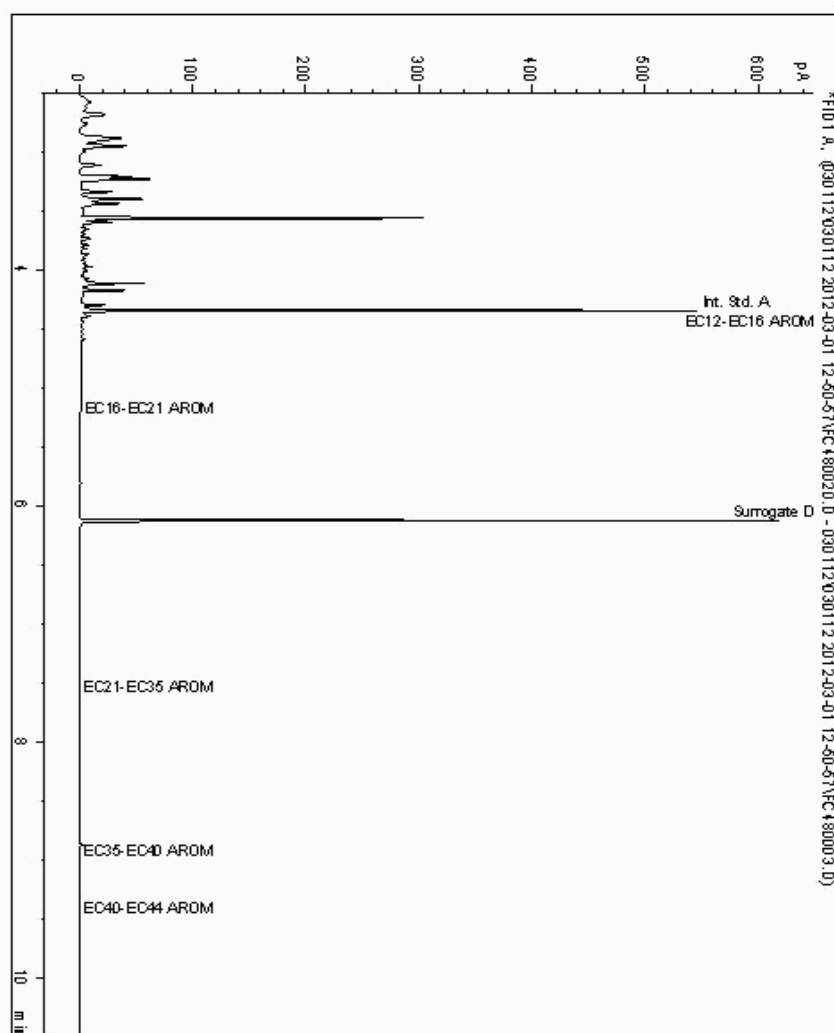
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 5242884
Sample ID : DUP01

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 5133908-5242884
Date Acquired : 01/03/12 18:47:00
Units :
Dilution :
CF : 1
Multiplier : 0.008





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

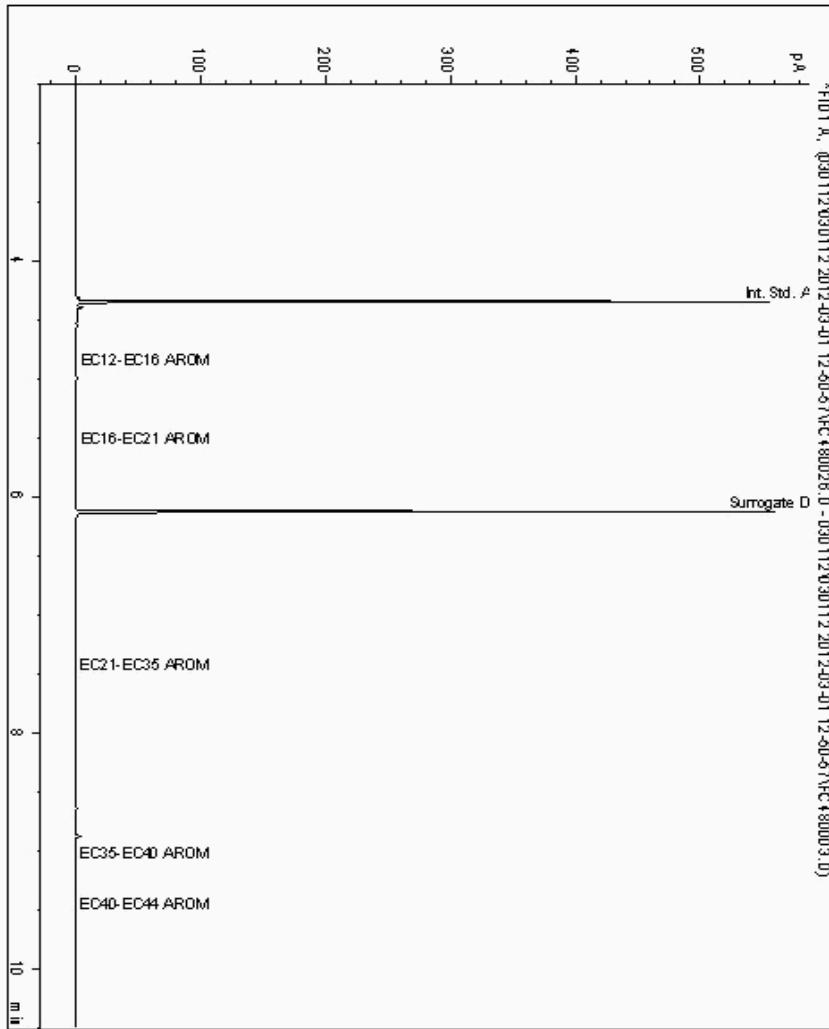
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 5242988
Sample ID : BH103

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 5133942-5242988
Date Acquired : 01/03/12 20:41:24
Units :
Dilution :
CF : 1
Multiplier : 0.008





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

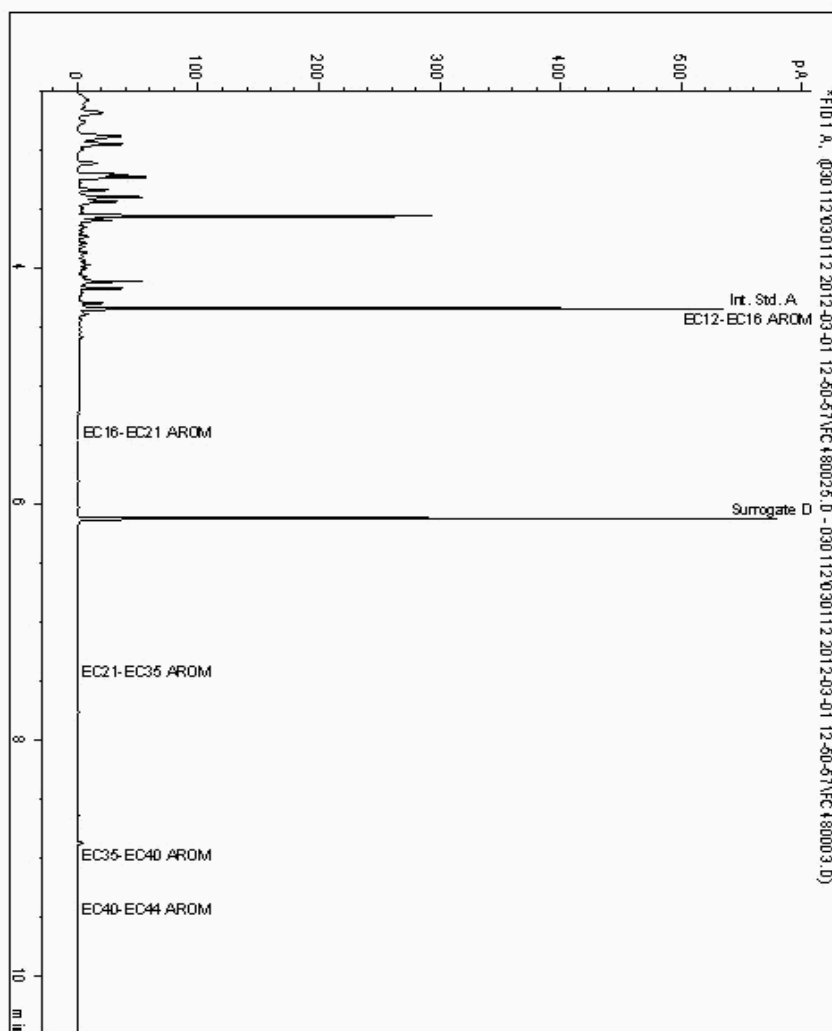
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 5243002
Sample ID : BH102

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 5133886-5243002
Date Acquired : 01/03/12 20:22:19
Units :
Dilution :
CF : 1
Multiplier : 0.008





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

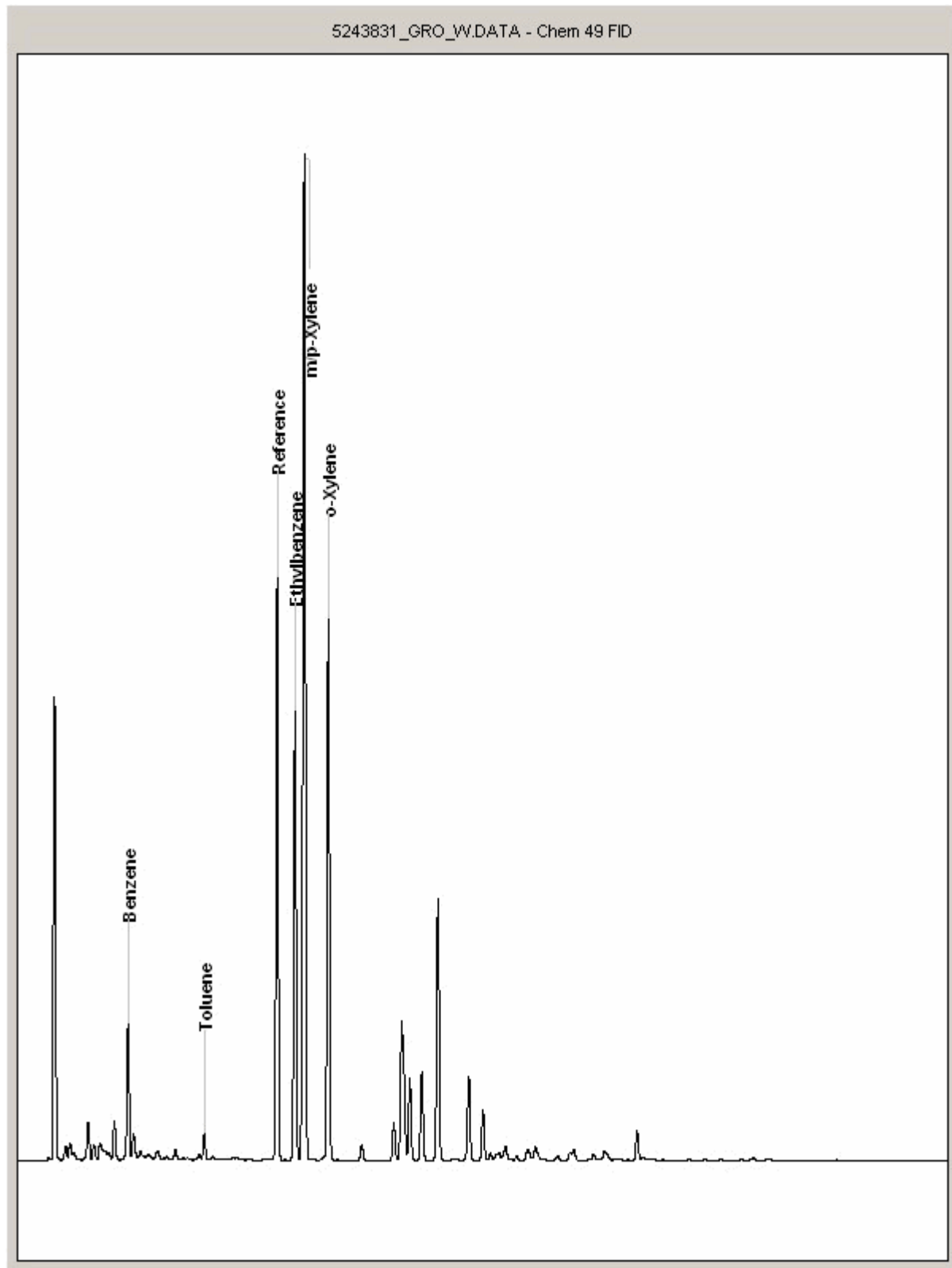
Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 5243831
Sample ID : BH102

Depth :





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

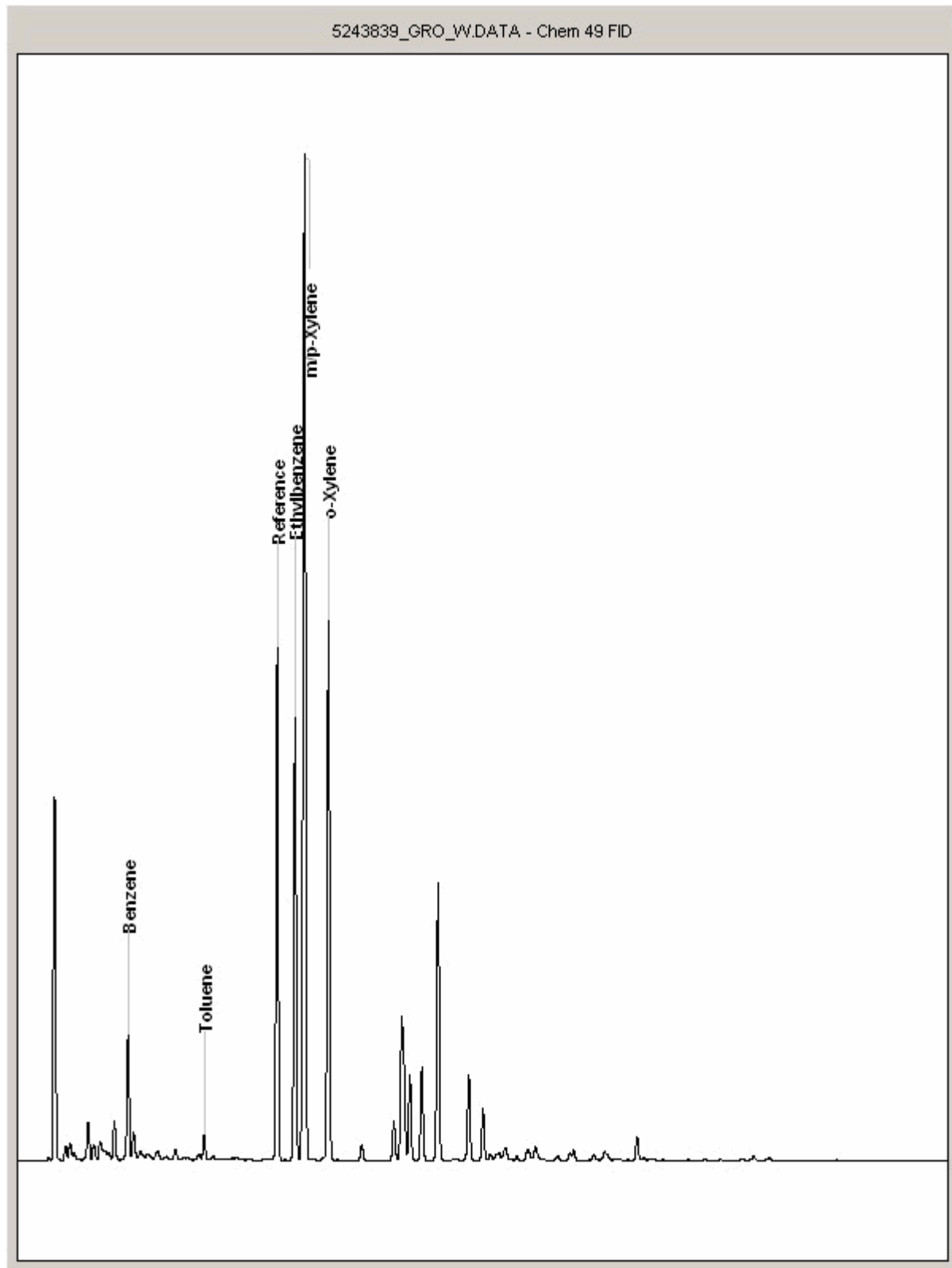
Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 5243839
Sample ID : DUP01

Depth :





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

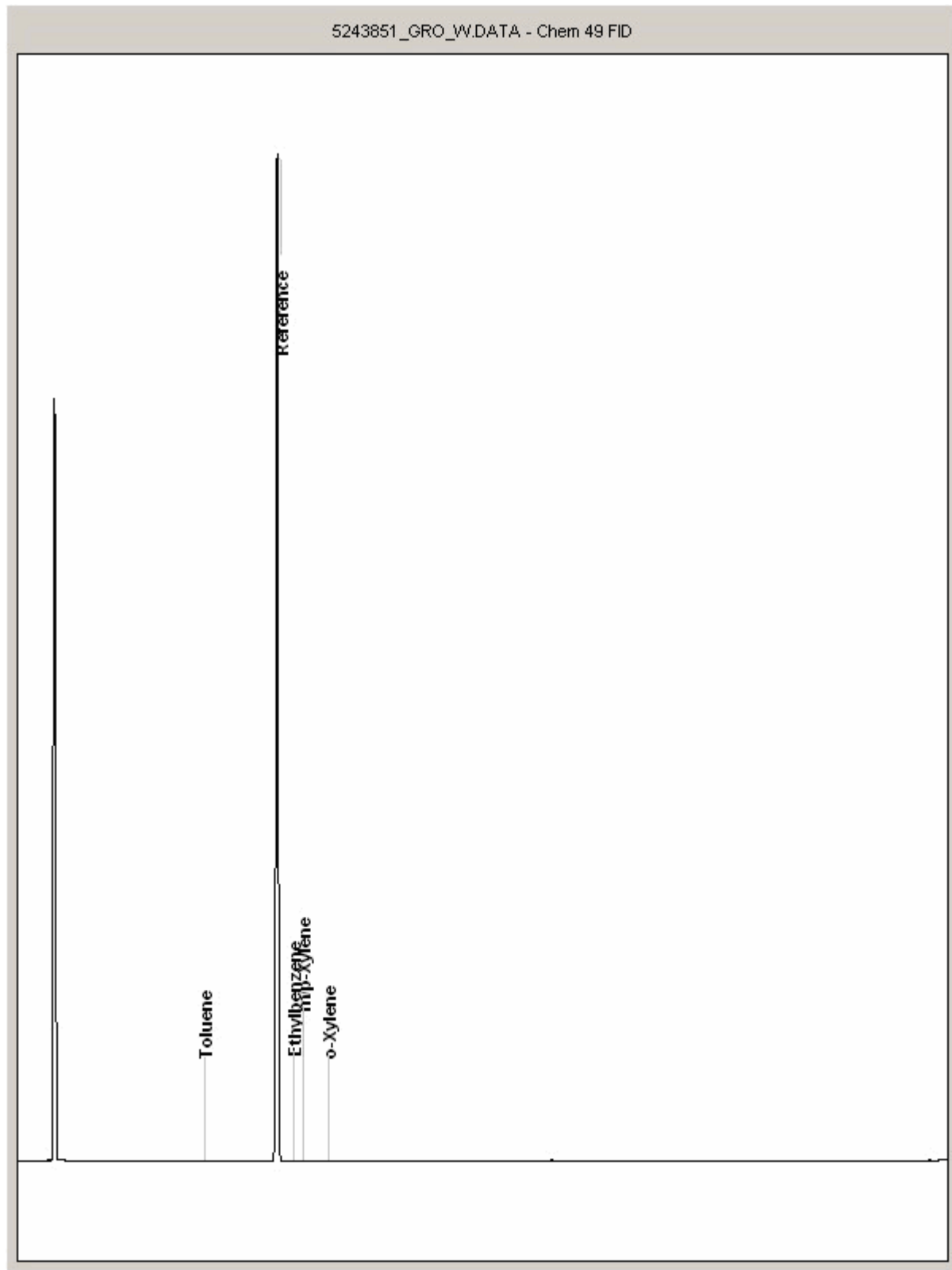
Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 5243851
Sample ID : BH102A

Depth :





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

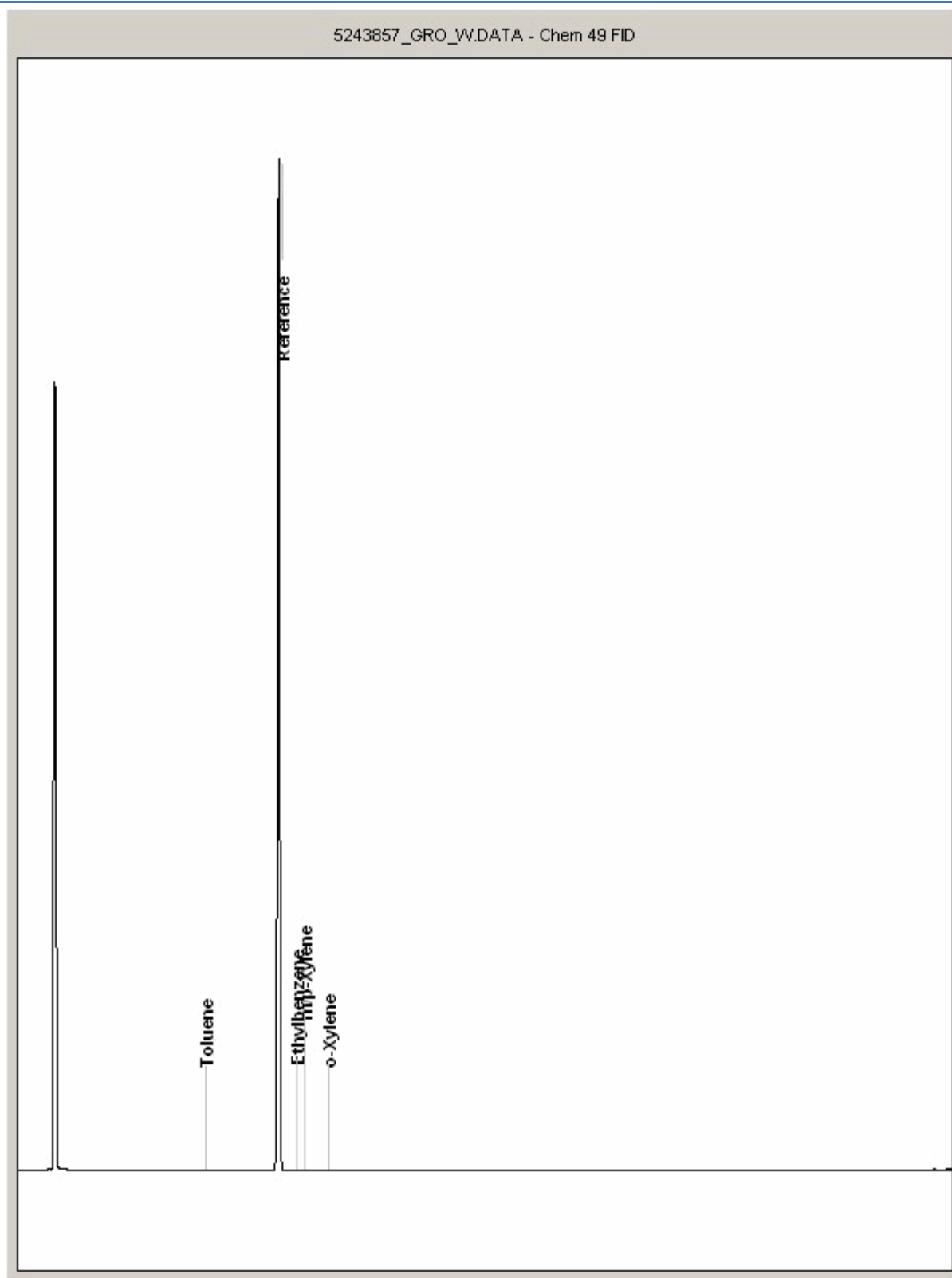
Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 5243857
Sample ID : BH103

Depth :





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

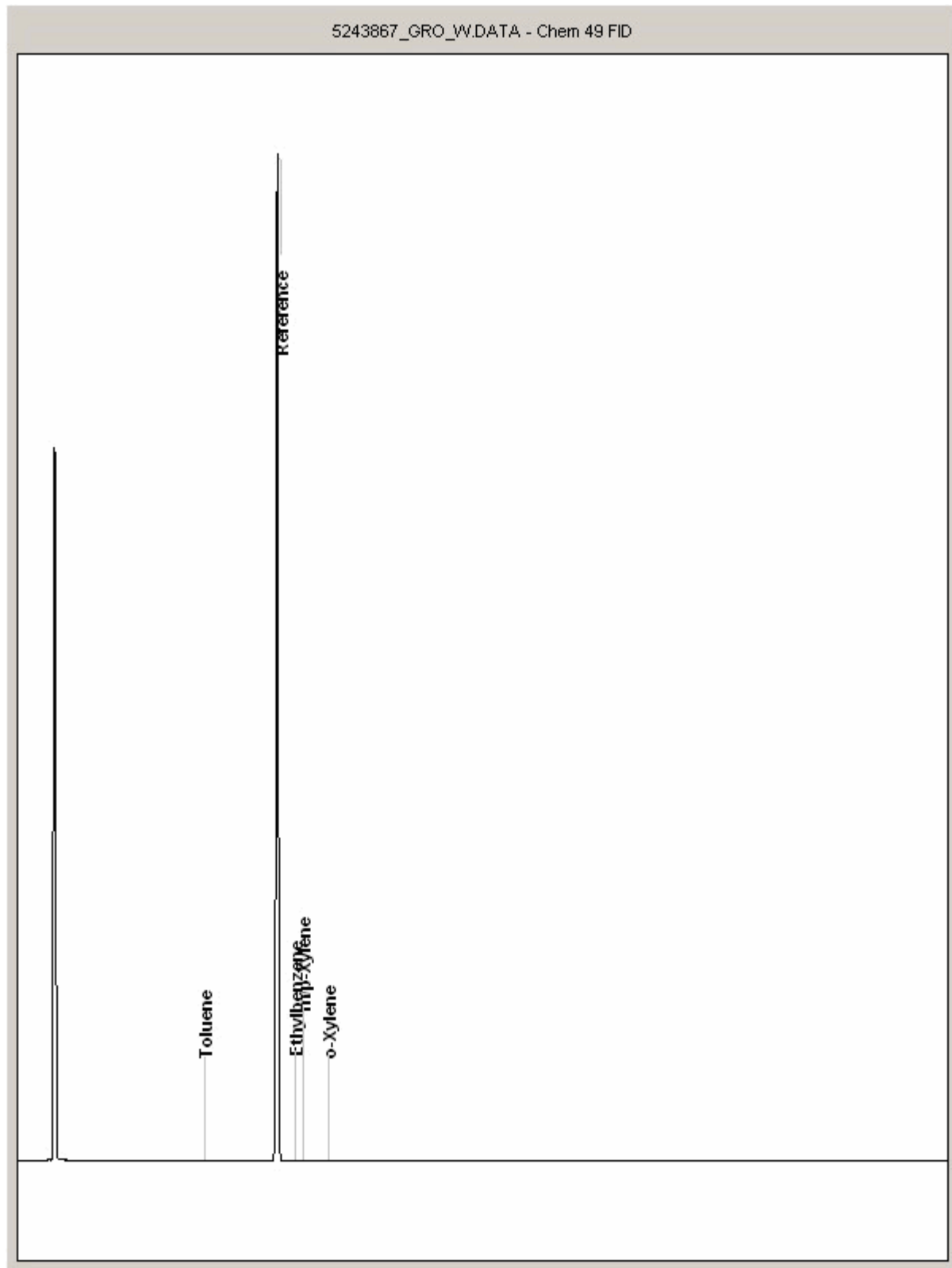
Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 5243867
Sample ID : EQUIPMENT BLANK

Depth :





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

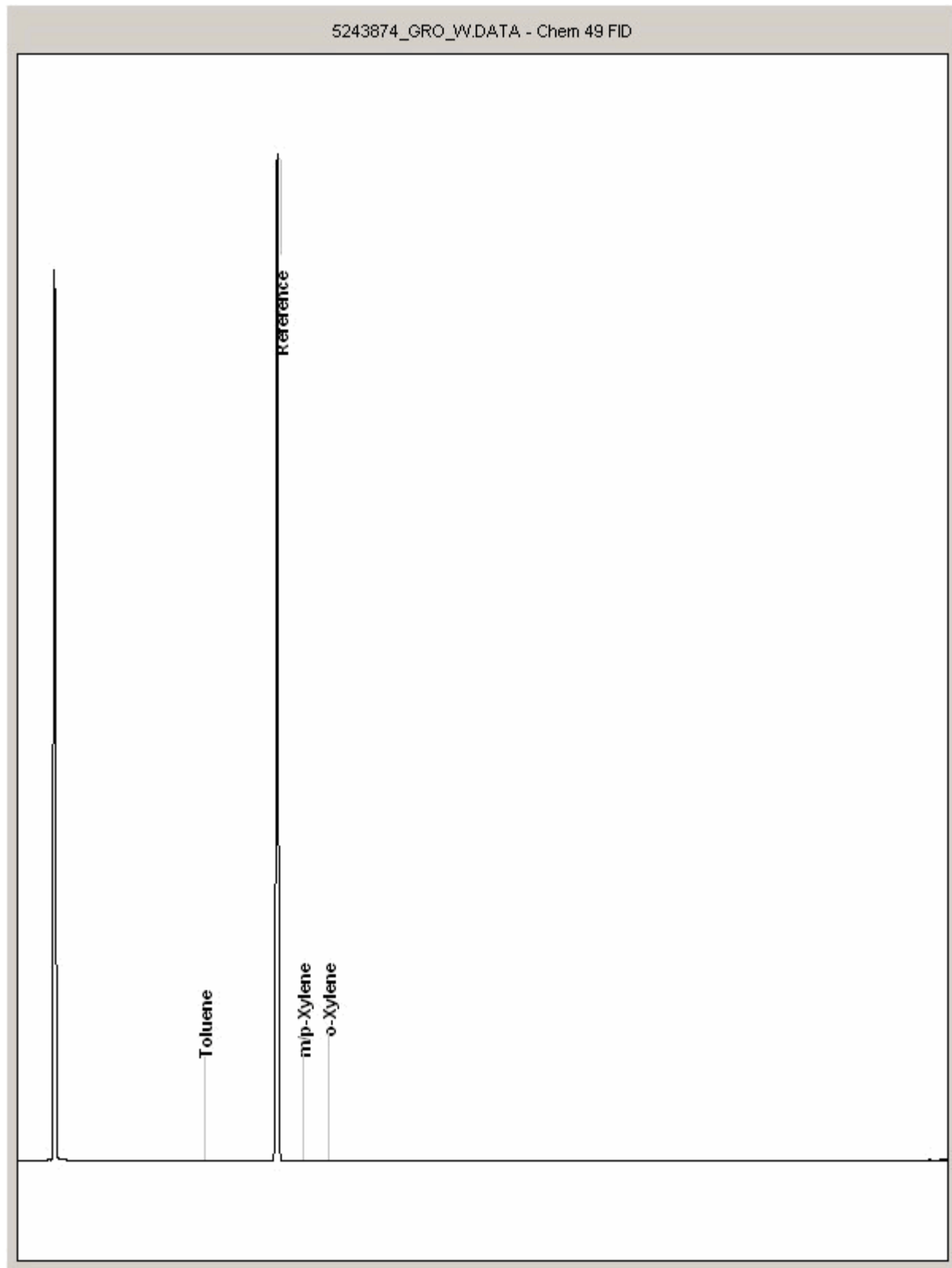
Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 5243874
Sample ID : BH106A

Depth :





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

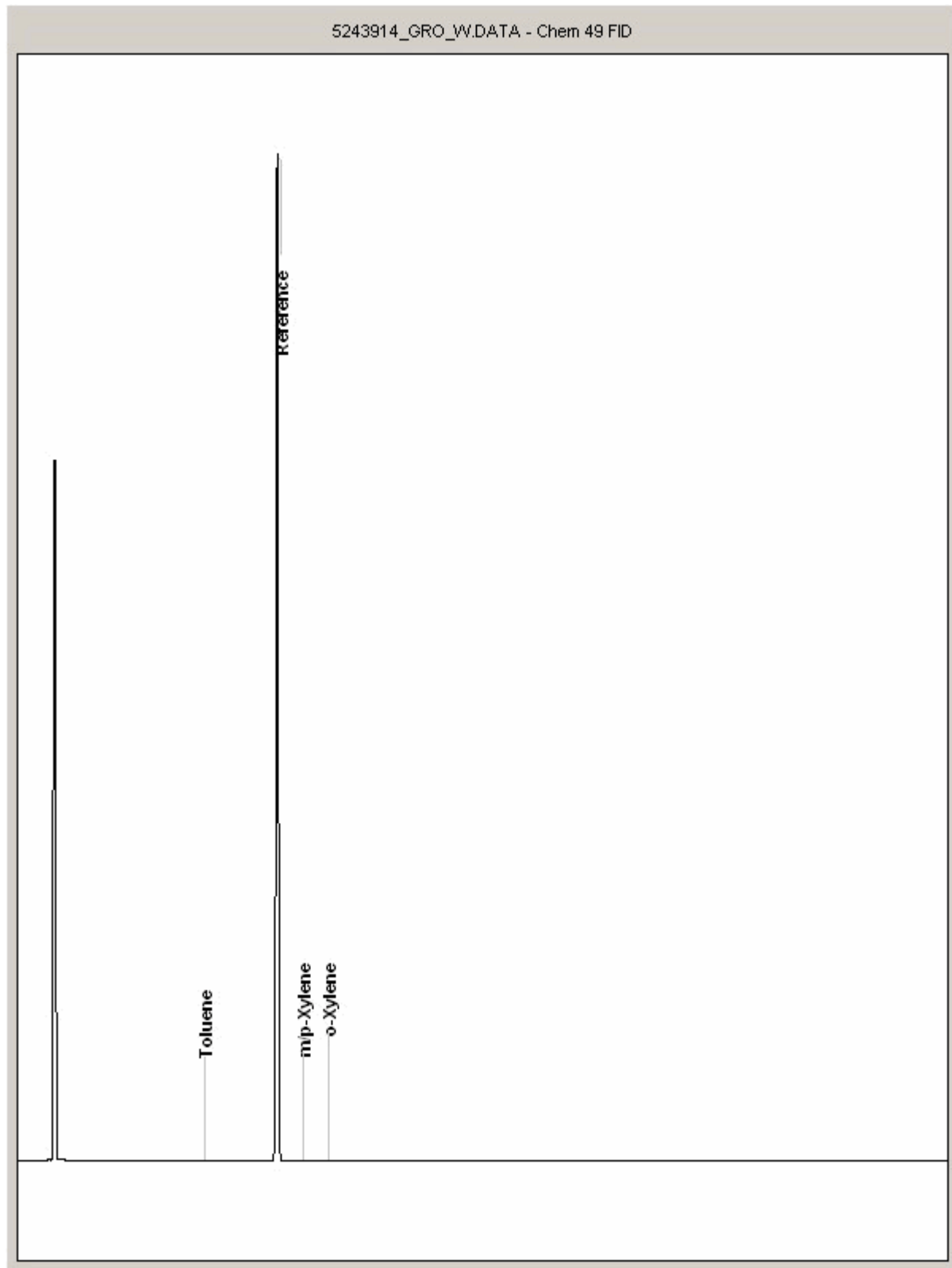
Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 5243914
Sample ID : BH105A

Depth :





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

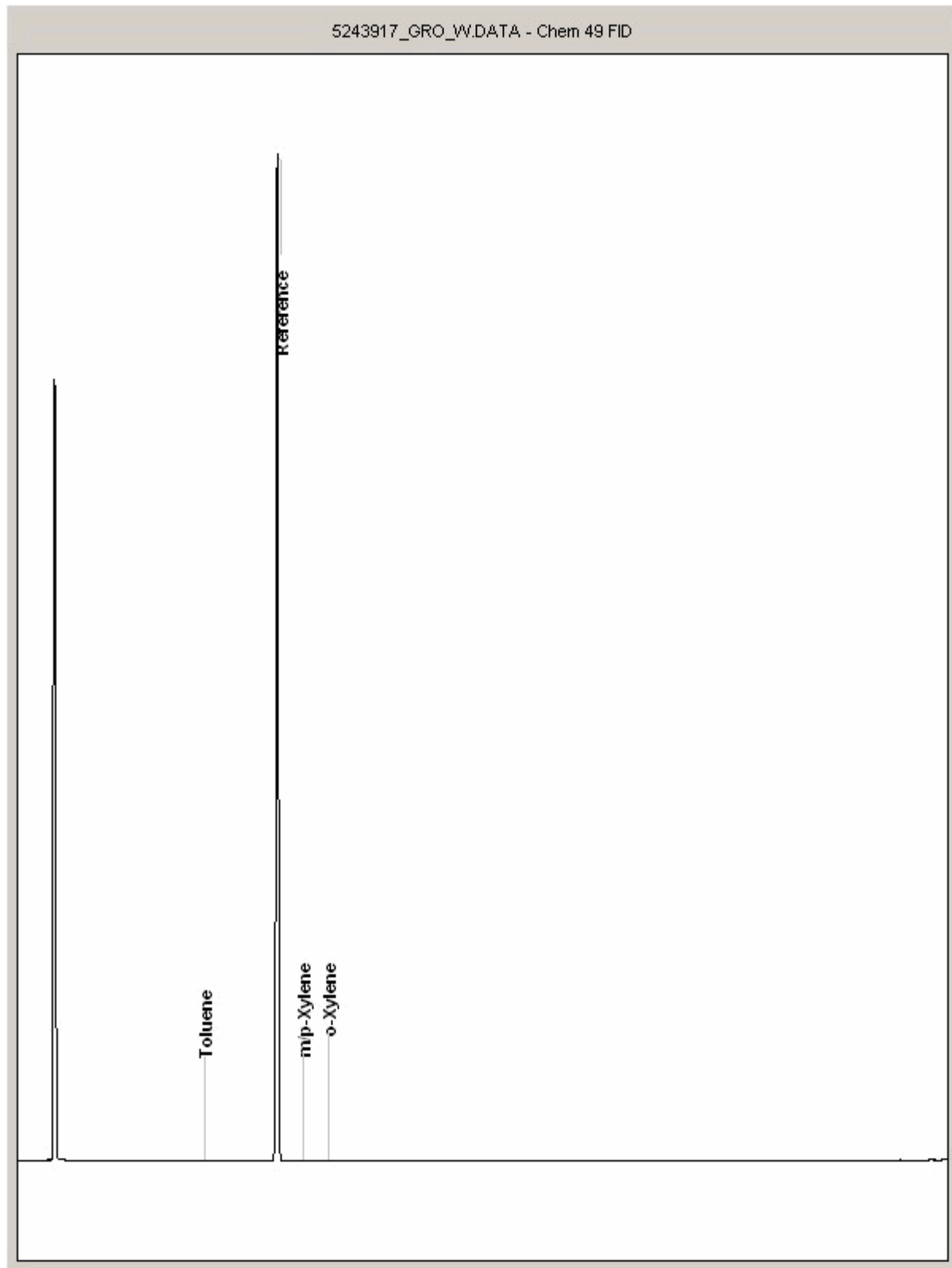
Order Number:
Report Number: 173041
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 5243917
Sample ID : BH101

Depth :





SDG: 120228-13
Job: H_URS_WIM-108
Client Reference: 46370079

Location: Shell Hitchin
Customer: URS Corporation Limited
Attention: Ben Schultz

Order Number:
Report Number: 173041
Superseded Report:

Appendix

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

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 2 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

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

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

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

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

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

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

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

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

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

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

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

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

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

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

SOLID MATRICES EXTRACTION SUMMARY

ANALYSIS	D&C OR WET	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
SOLVENT EXTRACTABLE MATTER	D&C	DCM	SOXTHERM	GRAVIMETRIC
CYCLOHEXANE EXT. MATTER	D&C	CYCLOHEXANE	SOXTHERM	GRAVIMETRIC
ELEMENTAL SULPHUR	D&C	DCM	SOXTHERM	HPLC
PHENOLS BY GOM S	WET	DCM	SOXTHERM	GC-MS
HERBICIDES	D&C	HEXANE: ACETONE	SOXTHERM	GC-MS
PESTICIDES	D&C	HEXANE: ACETONE	SOXTHERM	GC-MS
EPH (DFO)	D&C	HEXANE: ACETONE	END OVER END	GC-FID
EPH (MIN OIL)	D&C	HEXANE: ACETONE	END OVER END	GC-FID
EPH (CLEANED UP)	D&C	HEXANE: ACETONE	END OVER END	GC-FID
EPH CWG BY GC	D&C	HEXANE: ACETONE	END OVER END	GC-FID
PCB AROCLOR 1254 / PCB CON	D&C	HEXANE: ACETONE	END OVER END	GC-MS
POLYAROMATIC HYDROCARBONS (MS)	WET	HEXANE: ACETONE	MICROWAVE TM 218	GC-MS
>GC-C40	WET	HEXANE: ACETONE	SHAKER	GC-FID
POLYAROMATIC HYDROCARBONS RAPID GC	WET	HEXANE: ACETONE	SHAKER	GC-FID
SEMI VOLATILE ORGANIC COMPOUNDS	WET	DCM:ACETONE	SONICATE	GC-MS

LIQUID MATRICES EXTRACTION SUMMARY

ANALYSIS	EXTRACTION SOLVENT	EXTRACTION METHOD	ANALYSIS
PAH MS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
EPH	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
EPH CWG	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
MINERAL OIL	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC FID
PCB 7 CONGENERS	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
PCB AROCLOR 1254	HEXANE	STIRRED EXTRACTION (STIR-BAR)	GC MS
SVOC	DCM	LIQUID LIQUID SHAKE	GC MS
FREESULPHUR	DCM	SOLID PHASE EXTRACTION	HPLC
PESTOCLOPP	DCM	LIQUID LIQUID SHAKE	GC MS
TRIAZINE HERBS	DCM	LIQUID LIQUID SHAKE	GC MS
PHENOLS MS	ACETONE	SOLID PHASE EXTRACTION	GC MS
TPH BY INFRARED (IR)	TCE	STIRRED EXTRACTION (STIR-BAR)	IR
MINERAL OIL BY IR	TCE	STIRRED EXTRACTION (STIR-BAR)	IR
GLYCOLS	NONE	DIRECT INJECTION	GC FID

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials or those identified as potentially asbestos containing during sample description which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Visual Estimation Of Fibre Content

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

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

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



URS Corporation Limited
St. George's House
2nd Floor
5 St. George's Road
Wimbledon
Greater London
SW19 4DR

Attention: Jocelyn Willis

CERTIFICATE OF ANALYSIS

Date: 21 January 2013
Customer: H_URS_WIM
Sample Delivery Group (SDG): 130112-49
Your Reference: 46370079
Location: Hitchin
Report No: 209137

We received 8 samples on Saturday January 12, 2013 and 8 of these samples were scheduled for analysis which was completed on Monday January 21, 2013. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager





SDG:	130112-49	Location:	Hitchin	Order Number:	
Job:	H_URS_WIM-162	Customer:	URS Corporation Limited	Report Number:	209137
Client Reference:	46370079	Attention:	Jocelyn Willis	Superseded Report:	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
6764099	BH101			11/01/2013
6764100	BH102			11/01/2013
6764102	BH103			11/01/2013
6764103	BH105A			11/01/2013
6764104	BH106A			11/01/2013
6764105	DUP 01			11/01/2013
6764106	EQUIPMENT BLANK			11/01/2013
6764107	TRIP BLANK			11/01/2013

Only received samples which have had analysis scheduled will be shown on the following pages.



SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209137
Superseded Report:

LIQUID Results Legend X Test N No Determination Possible	Lab Sample No(s)		6764107	6764106	6764105	6764104	6764103	6764102	6764100	6764099
	Customer Sample Reference		TRIP BLANK	EQUIPMENT BLANK	DUP 01	BH106A	BH105A	BH103	BH102	BH101
	AGS Reference									
	Depth (m)									
	Container		Vial (ALE297)	Vial (ALE297)	1l green glass bottle	Vial (ALE297)	1l green glass bottle	Vial (ALE297)	1l green glass bottle	Vial (ALE297)
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 7								
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 7								
GRO by GC-FID (W)	All	NDPs: 0 Tests: 7								
Oxygenates (W)	All	NDPs: 0 Tests: 7								
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 7								
VOC MS (W)	All	NDPs: 0 Tests: 8								

Order Number:
Report Number: 209137
Superseded Report:

09:04:19 21/01/2013

Order Number:
Report Number: 209137
Superseded Report:

09:04:19 21/01/2013

Order Number:
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SDG:	130112-49	Location:	Hitchin	Order Number:	
Job:	H_URS_WIM-162	Customer:	URS Corporation Limited	Report Number:	209137
Client Reference:	46370079	Attention:	Jocelyn Willis	Superseded Report:	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample ¹	Surrogate Corrected
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM208	Modified: US EPA Method 8260b & 624	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM289		Determination of Oxygenates in Waters by Headspace/GC-MS		

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.



SDG: 130112-49
Job: H_URS_WIM-162
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Location: Hitchin
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Superseded Report:

Test Completion Dates

Lab Sample No(s)	6764099	6764100	6764102	6764103	6764104	6764105	6764106	6764107
Customer Sample Ref.	BH101	BH102	BH103	BH105A	BH106A	DUP 01	EQUIPMENT BLANK	TRIP BLANK
AGS Ref.								
Depth								
Type	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID	LIQUID
EPH CWG (Aliphatic) Aqueous GC (W)	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	
EPH CWG (Aromatic) Aqueous GC (W)	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	
GRO by GC-FID (W)	15-Jan-2013	15-Jan-2013	15-Jan-2013	15-Jan-2013	15-Jan-2013	15-Jan-2013	16-Jan-2013	
Oxygenates (W)	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	
PAH Spec MS - Aqueous (W)	21-Jan-2013	18-Jan-2013	18-Jan-2013	18-Jan-2013	18-Jan-2013	21-Jan-2013	18-Jan-2013	
TPH CWG (W)	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	17-Jan-2013	
VOC MS (W)	15-Jan-2013	16-Jan-2013	15-Jan-2013	15-Jan-2013	15-Jan-2013	16-Jan-2013	16-Jan-2013	15-Jan-2013



SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

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Superseded Report:

ASSOCIATED AQC DATA

EPH CWG (Aliphatic) Aqueous GC (W)

Component	Method Code	QC 69
Total Aliphatics >C12-C35	TM174	91.25 77.01 : 102.75

EPH CWG (Aromatic) Aqueous GC (W)

Component	Method Code	QC 67
Total Aromatics >EC12-EC35	TM174	96.67 79.28 : 109.64

GRO by GC-FID (W)

Component	Method Code	QC 61	QC 68
Benzene by GC	TM245	93.0 67.00 : 133.00	96.0 79.13 : 118.84
Ethylbenzene by GC	TM245	93.5 67.00 : 133.00	96.5 65.46 : 122.12
m & p Xylene by GC	TM245	94.0 67.00 : 133.00	97.0 64.75 : 122.51
MTBE GC-FID	TM245	93.5 67.00 : 133.00	97.0 76.45 : 114.88
o Xylene by GC	TM245	92.5 67.00 : 133.00	95.5 70.06 : 120.53
QC	TM245	106.03 67.00 : 133.00	114.6 74.41 : 140.07
Toluene by GC	TM245	93.0 67.00 : 133.00	96.0 73.44 : 116.60

Oxygenates (W)

Component	Method Code	QC 66
Benzene	TM289	99.5 79.73 : 131.69
Diisopropyl ether	TM289	98.0 72.91 : 124.47
Ethanol	TM289	102.8 60.84 : 141.13
Ethylbenzene	TM289	101.0 76.16 : 122.57
o-Xylene	TM289	97.5 77.08 : 124.38
p/m-Xylene	TM289	99.25 82.78 : 120.00
tert Butanol	TM289	102.0 70.51 : 143.48
tert-amyl methyl ether	TM289	99.0 78.92 : 124.29



SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
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Order Number:
Report Number: 209137
Superseded Report:

Oxygenates (W)

		QC 66
tert-butyl ethyl ether	TM289	98.0 78.17 : 124.34
tert-butyl methyl ether	TM289	99.5 78.27 : 127.85
Toluene	TM289	99.0 79.08 : 122.51

PAH Spec MS - Aqueous (W)

Component	Method Code	QC 65
Acenaphthene by GCMS	TM178	95.5 81.10 : 114.10
Acenaphthylene by GCMS	TM178	92.5 79.45 : 111.85
Anthracene by GCMS	TM178	91.0 83.69 : 106.27
Benz(a)anthracene by GCMS	TM178	91.0 76.69 : 110.97
Benzo(a)pyrene by GCMS	TM178	96.5 82.57 : 113.60
Benzo(b)fluoranthene by GCMS	TM178	97.5 87.25 : 114.25
Benzo(ghi)perylene by GCMS	TM178	98.5 81.58 : 107.32
Benzo(k)fluoranthene by GCMS	TM178	96.5 87.20 : 122.40
Chrysene by GCMS	TM178	97.0 87.92 : 108.35
Dibenzo(ah)anthracene by GCMS	TM178	96.5 75.97 : 112.60
Fluoranthene by GCMS	TM178	93.0 81.15 : 116.55
Fluorene by GCMS	TM178	96.0 82.30 : 114.10
Indeno(123cd)pyrene by GCMS	TM178	99.0 82.25 : 114.75
Naphthalene by GCMS	TM178	96.5 83.45 : 112.25
Phenanthrene by GCMS	TM178	96.0 88.74 : 112.07
Pyrene by GCMS	TM178	93.0 82.25 : 116.15

VOC MS (W)

Component	Method Code	QC 66	QC 64
1,1,1,2-Tetrachloroethane	TM208	104.5 88.25 : 118.28	103.5 86.47 : 123.48
1,1,1-Trichloroethane	TM208	109.5 83.85 : 123.10	104.5 84.58 : 123.50
1,1-Dichloroethane	TM208	109.0 82.87 : 126.33	107.0 85.03 : 127.99
1,2-Dichloroethane	TM208	108.5 77.68 : 127.05	98.0 77.53 : 124.64



SDG: 130112-49
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Client Reference: 46370079

Location: Hitchin
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Order Number:
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Superseded Report:

VOC MS (W)

		QC 66	QC 64
2-Chlorotoluene	TM208	99.5 83.14 : 115.73	96.5 83.27 : 124.81
4-Chlorotoluene	TM208	102.5 84.24 : 116.31	97.5 84.29 : 124.70
Benzene	TM208	105.0 86.76 : 117.52	102.0 86.11 : 127.43
Bromomethane	TM208	106.5 75.34 : 122.65	98.5 75.41 : 126.08
Carbontetrachloride	TM208	111.0 84.57 : 127.22	105.5 86.30 : 125.39
Chlorobenzene	TM208	99.0 84.79 : 115.59	98.5 87.08 : 121.66
Chloroform	TM208	108.0 84.84 : 119.97	102.5 80.91 : 119.98
Chloromethane	TM208	113.5 53.01 : 144.16	110.5 54.61 : 156.60
Cis-1,2-Dichloroethene	TM208	101.5 81.65 : 120.44	99.5 82.98 : 124.07
Dichloromethane	TM208	102.5 79.31 : 122.56	100.0 81.74 : 127.88
Ethylbenzene	TM208	98.0 82.91 : 114.00	97.0 80.29 : 125.75
Hexachlorobutadiene	TM208	114.0 76.59 : 123.95	101.0 74.78 : 134.63
o-Xylene	TM208	97.5 80.82 : 113.33	96.0 83.08 : 123.04
p/m-Xylene	TM208	97.75 83.73 : 113.41	96.75 84.32 : 109.96
Tert-butyl methyl ether	TM208	98.0 69.07 : 119.88	101.5 72.01 : 124.40
Tetrachloroethene	TM208	110.0 88.02 : 123.47	102.5 82.62 : 128.11
Toluene	TM208	102.0 84.73 : 115.19	98.0 85.43 : 121.75
Trichloroethene	TM208	105.5 85.11 : 127.08	103.0 85.42 : 122.53
Vinyl Chloride	TM208	114.5 85.58 : 129.54	113.5 67.16 : 131.54

The above information details the reference name of the analytical quality control sample (AQC) that has been run with the samples contained in this report for the different methods of analysis.

The figure detailed is the percentage recovery result for the AQC.

The subscript numbers below are the percentage recovery lower control limit (LCL) and the upper control limit (UCL). The percentage recovery result for the AQC should be between these limits to be statistically in control.



CERTIFICATE OF ANALYSIS

SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

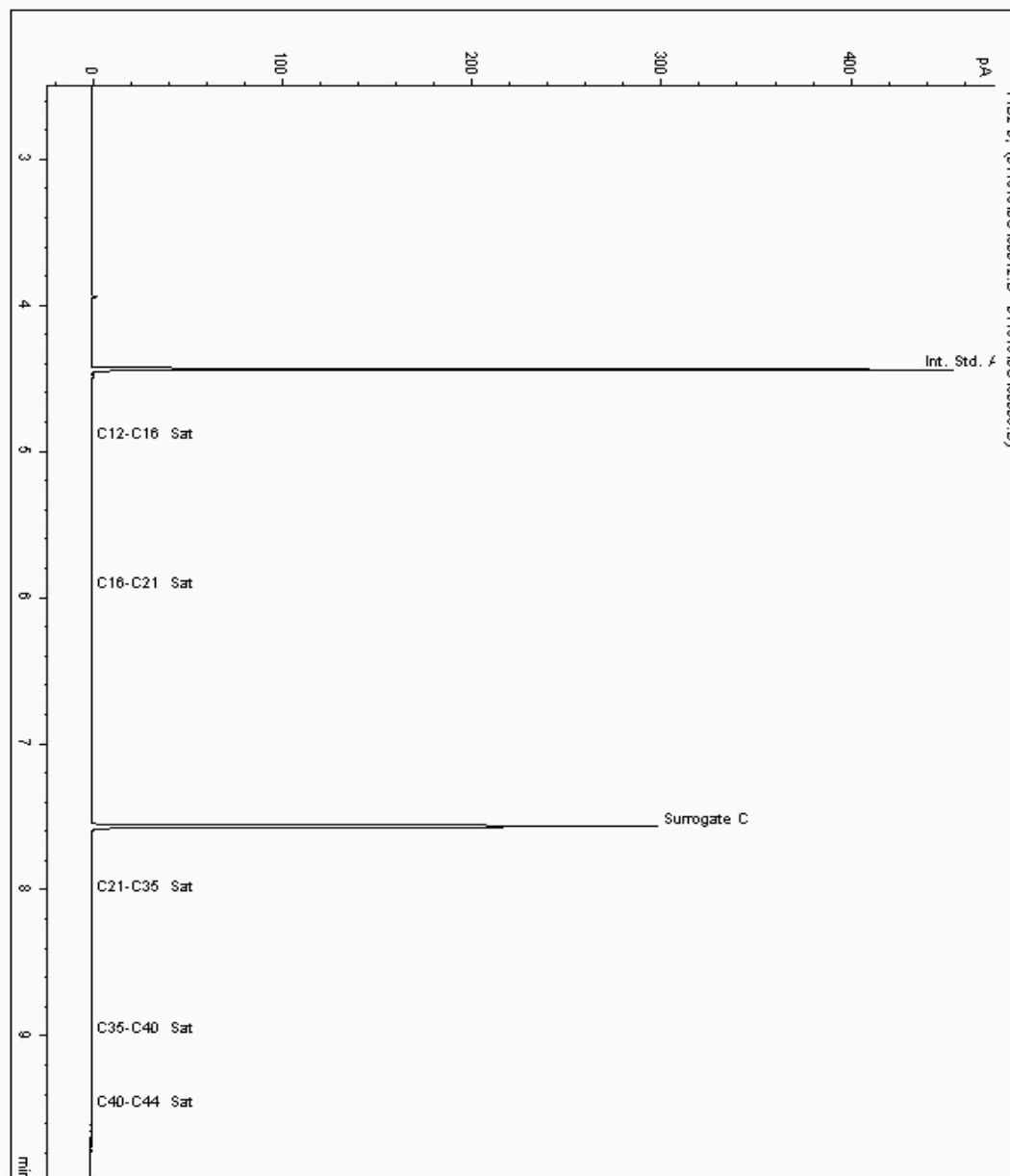
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 6772666
Sample ID : BH105A

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 6526578-6772666
Date Acquired : 16/01/2013 19:53:27 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

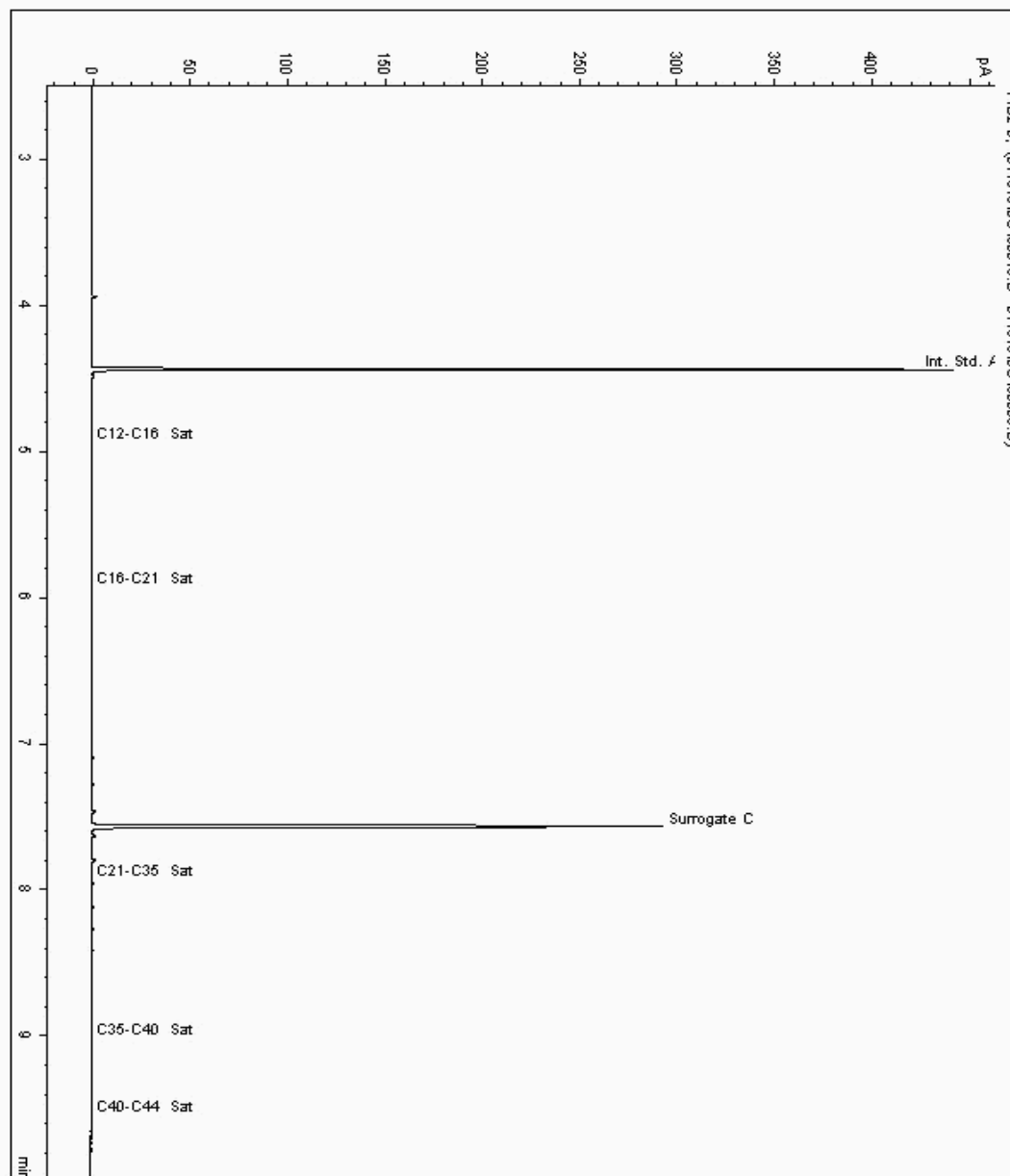
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 6772675
Sample ID : BH106A

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 6526601-6772675
Date Acquired : 16/01/2013 20:12:30 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





CERTIFICATE OF ANALYSIS

SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

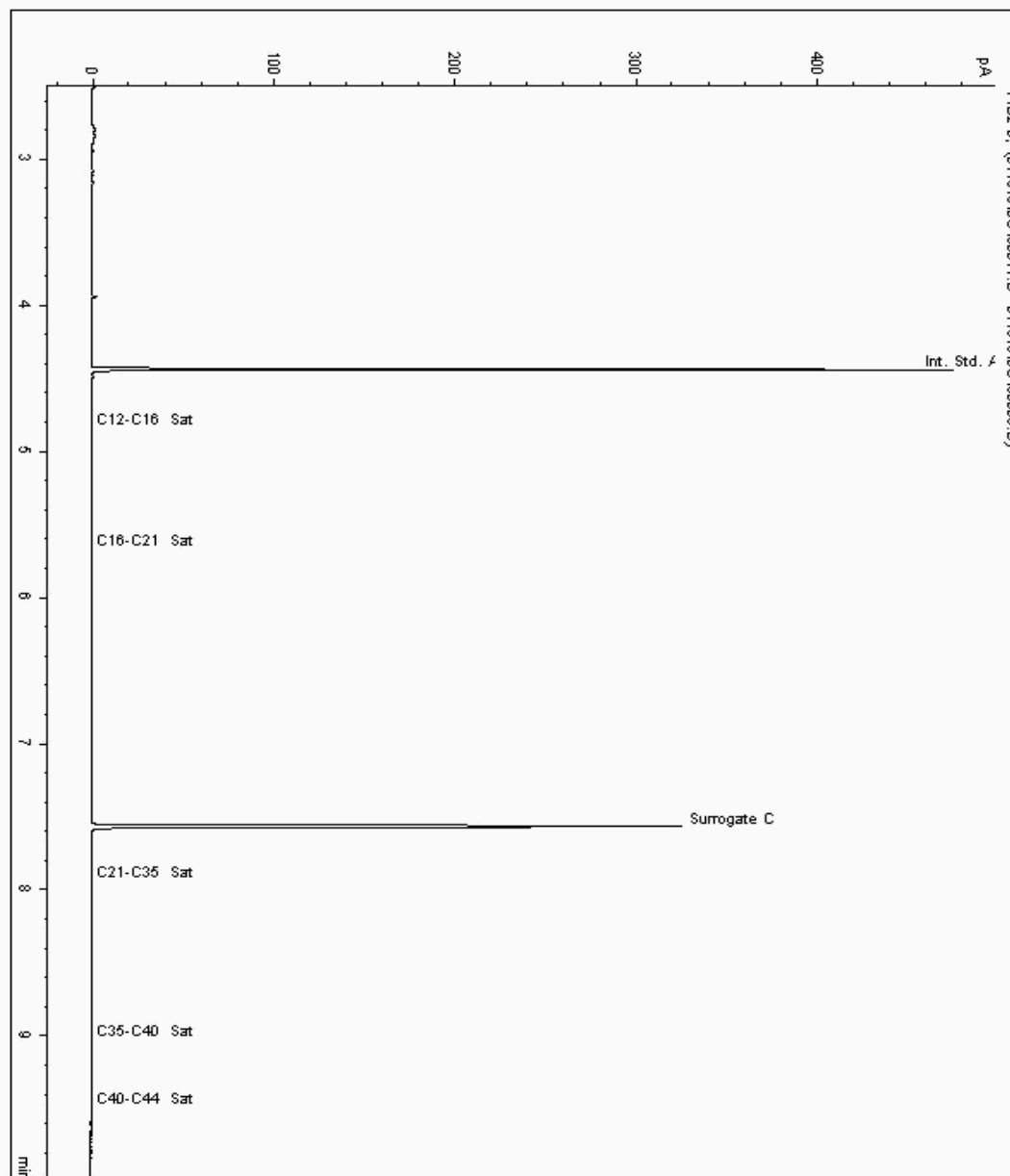
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 6772686
Sample ID : DUP 01

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 6526616-6772686
Date Acquired : 16/01/2013 19:34:39 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





CERTIFICATE OF ANALYSIS

SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

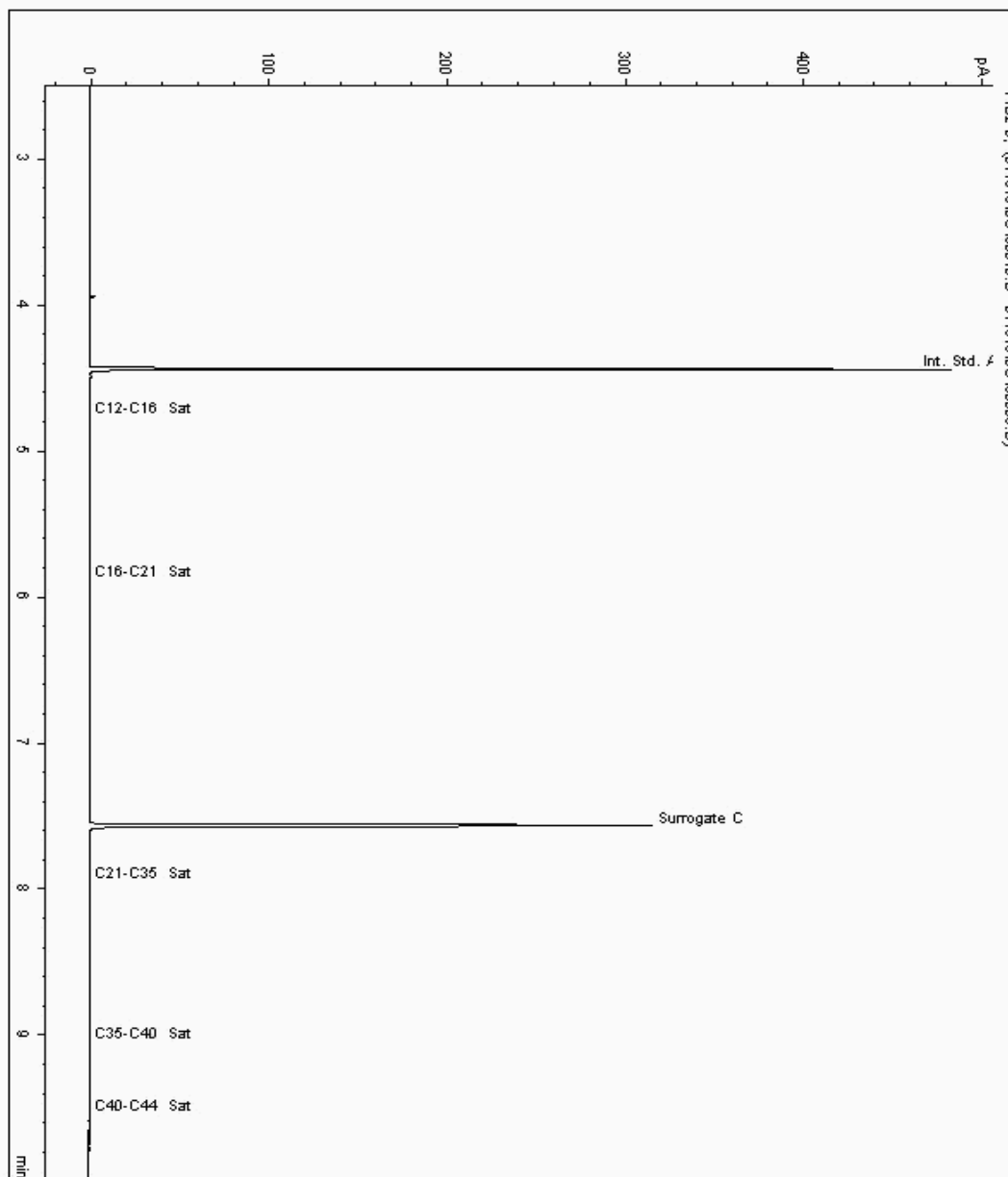
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 6772698
Sample ID : EQUIPMENT BLANK

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 6526631-6772698
Date Acquired : 16/01/2013 19:15:52 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





CERTIFICATE OF ANALYSIS

SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

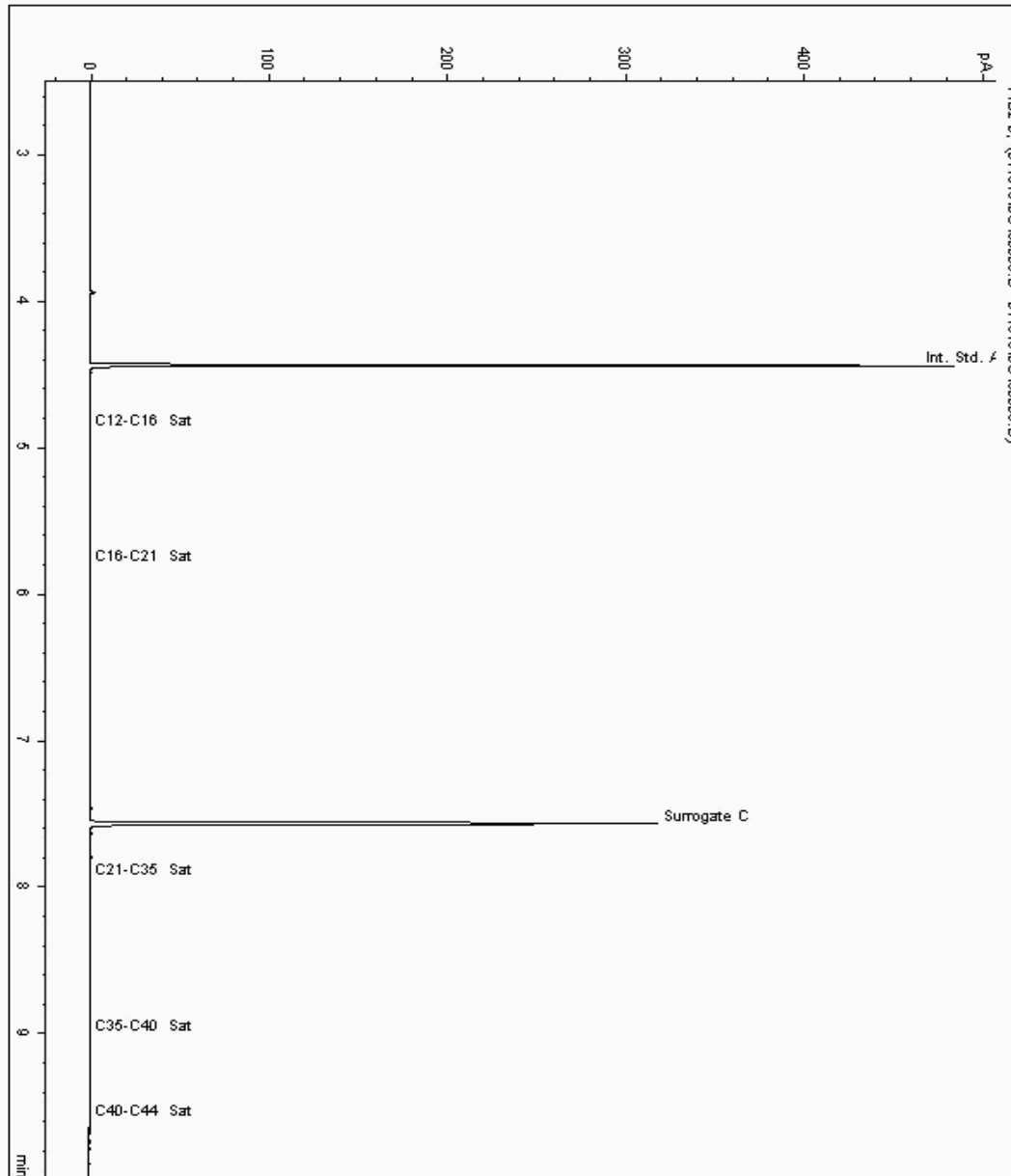
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 6772710
Sample ID : BH101

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 6526508-6772710
Date Acquired : 16/01/2013 18:57:08 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





CERTIFICATE OF ANALYSIS

SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

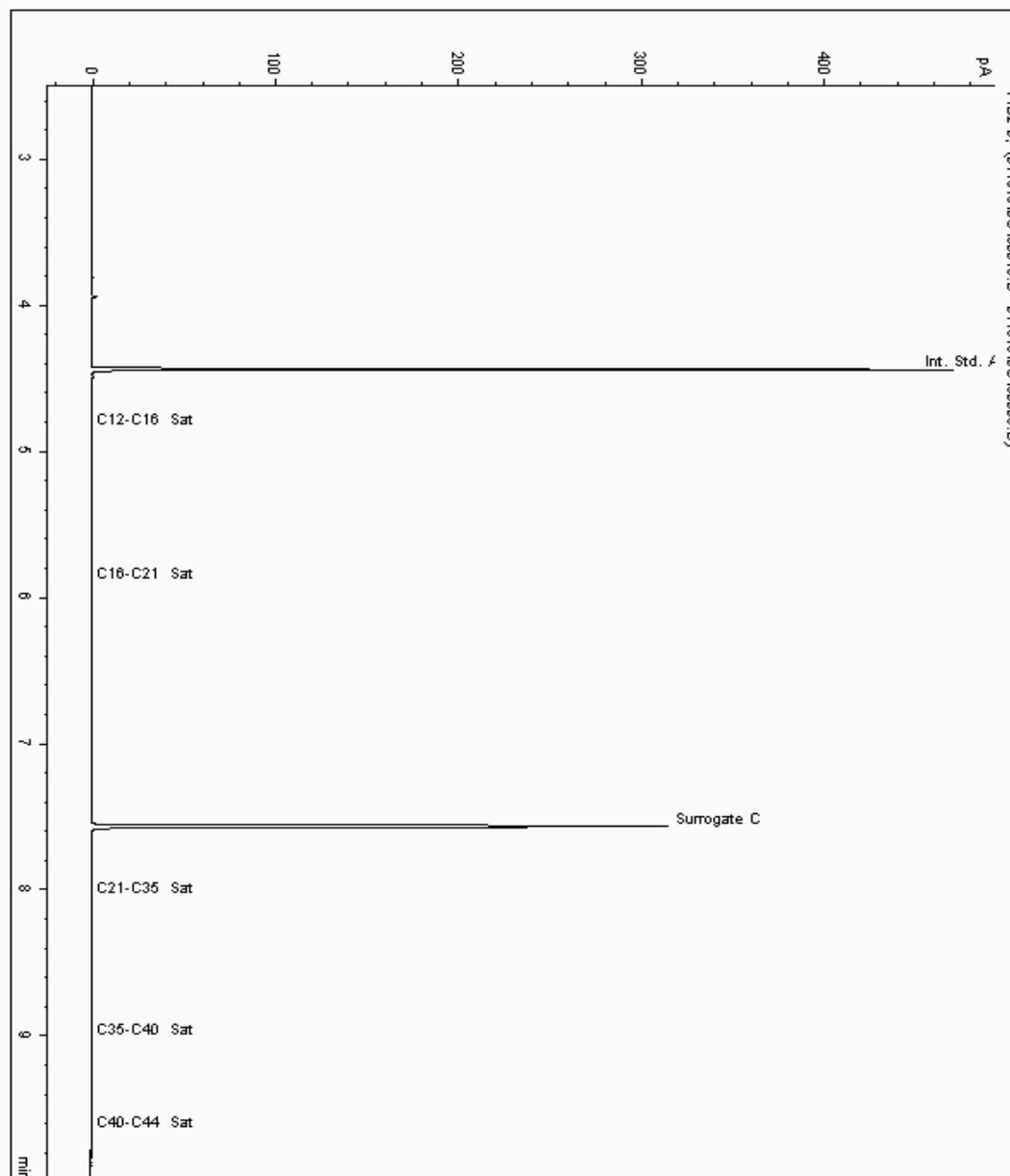
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 6772721
Sample ID : BH102

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 6526531-6772721
Date Acquired : 16/01/2013 20:50:13 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





CERTIFICATE OF ANALYSIS

SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

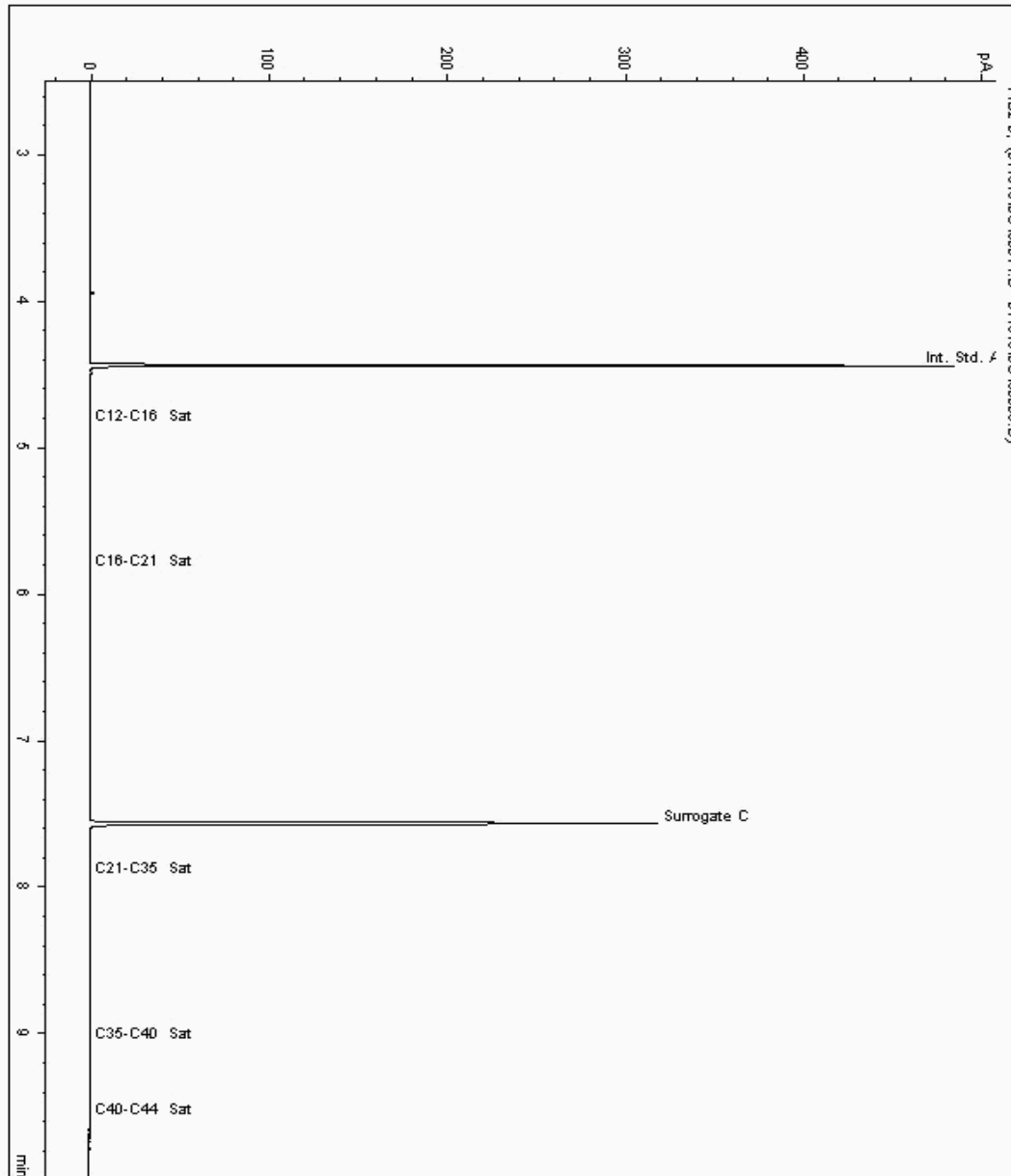
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 6772730
Sample ID : BH103

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 6526556-6772730
Date Acquired : 16/01/2013 20:31:23 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





CERTIFICATE OF ANALYSIS

SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

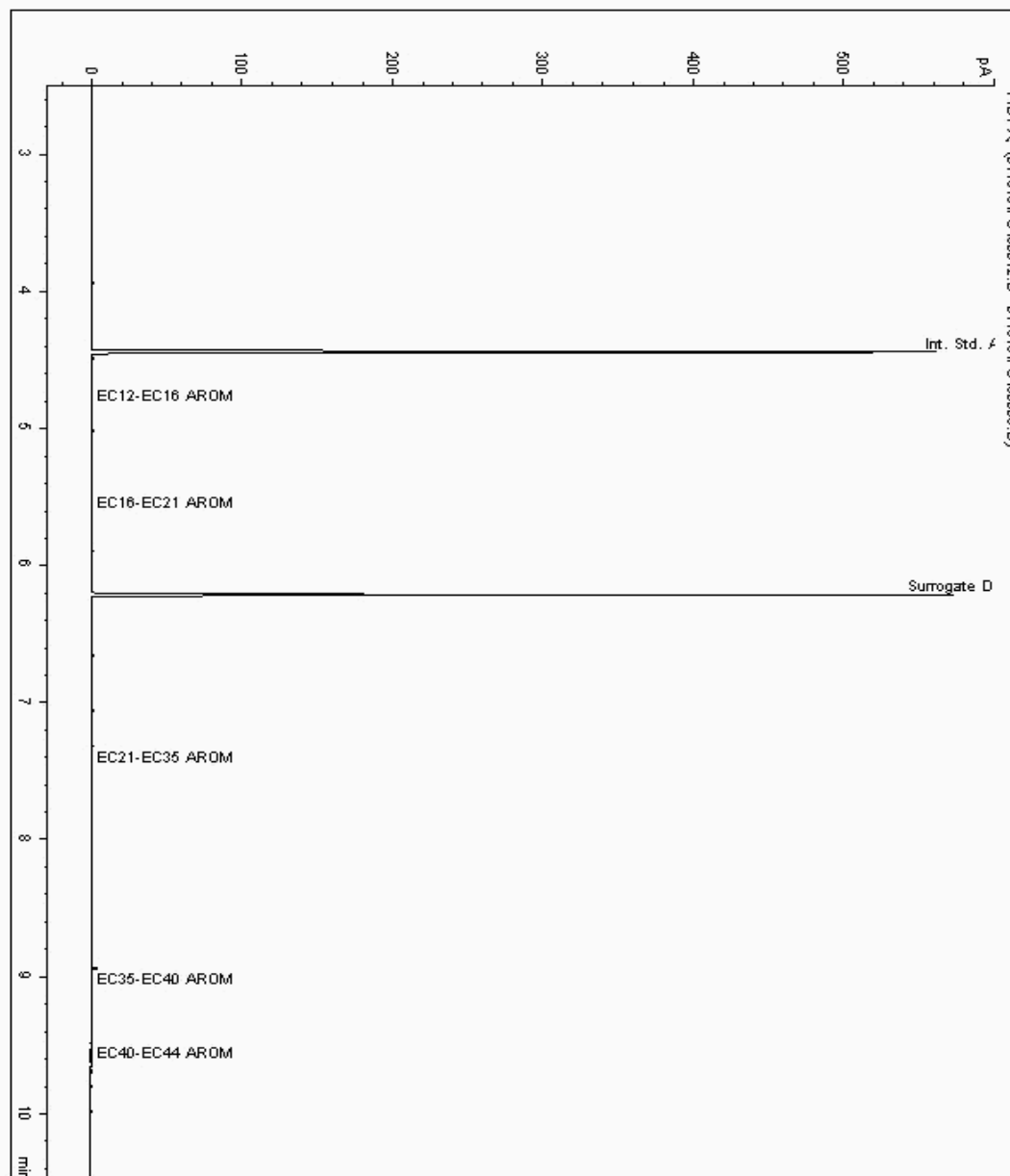
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 6772666
Sample ID : BH105A

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 6526579-6772666
Date Acquired : 16/01/2013 19:53:26 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

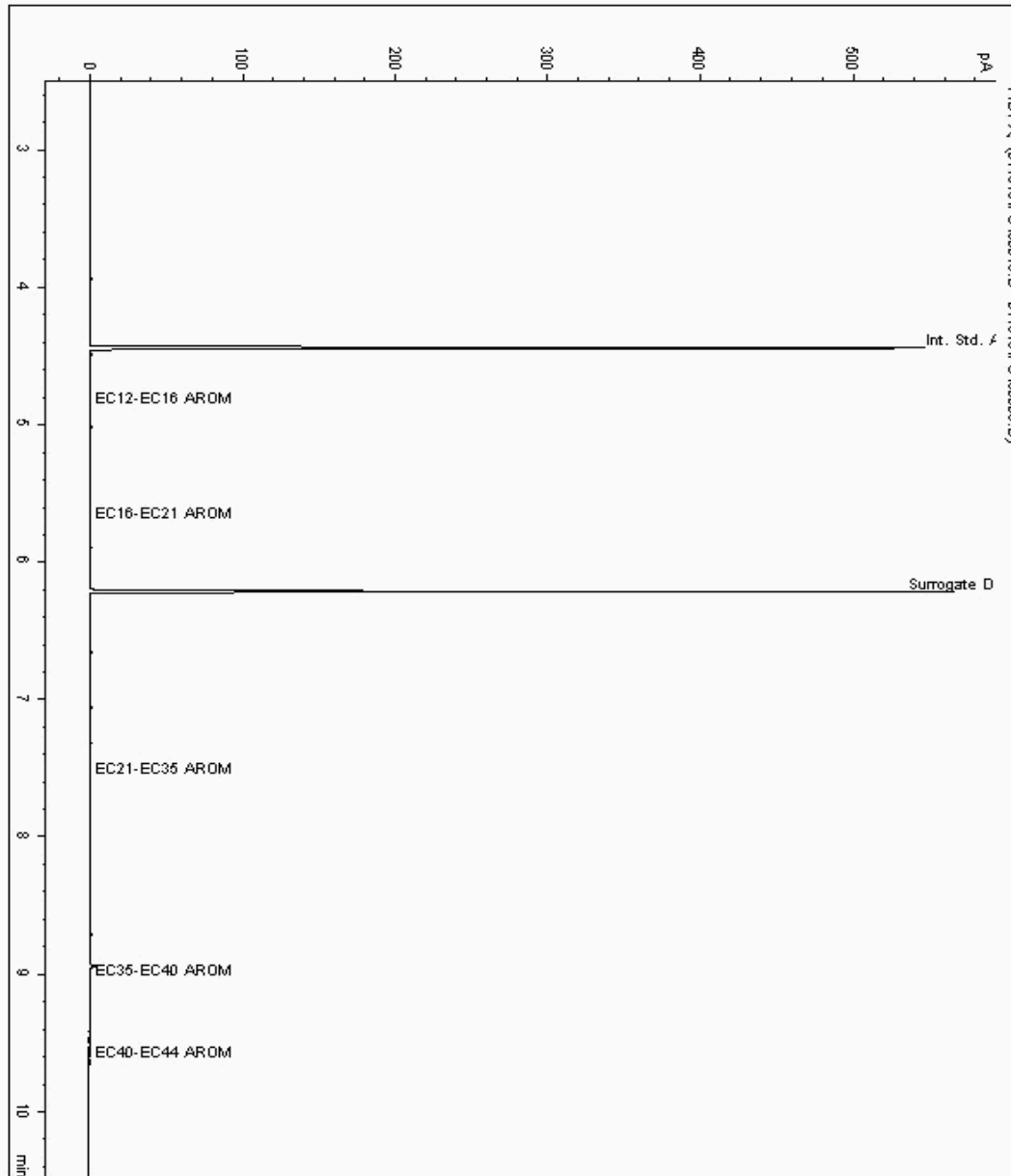
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 6772675
Sample ID : BH106A

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 6526602-6772675
Date Acquired : 16/01/2013 20:12:30 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

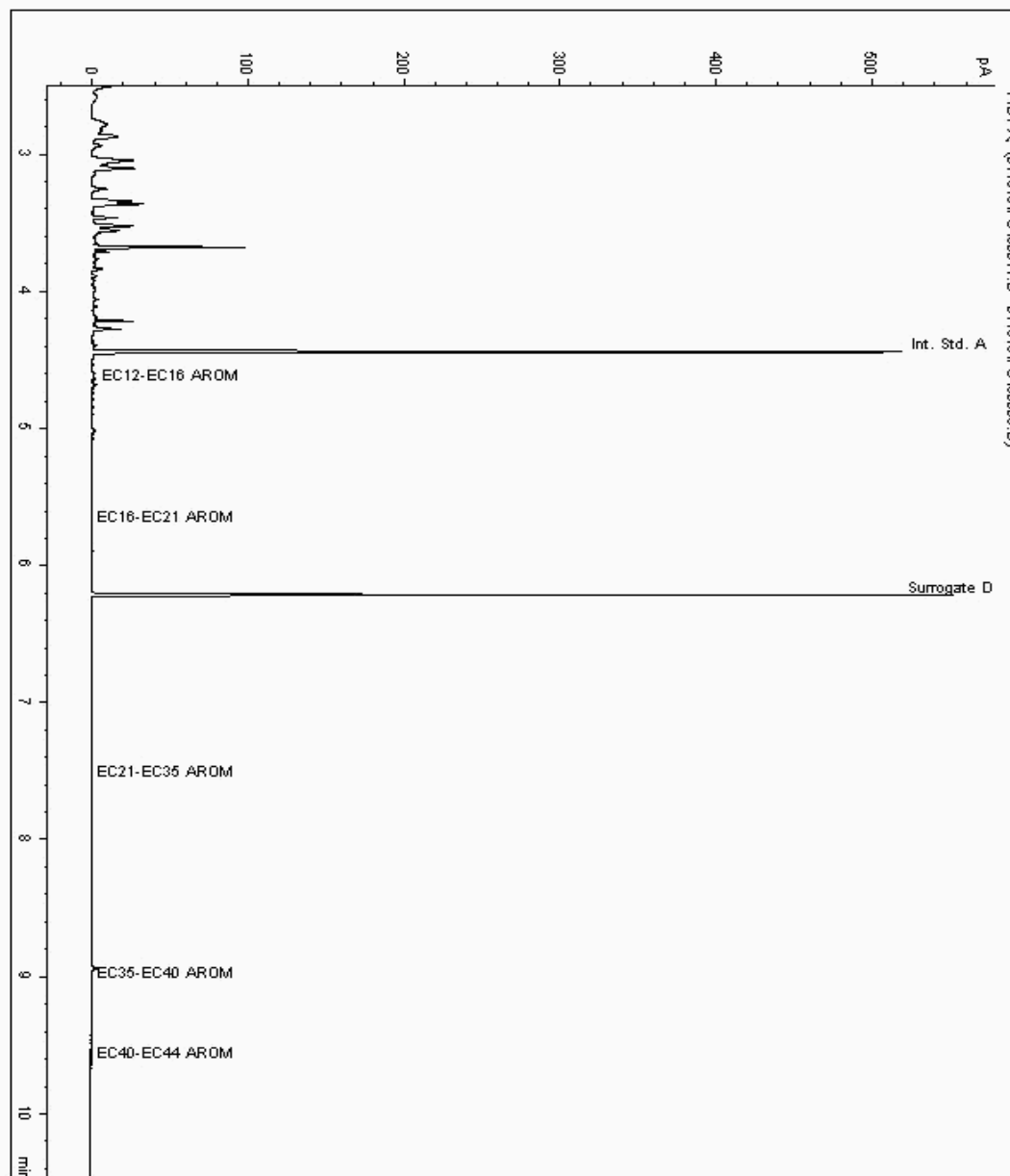
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 6772686
Sample ID : DUP 01

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 6526617-6772686
Date Acquired : 16/01/2013 19:34:38 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





CERTIFICATE OF ANALYSIS

SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

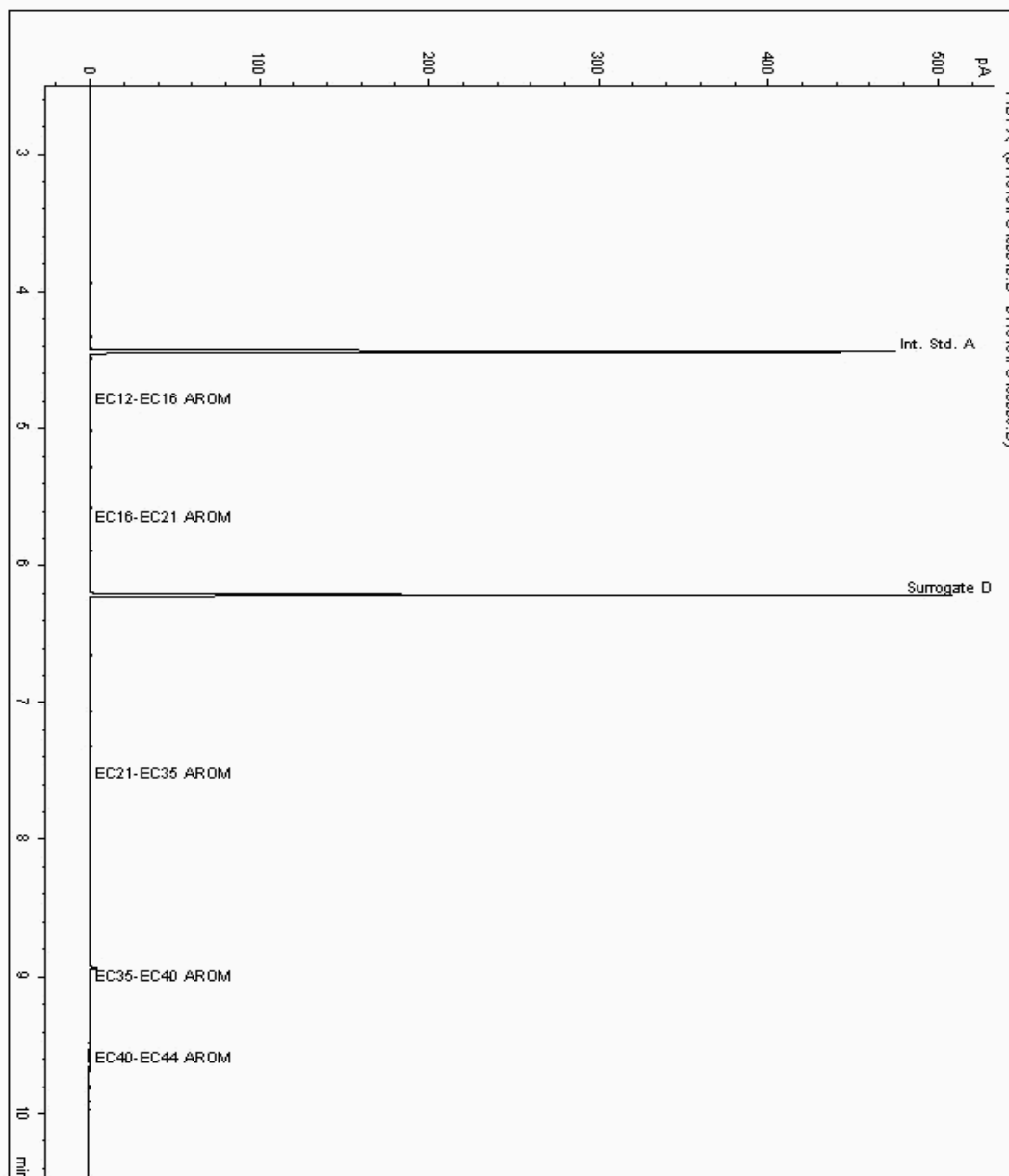
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 6772698
Sample ID : EQUIPMENT BLANK

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 6526632-6772698
Date Acquired : 16/01/2013 19:15:53 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

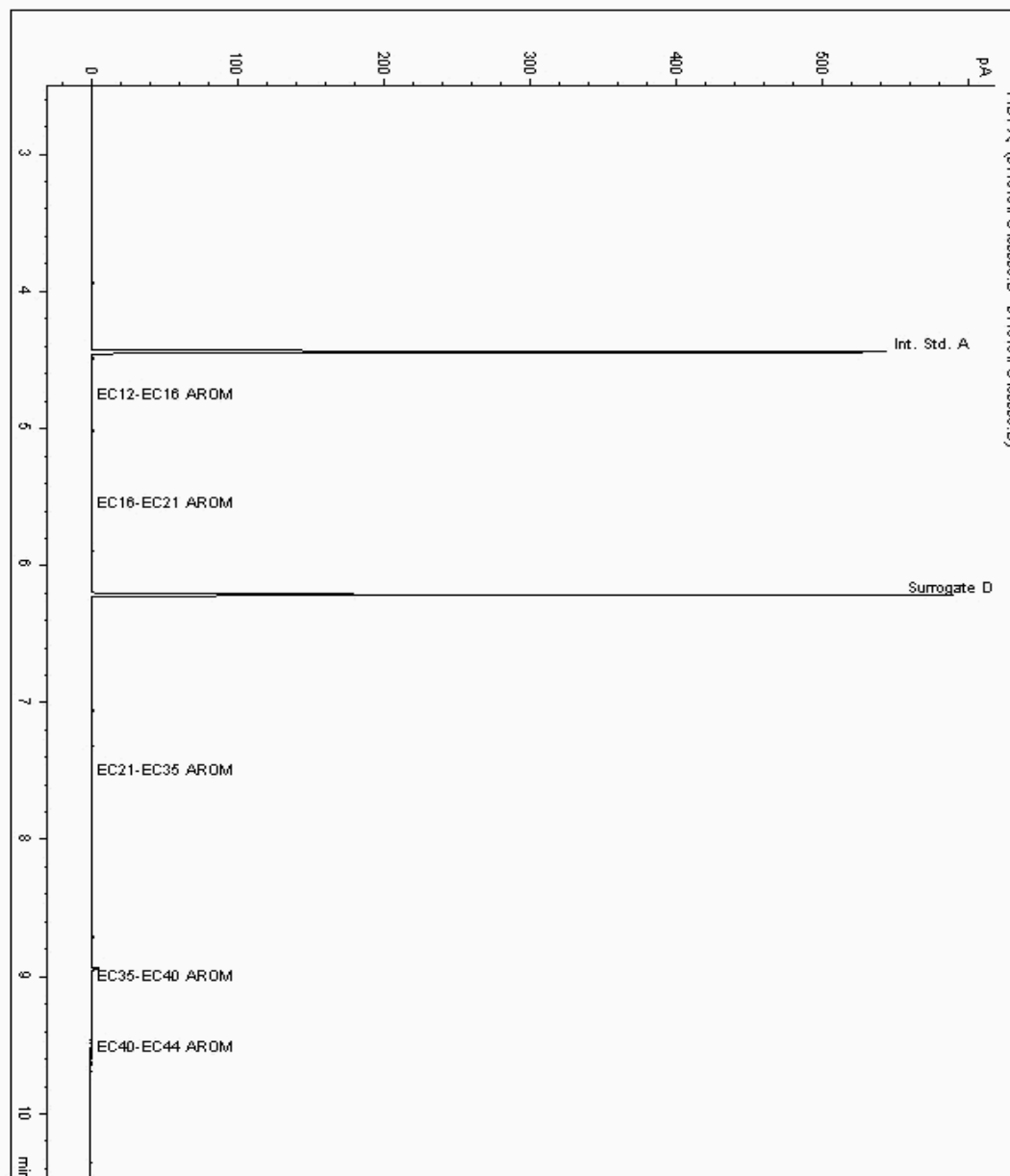
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 6772710
Sample ID : BH101

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 6526509-6772710
Date Acquired : 16/01/2013 18:57:07 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

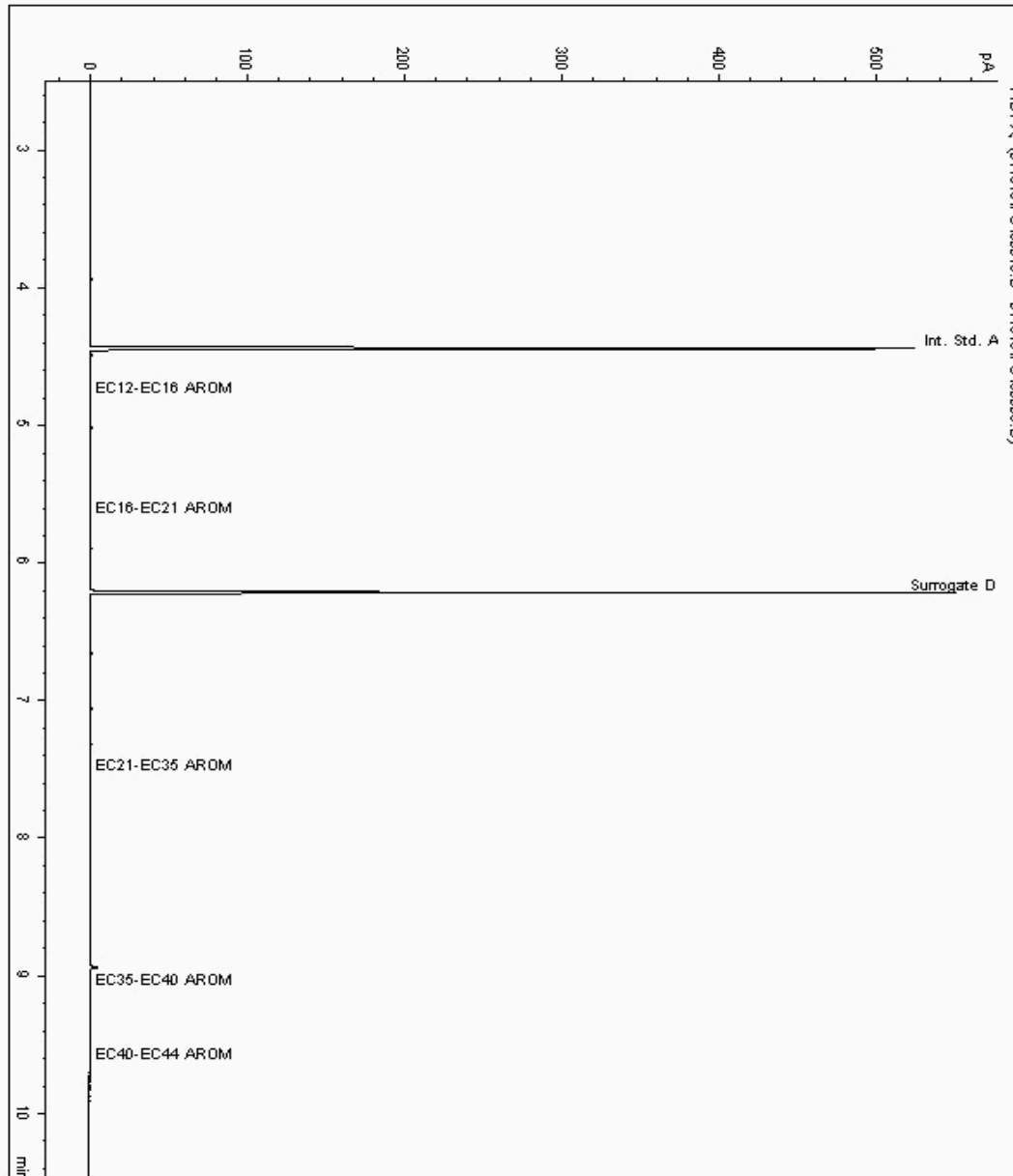
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 6772721
Sample ID : BH102

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 6526532-6772721
Date Acquired : 16/01/2013 20:50:13 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





CERTIFICATE OF ANALYSIS

SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

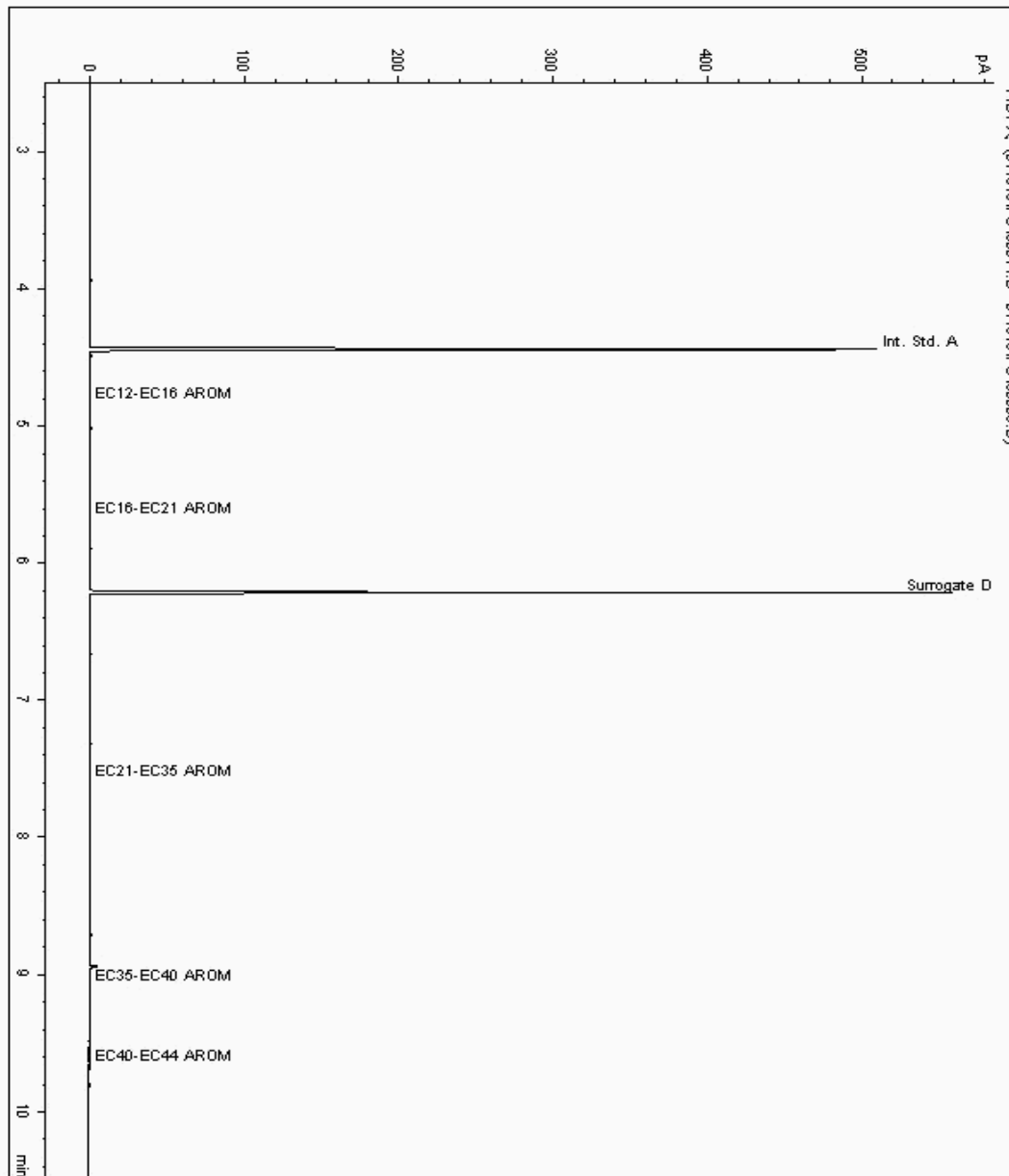
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 6772730
Sample ID : BH103

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 6526557-6772730
Date Acquired : 16/01/2013 20:31:22 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

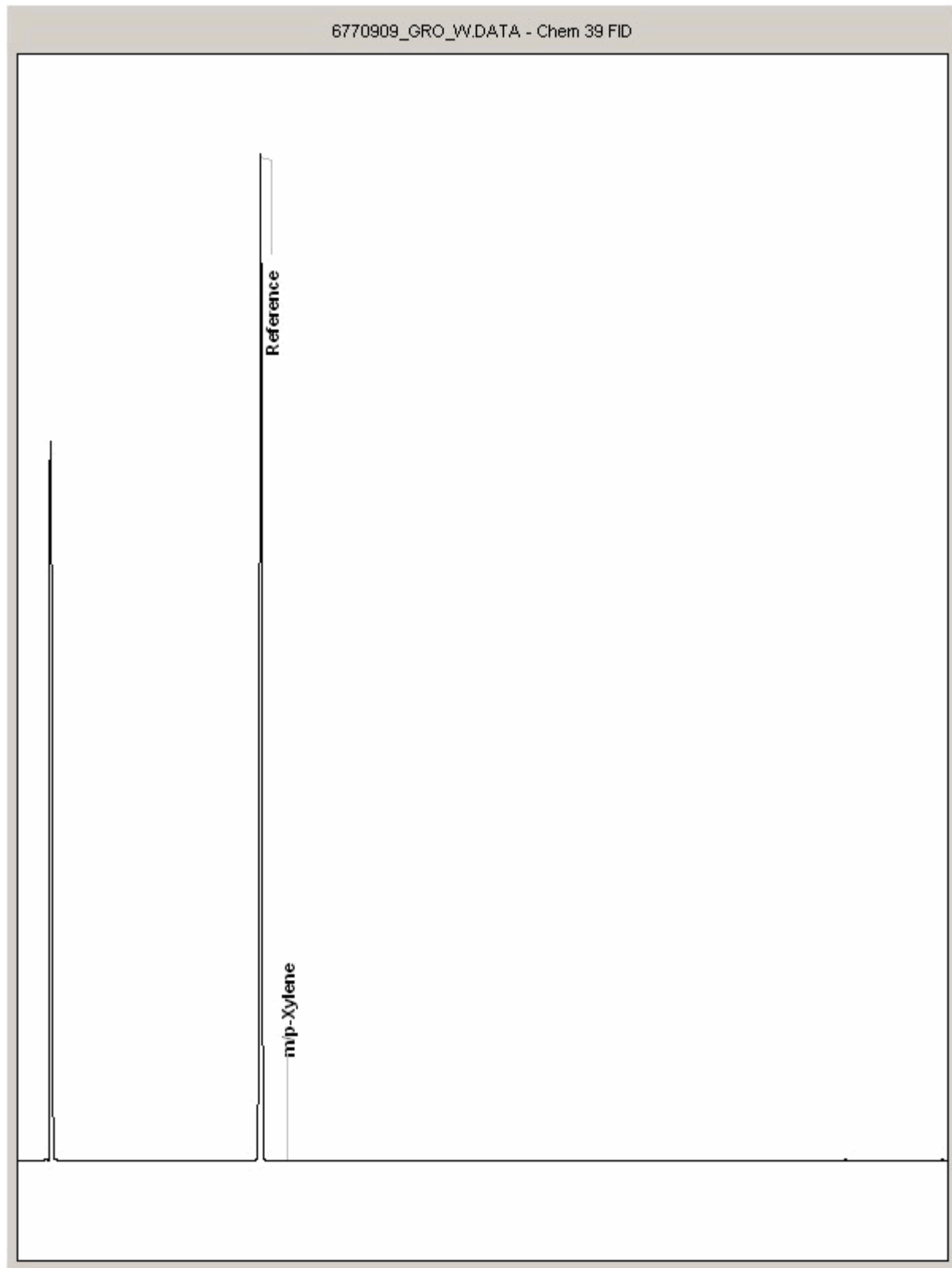
Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 6770909
Sample ID : BH101

Depth :





SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

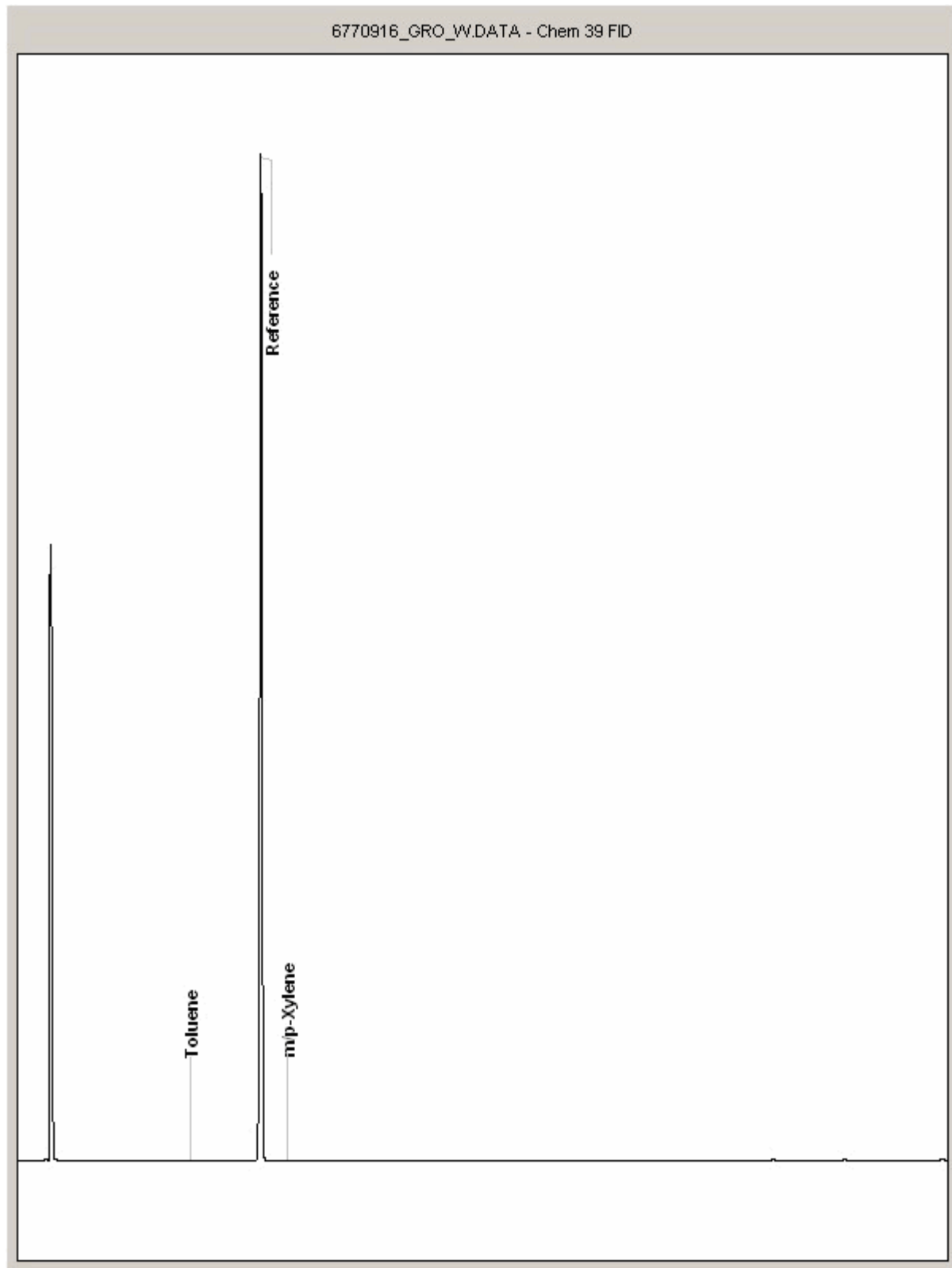
Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 6770916
Sample ID : BH106A

Depth :





SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

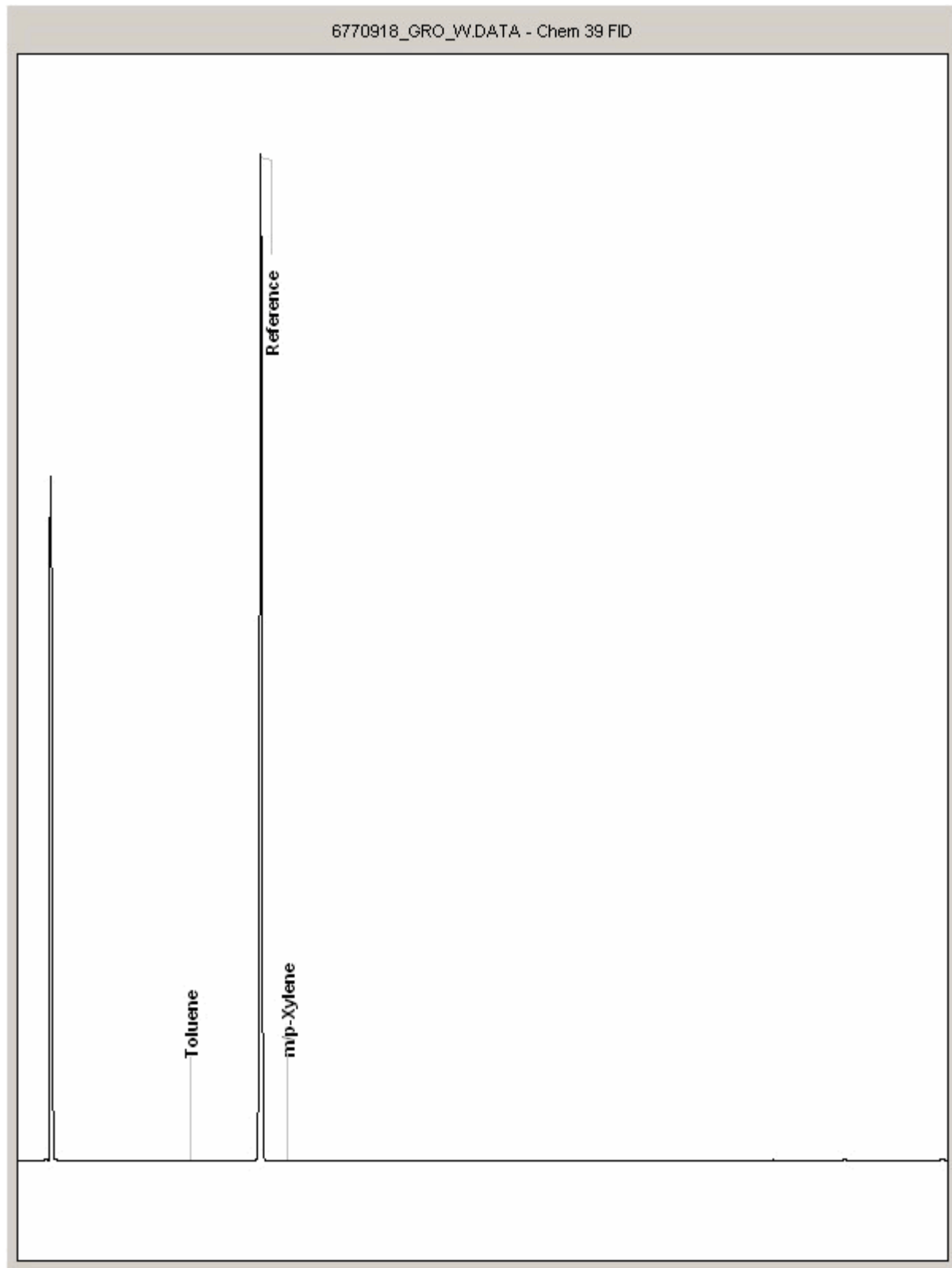
Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 6770918
Sample ID : BH105A

Depth :





SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

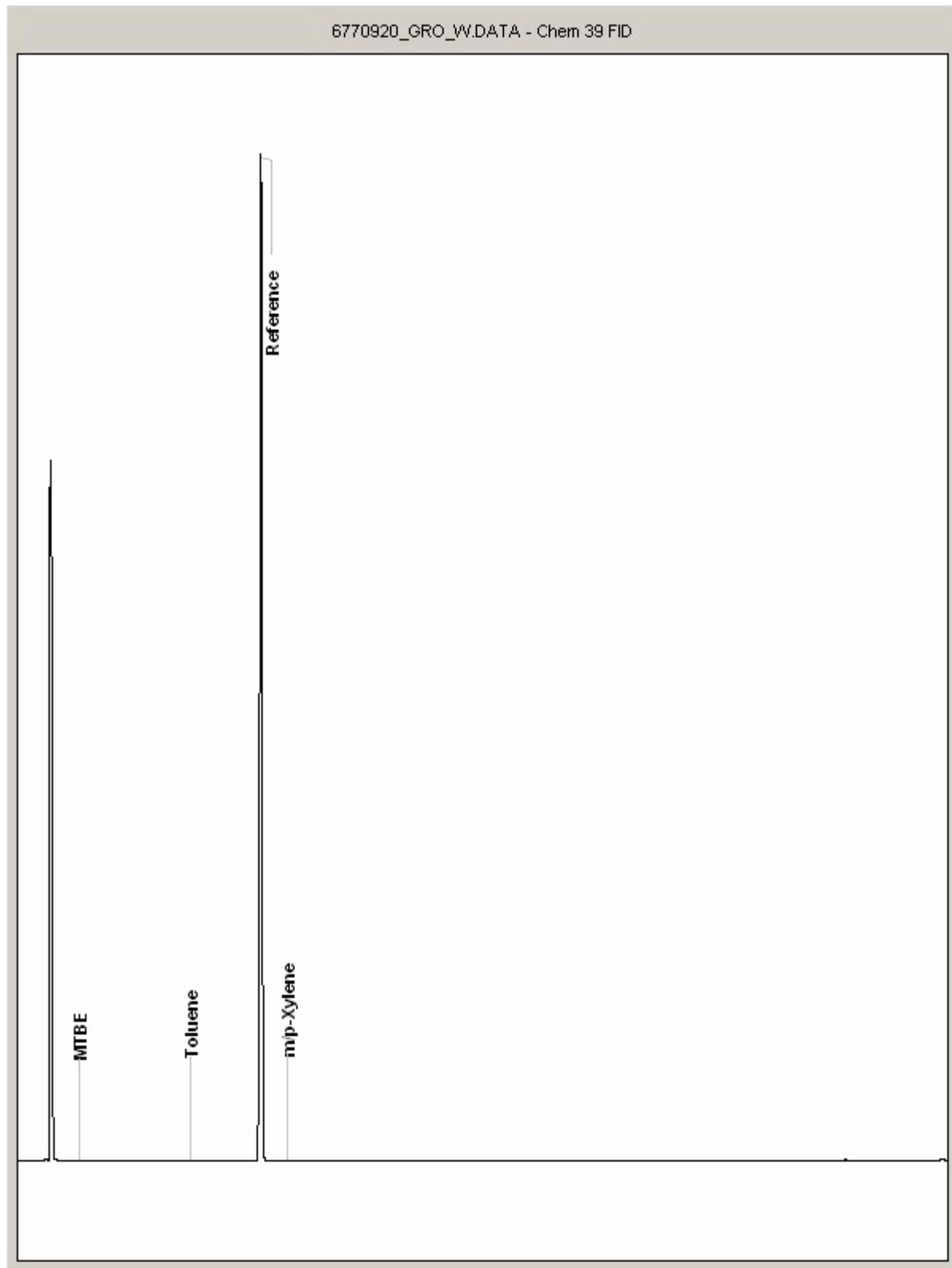
Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 6770920
Sample ID : BH103

Depth :





SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

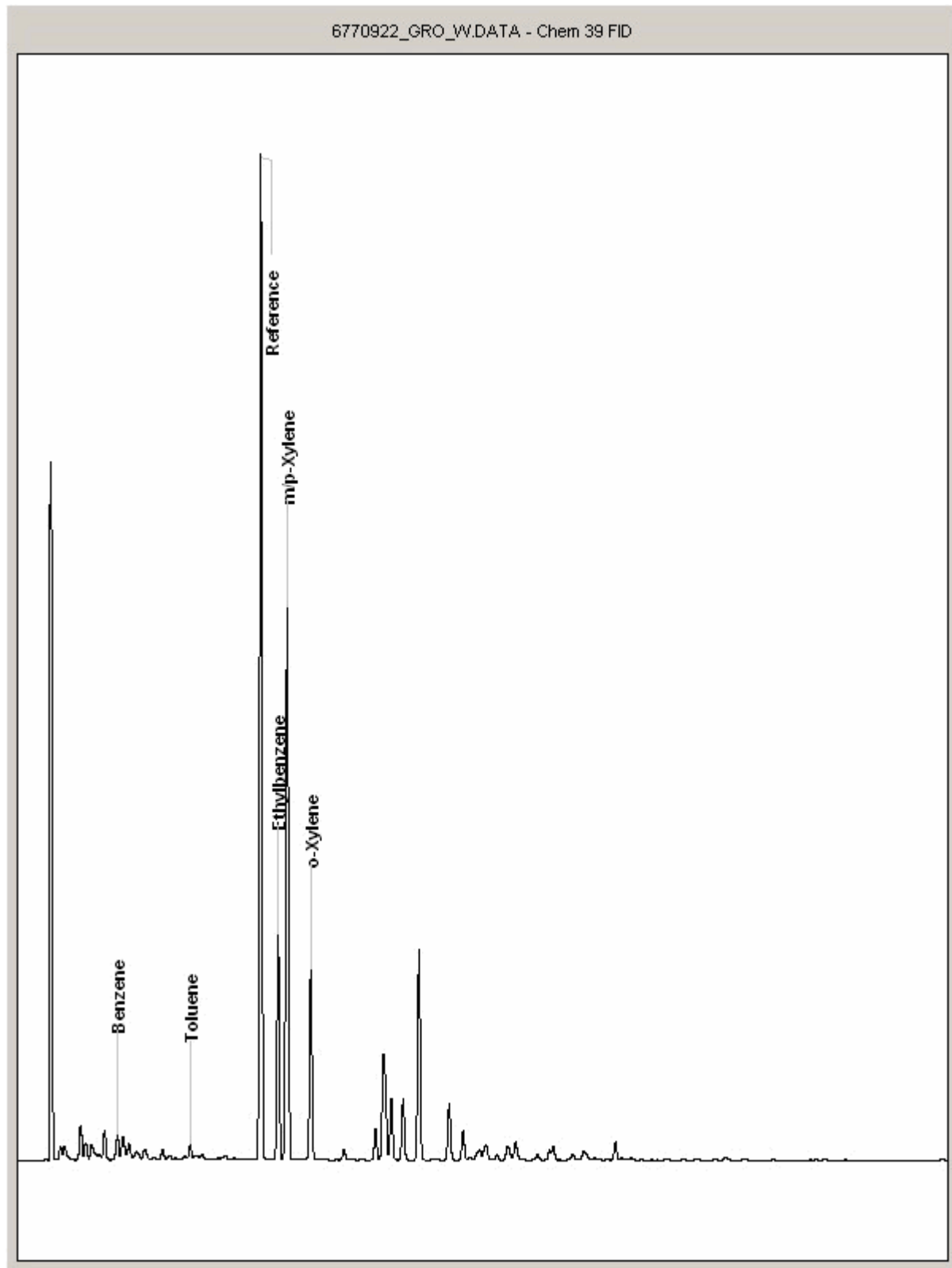
Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 6770922
Sample ID : BH102

Depth :





SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

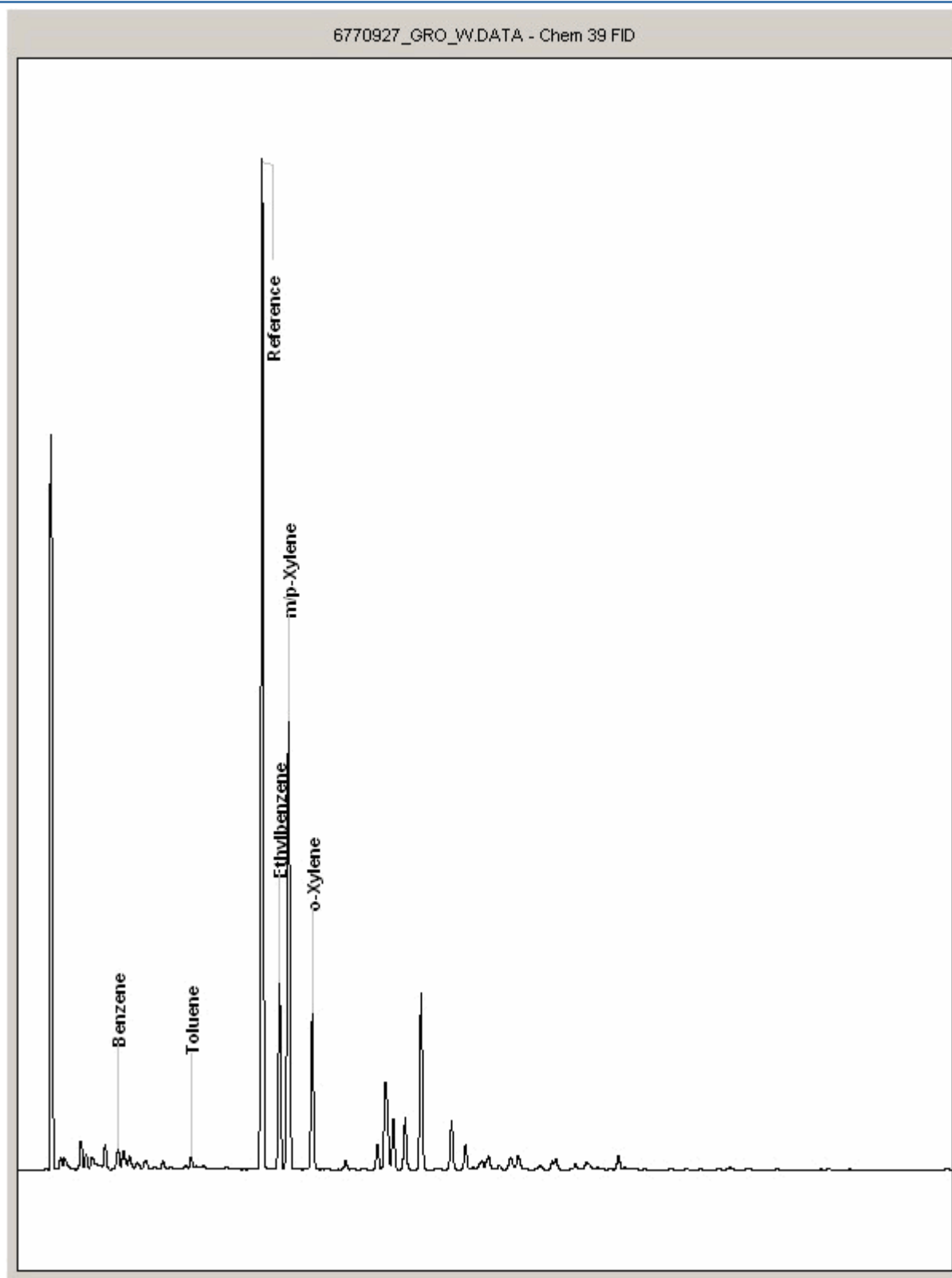
Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 6770927
Sample ID : DUP 01

Depth :





SDG: 130112-49
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

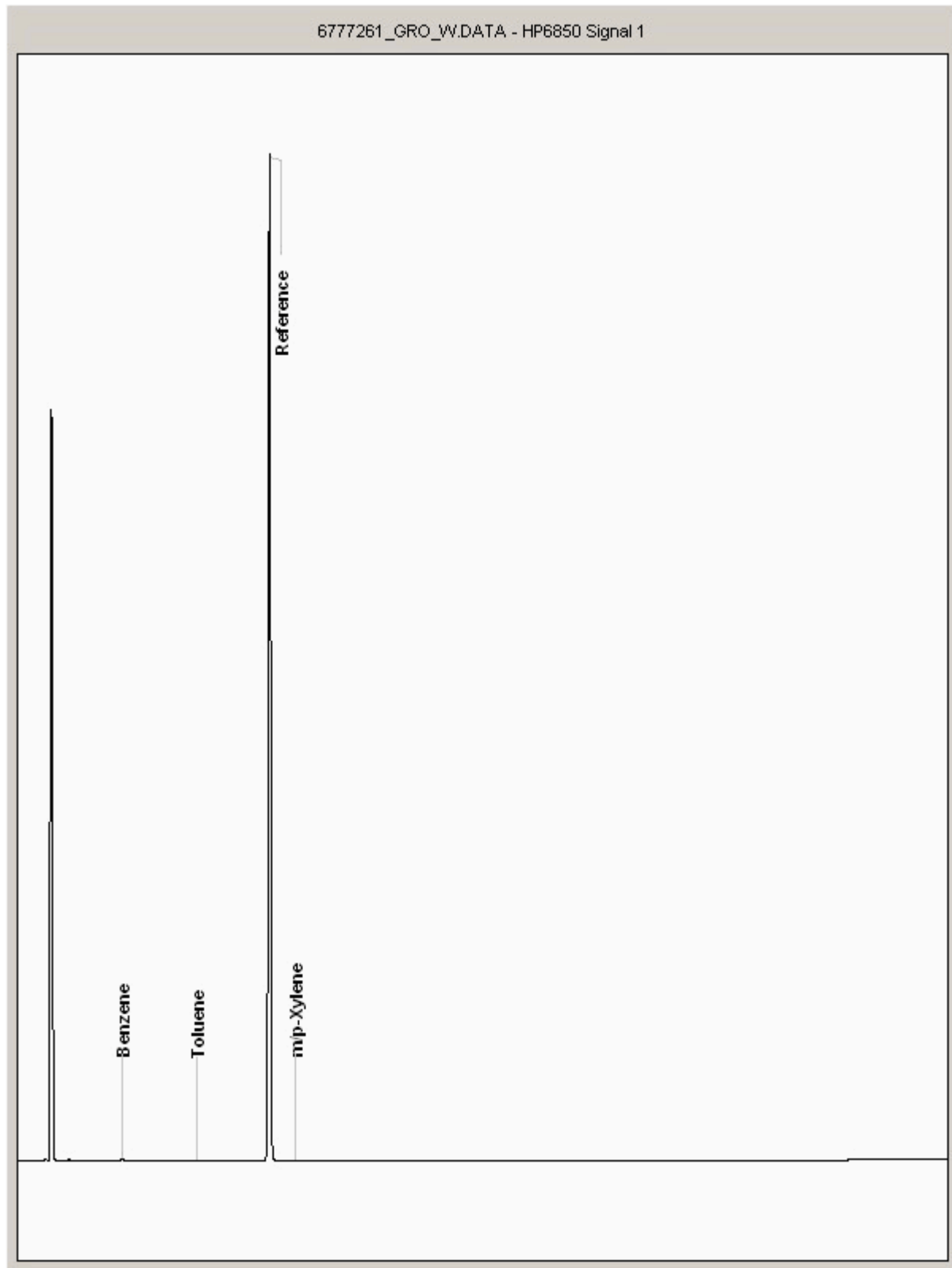
Order Number:
Report Number: 209137
Superseded Report:

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 6777261
Sample ID : EQUIPMENT BLANK

Depth :





SDG:	130112-49	Location:	Hitchin	Order Number:	
Job:	H_URS_WIM-162	Customer:	URS Corporation Limited	Report Number:	209137
Client Reference:	46370079	Attention:	Jocelyn Willis	Superseded Report:	

Appendix General

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.
2. Samples will be run in duplicate upon request, but an additional charge may be incurred.
3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 2 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.
4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.
5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.
6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.
7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.
8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.
9. NDP -No determination possible due to insufficient/unsuitable sample.
10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.
11. Results relate only to the items tested.
12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.
13. **Surrogate recoveries** -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.
14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.
15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).
16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).
17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.
18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.
19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.
21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.
22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill /made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.
23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
§	Sampled on date not provided
+	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

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

Visual Estimation Of Fibre Content

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

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

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



URS Corporation Limited
St. George's House
2nd Floor
5 St. George's Road
Wimbledon
Greater London
SW19 4DR

Attention: Jocelyn Willis

CERTIFICATE OF ANALYSIS

Date: 27 January 2013
Customer: H_URS_WIM
Sample Delivery Group (SDG): 130123-24
Your Reference: 46370079
Location: Hitchin
Report No: 209946

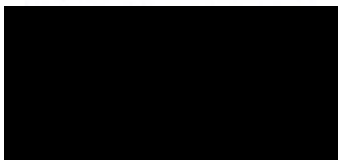
This report has been revised and directly supersedes 209931 in its entirety.

We received 2 samples on Wednesday January 23, 2013 and 2 of these samples were scheduled for analysis which was completed on Sunday January 27, 2013. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:



Sonia McWhan

Operations Manager





SDG:	130123-24	Location:	Hitchin	Order Number:	
Job:	H_URS_WIM-162	Customer:	URS Corporation Limited	Report Number:	209946
Client Reference:	46370079	Attention:	Jocelyn Willis	Superseded Report:	209931

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
6808342	BH102			22/01/2013
6808340	BH102A			22/01/2013

Only received samples which have had analysis scheduled will be shown on the following pages.



SDG: 130123-24
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209946
Superseded Report: 209931

LIQUID**Results Legend**

Test

No Determination
Possible**Lab Sample No(s)**

6808342

6808340

**Customer
Sample Reference**

BH102

BH102A

AGS Reference**Depth (m)****Container**

1l green glass bottle

Vial (ALE297)

Vial (ALE297)

EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 2		
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 2		
GRO by GC-FID (W)	All	NDPs: 0 Tests: 2		
Oxygenates (W)	All	NDPs: 0 Tests: 2		
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 2		
VOC MS (W)	All	NDPs: 0 Tests: 2		

Order Number:
Report Number: 209946
Superseded Report: 209931

16:52:09 27/01/2013

Order Number:
Report Number: 209946
Superseded Report: 209931

Page 5 of 21

Order Number:
Report Number: 209946
Superseded Report: 209931

Page 6 of 21

Order Number:
Report Number: 209946
Superseded Report: 209931

Page 7 of 21

Order Number:
Report Number: 209946
Superseded Report: 209931

Page 8 of 21

Order Number:
Report Number: 209946
Superseded Report: 209931

Page 9 of 21



SDG:	130123-24	Location:	Hitchin	Order Number:	
Job:	H_URS_WIM-162	Customer:	URS Corporation Limited	Report Number:	209946
Client Reference:	46370079	Attention:	Jocelyn Willis	Superseded Report:	209931

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample ¹	Surrogate Corrected
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM208	Modified: US EPA Method 8260b & 624	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM289		Determination of Oxygenates in Waters by Headspace/GC-MS		

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.



SDG:	130123-24	Location:	Hitchin	Order Number:	
Job:	H_URS_WIM-162	Customer:	URS Corporation Limited	Report Number:	209946
Client Reference:	46370079	Attention:	Jocelyn Willis	Superseded Report:	209931

Test Completion Dates

Lab Sample No(s)	6808342	6808340
Customer Sample Ref.	BH102	BH102A
AGS Ref.		
Depth		
Type	LIQUID	LIQUID

EPH CWG (Aliphatic) Aqueous GC (W)	25-Jan-2013	25-Jan-2013
EPH CWG (Aromatic) Aqueous GC (W)	25-Jan-2013	25-Jan-2013
GRO by GC-FID (W)	25-Jan-2013	25-Jan-2013
Oxygenates (W)	25-Jan-2013	25-Jan-2013
PAH Spec MS - Aqueous (W)	25-Jan-2013	25-Jan-2013
TPH CWG (W)	25-Jan-2013	25-Jan-2013
VOC MS (W)	27-Jan-2013	24-Jan-2013



SDG: 130123-24
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209946
Superseded Report: 209931

ASSOCIATED AQC DATA

EPH CWG (Aliphatic) Aqueous GC (W)

Component	Method Code	QC 61
Total Aliphatics >C12-C35	TM174	90.83 77.43 : 102.04

EPH CWG (Aromatic) Aqueous GC (W)

Component	Method Code	QC 60
Total Aromatics >EC12-EC35	TM174	97.33 81.38 : 107.30

GRO by GC-FID (W)

Component	Method Code	QC 69
Benzene by GC	TM245	91.5 79.00 : 121.00
Ethylbenzene by GC	TM245	96.5 79.00 : 121.00
m & p Xylene by GC	TM245	96.25 79.00 : 121.00
MTBE GC-FID	TM245	100.0 79.00 : 121.00
o Xylene by GC	TM245	96.5 79.00 : 121.00
QC	TM245	98.15 79.00 : 121.00
Toluene by GC	TM245	95.0 79.00 : 121.00

Oxygenates (W)

Component	Method Code	QC 66
Benzene	TM289	96.5 79.73 : 131.69
Diisopropyl ether	TM289	95.5 72.91 : 124.47
Ethanol	TM289	108.4 60.84 : 141.13
Ethylbenzene	TM289	95.5 76.16 : 122.57
o-Xylene	TM289	93.0 77.08 : 124.38
p/m-Xylene	TM289	94.25 82.78 : 120.00
tert Butanol	TM289	113.0 70.51 : 143.48
tert-amyl methyl ether	TM289	99.0 78.92 : 124.29



SDG:	130123-24	Location:	Hitchin	Order Number:	
Job:	H_URS_WIM-162	Customer:	URS Corporation Limited	Report Number:	209946
Client Reference:	46370079	Attention:	Jocelyn Willis	Superseded Report:	209931

Oxygenates (W)

		QC 66
tert-butyl ethyl ether	TM289	96.5 78.17 : 124.34
tert-butyl methyl ether	TM289	99.0 78.27 : 127.85
Toluene	TM289	94.0 79.08 : 122.51

PAH Spec MS - Aqueous (W)

Component	Method Code	QC 67
Acenaphthene by GCMS	TM178	95.5 81.10 : 114.10
Acenaphthylene by GCMS	TM178	99.0 79.45 : 111.85
Anthracene by GCMS	TM178	93.5 83.69 : 106.27
Benz(a)anthracene by GCMS	TM178	98.0 76.69 : 110.97
Benzo(a)pyrene by GCMS	TM178	97.0 82.57 : 113.60
Benzo(b)fluoranthene by GCMS	TM178	95.0 87.25 : 114.25
Benzo(ghi)perylene by GCMS	TM178	91.0 81.58 : 107.32
Benzo(k)fluoranthene by GCMS	TM178	95.5 87.20 : 122.40
Chrysene by GCMS	TM178	95.5 87.92 : 108.35
Dibenzo(ah)anthracene by GCMS	TM178	88.5 75.97 : 112.60
Fluoranthene by GCMS	TM178	95.5 81.15 : 116.55
Fluorene by GCMS	TM178	95.5 82.30 : 114.10
Indeno(123cd)pyrene by GCMS	TM178	93.0 82.25 : 114.75
Naphthalene by GCMS	TM178	96.5 83.45 : 112.25
Phenanthrene by GCMS	TM178	96.0 88.74 : 112.07
Pyrene by GCMS	TM178	94.5 82.25 : 116.15

VOC MS (W)

Component	Method Code	QC 61	QC 63	QC 66
1,1,1,2-Tetrachloroethane	TM208	96.0 86.47 : 123.48	98.0 86.47 : 123.48	105.0 86.47 : 123.48
1,1,1-Trichloroethane	TM208	101.5 84.58 : 123.50	100.5 84.58 : 123.50	105.0 84.58 : 123.50
1,1-Dichloroethane	TM208	105.0 85.03 : 127.99	103.5 85.03 : 127.99	108.0 85.03 : 127.99
1,2-Dichloroethane	TM208	104.5 77.53 : 124.64	98.0 77.53 : 124.64	110.0 77.53 : 124.64



CERTIFICATE OF ANALYSIS

SDG: 130123-24
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209946
Superseded Report: 209931

VOC MS (W)

		QC 61	QC 63	QC 66
2-Chlorotoluene	TM208	90.0 83.27 : 124.81	97.5 83.27 : 124.81	103.0 83.27 : 124.81
4-Chlorotoluene	TM208	90.0 84.29 : 124.70	97.5 84.29 : 124.70	103.5 84.29 : 124.70
Benzene	TM208	100.5 86.11 : 127.43	99.5 86.11 : 127.43	110.0 86.11 : 127.43
Bromomethane	TM208	104.5 75.41 : 126.08	99.5 75.41 : 126.08	108.5 75.41 : 126.08
Carbontetrachloride	TM208	100.0 86.30 : 125.39	101.5 86.30 : 125.39	107.5 86.30 : 125.39
Chlorobenzene	TM208	95.0 87.08 : 121.66	99.5 87.08 : 121.66	106.5 87.08 : 121.66
Chloroform	TM208	104.5 80.91 : 119.98	101.0 91.29 : 116.69	106.5 91.29 : 116.69
Chloromethane	TM208	110.5 54.61 : 156.60	104.0 54.61 : 156.60	113.0 54.61 : 156.60
Cis-1,2-Dichloroethene	TM208	104.0 82.98 : 124.07	95.0 82.98 : 124.07	108.5 82.98 : 124.07
Dichloromethane	TM208	103.5 81.74 : 127.88	97.5 81.74 : 127.88	111.0 81.74 : 127.88
Ethylbenzene	TM208	92.0 80.29 : 125.75	93.5 80.29 : 125.75	101.0 80.29 : 125.75
Hexachlorobutadiene	TM208	84.0 74.78 : 134.63	89.5 74.78 : 134.63	93.0 74.78 : 134.63
o-Xylene	TM208	91.0 83.08 : 123.04	98.5 83.08 : 123.04	102.0 83.08 : 123.04
p/m-Xylene	TM208	92.25 84.32 : 109.96	96.0 84.32 : 109.96	103.25 84.32 : 109.96
Tert-butyl methyl ether	TM208	105.5 72.01 : 124.40	103.5 72.01 : 124.40	105.0 72.01 : 124.40
Tetrachloroethene	TM208	98.5 82.62 : 128.11	99.0 82.62 : 128.11	103.5 82.62 : 128.11
Toluene	TM208	95.5 85.43 : 121.75	96.5 85.43 : 121.75	104.0 85.43 : 121.75
Trichloroethene	TM208	100.0 85.42 : 122.53	98.5 85.42 : 122.53	103.5 85.42 : 122.53
Vinyl Chloride	TM208	108.0 67.16 : 131.54	113.5 87.33 : 125.67	109.0 87.33 : 125.67

The above information details the reference name of the analytical quality control sample (AQC) that has been run with the samples contained in this report for the different methods of analysis.

The figure detailed is the percentage recovery result for the AQC.

The subscript numbers below are the percentage recovery lower control limit (LCL) and the upper control limit (UCL). The percentage recovery result for the AQC should be between these limits to be statistically in control.



SDG: 130123-24
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209946
Superseded Report: 209931

Chromatogram

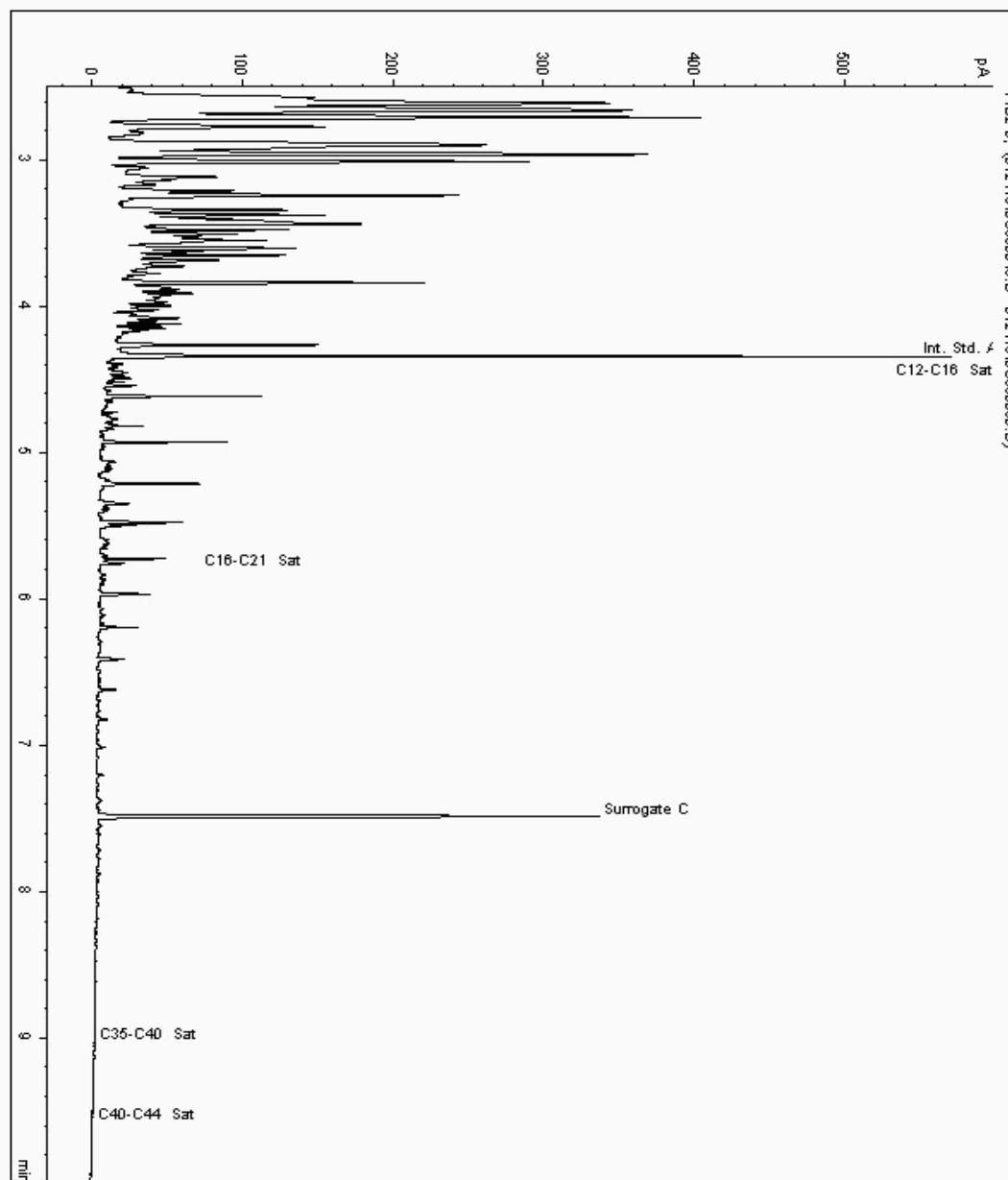
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 6810501
Sample ID : BH102

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 6563880-6810501
Date Acquired : 25/01/13 14:09:37 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





CERTIFICATE OF ANALYSIS

SDG: 130123-24
Job: H_URS_WIM-162
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Location: Hitchin
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Order Number:
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Superseded Report: 209931

Chromatogram

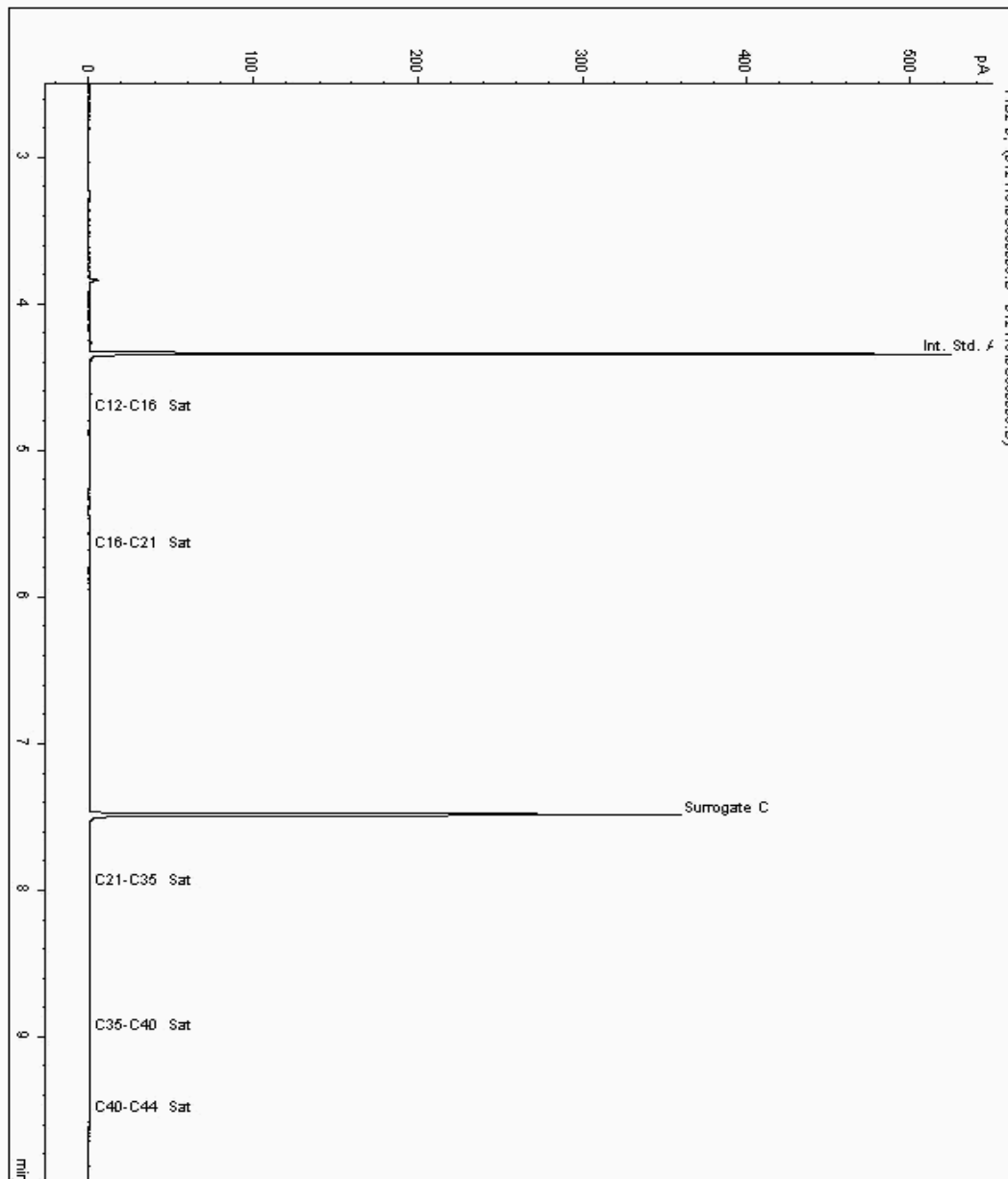
Analysis: EPH CWG (Aliphatic) Aqueous GC (W)

Sample No : 6810515
Sample ID : BH102A

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - SATS (C12 - C40)

Sample Identity: 6563866-6810515
Date Acquired : 24/01/13 18:52:40 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 130123-24
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209946
Superseded Report: 209931

Chromatogram

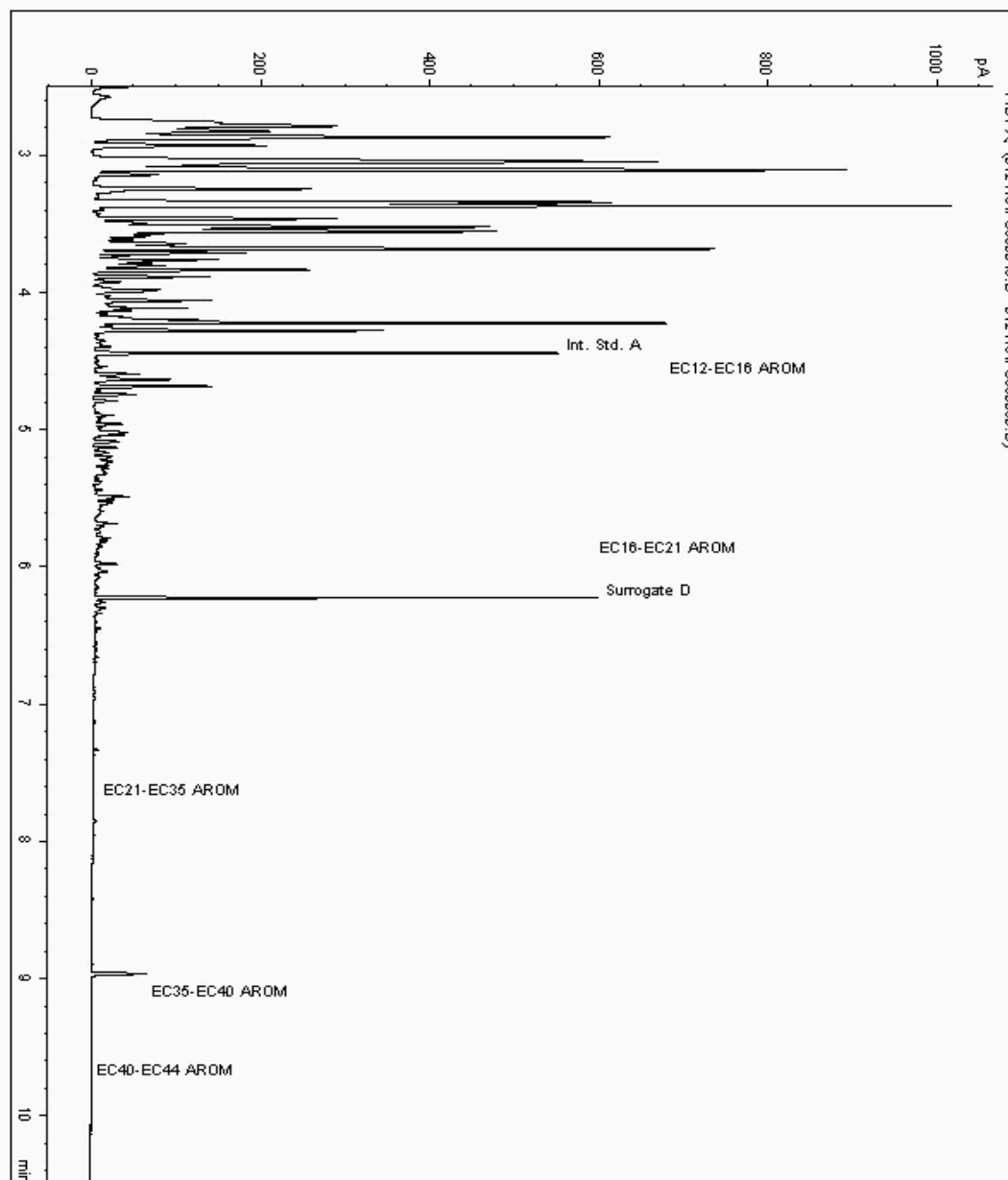
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 6810501
Sample ID : BH102

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 6563881-6810501
Date Acquired : 25/01/13 14:09:37 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 130123-24
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209946
Superseded Report: 209931

Chromatogram

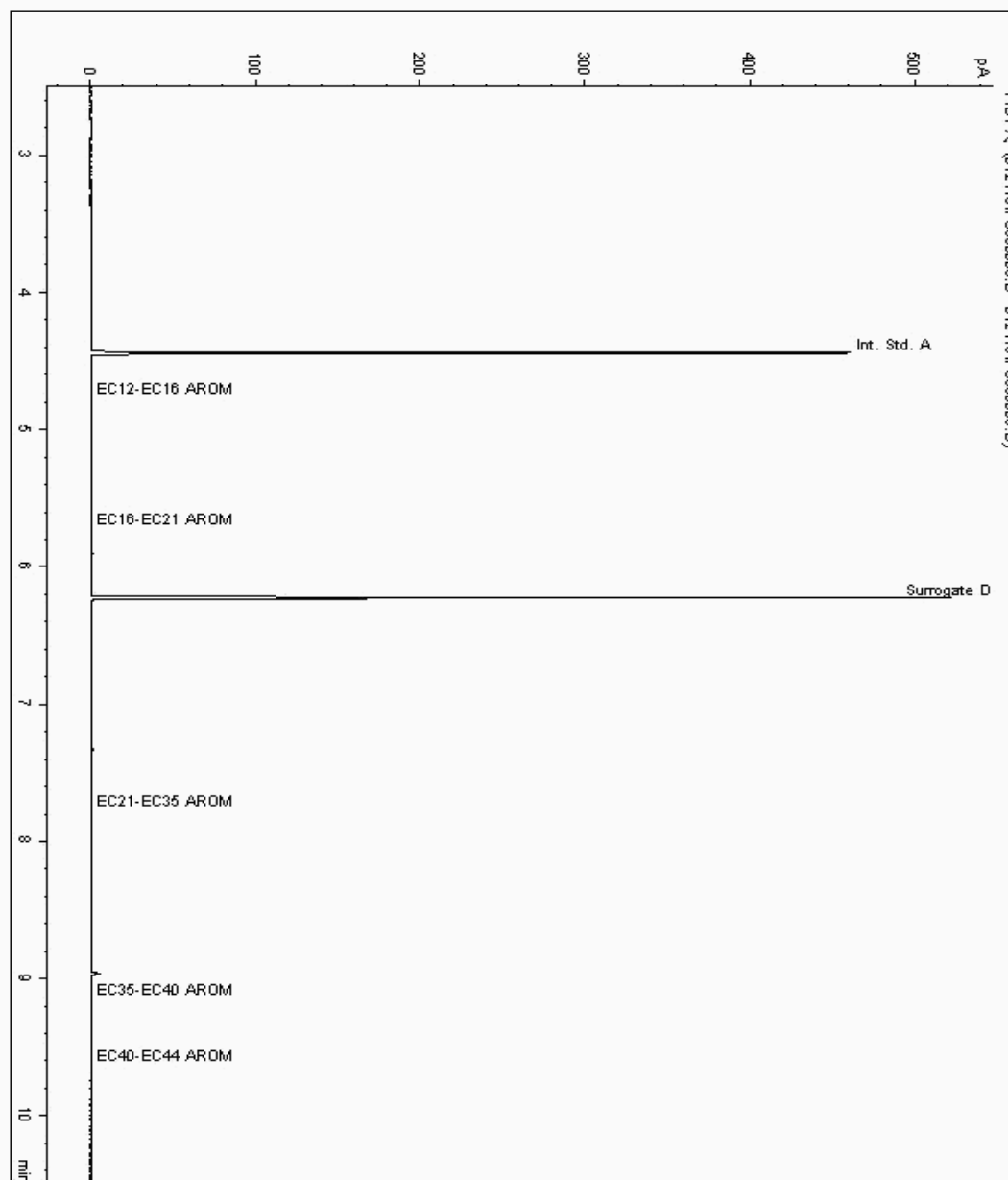
Analysis: EPH CWG (Aromatic) Aqueous GC (W)

Sample No : 6810515
Sample ID : BH102A

Depth :

Alcontrol/Geochem Analytical Services
Speciated TPH - AROM (C12 - C40)

Sample Identity: 6563867-6810515
Date Acquired : 24/01/13 18:52:40 PM
Units : ppb
Dilution :
CF : 1
Multiplier : 0.008





SDG: 130123-24
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

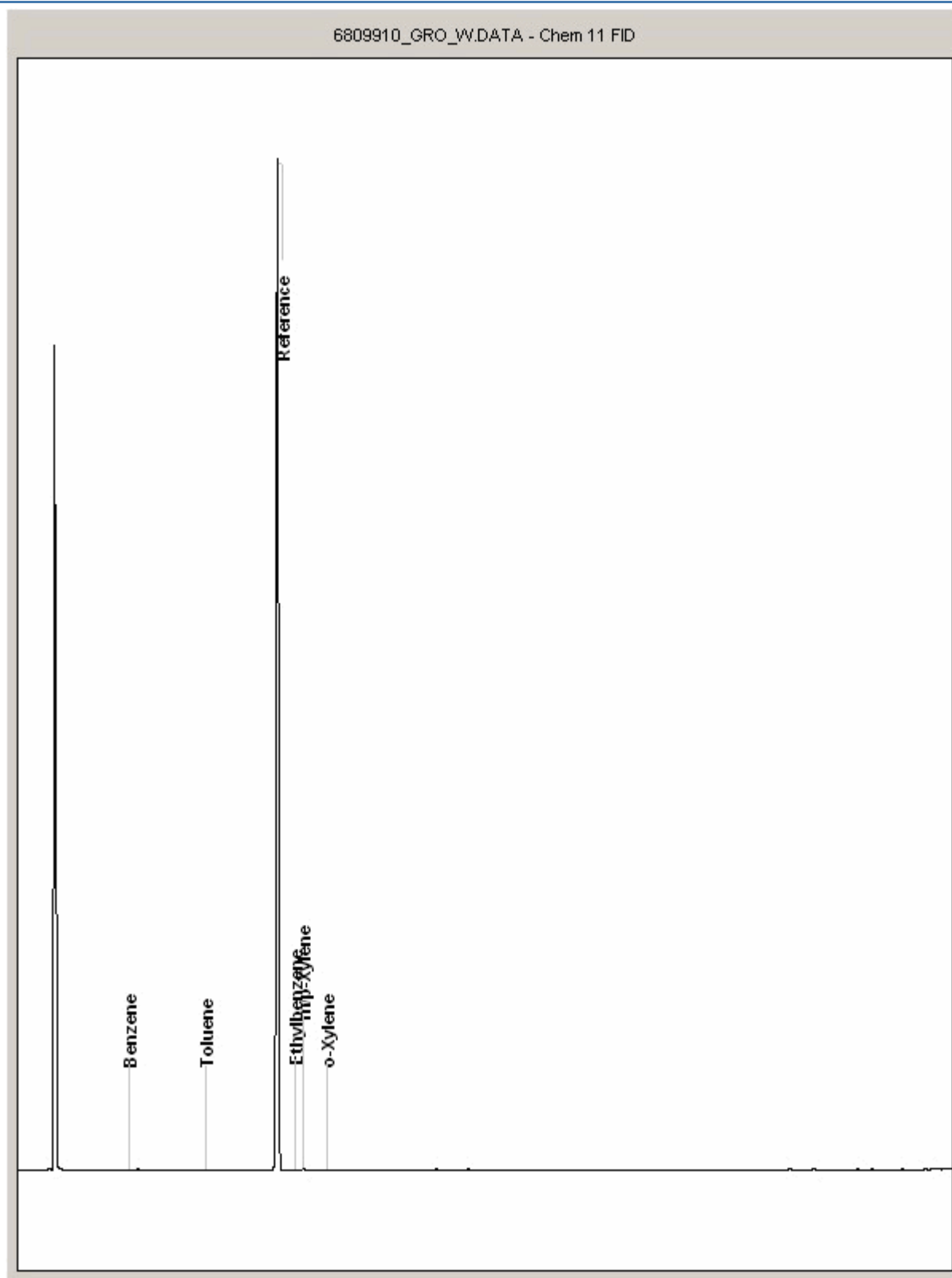
Order Number:
Report Number: 209946
Superseded Report: 209931

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 6809910
Sample ID : BH102A

Depth :





SDG: 130123-24
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

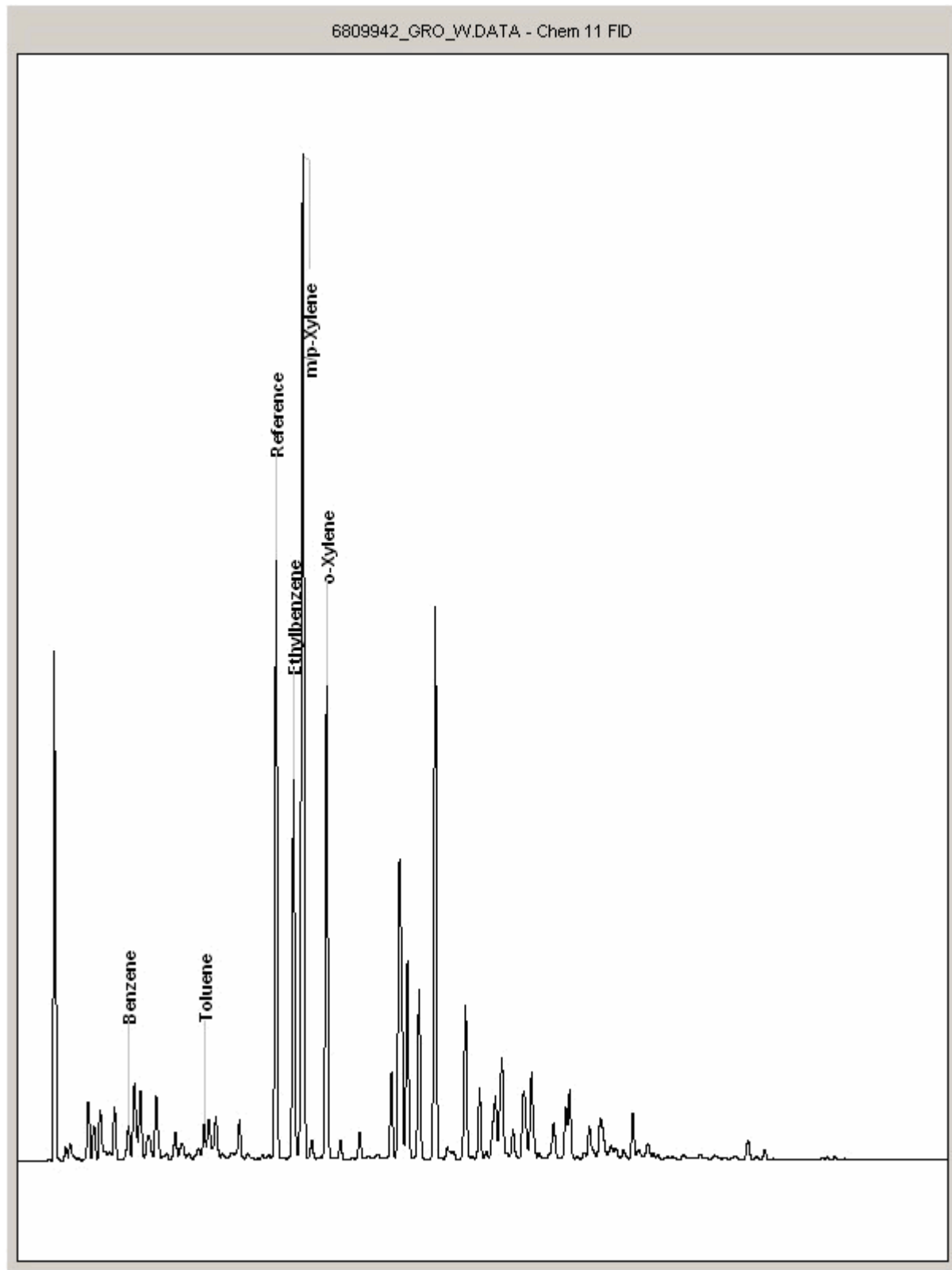
Order Number:
Report Number: 209946
Superseded Report: 209931

Chromatogram

Analysis: GRO by GC-FID (W)

Sample No : 6809942
Sample ID : BH102

Depth :





SDG: 130123-24
Job: H_URS_WIM-162
Client Reference: 46370079

Location: Hitchin
Customer: URS Corporation Limited
Attention: Jocelyn Willis

Order Number:
Report Number: 209946
Superseded Report: 209931

Appendix General

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

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 2 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

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

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

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

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

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

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

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** -Most of our organic methods include surrogates, the recovery of which is monitored and reported. For EPH, MO, PAH, GRO and VOCs on soils the result is not surrogate corrected, but a percentage recovery is quoted. Acceptable limits for most organic methods are 70 -130 %.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

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

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

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

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

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

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

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

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
§	Sampled on date not provided
+	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

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

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than :
 -

Trace -Where only one or two asbestos fibres were identified.

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

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

Appendix F - Quality Assurance/ Quality Control (QA/QC)

Duplicate RPD Summary

Hitchin February 2012

10019011_BH102 W		WATER		µg/l		120228-13			
Chem Class	Analyte	MDL	Sample	Dup	MDL Ratio	RPD Limit	RPD Value	Comment	Pass/Fail
BTEX	BENZENE	1	1100	917	1100	30	18.14576	Conc >20x MDL; RPD limit = 30%	OK
BTEX	ETHYLBENZENE	1	3600	2960	3600	30	19.5122	Conc >20x MDL; RPD limit = 30%	OK
BTEX	M_P_XYLENE	1	9330	7800	9330	30	17.8634	Conc >20x MDL; RPD limit = 30%	OK
BTEX	O_XYLENE	1	4380	3790	4380	30	14.44308	Conc >20x MDL; RPD limit = 30%	OK
BTEX	TOLUENE	1	150	180	180	30	-18.1818	Conc >20x MDL; RPD limit = 30%	OK
PAH	ACENAPHTHENE	0.015	0.193	0.2	13.3333	50	-3.56234	Conc >10x MDL but <20x MDL; RPD limit = 50%	OK
PAH	ACENAPHTHYLENE	0.011	0.0456	0.0389	4.14545	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	ANTHRACENE	0.015	0.0315	0.0292	2.1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	BENZO_A_ANTHRACENE	0.017	0.017	0.017	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	BENZO_A_PYRENE	0.009	0.009	0.009	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	BENZO_B_FLUORANTHENE	0.023	0.023	0.023	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	BENZO_G_H_I_PERYLENE	0.016	0.016	0.016	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	BENZO_K_FLUORANTHENE	0.027	0.027	0.027	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	CHRYSENE	0.013	0.013	0.013	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	DIBENZ_A_H_ANTHRACENE	0.016	0.016	0.016	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	FLUORANTHENE	0.017	0.0182	0.022	1.29412	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	FLUORENE	0.014	0.387	0.382	27.6429	50	1.300390	Conc >10x MDL but <20x MDL; RPD limit = 50%	OK
PAH	INDENO_1_2_3_CD_PYRENE	0.014	0.014	0.014	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	NAPHTHALENE	0.1	289	274	2890	30	5.328597	Conc >20x MDL; RPD limit = 30%	OK
PAH	PHENANTHRENE	0.022	0.146	0.112	6.63636	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	PYRENE	0.015	0.0234	0.0286	1.90667	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	TOTAL PAH	0.247	290	275	1174.09	30	5.309735	Conc >20x MDL; RPD limit = 30%	OK
RISKTPH	RISK_TPH_C10_C12_ALI	10	1400	1620	162	30	-14.5695	Conc >20x MDL; RPD limit = 30%	OK
RISKTPH	RISK_TPH_C10_C12_AROM	10	934	1080	108	30	-14.4985	Conc >20x MDL; RPD limit = 30%	OK

Duplicate RPD Summary

Hitchin February 2012

10019011_BH102 W		WATER		µg/l		120228-13			
Chem Class	Analyte	MDL	Sample	Dup	MDL Ratio	RPD Limit	RPD Value	Comment	Pass/Fail
RISKTPH	RISK_TPH_C12_C16_ALI	10	10	10	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C12_C16_AROM	10	306	283	30.6	30	7.809847	Conc >20x MDL; RPD limit = 30%	OK
RISKTPH	RISK_TPH_C16_C21_ALI	10	10	10	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C16_C21_AROM	10	17	26	2.6	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C21_C35_ALI	10	10	10	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C21_C35_AROM	10	10	10	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C5_C6_ALI	10	646	790	79	30	-20.0557	Conc >20x MDL; RPD limit = 30%	OK
RISKTPH	RISK_TPH_C6_C7_AROM	10	731	826	82.6	30	-12.203	Conc >20x MDL; RPD limit = 30%	OK
RISKTPH	RISK_TPH_C6_C8_ALI	10	1430	1780	178	30	-21.8069	Conc >20x MDL; RPD limit = 30%	OK
RISKTPH	RISK_TPH_C7_C8_AROM	10	131	155	15.5	50	-16.7832	Conc >10x MDL but <20x MDL; RPD limit = 50%	OK
RISKTPH	RISK_TPH_C8_C10_ALI	10	3250	4110	411	30	-23.3696	Conc >20x MDL; RPD limit = 30%	OK
RISKTPH	RISK_TPH_C8_C10_AROM	10	14500	18100	1810	30	-22.0859	Conc >20x MDL; RPD limit = 30%	OK
VOC	DIPE	1	1	1	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	ETBE	1	1	1	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	ETHANOL	50	50	50	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	MTBE	1	1	1	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	TAME	1	1	1	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	TBA	10	10	10	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	TOLUENE-D8 (SUR)	0	103	101	#Error	#Error	#Error	#Error	#Error

Duplicate RPD Summary

Hitchin October 2011

10019011_BH102 W		WATER		µg/l		111013-17			
Chem Class	Analyte	MDL	Sample	Dup	MDL Ratio	RPD Limit	RPD Value	Comment	Pass/Fail
BTEX	BENZENE	1	1460	1730	1730	30	-16.9279	Conc >20x MDL; RPD limit = 30%	OK
BTEX	ETHYLBENZENE	1	2350	2640	2640	30	-11.6232	Conc >20x MDL; RPD limit = 30%	OK
BTEX	M_P_XYLENE	1	6480	7270	7270	30	-11.4909	Conc >20x MDL; RPD limit = 30%	OK
BTEX	O_XYLENE	1	2460	2720	2720	30	-10.0386	Conc >20x MDL; RPD limit = 30%	OK
BTEX	TOLUENE	1	465	398	465	30	15.52723	Conc >20x MDL; RPD limit = 30%	OK
PAH	Acenaphthene	0.015	0.015	0.015	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	Acenaphthylene	0.011	0.011	0.011	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	Anthracene	0.015	0.015	0.015	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	BENZO_A_ANTHRACENE	0.017	0.017	0.017	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	BENZO_A_PYRENE	0.009	0.009	0.009	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	BENZO_B_FLUORANTHENE	0.023	0.023	0.023	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	BENZO_G_H_I_PERYLENE	0.016	0.016	0.016	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	BENZO_K_FLUORANTHENE	0.027	0.027	0.027	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	Chrysene	0.013	0.013	0.013	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	DIBENZ_A_H_ANTHRACENE	0.016	0.016	0.016	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	Fluoranthene	0.017	0.017	0.017	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	Fluorene	0.014	0.205	0.245	17.5	50	-17.7778	Conc >10x MDL but <20x MDL; RPD limit = 50%	OK
PAH	INDENO_1_2_3_CD_PYRENE	0.014	0.014	0.014	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	Naphthalene	0.1	175	186	1860	30	-6.09418	Conc >20x MDL; RPD limit = 30%	OK
PAH	Phenanthrene	0.022	0.022	0.022	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	Pyrene	0.015	0.015	0.015	1	0	0	Conc <10x MDL; No RPD Limit	OK
PAH	TOTAL_PAH	0.247	176	186	753.036	30	-5.52486	Conc >20x MDL; RPD limit = 30%	OK
RISKTPH	RISK_TPH_C10_C12_ALI	10	1510	1370	151	30	9.722222	Conc >20x MDL; RPD limit = 30%	OK
RISKTPH	RISK_TPH_C10_C12_AROM	10	1010	914	101	30	9.97921	Conc >20x MDL; RPD limit = 30%	OK

Duplicate RPD Summary

Hitchin October 2011

10019011_BH102 W		WATER		µg/l		111013-17			
Chem Class	Analyte	MDL	Sample	Dup	MDL Ratio	RPD Limit	RPD Value	Comment	Pass/Fail
RISKTPH	RISK_TPH_C12_C16_ALI	10	10	10	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C12_C16_AROM	10	143	151	15.1	50	-5.44218	Conc >10x MDL but <20x MDL; RPD limit = 50%	OK
RISKTPH	RISK_TPH_C16_C21_ALI	10	10	10	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C16_C21_AROM	10	10	10	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C21_C35_ALI	10	10	10	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C21_C35_AROM	10	10	10	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C5_C6_ALI	10	308	295	30.8	30	4.311774	Conc >20x MDL; RPD limit = 30%	OK
RISKTPH	RISK_TPH_C6_C7_AROM	10	1210	1160	121	30	4.219409	Conc >20x MDL; RPD limit = 30%	OK
RISKTPH	RISK_TPH_C6_C8_ALI	10	697	632	69.7	30	9.781791	Conc >20x MDL; RPD limit = 30%	OK
RISKTPH	RISK_TPH_C7_C8_AROM	10	392	400	40	30	-2.02020	Conc >20x MDL; RPD limit = 30%	OK
RISKTPH	RISK_TPH_C8_C10_ALI	10	3220	2900	322	30	10.45752	Conc >20x MDL; RPD limit = 30%	OK
RISKTPH	RISK_TPH_C8_C10_AROM	10	13300	12700	1330	30	4.615385	Conc >20x MDL; RPD limit = 30%	OK
VOC	DIPE	1	1	1	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	ETBE	1	1	1	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	ETHANOL	50	50	50	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	MTBE	1	1	1	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	TAME	1	1	1	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	TBA	10	10	10	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	TOLUENE_D8	0	100	102	#Error	#Error	#Error	#Error	#Error

Duplicate RPD Summary

Hitchin October 2011

10019011_BH105 4.1		SOIL	mg/kg		110930-19				
Chem Class	Analyte	MDL	Sample	Dup	MDL Ratio	RPD Limit	RPD Value	Comment	Pass/Fail
BTEX	BENZENE	0.009	0.009	0.009	1	0	0	Conc <10x MDL; No RPD Limit	OK
BTEX	BENZENE	1	1	0.009	1	0	0	Conc <10x MDL; No RPD Limit	OK
BTEX	BENZENE	0.002	0.002	0.009	4.5	0	0	Conc <10x MDL; No RPD Limit	OK
BTEX	ETHYLBENZENE	1	1	0.004	1	0	0	Conc <10x MDL; No RPD Limit	OK
BTEX	ETHYLBENZENE	0.002	0.002	0.004	2	0	0	Conc <10x MDL; No RPD Limit	OK
BTEX	ETHYLBENZENE	0.004	0.004	0.004	1	0	0	Conc <10x MDL; No RPD Limit	OK
BTEX	M_P_XYLENE	1	1	0.014	1	0	0	Conc <10x MDL; No RPD Limit	OK
BTEX	M_P_XYLENE	0.014	0.014	0.014	1	0	0	Conc <10x MDL; No RPD Limit	OK
BTEX	M_P_XYLENE	0.002	0.002	0.014	7	0	0	Conc <10x MDL; No RPD Limit	OK
BTEX	O_XYLENE	1	1	0.01	1	0	0	Conc <10x MDL; No RPD Limit	OK
BTEX	O_XYLENE	0.01	0.01	0.01	1	0	0	Conc <10x MDL; No RPD Limit	OK
BTEX	O_XYLENE	0.002	0.002	0.01	5	0	0	Conc <10x MDL; No RPD Limit	OK
BTEX	TOLUENE	0.002	0.002	0.005	2.5	0	0	Conc <10x MDL; No RPD Limit	OK
BTEX	TOLUENE	1	1	0.005	1	0	0	Conc <10x MDL; No RPD Limit	OK
BTEX	TOLUENE	0.005	0.005	0.005	1	0	0	Conc <10x MDL; No RPD Limit	OK
MISC	Total_Organic_Carbon	0.2	0.2	0.2	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C10_C12_ALI	0.01	0.01	0.01	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C10_C12_AROM	0.01	0.01	0.01	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C12_C16_ALI	10	10	44.2	4.42	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C12_C16_ALI	0.02	0.02	44.2	2210	30	99.81909	Conc >20x MDL; RPD limit = 30%	FAIL
RISKTPH	RISK_TPH_C12_C16_ALI	0.1	7.29	44.2	442	30	43.36764	Conc >20x MDL; RPD limit = 30%	FAIL
RISKTPH	RISK_TPH_C12_C16_AROM	0.1	0.1	0.1	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C12_C16_AROM	0.02	0.02	0.1	5	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C12_C16_AROM	10	10	0.1	1	0	0	Conc <10x MDL; No RPD Limit	OK

Duplicate RPD Summary

Hitchin October 2011

10019011_BH105	4.1	SOIL	mg/kg		110930-19				
Chem Class	Analyte	MDL	Sample	Dup	MDL Ratio	RPD Limit	RPD Value	Comment	Pass/Fail
RISKTPH	RISK_TPH_C16_C21_ALI	0.1	5.6	1.98	56	30	95.51451	Conc >20x MDL; RPD limit = 30%	FAIL
RISKTPH	RISK_TPH_C16_C21_ALI	10	10	1.98	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C16_C21_ALI	0.02	0.02	1.98	99	30	96	Conc >20x MDL; RPD limit = 30%	FAIL
RISKTPH	RISK_TPH_C16_C21_AROM	10	10	0.1	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C16_C21_AROM	0.1	0.1	0.1	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C16_C21_AROM	0.02	0.02	0.1	5	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C21_C35_ALI	0.02	0.02	0.1	5	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C21_C35_ALI	0.1	0.1	0.1	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C21_C35_ALI	10	10	0.1	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C21_C35_AROM	10	10	0.1	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C21_C35_AROM	0.02	0.02	0.1	5	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C21_C35_AROM	0.1	0.1	0.1	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C35_C44_ALI	0.1	0.1	0.1	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C5_C6_ALI	0.01	0.01	0.01	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C6_C7_AROM	0.01	0.01	0.01	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C6_C8_ALI	0.01	0.01	0.01	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C7_C8_AROM	0.01	0.01	0.01	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C8_C10_ALI	0.01	0.01	0.01	1	0	0	Conc <10x MDL; No RPD Limit	OK
RISKTPH	RISK_TPH_C8_C10_AROM	0.01	0.01	0.01	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	DIPE	0.001	0.001	0.001	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	ETBE	0.001	0.001	0.001	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	ETHANOL	0.05	0.05	0.05	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	MTBE	0.011	0.011	0.011	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	TAME	0.015	0.015	0.015	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	TAME	1	1	0.015	1	0	0	Conc <10x MDL; No RPD Limit	OK

Duplicate RPD Summary

Hitchin October 2011

10019011_BH105 4.1		SOIL	mg/kg		110930-19				
Chem Class	Analyte	MDL	Sample	Dup	MDL Ratio	RPD Limit	RPD Value	Comment	Pass/Fail
VOC	TAME	0.002	0.002	0.015	7.5	0	0	Conc <10x MDL; No RPD Limit	OK
VOC	TBA	0.01	0.01	0.01	1	0	0	Conc <10x MDL; No RPD Limit	OK
VOCSURR	TOLUENE_D8	0	104	104	#Error	#Error	#Error	#Error	#Error

A duplicate sample should be taken for every 20 samples or 1 per sampling event, if less than 20 samples are collected. It is best to avoid taking duplicates of samples that are likely to return concentrations close to the detection limit, and also samples where concentrations may be close to the solubility limit, e.g. where globules of free product are present. The duplicate must not be identified as such. Instead it should be assigned a reference number similar to the sample numbering notation such that it is unrecognisable to the laboratory as a duplicate. For example if nine boreholes, BH1 to BH9 are being sampled, and a duplicate of borehole BH5 is taken, this should be referred to as BH4 and not BH5A. The lab also needs to report the duplicate sample electronically as sample_type DUP so that the S&GW database can then be used to compare results.

On receipt of the laboratory data, the following assessment should be performed.

To evaluate the precision of the data, firstly calculate the Relative Percent Difference, RPD, as follows:

$$RPD = \frac{(S - D)}{\frac{(S + D)}{2}} \times 100$$

where S = Sample Result and D = Duplicate Result

Next, compare the RPD to the Reporting Limit, which should be provided on the laboratory certificate. As a guideline:

- If the sample concentration is less than 10 times the reporting limit, the RPD is not overly critical.
- If the sample concentration is between 10 times and 20 times the reporting limit, the RPD should be less than 50%.
- If the sample concentration is greater than 20 times the reporting limit, the RPD should be less than 30%.
- If the RPD falls outside these criteria, then professional judgement should be used to evaluate the acceptability of the data using the following criteria as guidance:
 - If the sample is soil there is a strong possibility that the elevated RPD relates to a matrix effect, particularly with highly heterogeneous media, or where textural characteristics make homogenisation difficult (e.g. a stiff clay). Refer to borehole logs and field notes.
 - If the sample is an aqueous sample check that the well has been adequately purged or whether only a limited volume of water was recoverable – e.g. with discontinuous perched groundwater. In this case some variation between samples may be expected.
 - If the sample has entrained free product – this could relate to small globules, not a distinct layer – then small differences in the amount present could result in significant variation in concentrations measured, the latter not being truly reflective of 'dissolved phase' concentrations.
 - If none of these are applicable and there is no additional reason to suppose that lesser or greater losses of the compound in question took place from the sample compared to its duplicate, as a result of handling issues, then an explanation should be sought from the laboratory, with the lab QA coordinator being copied on all correspondence.

PM Comments

Project Manager:

Date:

Holding Times >7 Days from Sample to Extraction

Sample Type: SOIL
Site: Hitchin

Sample ID	Depth (m)	Analyte	Lab Sample	Sample Date	Extraction Date	Holding Time (Days)
10019011_BH102A	13.2	RISK_TPH_C21_C35_AROM	5194606	16/02/2012	24/02/2012	8
10019011_BH102A	5.7	Total_Organic_Carbon	5194604	16/02/2012	24/02/2012	8
10019011_BH102A	13.6	RISK_TPH_C21_C35_AROM	5194607	16/02/2012	24/02/2012	8
10019011_BH102A	13.6	RISK_TPH_C16_C21_AROM	5194607	16/02/2012	24/02/2012	8
10019011_BH102A	13.6	RISK_TPH_C12_C16_AROM	5194607	16/02/2012	24/02/2012	8
10019011_BH102A	13.6	RISK_TPH_C35_C44_ALI	5194607	16/02/2012	24/02/2012	8
10019011_BH102A	13.6	RISK_TPH_C21_C35_ALI	5194607	16/02/2012	24/02/2012	8
10019011_BH102A	13.6	RISK_TPH_C12_C16_ALI	5194607	16/02/2012	24/02/2012	8
10019011_BH102A	13.2	RISK_TPH_C16_C21_AROM	5194606	16/02/2012	24/02/2012	8
10019011_BH102A	13.2	RISK_TPH_C12_C16_AROM	5194606	16/02/2012	24/02/2012	8
10019011_BH102A	13.2	RISK_TPH_C35_C44_ALI	5194606	16/02/2012	24/02/2012	8
10019011_BH102A	13.2	RISK_TPH_C21_C35_ALI	5194606	16/02/2012	24/02/2012	8
10019011_BH102A	5.7	RISK_TPH_C12_C16_ALI	5194604	16/02/2012	24/02/2012	8
10019011_BH102A	13.6	RISK_TPH_C16_C21_ALI	5194607	16/02/2012	24/02/2012	8
10019011_BH102A	13.6	Total_Organic_Carbon	5194607	16/02/2012	24/02/2012	8
10019011_BH102A	13.2	RISK_TPH_C16_C21_ALI	5194606	16/02/2012	24/02/2012	8
10019011_BH102A	5.7	RISK_TPH_C16_C21_ALI	5194604	16/02/2012	24/02/2012	8
10019011_BH102A	5.7	RISK_TPH_C21_C35_ALI	5194604	16/02/2012	24/02/2012	8
10019011_BH102A	5.7	RISK_TPH_C35_C44_ALI	5194604	16/02/2012	24/02/2012	8
10019011_BH102A	5.7	RISK_TPH_C12_C16_AROM	5194604	16/02/2012	24/02/2012	8
10019011_BH102A	5.7	RISK_TPH_C16_C21_AROM	5194604	16/02/2012	24/02/2012	8
10019011_BH102A	5.7	RISK_TPH_C21_C35_AROM	5194604	16/02/2012	24/02/2012	8
10019011_BH102A	13.2	RISK_TPH_C12_C16_ALI	5194606	16/02/2012	24/02/2012	8
10019011_BH102A	13.2	Total_Organic_Carbon	5194606	16/02/2012	24/02/2012	8

Surrogate Recovery Data

Hitchin February 2012

SDG:

5194604

10019011_BH102A 5.7

SOIL

%

Analyte	Chem Class	Method	Result	Pass/Fail
ACENAPHTHENE-D10 SURROGATE RECOVERY	PAH	GCMS	93	OK
ACENAPHTHENE-D10 SURROGATE RECOVERY	PAH	GCMS	97.5	OK
CHRYSENE-D12 SURROGATE RECOVERY	PAH	GCMS	91.3	OK
PHENANTHRENE-D10 SURROGATE RECOVERY	PAH	GCMS	91.5	OK
PERYLENE-D12 SURROGATE RECOVERY	PAH	GCMS	86.7	OK
NAPHTHALENE-D8 SURROGATE RECOVERY	PAH	GCMS	94.5	OK
NAPHTHALENE-D8 SURROGATE RECOVERY	PAH	GCMS	98.7	OK
PHENANTHRENE-D10 SURROGATE RECOVERY	PAH	GCMS	91.6	OK
PERYLENE-D12 SURROGATE RECOVERY	PAH	GCMS	88	OK
NAPHTHALENE-D8 SURROGATE RECOVERY	PAH	GCMS	98	OK
CHRYSENE-D12 SURROGATE RECOVERY	PAH	GCMS	91	OK
PERYLENE-D12 SURROGATE RECOVERY	PAH	GCMS	86.9	OK
ACENAPHTHENE-D10 SURROGATE RECOVERY	PAH	GCMS	97.2	OK
PHENANTHRENE-D10 SURROGATE RECOVERY	PAH	GCMS	87.8	OK
CHRYSENE-D12 SURROGATE RECOVERY	PAH	GCMS	87.2	OK
GRO SURROGATE	TPH	VOLATILES	127	HIGH
GRO SURROGATE	TPH	VOLATILES	145	HIGH
GRO SURROGATE	TPH	VOLATILES	125	HIGH
TOLUENE-D8 (SUR)	VOCSURR	VOLATILES	102	OK
TOLUENE-D8 (SUR)	VOCSURR	VOLATILES	103	OK
TOLUENE-D8 (SUR)	VOCSURR	VOLATILES	103	OK
GRO SURROGATE	TPH	VOLATILES	94	OK

Surrogate Recovery Data					
Hitchin February 2012			SDG:	5239898	
10019011_BH105A	W	WATER	%		
Analyte	Chem Class		Method		Result
GRO SURROGATE	TPH		VOLATILES		107
					OK

10019011_BH105A W

5239898

%

Analyte	Chem Class	Method	Result	Pass/Fail
GRO SURROGATE	TPH	VOLATILES	107	OK

Surrogate Recovery Data

Hitchin February 2012

SDG:

5180218

10019011_BH106A 1.5

SOIL

%

Analyte	Chem Class	Method	Result	Pass/Fail
PERYLENE-D12 SURROGATE RECOVERY	PAH	GCMS	86.6	OK
ACENAPHTHENE-D10 SURROGATE RECOVERY	PAH	GCMS	98	OK
NAPHTHALENE-D8 SURROGATE RECOVERY	PAH	GCMS	97.4	OK
PHENANTHRENE-D10 SURROGATE RECOVERY	PAH	GCMS	96.6	OK
ACENAPHTHENE-D10 SURROGATE RECOVERY	PAH	GCMS	100	OK
CHRYSENE-D12 SURROGATE RECOVERY	PAH	GCMS	92.8	OK
NAPHTHALENE-D8 SURROGATE RECOVERY	PAH	GCMS	99.4	OK
PERYLENE-D12 SURROGATE RECOVERY	PAH	GCMS	88.3	OK
PHENANTHRENE-D10 SURROGATE RECOVERY	PAH	GCMS	99	OK
CHRYSENE-D12 SURROGATE RECOVERY	PAH	GCMS	90.8	OK
GRO SURROGATE	TPH	VOLATILES	137	HIGH
GRO SURROGATE	TPH	VOLATILES	128	HIGH
TOLUENE-D8 (SUR)	VOCSURR	VOLATILES	99.9	OK
TOLUENE-D8 (SUR)	VOCSURR	VOLATILES	99.6	OK
GRO SURROGATE	TPH	VOLATILES	94	OK

Surrogate Recovery Data

Hitchin October 2011

SDG:

4491079

10019011_EQUIP W

WATER

%

Analyte	Chem Class	Method	Result	Pass/Fail
TPH_GRO	TPH	VOLATILES	118	OK
GRO SURROGATE	TPH	VOLATILES	100	OK

Surrogate Recovery Data

Hitchin October 2011

SDG:

4401786

10019011_WAC02 W

SOIL

%

Analyte	Chem Class	Method	Result	Pass/Fail
TPH_GRO	TPH	VOLATILES	138	HIGH

Surrogates are organic compounds chemically similar to the target compounds that are spiked in each sample at a known concentration prior to sample preparation. The percentage recovery of the surrogate can then be evaluated. The criteria for evaluation are typically developed by the laboratory and/or based upon published values provided for related methods by the US EPA. As detailed in the US EPA CLP Functional guidelines, *the evaluation of the results of these surrogate spikes is not necessarily straightforward. The sample itself may produce effects due to such factors as interferences and high concentrations of analytes. Since the effects of the sample matrix are frequently outside the control of the laboratory and may present relatively unique problems, the evaluation and review of data based on specific sample results is frequently subjective and demands analytical experience and professional judgment.*

Nonetheless, the data reviewer should;

- Check that surrogate data are presented for all GC/MS analyses.
- If the laboratory provides criteria then check that surrogate recoveries are within these stipulated criteria. If any recoveries fall outside the criteria, use professional judgement to evaluate whether there is a potential matrix effect, in discussion with the laboratory and if so, whether this needs to be identified in the interpretation of the data.
- If the laboratory provides no criteria and the surrogate recovery falls below 10% then contact the laboratory for an explanation. This may also potentially be the result of a matrix effect and the data may not be usable.

PM Comments

Project Manager:

Date:

Appendix G - CW DQRA Model Parameters & Output

URS Controlled Waters Model Information

Model 1: Groundwater in the Chalk

Model 2: Groundwater in the Drift Deposits



URS site-specific controlled waters risk assessment tool

designed on the principles and methodologies contained within EA Remedial Targets Methodology, 2006



APPENDIX DATA SHEETS

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Version: **CWRA, version 7.292min**

Date: 13/07/2011

QRA BACKGROUND AND MODEL SUMMARY

LEGISLATIVE BACKGROUND

The Environment Act 1995 contains key provisions related to contaminated land and waters. Section 57 of the Act (inserted as Part IIA into the Environmental Protection Act 1990), requires the identification of contaminated land by local authorities and the instigation of remediation, if necessary, paid for by responsible parties. Contaminated land has a specific definition in the Act, being;

“land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in or under land, that:

- (a) significant harm is being caused or there is a significant possibility of such harm being caused; or
- (b) pollution of controlled waters is being, or is likely to be, caused”.

The assessment and remediation of such land is undertaken according to a risk-based approach and considering the current use of the land concerned (e.g. industrial, residential, etc) such that it is “fit for use”. Although Part II A relates only to the current use of the land, in the event of a change of use the regulators will normally expect to see a similar assessment and work done such that the site is not considered ‘contaminated land’ following any change of use.

Potentially contaminated land is assessed through the identification and assessment of pollutant linkages (source-pathway-receptor relationships) as defined in the DETR (Department of Environment, Transport and the Regions) Statutory Guidance on Contaminated Land, March 2000. Implicit in the guidance is the application of risk assessment to assess whether identified pollutant linkages may be significant.

For assessment of contaminated land, the following documents are also of relevance:

- Water Resources Act 1991;
- Model Procedures for the Management of Land Contamination (CLR11); and
- Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources, R&D Publication 20 (1999 and 2006). Environment Agency.

The adopted approach currently involves the following stages:

- Development of a Conceptual Site Model (CSM) to summarise identified sources of contamination, potential migration/exposure pathways and potential receptors at the site;
- Selection of generic (Stage 2) screening criteria appropriate to the “pollutant linkages” (source-pathway-receptor relationships) identified at the site (e.g. UK Soil Guidance Values (SGVs)); and
- Comparison of maximum measured contaminant concentrations with the selected generic criteria, termed a “Stage 2” assessment.

The Stage 2 screening criteria provides an initial filter to differentiate contamination unlikely to pose a significant risk from that which may require further assessment. It may be viewed as being generally conservative.

Where Stage 2 criteria are exceeded, then the assessment may pass to a site-specific Stage 3 quantitative risk assessment, if this is considered appropriate.



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ADOPTED RISK ASSESSMENT APPROACH

The approach for controlled waters follows the Environment Agency's preferred risk assessment method. This involves development of a conceptual model describing the contaminated areas, the migration pathway or pathways of the contaminant and the controlled waters receptor, where quality criteria are defined. The process consists of three main components:

- Stage 1: Definition of the Conceptual Site Model (CSM), in which the contaminated areas of soil and groundwater, the potential migration pathways and receptors are defined. The contaminated source areas, which in this case relate to residual contamination in the soil and in groundwater, will be estimated from our understanding of the oil tank and associated infrastructure layout, the observed data and from the Tier 1 analysis of soil contamination during Stage 2, while data and general observations from the field works and the Phase I assessments will be used to conceptualise the pathways and receptors.
- Stage 2: Generic Assessment This involves the comparison of groundwater concentrations with the water target concentrations defined for the receptor (irrespective of the pathway). If the concentrations are below the water target values, then the risks are considered negligible. If the concentrations are above the water target value, there is a potential risk and the analysis moves on to the simulation of attenuation through the pathways defined in the CSM.
- Stage 3: Site-Specific Assessment. The contaminant concentrations are attenuated along the pathways defined in the CSM. There are several attenuating mechanisms that may be considered including dilution within groundwater, retardation, dispersion and biological decay. The simulated concentrations at the receptor are then compared with the water target concentrations and an assessment of risk is made. If the simulated concentrations are lower than the water target concentrations, the risk is not considered significant provided the source of release is residual contamination rather than due to ongoing releases. If the concentrations exceed the water target value then there is potential for the contaminated areas to pose a risk to controlled waters. The criteria developed for the assessment of risk balances the immediate risks, which are assumed to occur over 100 years, with the long-term, steady state risks.

In the assessment of risks to controlled waters a probabilistic approach will be adopted, where uncertainties in the pathway parameters are included within the assessment and risks are based on the probability of the risks arising.



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MODEL SUMMARY

Constraints

Although a probabilistic approach has been incorporated into the controlled waters risk assessment to understand and account for the uncertainties, there remain a number of limitations to the technique. In addition to those limitations presented by Whittaker et al (2001, table 5.1), particular data availability constraints exist and include:

- actual depth to the major aquifer (as defined by groundwater vulnerability maps of England & Wales) or equivalent below the site where these are present at the depths of previously installed wells;
- properties of the major aquifer (e.g. conductivity, bulk density porosity, dispersive characteristics); and
- simulation of high conductivity zones within the shallow aquifer (e.g. sand lenses, underground services and drains).

Domenico Solution Constraints

The main assumptions of the Domenico model are as follows:

the source zone input is constant through time;
the aquifer is intergranular, homogeneous and isotropic;
groundwater flow within the aquifer is steady-state;
a uniform hydraulic gradient exists;
Darcy's Law applies;
adsorption is linear, instantaneous and reversible; and
decay (due to biodegradation) is governed by first order kinetics.

In addition the Domenico solution itself is a non-exact solution to the advection-dispersion equation. This means that at long flow path distances the Domenico solution becomes less conservative (i.e. simulates lower concentrations) than the exact solution. For simple risk assessments with flow paths typically below 100m this should not introduce any significant errors, especially given the uncertainty in input parameters. For a well constrained data set and where flow paths may be longer than 200m the Domenico solution should only be used with caution, taking into account this specific limitation and where appropriate adjustments to degradation rates and/or dispersion should be considered.



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Source Area

The area defined as the “source” of contamination will be assessed on a site by site basis, from analysis of the soil and groundwater analytical results and any pertinent issues identified during the tank-pull. Typically, a single source area representing residual contamination in the soil and groundwater will be defined for all contaminants of concern. This single source area will be defined to cover multiple sources (e.g. UST’s, interceptors etc). However, in some cases clear distinction may be able to be made between the source zones for groups or individual contaminants which will allow the definition of more than one source zone. Generally source areas will be defined by:

- due consideration of the historical locations of underground tanks and other sources of contamination and associated delivery infrastructure;
- plotting of the Stage 1/Tier 1 exceedences on a scaled map of the site. From a spatial perspective if exceedences are present over the entire site, then the entire site may considered to be contaminated;
- determining the source zone dimensions of the area relevant to groundwater flow direction;
- assessing the thickness of the source zone is defined as being the depths over which contaminant exceedences have occurred; and
- calculating the 95th percentile mean concentration, in accordance with the CLR 7 guidance, to represent the residual contamination across the entire site (entire site source zone) if considered appropriate.

Where it is apparent that a particular area is significantly more contaminated than the surrounding residual contamination, another source will be modelled with dimensions determined by the zones with significantly higher contamination. Input concentrations would be adjusted accordingly.

In this case, the maximum concentrations recorded on site will be used to represent the source zone concentration. The contaminant groups that will be investigated at each site will vary but provision i n the assessment tool is provided for common TPH/BTEX, Metals, PAH, VOC, SVOC, Pesticide/PCB and Misc compounds with the option to add up to 17 new compounds. All compounds are to be assessed in both soil and groundwater with the exception of metals, which should only be analysed in water or leachate samples.



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Pathway Selection

From the site investigations and Phase I assessments, the different potential pathways between the “source” and the receptor will be defined. The following pathways may exist:

- the leaching of contaminants from the soil into pore water;
- vertical migration of contaminated water from a soil source through the unsaturated zone to the groundwater table;
- dilution of contaminated water entering saturated groundwater (whether in drift deposits, non, minor or major aquifers);
- vertical migration through the saturated zone of Drift deposits to an underlying major or minor aquifer; and,
- horizontal migration through the saturated zone of Drift deposits and within a minor/major aquifer a towards a receptor.

Various combinations of the above pathways can be assessed within this risk assessment framework.

Once the potential pathways have been defined, the model parameters required to represent each selected pathway will be assigned, as follows:

- Soil parameters, soil density, air and water filled porosity (from literature, depending upon soil type) and fraction of organic carbon (as derived from field samples);
- Depth to the groundwater table, or the unsaturated zone pathway length. measured from site investigations data, wherever possible;
- Infiltration rate through the root zone, assessed from published annual rainfall rates and surface cover type (e.g. tarmac, concrete, natural etc) from site observations;
- Decay rate of contaminant selected from a generic list derived from an extensive literature review; • Conductivity of the Drift/Made Ground will be evaluated from the project specific particle size distribution or from literature derived rates;
- Hydraulic Gradient between the contaminated area and the receptor, derived from measured groundwater levels and an assessment of topographical slopes on site;
- Thickness of mixing zone of the groundwater source;
- Thickness of the Drift/Made Ground, estimated. Where a major aquifer exists beneath the site the thickness of the deposits overlying the aquifer will be assessed from existing on-site borehole logs where possible;
- Horizontal Distance to the Receptor, from maps and as defined by field teams;
- Properties of the Major Aquifer such as the effective thickness and hydraulic conductivity from the BGS aquifer properties publication; and
- Drains/Services. From the site investigation work, the locations of potential drainage/service pathways will be noted where possible.



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Receptors

The process of identifying potential receptors for the CSM will include:

1. A review of the receptors identified in the tier 1 report;
2. Confirmation of the receptors identified by field staff;
3. A review of ordnance survey maps, the EA website for source protection zones, the aquifer properties database and groundwater vulnerability maps for aquifer categorisation and licensed water abstraction data, where available, will also be completed to confirm the location of identified receptors;
4. Determination of flow direction of groundwater on site and hence the viable down-gradient receptors by:

- Plotting the URS obtained groundwater elevation monitoring data conducted at each site,
- Examining the relevant hydrogeological maps for each site where available, and
- Examination of surface topography to determine the likely flow directions within the hydrological catchment of the site and, therefore, estimate the groundwater flow directions.

The following potential controlled waters receptors will be identified in the CSM.

- Groundwater abstractions,
- Springs,
- Groundwater within any major or minor aquifer at a distance 50 m from the site boundary,
- The boundary of any source protection zone (SPZ) or zones of special interest as defined by the EA website,
- Estuaries and near shore environments,
- Surface water courses, including lakes (of any water quality), and
- Wetlands (of any water quality).

Provided that viable source-pathway-receptor linkages have been identified then any one, or a number, of these potential receptors will be used as points of compliance in the stage 3 assessment. In the absence of data to identify receptors, the following theoretical receptors (default conditions) will be adopted and used as the points of compliance in the stage 3 risk assessments:

- Groundwater of any water bearing 'aquifer' at a distance of 50 m from the site, or directly beneath the site through an overlying layer of saturated drift deposits, provided these conditions potentially exist at the site, and
- A surface water body at a distance of 250 m from the site if the groundwater beneath the site is potentially in hydraulic continuity with groundwater present offsite.



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STAGE 3 ASSESSMENT APPROACH

The general approach for soil assessments follows the three tiers outlined in the Agency's R&D Publication 20:

- Stage 1, leaching of soil contaminants to pore water;
- Stage 2, dilution of pore water in groundwater beneath the contaminated soils;
- Stage 3, attenuation by dispersion and decay between the groundwater beneath the soil source and the identified compliance point within the aquifer.

For groundwater only the Stage 3 approach is relevant. The mathematics, assumptions and parameters for each of these tiers of assessment are described in the following sections. The model has been developed by URS over the last 10 years. The results have been compared with standard case studies presented by the Agency in the benchmarking of other models in the Agency Report NGWCLC-NC/00/14, "Benchmarking and Guidance on the Comparison of Selected Groundwater Risk Assessment Methods".

STAGE 1 - See attached Figure 1

The Stage 1a assessment involves comparing the measured groundwater concentrations (as in the Stage 1 Generic Assessment) and calculated soil pore water concentrations against the water target values. A partitioning equation (USEPA, 1994) is used to calculate the concentration of contaminant in pore waters that is in equilibrium with the measured soil concentration.

Soil partitioning equation:

$$C_s = C_T (K_d + (\theta_w + \theta_a H) / \rho_b) \quad (1.1)$$

where:

K_d = soil-water partition coefficient (l/kg)
 θ_w = water-filled soil porosity (l_{water}/l_{soil})
 θ_a = air-filled soil porosity (l_{air}/l_{soil})
 H = Henry's law constant (unitless)
 ρ_b = dry soil bulk density (g/cc)
 C_s = concentration in soil (mg/kg)
 C_T = concentration in porewater (mg/l)

Calculation of K_d for non-polar organic chemicals:

$$K_d = K_{oc} f_{oc} \quad (1.2)$$

where:

K_{oc} = organic carbon partition coefficient (l/kg)

The K_{oc} value used in the assessment is adjusted based on the f_{oc} . The KOC values and references are provided with the URS model (see Phys-Chem Database Worksheet).



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Fraction of organic carbon (Dragun 1988):

$$foc = fom/1.724 \quad (1.3)$$

where:

foc = fraction of organic carbon

fom = fraction of organic matter

STAGE 1b - See attached Figure 1

Stage 1b allows for degradation of contaminants during transport through the unsaturated zone. This mechanism is only applicable if the groundwater table lies below the area of soil contamination, and is described by the following equation (Golders, 1995):

$$C_{wt} = C_T \exp \left[\frac{D_u}{2\alpha_v} - \left\{ \frac{D_u}{2\alpha_v} \sqrt{1 + \left(\frac{4\alpha_v \lambda}{v_u} \right)} \right\} \right] \quad (1.4)$$

where:

Cwt = pore water concentration

CT = concentration of leachate entering groundwater from above

Du = unsaturated zone thickness from base of contaminated soil horizon to water table α_v = dispersivity (= 0.1Du)

$$\lambda = (0.693/t_{1/2})^4$$

t1/2 = half life of contaminant (years)

v_u = retarded velocity = $(INF/\theta_u) * (1 + Kd/\theta_u)$

I = infiltration rate

Kd = partition coefficient

θ_u = water filled porosity of the unsaturated zone

ρ = soil bulk density

In the CONSIM model, developed by Golders/Environment Agency, this decay term is calculated using the equation $(0.693/t_{1/2})\exp(-0.07Du)$. However URS has found that this is incorrect as it results in increased contaminant concentrations at the water table for increased unsaturated flow path lengths. URS has adopted the more robust term, in which the half life is independent of unsaturated flow path length.

For unsaturated zone decay, the saturated decay rates presented below will be adopted. This is a relatively conservative assumption since aerobic activity is expected to be more prevalent in the unsaturated zone than the saturated zone.

If no decay is defined, then $C_{wt}=C_T$.

No decay will be defined whenever any of the following conditions apply:

- free product is observed in the unsaturated zone;
- the soil has a grain size lower than that of a silty clay.



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STAGE 2 - See attached Figure 2

The Stage 2 assessment calculated the concentrations of contaminants in groundwater beneath the soil source. In this assessment the principal process is dilution of contaminated water within the groundwater beneath the soil source. These mechanisms are described below.

Allowing the dilution of List I contaminants, within a major or minor aquifer, could contravene the groundwater regulations, 1998. However, this is considered impractical in most cases and would only really be considered applicable if there was no groundwater contamination observed beneath the soil source (i.e. no groundwater contamination had yet occurred) and the site was located within designated groundwater protection zones.

Therefore, when these conditions are not present the effect of dilution is included in the Stage 3 assessment. The pore water is mixed into the aquifer, based on a mass balance approach. This gives a dilution factor by which the leaching pore water is diluted.

The dilution factor equation describing the mixing of pore water into an aquifer is as follows:

(1.5)

where

$$DF = 1 + \frac{(k i d)}{(I L)}$$

K = aquifer hydraulic conductivity (m/yr)

d = mixing zone depth (m)

i = hydraulic gradient

I = infiltration rate (m)

L = length of source parallel to groundwater flow (m)

Mixing Zone Depth (DoE, 1994)

$$d = (0.0112 L^2)^{0.5} + da \{1 - \exp[(-LI)/(Kida)]\} \quad (1.6)$$

where:

d = mixing zone depth (m)

L = source length parallel to groundwater flow (m)

I = infiltration rate (m/yr)

k = aquifer hydraulic conductivity (m/yr)

i = hydraulic gradient (m/m)

da = effective aquifer thickness (m)

The simulated groundwater concentration beneath the soil source is therefore given by:

$$C_{gw_s} = C_{wt}/DF \quad (1.7)$$



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STAGE 3 Horizontal Migration - See attached Figure 3

This involves the retardation, dispersion and decay of contaminant as it migrates within saturated groundwater and can include vertical migration and horizontal migration.

Horizontal Migration

The horizontal migration of contamination in groundwater is simulated using the transient version of the Domenico analytical model (1987). This is a non-exact analytical solution of the advection-dispersion equation for solute transport, which allows for retardation and decay of the contaminant. For a given input concentration, the model calculates the maximum concentration at a given distance down the centreline of a contaminant plume, at the time when the plume has reached steady-state. Steady-state is reached when the amount of contaminant input is balanced by the amount of contaminant decayed.

The concentration along the centreline ($x, y = 0, z = 0$) at a time, t of a dissolved plume is;

$$C(x,t) = \frac{C_{sv}}{2} \exp\left[\frac{x}{2\alpha_x} \left(1 - \left(1 + \frac{4\lambda\alpha_x}{u}\right)^{1/2}\right)\right] \operatorname{erfc}\left[\frac{1}{2\sqrt{\alpha_x u t}} \left(x - ut \sqrt{1 + \frac{4\lambda\alpha_x}{u}}\right)\right] \left(\operatorname{erf}\left[\frac{S_w}{4\sqrt{\alpha_y x}}\right]\right) \left(\operatorname{erf}\left[\frac{S_D}{2\sqrt{\alpha_z x}}\right]\right)$$

$u = Ks/q_s$

Ks = saturated hydraulic conductivity (cm/d)

i = hydraulic gradient

q_s = volumetric water content of saturated zone

x = distance along centreline from down-gradient edge of dissolved plume source[cm] α_x = longitudinal dispersivity (approximately $0.1x$)

α_y = transverse dispersivity (approximately $0.1\alpha_x$)

α_z = vertical dispersivity (approximately $0.01\alpha_x$)

λ = first order degradation constant

S_w = source width (perpendicular to flow in the horizontal plane (cm)

S_D = source depth (perpendicular to flow in the vertical plane (cm)

erf = error function

erfc = complimentary error

To take account of retardation of the contamination due to sorption the following U_d may be substituted for u :

$$U_d = \frac{K_s i}{\theta_s R_c} \quad (1.9)$$

where:

K_s = saturated hydraulic conductivity (cm/day)

i = hydraulic gradient

θ_s = volumetric water content of saturated zone

R_c = retardation factor defined by:



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$$R_c = \left[1 + \frac{K_d \rho_s}{\theta_s} \right] \quad (1.10)$$

Where:

ρ_s = soil bulk density (g/cm³)

K_d = soil water partition coefficient (l/kg)

θ_s = volumetric water content of saturated zone

STAGE 4 Vertical Migration - See attached Figure 4

The vertical flow path will be considered whenever the underlying aquifer is believed to be a major aquifer or a minor aquifer in which groundwater abstractions or discharge to surface water bodies are known to take place within 100 m of the site. Contaminant attenuation in the vertical pathway is through decay of the contaminant as it migrates vertically from the overlying deposits to the major or minor aquifer (as described by equation 1.4). For cases where there is no existing contamination of groundwater in a major or minor aquifer directly beneath the site, dilution of List 1 substances will not be simulated, adhering to the requirements of the Groundwater Regulations, 1998.

Simulation Times

Using the Domenico model, the concentrations at any time, can be estimated for potential receptors at defined distances down-hydraulic gradient of the source. In this study, eight time frames can be assessed. This range of time frames has been selected so that a graph of concentration vs. time can be constructed for the contaminants of concern. Time ranges can be adjusted by the risk assessor but should always include a 10,000 year step to simulate the effective steady state results. For less retarded contaminants the actual steady state time will be much quicker. The steady state breakthrough is calculated in the model and presented in the results summary tables.

For assessment of the potential for on-going impact on controlled waters, the contaminant source concentrations for input to the model will be taken as the CLR7 95th percentile mean test value or the maximum detected concentrations on site with a constant source. Where free product has been encountered, either fraction specific solubility limits adjusted using Raoult's Law, maximum observed concentrations or solubility limits will be used as the input concentrations for the groundwater analytes.

Where degradation is considered likely to be taking place, first order decay rates have been adopted. A probabilistic approach to degradation rates is proposed, to be consistent with the probabilistic nature of the controlled waters risk assessment. The range of values are provided in the Degradation Database in the risk assessment spreadsheet. It should be noted that the degradation rates selected for the 'middle range' scenario, adopted here as the 'most likely' are relatively conservative in nature. They have been derived as a result of extensive literature reviews of degradation rates in field examples, including but not limited to, publications by Wiedemeier et al., 1999⁴; Rifai et al. (1995)⁵, Aronson & Howard (1997)⁶ and information provided by BP (1994)⁷ and Sloan et al., (2001)⁸ the latter on behalf of the European Fuel Oxygenates Association.



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- 4 Wiedemeier, T.H., Rifai, H.S., Newell, C.J. & Wilson, J.T. (1999) Natural Attenuation of Fuels and Chlorinated Solvents in the Subsurface. Wiley & Sons, Inc., New York, Chichester.
- 5 Rifai, H.S., Borden, R.C., Wilson, J.T. & Ward, C.H. (1995). Intrinsic Bioattenuation for subsurface restoration. In: Intrinsic Bioremediation, ed. Hinchee, R.E., Wison, J.T., & Downey, D.C., Battelle Press, Columbus, OH., USA, pp 1-29.
- 6 Aronson, D., & Howard, P.H. (1997) Anaerobic Biodegradation of Organic Chemicals in Groundwater: A Summary of Field and Laboratory Studies, Final Report. Prepared for the American Petroleum Institute, Chemical Manufacturer's Association, National Council of the Paper Industry for Air and Stream Improvement, Edison Electric Institute, American Forest and Paper Association, Washington DC, USA.
- 7 BP Green (1994) Groundwater Remediation & Environmental Engineering News, Issue 2, Third Quarter.
- 8 Sloan, R. et al., (2001) MTBE Remediation Seminar, presented in Birmingham, UK, May 8, 2001 on behalf of EFOA

Parameters

Input Parameters are discussed in detail in TGN4 while site specific risk assessment assumptions are provided in the risk assessment input sheets.

Probabilistic Approach

As previously mentioned, a probabilistic approach will be adopted. The aim of the probabilistic approach is to account for parameter uncertainty in the assessment of risk. The probabilistic approach follows the advice of Environment Agency Report NC/99/38/3 "Guidance on Assigning Values to Uncertain Parameters in Subsurface Contaminant Fate and Transport". There are three main reasons why a probabilistic approach has been adopted:

- To understand uncertainty in our understanding of contaminant fate and transport in the sub-surface;
- To ensure the mathematical description of the contaminant fate and transport processes adequately define the uncertainty; and
- To ensure plausible ranges of parameters are defined.

This is important in these studies where the parameters, and in particular the pathway parameters, are derived from limited field data. A "Monte-Carlo" approach will be adopted to assess the risks. The Monte-Carlo method is the most widely used method of uncertainty analysis and involves:

- the definition of probability distributions for the model parameters, based on the advice included in the Agency guidance report, NC/99/38/3 automated repeated running of the model with parameter sets chosen from the distributions. The result from each run is recorded to build up a picture of the possible outcomes from combining different parameter values;
- the analysis of the results from each model calculation to obtain a probability distribution. Ranges of values will be adopted for selected parameters to ensure that the following key mechanisms are adequately covered within the assessment method: partitioning soil to groundwater; attenuation within the unsaturated zone;
- dilution within the receiving groundwater body (not applicable for major aquifers); retardation within horizontal migration;



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- decay within the unsaturated zone.

The parameter and indicative ranges to be adopted are discussed in detail in TGN04 and TGN05.

The results are expressed in terms of the likelihood that a given value will be exceeded. For each contaminant any percentile output can be selected from the model. A range of probabilistic outputs at steady state can also be generated. Typically the 95th percentile output is taken as the appropriate confidence level for an initial Stage 3 assessment. this may be adjusted based on further review and/or discussion with the Regulators.

Each simulation is run using 1001 iterations.

Risk Estimation

The following assessment of risk has been developed:

Simulated concentrations are calculated at the receptor for each of the defined time steps. The simulated concentration is converted to a hazard index by dividing the simulated concentration by the target concentration;

$$HI = C_{sim}/C_{target} \text{ (1.11)}$$

A hazard index greater than unity indicates a potential risk to the receptor at that time interval. For reporting purposes the steady state result (i.e. time step 8) is usually reported, however other time steps may be appropriate dependent on site setting, contaminants of concern etc.

For those contaminants with a $HI > 1$ a threshold concentration is calculated.

The threshold concentration is defined by a simple calculation:

$$TC = C_{source} / HI$$

where:

C_{sim} = simulated X percentile at time period Y

C_{source} = source concentration

C_{target} = target concentration T

Dilution

Simple dilution may be incorporated taking into account mixing of groundwater in surface water or at a groundwater abstraction well. **Figure 5** illustrates the process of estimating a dilution factor in a receiving water course. More details on dilution in the model are provided as appropriate in the dilution section of the CSM.

Risk review and Iteration

As part of the process of moving on to remedial action, a 'reality check' on the site investigation information will be completed, including examining the viability of the contaminant pathways and also the likely magnitude of the source of contamination.



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This may result in revision of some of the model's input parameters and the requirement to re-run some models to test the simulated outputs against the threshold concentration.

This reality check will include an assessment of the following:

- the water mass balance to assess whether the site input parameters are appropriate.
- the sensitivity of the source dimensions in order to establish whether the remedial areas can be reduced by obtaining more accurate information on the source term;
- the sensitivity of key pathway parameters (e.g. hydraulic conductivity, fraction of organic carbon, with or without decay) in order to define confidence in the SSTCs using more extensive pathway lengths (e.g. 100m, 250m, rather than the maximum of 50m for a major aquifer defined here) to establish the impact of pathway length on SSTCs and remedial extents;
- consider the added attenuation of dilution within surface water bodies (if this is the main risk driver) to establish whether remediation should proceed as defined by the risk assessment or it would be prudent to discuss with the regulator to establish whether any dilution could be allowed, reducing remedial extent; and
- the simulated travel times from the source to the receptor to establish the viability of the pathway.

The Stage 3 risk assessment described herein may therefore be iterated a number of times based on collection of additional data from the site. Only once sufficient confidence in the data has been obtained and a risk is still simulated will a remedial plan be developed for the site. Once the assessment is completed the output values will be termed Site Specific Threshold Concentrations (SSTCs). More details on the risk assessment revision process is provided in TGN7.

The process for estimating the water mass balance is illustrated in the attached **Figure 6**. The mass balance assess the calculated groundwater flux from the site based on the site width, saturated thickness, permeability and gradient and compares this with the estimated daily recharge to the aquifer over the site width within the sites catchment. This is a simplistic approach and bounds of 0.2 to 5 are used to assess whether the site parameters are reasonable for the site setting. If the aquifer is confined or there is great variability in land-use cover over the catchment then this assessment may not be accurate and a more detailed review of the mass balance may be required.

Examples of the graphical output generated by the assessment are provided as attached **Figure 7**. These include presentation of simulated concentrations against time, distance and probability. These graphical output can be produced for each contaminant of concern and for deterministic and probabilistic assessments using soil or groundwater data as input. Further detailed output in the form of summary tables is also provided. Further details on how the model works is provided in TGN05.



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Key References

Allen D. J., Brewerton L. J., Coleby L. M., Gibbs B. R., Lewis M. A., Macdonald A. M., Wagstaff S. J., and Williams A. T., (1997) The physical properties of major aquifers in England and Wales, British Geological Survey Technical Report WD/97/34;

ASTM (2000) Standard Guide for Risk-Based Corrective Action, Report E2081-00 Barnes S. (2002) Solid organic matter in UK aquifers: its role in sorption of organic contaminants,

Defra and Environment Agency (2002a) Assessment of Risks to Human Health from Land Contamination: An Overview of the Development of Guideline Values and Related Research, Report CLR7.

Defra and Environment Agency (2002b) Priority Contaminants for the Assessment of Land, Report CLR8. Defra and Environment Agency (2002c) Contaminants in Soil: Collation of Toxicological Data and Intake Values for Humans, Report CLR9.

Defra and Environment Agency (2002d) Contaminated Land Exposure Assessment Model (CLEA): Technical Basis and Algorithms, Report CLR10.

DETR (2000) Environmental Protection Act 1990: Part IIA. Contaminated Land Circular 02/2000.

DETR, Environment Agency and IEH (2000) Guidelines for Environmental Risk Assessment and Management.

Environment Agency (2002) Integrated Pollution Prevention and Control (IPPC): Environmental Assessment and Appraisal of BAT, Report IPPC H1

Applied Hydrogeology, Collier Macmillan, Canada. Johnson P. and Ettinger R. (1991) Heuristic model for predicting the intrusion rate of contaminant vapours into buildings,

Environmental Science & Technology 25(8): 1445 – 1452 Jones H. K., Morris B. L., Coleby L. M., Cheney C. S., Brewerton L. J., Merrin P. D., Lewis M. A., Mac Donald A. M., Talbot J. C., McKenzie A. A., Bird, M. J., Cunningham J. and Robinson, V. K., (2000); The physical properties of minor aquifers in England and Wales, British Geological Survey Technical Report WD/00/04;

Kruseman, G. P. and de Ridder, N. A., (1994) Analysis and Evaluation of Pumping Test Data, 2nd edition

Whittaker, J.J., Buss, S.R., Herbert, A.W., Fermor, M., (2001) Benchmarking and Guidance on the Comparison of Selected Groundwater Risk Assessment Models, NGWCLC report NC/00/14, Environment Agency – National Groundwater and Contaminated Land Centre, Solihull, U.K.

A more complete list of publications and reference documents for completing a risk assessment is provided as TGN01 and TGN08.



QRA BACKGROUND AND MODEL SUMMARY

Calculation of Kd for an ionised species

$$K_d = K_{oc,n} \frac{1}{1 + 10^{pH-pK_a}} + K_{oc,i} \left(1 - \frac{1}{1 + 10^{pH-pK_a}} \right)$$

where:

Kd = soil-water partition coefficient (l/kg)

Koc,n = sorption coefficient for related species (l/kg)

Koc,i = sorption coefficient for related species (l/kg)

pH = pH value

pKa = acid dissociation constant



SUMMARY SCHEMATICS OF RISK ASSESSMENT PROCESSES

FIGURE 1a - Illustration of Stage 1A Pore water Leachate generation and soil/groundwater contaminant equilibrium

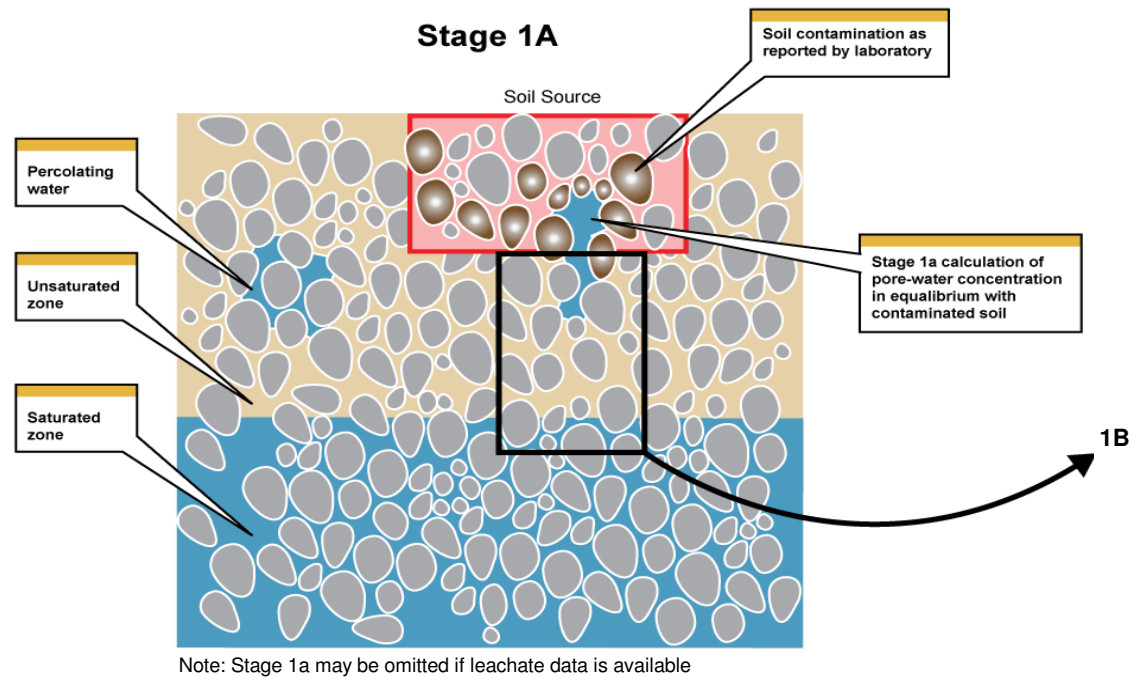
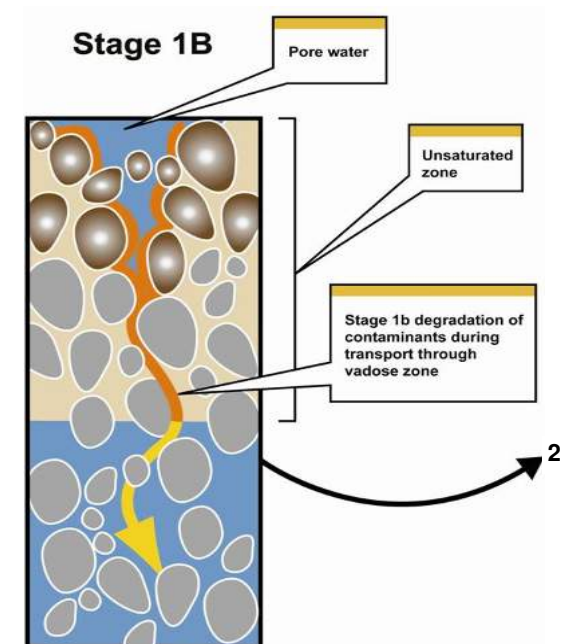
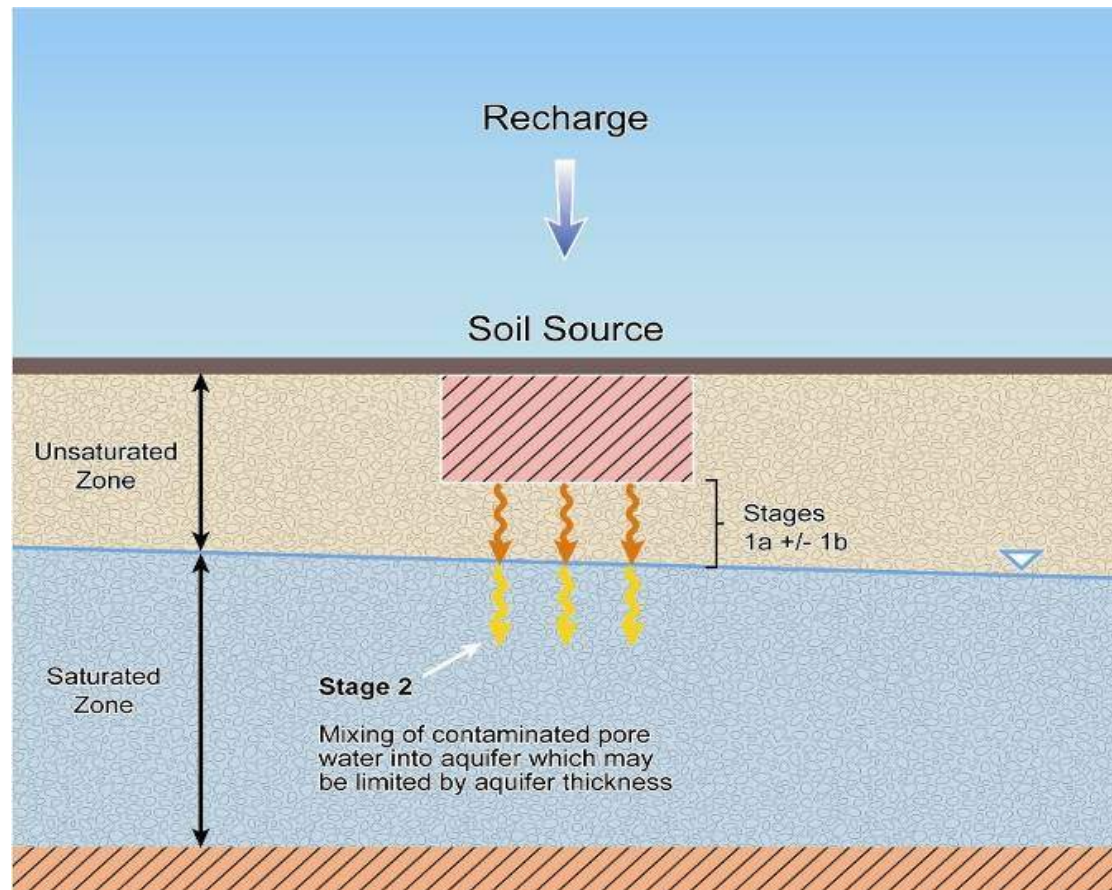


FIGURE 1b - Illustration of Stage 1B Attenuation from pore water through unsaturated zone down to groundwater table (where confirmed uncontaminated zone exists)



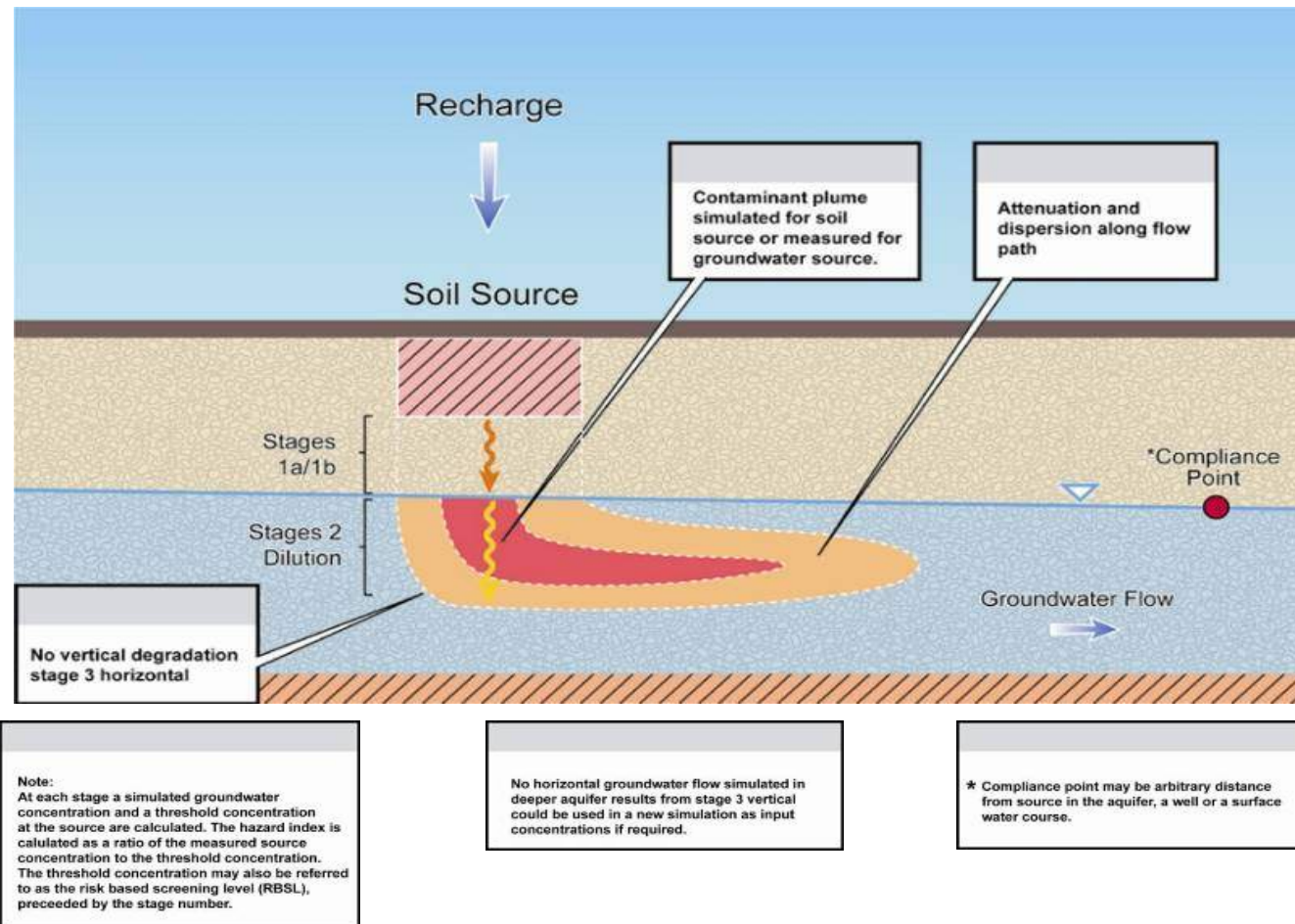
SUMMARY SCHEMATICS OF RISK ASSESSMENT PROCESSES

FIGURE 2 - Illustration of Stage 2 mixing within groundwater



SUMMARY SCHEMATICS OF RISK ASSESSMENT PROCESSES

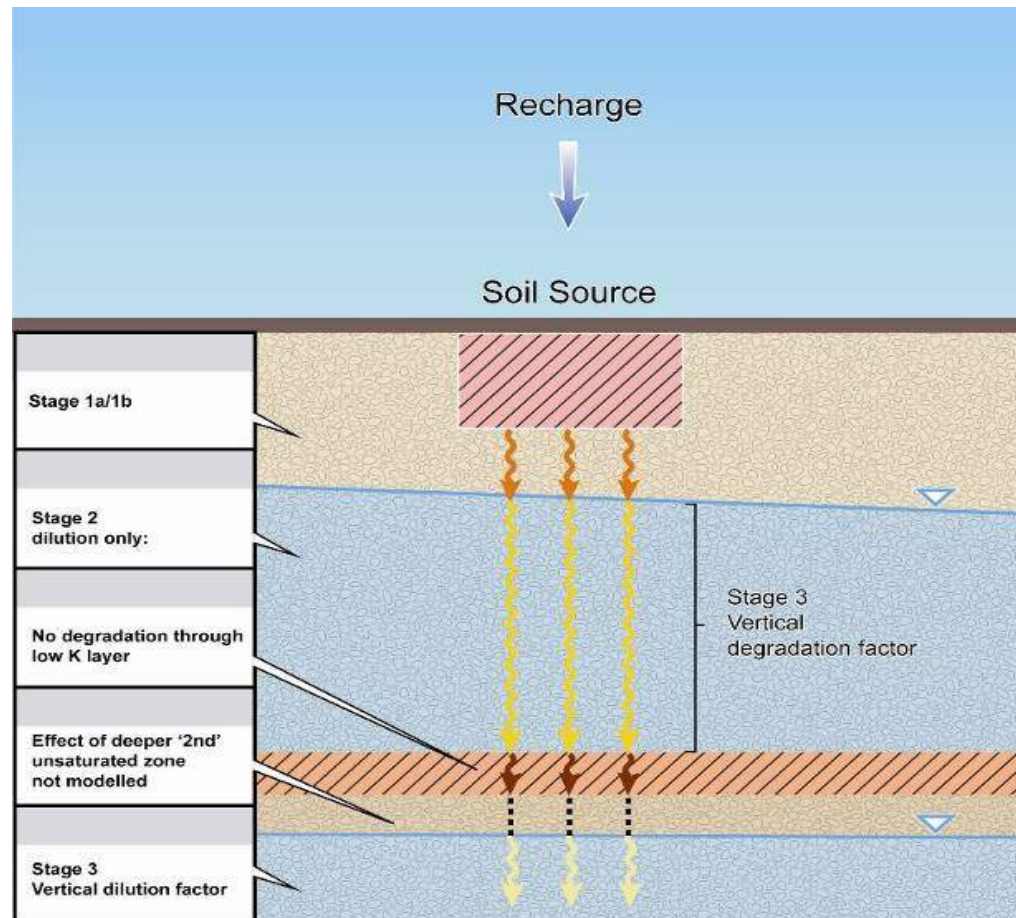
FIGURE 3 - Illustration of Stage 3 Horizontal Flow through upper aquifer towards compliance point, incorporating dispersion and degradation



URS

SUMMARY SCHEMATICS OF RISK ASSESSMENT PROCESSES

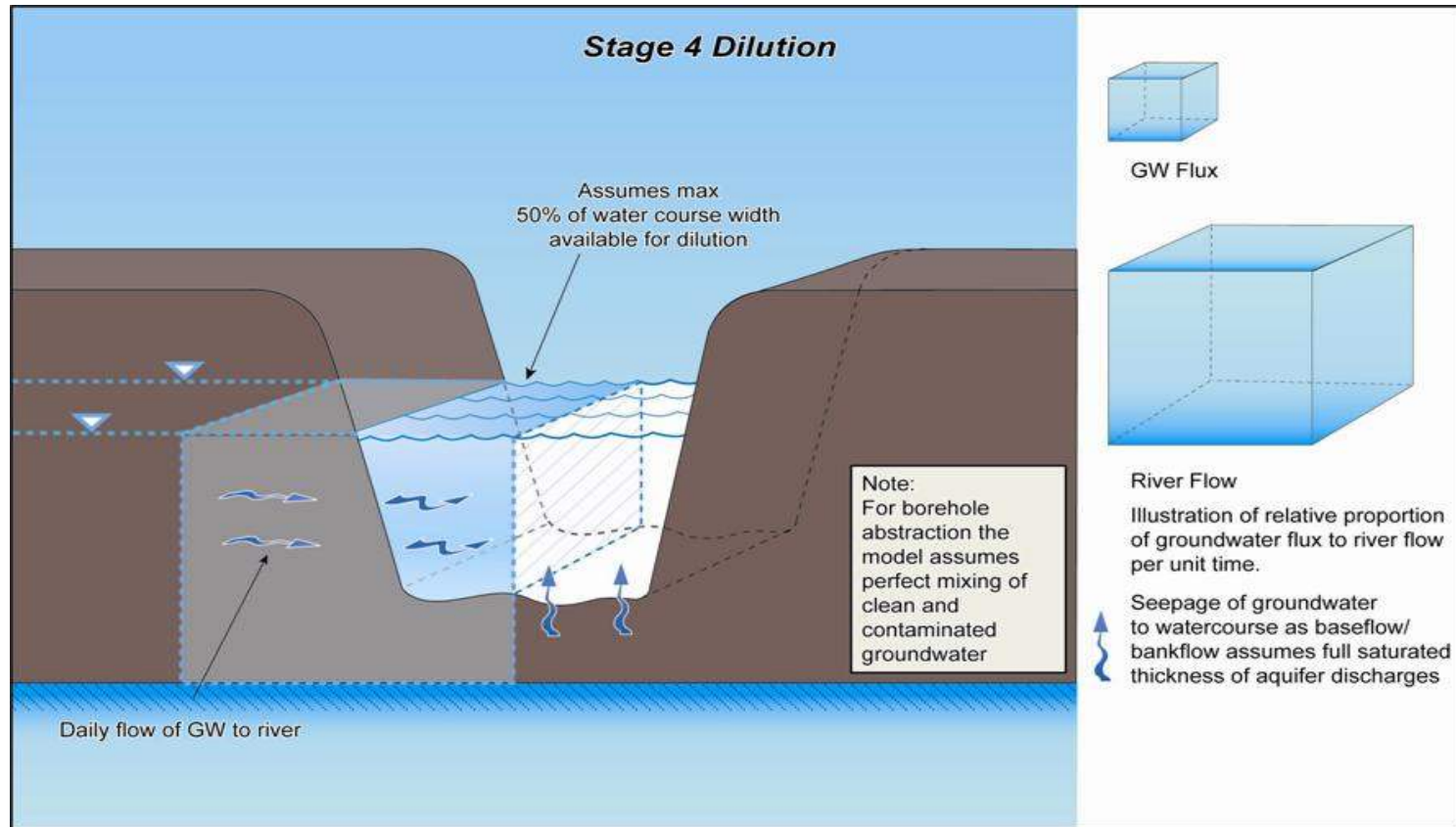
FIGURE 4 - Illustration of Stage 3 Vertical flow from shallow non-sensitive aquifer to deeper more sensitive aquifer including degradation through upper saturated zone and dilution in lower aquifer



URS

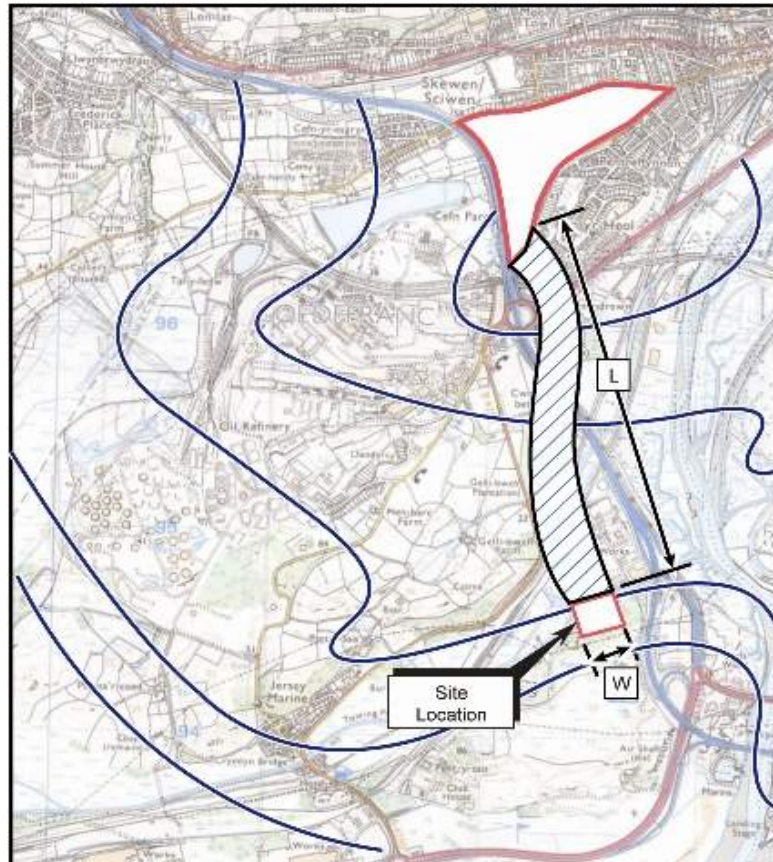
SUMMARY SCHEMATICS OF RISK ASSESSMENT PROCESSES

FIGURE 5 - Dilution Calculations



SUMMARY SCHEMATICS OF RISK ASSESSMENT PROCESSES

FIGURE 6 - Recharge Estimation for Water Mass Balance Check



	Topographical contours (5m)	Site	
	Area of highground in area of site	$K \times i \times da \times w$	= Catchment $I \times L \times W$
	Site Location	I	= Recharge
	Assumed up gradient recharge area	k	= Permeability
	Width of site	i	= Gradient
	Length of catchment	da	= Aquifer thickness
		W	= Site width

SUMMARY SCHEMATICS OF RISK ASSESSMENT PROCESSES

FIGURE 7a - Simulation of Concentration vs Time

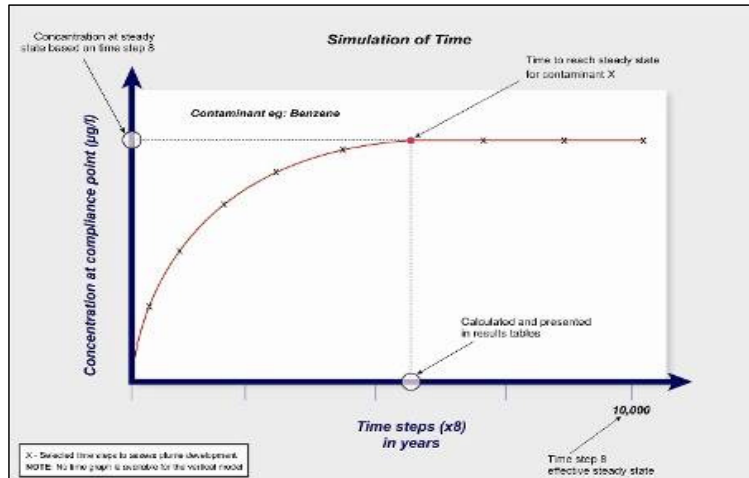


FIGURE 7b - Simulation of Concentration vs Probability

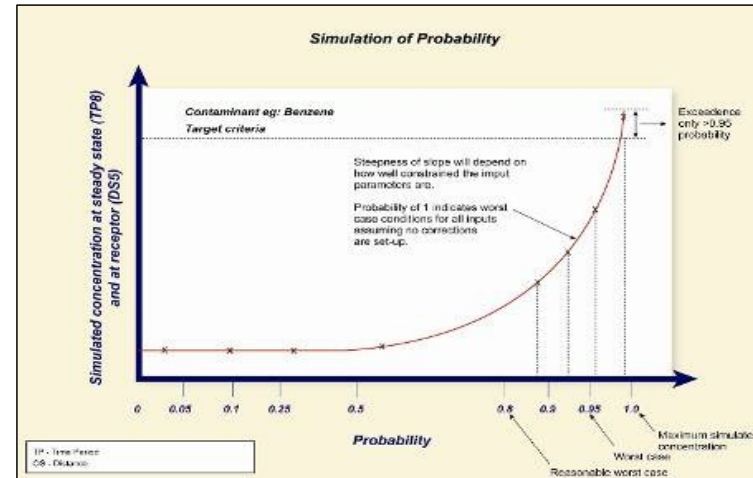
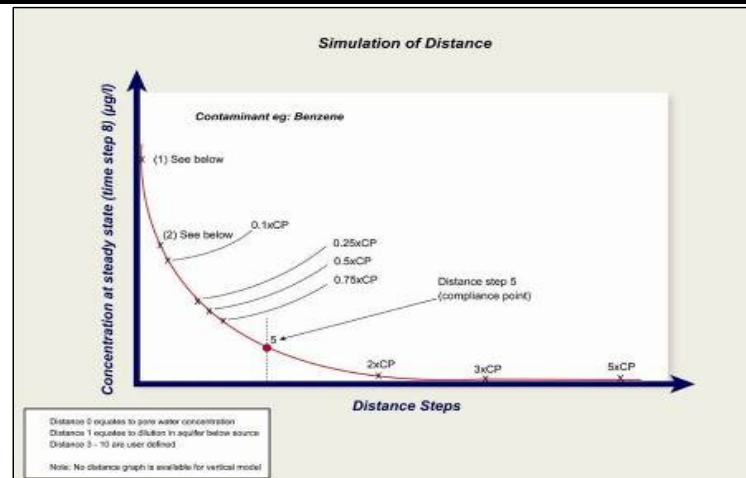


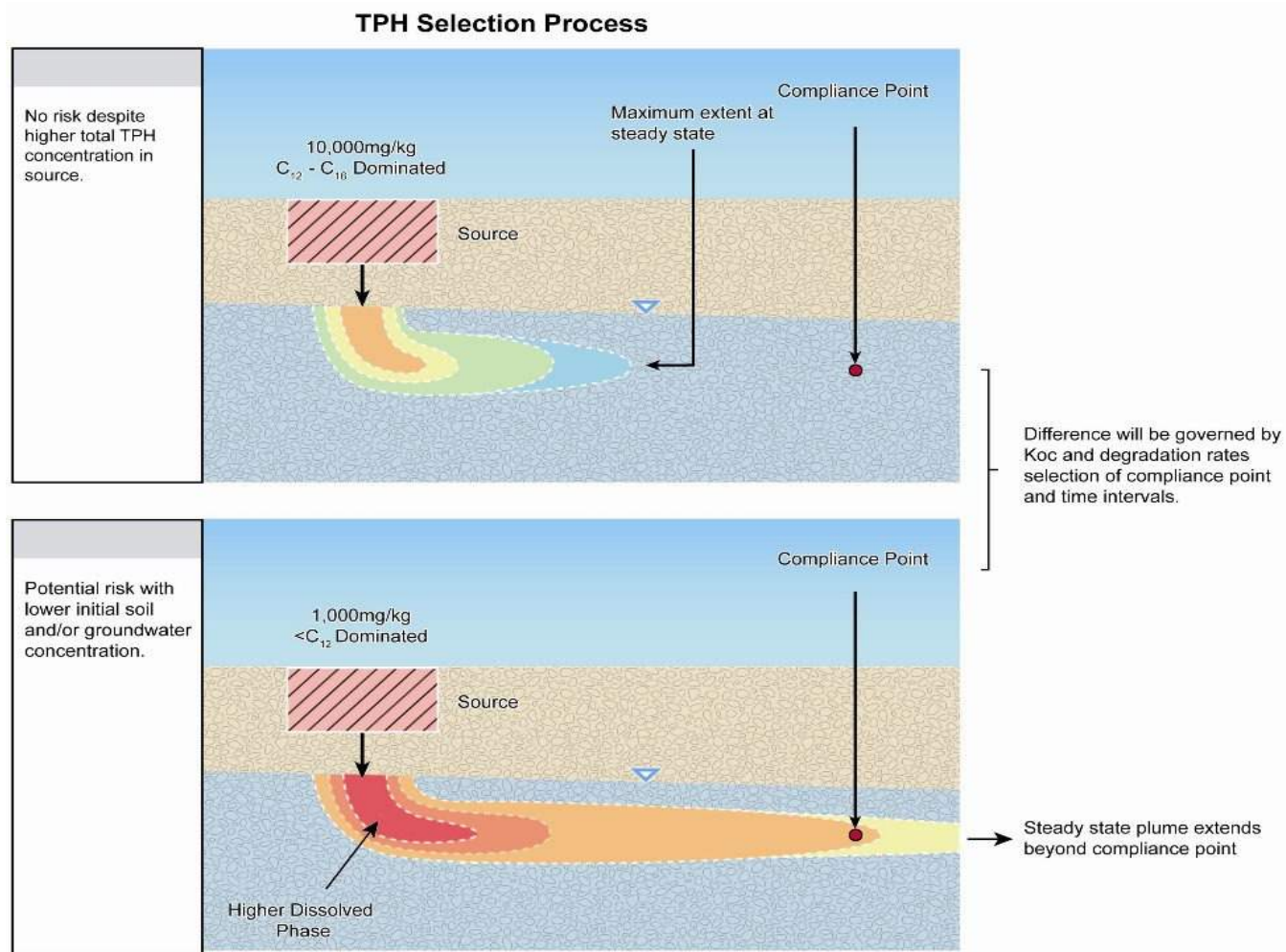
FIGURE 7c - Simulation of Concentration vs Distance



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SUMMARY SCHEMATICS OF RISK ASSESSMENT PROCESSES

FIGURE 8 - TPH Selection Process





URS site-specific controlled waters risk assessment tool

designed on the principles and methodologies contained within EA Remedial Targets Methodology, 2006



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Version: CWRA, version 7.292min

Date: 13/07/2011

MODEL 1 - GROUNDWATER IN THE CHALK INPUTS SUMMARY

MODEL 1: CONTROLLED WATERS RISK ASSESSMENT
PROJECT RECORD

Project Record

Navigation Page

Project Title

Project Site
Project Number
Project Description
Revision Number
Proposed or Current End-Use
City
Region
Country
URS Office
Industry Sector
Service Code
SF330 Code
Project Budget
QRA Budget
Currency

Shell Hitchin - Model 2 Groundwater in the Drift Deposits

Service Station QRA
Rev 1

Hitchin
South East England
England
Wimbledon
1115-Downstream, Refining/Marketing
100-Planning, Consulting & Permitting
R10-Risk Analysis

£

England / Wales / NI

Country Criteria

Filename/location stored

J:\Wimbledon-Job\Shell International Limited\49319130 GESS 2010 Global RFP\Technical\London Projects\Site\Hitchin\Technical\Reports\Phase 2 - 3rd Report\QRA\QRA(SHELL - HITCHIN - Chalk - no drift.xls)\Project Record

Assessment completed by
Date created
Date modified
QC'd by
QA'd by

J Willis
24/01/2013
28/01/2013
Emma Peace
Emma Peace

Stage 1 Assessment
Stage 2 Assessment

Navigation Page

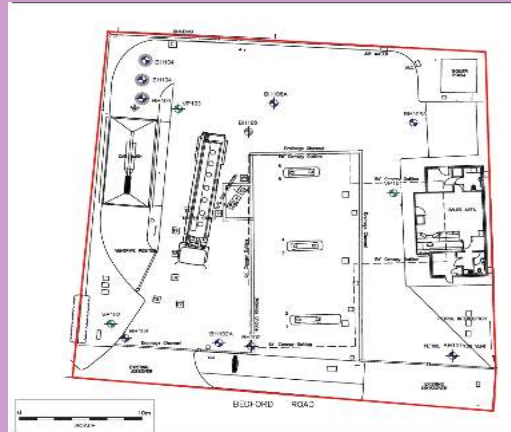
SUMMARY OF RISK ASSESSMENT OBJECTIVE

Soil and groundwater exceedances have been identified above the Stage 2 GAC. A DORA is required to further investigate these risks.

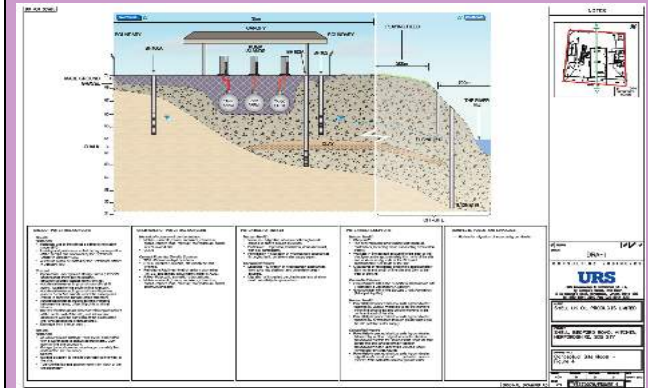
Site Location Plan



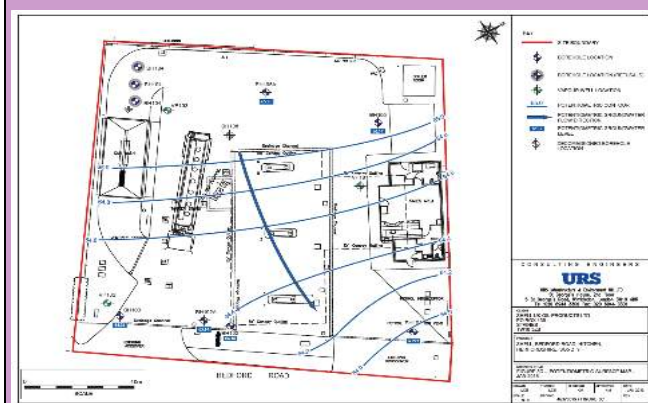
Site Location Plan



Schematic Section



GW Contours



URS

**MODEL 1: CONCEPTUAL SITE MODEL
PART 1 - SOURCE TERMS**

Conceptual Model Set-Up - PART 1, SOURCES

Navigation Page

SOURCE DIMENSIONS	SOIL			GW			COMMENTS
	1	2	3	1	2	3	
	HS1	HS2	HS3	SITE	HS1	HS2	
LENGTH (PARALLEL TO FLOW)	33	30	10	10			Metres
WIDTH (PERPENDICULAR TO FLOW)	35	25	10	10			Metres
SOURCE AREA	1155	750	100	100	0	0	m ²
BASIS FOR DIMENSIONS	a	a	a	a	a	a	See below
SOIL/LEACHATE DATA	Soil						
LEACHATE DATA TYPE	N/A						
LEACHATE DILUTION FACTOR	N/A						

NOTE: ADDITIONAL SOURCE DETAILS RELATING TO TPH COMPOSITION AND FREE PRODUCT ARE DESCRIBED ON THE PATHWAYS SHEET

HS* - Hot Spot Source

Saturated Vertical Pathway

NO

Dimensions

- (a) - Based on delineation using analytical data (e.g. distance to nearest clean data point)
- (b) - Based on known extent of site infrastructure (e.g. hotspot around tankfarm etc)
- (c) - Other, described below

DESCRIPTION OF SOURCE(S)

*Note: Information on Product and concentration data used in the assessment is covered on the pathways sheet.

Soil Sources: Multiple TPH fractions were detected in excess of the Stage 2 GAC from all sample locations across the site. A site wide source of 35m x 33m has been assumed for soil source 1. Metals and PAH compounds were found in excess of the Stage 2 GAC in BH101, BH103, BH105 and BH106. A 25m x 30m has been assumed for soil source 2. Benzene was detected in concentrations exceeding the GAC at BH105. A small 10m x 10m source zone has been assumed for Soil Source 3.

Groundwater Sources: Naphthalene, BTEX and multiple TPH bands were reported at concentrations exceeding the Stage 2 GAC from groundwater sampled from BH102. A source zone of 10m x 10m has been assumed for groundwater source 1.

Key to Data Worksheets

All cells on the user data worksheets ("name" Data) are colour coded as follows.

User Values		These worksheet cells can be edited directly and are specifically for adding comments.
User Values		These worksheet cells can be edited directly and are specifically for values
Calculated Values		These worksheet cells contain calculated values and are protected. User values should not be entered directly into these cells.
User Values		These worksheet cells have been edited from the default formula. Justification to be provided.



MODEL 1: SCHEMATIC CONCEPTUAL SITE MODEL

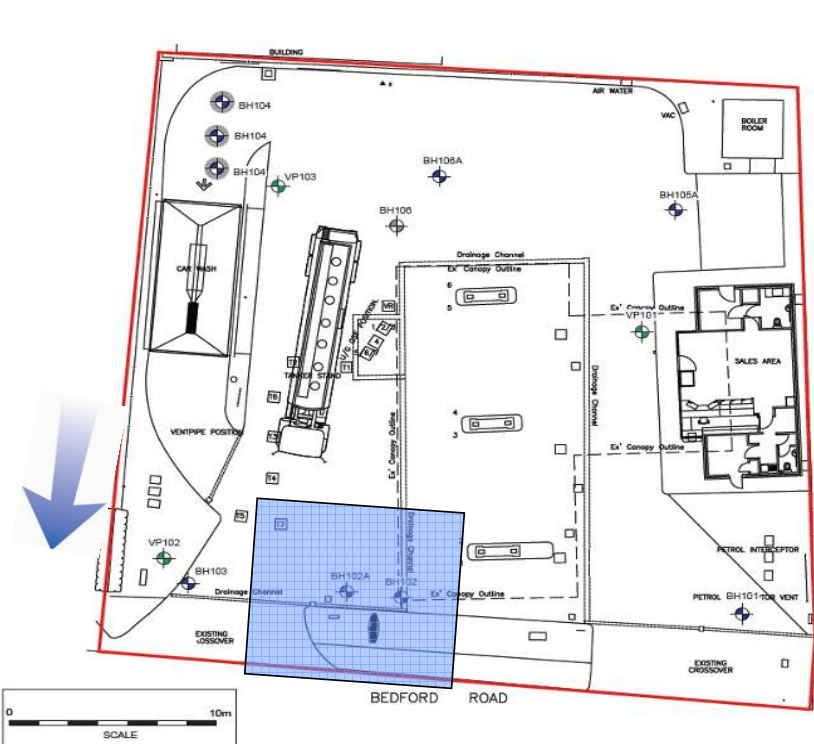
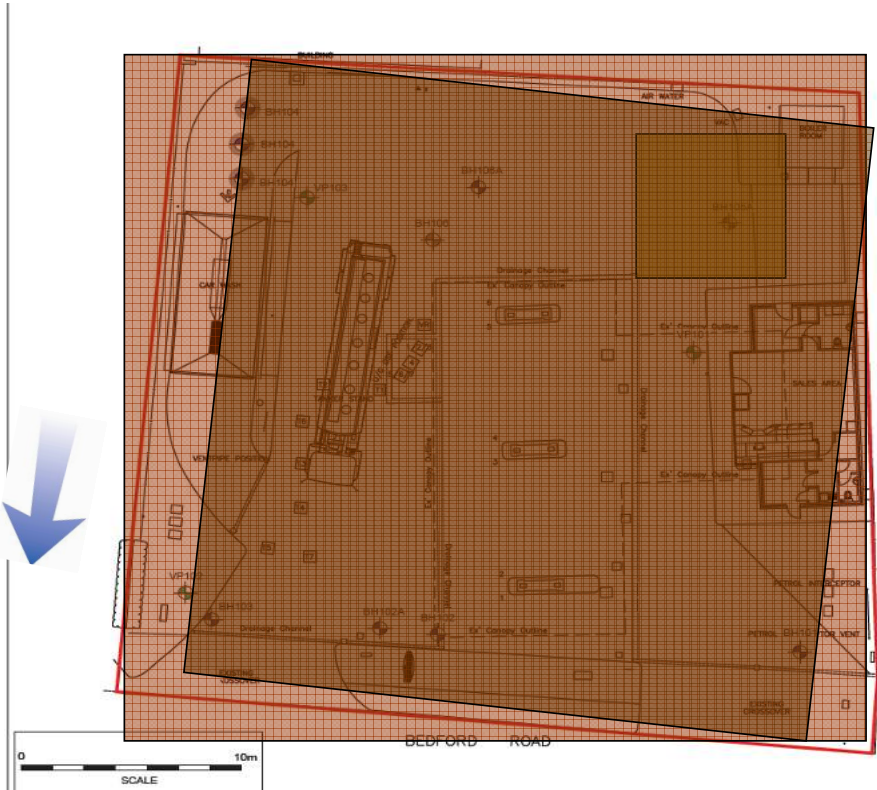
SOURCE AREAS

Source Area	
Soil to Groundwater Attenuation:	NO
Soil or Leachate:	Soil
Free Product:	NO
Product Type:	-
Product Input:	-
Ground Type:	Hard-Standing

Source Dimensions				
	Width	Length	Area	Age
	m	m	m2	Yrs
	35	33	1155	
	25	30	750	
	10	10	100	
	10	10	100	
	0	0	0	
	0	0	0	

SOIL MAX

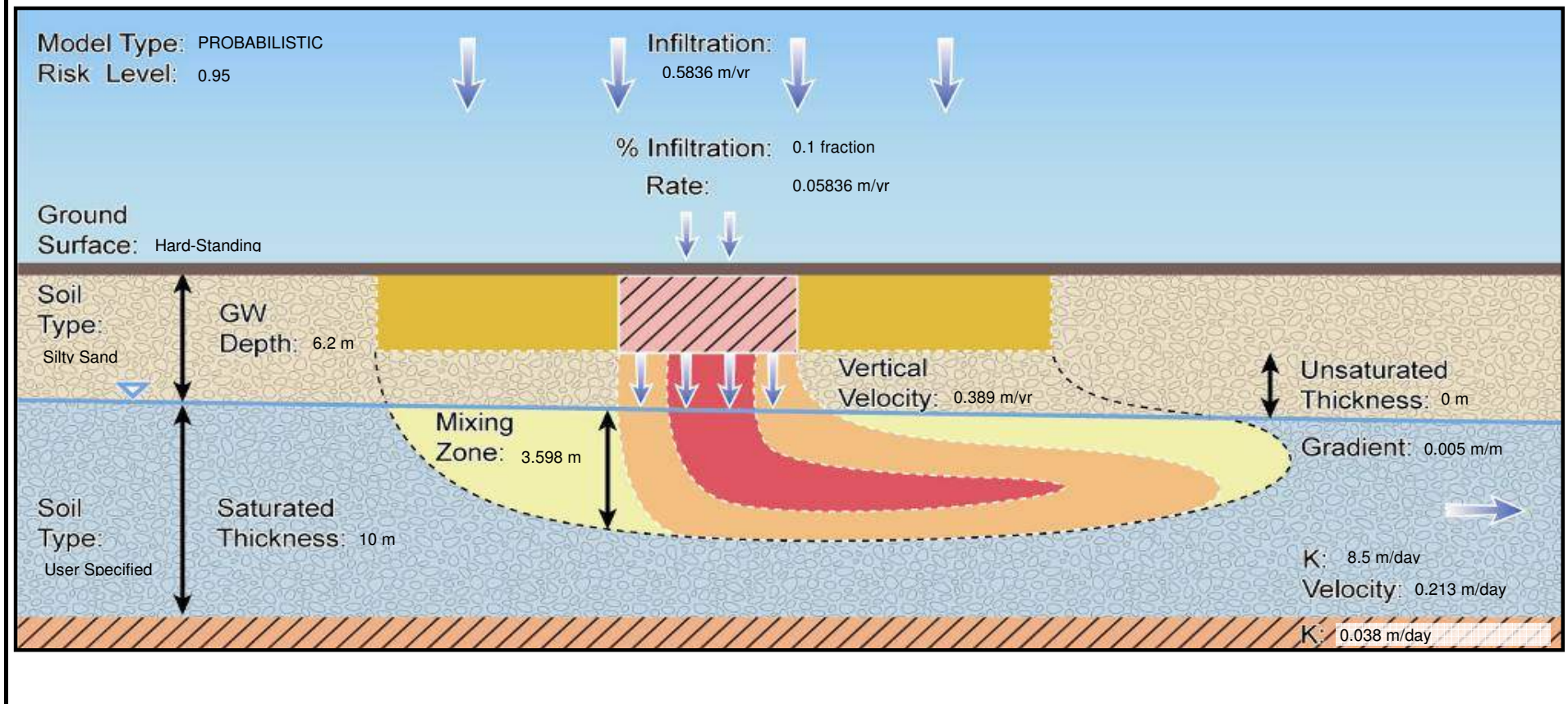
GROUNDWATER MAX



MODEL 1: SCHEMATIC CONCEPTUAL SITE MODEL

PATHWAYS

Unsaturated Zone	Saturated Zone	Saturated Zone	Saturated Zone
Bulk Density: 1.62 g/cm ³	Dilution in GW: YES	Foc: 0.045 %	Phases: All Phases
Water Filled Porosity: 0.15 fraction	Attenuation Vertical: NO	GW Ph: 7.59 pH units	Longitudinal Dispersivity: 0.1 fraction
Air Filled Porosity: 0.24 fraction	Attenuation Horizontal: YES	GW Eh: 205 mV	Lateral Dispersivity: 0.01 fraction
Foc: 0.73 %	Bulk Density: 1.79 g/cm ³	Aquifer Condition: Aerobic	Vertical Dispersivity: 0.001 fraction
Ph n/a pH units	Effective Porosity: 0.2 fraction	Decay Type: Default Decav	Dispersion Type: Pickens & Grisak (Flow Path)
Decay Type: No Decav			



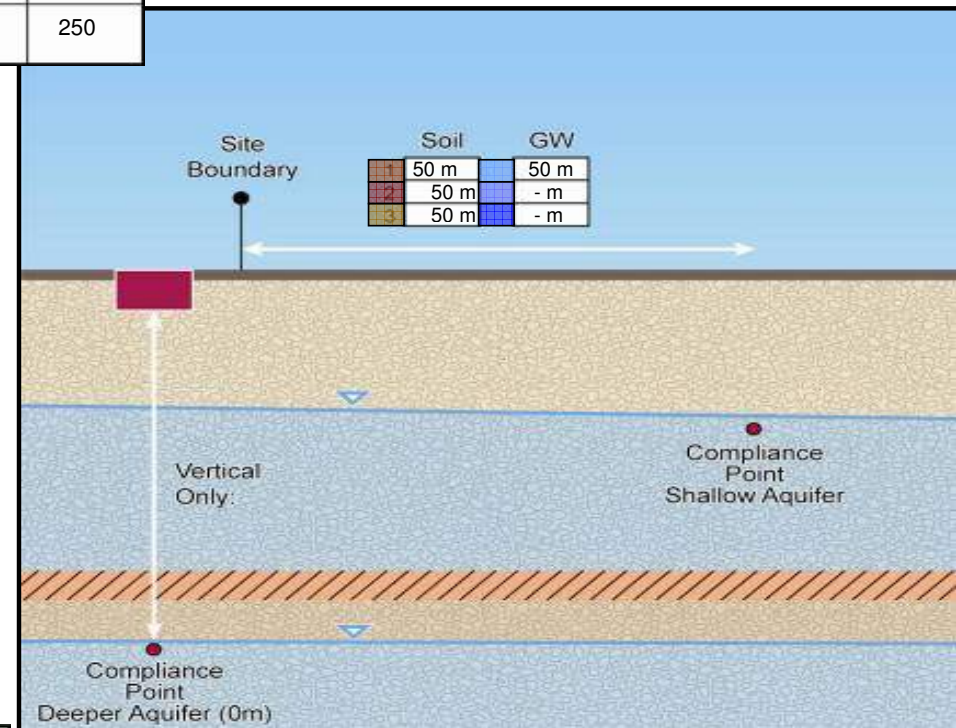
MODEL 1: SCHEMATIC CONCEPTUAL SITE MODEL

RECEPTORS

Distance Summary (m)								
	1	2	3	4	5	6	7	8
Soil 1	5	12.5	25	37.5	50	75	100	250
2	5	12.5	25	37.5	50	75	100	250
3	5	12.5	25	37.5	50	75	100	250
GW 1	5	12.5	25	37.5	50	75	100	250
2	5	12.5	25	37.5	50	75	100	250
3	5	12.5	25	37.5	50	75	100	250

Distance to receptor from source area

Target Criteria	
Compliance Point Type:	Groundwater Secondary Aquifer
Target Criteria:	DWS



Time Period (Years)							
1	2	3	4	5	6	7	8
1	2	5	10	50	100	1000	10000

Steady State Time Period

**MODEL 1: CONCEPTUAL SITE MODEL
PART 2 - PATHWAYS**

Conceptual Model Set-Up - PART 2, PATHWAYS

Navigation Page

PATHWAYS	ACTIVE	COMMENTS
MODEL TYPE	P	P - Probabilistic or D - Deterministic
RISK LEVEL	0.95	Risk Level for Probabilistic Output. Needs to be a decimal between 0 and 1. For Deterministic model set to 1.
FREE PRODUCT IDENTIFIED	NO	If free product has been identified the model can use Raoult's Law to assess input concentrations. Select Yes if product model required. Input concentrations are limited to BTEX/TPH.
PRODUCT TYPE (if present)	None	If the product has not been analysed for composition select the product type from the list to assess typical proportions of constituents
INPUT DATA FOR PRODUCT	None	Select either solubility limits or fraction specific data
SOIL SOLUBILITY LIMITATION	ON	Choose whether to limit soil leaching and mixing within groundwater (Stage 2 soil) to solubility limits. This reduction is not applied at Stage 1a/1b as it is assumed that free phase product can exist in pore spaces.
GROUNDWATER SOLUBILITY LIMITATION	ON	Choose whether to limit groundwater concentration inputs to the solubility limit (as referenced on the physchem database sheet and corrected for temperature).
LEACHATE SOLUBILITY LIMITATION	ON	Choose whether to limit reported leachate concentration inputs to the solubility limit (as referenced on the physchem database sheet and corrected for temperature). Note that due to dilution effects in the test procedure the Limit has been set at 10 x Solubility Limit.
ATTENUATION SOIL TO GROUNDWATER (UNSATURATED VERTICAL)	NO	Applies degradation of contaminants during leaching from soil to groundwater. Set to No if soil contamination reaches GW table or if free product identified. This should be set to No if the soil type has a grain size lower than a silty clay.
ATTENUATION ALONG VERTICAL (SATURATED)	NO	Only one of horizontal/vertical flow should be simulated. If horizontal flow set to YES then vertical should be set to NO.
ATTENUATION ALONG HORIZONTAL (SATURATED)	YES	Degradation of Contaminants along horizontal flow Path.
DILUTION WITHIN GROUNDWATER for List I & II Substances	YES	Dilution should not be applied to List I Substances if no groundwater contamination is present and the site is located in a GPZ (see note below).
EVIDENCE FOR SOURCE DEPLETION	N/A	<u>Justification required</u>
DECLINING SOURCE TERM	NO	Uses Bioscreen solutions (First Order and Instantaneous Reaction source depletion) and Consim based Leaching solution (interpreted as an equivalent first order decay rate)
PULSE SOURCE TERM	NO	Uses superposition to calculate results based on off-set steady state solutions (+ive and -ve contributions separated by pulse duration) to represent a pulse of contamination
DURATION OF PULSE SOURCE		Used to adjust the time element for the pulse solution. Time intervals may need to be changed on a contaminant by contaminant basis to review all of the graphical output
ASSESS ALL TPH SAMPLES	YES	Please review TPH data on the TPH Review sheets and select the most representative TPH composition for the site based on TPH properties and overall composition
CONCENTRATION DATA SOIL SOURCE 1	MAX	<u>Justification</u>
CONCENTRATION DATA SOIL SOURCE 2	MAX	<u>Justification</u>
CONCENTRATION DATA SOIL SOURCE 3	MAX	<u>Justification</u>
CONCENTRATION DATA GW SOURCE 1	MAX	<u>Justification</u>
CONCENTRATION DATA GW SOURCE 2	N/A	<u>Justification</u>
CONCENTRATION DATA GW SOURCE 3	N/A	<u>Justification</u>
DILUTION AT RECEPTOR	N/A	<u>Justification</u> - Only to be used with guidance / approval
DISPERSIVITY	Pickens & Grisak (Flow Path)	Pickens and Grisak, 1981 based on 10% of the flow path length (Default for short flow path). Other options should be considered to limit the effect of dispersion; - Neuman, 1990 based on $0.0175 \cdot L^{1.46}$ - Xu and Eckstein, 1995 based on $Mx \cdot [\text{Log } L] \cdot \text{Mexp}$

Note: Dilution in Aquifer

Allowing the dilution of List I contaminants, within a major or minor aquifer, could contravene the groundwater regulations, 1998. However, this is considered impractical in most cases and would only really be considered applicable if there was no groundwater contamination observed beneath the soil source (i.e. no groundwater contamination had yet occurred) and the site was located within designated groundwater protection zones. Therefore, when these conditions are not present the effect of dilution is included in the Stage 3 assessment. The pore water is mixed into the aquifer, based on a mass balance approach. This gives a dilution factor by which the leaching pore water is diluted.



**MODEL 1: CONCEPTUAL SITE MODEL
PART 3 - RECEPTORS**

Conceptual Model Set-Up - PART 3, RECEPTORS

Navigation Page

SOURCE DIMENSIONS	SOIL			GW			Comments
	1	2	3	1	2	3	
	HS1	HS2	HS3	SITE	HS1	HS2	
SOURCE PRESENT	YES	YES	YES	YES	NO	NO	
DISTANCES FOR PLOTS - 1	5	5	5	5			Minimum distance should not be <5m or 10% distance to Compliance Point, whichever is larger.
DISTANCES FOR PLOTS - 2	12.5	12.5	12.5	12.5			Can be adjusted
DISTANCES FOR PLOTS - 3	25	25	25	25			Can be adjusted
DISTANCES FOR PLOTS - 4	37.5	37.5	37.5	37.5			Can be adjusted
COMPLIANCE POINT	50	50	50	50			Main assessment point
DISTANCES FOR PLOTS - 6	75	75	75	75			Can be adjusted
DISTANCES FOR PLOTS - 7	100	100	100	100			Can be adjusted
DISTANCES FOR PLOTS - 8	250	250	250	250			Can be adjusted
COMPLIANCE POINT TYPE	Groundwater Secondary Aquifer (A/B/Undifferentiated)						Select from List
TARGET CRITERIA	DWS						Rationale
RECEIVING WATER HARDNESS*							mg/l as CaCO3.
RECEIVING WATER FISH TYPE							Criteria for EQS Metals
WATER TYPE							Select from List
DATA SOURCE FOR RECEIVING WATER HARDNESS AND TYPE							Add Comment

STAGE 3 SOIL HORIZONTAL AND GROUNDWATER DISPERSION FACTORS

LONGITUDINAL DISPERSION FACTOR	0.1	0.1	0.1	0.1			
LATERAL DISPERSION FACTOR	0.01	0.01	0.01	0.01			
VERTICAL DISPERSION FACTOR	0.001	0.001	0.001	0.001			
LONGITUDINAL DISPERSION	5	5	5	5			
LATERAL DISPERSION	0.5	0.5	0.5	0.5			
VERTICAL DISPERSION	0.05	0.05	0.05	0.05			
TRANSVERSE DISPERSION REDUCTION FACTOR 1	1.0000	1.0000	1.0000	1.0000			
TRANSVERSE DISPERSION REDUCTION FACTOR 2	1.0000	1.0000	0.9953	0.9953			
TRANSVERSE DISPERSION REDUCTION FACTOR 3	1.0000	0.9996	0.8427	0.8427			
TRANSVERSE DISPERSION REDUCTION FACTOR 4	0.9990	0.9816	0.6542	0.6542			
TRANSVERSE DISPERSION REDUCTION FACTOR 5	0.9867	0.9229	0.5205	0.5205			
TRANSVERSE DISPERSION REDUCTION FACTOR 6	0.9010	0.7614	0.3626	0.3626			
TRANSVERSE DISPERSION REDUCTION FACTOR 7	0.7841	0.6232	0.2763	0.2763			
TRANSVERSE DISPERSION REDUCTION FACTOR 8	0.3794	0.2763	0.1125	0.1125			

HS* - Hot Spot Source

* Default hardness should be set to 0 unless site/receptor data is available

Dimensions

(a) - Based on delineation using analytical data (e.g. distance to nearest clean data point)

(b) - Based on known extent of site infrastructure (e.g. hotspot around tankfarm etc)

(c) - Other, described below

DESCRIPTION OF RECEPTORS

The principal controlled waters receptor for the site is considered to be the underlying Zig Zag Chalk Principal Aquifer which has been modelled in this assessment. Groundwater within the superficial deposits is also considered to be a secondary receptor. The surface water features in the vicinity of the site which consist Bearton Pond approximately 200m north and cross gradient of the site, the River Hiz, located approximately 850m east of the site and the River Oughton and River Purwell, located greater than 1km north/north-east of the site, and not considered as potential receptors based on their distance from the site.

Use Alt+Enter to get a new line

Key to Data Worksheets

All cells on the user data worksheets ("name" Data) are colour coded as follows.

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User Values		These worksheet cells can be edited directly and are specifically for values
Calculated Values		These worksheet cells contain calculated values and are protected. User values should not be entered directly into these cells.
User Values		These worksheet cells have been edited from the default formula. Justification to be provided.



**MODEL 1: CONCEPTUAL SITE MODEL
PART 4 - DILUTION**

Conceptual Model Set-Up - PART 4, DILUTION

Navigation Page

DILUTION: N/A

NOTES FOR DILUTION FACTORS

Dilution should only be considered when the following have been met;

The impact of groundwater contamination on the aquifer between source and receptor has been assessed

The impact does not prevent current or future use of the aquifer

The predicted impact at the receptor does not result in any measurable deterioration in water quality

The predicted impact at the receptor does not result in any exceedence of environmental standards

Needs to be supported by cost-benefit assessment

Dilution may not be suitable when;

No impact has been identified between the source and receptor

the aquifer has a high resource value

the current level of groundwater or surface water contamination is unacceptable

For dilution in streams the calculations should use low flow conditions (Q95 flow) and in addition;

needs to consider the total contaminant loading to the stream

whether impact would be detectable

upstream surface water quality

Consideration of potential impacts from other sources with subsequent reduction in target concentration

Currently assumes no attenuation of contaminants in river sediments

Dilution is site specific and needs to be treated with caution

Dilution at an abstraction well MUST NOT be used to back calculate remedial targets as the degree of risk

may increase in the future if abstraction rates change. It is therefore only a qualitative indication of

whether the current observed conditions present a significant risk

General Notes on Dilution



MODEL MODE:	PROBABILISTIC	0.95
-------------	---------------	------

GEOLOGY SUMMARY	The site consists of made ground underlain by Lowestoft Formation. This formation forms an extensive sheet of chalky till, together with outwash sands and gravels, silts and clays. The till is characterised by its chalk and flint content. The carbonate content of the till matrix is about 30%, and tills within the underlying Happisburgh Formation have less than 20%. The Bedrock Geology of the site is reported to be the Zig Zag Chalk Formation. This consists of mostly firm, pale grey to off-white blocky chalk with a lower part characterised by rhythmic alternations of marls and marly chalks with firm white chalk. Thin gritty, silty chalk beds act as markers in the sequence. The thickness is typically 35–50 m bgl.
HYDROGEOLOGY SUMMARY	The Environment Agency website classifies the superficial Lowestoft formation as Unproductive Strata. These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. The Environment Agency Website classifies the Zig Zag Chalk Formation as a Principal Aquifer. These are layers of rock or drift deposits that have high inter-granular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.
SURROUNDING LAND-USE AND SITE DESCRIPTION/HISTORY	North: STS Tyre Pros (Tyre Dealers) is situated approximately 5m north of the site beyond an access road. A three story apartment block with surrounding garden lies approximately 30m north of the site. South: The Fir Hotel lies approximately 5m south of the site beyond a small car parking area. Residential properties are situated approximately 30m south of the site. East: The site is bounded to the east by the A550 Bedford Road. Hitchin Town FC football ground is approximately 20m east of the site. West: The site is bounded to the west by a Garage and car park. Residential properties with gardens lie approximately 20m west the site.
DISTRIBUTIONS/JUSTIFICATION	Describe rationale for distribution choice if it differs from the defaults recommended in TGN04. 
ATTENUATION AND COMPLIANCE POINT JUSTIFICATION AND PRODUCT SUMMARY	A 50m compliance point has been used to assess potential risks to the aquifer from hazardous substances.

Model Parameter	Minimum Value 5%	Expected Value 50%	Maximum Value 95%	Truncate Min	Truncate Max	Distribution Type	Stochastic Input	Units	Source/Comments
UNSATURATED ZONE PARAMETERS									
Soil Type at Source	Silty Sand						4	Soil Type Database sheet to define site	Select from list. Use Soil Type Database sheet to define site specific parameters if required.
Soil Type Description								Brief summary of soil type	Brief summary of soil type
Unsaturated Zone Dry Bulk Density	1.54	1.6200	1.70	1.539	1.701	Triangular	1.62	g/cm ³	selected soil type. User specified values can be entered here
Water Filled Porosity	0.14	0.1500	0.16	0.143	0.158	Triangular	0.15	fraction	selected soil type. User specified values can be entered here
Air Filled Porosity	0.23	0.2400	0.25	0.228	0.252	Triangular	0.24	fraction	selected soil type. User specified values can be entered here
Vertical Velocity (Stage 1b)	0.37	0.3891	0.41	0.370	0.409	Triangular	0.39	m/yr	Calculated
Organic Carbon - Unsaturated Zone	0.37	0.73	1.10	0.365	1.095	Triangular	0.73	%	unsaturated zone data where available. Organic carbon should be adjusted for TPH content (10,000mg/kg = Geomean of 13 samples from BH101, BH102, BH103, BH105, BH106 & VP101 - 103.
Unsaturated Zone Thickness below Source	0.00	0.00	0.00	0.00	0.00	Triangular	0.00	m	significant thickness of clean soils identified in vadose zone
Unsaturated Zone Hydraulic Conductivity	0.75	1.00	1.25	0.750	1.250	Triangular	1.00	m/day	Only relevant if significant thickness of clean soils identified in vadose zone
Soil pH	-	n/a	-					pH units	Used for reference purposes only
Depth to Groundwater	3.10	6.20	12.40	3.10	12.40	Triangular	7.23	m	Used for reference purposes only
Soil Source Thickness	3.10	6.20	12.40	3.10	12.40	Triangular	7.23		source for isolated exceedences only
Land Use Type for Infiltration	Hard-Standing								Depth of deepest soil exceedance at BH101 5.4m
%Age of Rainfall Infiltrating	0.08	0.10	0.13	0.08	0.13	Triangular	0.10	fraction	options to determined %infiltration.
Annual Rainfall (Long-term Average)	0.44	0.584	0.73	0.44	0.73	Triangular	0.58	m/yr	selected by default based on surface covering. Only over-type if justification can be provided.
Infiltration Rate	0.033	0.058	0.091	0.03	0.09		0.06	m/yr	Based on Met Office or other appropriate data
Aquifer Conditions (see Degradation Worksheets)	Aerobic								Greenwich gauging station 1971-2000 - Met Office
Decay Type - Unsaturated Zone	No Decay								Calculated from Rainfall and recharge rate
							2		For site specific degradation rates follow the guidance provided. For default rates an assessment of the likely aquifer type is required using the provided worksheet and the end choice entered here.
							0		See Database_COC sheet for degradation
									0 - No Decay, 1 - Decay. See Database_COC sheet for degradation Rates

Model Parameter	Minimum Value 5%	Expected Value 50%	Maximum Value 95%	Truncate Min	Truncate Max	Distribution Type	Stochastic Input	Units	Source/Comments
SATURATED ZONE PARAMETERS									
URS Corporation Ltd									
DRAFT									

MODEL 1: MODEL INPUT PARAMETER SUMMARY

MODEL MODE:	PROBABILISTIC	0.95
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Soil Type in Saturated Zone	User Specified							9	Soil Type Database sheet to define site	Select from list. Use Soil Type Database sheet to define site specific parameters if required.
Soil Type Description									groundwater bearing geological unit	Description of Main groundwater bearing geological unit
Organic Carbon - Saturated Zone	0.023	0.045	0.12	0.02	0.12	Triangular	0.06	%	Organic carbon should be adjusted for TPH content (10,000mg/kg = 1%) i.e. Actual TOC = measured TOC	Site specific TOC results taken from soil samples from BH102A collected at 13.2m and 13.6m bgl in saturated zone.
Saturated Zone Dry Bulk Density	1.70	1.7900	1.9	1.70	1.88	Triangular	1.79	g/cm ³	selected soil type. User specified values can be used wherever possible	Default based on selected soil type. User specified values can be input and justified in the Soil Type Database. A summary of any adjustment should be entered here.
Hydraulic Conductivity	4.25	8.50	17.0	4.25	17.00	Triangular	9.92	m/day	Hydraulic Conductivity. If site specific values are available these may supersede literature	Calculated from the mean of slug test data from BH101, BH102, BH102A, BH103.
Hydraulic Gradient	0.0040	0.0050	0.0060	0.0040	0.0060	Triangular	0.0050	m/m	See note below on Hydraulic Gradient. Site specific gradients should be used wherever possible.	A gradient of 0.005 has been calculated for the site from monitoring wells screened in the Chalk and drift deposits in continuity with the Chalk. The gradient in the drift will be higher but cannot be measured with the current on site network. A gradient of 0.0075 has been assumed based on likely gradient over catchment to river.
Effective Porosity	0.15	0.20	0.25	0.150	0.250	Triangular	0.20	fraction	should be based on saturated geology type	Calculated based on porosity values from Fetter 1986
Aquifer Saturated Thickness	7.50	10.00	12.50	7.500	12.500	Triangular	10.00	m	specific data should be used wherever possible.	3m thickness based on BH102A where groundwater was encountered at 7m bgl and CLAY was encountered at 10m bgl.
Groundwater pH	-	7.59	-					pH units	Used for reference purposes only	Used for reference purposes only
Groundwater Eh	-	205.00	-					mV	Used for reference purposes only	Used for reference purposes only
Mixing Zone Thickness		3.60						m	for TPH. This value may be overwritten with site	Based on source term for TPH. This value may be overwritten with site specific data but must not exceed the saturated thickness. This value is generated for general information only
Groundwater Source Thickness		3.60						m	limited to thickness of 5m	Groundwater source limited to thickness of 20m. Source thickness can be input directly if required to minimise vertical dispersion from a groundwater source in the aquifer.
Groundwater Horizontal Velocity	0.113	0.213	0.408	0.113	0.408	Triangular	0.24	m/day	Calculated	Calculated values for general information
Dilution Factor in Aquifer		34.81							assessing dilution of porewater	Used for sense check for assessing dilution of porewater concentrations within the aquifer underlying the site. Probabilistic output which can be reviewed once simulation has been run
Decay Type - Saturated Zone	Default Decay							1	See Database COC sheet for degradation	0 - No Decay, 1 - Decay. See Database COC sheet for degradation Rates
Aquifer Conditions (see Degradation Worksheets)	Aerobic							2	For site specific degradation rates follow	For site specific degradation rates follow the guidance provided. For default rates an assessment of the likely aquifer type is required using the provided worksheet and the end choice entered here.
Decay Phase - Saturated Zone	All Phases								assumes all phases. For user specified this may be adjusted so	Default degradation assumes all phases. For user specified this may be adjusted so degradation only occurs in the dissolved phase. Note this applies to all contaminants so using a mixture of rates will require user specified values to be adjusted back in line with the retardation factor. This is not automated.

VERTICAL PATHWAY NOT CONSIDERED

Model Parameter	Minimum Value	Expected Value	Maximum Value	Truncate Min	Truncate Max	Distribution Type	Stochastic Input	Units	Source/Comments
UNDERLYING AQUIFER - STAGE 3 VERTICAL DEGRADATION CALCULATIONS									
Underlying Geology									groundwater bearing geological unit Description of Main groundwater bearing geological unit
Vertical Conductivity in Upper Aquifer								m/day	aquiclude. Default calculated as 1/10th Conductivity across aquiclude. Default calculated as 1/10th horizontal conductivity
Vertical Gradient across aquifers								m/m	can be adjusted based on site data Default value of 1 but can be adjusted based on site data
Groundwater Vertical Velocity (Stage 3 vert)								m/year	on recharge or vertical permeability being 1/10th Minimum velocity based on recharge or vertical permeability being 1/10th horizontal permeability of upper aquifer
Vertical Distance Through Saturated Aquifer								m	in which vertical Thickness through saturated aquifer in which vertical degradation will occur (Stage 3 vertical model)

Model Parameter	Minimum Value	Expected Value	Maximum Value	Truncate Min	Truncate Max	Distribution Type	Stochastic Input	Units	Source/Comments
UNDERLYING AQUIFER - STAGE 3 VERTICAL DILUTION CALCULATIONS									
Lower Aquifer Horizontal Hydraulic Conductivity								m/day	data or literature value if site data not available Should be based on site data or literature value if site data not available
Lower Aquifer Horizontal Hydraulic Gradient								m/m	data or topographic information if site data Should be based on site data or topographic information if site data not available
Lower Aquifer Effective Thickness								m	low value to minimise potential for over This should be kept to a low value to minimise potential for over estimating dilution

SIMULATION PARAMETERS						Please refer to GW Horizontal Time worksheet for code for calculating breakthrough times for contaminants and if necessary to reset the Time slices below to default Note: If user specified time intervals are entered the breakthrough time element will not function.
Time Periods	TIME SINCE RELEASE	TIME SINCE REMOVAL	PULSE CHECK	Benzene	LINK...	We have adopted the pragmatic approach that there is no feasible pathway for contaminants that theoretically take more than 10,000 years to migrate from source to point of compliance.
Pulse Duration						
Period 1	1					For non-steady state assessments the risk assessor is required to select appropriate timescales for the contaminants of concern. For pulse source and declining source solutions these will need to be based on contaminant retarded velocity and compliance point distance. The timescales can be re-set for each contaminant and output graphs generated to present the data accordingly. The risk assessor should acknowledge that the summary tables may only be appropriate in detail for a number of contaminants at a time (since the peak concentration under these conditions will occur at different times and for different durations. This model is not programmed to adjust timescales for individual contaminants, however, a Time Interval Worksheet is provided as a guide to selecting appropriate time intervals based on the contaminant and solution being considered.
Period 2	2					
Period 3	5					
Period 4	10					Example: Assume spill in 2006 for benzene. The contaminated soils were removed in 2008. Providing a soil source duration for a pulse of contamination of 2 years. The 2 year pulse is described on the Pathways sheet. The key contaminant of concern is benzene. Based on the site parameters and phys-chem parameters for benzene it is calculated that normal breakthrough at the receptor would take 2 years (Time interval 4 on Time Intervals sheet). To create a breakthrough curve that covers the time before and after source removal the time intervals sheet suggests ranging the time intervals between 0.2 and 6 years. These time intervals are then copied over to column C as the model times and the results to the
Period 5	50					
Period 6	100					

MODEL MODE:	PROBABILISTIC	0.95
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Period 7	1000					simulations reviewed.
Period 8	10000					

WATER BALANCE CHECK		Units	
Site Length	33	m	The local high point has been set at 700m southwest of the site on the boundary of the bolder clay at Foxholes. The area is hardstanding so infiltration has been set at 0.1.
Site Width	35	m	
Site Area	1155	m ²	
Groundwater Flow	17.35	m ³ /day	
Length of Catchment	700	m	
Area of Groundwater Catchment	24500	m ²	
Infiltration Rate	0.10	fraction	
Rainfall	0.584	m/year	
Adjustment Factor for flow not in main aquifer unit	0.20	-	
Total recharge	0.78	m ³ /day	
Recharge Factor	0.045	ratio	

Fraction of organic carbon

Site data is preferentially used.

If a literature value is required, the following sources will be considered:
P20, ConSim 2.02 manual, Barnes (2002).

Water/Air Filled Porosity Values

PSD and borehole log data used to classify soils to a USDA soil classification category

CLEA database values then selected by default.

These values may be over-written with user defined values if other reference is available

Infiltration

Total annual rainfall measured at the closest Met Office weather station, as listed on the Met Office Website (1971-2000 annual averages) will be used to estimate infiltration. 10 % or 25 % of the annual rainfall will be used in the QRA depending on the predicted end use. The 10% value can be associated with a run-off coefficient between 0.8 and 0.9, which is a range derived to represent a hard-standing area that is 70% or greater than the total site area. Therefore, this will be assigned to commercial and high-density residential end-uses. Low-density residential end-uses will be assigned a 25% infiltration rate.

Alternative rates will require further justification. Site specific recharge rates may be calculated using MORECS data (only appropriate where there is no hard standing).

Hydraulic Conductivity

Where the saturated pathway is a documented principal or secondary aquifer, the conductivity values listed in the major aquifer properties database (Allen et al, 1997) or the minor aquifer properties database (Jones et al, 2000) will be adopted where site specific data is unavailable. Where a classification of the saturated pathway is not available within these documents, a hydraulic conductivity value for the identified soil type or aquifer will be adopted from Fetter (1986).

Preference will be given to site derived data (eg slug tests) for shallow aquifers. Variability in permeability must be assessed for bedrock aquifers including preferential flow paths.

Hydraulic Gradient

The decision process for adopting the hydraulic gradient values on site are as follows: Plotting of URS obtained groundwater elevation monitoring data conducted at each site; Examining the relevant hydrogeological maps for each site where available to determine deeper aquifer gradients, and Examination of surface topography to determine the likely flow directions within the hydrological catchment of the site and, therefore, estimate the groundwater flow directions.

Effective Porosity

Where the main saturated pathway is a major or minor aquifer, the major aquifer properties database (Allen et al, 1997) or the minor aquifer properties database (Jones et al, 2000) will be used to derive the effective porosity.

Where no data is available, the effective porosity will be assumed to be equal to the specific yield and representative values will be adopted from those listed in Kruseman and de Ridder (1994, p 25, Table 3.1).

Aquifer Thickness

The aquifer thickness will be selected using the following data sources: Borehole log data, where the log data proves the aquifer thickness, the effective aquifer thickness' described in the major aquifer properties database (Allen et al, 1997) or the minor aquifer properties database (Jones et al, 2000).

Where none of the above data are available the greatest saturated depth of water column present in the onsite boreholes will be used as the aquifer thickness,

Where none of the above data are available a default aquifer thickness of 5 m will be adopted.

Additional Notes for Site

Include any additional details regarding source/pathway/receptor assumptions and any additional observations about the data/CSM and whether specific conservative assumptions have been made in relation to the assessment.

MODEL 1: INPUT CONCENTRATIONS



Navigation Page

TPH: Adjusted TPH Data Incorporated, Refer to TPH Review Sheets for detail

Order	Group	Determinand	Select	DWS / Freshwater	PhysChem	Reported Soil Conc	Model Soil Conc	Calculated Leachate Conc	Reported Leachate Conc	Model Leachate Conc	Product Conc	Reported GW Conc	GW Conc / DF	Model GW Conc	SW Conc	Comments	List 1 or 2 substance	Solubility Limit	Soil Saturation Limit	Soil Source Zone (1, 2 or 3)	GW Source Zone (1, 2 or 3)
1.01	TPH 1	TPH (<EC5-7) aromatic (1)	Y	µg/l		mg/kg	mg/kg	µg/l	µg/l	µg/l	µg/l	µg/l	98	µg/l	µg/l		1	µg/l	mg/kg	1	1
1.02	TPH 1	TPH (<EC7-8) aromatic (1)	Y	1.00E+01	Present	-	-	-	-	-	-	5.37E+02	5.46E+00	5.46E+00	-		1	1.80E+06	1116.37	1	1
1.03	TPH 1	TPH (<EC8-10) aromatic (1)	Y	7.00E+02	Present	-	-	-	-	-	-	3.92E+02	3.98E+00	3.98E+00	-		1	1.30E+05	208.01	1	1
1.04	TPH 1	TPH (<EC10-12) aromatic (1)	Y	3.00E+02	Present	0.31	0.31	2.66E+01	-	-	-	1.96E+04	1.99E+02	1.99E+02	-		1	6.50E+04	760.49	1	1
1.05	TPH 1	TPH (<EC12-16) aromatic (1)	Y	9.00E+01	Present	0.37	0.37	1.98E+01	-	-	-	4.82E+03	4.90E+01	4.90E+01	-		1	2.50E+04	461.00	1	1
1.06	TPH 1	TPH (<EC16-21) aromatic (1)	Y	9.00E+01	Present	52.40	52.40	1.43E+03	-	-	-	2.12E+03	2.15E+01	2.15E+01	-		1	5.80E+03	212.75	1	1
1.07	TPH 1	TPH (<EC21-35) aromatic (1)	Y	9.00E+01	Present	271.00	67.09	6.50E+02	-	-	-	6.17E+02	6.27E+00	6.27E+00	-		1	6.50E+02	67.09	1	1
1.08	TPH 1	TPH (<EC5-6) aliphatic (1)	Y	9.00E+01	Present	641.00	6.07	6.60E+00	-	-	-	3.07E+02	3.12E+00	3.12E+00	-		1	6.60E+00	6.07	1	1
1.09	TPH 1	TPH (<EC6-8) aliphatic (1)	Y	1.50E+04	Present	0.02	0.02	2.22E+00	-	-	-	1.51E+03	1.53E+01	1.53E+01	-		1	3.60E+04	328.95	1	1
1.1	TPH 1	TPH (<EC8-10) aliphatic (1)	Y	1.50E+04	Present	0.15	0.15	4.64E+00	-	-	-	6.35E+03	6.45E+01	6.45E+01	-		1	5.40E+03	172.21	1	1
1.11	TPH 1	TPH (<EC10-12) aliphatic (1)	Y	3.00E+02	Present	0.38	0.38	1.67E+00	-	-	-	9.34E+03	9.49E+01	9.49E+01	-		1	4.30E+02	97.48	1	1
1.12	TPH 1	TPH (<EC12-16) aliphatic (1)	Y	3.00E+02	Present	0.55	0.55	3.11E+01	-	-	-	7.23E+03	7.35E+01	7.35E+01	-		1	3.40E+01	59.87	1	1
1.13	TPH 1	TPH (<EC16-21) aliphatic (1)	Y	3.00E+02	Present	77.70	29.81	7.60E+01	-	-	-	1.95E+03	1.98E+01	1.98E+01	-		1	7.60E+01	29.81	1	1
1.14	TPH 1	TPH (<EC21-35) aliphatic (1)	Y	1.00E+01	Present	223.00	11.52	2.50E+03	-	-	-	7.82E+02	7.74E+00	7.74E+00	-		1	2.50E+03	11.52	1	1
1.2	TPH 1	TOTAL TPH (1)	Y	1.00E+01	Present	411.00	411.00	7.42E+03	-	-	-	7.66E+02	7.78E+00	7.78E+00	-		1	8.91E+02	4937.03	1	1
2	BTEX	Benzene	Y	No Criterion	Present	1.68E+03	5.80E+02	2.14E+03	-	-	-	5.63E+04	5.72E+02	5.33E+02	-		1	-	-	1	1
2.01	BTEX	Toluene	Y	1.00E+00	Present	0.00	0.00	3.68E+00	-	-	-	7.68E+02	7.80E+00	7.80E+00	-		1	1.78E+06	1073.80	3	1
2.02	BTEX	Ethylbenzene	Y	7.00E+02	Present	0.01	0.01	7.07E+00	-	-	-	4.65E+02	4.73E+00	4.73E+00	-		1	5.90E+05	943.31	1	1
2.03	BTEX	Xylenes	Y	3.00E+02	Present	0.01	0.01	2.35E+00	-	-	-	3.76E+03	3.82E+01	3.82E+01	-		1	1.69E+05	570.59	1	1
3	PAH	Acenaphthene	Y	5.00E+02	Present	0.02	0.02	4.77E+00	-	-	-	1.24E+04	1.26E+02	1.26E+02	-		1	2.00E+05	683.84	1	1
3	PAH	Acenaphthylene	Y	2.20E+03	Present	20.90	20.90	1.21E+03	-	-	-	2.35E+00	2.39E+02	2.39E+02	-		1	3.80E+03	65.38	2	1
3	PAH	Anthracene	Y	1.00E+01	Present	1.76	1.76	1.32E+02	-	-	-	7.53E-01	7.65E-03	7.65E-03	-		1	1.61E+04	215.36	2	1
3	PAH	Benzo(a)anthracene	Y	1.10E+04	Present	17.80	1.85	4.50E+01	-	-	-	1.43E+00	1.45E-02	1.45E-02	-		1	4.50E+01	1.85	2	1
3	PAH	Benzo(a)pyrene	Y	2.90E-02	Present	23.40	2.15	3.80E+00	-	-	-	4.95E-01	5.03E-03	5.03E-03	-		1	3.80E+00	2.15	2	1
3	PAH	Benzo(b)fluoranthene	Y	1.00E-02	Present	23.90	3.58	3.80E+00	-	-	-	3.59E-01	3.65E-03	3.65E-03	-		1	3.80E+00	3.58	2	1
3	PAH	Benzo(g,h,i)perylene	Y	2.50E-02	Present	26.70	1.53	2.00E+00	-	-	-	3.72E-02	3.78E-04	3.78E-04	-		1	2.00E+00	1.53	2	1
3	PAH	Benzo(k)fluoranthene	Y	2.50E-02	Present	13.70	0.79	2.60E-01	-	-	-	2.33E-02	2.37E-04	2.37E-04	-		1	2.60E-01	0.79	2	1
3	PAH	Chrysene	Y	2.50E-02	Present	9.62	0.86	8.00E-01	-	-	-	4.31E-02	4.38E-04	4.38E-04	-		1	8.00E-01	0.86	2	1
3	PAH	Dibenz(a,h)anthracene	Y	2.90E+00	Present	17.30	0.80	2.00E+00	-	-	-	6.39E-01	6.49E-03	6.49E-03	-		1	2.00E+00	0.80	2	1
3	PAH	Fluoranthene	Y	2.90E-03	Present	3.44	0.82	6.00E-01	-	-	-	-	-	-	-		1	6.00E-01	0.82	2	1
3	PAH	Fluorene	Y	2.00E-01	Present	55.60	30.58	2.30E+02	-	-	-	1.21E+00	1.23E-02	1.23E-02	-		1	2.30E+02	30.58	2	1
3	PAH	Indeno(1,2,3-cd)pyrene	Y	1.50E+03	Present	17.70	17.70	8.56E+02	-	-	-	5.51E+00	5.60E-02	5.60E-02	-		1	1.90E+03	39.27	2	1
3	PAH	Naphthalene	Y	2.50E-02	Present	11.70	0.13	2.00E-01	-	-	-	2.16E-02	2.20E-04	2.20E-04	-		1	2.00E-01	0.13	2	1
3	PAH	Phenanthrene	Y	1.00E+00	Present	4.20	4.20	8.74E+02	-	-	-	5.60E+02	5.69E+00	5.69E+00	-		1	1.90E+04	91.33	2	1
3	PAH	Pyrene	Y	1.00E+01	Present	62.70	44.23	1.10E+03	-	-	-	7.34E+00	7.46E-02	7.46E-02	-		1	1.10E+03	44.23	2	1
4	METALS	Arsenic	Y	1.10E+03	Present	46.50	15.39	1.30E+02	-	-	-	2.11E+00	2.14E-02	2.14E-02	-		1	1.30E+02	15.39	2	1
4	METALS	Boron	Y	1.00E+01	Present	21.90	21.90	4.38E+01	-	-	-	-	-	-	-		2	1.70E+07	8501574.07	2	1
4	METALS	Cadmium	Y	1.00E+03	Present	13.60	13.60	1.35E+03	-	-	-	-	-	-	-		2	5.50E+08	5550925.93	2	1
4	METALS	Chromium III	Y	5.00E+00	Present	8.75E-01	0.88	8.74E+00	-	-	-	-	-	-	-		1	5.70E+08	57052777.78	2	1
4	METALS	Cobalt	Y	5.00E+01	Present	31.10	31.10	6.48E+00	-	-	-	-	-	-	-		2	6.29E+08	3019258240.74	2	1
4	METALS	Copper	Y	1.10E+01	Present	1.05E+01	10.50	2.33E+02	-	-	-	-	-	-	-		2	1.40E+07	631296.30	2	1
4	METALS	Lead	Y	2.00E+03	Present	106.00	106.00	1.06E+03	-	-	-	-	-	-	-		2	8.00E+04	8007.41	2	1
4	METALS	Molybdenum	Y	2.50E+01	Present	128.00	128.00	3.56E+00	-	-	-	-	-	-	-		2	5.00E+01	1800.00	2	1
4	METALS	Nickel	Y	2.00E+01	Present	0.29	0.29	1.46E+01	-	-	-	-	-	-	-		2	4.90E+05	9845.37	2	1
4	METALS	Tin	Y	2.00E+01	Present	37.50	37.50	7.50E+01	-	-	-	-	-	-	-		2	1.90E+05	95017.59	2	1
4	METALS	Zinc	Y	2.20E+04	Present	12.20	3.18	1.27E+01	-	-	-	-	-	-	-		2	1.27E+01	3.18	2	1
4	METALS	Zinc	Y	5.00E+03	Present	230.00	230.00	6.04E+03	-	-	-	-	-	-	-		1	1.62E+07	617100.00	2	1



URS site-specific controlled waters risk assessment tool

designed on the principles and methodologies contained within EA Remedial Targets Methodology, 2006



MODEL 1: DATABASES

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Version: CWRA, version 7.292min

Date: 13/07/2011

MODEL 1: PHYSICO-CHEMICAL DATA



Navigation Page

Option to update for polar compounds to calculate Koc values
Option to provide range of values for use in probabilistic assessment

Order	Group	Determinand	Select	Chemical Type	Molecular Weight	Source	Henry's Law Constant	Source	Henry's Law Constant Reference Temperature	Source	Organic C - water partition coefficient (Koc)	Source	Inorganic Substance Soil -water Partition Coefficient	Source	Aqueous Solubility (S)	Aqueous Solubility Reference Temperature	Source	Retardation Factor
			Y		(g.mol-1)		(unitless)		(K)		(ml/g)		cm3.g-1		(mg/l)	(K)		
1.01	TPH 1	TPH (>EC5-7) aromatic (1)	Y	Organic	78.1	cb	2.30E-01	CC	283.0	h calc	6.78E+01	LQ			1.80E+03	293.2	b	1.3
1.02	TPH 1	TPH (>EC7-8) aromatic (1)	Y	Organic	92.0	g	1.15E-01	LQ	283.0	h calc	2.04E+02	LQ			1.30E+02	298.2	g	1.8
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	Organic	116.0	g	2.53E-01	LQ	283.0	h calc	1.58E+03	LQ			6.50E+01	298.2	g	7.4
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	Organic	126.0	g	7.22E-02	LQ	283.0	h calc	2.51E+03	LQ			2.50E+01	298.2	g	11.1
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	Organic	145.0	g	1.26E-02	LQ	283.0	h calc	5.01E+03	LQ			5.80E+00	298.2	g	21.2
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	Organic	168.0	g	6.95E-04	LQ	283.0	h calc	1.41E+04	LQ			6.50E-01	298.2	g	57.9
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	Organic	239.0	g	2.48E-05	LQ	283.0	h calc	1.29E+05	LQ			6.60E-03	298.2	g	508.0
1.08	TPH 1	TPH (>EC5-8) aliphatic (1)	Y	Organic	81.0	g	2.10E+01	LQ	283.0	h calc	8.19E+02	LQ			3.60E+01	298.2	j	4.3
1.09	TPH 1	TPH (>EC8-8) aliphatic (1)	Y	Organic	102.0	g	2.73E+01	LQ	283.0	h calc	3.80E+03	LQ			5.40E+00	298.2	g	16.3
1.10	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	Organic	130.0	g	4.15E+01	LQ	283.0	h calc	3.02E+04	LQ			4.30E-01	298.2	g	122.6
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	Organic	159.0	g	6.44E+01	LQ	283.0	h calc	2.40E+05	LQ			3.40E-02	298.2	g	967.1
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	Organic	200.0	g	1.71E+02	LQ	283.0	h calc	5.37E+06	LQ			7.60E-04	298.2	g	21630.0
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	Organic	269.0	g	4.90E+03	g	283.0	h calc	6.31E+08	g			2.50E-06	298.2	g	2541181.7
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	Organic	392.0	g	2.00E+04	CC	283.0	h calc	7.59E+09	LQ			8.91E-05	298.2	g	30568726.0
1.20	TPH 1	TOTAL TPH (1)	Y	Organic	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	BTEX	Benzene	Y	Organic	78.1	k	1.16E-01	SR7	283.0	k	6.78E+01	SR7			1.79E+03	283.0	SR7	1.3
2.01	BTEX	Toluene	Y	Organic	92.2	k	1.15E-01	SR7	283.0	k	2.04E+02	SR7			5.90E+02	283.0	SR7	1.8
2.02	BTEX	Ethylbenzene	Y	Organic	106.2	k	1.39E-01	SR7	283.0	k	4.47E+02	SR7			1.69E+02	298.2	SR7	2.8
2.03	BTEX	Xylenes	Y	Organic	106.0	cb	1.04E-01	SR7	283.0	c	4.54E+02	SR7			2.00E+02	298.2	cb	2.8
3	PAH	Acenaphthene	Y	Organic	154.2	k	7.59E-04	LQ	283.0	k	2.34E+03	LQ			3.80E+00	298.2	k	10.4
3	PAH	Acenaphthylene	Y	Organic	152.2	k	5.68E-04	LQ	283.0	k	1.82E+03	LQ			1.61E+01	298.2	k	8.3
3	PAH	Anthracene	Y	Organic	178.2	k	1.81E-04	LQ	283.0	k	5.62E+03	LQ			4.50E-02	298.2	k	23.6
3	PAH	Benzo(a)anthracene	Y	Organic	228.3	k	3.16E-05	SR7	283.0	k	7.76E+04	LQ			3.80E-03	298.2	SR7	313.5
3	PAH	Benzo(a)pyrene	Y	Organic	252.3	k	1.76E-06	SR7	283.0	k	1.29E+05	LQ			3.80E-03	298.2	SR7	520.5
3	PAH	Benzo(b)fluoranthene	Y	Organic	252.3	k	2.05E-06	SR7	283.0	k	1.05E+05	LQ			2.00E-03	293.2	SR7	423.9
3	PAH	Benzo(g,h,i)perylene	Y	Organic	276.3	k	2.86E-06	LQ	283.0	k	4.17E+05	LQ			2.60E-04	298.2	SR7	1680.5
3	PAH	Benzo(k)fluoranthene	Y	Organic	252.3	k	1.74E-06	SR7	283.0	k	1.48E+05	LQ			8.00E-04	298.2	SR7	597.1
3	PAH	Chrysene	Y	Organic	228.3	k	3.18E-06	SR7	283.0	k	5.50E+04	LQ			2.00E-03	298.2	SR7	222.3
3	PAH	Dibenzo(a,h)anthracene	Y	Organic	278.4	k	5.40E-06	SR7	283.0	k	1.86E+05	LQ			6.00E-04	298.2	SR7	751.0
3	PAH	Fluoranthene	Y	Organic	202.3	k	6.29E-05	SR7	283.0	k	1.82E+04	LQ			2.30E-01	298.2	SR7	74.3
3	PAH	Fluorene	Y	Organic	166.2	k	4.12E-04	LQ	283.0	k	2.82E+03	LQ			1.90E+00	298.2	k	12.4
3	PAH	Indeno[1,2,3-cd]pyrene	Y	Organic	276.3	k	2.05E-06	SR7	283.0	k	8.71E+04	LQ			2.00E-04	293.2	SR7	351.8
3	PAH	Naphthalene	Y	Organic	128.2	k	6.62E-03	SR7	283.0	k	6.46E+02	LQ			1.90E+01	283.0	SR7	3.6
3	PAH	Phenanthrene	Y	Organic	178.2	k	1.43E-04	LQ	283.0	k	5.50E+03	LQ			1.10E+00	298.2	k	23.1
3	PAH	Pyrene	Y	Organic	202.3	k	5.64E-05	SR7	283.0	k	1.62E+04	LQ			1.30E-01	298.2	SR7	66.2
4	METALS	Arsenic	Y	Inorganic	74.9	cb							500	0201/Arsenic	1.70E+04	289.2	cb calc	
4	METALS	Boron	Y	Inorganic	10.8	cb							10.0	01/CIENH2	5.50E+05	398.2	cb calc	
4	METALS	Cadmium	Y	Inorganic	112.4	cb							100.0	0201/Cadmium	5.70E+05	283.2	cb calc	
4	METALS	Chromium III	Y	Inorganic	52.0	cb							4800	cc	6.29E+05			
4	METALS	Cobalt	Y	Inorganic	58.9	cb							45.0	cc	1.40E+04	298.2	cb calc	
4	METALS	Copper	Y	Inorganic	63.7	cb							100.0	CLEA UK	8.00E+01	291.2		
4	METALS	Lead	Y	Inorganic	207.2	cb							36000.0	CLEA UK	5.00E-02			
4	METALS	Molybdenum	Y	Inorganic	96.0	cb							20	OR	4.90E+02	298.2	cb calc	
4	METALS	Nickel	Y	Inorganic	58.7	cb							500.0	0201/Nickel	1.90E+02	283.0	cb calc	
4	METALS	Tin	Y	Inorganic	118.7	cb							250	cc	1.27E-02	288.2	cb calc	
4	METALS	Zinc	Y	Inorganic	65.4	cb							38.00	01/CIENH2	1.62E+04	293.2	cb calc	

MODEL 1: PHYSICO-CHEMICAL DATA



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Option to update for polar compounds to calculate Koc values
Option to provide range of values for use in probabilistic assessment

Order	Group	Determinand	Select	Chemical Type	Molecular Weight	Source	Henry's Law Constant	Source	Henry's Law Constant Reference Temperature	Source	Organic C - water partition coefficient (Koc)	Source	Inorganic Substance Soil -water Partition Coefficient	Source	Aqueous Solubility (S)	Aqueous Solubility Reference Temperature	Source	Retardation Factor
			Y		(g.mol-1)		(unitless)		(K)		(ml/g)		cm3.g-1		(mg/l)	(K)		

KEY TO NOTES

CC	h calc, compensated to 10C using Clausius-Clapeyron relationship
b	European Chemicals Bureau European Chemical Substances Information System (ESIS) (web-based) http://ecb.jrc.it/esis/
c	US EPA 2003 User's Guide for Evaluating Subsurface Vapour Intrusion into Buildings
cb	www.toxnet.nlm.nih.gov
cc	2001, USEPA, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft.
d	Mackay, D, Wan-Ying, S., Kuo-Ching, M. 1997. Illustrated Handbook of Physical-Chemical Properties and Environmental Fate for Organic Chemicals. CRC Press LLC, Florida.
e	2001, US Department of Energy, Comments on Draft Supplemental Guidance for Dermal Risk Assessment Risk Assessment Guidance for Superfund, Volume I, Part E.
e est	2001, US Department of Energy, Comments on Draft Supplemental Guidance for Dermal Risk Assessment Risk Assessment Guidance for Superfund, Volume I, Part E.
g est	Gustafson, J.B., Tell, J.G., Orem, D., Selection of Representative TPH Fractions Based on Fate and Transport Considerations, Volume 3, Total Petroleum Hydrocarbon Criteria Working Group Series. (table 4)
j	1999, Vorhees, D.J., Weisman, W.H., Gustafson, Human Health Risk-Based Evaluation of Petroleum Release Sites: Implementing the Working Group Approach, Volume 5, Total Petroleum Hydrocarbon Criteria Working group.
f	CLR10
g	Gustafson, J.B., Tell, J.G., Orem, D., Selection of Representative TPH Fractions Based on Fate and Transport Considerations, Volume 3, Total Petroleum Hydrocarbon Criteria Working Group Series. (table 8)
h	EU 1998, Technical Guidance Document in Support of Commission Directive 93/67/EEC on Risk Assessments for New Notified Substance and Commission Regulations, EC.
Water9	Water 9 database, the same as used for US EPA SSLs.
ce or bayes	Baas.C.F., Sharp R.D., Sjoreen A.L., Shor R.W., (1984) A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture, Oak Ridge National laboratory for the US DoE
k	Review of the Fate and Transport of Selected Contaminants in the Soil Environment, Draft R&D Technical Report P5-079/TR1
m	WHO (2003) CICAD 55
n	RIVM (2001) Technical evaluation of the Intervention Values for soil/sediment and Groundwater, Report 711701-023
calc est	US EPA 2001, Factsheet: Correcting the Henry's Law Constant for Soil Temperature, June 2001
X	Other reference - please refer to report and/or master contaminant list held on T:\Bristol-Technical/Controlled Water/Contaminant Data\
unless	Unless Henry's Law constants are adjusted based on the dimensioned constant multiplied by 42.3 as stipulated in the remedial targets methodology to correct to 15oC
LQ	LQM/CIEH 2009, Temperature corrected to 10oC
OR	Baas.C.F., Sharp R.D., Sjoreen A.L., Shor R.W., (1984) A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture, Oak Ridge National laboratory for the US Department of Energy.
URS	Physchem data from review of oxygenate information ref Shell oxygenates - www search version 4 spreadsheet dated 1/11/10
SR7	Science Report - SC050021/SR7

MODEL 1: CRITERIA SUMMARY



Navigation Page

Order	Group	Determinand	Select	Site Specific	Aquifer Protection		Drinking Water Standards (µg/l)													Aquifer		DWS FINAL				
					Groundwater Quality Protection	Notes	UK DWS (2000)	Notes	SCOTLAND DWS (2000)	Notes	Irish (2007) DWS	Notes	Irish (2007) IGV	Notes	WHO DWG	Notes	Calculated Value	Notes	USEPA Region 9 (pathway specific, Tap Water, 2008)	Notes	Protection Value	DWS (µg/l)	DWS (µg/l)	DWS (µg/l)	DWS (µg/l)	DWS (µg/l)
																					ALL	IRELAND	SCOTLAND	ENGLAND/WALES	SELECTED	
1.01	TPH 1	TPH (>EC5-7) aromatic (1)	Y	-		-		-		-		-		10.0	2008 WHO DWG	-		-		10.0	10.0	10.0	10.0	10.0		
1.02	TPH 1	TPH (>EC7-8) aromatic (1)	Y	-		-		-		-		-		700.0	2008 WHO DWG	-		-		700.0	700.0	700.0	700.0	700.0		
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	-		-		-		-		-		300.0	2008 WHO DWG	-		-		300.0	300.0	300.0	300.0	300.0		
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	-		-		-		-		-		90.0	2008 WHO DWG	-		-		90.0	90.0	90.0	90.0	90.0		
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	-		-		-		-		-		90.0	2008 WHO DWG	-		-		90.0	90.0	90.0	90.0	90.0		
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	-		-		-		-		-		90.0	2008 WHO DWG	-		-		90.0	90.0	90.0	90.0	90.0		
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	-		-		-		-		-		90.0	2008 WHO DWG	-		-		90.0	90.0	90.0	90.0	90.0		
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	-		-		-		-		-		15,000.0	2008 WHO DWG	-		-		15,000.0	0.0	15,000.0	15,000.0	15,000.0		
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	-		-		-		-		-		15,000.0	2008 WHO DWG	-		-		15,000.0	15,000.0	15,000.0	15,000.0	15,000.0		
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	-		-		-		-		-		300.0	2008 WHO DWG	-		-		300.0	300.0	300.0	300.0	300.0		
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	-		-		-		-		-		300.0	2008 WHO DWG	-		-		300.0	300.0	300.0	300.0	300.0		
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	-		-		-		-		-		300.0	2008 WHO DWG	-		-		300.0	300.0	300.0	300.0	300.0		
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	-		-		-		-		-		10.0	Burrogate of lowest value	-		-		10.0	10.0	10.0	10.0	10.0		
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	-		-		-		-		-		10.0	Burrogate of lowest value	-		-		10.0	10.0	10.0	10.0	10.0		
1.2	TPH 1	TOTAL TPH (1)	Y	-		-		-		-		-		-		-		-		No criterion	No Criterion	No Criterion	No Criterion	No Criterion		
2	BTEX	Benzene	Y	-	0.75	ECEO2010	1.0	Water, England and Wales, Water Supply Regs, 2010. At consumers tap.	1.0		1.0		1.0		10.0	4-ATO	-		0.4		0.8	1.0	1.0	1.0	1.0	
2.01	BTEX	Toluene	Y	-	700.0	RPV	700.0	WHO Value	700.0	RPV value from WAT-PS-10-01	-		10.0		700.0	4-ATO	-		2,300.0		700.0	10.0	700.0	700.0	700.0	
2.02	BTEX	Ethylbenzene	Y	-	300.0	RPV	300.0	WHO Value	300.0	RPV value from WAT-PS-10-01	-		10.0		300.0	4-ATO	-		1.5		300.0	10.0	300.0	300.0	300.0	
2.03	BTEX	Xylenes	Y	-	500.0	ECEO2010	500.0	Sum o-xylene and m,p-xylene and use criteria for "Xylenes"	500.0	Sum o-xylene and m,p-xylene and use criteria for "Xylenes"	-		10.0		500.0		-		1,500.0		500.0	10.0	500.0	500.0	500.0	

MODEL 1: CRITERIA SUMMARY



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					Aquifer Protection		Drinking Water Standards (µg/l)														Aquifer		DWS FINAL				
Order	Group	Determinand	Select	Site Specific	Groundwater Quality Protection	Notes	UK DWS (2000)	Notes	SCOTLAND DWS (2000)	Notes	Irish (2007) DWS	Notes	Irish (2007) IGW	Notes	WHO DWG	Notes	Calculated Value	Notes	USEPA Region 9 (pathway specific, Tap Water, 2006)	Notes	Protection Value	DWS (µg/l)	DWS (µg/l)	DWS (µg/l)	DWS (µg/l)	DWS (µg/l)	
																					ALL	IRELAND	SCOTLAND	ENGLAND & WALES	SELECTED		
3	PAH	Acenaphthene	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,200.0	-	2,200.0	2,200.0	2,200.0	2,200.0	2,200.0		
3	PAH	Acenaphthylene	Y	-	-	-	10.0	EU DWS for TPH applied for conservation	-	-	-	-	-	-	-	-	-	-	-	-	10.0	10.0	10.0	10.0	10.0		
3	PAH	Anthracene	Y	-	-	-	-	-	-	-	-	-	10,000.0	-	-	-	-	-	11,000.0	-	11,000.0	10,000.0	11,000.0	11,000.0	11,000.0		
3	PAH	Benzo(a)anthracene	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.029	-	0.0	0.0	0.03	0.0	0.0		
3	PAH	Benzo(a)pyrene	Y	-	7.50	ECEO2010	0.01	Water, England and Wales, Water Supply Regs, 2010. At consumers taps.	0.01	-	0.01	-	0.01	-	0.7	-	-	-	0.0029	-	7.5	0.010	0.010	0.010	0.010		
3	PAH	Benzo(b)fluoranthene	Y	-	-	-	0.025	Sum of 4 specified nitrovl. For assessment purposes 1/4 of the target criteria is applied to each compound	0.025	Sum of 4 specified nitrovl. For assessment purposes 1/4 of the target criteria is applied to each compound	-	-	0.5	-	-	-	-	-	0.03	-	0.0	0.5	0.025	0.025	0.025		
3	PAH	Benzo(g,h,i)perylene	Y	-	-	-	0.025	Sum of 4 specified nitrovl. For assessment purposes 1/4 of the target criteria is applied to each compound	0.025	Sum of 4 specified nitrovl. For assessment purposes 1/4 of the target criteria is applied to each compound	-	-	0.05	-	-	-	-	-	-	-	0.0	0.1	0.025	0.025	0.025		
3	PAH	Benzo(k)fluoranthene	Y	-	-	-	0.025	Sum of 4 specified nitrovl. For assessment purposes 1/4 of the target criteria is applied to each compound	0.025	Sum of 4 specified nitrovl. For assessment purposes 1/4 of the target criteria is applied to each compound	-	-	0.05	-	-	-	-	-	0.29	-	0.0	0.1	0.025	0.025	0.025		
3	PAH	Chrysene	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.9	-	2.9	2.9	2.9	2.9	2.9		
3	PAH	Dibenz(a,h)anthracene	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0029	-	0.0	0.003	0.003	0.003	0.003		
3	PAH	Fluoranthene	Y	-	-	-	0.2	EEC MAC 1980	-	-	-	-	1.0	-	WHO note (L)	-	-	-	1,500.0	-	0.2	1,000	0.200	0.200	0.200		
3	PAH	Fluorene	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,500.0	-	1,500.0	1,500.0	1,500.0	1,500.0	1,500.0		
3	PAH	Indeno[1,2,3-cd]pyrene	Y	-	-	-	0.025	Sum of 4 specified nitrovl. For assessment purposes 1/4 of the target criteria is applied to each compound	0.025	Sum of 4 specified nitrovl. For assessment purposes 1/4 of the target criteria is applied to each compound	-	-	0.05	-	-	-	-	-	0.029	-	0.0	0.050	0.025	0.025	0.025		
3	PAH	Naphthalene	Y	-	-	-	1.0	Irish IGW used as surrogate	-	-	-	-	1.0	-	-	-	-	-	0.14	-	1.0	1.0	1.0	1.0	1.0		
3	PAH	Phenanthrene	Y	-	-	-	10.0	EU DWS for TPH applied for conservation	-	-	-	-	-	-	-	-	-	-	-	-	10.0	10.0	10.0	10.0	10.0		
3	PAH	Pyrene	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,100.0	-	1,100.0	1,100.0	1,100.0	1,100.0	1,100.0		
4	METALS	Arsenic	Y	-	7.5	ECEO2010	10.0	Water, England and Wales, Water Supply Regs, 2010. At consumers taps.	10.0	µgAs/l	10.0	-	-	-	10.0	(P)	-	-	0.045	-	7.5	10.0	10.0	10.0	10.0		
4	METALS	Boron	Y	-	750.0	ECEO2010	1,000.0	Water, England and Wales, Water Supply Regs, 2010. At consumers taps.	1,000.0	µgB/l	1,000.0	1,000.0	1,000.0	500.0	(P)	-	-	-	7,300.0	-	750.0	1,000.0	1,000.0	1,000.0	1,000.0		
4	METALS	Cadmium	Y	-	3.8	ECEO2010	5.0	Water, England and Wales, Water Supply Regs, 2010. At consumers taps.	5.0	µgCd/l	5.0	5.0	5.0	3.0	-	-	-	-	18.0	-	3.8	5.0	5.0	5.0	5.0		
4	METALS	Chromium III	Y	-	37.5	ECEO2010	50.0	Water, England and Wales, Water Supply Regs, 2010. At consumers taps.	50.0	µgCr/l	50.0	50.0	30.0	50.0	(P)	-	-	-	55,000.0	-	37.5	50.0	50.0	50.0	50.0		
4	METALS	Cobalt	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11.0	USEPA Tap Water PRG	-	11.0	11.0	11.0	11.0		
4	METALS	Copper	Y	-	1,500	ECEO2010	2,000	Water, England and Wales, Water Supply Regs, 2010. At consumers taps.	2,000	µgCu/l Note: (I)	2,000.0	Note: (I)	30.0	Note: (I)	2,000.0	(P)	-	-	1,500.0	-	1,500.0	2,000.0	2,000.0	2,000.0	2,000.0		
4	METALS	Lead	Y	-	18.75	ECEO2010	25.0	Water, England and Wales, Water Supply Regs, 2010. At consumers taps. Dropping to 10 after 25th December 2013.	25.0	µgPb/l Note: (I) & (L)	25.0	Note: (I), (L), (X)	10.0	-	10.0	-	-	-	15,000.0	-	18.8	25.0	25.0	25.0	25.0		

MODEL 1: CRITERIA SUMMARY



Navigation Page

				Aquifer Protection				Drinking Water Standards (µg/l)												Aquifer		DWS FINAL				
Order	Group	Determinand	Select	Site Specific	Notes	UK DWS (2000)	Notes	SCOTLAND DWS (2000)	Notes	Irish (2007) DWS	Notes	Irish (2007) IGV	Notes	WHO DWG	Notes	Calculated Value	Notes	USEPA Region 9 (pathway specific, Tap Water, 2006)	Notes	Protection Value	DWS (µg/l)	DWS (µg/l)	DWS (µg/l)	DWS (µg/l)	DWS (µg/l)	
			Y																	ALL	IRELAND	SCOTLAND	ENGLAND-WALES	SELECTED		
4	METALS	Molybdenum	Y	-	15.0 ECEO2010	20.0	Water, England and Wales, Water Supply Regs. 2010 - At consumers taps. Dropping to 10 after 25th December 2013	20.0	µg/l1 Note (i)	20.0	Note (i)	20.0		20.0	(P)	-				730.0	-	15.0	20.0	20.0	20.0	20.0
4	METALS	Nickel	Y	-	15.0 ECEO2010	20.0	Water, England and Wales, Water Supply Regs. 2010 - At consumers taps. Dropping to 10 after 25th December 2013	20.0	µg/l1 Note (i)	20.0	Note (i)	20.0		20.0	(P)	-				730.0	-	15.0	20.0	20.0	20.0	20.0
4	METALS	Tin	Y	-		-	-	-	-	-		-		-		-			22,000.0	USEPA Tap Water PWS	22,000.0	22,000.0	22,000.0	22,000.0	22,000.0	
4	METALS	Zinc	Y	-		5,000	Water Supply (Water Quality) Regs 1989 SI No 1147	-	-	-		100.0		3,000.0		-			11,000.0		5,000.0	100.0	5,000.0	5,000.0	5,000.0	

			Aquifer Protection		Drinking Water Standards (µg/l)										Aquifer		DWS FINAL									
Order	Group	Determinand	Select	Site Specific	Groundwater Quality Protection	Notes	UK DWS (2005)	Notes	SCOTLAND DWS (2000)	Notes	Irish (2007) DWS	Notes	Irish (2007) IGV	Notes	WHO DWG	Notes	Calculated Value	Notes	USEPA Region 9 (Tap Water, specific)	Notes	Protection Value	DWS (µg/l)	DWS (µg/l)	DWS (µg/l)	DWS (µg/l)	
			Y																							
																						ALL	IRELAND	SCOTLAND	ENGLAND WALES	SELECTED

ETBE 2001, both references do not refer to the original data source). For ETBE, an odour threshold between 13 and 25 and a taste threshold of 47 µg L⁻¹ (EPA, 1999; ECHA, 2006, both references do not refer to the original data source). For both TAME and ETBE, the thresholds observed in the current study are lower than the scarce literature data available.	TAME For TAME there are few literature data available: indicative odour and flavor thresholds of 443 and 128 µg L⁻¹ were determined in distilled water (Versteeg, 1993) and taste and odour thresholds of 128 and 27 µg L⁻¹ were reported (EPA, 1999; DNREC, 2001, both references do not refer to the original data source). For	Fuel oxygenate criteria taken from New Hampshire, USA, ref.: Gasoline Oxygenate Additives: Health Information Summary, 2009, ref. AED-EPD-32
the State of California derived a draft health protective concentration of ethanol in water at 1,100 mg/L, equal to a 0.11 percent concentration. As a comparison to the two ethanol drinking water values presented, consuming one beer daily is equivalent to an adult ingesting drinking water containing 6,500 mg/L of ethanol, ref. AED-EPD-32		

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Database_Criteria

MODEL 1: CRITERIA SUMMARY



Navigation Page

			UK & IRELAND Environmental Quality Standard (Aquatic Ecology)																	Agriculture / Other Criteria					
Order	Group	Determinand	Select	Freshwater EQS (AA)	Note	Freshwater EQS (MAC)	Note	Estuarine	Note	Marine EQS (AA)	Note	Marine EQS (MAC)	Note	Source	Irish Freshwater EQS (AA)	Source	Irish Freshwater EQS (MAC)	Source	Irish Marine EQS	Source	ADAS (irrigation water)				
			Y	-		-		-		-		-			-		-		-						
1.01	TPH 1	TPH (>EC5-7) aromatic (1)	Y	-		-		-		-		-			-		-		-						
1.02	TPH 1	TPH (>EC7-8) aromatic (1)	Y	-		-		-		-		-			-		-		-						
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	-		-		-		-		-			-		-		-						
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	-		-		-		-		-			-		-		-						
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	-		-		-		-		-			-		-		-						
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	-		-		-		-		-			-		-		-						
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	-		-		-		-		-			-		-		-						
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	-		-		-		-		-			-		-		-						
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	-		-		-		-		-			-		-		-						
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	-		-		-		-		-			-		-		-						
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	-		-		-		-		-			-		-		-						
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	-		-		-		-		-			-		-		-						
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	-		-		-		-		-			-		-		-						
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	-		-		-		-		-			-		-		-						
1.2	TPH 1	TOTAL TPH (1)	Y	-		-		-		-		-			-		-		-						
2	BTEX	Benzene	Y	10.0	EQS (2010)	50.0	(g)	10.0	EQS (2010)	10.0	EQS (2010)	50	EQS (2010)	Surface Waters (Dangerous Substances) (Classification) Regulations 1998 No 389 (Water Resources, England & Wales)	10		50		8						
2.01	BTEX	Toluene	Y	50.0		380.0	Adjusted from UK EQS to match 95th percentile in Scottish SW Regs, 2009	40.0		40.0		370	Adjusted from UK EQS to match 95th percentile in Scottish SW Regs, 2009	Surface Waters (Dangerous Substances) (Classification) Regulations 1998 No 389 (Water Resources, England & Wales)	10		-		10						
2.02	BTEX	Ethylbenzene	Y	20.0		200.0		20.0		20.0		200		EA Proposed EQS (not adopted) - WRC R&D Technical Report P2-115/TR3 (2002). EA publication reference SP2-115-TR3-E-E	10		-		10						
2.03	BTEX	Xylenes	Y	30.0	Sum o-xylene and m,p-xylene and use criteria for "Xylenes"	30.0		30.0	Sum o-xylene and m,p-xylene and use criteria for "Xylenes"	30.0		-			10.0		-		10.0						

MODEL 1: CRITERIA SUMMARY



Navigation Page

				UK & IRELAND Environmental Quality Standard (Aquatic Ecology)																	Agriculture / Other Criteria				
Order	Group	Determinand	Select	Freshwater EQS (AA)	Note	Freshwater EQS (MAC)	Note	Estuarine	Note	Marine EQS (AA)	Note	Marine EQS (MAC)	Note	Source	Irish Freshwater EQS (AA)	Source	Irish Freshwater EQS (MAC)	Source	Irish Marine EQS	Source	ADAS (irrigation water)				
3	PAH	Acenaphthene	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	PAH	Acenaphthylene	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	PAH	Anthracene	Y	0.10	EQS (2010)	0.4	EQS (2010)	0.1	EQS (2010)	0.10	EQS (2010)	0.4	EQS (2010)	-	0.1	-	0.4	-	0.1	-	-	-	-	-	-
3	PAH	Benzo(a)anthracene	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	PAH	Benzo(a)pyrene	Y	0.05	EQS (2010)	0.1	Scottish SW Regs. 2009	-	-	0.050	EQS (2010)	0.10	Scottish SW Regs. 2009	-	0.05	-	0.1	-	0.05	-	-	-	-	-	-
3	PAH	Benzo(b)fluoranthene	Y	0.03	Scottish SW Regs. 2009. Sum of Benzo(b) and Benzo(k)fluoranthene. Manual review recommended to assess significance. Also EQS (2010)	-	-	0.03	Scottish SW Regs. 2009. Sum of Benzo(b) and Benzo(k)fluoranthene. Manual review recommended to assess significance. Also EQS (2010)	0.03	Scottish SW Regs. 2009. Sum of Benzo(b) and Benzo(k)fluoranthene. Manual review recommended to assess significance. Also EQS (2010)	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	PAH	Benzo(g,h,i)perylene	Y	0.002	Scottish SW Regs for sum of benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene. Manual review suggested to assess significance	-	-	-	-	0.002	Scottish SW Regs for sum of benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene. Manual review suggested to assess significance	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	PAH	Benzo(k)fluoranthene	Y	0.03	Scottish SW Regs. 2009. Sum of Benzo(b) and Benzo(k)fluoranthene. Manual review recommended to assess significance. Also EQS (2010)	-	-	0.03	Scottish SW Regs. 2009. Sum of Benzo(b) and Benzo(k)fluoranthene. Manual review recommended to assess significance. Also EQS (2010)	0.030	Scottish SW Regs. 2009. Sum of Benzo(b) and Benzo(k)fluoranthene. Manual review recommended to assess significance. Also EQS (2010)	-	-	-	-	-	-	-	-	-	-	-	-	-	
3	PAH	Chrysene	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	PAH	Dibenz(a,h)anthracene	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	PAH	Fluoranthene	Y	0.10	EQS (2010)	1.0	EQS (2010)	-	-	0.100	EQS (2010)	1.00	EQS (2010)	-	0.1	-	1	-	0.1	-	-	-	-	-	-
3	PAH	Fluorene	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	PAH	Indeno(1,2,3-cd)pyrene	Y	0.002	Scottish SW Regs for sum of benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene. Manual review suggested to assess significance	-	-	0.0	-	0.002	Scottish SW Regs for sum of benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene. Manual review suggested to assess significance	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	PAH	Naphthalene	Y	2.4	EQS (2010)	-	-	1.2	EQS (2010)	1.2	EQS (2010)	-	-	Surface Waters (Dangerous Substances) (Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC	2.4	-	-	-	1.2	-	-	-	-	-	-
3	PAH	Phenanthrene	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	PAH	Pyrene	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	METALS	Arsenic	Y	50.0	①	-	-	25.0	①	25.0	①	-	-	Surface Waters (Dangerous Substances) (Classification) Regulations 1957 No 2560 (Water Resources, England & Wales)	25	Ref Irish Dangerous Substances Regs (SI No.12, 2001), ref Table 2	-	20	-	40.0	-	-	-	-	-
4	METALS	Boron	Y	2,000.0	①	-	-	7,000.0	①	7,000.0	①	-	-	Surface Waters (Dangerous Substances) (Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC	-	-	2000	(Note 5)	2000	(Note 5)	-	-	-	-	-
4	METALS	Cadmium	Y	0.1	EQS (2010) but varies based on hardness class	1.5	EQS (2010)	0.2	EQS (2010)	0.2	EQS (2010)	1.50	EQS (2010)	Surface Waters (Dangerous Substances) (Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC	0.08	Irish EPA Consultation Document, EQS values, 2007	0.4	-	0.2	-	20.0	-	-	-	-
4	METALS	Chromium III	Y	4.7	Based on Scottish Surface Water Classification Scheme 2005. England/Wales value may be as high as 5ug/l	-	-	15.0	Not specified in Scottish Regs as UK EQS adopted	15.0	Not specified in Scottish Regs as UK EQS adopted	-	-	Surface Waters (Dangerous Substances) (Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC	5	Range 5-30ug/l based on whether >100 or <100 total hardness. Ref Irish Dangerous Substances Regs (SI No.12, 2001), ref Table 2	30	-	-	-	-	-	-	-	
4	METALS	Cobalt	Y	730.0	EQS AA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	METALS	Copper	Y	1.0	①	-	-	5.0	①	5.0	①	-	-	Surface Waters (Dangerous Substances) (Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC	5	Note (3) Range 5-30ug/l based on whether >100 or <100 total hardness. Ref Irish Dangerous Substances Regs (SI No.12, 2001), ref Table 2	-	-	-	500.0	-	-	-	-	
4	METALS	Lead	Y	7.2	EQS (2010)	-	-	7.2	EQS (2010)	7.2	EQS (2010)	-	-	Surface Waters (Dangerous Substances) (Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC	5	Range 5-10ug/l based on whether >100 or <100 total hardness. Ref Irish Dangerous Substances Regs (SI No.12, 2001), ref Table 2	-	5	-	2,000.0	-	-	-	-	

MODEL 1: CRITERIA SUMMARY



Navigation Page

			UK & IRELAND Environmental Quality Standard (Aquatic Ecology)																		Agriculture / Other Criteria				
Order	Group	Determinand	Select	Freshwater EQS (AA)	Note	Freshwater EQS (MAC)	Note	Estuarine	Note	Marine EQS (AA)	Note	Marine EQS (MAC)	Note	Source	Irish Freshwater EQS (AA)	Source	Irish Freshwater EQS (MAC)	Source	Irish Marine EQS	Source	ADAS (irrigation water)				
			Y																						
4	METALS	Molybdenum	Y	20.0	EQS (2016)	-	-	20.0	EQS (2016)	20.0	EQS (2016)	-	-	Surface Waters (Dangerous Substances) (Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC	8	Range 8-50µl based on whether >100 or <100 total hardness. Ref Irish Dangerous Substances Regs (SI No.12, 2001), ref Table 2.	50	Ref Irish Dangerous Substances Regs (SI No.12, 2001), ref Table 2.	25		150.0	-	-	-	
4	METALS	Nickel	Y	20.0	EQS (2016)	-	-	20.0	EQS (2016)	20.0	EQS (2016)	-	-	Surface Waters (Dangerous Substances) (Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC	8	Range 8-50µl based on whether >100 or <100 total hardness. Ref Irish Dangerous Substances Regs (SI No.12, 2001), ref Table 2.	50	Ref Irish Dangerous Substances Regs (SI No.12, 2001), ref Table 2.	25		150.0	-	-	-	
4	METALS	Tin	Y	25.0	EQS AA	-	-	-	-	10.0	-	-	-		-		-		-		-	-	-	-	
4	METALS	Zinc	Y	8.0	-	-	-	40.0	-	40.0	-	-	-	Surface Waters (Dangerous Substances) (Classification) Regulations 1989 No 2286 (Water Resources, England & Wales) 83/513/EEC	8	Range 8-100µl based on whether >100 or <100 total hardness. Ref Irish Dangerous Substances Regs (SI No.12, 2001), ref Table 2.	100		40		1,000.0	-	-	-	

MODEL 1: CRITERIA SUMMARY



Navigation Page

UK & IRELAND Environmental Quality Standard (Aquatic Ecology)														Agriculture / Other Criteria										
Order	Group	Determinand	Select	Freshwater EQS (AA)	Note	Freshwater EQS (MAC)	Note	Estuarine	Note	Marine EQS (AA)	Note	Marine EQS (MAC)	Note	Source	Irish Freshwater EQS (AA)	Source	Irish Freshwater EQS (MAC)	Source	Irish Marine EQS	Source	ADAS (Irrigation water)			
			Y																					
KEY TO NOTES UK EQS																								
MAC = MAXIMUM ALLOWABLE CONCENTRATION AA = ANNUAL AVERAGE (a) Not all chemicals with proposed EQS values is not complete (b) After 24 hours from application 0.6 µg/L after 1 hour 25 µg/L, acceptable concentration before next application 6 µg/L (c) 7 & 8.5 for protection of shellfish (d) 24-hour average 2.5-10 µg/L (e) 24-hour average 10 µg/L (f) total chlorobenzenes (g) 95 percentile (h) hardness (CaCO ₃)-dependent (i) Regulation 2288 specifies that Aldrin + Dieldrin + Endrin+ Isodrin should not exceed 0.03 µg/L, with Endrin not to exceed 0.005 µg/L (j) total - soluble + insoluble forms (k) dissolved only (l) EC519/EEC specifies 5 µg/L for cadmium in estuarial waters - the UK regulation is more stringent (m) EC 178/EEC specifies 0.5 µg/L for mercury in estuarial waters - the UK regulation is more stringent (n) not in the Regulations - proposed by WRc May 1988 (o) range for Salted waters in Regulation 1331 - see Table 1 (p) Proposed value only - not set in legislation. Frequent proposed values exist for MACs where AA's are final - in such cases the reference for the final AA is given and the proposed MAC has been taken from DETR RAD papers (q) EA/SEPA may set a higher value, esp at low temperature or reduced nitrification conditions (r) No AA is proposed since nevirapine is not persistent (contamination is associated with illegal use of the insecticide) (s) free available chlorine (t) not in Regulation - EA RAD Report P12 (u) Temperature and hardness-dependent (v) EA P12 quotes 0.005 µg/L AA (w) Proposed EQS should also apply to total of Duxon, Linuron, Isoproturon and Chlorotoluron (EA RAD Tech Sum 179)(u) 1999). Note that EQS for Chlorotoluron is interim only (x) Value represents [Σ (PQ ₁) ^{1/4} + (PQ ₂) ^{1/4}] ⁴ (y) To be determined by Gas chromatography with electron capture (z) To be determined by Gas chromatography with electron capture. There must also be no slip-increase over time in sediment, molluscs, shellfish, and/or fish																								
KEY TO NOTES Irish EQS and Irish DWs																								
MAC = MAXIMUM ALLOWABLE CONCENTRATION AA = ANNUAL AVERAGE (1) Sum Benzofluoranthene + Benzofluoranthene + 0.03µg/L for Freshwater and Marine EQS (AA) (2) Sum Benzofluoranthene + Benzofluoranthene + Indeno(1,2,3-cd)pyrene + 0.003µg/L for Freshwater and Marine EQS (AA) (3) Hardness dependent according to Irish Dangerous Substances Regulations S.I. No. 12/2001. Bµg/L Cu if hardness <=100mg/L CaCO ₃ 0.3µg/L Cu if hardness >100mg/L CaCO ₃ (4) Hardness dependent according to Irish Dangerous Substances Regulations S.I. No. 12/2001. Bµg/L Zn if hardness <= 10mg/L CaCO ₃ 0.3µg/L Zn if hardness >100mg/L CaCO ₃ 10µg/L Zn if hardness >100mg/L CaCO ₃ (5) Compliance in 95% of the samples (6) Allowable range for soft water: 4.5 - 9.0. Allowable range for hard waters: 6.0 - 9.0. (7) Applies to water of high to good and good to moderate status respectively, according to Water Framework Directive (2000) (8) Sum dichlorobenzenes + 10µg/L Freshwater and Marine AA (9) Higher values are permissible in exceptional climatic/meteorological conditions. (10) 200µg/L: Salted waters, 400µg/L: Cypriot waters (11) Total pesticides parameter is either non or partly specific with regard to selection of compounds. A value of 0.1µg/L applied to individual pesticide compounds. Note (1) Total of PAHs (2µg/L, fluoranthene, benzo(a)pyrene, benzo(a)anthracene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, benzo(g,h,i)perylene). (EPA EQS 1997) (2) Standard where hardness of water is >100 mg/L CaCO ₃ (3) The specified compounds are: Benzofluoranthene, Benzofluoranthene, Benzofluoranthene, Benzo(g,h,i)perylene, Indeno(1,2,3-cd)pyrene. The parametric value applies to the sum of the concentrations of the individual compounds detected and quantified in the monitoring process. General Irish Criteria reference Data EQS (1997): EPA (1997) Environmental Quality Objectives and Environmental Quality Standards - The Aquatic Environment. Discussion Document. EQS(2007): EPA (2007) Water Framework Directive Proposed Quality Standards for Surface Water Classification. Discussion Document. Irish Guideline Values (IGVs): EPA (2003) Towards setting guideline values for the protection of groundwater in Ireland. Interim Report. Irish (Drinking Water) Regulations 2007: S.I. No. 106/2007																								

DEGRADATION RATES



Navigation Page

Degradation Saturated Zone:

Default Decay

Saturated Zone Degradation Type:

Aerobic

Order	Group	Determinand	Select	Retardation Factor	Sat Degradation Rate					Site Specific Sat (Calculated) Degradation Rate				
					Half-life (Minimum)	Half-life (Most Likely)	Half-life (Maximum)	Stochastic Input	Source	Half-life (Minimum)	Half-life (Most Likely)	Half-life (Maximum)	Stochastic Input	Source
			Y	fraction	Days	Days	Days	Days		Days	Days	Days	Days	
1.01	TPH 1	TPH (>EC5-7) aromatic (1)	Y	1.38E+00	5.00E+01	2.00E+02	5.00E+02	2.50E+02	(2) URS/EA	50	200	500	2.50E+02	(2) URS/EA
1.02	TPH 1	TPH (>EC7-8) aromatic (1)	Y	2.14E+00	5.00E+01	1.50E+02	3.50E+02	1.83E+02	(2) URS/EA	50	150	350	1.83E+02	(2) URS/EA
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	9.87E+00	5.00E+01	2.00E+02	5.00E+02	2.50E+02	(2) URS/EA	50	200	500	2.50E+02	(2) URS/EA
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	1.51E+01	2.00E+02	5.00E+02	1.00E+03	5.67E+02	(5) URS	200	500	1,000	5.67E+02	(5) URS
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	2.90E+01	2.00E+02	5.00E+02	1.00E+03	5.67E+02	(5) URS	200	500	1,000	5.67E+02	(5) URS
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	8.00E+01	5.00E+02	1.00E+03	3.00E+03	1.50E+03	(5) URS	500	1,000	3,000	1.50E+03	(5) URS
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	7.05E+02	1.00E+03	3.00E+03	1.00E+04	4.67E+03	(5) URS	1,000	3,000	10,000	4.67E+03	(5) URS
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	5.55E+00	5.00E+01	2.00E+02	3.50E+02	2.00E+02	(5) URS	50	200	350	2.00E+02	(5) URS
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	2.23E+01	5.00E+01	2.00E+02	3.50E+02	2.00E+02	(5) URS	50	200	350	2.00E+02	(5) URS
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	1.70E+02	1.00E+02	3.00E+02	5.00E+02	3.00E+02	(5) URS	100	300	500	3.00E+02	(5) URS
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	1.34E+03	2.00E+02	3.50E+02	1.00E+03	5.17E+02	(5) URS	200	350	1,000	5.17E+02	(5) URS
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+04	2.00E+02	5.00E+02	1.00E+03	5.67E+02	(5) URS	200	500	1,000	5.67E+02	(5) URS
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	3.53E+06	3.50E+02	1.00E+03	3.00E+03	1.45E+03	(5) URS	350	1,000	3,000	1.45E+03	(5) URS
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	4.25E+07	7.50E+02	2.50E+03	1.00E+04	4.42E+03	(5) URS	750	2,500	10,000	4.42E+03	(5) URS
1.2	TPH 1	TOTAL TPH (1)	Y											
2	BTEX	Benzene	Y	1.38E+00	5.00E+01	2.00E+02	5.00E+02	2.50E+02	(1) EA	50	200	500	2.50E+02	(1) EA
2.01	BTEX	Toluene	Y	2.14E+00	5.00E+01	1.50E+02	3.50E+02	1.83E+02	(1) EA	50	150	350	1.83E+02	(1) EA
2.02	BTEX	Ethylbenzene	Y	3.50E+00	5.00E+01	2.00E+02	5.00E+02	2.50E+02	(1) EA	50	200	500	2.50E+02	(1) EA
2.03	BTEX	Xylenes	Y	3.54E+00	5.00E+01	2.00E+02	5.00E+02	2.50E+02	(1) EA	50	200	500	2.50E+02	(1) EA
3	PAH	Acenaphthene	Y	1.41E+01	2.00E+02	5.00E+02	1.00E+03	5.67E+02	(3) URS/PAHs	200	500	1,000	5.67E+02	(3) URS/PAHs
3	PAH	Acenaphthylene	Y	1.12E+01	2.00E+02	5.00E+02	1.00E+03	5.67E+02	(3) URS/PAHs	200	500	1,000	5.67E+02	(3) URS/PAHs
3	PAH	Anthracene	Y	3.25E+01	5.00E+02	1.50E+03	3.00E+03	1.67E+03	(3) URS/PAHs	500	1,500	3,000	1.67E+03	(3) URS/PAHs
3	PAH	Benzo(a)anthracene	Y	4.35E+02	1.00E+03	3.00E+03	1.00E+04	4.67E+03	(3) URS/PAHs	1,000	3,000	10,000	4.67E+03	(3) URS/PAHs
3	PAH	Benzo(a)pyrene	Y	7.23E+02	1.00E+03	3.00E+03	1.00E+04	4.67E+03	(3) URS/PAHs	1,000	3,000	10,000	4.67E+03	(3) URS/PAHs
3	PAH	Benzo(b)fluoranthene	Y	5.88E+02	1.00E+03	3.50E+03	1.00E+04	4.83E+03	(3) URS/PAHs	1,000	3,500	10,000	4.83E+03	(3) URS/PAHs
3	PAH	Benzo(g,h,i)perylene	Y	2.33E+03	1.00E+03	3.50E+03	1.00E+04	4.83E+03	(3) URS/PAHs	1,000	3,500	10,000	4.83E+03	(3) URS/PAHs
3	PAH	Benzo(k)fluoranthene	Y	8.29E+02	1.00E+03	3.50E+03	1.00E+04	4.83E+03	(3) URS/PAHs	1,000	3,500	10,000	4.83E+03	(3) URS/PAHs
3	PAH	Chrysene	Y	3.08E+02	1.00E+03	2.50E+03	1.00E+04	4.50E+03	(3) URS/PAHs	1,000	2,500	10,000	4.50E+03	(3) URS/PAHs
3	PAH	Dibenzo(a,h)anthracene	Y	1.04E+03	1.00E+03	3.50E+03	1.00E+04	4.83E+03	(3) URS/PAHs	1,000	3,500	10,000	4.83E+03	(3) URS/PAHs
3	PAH	Fluoranthene	Y	1.03E+02	5.00E+02	2.00E+03	5.00E+03	2.50E+03	(3) URS/PAHs	500	2,000	5,000	2.50E+03	(3) URS/PAHs
3	PAH	Fluorene	Y	1.68E+01	2.00E+02	5.00E+02	1.00E+03	5.67E+02	(3) URS/PAHs	200	500	1,000	5.67E+02	(3) URS/PAHs
3	PAH	Indeno[1,2,3-cd]pyrene	Y	4.88E+02	1.00E+03	3.00E+03	1.00E+04	4.67E+03	(3) URS/PAHs	1,000	3,000	10,000	4.67E+03	(3) URS/PAHs
3	PAH	Naphthalene	Y	4.61E+00	2.00E+02	5.00E+02	1.00E+03	5.67E+02	(1) EA; (3) URS/PAHs	200	500	1,000	5.67E+02	(1) EA; (3) URS/PAHs
3	PAH	Phenanthrene	Y	3.17E+01	5.00E+02	1.00E+03	2.50E+03	1.33E+03	(3) URS/PAHs	500	1,000	2,500	1.33E+03	(3) URS/PAHs
3	PAH	Pyrene	Y	9.16E+01	7.50E+02	2.00E+03	7.50E+03	3.42E+03	(3) URS/PAHs	750	2,000	7,500	3.42E+03	(3) URS/PAHs
4	METALS	Arsenic	Y	4.48E+03	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg
4	METALS	Boron	Y	9.05E+01	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg
4	METALS	Cadmium	Y	8.96E+02	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg
4	METALS	Chromium III	Y	4.30E+04	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg
4	METALS	Cobalt	Y	4.04E+02	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg
4	METALS	Copper	Y	8.96E+02	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg
4	METALS	Lead	Y	3.22E+05	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg
4	METALS	Molybdenum	Y	1.80E+02	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg
4	METALS	Nickel	Y	4.48E+03	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg

DEGRADATION RATES



[Navigation Page](#)

Degradation Saturated Zone:

Default Decay

Saturated Zone Degradation Type:

Aerobic

				Sat Degradation Rate						Site Specific Sat (Calculated) Degradation Rate				
Order	Group	Determinand	Select	Retardation Factor	Half-life (Minimum)	Half-life (Most Likely)	Half-life (Maximum)	Stochastic Input	Source	Half-life (Minimum)	Half-life (Most Likely)	Half-life (Maximum)	Stochastic Input	Source
			Y	fraction	Days	Days	Days	Days		Days	Days	Days	Days	
4	METALS	Tin	Y	2.24E+03	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg
4	METALS	Zinc	Y	3.41E+02	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg	1.00E+09	1.00E+09	1.00E+09	1.00E+09	No Deg

DEGRADATION RATES



[Navigation Page](#)

Degradation Saturated Zone:

Default Decay

Saturated Zone Degradation Type:

Aerobic

				Sat Degradation Rate						Site Specific Sat (Calculated) Degradation Rate				
Order	Group	Determinand	Select	Retardation Factor	Half-life (Minimum)	Half-life (Most Likely)	Half-life (Maximum)	Stochastic Input	Source	Half-life (Minimum)	Half-life (Most Likely)	Half-life (Maximum)	Stochastic Input	Source
			Y	fraction	Days	Days	Days	Days		Days	Days	Days	Days	

(1) EA: The rationale for the degradation rate has been taken from the information presented in the Environment Agency (2002) document. Professional judgement has been used to set a reasonably conservative rate that is reflective of the range of field examples cited in this document for the particular compound. In making this judgement, recognition has been made of the general information available concerning the ease of degradability of similar compounds in order to obtain comparative estimates of the likely range, where field examples are sparse.

(2) URS/EA: The rationale for the degradation rate is based upon that which has been used for individual compounds included in this category as in (1). A degree of conservatism has also been applied to reflect the inclusion within this group, of compounds that have slower rates of degradation. However, to avoid over-conservatism the upper rate has not necessarily been set at the equivalent of that of the most recalcitrant compound within that group, where for example, separate rates are provided for the trimethylbenzene isomers (EC 9.8).

(3) URS/PAHs: The rationale for the degradation rate for PAHs initially derives from field derivation of long-term degradation rates for PAHs derived from research by the University of Lancaster in unsaturated zone soils (Wild et al., 1990; Wild & Jones, 1995) together with estimates provided by Howard et al (1991). Professional judgement has been used to derive rates based on these sources recognising that the unsaturated zone soils will likely be more reflective of aerobic degradation rates, but that the presence of organic amendments (sewage sludge) will have reduced degradation rates through reductions in bioavailability. Additionally the estimates for field degradation provided by Howard et al. (1991), are derived from laboratory based studies and based on professional judgement only. Further information on field rates has been derived from ref (1) for naphthalene and a restricted number of studies from Aronson & Howard (1997).

(4) URS/A&H: The rationale for degradation rates is based on studies cited by Aronson & Howard (1997), applying a degree of conservatism where limited data are available.

(5) URS: The rationale for the degradation rate is based upon an estimate that is 'benchmarked' against compounds of similar chemical grouping or structure that are known from laboratory studies to be of comparative degradability to those derived from (1) or (3). For the aromatic TPH this has involved benchmarking against the rates used for particular PAHs within a specific EC band as derived in (3). Professional judgement based upon the relative ease of degradation of the various types of hydrocarbon has then been used to derive estimates for the corresponding aliphatic hydrocarbons.

(6) EA/USEPA. Oxygenate Degradation Rationale is described below. Referencing EA (2002) and USEPA (2004)

Literature cited

Environment Agency (2002) The effects of Contaminant Concentration on the Potential for Natural Attenuation. (Authored by Noble, P. & Morgan, P.) Environment Agency R&D Technical Report P2-228/TR, Environment Agency, Bristol.

Aronson, D., & Howard, P.H. (1997) Anaerobic Biodegradation of Organic Chemicals in Groundwater: A Summary of Field and Laboratory Studies, Final Report. Prepared for the American Petroleum Institute, Chemical Manufacturer's Association, National Council of the Paper Industry for Air and Stream Improvement, Edison Electric Institute, American Forest and Paper Association, Washington DC, USA.

Howard, P.H., Boethling, R.S., Jarvis, W.F., Meylan, W.M. & Michalenko, E.M. (1991) Handbook of Environmental Degradation Rates. Lewis Publishers Inc., Chelsea, MI, USA.

Wild, S.R., Waterhouse, K.S., McGrath, S., & Jones, K. (1990) Organic contaminants in an agricultural soil with a known history of sewage sludge amendments: polynuclear aromatic hydrocarbons. Environ. Sci. Technol., 24:1706-1711.

Wild, S.R. & Jones, K.C. (1995) Polynuclear aromatic hydrocarbons in the United Kingdom environment: a preliminary source inventory and budget. Environ. Pollut., 88: 91-108.

U.S. Environmental Protection Agency (2004) Technologies for Treating MTBE and Other Fuel Oxygenates U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response Office of Superfund Remediation and Technology Innovation Washington, DC 20460

Reference - Site Specific

Values **highlighted in red** have been amended from the defaults. The process followed is provided in the accompanying flow charts and calculation sheets.

DEGRADATION RATES



[Navigation Page](#)

Degradation Saturated Zone:

Default Decay

Saturated Zone Degradation Type:

Aerobic

				Sat Degradation Rate						Site Specific Sat (Calculated) Degradation Rate				
Order	Group	Determinand	Select	Retardation Factor	Half-life (Minimum)	Half-life (Most Likely)	Half-life (Maximum)	Stochastic Input	Source	Half-life (Minimum)	Half-life (Most Likely)	Half-life (Maximum)	Stochastic Input	Source
			Y	fraction	Days	Days	Days	Days		Days	Days	Days	Days	

Degradation rates for oxygenates and ethanol

The following rationale has been used to develop default degradation rate estimates for MTBE, TBA, DIPE, ETBE , TAME and ethanol

For MTBE, the Environment Agency (2002) has published estimates of half lives of 100 to 1000 days for aerobic degradation and 200 to 2000 days for anaerobic degradation (assuming sand/gravel aquifers).

To allow for some conservatism due to the aquifer properties falling outside these conditions, together with the potential inhibition of degradation by the simultaneous occurrence of BTEX, it is proposed that for a mostly aerobic system the 'most likely' half life is estimated as 1000 days at the top range of the sand and gravel examples and a 100 day estimate is used as the best case. The 'assumed worst case' is set at 5000 days, which for benchmarking purposes is more than twice as long as the 2000 day rate that is published by the EA for anaerobic conditions (see below). If there is clear evidence of MTBE attenuation (without intermediate accumulation) then it is considered acceptable to use the 100 and 1000 days as lower and upper estimates directly from the published source.

For an anaerobic scenario, the corresponding value at the upper end of the normal range is proposed as the most likely estimate for consistency ,in this case 2000 days, but with 500 days as the best case (rather than 200 days, to allow longer for intermediate formation and degradation). Additionally the assumed worst case is increased to 10000 days, again in proportion with the aerobic scenario. Where there is evidence that indicates minimal degradation is taking place, respective values of 2000, 10,000 and 50,000 days are proposed.

There are few published examples of degradation rates of oxygenates outside MTBE. However in a review of fuel oxygenates, the US EPA notes that

- Laboratory studies (albeit in aerobic environments) have indicated that the degradation rates of each of these compounds was similar
- There is a biochemical similarity in the degradation pathways, suggesting that similar enzyme systems are responsible,

so that on this basis the degradation rates proposed for MTBE are also proposed for all of these oxygenates, on the basis that the rates assume mineralisation .

Because TBA is an intermediate of both MTBE and ETBE, it would therefore be expected to have a shorter half life than the parent compound, but on the basis that the rate of degradation for TBA will be the rate limiting step, it is considered that the overall half life will not be significantly shorter.

The degradation of ethanol is a biochemically well-established process and the evidence of relatively rapid degradation is reflected in EA data indicating a range from 10 to 100 days under both aerobic and anaerobic conditions, albeit for a shallow sand and gravel aquifer. Again, allowing for some conservatism, 10, 100 and 500 days are proposed for the aerobic scenario for best, most likely and assumed worst case conditions with 50, 100 and 1000 day half lives for the anaerobic conditions.



URS site-specific controlled waters risk assessment tool

designed on the principles and methodologies contained within EA Remedial Targets Methodology, 2006



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Version: CWRA, version 7.292min

Date: 13/07/2011

MODEL 1: PROBABILISTIC GROUNDWATER RESULTS

MODEL 1: WATER RESULTS OUTPUT SUMMARY - PROBABILISTIC OUTPUT BY TIME

Navigation Page				RISK LEVEL		9.50E-01																						
Vert:	NO							VERTICAL				Year: 1	Year: 2	Year: 5	Year: 10	Year: 50	Year: 100	Year: 1000	Year: 10000	Year: 1	Year: 2	Year: 5	Year: 10	Year: 50	Year: 100	Year: 1000	Year: 10000	
Dil:	NO											SIMULATED CONCENTRATION								CALCULATED HAZARD INDEX								
Order	Group	Determinand	Select	DWS / Freshwater	Solubility	Model GW Conc	Time for S/S	Simulated	HI	GWTC3																		
					µg/l	µg/l	Years	µg/l			µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l									
1.01	TPH 1	TPH (<EC5-7) aromatic (t)	Y		1.00E+01	1.80E+06	5.46E+00	7.62E-01			6.61E-01	7.15E-01	7.17E-01	7.17E-01	7.17E-01	7.17E-01	7.17E-01	7.17E-01	7.17E-01	6.61E-02	7.15E-02	7.17E-02	7.17E-02	7.17E-02	7.17E-02	7.17E-02	7.17E-02	7.17E-02
1.02	TPH 1	TPH (>EC7-8) aromatic (t)	Y		7.00E+02	1.30E+05	3.98E+00	1.04E+00			2.83E-01	3.52E-01	3.55E-01	3.55E-01	3.55E-01	3.55E-01	3.55E-01	3.55E-01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
1.03	TPH 1	TPH (>EC8-10) aromatic (t)	Y		3.00E+02	6.50E+04	1.99E+02	3.36E+00			1.42E-01	2.07E+00	5.17E+00	5.33E+00	5.33E+00	5.33E+00	5.33E+00	5.33E+00	<.01	<.01	1.72E-02	1.78E-02	1.78E-02	1.78E-02	1.78E-02	1.78E-02	1.78E-02	
1.04	TPH 1	TPH (>EC10-12) aromatic (t)	Y		9.00E+01	2.50E+04	4.90E+01	5.87E+00			1.66E-03	2.20E-01	1.63E+00	2.13E+00	2.14E+00	2.14E+00	2.14E+00	2.14E+00	<.01	<.01	1.81E-02	2.36E-02	2.38E-02	2.38E-02	2.38E-02	2.38E-02	2.38E-02	
1.05	TPH 1	TPH (>EC12-16) aromatic (t)	Y		9.00E+01	5.80E+03	2.15E+01	8.98E+00			5.17E-08	8.67E+04	1.26E+01	3.07E-01	3.51E-01	3.51E-01	3.51E-01	3.51E-01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
1.06	TPH 1	TPH (>EC16-21) aromatic (t)	Y		9.00E+01	6.50E+02	6.12E+00	2.44E+01			6.27E-09	6.27E-09	1.20E-04	1.27E-02	9.54E-02	9.57E-02	9.57E-02	9.57E-02	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
1.07	TPH 1	TPH (>EC21-35) aromatic (t)	Y		9.00E+01	6.60E+00	3.27E+00	1.38E+02			3.12E-09	3.12E-09	3.12E-09	3.12E-09	4.68E-05	1.02E-03	2.36E-03	2.36E-03	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
1.08	TPH 1	TPH (>EC35-68) aliphatic (l)	Y		1.50E+04	3.60E+04	1.53E+01	2.13E+00			1.53E-01	4.73E-01	5.97E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01	5.98E-01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
1.09	TPH 1	TPH (>EC68-8) aliphatic (l)	Y		1.50E+04	5.40E+03	6.45E+01	4.99E+00			7.59E-06	7.05E-03	9.89E-02	1.14E-01	1.14E-01	1.14E-01	1.14E-01	1.14E-01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
1.1	TPH 1	TPH (>EC8-10) aliphatic (l)	Y		3.00E+02	4.30E+02	9.49E+01	1.78E+01			9.49E-08	9.49E-08	9.49E-08	2.30E-06	1.07E-05	1.07E-05	1.07E-05	1.07E-05	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
1.11	TPH 1	TPH (>EC10-12) aliphatic (l)	Y		3.00E+02	3.40E+01	3.40E+01	6.63E+01			6.73E-09	6.73E-09	6.73E-09	6.73E-09	6.73E-09	6.73E-09	6.73E-09	6.73E-09	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
1.12	TPH 1	TPH (>EC12-16) aliphatic (l)	Y		3.00E+02	7.60E+01	1.98E+01	3.29E+02			3.92E-09	3.92E-09	3.92E-09	3.92E-09	3.92E-09	3.92E-09	3.92E-09	3.92E-09	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
1.13	TPH 1	TPH (>EC16-21) aliphatic (l)	Y		1.00E+01	2.50E+03	7.74E+00	5.71E+03			1.53E-09	1.53E-09	1.53E-09	1.53E-09	1.53E-09	1.53E-09	1.53E-09	1.53E-09	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
1.14	TPH 1	TPH (>EC21-35) aliphatic (l)	Y		1.00E+01	8.91E-02	7.78E+00	3.46E+04			1.54E-09	1.54E-09	1.54E-09	1.54E-09	1.54E-09	1.54E-09	1.54E-09	1.54E-09	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
1.2	TPH 1	TOTAL TPH (t)	Y	No Criterion		5.33E+02					1.13E+00	3.84E+00	8.02E+00	8.69E+00	8.74E+00	8.74E+00	8.74E+00	8.74E+00										
2	BTEX	Benzene	Y		1.00E+00	1.78E+06	7.80E+00	7.62E-01			9.42E-01	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	9.42E-01	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	1.01E+00	
2.01	BTEX	Toluene	Y		7.00E+02	5.90E+05	4.73E+00	1.04E+00			3.44E-01	4.16E-01	4.20E-01	4.20E-01	4.20E-01	4.20E-01	4.20E-01	4.20E-01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
2.02	BTEX	Ethylbenzene	Y		3.00E+02	1.69E+05	3.82E+01	1.63E+00			1.54E+00	2.88E+00	3.12E+00	3.12E+00	3.12E+00	3.12E+00	3.12E+00	3.12E+00	<.01	<.01	1.04E-02	1.04E-02	1.04E-02	1.04E-02	1.04E-02	1.04E-02	1.04E-02	
2.03	BTEX	Xylenes	Y		5.00E+02	2.00E+05	1.26E+02	1.64E+00			4.99E+00	9.24E+00	1.01E+01	1.01E+01	1.01E+01	1.01E+01	1.01E+01	1.01E+01	<.01	1.85E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	2.03E-02	
3	PAH	Acenaphthene	Y		2.20E+03	3.80E+03	2.39E-02	5.62E+00			1.51E-06	1.47E+04	1.02E-03	1.21E-03	1.22E-03	1.22E-03	1.22E-03	1.22E-03	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
3	PAH	Acenaphthylene	Y		1.00E+01	1.61E+04	7.65E-03	4.77E+00			3.57E-06	1.19E+04	1.07E-04	4.53E-04	4.54E-04	4.54E-04	4.54E-04	4.54E-04	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
3	PAH	Anthracene	Y		1.10E+04	4.50E+01	1.45E-02	1.39E+01			1.45E-11	2.88E-07	1.46E-04	6.43E-04	9.20E-04	9.20E-04	9.20E-04	9.20E-04	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
3	PAH	Benzo(a)anthracene	Y		2.90E-02	3.80E+00	5.03E-03	1.05E+02			5.03E-12	5.03E-12	5.03E-12	5.03E-12	2.18E-06	1.37E-05	2.05E-05	2.05E-05	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
3	PAH	Benzo(a)pyrene	Y		1.00E-02	3.80E+00	3.65E-03	1.40E+02			3.65E-12	3.65E-12	3.65E-12	3.65E-12	3.39E-08	1.15E-06	3.15E-06	3.15E-06	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
3	PAH	Benzo(b)fluoranthene	Y		2.50E-02	2.00E+00	3.78E-04	1.27E+02			3.78E-13	3.78E-13	3.78E-13	3.78E-13	3.54E-08	4.12E-07	7.15E-07	7.15E-07	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
3	PAH	Benzo(g,h,i)perylene	Y		2.50E-02	2.60E-01	2.37E-04	2.64E+02			2.37E-13	2.37E-13	2.37E-13	2.37E-13	2.37E-13	6.01E-13	2.40E-10	2.40E-10	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
3	PAH	Benzo(k)fluoranthene	Y		2.50E-02	8.00E-01	4.38E-04	1.53E+02			4.38E-13	4.38E-13	4.38E-13	4.38E-13	1.02E-09	6.27E-08	2.15E-07	2.15E-07	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
3	PAH	Chrysene	Y		2.90E+00	2.00E+00	6.49E-03	8.50E+01			6.49E-12	6.49E-12	6.49E-12	6.49E-12	2.01E-05	5.59E-05	6.28E-05	6.28E-05	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
3	PAH	Fluoranthene	Y		2.00E-01	2.30E+02	1.23E-02	3.45E+01			1.23E-11	1.23E-11	1.44E-08	9.77E-06	2.98E-04	2.98E-04	2.98E-04	2.98E-04	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
3	PAH	Fluorene	Y		1.50E+03	1.90E+03	5.60E-02	6.31E+00			5.84E-07	1.45E-04	7.71E-03	2.27E-03	2.30E-03	2.30E-03	2.30E-03	2.30E-03	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
3	PAH	Indeno(1,2,3-cd)pyrene	Y		2.50E-02	2.00E-01	2.20E-04	2.40E+00			2.50E-13	2.20E-13	2.20E-13	2.20E-13	5.26E-08	3.77E-07	6.06E-07	6.06E-07	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
3	PAH	Naphthalene	Y		1.00E+00	1.90E+04	5.69E+00	2.40E+00			1.78E-01	5.23E-01	6.52E-01	6.53E-01	6.53E-01	6.53E-01	6.53E-01	6.53E-01	1.78E-01	5.23E-01	6.52E-01	6.53E-01	6.53E-01	6.53E-01	6.53E-01	6.53E-01	6.53E-01	
3	PAH	Phenanthrene	Y		1.00E+01	1.10E+03	7.46E-02	1.28E+01			7.46E-11	1.89E-06	7.43E-04	2.87E-03	4.02E-03	4.02E-03	4.02E-03	4.02E-03	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01
3	PAH	Pyrene	Y		1.10E+03	1.30E+02	2.14E-02	3.56E+01			2.14E-11	2.14E-11	1.21E-07	4.26E-05	1.14E-03	1.18E-03	1.18E-03	1.18E-03	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01	<.01

MODEL 1: WATER RESULTS OUTPUT SUMMARY -
PROBABILISTIC OUTPUT BY TIME

Navigation Page																																																									
Vert:	NO	RISK LEVEL 9.50E-01																																																							
Dil:	NO																																																								
																Year: 1Year: 2Year: 5Year: 10Year: 50Year: 100Year: 1000Year: 10000																												TIME													
Order	Group	Determinand	Select	DWS / Freshwater	Solubility	Model GW Conc	GWTC3 horizontal										GWTC4 Dilution	Vertical	Stage 3: Year: 1	Stage 3: Year: 2	Stage 3: Year: 5	Stage 3: Year: 10	Stage 3: Year: 50	Stage 3: Year: 100	Stage 3: Year: 1000	Stage 3: Year: 10000	Stage 4: Dilution																														
							µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l												µg/l																													
1.01	TPH 1	TPH (>EC5-7) aromatic (1)	Y	1.00E+01	1.80E+06	5.46E+00	8.26E+01	7.64E+01	7.62E+01	7.62E+01	7.62E+01	7.62E+01	7.62E+01	7.62E+01	7.62E+01	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
1.02	TPH 1	TPH (>EC7-8) aromatic (1)	Y	7.00E+02	1.30E+05	3.98E+00	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	3.00E+02	6.50E+04	1.99E+02	IR	IR	1.16E+04	1.12E+04	1.12E+04	1.12E+04	1.12E+04	1.12E+04	1.12E+04	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	9.00E+01	2.50E+04	4.90E+01	IR	IR	2.70E+03	2.07E+03	2.06E+03	2.06E+03	2.06E+03	2.06E+03	2.06E+03	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	9.00E+01	5.80E+03	2.15E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	9.00E+01	6.50E+02	6.27E+00	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	6.60E+00	3.12E+00	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	1.50E+04	3.60E+04	1.53E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	1.50E+04	5.40E+03	6.45E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	3.00E+02	4.30E+02	9.49E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	3.00E+02	3.40E+01	3.40E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+02	7.60E-01	1.98E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	1.00E+01	2.50E-03	7.74E+00	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	1.00E+01	8.91E-02	7.78E+00	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
1.2	TPH 1	TOTAL TPH (1)	Y	No Criterion		5.33E+02										µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
2	BTEX	Benzene	Y	1.00E+00	1.78E+06	7.80E+00	8.28E+00	7.73E+00	7.72E+00	7.72E+00	7.72E+00	7.72E+00	7.72E+00	7.72E+00	7.72E+00	µg/l	✓	✗	✗	✗	✗	✗	✗	✗	✗	✗																															
2.01	BTEX	Toluene	Y	7.00E+02	5.90E+05	4.73E+00	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
2.02	BTEX	Ethylbenzene	Y	3.00E+02	1.69E+05	3.82E+01	IR	IR	3.68E+03	3.68E+03	3.68E+03	3.68E+03	3.68E+03	3.68E+03	3.68E+03	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
2.03	BTEX	Xylenes	Y	5.00E+02	2.00E+05	1.26E+02	IR	6.82E+03	6.21E+03	6.21E+03	6.21E+03	6.21E+03	6.21E+03	6.21E+03	6.21E+03	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
3	PAH	Acenaphthene	Y	2.20E+03	3.80E+03	2.39E-02	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
3	PAH	Acenaphthylene	Y	1.00E+01	1.61E+04	7.65E-03	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
3	PAH	Anthracene	Y	1.10E+04	4.50E+01	1.45E-02	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
3	PAH	Benzo(a)anthracene	Y	2.90E-02	3.80E+00	5.03E-03	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
3	PAH	Benzo(a)pyrene	Y	1.00E-02	3.80E+00	3.65E-03	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
3	PAH	Benzo(b)fluoranthene	Y	2.50E-02	2.00E+00	3.78E-04	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
3	PAH	Benzo(g,h,i)perylene	Y	2.50E-02	2.60E-01	2.37E-04	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
3	PAH	Benzo(k)fluoranthene	Y	2.50E-02	8.00E-01	4.38E-04	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
3	PAH	Chrysene	Y	2.90E+00	2.00E+00	6.49E-03	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
3	PAH	Fluoranthene	Y	2.00E-01	2.30E+02	1.23E-02	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
3	PAH	Fluorene	Y	1.50E+03	1.90E+03	5.60E-02	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
3	PAH	Indeno[1,2,3-cd]pyrene	Y	2.50E-02	2.00E-01	2.20E-04	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
3	PAH	Naphthalene	Y	1.00E+00	1.90E+04	5.69E+00	3.21E+01	1.09E+01	8.73E+00	8.72E+00	8.72E+00	8.72E+00	8.72E+00	8.72E+00	8.72E+00	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
3	PAH	Phenanthrene	Y	1.00E+01	1.10E+03	7.46E-02	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															
3	PAH	Pyrene	Y	1.10E+03	1.30E+02	2.14E-02	IR	IR	IR	IR	IR	IR	IR	IR	IR	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓																															

MODEL 1: WATER RESULTS OUTPUT SUMMARY -
PROBABILISTIC OUTPUT BY DISTANCE

Navigation Page				RISK LEVEL		9.50E-01																							
Vert:	NO																												
Dist:	NO																												
Order	Group	Determinand	Select	DWS / Freshwater	Solubility	Model GW Conc	STEADY STATE TIMES								Simulated	HI	GWTC3	SIMULATED CONCENTRATION											
							Distance 1	Distance 2	Distance 3	Distance 4	Distance 5	Distance 6	Distance 7	Distance 8				Distance 1	Distance 2	Distance 3	Distance 4	Distance 5	Distance 6	Distance 7	Distance 8				
							Years	Years	Years	Years	Years	Years	Years	Years	µg/l			µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1.01	TPH 1	TPH (>EC5-7) aromatic (1)	Y	1.00E+01	1.80E+06	5.46E+00	8.73E-02	2.13E-01	4.09E-01	5.91E-01	7.88E-01	1.07E+00	1.36E+00	2.66E+00				5.24E+00	4.66E+00	2.52E+00	1.28E+00	7.17E-01	2.83E-01	1.36E-01	8.51E-03				
1.02	TPH 1	TPH (>EC7-8) aromatic (1)	Y	7.00E+02	1.30E+05	3.98E+00	1.33E-01	3.16E-01	5.88E-01	8.26E-01	1.10E+00	1.41E+00	1.74E+00	3.15E+00				3.66E+00	3.06E+00	1.51E+00	6.97E-01	3.55E-01	1.19E-01	4.92E-02	1.44E-03				
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	3.00E+02	6.50E+04	1.99E+02	5.67E-01	1.24E+00	2.10E+00	2.79E+00	3.71E+00	4.33E+00	5.13E+00	8.54E+00				1.58E+02	1.07E+02	3.85E+01	1.35E+01	5.33E+00	1.13E+00	3.13E-01	1.70E-03				
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	9.00E+01	2.50E+04	4.90E+01	8.96E-01	2.03E+00	3.55E+00	4.80E+00	6.40E+00	7.67E+00	9.18E+00	1.56E+01				4.13E+01	3.06E+01	1.25E+01	4.90E+00	2.14E+00	5.37E-01	1.72E-01	1.75E-03				
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	9.00E+01	5.80E+03	2.15E+01	1.82E+00	3.45E+00	5.73E+00	7.50E+00	9.99E+00	1.14E+01	1.35E+01	2.22E+01				1.59E+01	9.88E+00	3.11E+00	9.76E-01	3.51E-01	6.30E-02	1.52E-02	4.21E-05				
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	9.00E+01	6.50E+02	6.27E+00	4.44E+00	9.43E+00	1.56E+01	2.04E+01	2.71E+01	3.10E+01	3.66E+01	6.01E+01				4.60E+00	2.82E+00	8.74E-01	2.70E-01	9.57E-02	1.69E-02	3.98E-03	1.09E-05				
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	6.60E+00	3.12E+00	3.23E+01	6.11E+01	9.33E+01	1.18E+02	1.57E+02	1.72E+02	2.00E+02	3.21E+02				1.40E+00	4.75E-01	6.80E-02	1.13E-02	2.36E-03	1.72E-04	1.94E-05	2.14E-09				
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	1.50E+04	3.60E+04	1.53E+01	3.29E-01	7.42E-01	1.30E+00	1.75E+00	2.33E+00	2.78E+00	3.33E+00	5.64E+00				1.28E+01	9.27E+00	3.67E+00	1.40E+00	5.98E-01	1.45E-01	4.50E-02	3.76E-04				
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	1.50E+04	5.40E+03	6.45E+01	1.09E+00	2.14E+00	3.33E+00	4.24E+00	5.65E+00	6.24E+00	7.29E+00	1.17E+01				3.37E+01	1.36E+01	2.41E+00	4.75E-01	1.14E-01	1.05E-02	1.44E-03	3.62E-07				
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	3.00E+02	4.30E+02	9.49E+01	5.06E+00	8.56E+00	1.24E+01	1.53E+01	2.04E+01	2.19E+01	2.53E+01	4.02E+01				6.10E+00	3.30E-01	5.75E-03	1.93E-04	1.07E-05	8.52E-08	5.16E-09	9.16E-10				
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	3.00E+02	3.40E+01	3.40E+01	2.04E+01	3.29E+01	4.67E+01	5.73E+01	7.65E+01	8.13E+01	9.39E+01	1.49E+02				6.25E-03	5.32E-06	1.95E-08	1.09E-08	6.73E-09	3.19E-09	1.84E-09	3.28E-10				
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+02	7.60E-01	1.98E+01	1.04E+02	1.65E+02	2.33E+02	2.85E+02	3.80E+02	4.03E+02	4.66E+02	7.36E+02				1.98E-08	1.88E-08	1.13E-08	6.37E-09	3.92E-09	1.86E-09	1.07E-09	1.91E-10				
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	1.00E+01	2.50E+03	7.74E+00	1.81E+03	2.85E+03	4.04E+03	4.94E+03	6.59E+03	6.99E+03	8.07E+03	1.28E+04				7.74E-09	7.34E-09	4.43E-09	2.49E-09	1.53E-09	7.28E-10	4.19E-10	7.48E-11				
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	1.00E+01	8.91E-02	7.78E+00	1.09E+04	1.73E+04	2.44E+04	2.99E+04	3.99E+04	4.23E+04	4.89E+04	7.73E+04				7.78E-09	7.38E-09	4.45E-09	2.50E-09	1.54E-09	7.32E-10	4.21E-10	7.51E-11				
1.2	TPH 1	TOTAL TPH (1)	Y	No Criterion		5.33E+02												2.72E+02	1.74E+02	6.11E+01	2.15E+01	8.74E+00	2.05E+00	6.29E-01	1.18E-02				
2	BTEX	Benzene	Y	1.00E+00	1.78E+06	7.80E+00	8.73E-02	2.13E-01	4.09E-01	5.91E-01	7.88E-01	1.07E+00	1.36E+00	2.66E+00				7.48E+00	6.64E+00	3.59E+00	1.82E+00	1.01E+00	3.94E-01	1.88E-01	1.16E-02				
2.01	BTEX	Toluene	Y	7.00E+02	5.90E+05	4.73E+00	1.33E-01	3.16E-01	5.87E-01	8.26E-01	1.10E+00	1.41E+00	1.74E+00	3.15E+00				4.35E+00	3.63E+00	1.78E+00	8.22E-01	4.20E-01	1.40E-01	5.77E-02	1.69E-03				
2.02	BTEX	Ethylbenzene	Y	3.00E+02	1.69E+05	3.82E+01	2.16E-01	5.09E-01	9.35E-01	1.30E+00	1.74E+00	2.20E+00	2.68E+00	4.78E+00				3.48E+01	2.86E+01	1.38E+01	6.23E+00	3.12E+00	9.98E-01	3.97E-01	1.05E-02				
2.03	BTEX	Xylenes	Y	5.00E+02	2.00E+05	1.26E+02	2.18E-01	5.14E-01	9.43E-01	1.31E+00	1.75E+00	2.22E+00	2.70E+00	4.81E+00				1.15E+02	9.41E+01	4.50E+01	2.03E+01	1.01E+01	3.24E+00	1.28E+00	3.13E-02				
3	PAH	Acenaphthene	Y	2.20E+03	3.80E+03	2.39E+02	8.44E-01	1.92E+00	3.38E+00	4.58E+00	6.11E+00	7.36E+00	8.83E+00	1.51E+01				2.05E+02	1.56E+02	6.64E+03	2.70E+03	1.22E+03	3.26E+04	1.10E+04	1.36E+06				
3	PAH	Acenaphthylene	Y	1.00E+01	1.61E+04	7.65E+03	6.78E-01	1.57E+00	2.81E+00	3.86E+00	5.14E+00	6.31E+00	7.62E+00	1.32E+01				6.71E-03	5.24E-03	2.32E-03	9.74E-04	4.54E-04	1.29E-04	4.59E-05	7.01E-07				
3	PAH	Anthracene	Y	1.10E+04	4.50E+01	1.45E+02	1.97E+00	4.56E+00	8.18E+00	1.12E+01	1.50E+01	1.84E+01	2.22E+01	3.86E+01				1.28E-02	1.01E-02	4.56E-03	1.94E-03	9.20E-04	2.64E-04	9.61E-05	1.58E-06				
3	PAH	Benzo(a)anthracene	Y	2.90E+02	3.80E+00	5.03E+03	2.21E+01	4.42E+01	6.98E+01	8.92E+01	1.19E+02	1.32E+02	1.55E+02	2.50E+02				3.02E-03	1.43E-03	3.16E-04	7.36E-05	2.05E-05	2.39E-06	4.01E-07	2.38E-10				
3	PAH	Benzo(a)pyrene	Y	1.00E+02	3.80E+00	3.65E+03	3.29E+01	6.20E+01	9.47E+01	1.19E+02	1.59E+02	1.74E+02	2.02E+02	3.25E+02				1.68E-03	5.85E-04	8.65E-05	1.47E-05	3.15E-06	2.38E-07	2.77E-08	3.47E-12				
3	PAH	Benzo(b)fluoranthene	Y	2.50E+02	2.00E+00	3.78E-04	2.83E+01	5.49E+01	8.51E+01	1.08E+02	1.44E+02	1.58E+02	1.85E+02	2.97E+02				2.00E-04	8.14E-05	1.47E-05	2.94E-06	7.15E-07	6.69E-08	9.32E-09	2.54E-12				
3	PAH	Benzo(g,h,i)perylene	Y	2.50E+02	2.60E-01	2.37E-04	7.38E+01	1.26E+02	1.84E+02	2.27E+02	3.03E+02	3.25E+02	3.76E+02	5.97E+02				2.59E-05	2.21E-06	6.43E-08	3.17E-09	2.40E-10	3.23E-12	8.96E-14	2.29E-15				
3	PAH	Benzo(k)fluoranthene	Y	2.50E+02	8.00E-01	4.38E-04	3.67E+01	6.86E+01	1.04E+02	1.31E+02	1.74E+02	1.90E+02	2.21E+02	3.54E+02				1.82E-04	5.65E-05	7.23E-06	1.10E-06	2.15E-07	1.39E-08	1.43E-09	1.05E-13				
3	PAH	Chrysene	Y	2.90E+00	2.00E+00	6.49E+03	1.65E+01	3.42E+01	5.53E+01	7.15E+01	9.53E+01	1.07E+02	1.26E+02	2.08E+02				4.46E-03	2.50E-03	6.88E-04	1.93E-04	6.28E-05	9.55E-06	2.80E-06	3.94E-09				
3	PAH	Fluoranthene	Y	2.00E+01	2.30E+02	1.23E+02	5.88E+00	1.28E+01	2.17E+01	2.88E+01	3.82E+01	4.44E+01	5.25E+01	8.73E+01				9.62E-03	6.41E-03	2.24E-03	7.68E-04	2.98E-04	6.13E-05	1.65E-05	8.04E-08				
3	PAH	Fluorene	Y	1.50E+03	1.90E+03	5.60E+02	9.89E-01	2.22E+00	3.85E+00	5.18E+00	6.91E+00	8.21E+00	9.80E+00	1.66E+01				4.69E-02	3.43E-02	1.38E-02	5.32E-03	2.30E-03	5.66E-04	1.79E-04	1.59E-06				
3	PAH	Indeno(1,2,3-cd)pyrene	Y	2.50E+02	2.00E-01	2.20E-04	2.43E+01	4.78E+01	7.49E+01	9.54E+01	1.27E+02	1.41E+02	1.64E+02	2.66E+02				1.24E-04	5.44E-05	1.08E-05	2.33E-06	6.06E-07	6.31E-08	9.63E-09	3.83E-12				
3	PAH	Naphthalene	Y	1.00E+00	1.90E+04	5.69E+00	2.90E-01	6.98E-01	1.32E+00	1.89E+00	2.51E+00	3.33E+00	4.14E+00	7.78E+00				5.38E+00	4.68E+00	2.45E+00	1.21E+00	6.53E-01	2.42E-01	1.10E-01	5.15E-03				
3	PAH	Phenanthrene	Y	1.00E+01	1.10E+03	7.46E-02	1.90E+00	4.34E+00	7.68E+00	1.04E+01	1.39E+01	1.68E+01	2.02E+01	3.46E+01				6.46E-02	4.96E-02	2.13E-02	8.78E-03	4.02E-03	1.10E-03	3.79E-04	4.94E-06				
3	PAH	Pyrene	Y	1.10E+03	1.30E+02	2.14E-02	5.45E+00	1.23E+01	2.16E+01	2.91E+01	3.88E+01	4.65E+01	5.57E+01	9.46E+01				1.86E-02	1.43E-02	6.21E-03	2.57E-03	1.18E-03	3.23E-04	1.12E-04	1.52E-06				

**MODEL 1: WATER RESULTS OUTPUT SUMMARY -
PROBABILISTIC OUTPUT BY DISTANCE**

[illegible]

MODEL 1: WATER RESULTS OUTPUT SUMMARY -
PROBABILISTIC SUMMARY (SS @ CP)

Navigation Page		RISK LEVEL 9.50E-01																						
Vert:	NO																							
Dil:	NO																							
Order	Group	Determinand	Select	DWS / Freshwater	Solubility	Model GW Conc	SIMULATED CONCENTRATION								CALCULATED HAZARD INDEX									
							0.05	0.1	0.25	0.5	0.8	0.9	0.95	1	0.05	0.1	0.25	0.5	0.8	0.9	0.95	1		
1.01	TPH 1	TPH (>EC5-7) aromatic (1)	Y	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	1.90E-02	2.50E-02	3.62E-02	4.86E-02	6.22E-02	6.84E-02	7.17E-02	8.44E-02		
1.02	TPH 1	TPH (>EC7-8) aromatic (1)	Y	1.00E+01	1.80E+06	5.46E+00	1.90E-01	2.50E-01	3.62E-01	4.86E-01	6.22E-01	6.84E-01	7.17E-01	8.44E-01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	7.00E+02	1.30E+05	3.98E+00	3.29E-02	4.69E-02	9.98E-02	1.70E-01	2.70E-01	3.20E-01	3.55E-01	4.77E-01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1.31E-02	1.78E-02	4.95E-02	
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	3.00E+02	6.50E+04	1.99E+02	6.40E-03	2.42E-02	1.49E-01	6.04E-01	2.33E+00	3.94E+00	5.33E+00	1.49E+01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1.35E-02	1.80E-02	2.38E-02	4.68E-02
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	9.00E+01	5.80E+03	2.15E+01	4.48E-04	1.00E-03	6.35E-03	2.89E-02	1.24E-01	2.38E-01	3.51E-01	1.05E+00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1.17E-02	
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	9.00E+01	6.50E+02	6.27E+00	4.05E-05	1.49E-04	1.29E-03	7.07E-03	3.30E-02	6.37E-02	9.57E-02	4.14E-01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	6.60E+00	3.12E+00	6.11E-10	4.31E-09	3.26E-07	1.16E-05	3.28E-04	1.08E-03	2.36E-03	2.50E-02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	1.50E+04	3.60E+04	1.53E+01	6.39E-03	1.43E-02	4.72E-02	1.41E-01	3.41E-01	4.80E-01	5.98E-01	1.19E+00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	1.50E+04	5.40E+03	6.45E+01	1.63E-06	1.14E-05	1.66E-04	1.99E-03	2.50E-02	6.54E-02	1.14E-01	8.21E-01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	4.30E+02	4.30E+02	9.49E+01	1.83E-08	1.84E-08	1.85E-08	1.86E-08	2.13E-07	1.98E-06	1.07E-05	4.91E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	3.00E+02	3.40E-01	3.40E-01	6.57E-09	6.58E-09	6.60E-09	6.63E-09	6.67E-09	6.70E-09	6.73E-09	6.88E-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+02	7.60E-01	1.98E+01	3.83E-09	3.83E-09	3.85E-09	3.86E-09	3.89E-09	3.91E-09	3.92E-09	4.01E-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	1.00E+01	2.50E-03	7.74E+00	1.50E-09	1.50E-09	1.50E-09	1.51E-09	1.52E-09	1.53E-09	1.53E-09	1.57E-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	1.00E+01	8.91E-02	7.78E+00	1.50E-09	1.51E-09	1.51E-09	1.52E-09	1.53E-09	1.53E-09	1.54E-09	1.57E-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.2	TPH 1	TOTAL TPH (1)	Y	No Criterion		5.33E+02	5.54E-01	7.40E-01	1.22E+00	2.15E+00	4.85E+00	6.74E+00	8.74E+00	1.88E+01										
2	BTEX	Benzene	Y	1.00E+00	1.78E+06	7.80E+00	2.42E-01	3.57E-01	5.25E-01	7.01E-01	8.82E-01	9.61E-01	1.01E+00	1.19E+00	2.42E-01	3.57E-01	5.25E-01	7.01E-01	8.82E-01	9.61E-01	1.01E+00	1.19E+00		
2.01	BTEX	Toluene	Y	7.00E+02	5.90E+05	4.73E+00	3.53E-02	6.02E-02	1.14E-01	1.96E-01	3.08E-01	3.67E-01	4.20E-01	5.60E-01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
2.02	BTEX	Ethylbenzene	Y	3.00E+02	1.69E+05	3.82E+01	1.33E-01	2.86E-01	5.89E-01	1.18E+00	2.23E+00	2.72E+00	3.12E+00	4.62E+00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
2.03	BTEX	Xylenes	Y	5.00E+02	2.00E+05	1.26E+02	4.42E-01	8.92E-01	2.03E+00	4.08E+00	7.45E+00	9.01E+00	1.01E+01	1.39E+01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1.49E-02	1.80E-02	2.03E-02	2.78E-02
3	PAH	Acenaphthene	Y	2.20E+03	3.80E+03	2.39E-02	1.89E-05	3.84E-05	1.08E-04	2.67E-04	6.43E-04	9.28E-04	1.22E-03	2.49E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Acenaphthylene	Y	1.00E+01	1.61E+04	7.65E-03	1.34E-05	2.43E-05	6.34E-05	1.48E-04	3.00E-04	3.85E-04	4.54E-04	7.65E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Anthracene	Y	1.10E+04	4.50E+01	1.45E-02	2.32E-05	4.72E-05	1.36E-04	2.97E-04	5.92E-04	7.84E-04	9.20E-04	1.84E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Benzo(a)anthracene	Y	2.90E-02	3.80E+00	5.03E-03	1.22E-10	9.47E-10	2.94E-08	3.92E-07	4.22E-06	1.00E-05	2.05E-05	1.12E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Benzo(a)pyrene	Y	1.00E-02	3.80E+00	3.65E-03	7.13E-13	5.69E-12	3.14E-10	1.23E-08	3.50E-07	1.28E-06	3.15E-06	5.33E-05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Benzo(b)fluoranthene	Y	2.50E-02	2.00E+00	3.78E-04	5.16E-13	1.09E-11	2.92E-10	6.80E-09	1.18E-07	3.46E-07	7.15E-07	8.10E-06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Benzo(g,h,i)perylene	Y	2.50E-02	2.60E-01	2.37E-04	4.58E-14	4.59E-14	4.61E-14	4.67E-14	3.78E-12	4.69E-11	2.40E-10	1.28E-08	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Benzo(k)fluoranthene	Y	2.50E-02	8.00E-01	4.38E-04	8.57E-14	3.54E-13	1.85E-11	7.29E-10	2.04E-08	8.32E-08	2.15E-07	2.66E-06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Chrysene	Y	2.90E+00	2.00E+00	6.49E-03	2.70E-09	1.48E-08	1.97E-07	2.13E-06	1.68E-05	4.03E-05	6.28E-05	2.56E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Fluoranthene	Y	2.00E-01	2.30E+02	1.23E-02	3.80E-07	1.24E-06	6.86E-06	3.84E-05	1.35E-04	2.17E-04	2.98E-04	1.08E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Fluorene	Y	1.50E+03	1.90E+03	5.60E-02	2.06E-05	4.46E-05	1.42E-04	4.31E-04	1.18E-03	1.76E-03	2.30E-03	4.58E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Indeno[1,2,3-cd]pyrene	Y	2.50E-02	2.00E-01	2.20E-04	2.67E-12	1.27E-11	4.02E-10	9.44E-09	1.30E-07	3.06E-07	6.06E-07	4.37E-06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Naphthalene	Y	1.00E+00	1.90E+04	5.69E+00	1.25E-01	1.63E-01	2.55E-01	3.71E-01	5.31E-01	6.02E-01	6.53E-01	8.33E-01	1.25E-01	1.63E-01	2.55E-01	3.71E-01	5.31E-01	6.02E-01	6.53E-01	8.33E-01		
3	PAH	Phenanthrene	Y	1.00E+01	1.10E+03	7.46E-02	5.24E-05	1.08E-04	3.31E-04	1.01E-03	2.28E-03	3.14E-03	4.02E-03	7.79E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Pyrene	Y	1.10E+03	1.30E+02	2.14E-02	4.83E-06	1.21E-05	5.78E-05	1.99E-04	5.59E-04	8.35E-04	1.18E-03	2.06E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	

MODEL 1: WATER RESULTS OUTPUT SUMMARY -
PROBABILISTIC SUMMARY (SS @ CP)

Navigation Page																																		
Vert:	NO	RISK LEVEL 9.50E-01																																
Dil:	NO											0.05	0.1	0.25	0.5	0.8	0.9	0.95	1	RISK LEVEL														
Order	Group	Determinand	Select	DWS / Freshwater	Solubility	Model GW Conc	GWTC3 horizontal								GWTC4 Dilution	Stage 3: 0.05	Stage 3: 0.1	Stage 3: 0.25	Stage 3: 0.5	Stage 3: 0.8	Stage 3: 0.9	Stage 3: 0.95	Stage 3: 1	Stage 4 - Dilution										
			Y	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l		
1.01	TPH 1	TPH (>EC5-7) aromatic (1)	Y	1.00E+01	1.80E+06	5.46E+00	2.88E+02	2.18E+02	1.51E+02	1.12E+02	8.77E+01	7.98E+01	7.62E+01	6.46E+01																				
1.02	TPH 1	TPH (>EC7-8) aromatic (1)	Y	7.00E+02	1.30E+05	3.98E+00	IR	IR	IR	IR	IR	IR	IR	IR																				
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	3.00E+02	6.50E+04	1.99E+02	IR	IR	IR	IR	IR	IR	1.52E+04	1.12E+04	4.02E+03																			
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	9.00E+01	2.50E+04	4.90E+01	IR	IR	IR	IR	IR	3.62E+03	2.72E+03	2.06E+03	1.05E+03																			
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	9.00E+01	5.80E+03	2.15E+01	IR	IR	IR	IR	IR	IR	IR	IR	1.84E+03																			
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	9.00E+01	6.50E+02	6.27E+00	IR	IR	IR	IR	IR	IR	IR	IR																				
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	6.60E+00	3.12E+00	IR	IR	IR	IR	IR	IR	IR	IR																				
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	1.50E+04	3.60E+04	1.53E+01	IR	IR	IR	IR	IR	IR	IR	IR																				
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	1.50E+04	5.40E+03	6.45E+01	IR	IR	IR	IR	IR	IR	IR	IR																				
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	3.00E+02	4.30E+02	9.49E+01	IR	IR	IR	IR	IR	IR	IR	IR																				
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	3.00E+02	3.40E+01	3.40E+01	IR	IR	IR	IR	IR	IR	IR	IR																				
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+02	7.60E-01	1.98E+01	IR	IR	IR	IR	IR	IR	IR	IR																				
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	1.00E+01	2.50E-03	7.74E+00	IR	IR	IR	IR	IR	IR	IR	IR																				
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	1.00E+01	8.91E-02	7.78E+00	IR	IR	IR	IR	IR	IR	IR	IR																				
1.2	TPH 1	TOTAL TPH (1)	Y	No Criterion		5.33E+02																												
2	BTEX	Benzene	Y	1.00E+00	1.78E+06	7.80E+00	3.22E+01	2.18E+01	1.49E+01	1.11E+01	8.85E+00	8.12E+00	7.72E+00	6.57E+00																				
2.01	BTEX	Toluene	Y	7.00E+02	5.90E+05	4.73E+00	IR	IR	IR	IR	IR	IR	IR	IR																				
2.02	BTEX	Ethylbenzene	Y	3.00E+02	1.69E+05	3.82E+01	IR	IR	IR	IR	IR	IR	IR	3.68E+03	2.48E+03																			
2.03	BTEX	Xylenes	Y	5.00E+02	2.00E+05	1.26E+02	IR	IR	IR	IR	IR	8.45E+03	6.99E+03	6.21E+03	4.53E+03																			
3	PAH	Acenaphthene	Y	2.20E+03	3.80E+03	2.39E-02	IR	IR	IR	IR	IR	IR	IR	IR																				
3	PAH	Acenaphthylene	Y	1.00E+01	1.61E+04	7.65E-03	IR	IR	IR	IR	IR	IR	IR	IR																				
3	PAH	Anthracene	Y	1.10E+04	4.50E+01	1.45E-02	IR	IR	IR	IR	IR	IR	IR	IR																				
3	PAH	Benzo(a)anthracene	Y	2.90E-02	3.80E+00	5.03E-03	IR	IR	IR	IR	IR	IR	IR	IR																				
3	PAH	Benzo(a)pyrene	Y	1.00E-02	3.80E+00	3.65E-03	IR	IR	IR	IR	IR	IR	IR	IR																				
3	PAH	Benzo(b)fluoranthene	Y	2.50E-02	2.00E+00	3.78E-04	IR	IR	IR	IR	IR	IR	IR	IR																				
3	PAH	Benzo(g,h,i)perylene	Y	2.50E-02	2.60E-01	2.37E-04	IR	IR	IR	IR	IR	IR	IR	IR																				
3	PAH	Benzo(k)fluoranthene	Y	2.50E-02	8.00E-01	4.38E-04	IR	IR	IR	IR	IR	IR	IR	IR																				
3	PAH	Chrysene	Y	2.90E+00	2.00E+00	6.49E-03	IR	IR	IR	IR	IR	IR	IR	IR																				
3	PAH	Fluoranthene	Y	2.00E-01	2.30E+02	1.23E-02	IR	IR	IR	IR	IR	IR	IR	IR																				
3	PAH	Fluorene	Y	1.50E+03	1.90E+03	5.60E-02	IR	IR	IR	IR	IR	IR	IR	IR																				
3	PAH	Indeno[1,2,3-cd]pyrene	Y	2.50E-02	2.00E-01	2.20E-04	IR	IR	IR	IR	IR	IR	IR	IR																				
3	PAH	Naphthalene	Y	1.00E+00	1.90E+04	5.69E+00	4.55E+01	3.49E+01	2.23E+01	1.53E+01	1.07E+01	9.45E+00	8.72E+00	6.83E+00																				
3	PAH	Phenanthrene	Y	1.00E+01	1.10E+03	7.46E-02	IR	IR	IR	IR	IR	IR	IR	IR																				
3	PAH	Pyrene	Y	1.10E+03	1.30E+02	2.14E-02	IR	IR	IR	IR	IR	IR	IR	IR																				



URS site-specific controlled waters risk assessment tool

designed on the principles and methodologies contained within EA Remedial Targets Methodology, 2006



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Version: CWRA, version 7.292min

Date: 13/07/2011

MODEL 1 - PROBABILISTIC SOIL RESULTS

MODEL 1: SOIL RESULTS OUTPUT SUMMARY -
PROBABILISTIC OUTPUT BY TIME

Navigation Page		Ver:		NO		Dil:		NO		RISK LEVEL		9.50E-01																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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MODEL 1: SOIL RESULTS OUTPUT SUMMARY -
PROBABILISTIC OUTPUT BY TIME

Navigation Page																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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Navigation Page	
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Dil:	NO

Site	NO						Distance 1	Distance 2	Distance 3	Distance 4	Distance 5	Distance 6	Distance 7	Distance 8	VERTICAL											
Order	Group	Determinand	Select	DWS / Freshwater	Solubility	Soil Saturation Limit	Model Soil Conc	STEADY STATE TIMES (Deterministic)								Simulated	HI	STC3	SIMULATED CONCENTRATION							
								Years	Years	Years	Years	Years	Years	Years	Years				Years	Years	μg/l	μg/l	mg/kg	μg/l	μg/l	μg/l
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	3.00E+02	6.50E+04	7.60E+02	3.11E-01	5.67E-01	1.24E+00	2.10E+00	2.79E+00	3.36E+00	4.33E+00	5.13E+00	8.54E+00	8.69E-01	5.46E-01	3.01E-01	1.73E-01	9.67E-02	3.10E-02	1.06E-02	9.28E-05			
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	9.00E+01	2.50E+04	4.61E+02	3.65E-01	8.96E-01	2.03E+00	3.55E+00	4.80E+00	5.87E+00	7.67E+00	9.18E+00	1.56E+01	7.47E-01	5.25E-01	3.17E-01	2.00E-01	1.28E-01	4.90E-02	1.86E-02	2.92E-04			
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	9.00E+01	5.80E+03	2.13E+02	5.24E-01	1.62E+00	3.45E+00	5.73E+00	7.50E+00	8.98E+00	1.14E-01	1.35E+01	2.22E+01	4.20E+01	2.45E+01	1.20E+01	6.52E+00	3.34E+00	9.27E-01	2.81E-01	1.27E-03			
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	9.00E+01	6.50E+02	6.71E+01	6.71E-01	4.44E+00	9.43E+00	1.56E+01	2.04E+01	2.44E+01	3.10E+01	3.66E+01	6.01E+01	1.67E+01	9.91E+00	5.02E+00	2.64E+00	1.39E+00	3.89E-01	1.12E-01	4.69E-04			
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	6.80E+00	6.07E+00	6.07E+00	3.23E-01	6.11E+01	9.33E-01	1.19E+02	1.38E+02	1.72E+02	2.00E+02	3.21E+02	9.53E-02	3.35E-02	7.97E-03	3.21E-03	6.73E-04	7.26E-05	1.03E-05	2.01E-09			
1.08	TPH 1	TPH (>EC5-8) aliphatic (1)	Y	1.50E+04	3.60E+04	3.29E+02	2.03E-02	3.29E-01	7.42E-01	1.30E+00	1.75E+00	2.13E+00	2.78E+00	3.33E+00	5.64E+00	7.59E-02	5.38E-02	3.35E-02	1.23E-02	1.31E-02	4.87E-03	1.90E-03	2.30E-05			
1.09	TPH 1	TPH (>EC8-9) aliphatic (1)	Y	1.50E+04	5.40E+03	1.72E+02	1.48E-01	1.09E+00	2.14E+00	3.33E+00	4.24E+00	4.99E+00	6.24E+00	7.29E+00	1.17E+01	8.90E-02	4.02E-02	9.91E-03	3.21E-03	1.20E-03	1.77E-04	3.00E-05	1.10E-08			
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	3.00E+02	4.30E+02	9.75E+01	3.78E-01	5.06E+00	8.56E+00	1.24E-01	1.53E+01	1.78E+01	2.19E+01	2.53E+01	4.02E+01	3.86E-03	2.09E-04	6.27E-06	3.79E-07	3.10E-08	3.62E-10	4.55E-11	1.11E-11			
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	3.00E+02	3.40E+01	5.99E+01	5.47E-01	2.04E+01	3.29E+01	4.67E+01	5.73E+01	6.63E+01	8.13E+01	9.39E+01	1.49E+02	1.85E-06	1.70E-09	1.75E-11	1.60E-11	1.44E-11	1.06E-11	7.49E-12	2.08E-12			
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+02	7.60E-01	2.98E+01	2.98E+01	1.04E+02	1.65E+02	2.33E+02	2.85E+02	3.29E+02	4.03E+02	4.66E+02	7.36E+02	3.34E-11	3.34E-11	3.34E-11	3.24E-11	2.96E-11	2.18E-11	1.54E-11	4.32E-12			
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	1.00E+01	2.50E-03	1.15E+01	1.15E+01	1.81E+03	2.85E+03	4.04E+03	4.94E+03	5.71E+03	6.99E+03	8.07E+03	1.28E+04	1.10E-13	1.10E-13	1.10E-13	1.07E-13	9.74E-14	7.18E-14	5.06E-14	1.42E-14			
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	1.00E+01	8.91E-02	4.94E+03	4.11E-02	1.09E+04	1.73E+04	2.44E+04	2.99E+04	3.46E+04	4.23E+04	4.89E+04	7.73E+04	3.89E-13	3.89E-13	3.89E-13	3.78E-13	3.46E-13	2.54E-13	1.79E-13	4.98E-14			

Navigation Page		Vert:		RISK LEVEL																														
Dil:		NO		RISK LEVEL	9.5E-01																													
						Distance 1	Distance 2	Distance 3	Distance 4	Distance 5	Distance 6	Distance 7	Distance 8	Distance 1	Distance 2	Distance 3	Distance 4	Distance 5	Distance 6	Distance 7	Distance 8	DISTANCE												
Order	Group	Terminand	Select	DWS / Freshwater	Solubility	Soil Saturation Limit	Model Soil Conc	CALCULATED HAZARD INDEX								STC3 horizontal								STC4 Dilution	Vertcal	Distance 1	Distance 2	Distance 3	Distance 4	Distance 5	Distance 6	Distance 7	Distance 8	Stage 4 - Duijon
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	µg/l	µg/l	mg/kg	mg/kg	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	IR	IR	IR	IR	IR	IR	IR	IR	IR												
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	9.00E+01	2.50E+04	4.61E+02	3.65E+01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	IR	IR	IR	IR	IR	IR	IR	IR	IR												
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	9.00E+01	5.80E+03	2.13E+02	5.24E+01	4.67E-01	2.72E-01	1.33E-01	7.24E-02	3.71E-02	1.03E-02	<-0.01	<-0.01	1.12E+02	1.93E+02	3.94E+02	7.24E+02	1.41E+03	5.09E+03	IR	IR											
1.06	TPH 1	TPH (>EC18-21) aromatic (1)	Y	9.00E+01	6.50E+02	6.71E+01	1.85E-01	1.19E-01	5.59E-02	2.93E-02	1.54E-02	<-0.01	<-0.01	<-0.01	<-0.01	3.62E+02	6.10E+02	1.20E+03	2.29E+03	4.36E+03	IR	IR												
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	6.60E+00	6.07E+00	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	IR	IR	IR	IR	IR	IR	IR	IR												
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	1.50E+04	3.60E+04	3.29E+02	2.03E+02	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	IR	IR	IR	IR	IR	IR	IR	IR											
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	1.50E+04	5.40E+03	1.72E+02	1.48E+01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	IR	IR	IR	IR	IR	IR	IR	IR											
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	3.00E+02	4.30E+02	9.75E+01	3.78E+01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	IR	IR	IR	IR	IR	IR	IR	IR											
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	3.00E+02	3.40E+01	5.99E+01	5.47E+01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	IR	IR	IR	IR	IR	IR	IR	IR											
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+02	7.60E-01	2.98E+01	2.98E+01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	IR	IR	IR	IR	IR	IR	IR	IR											
1.13	TPH 1	TPH (>EC18-21) aliphatic (1)	Y	1.00E+01	2.50E-03	1.15E+01	1.15E+01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	IR	IR	IR	IR	IR	IR	IR	IR											
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	1.00E+01	8.91E-02	4.94E+03	4.11E+02	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	<-0.01	IR	IR	IR	IR	IR	IR	IR	IR											
1.2	TPH 1	TOTAL TPH (1)	Y	No Criterion			5.80E+02																											
2	BTEX	Benzene	Y	1.00E+00	1.78E+06	1.07E+03	2.22E+03	1.65E-01	1.40E-01	7.05E-02	3.44E-02	1.85E-02	<-0.01	<-0.01	<-0.01	1.35E-02	1.59E-02	3.15E-02	6.45E-02	1.20E-01	IR	IR	IR											

MODEL 1: SOIL RESULTS OUTPUT SUMMARY -
PROBABILISTIC SUMMARY (SS @ CP)

Navigation Page																																					
Vert:	NO																	0.05	0.10	0.25	0.50	0.80	0.90	0.95	1.00	0.05	0.10	0.25	0.50	0.80	0.90	0.95	1.00				
Dil:	NO																																				
Order	Group	Determinand	Select	DWS / Freshwater	Solubility	Soil Saturation Limit	Model Soil Conc	SIMULATED CONCENTRATION								CALCULATED HAZARD INDEX																					
			Y	µg/l	µg/l	mg/kg	mg/kg	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l																						
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	3.00E+02	6.50E+04	7.60E+02	3.11E-01	1.18E-04	3.92E-04	2.47E-03	1.10E-02	4.42E-02	7.61E-02	9.67E-02	3.48E+01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	9.00E+01	2.50E+04	4.61E+02	3.65E-01	1.60E-03	2.87E-03	1.06E-02	2.67E-02	6.77E-02	9.52E-02	1.28E-01	3.17E-01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	9.00E+01	5.80E+03	2.13E+02	5.24E+01	3.80E-03	8.55E-03	5.37E-02	2.56E-01	1.15E+00	2.21E+00	3.34E+00	1.23E+01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	9.00E+01	6.50E+02	6.71E+01	6.71E+01	5.78E-04	2.14E-03	1.71E-02	9.99E-02	4.59E-01	8.83E-01	1.39E+00	5.14E+00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	6.60E+00	6.07E+00	6.07E+00	1.84E-10	1.29E-09	9.81E-08	3.32E-06	9.53E-05	3.31E-04	6.73E-04	6.04E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	1.50E+04	3.60E+04	3.29E+02	2.03E-02	1.12E-04	2.53E-04	8.80E-04	2.69E-03	6.71E-03	1.03E-02	1.31E-02	3.39E-02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	1.50E+04	5.40E+03	1.72E+02	1.48E-01	1.46E-08	9.91E-08	1.53E-06	2.04E-05	2.42E-04	6.25E-04	1.20E-03	9.82E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	3.00E+02	4.30E+02	9.75E+01	3.78E-01	2.76E-11	3.12E-11	3.85E-11	5.29E-11	5.03E-10	5.06E-09	3.10E-08	7.29E-06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	3.00E+02	3.40E+01	5.99E+01	5.47E-01	4.94E-12	5.48E-12	6.62E-12	8.11E-12	1.09E-11	1.25E-11	1.44E-11	2.14E-11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+02	7.60E-01	2.98E+01	2.98E+01	1.35E-11	1.46E-11	1.67E-11	1.97E-11	2.41E-11	2.71E-11	2.96E-11	4.36E-11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	1.00E+01	2.50E-03	1.15E+01	1.15E+01	4.45E-14	4.81E-14	5.51E-14	6.47E-14	7.91E-14	8.91E-14	9.74E-14	1.44E-13	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	1.00E+01	8.91E-02	4.94E+03	4.11E+02	1.18E-13	1.31E-13	1.58E-13	1.94E-13	2.61E-13	2.98E-13	3.46E-13	5.14E-13	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			
1.2	TPH 1	TOTAL TPH (1)	Y	No Criterion			5.80E+02	1.72E-02	4.23E-02	1.61E-01	5.02E-01	1.73E+00	3.02E+00	4.56E+00	1.54E+01																						
2	BTEX	Benzene	Y	1.00E+00	1.78E+06	1.07E+03	2.22E-03	3.15E-03	4.35E-03	6.67E-03	9.43E-03	1.36E-02	1.61E-02	1.85E-02	3.41E-02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
2.01	BTEX	Toluene	Y	7.00E-02	5.90E+05	9.43E+02	1.13E-02	6.55E-03	1.11E-02	2.22E-02	3.86E-02	6.69E-02	8.44E-02	1.03E-01	1.99E-01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
2.02	BTEX	Ethylbenzene	Y	3.00E+02	1.69E+05	5.71E+02	7.92E-03	1.10E-03	2.28E-03	4.72E-03	1.00E-02	1.84E-02	2.54E-02	3.10E-02	6.37E-02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
2.03	BTEX	Xylenes	Y	5.00E+02	2.00E+05	6.84E+02	1.63E-02	2.00E-03	4.24E-03	9.92E-03	2.07E-02	3.86E-02	5.09E-02	6.19E-02	1.23E-01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Acenaphthene	Y	2.20E+03	3.80E+03	6.54E+01	2.09E+01	1.11E-01	2.31E-01	6.27E-01	1.62E+00	4.20E+00	6.04E+00	7.77E+00	1.87E+01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Acenaphthylene	Y	1.00E+01	1.61E+04	2.15E+02	1.76E+00	2.71E-02	4.79E-02	1.30E-01	3.09E-01	6.53E-01	8.62E-01	1.09E+00	2.27E+00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Anthracene	Y	1.10E+04	4.50E+01	1.85E+00	1.85E+00	8.23E-03	1.86E-02	4.97E-02	1.09E-01	2.26E-01	3.08E-01	3.66E-01	6.87E-01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Benzo(a)anthracene	Y	2.90E-02	3.80E+00	2.15E+00	2.15E+00	9.95E-09	8.01E-08	2.58E-06	3.66E-05	3.90E-04	9.30E-04	1.85E-03	1.01E-02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Benzo(a)pyrene	Y	1.00E-02	3.80E+00	3.58E+00	3.58E+00	9.58E-11	5.92E-10	3.57E-08	1.37E-06	4.71E-05	1.58E-04	3.56E-04	5.67E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Benzo(b)fluoranthene	Y	2.50E-02	2.00E+00	1.53E+00	1.53E+00	3.92E-10	6.22E-09	1.72E-07	4.57E-06	7.26E-05	2.32E-04	4.52E-04	4.38E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Benzo(g,h,i)perylene	Y	2.50E-02	2.60E-01	7.91E-01	7.91E-01	4.47E-12	4.91E-12	5.79E-12	8.12E-12	5.04E-10	6.60E-09	3.11E-08	1.93E-06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Benzo(k)fluoranthene	Y	2.50E-02	8.00E-01	8.64E-01	8.64E-01	2.03E-11	8.43E-11	4.00E-09	1.56E-07	4.86E-06	1.78E-05	4.47E-05	5.73E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Chrysene	Y	2.90E+00	2.00E+00	8.03E-01	8.03E-01	7.91E-08	5.33E-07	7.38E-06	7.51E-05	6.49E-04	1.46E-03	2.35E-03	8.98E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Dibenzo(a,h)anthracene	Y	2.90E-03	6.00E-01	8.16E-01	8.16E-01	1.21E-11	1.59E-11	2.70E-10	1.53E-08	6.87E-07	3.52E-06	1.03E-05	3.02E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Fluoranthene	Y	2.00E-01	2.30E+02	3.06E+01																															

[illegible]

MODEL 1 GROUNDWATER IN THE CHALK SSTL SUMMARY

Navigation Page																			98	
Vert:	NO	RISK LEVE 9.50E-01																		
Dil:	NO																			
Order	Group	Determinand	Select	DWS / Freshwater	Solubility	Soil Saturation Limit	Max Soil Conc	Model GW Conc	SOIL - STC3				GROUNDWATER - GWTC3 in Chalk				GROUNDWATER - GWTC3 in drift including DF			
									50 m	75 m	100 m	250 m	50 m	75 m	100 m	250 m	50 m	75 m	100 m	250 m
									mg/kg	mg/kg	mg/kg	mg/kg	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
1.01	TPH 1	TPH (>EC5-7) aromatic (1)	Y	1.00E+01	1.80E+06	1.12E+03	-	5.46E+00	-	-	-	-	7.56E+01	1.91E+02	3.96E+02	6.27E+03	7.43E+03	1.88E+04	3.90E+04	6.17E+05
1.02	TPH 1	TPH (>EC7-8) aromatic (1)	Y	7.00E+02	1.30E+05	2.08E+02	-	3.98E+00	-	-	-	-	7.75E+03	2.32E+04	5.59E+04	>Sol	>Sol	>Sol	>Sol	>Sol
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	3.00E+02	6.50E+04	7.60E+02	3.11E-01	1.99E+02	>Sat	>Sat	>Sat	>Sat	1.09E+04	5.10E+04	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	9.00E+01	2.50E+04	4.61E+02	3.65E-01	4.90E+01	2.46E+02	>Sat	>Sat	>Sat	2.00E+03	7.80E+03	2.39E+04	>Sol	>Sol	>Sol	>Sol	>Sol
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	9.00E+01	5.80E+03	2.13E+02	5.24E+01	2.15E+01	>Sat	>Sat	>Sat	>Sat	5.62E+03	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	9.00E+01	6.50E+02	6.71E+01	6.71E+01	6.27E+00	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	6.60E+00	6.07E+00	6.07E+00	3.12E+00	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	1.50E+04	3.60E+04	3.29E+02	2.03E-02	1.53E+01	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	1.50E+04	5.40E+03	1.72E+02	1.48E-01	6.45E+01	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	3.00E+02	4.30E+02	9.75E+01	3.78E-01	9.49E+01	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	3.00E+02	3.40E+01	5.99E+01	5.47E-01	3.40E+01	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+02	7.60E-01	2.98E+01	2.98E+01	1.98E+01	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	1.00E+01	2.50E-03	1.15E+01	1.15E+01	7.74E+00	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	1.00E+01	8.91E-02	4.94E+03	4.11E+02	7.78E+00	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
1.2	TPH 1	TOTAL TPH (1)	Y	No Criterion			5.80E+02	5.33E+02												
2	BTEX	Benzene	Y	1.00E+00	1.78E+06	1.07E+03	2.22E-03	7.80E+00	1.21E-01	3.25E-01	6.93E-01	1.21E+01	7.59E+00	1.93E+01	4.01E+01	6.47E+02	7.47E+02	1.90E+03	3.94E+03	6.36E+04
2.01	BTEX	Toluene	Y	7.00E+02	5.90E+05	9.43E+02	1.13E-02	4.73E+00	7.73E+01	1.57E+02	3.20E+02	>Sat	7.89E+03	2.37E+04	5.74E+04	>Sol	>Sol	>Sol	>Sol	>Sol
2.02	BTEX	Ethylbenzene	Y	3.00E+02	1.69E+05	5.71E+02	7.92E-03	3.82E+01	7.62E+01	1.55E+02	3.13E+02	>Sat	3.49E+03	1.06E+04	2.62E+04	>Sol	>Sol	>Sol	>Sol	>Sol
2.03	BTEX	Xylenes	Y	5.00E+02	2.00E+05	6.84E+02	1.63E-02	1.26E+02	1.33E+02	2.73E+02	5.72E+02	>Sat	6.10E+03	1.89E+04	4.73E+04	>Sol	>Sol	>Sol	>Sol	>Sol
3	PAH	Acenaphthene	Y	2.20E+03	3.80E+03	6.54E+01	2.09E+01	2.39E-02	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
3	PAH	Acenaphthylene	Y	1.00E+01	1.61E+04	2.15E+02	1.76E+00	7.65E-03	1.66E+01	4.33E+01	1.10E+02	>Sat	1.63E+02	5.66E+02	1.57E+03	>Sol	1.60E+04	>Sol	>Sol	>Sol
3	PAH	Anthracene	Y	1.10E+04	4.50E+01	1.85E+00	1.85E+00	1.45E-02	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
3	PAH	Benzo(a)anthracene	Y	2.90E-02	3.80E+00	2.15E+00	2.15E+00	5.03E-03	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
3	PAH	Benzo(a)pyrene	Y	1.00E-02	3.80E+00	3.58E+00	3.58E+00	3.65E-03	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
3	PAH	Benzo(b)fluoranthene	Y	2.50E-02	2.00E+00	1.53E+00	1.53E+00	3.78E-04	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
3	PAH	Benzo(g,h,i)perylene	Y	2.50E-02	2.60E-01	7.91E-01	7.91E-01	2.37E-04	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
3	PAH	Benzo(k)fluoranthene	Y	2.50E-02	8.00E-01	8.64E-01	8.64E-01	4.38E-04	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
3	PAH	Chrysene	Y	2.90E+00	2.00E+00	8.03E-01	8.03E-01	6.49E-03	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
3	PAH	Dibenzo(a,h)anthracene	Y	2.90E-03	6.00E-01	8.16E-01	8.16E-01	-	>Sat	>Sat	>Sat	>Sat	-	-	-	-	-	-	-	-
3	PAH	Fluoranthene	Y	2.00E-01	2.30E+02	3.06E+01	3.06E+01	1.23E-02	7.99E+00	2.63E+01	>Sat	>Sat	7.07E+00	3.27E+01	1.16E+02	>Sol	>Sol	>Sol	>Sol	>Sol
3	PAH	Fluorene	Y	1.50E+03	1.90E+03	3.93E+01	1.77E+01	5.60E-02	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
3	PAH	Indeno[1,2,3-cd]pyrene	Y	2.50E-02	2.00E-01	1.27E-01	1.27E-01	2.20E-04	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
3	PAH	Naphthalene	Y	1.00E+00	1.90E+04	9.13E+01	4.20E+00	5.69E+00	2.80E-01	5.85E-01	1.21E+00	1.93E+01	8.88E+00	2.41E+01	5.34E+01	1.15E+03	8.74E+02	2.37E+03	5.25E+03	>Sol
3	PAH	Phenanthrene	Y	1.00E+01	1.10E+03	4.42E+01	4.42E+01	7.46E-02	>Sat	>Sat	>Sat	>Sat	1.89E+02	6.94E+02	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
3	PAH	Pyrene	Y	1.10E+03	1.30E+02	1.54E+01	1.54E+01	2.14E-02	>Sat	>Sat	>Sat	>Sat	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol	>Sol
4	METALS	Arsenic	Y	1.00E+01	1.70E+07	8.50E+06	2.19E+01	-	1.45E+02	2.30E+02	3.70E+02	2.99E+03	-	-	-	-	-	-	-	-
4	METALS	Boron	Y	1.00E+03	5.50E+08	5.55E+06	1.36E+01	-	2.91E+02	4.49E+02	6.85E+02	2.81E+03	-	-	-	-	-	-	-	-
4	METALS	Cadmium	Y	5.00E+00	5.70E+08	5.71E+07	8.75E-01	-	1.44E+01	2.23E+01	3.40E+01	1.40E+02	-	-	-	-	-	-	-	-
4	METALS	Chromium III	Y	5.00E+01	6.29E+08	3.02E+09	3.11E+01	-	6.79E+04	7.55E+05	8.54E+06	>Sat	-	-	-	-	-	-	-	-
4	METALS	Cobalt	Y	1.10E+01	1.40E+07	6.31E+05	1.05E+01	-	1.43E+01	2.21E+01	3.37E+01	1.38E+02	-	-	-	-	-	-	-	-
4	METALS	Copper	Y	2.00E+03	8.00E+04	8.01E+03	1.06E+02	-	5.78E+03	>Sat	>Sat	>Sat	-	-	-	-	-	-	-	-
4	METALS	Lead	Y	2.50E+01	5.00E+01	1.80E+03	1.28E+02	-	>Sat	>Sat	>Sat	>Sat	-	-	-	-	-	-	-	-
4	METALS	Molybdenum	Y	2.00E+01	4.90E+05	9.85E+03	2.94E-01	-	1.16E+01	1.79E+01	2.73E+01	1.12E+02	-	-	-	-	-	-	-	-
4	METALS	Nickel	Y	2.00E+01	1.90E+05	9.50E+04	3.75E+01	-	2.91E+02	4.60E+02	7.41E+02	5.99E+03	-	-	-	-	-	-	-	-
4	METALS	Tin	Y	2.20E+04	1.27E+01	3.18E+00	3.18E+00	-	>Sat	>Sat	>Sat	>Sat	-	-	-	-	-	-	-	-
4	METALS	Zinc	Y	5.00E+03	1.62E+07	6.17E+05	2.30E+02	-	5.50E+03	8.47E+03	1.29E+04	5.30E+04	-	-	-	-	-	-	-	-



URS site-specific controlled waters risk assessment tool

designed on the principles and methodologies contained within EA Remedial Targets Methodology, 2006



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Version: CWRA, version 7.292min

Date: 13/07/2011

MODEL 2 - GROUNDWATER IN THE DRIFT DEPOSITS INPUTS SUMMARY

MODEL 2: CONTROLLED WATERS RISK ASSESSMENT
PROJECT RECORD

Project Record

Navigation Page

Project Title

Project Site
Project Number
Project Description
Revision Number
Proposed or Current End-Use
City
Region
Country
URS Office
Industry Sector
Service Code
SF330 Code
Project Budget
QRA Budget
Currency

Shell Hitchin - Model 2 Groundwater in the Drift Deposit

Service Station QRA

Rev 1

Hitchin
South East England
England
Wimbledon
1115-Downstream: Refining/Marketing
100-Planning, Consulting & Permitting
R10-Risk Analysis

£

England / Wales / NI

Country Criteria

Filename/location stored

J:\Wimbledon-Jobs\Shell International Limited\49319130 GESS 2010 Global RFP\Technical\London Projects\Site\Hitchin\Technical\Reports\Phase 2 - 3rd Report\QRA\{SHELL - HITCHIN - Drift.xls\}Project Record

Assessment completed by
Date created
Date modified
QC'd by
QA'd by

J Willis
24/01/2013
28/01/2013
Emma Peace
Emma Peace

Stage 1 Assessment
Stage 2 Assessment

Navigation Page

SUMMARY OF RISK ASSESSMENT OBJECTIVE

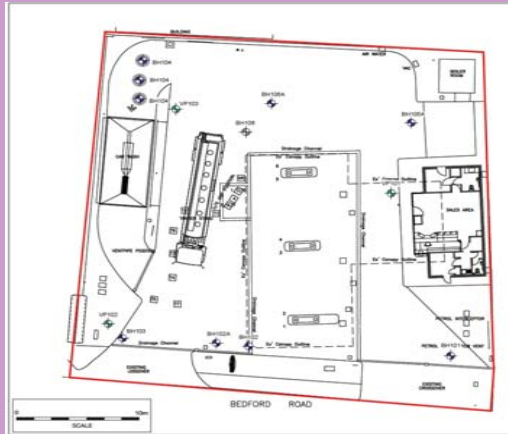
Soil and groundwater exceedances have been identified above the Stage 2 GAC. A DQRA is required to further investigate these risks.

URS

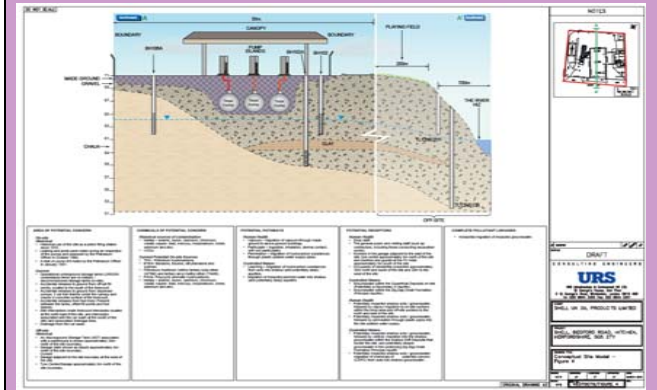
Site Location Plan



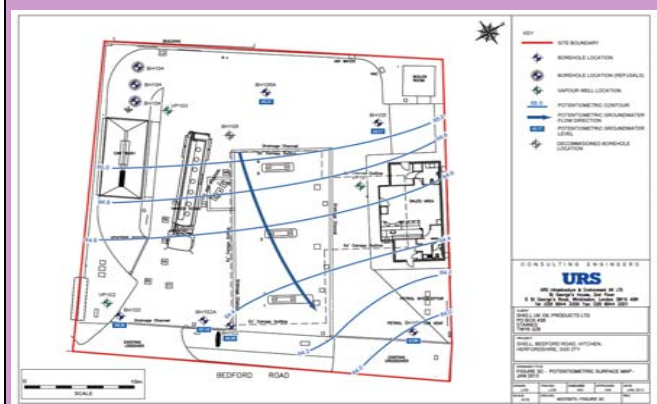
Site Location Plan



Schematic Section



GW Contours



**MODEL 2: CONCEPTUAL SITE MODEL
PART 1 - SOURCE TERMS**

Conceptual Model Set-Up - PART 1, SOURCES

Navigation Page

SOURCE DIMENSIONS	SOIL			GW			COMMENTS
	1	2	3	1	2	3	
	HS1	HS2	HS3	SITE	HS1	HS2	
LENGTH (PARALLEL TO FLOW)	33	30	10	10			Metres
WIDTH (PERPENDICULAR TO FLOW)	35	25	10	10			Metres
SOURCE AREA	1155	750	100	100	0	0	m ²
BASIS FOR DIMENSIONS	a	a	a	a	a	a	See below
SOIL/LEACHATE DATA	Soil						
LEACHATE DATA TYPE	N/A						
LEACHATE DILUTION FACTOR	N/A						

NOTE: ADDITIONAL SOURCE DETAILS RELATING TO TPH COMPOSITION AND FREE PRODUCT ARE DESCRIBED ON THE PATHWAYS SHEET

HS* - Hot Spot Source

Saturated Vertical Pathway

NO

Dimensions

- (a) - Based on delineation using analytical data (e.g. distance to nearest clean data point)
- (b) - Based on known extent of site infrastructure (e.g. hotspot around tankfarm etc)
- (c) - Other, described below

DESCRIPTION OF SOURCE(S)

*Note: Information on Product and concentration data used in the assessment is covered on the pathways sheet.

Soil Sources: Multiple TPH fractions were detected in excess of the Stage 2 GAC from all sample locations across the site. A site wide source of 35m x 33m has been assumed for soil source 1. Metals and PAH compounds were found in excess of the Stage 2 GAC in BH101, BH103, BH105 and BH106. A 25m x 30m has been assumed for soil source 2. Benzene was detected in concentrations exceeding the GAC at BH105. A small 10m x 10m source zone has been assumed for Soil Source 3.

Groundwater Sources: Naphthalene, BTEX and multiple TPH bands were reported at concentrations exceeding the Stage 2 GAC from groundwater sampled from BH102. A source zone of 10m x 10m has been assumed for groundwater source 1.

Key to Data Worksheets

All cells on the user data worksheets ("name" Data) are colour coded as follows.

User Values		These worksheet cells can be edited directly and are specifically for adding comments.
User Values		These worksheet cells can be edited directly and are specifically for values
Calculated Values		These worksheet cells contain calculated values and are protected. User values should not be entered directly into these cells.
User Values		These worksheet cells have been edited from the default formula. Justification to be provided.



MODEL 2: SCHEMATIC CONCEPTUAL SITE MODEL

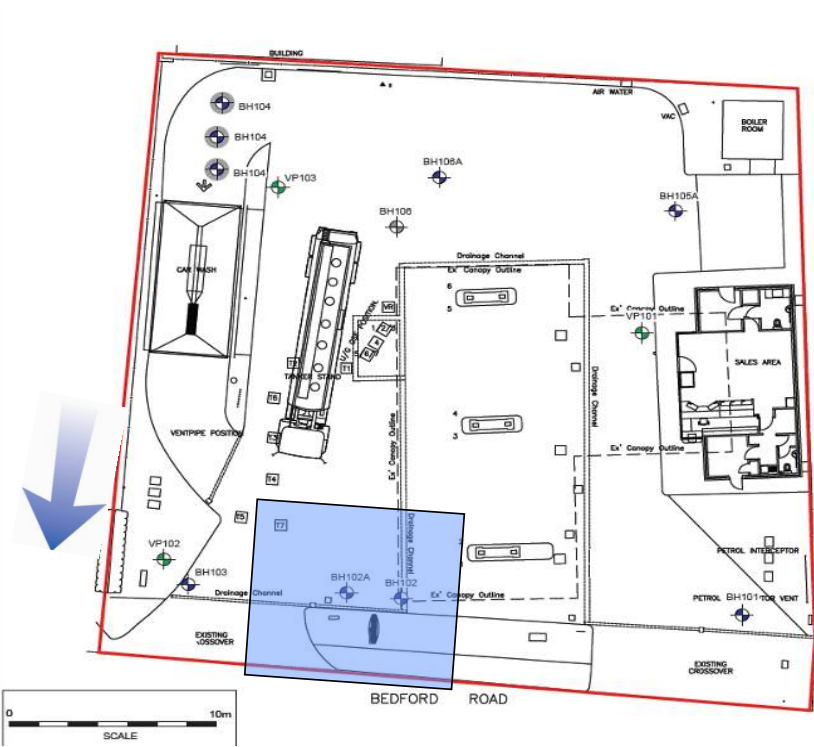
SOURCE AREAS

Source Area	
Soil to Groundwater Attenuation:	NO
Soil or Leachate:	Soil
Free Product:	NO
Product Type:	-
Product Input:	-
Ground Type:	Hard-Standing

Source Dimensions				
	Width	Length	Area	Age
	m	m	m2	Yrs
	35	33	1155	
	25	30	750	
	10	10	100	
	10	10	100	
	0	0	0	
	0	0	0	

SOIL MAX

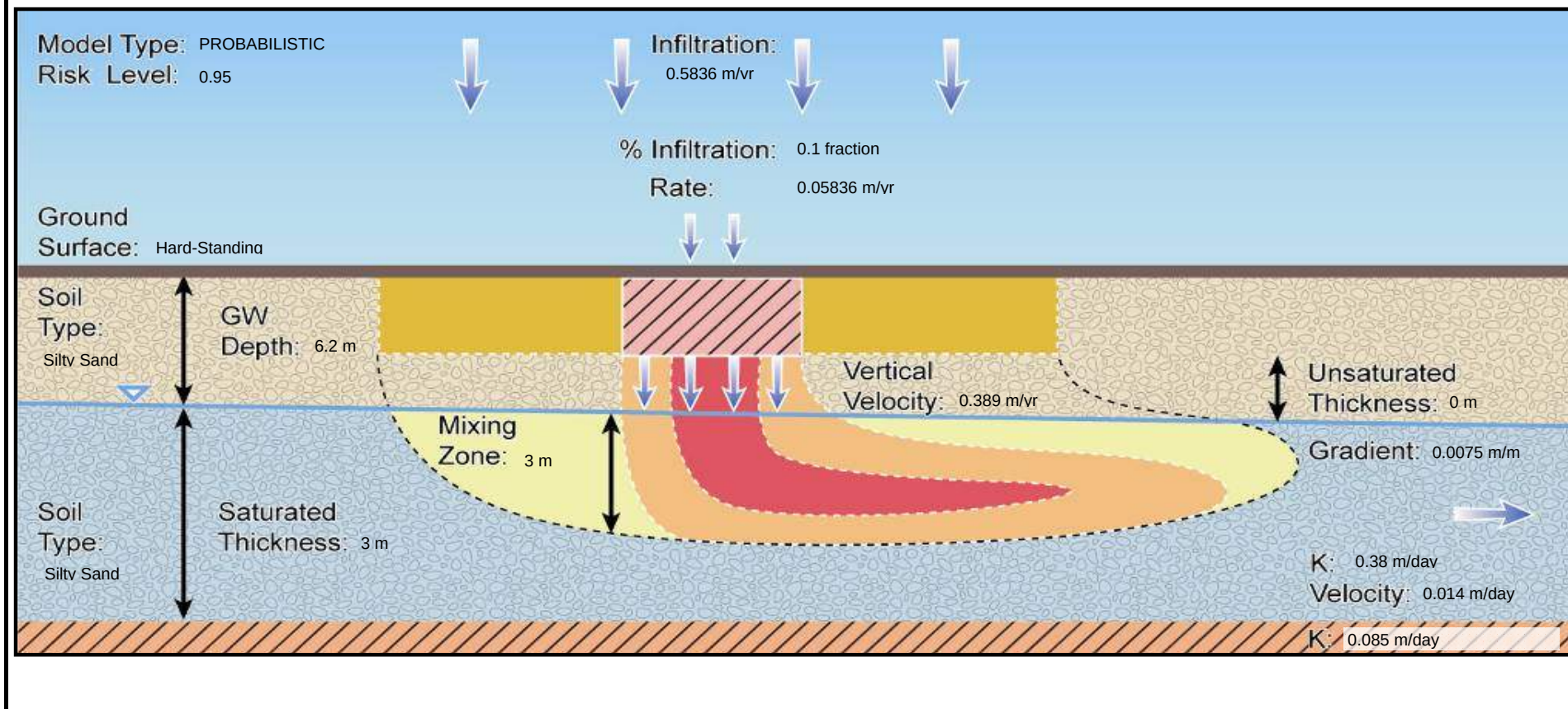
GROUNDWATER MAX



MODEL 2: SCHEMATIC CONCEPTUAL SITE MODEL

PATHWAYS

Unsaturated Zone	Saturated Zone	Saturated Zone	Saturated Zone
Bulk Density: 1.62 g/cm ³ Water Filled Porosity: 0.15 fraction Air Filled Porosity: 0.24 fraction Foc: 0.73 % Ph n/a pH units Decay Type: No Decay	Dilution in GW: YES Attenuation Vertical: NO Attenuation Horizontal: YES Bulk Density: 1.62 g/cm ³ Effective Porosity: 0.2 fraction	Foc: 0.2 % GW Ph: 7.59 pH units GW Eh: 205 mV Aquifer Condition: Aerobic Decay Type: Default Decay	Phases: All Phases Longitudinal Dispersivity: 0.1 fraction Lateral Dispersivity: 0.01 fraction Vertical Dispersivity: 0.001 fraction Dispersion Type: Pickens & Grisak (Flow Path)



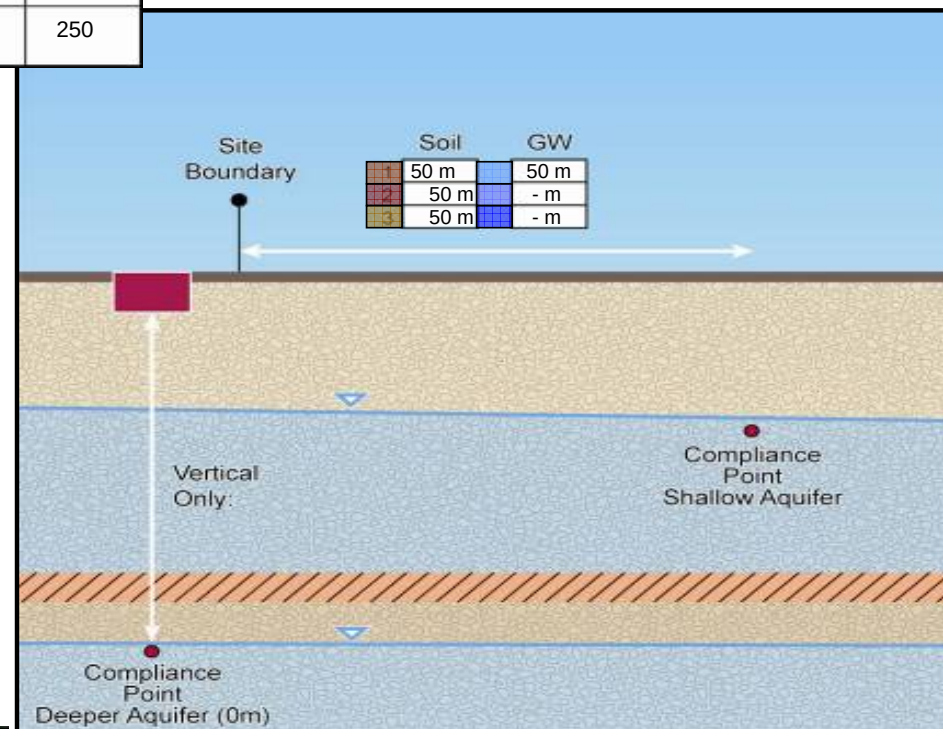
MODEL 2: SCHEMATIC CONCEPTUAL SITE MODEL

RECEPTORS

Distance Summary (m)								
	1	2	3	4	5	6	7	8
Soil 1	5	12.5	25	37.5	50	75	100	250
2	5	12.5	25	37.5	50	75	100	250
3	5	12.5	25	37.5	50	75	100	250
GW 1	5	12.5	25	37.5	50	75	100	250
2	5	12.5	25	37.5	50	75	100	250
3	5	12.5	25	37.5	50	75	100	250

Distance to receptor from source area

Target Criteria	
Compliance Point Type:	Groundwater Secondary Aquifer
Target Criteria:	DWS



Time Period (Years)							
1	2	3	4	5	6	7	8
1	2	5	10	50	100	1000	10000

Steady State Time Period

**MODEL 2: CONCEPTUAL SITE MODEL
PART 2 - PATHWAYS**

Conceptual Model Set-Up - PART 2, PATHWAYS

Navigation Page

PATHWAYS	ACTIVE	COMMENTS
MODEL TYPE	P	P - Probabilistic or D - Deterministic
RISK LEVEL	0.95	Risk Level for Probabilistic Output. Needs to be a decimal between 0 and 1. For Deterministic model set to 1.
FREE PRODUCT IDENTIFIED	NO	If free product has been identified the model can use Raoult's Law to assess input concentrations. Select Yes if product model required. Input concentrations are limited to BTEX/TPH.
PRODUCT TYPE (if present)	None	If the product has not been analysed for composition select the product type from the list to assess typical proportions of constituents
INPUT DATA FOR PRODUCT	None	Select either solubility limits or fraction specific data
SOIL SOLUBILITY LIMITATION	ON	Choose whether to limit soil leaching and mixing within groundwater (Stage 2 soil) to solubility limits. This reduction is not applied at Stage 1a/1b as it is assumed that free phase product can exist in pore spaces.
GROUNDWATER SOLUBILITY LIMITATION	ON	Choose whether to limit groundwater concentration inputs to the solubility limit (as referenced on the physchem database sheet and corrected for temperature).
LEACHATE SOLUBILITY LIMITATION	ON	Choose whether to limit reported leachate concentration inputs to the solubility limit (as referenced on the physchem database sheet and corrected for temperature). Note that due to dilution effects in the test procedure the Limit has been set at 10 x Solubility Limit.
ATTENUATION SOIL TO GROUNDWATER (UNSATURATED VERTICAL)	NO	Applies degradation of contaminants during leaching from soil to groundwater. Set to No if soil contamination reaches GW table or if free product identified. This should be set to No if the soil type has a grain size lower than a silty clay.
ATTENUATION ALONG VERTICAL (SATURATED)	NO	Only one of horizontal/vertical flow should be simulated. If horizontal flow set to YES then vertical should be set to NO.
ATTENUATION ALONG HORIZONTAL (SATURATED)	YES	Degradation of Contaminants along horizontal flow Path.
DILUTION WITHIN GROUNDWATER for List I & II Substances	YES	Dilution should not be applied to List I Substances if no groundwater contamination is present and the site is located in a GPZ (see note below).
EVIDENCE FOR SOURCE DEPLETION	N/A	<u>Justification required</u>
DECLINING SOURCE TERM	NO	Uses Bioscreen solutions (First Order and Instantaneous Reaction source depletion) and Consim based Leaching solution (interpreted as an equivalent first order decay rate)
PULSE SOURCE TERM	NO	Uses superposition to calculate results based on off-set steady state solutions (+ive and -ve contributions separated by pulse duration) to represent a pulse of contamination
DURATION OF PULSE SOURCE		Used to adjust the time element for the pulse solution. Time intervals may need to be changed on a contaminant by contaminant basis to review all of the graphical output
ASSESS ALL TPH SAMPLES	YES	Please review TPH data on the TPH Review sheets and select the most representative TPH composition for the site based on TPH properties and overall composition
CONCENTRATION DATA SOIL SOURCE 1	MAX	<u>Justification</u>
CONCENTRATION DATA SOIL SOURCE 2	MAX	<u>Justification</u>
CONCENTRATION DATA SOIL SOURCE 3	MAX	<u>Justification</u>
CONCENTRATION DATA GW SOURCE 1	MAX	<u>Justification</u>
CONCENTRATION DATA GW SOURCE 2	N/A	<u>Justification</u>
CONCENTRATION DATA GW SOURCE 3	N/A	<u>Justification</u>
DILUTION AT RECEPTOR	N/A	<u>Justification</u> - Only to be used with guidance / approval
DISPERSIVITY	Pickens & Grisak (Flow Path)	Pickens and Grisak, 1981 based on 10% of the flow path length (Default for short flow path). Other options should be considered to limit the effect of dispersion; - Neuman, 1990 based on $0.0175 \cdot L^{1.46}$ - Xu and Eckstein, 1995 based on $M \cdot [\log L] \cdot M_{exp}$

Note: Dilution in Aquifer

Allowing the dilution of List I contaminants, within a major or minor aquifer, could contravene the groundwater regulations, 1998. However, this is considered impractical in most cases and would only really be considered applicable if there was no groundwater contamination observed beneath the soil source (i.e. no groundwater contamination had yet occurred) and the site was located within designated groundwater protection zones. Therefore, when these conditions are not present the effect of dilution is included in the Stage 3 assessment. The pore water is mixed into the aquifer, based on a mass balance approach. This gives a dilution factor by which the leaching pore water is diluted.



**MODEL 2: CONCEPTUAL SITE MODEL
PART 3 - RECEPTORS**

Conceptual Model Set-Up - PART 3, RECEPTORS

Navigation Page

SOURCE DIMENSIONS	SOIL			GW			Comments
	1 HS1	2 HS2	3 HS3	1 SITE	2 HS1	3 HS2	
SOURCE PRESENT	YES	YES	YES	YES	NO	NO	
DISTANCES FOR PLOTS - 1	5	5	5	5			Minimum distance should not be <5m or 10% distance to Compliance Point, whichever is larger
DISTANCES FOR PLOTS - 2	12.5	12.5	12.5	12.5			Can be adjusted
DISTANCES FOR PLOTS - 3	25	25	25	25			Can be adjusted
DISTANCES FOR PLOTS - 4	37.5	37.5	37.5	37.5			Can be adjusted
COMPLIANCE POINT	50	50	50	50			Main assessment point
DISTANCES FOR PLOTS - 6	75	75	75	75			Can be adjusted
DISTANCES FOR PLOTS - 7	100	100	100	100			Can be adjusted
DISTANCES FOR PLOTS - 8	250	250	250	250			Can be adjusted
COMPLIANCE POINT TYPE	Groundwater Secondary Aquifer (A/B/Undifferentiated)						Select from List
TARGET CRITERIA	DWS						Rationale
RECEIVING WATER HARDNESS*							mg/l as CaCO3.
RECEIVING WATER FISH TYPE							Criteria for EQS Metals
WATER TYPE							Select from List
DATA SOURCE FOR RECEIVING WATER HARDNESS AND TYPE							Add Comment
STAGE 3 SOIL HORIZONTAL AND GROUNDWATER DISPERSION FACTORS							
LONGITUDINAL DISPERSION FACTOR	0.1	0.1	0.1	0.1			
LATERAL DISPERSION FACTOR	0.01	0.01	0.01	0.01			
VERTICAL DISPERSION FACTOR	0.001	0.001	0.001	0.001			
LONGITUDINAL DISPERSION	5	5	5	5			
LATERAL DISPERSION	0.5	0.5	0.5	0.5			
VERTICAL DISPERSION	0.05	0.05	0.05	0.05			
TRANSVERSE DISPERSION REDUCTION FACTOR 1	1.0000	1.0000	1.0000	1.0000			
TRANSVERSE DISPERSION REDUCTION FACTOR 2	1.0000	1.0000	0.9953	0.9953			
TRANSVERSE DISPERSION REDUCTION FACTOR 3	1.0000	0.9996	0.8427	0.8427			
TRANSVERSE DISPERSION REDUCTION FACTOR 4	0.9990	0.9816	0.6542	0.6542			
TRANSVERSE DISPERSION REDUCTION FACTOR 5	0.9867	0.9229	0.5205	0.5205			
TRANSVERSE DISPERSION REDUCTION FACTOR 6	0.9010	0.7614	0.3626	0.3626			
TRANSVERSE DISPERSION REDUCTION FACTOR 7	0.7841	0.6232	0.2763	0.2763			
TRANSVERSE DISPERSION REDUCTION FACTOR 8	0.3794	0.2763	0.1125	0.1125			

HS* - Hot Spot Source

* Default hardness should be set to 0 unless site/receptor data is available

Dimensions

(a) - Based on delineation using analytical data (e.g. distance to nearest clean data point)

(b) - Based on known extent of site infrastructure (e.g. hotspot around tankfarm etc)

(c) - Other, described below

DESCRIPTION OF RECEPTORS
The principal controlled waters receptor for the site is considered to be the underlying Zig Zag Chalk Principal Aquifer. Groundwater within the superficial deposits is also considered to be a secondary receptor and has been modelled separately in this assessment. The surface water features in the vicinity of the site which consist Bearton Pond approximately 200m north and cross gradient of the site, the River Hiz, located approximately 850m east of the site and the River Oughton and River Purwell, located greater than 1km north/north-east of the site, and not considered as potential receptors based on their distance from the site.

Use Alt+Enter to get a new line

Key to Data Worksheets

All cells on the user data worksheets (name* Data) are colour coded as follows.

User Values		These worksheet cells can be edited directly and are specifically for adding comments.
User Values		These worksheet cells can be edited directly and are specifically for values
Calculated Values		These worksheet cells contain calculated values and are protected. User values should not be entered directly into these cells.
User Values		These worksheet cells have been edited from the default formula. Justification to be provided.



MODEL 2: CONCEPTUAL SITE MODEL
PART 4 - DILUTION

Conceptual Model Set-Up - PART 4, DILUTION

Navigation Page

DILUTION: N/A

NOTES FOR DILUTION FACTORS

Dilution should only be considered when the following have been met;

The impact of groundwater contamination on the aquifer between source and receptor has been assessed

The impact does not prevent current or future use of the aquifer

The predicted impact at the receptor does not result in any measurable deterioration in water quality

The predicted impact at the receptor does not result in any exceedence of environmental standards

Needs to be supported by cost-benefit assessment

Dilution may not be suitable when;

No impact has been identified between the source and receptor

the aquifer has a high resource value

the current level of groundwater or surface water contamination is unacceptable

For dilution in streams the calculations should use low flow conditions (Q95 flow) and in addition;

needs to consider the total contaminant loading to the stream

whether impact would be detectable

upstream surface water quality

Consideration of potential impacts from other sources with subsequent reduction in target concentration

Currently assumes no attenuation of contaminants in river sediments

Dilution is site specific and needs to be treated with caution

Dilution at an abstraction well MUST NOT be used to back calculate remedial targets as the degree of risk

may increase in the future if abstraction rates change. It is therefore only a qualitative indication of

whether the current observed conditions present a significant risk

General Notes on Dilution



MODEL MODE:	PROBABILISTIC	0.95
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GEOLOGY SUMMARY	The site consists of made ground underlain by Lowestoft Formation. This formation forms an extensive sheet of chalky till, together with outwash sands and gravels, silts and clays. The till is characterised by its chalk and flint content. The carbonate content of the till matrix is about 30%, and tills within the underlying Happisburgh Formation have less than 20%. The Bedrock Geology of the site is reported to be the Zig Zag Chalk Formation. This consists of mostly firm, pale grey to off-white blocky chalk with a lower part characterised by rhythmic alternations of marls and marly chalks with firm white chalk. Thin gritty, silty chalk beds act as markers in the sequence. The thickness is typically 35–50 m bgl.
HYDROGEOLOGY SUMMARY	The Environment Agency website classifies the superficial Lowestoft formation as Unproductive Strata. These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow. The Environment Agency Website classifies the Zig Zag Chalk Formation as a Principal Aquifer. These are layers of rock or drift deposits that have high inter-granular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.
SURROUNDING LAND-USE AND SITE DESCRIPTION/HISTORY	North: STS Tyre Pros (Tyre Dealers) is situated approximately 5m north of the site beyond an access road. A three story apartment block with surrounding garden lies approximately 30m north of the site. South: The Fir Hotel lies approximately 5m south of the site beyond a small car parking area. Residential properties are situated approximately 30m south of the site. East: The site is bounded to the east by the A550 Bedford Road. Hitchin Town FC football ground is approximately 20m east of the site. West: The site is bounded to the west by a Garage and car park. Residential properties with gardens lie approximately 20m west of the site.
DISTRIBUTIONS/JUSTIFICATION	Describe rationale for distribution choice if it differs from the defaults recommended in TGN04. 
ATTENUATION AND COMPLIANCE POINT JUSTIFICATION AND PRODUCT SUMMARY	A 50m compliance point has been used to assess potential risks to the aquifer from hazardous substances.

Model Parameter	Minimum Value 5%	Expected Value 50%	Maximum Value 95%	Truncate Min	Truncate Max	Distribution Type	Stochastic Input	Units	Source/Comments
UNSATURATED ZONE PARAMETERS									
Soil Type at Source	Silty Sand						4	Soil Type Database sheet to define site	Select from list. Use Soil Type Database sheet to define site specific parameters if required.
Soil Type Description								Brief summary of soil type	Brief summary of soil type
Unsaturated Zone Dry Bulk Density	1.54	1.6200	1.70	1.539	1.701	Triangular	1.62	g/cm ³	selected soil type. User specified values can be entered here
Water Filled Porosity	0.14	0.1500	0.16	0.143	0.158	Triangular	0.15	fraction	This input is correlated with the air filled porosity at a level of -0.8 (i.e. inverse correlation) and @Risk will tend towards selecting high values of air filled when low values of water filled are selected and vice-versa.
Air Filled Porosity	0.23	0.2400	0.25	0.228	0.252	Triangular	0.24	fraction	Default based on selected soil type. User specified values can be input and justified in the Soil Type Database. A summary of any adjustment should be entered here.
Vertical Velocity (Stage 1b)	0.37	0.3891	0.41	0.370	0.409	Triangular	0.39	m/yr	Calculated
Organic Carbon - Unsaturated Zone	0.37	0.73	1.10	0.365	1.095	Triangular	0.73	%	unsaturated zone data where available. Organic carbon should be adjusted for TPH content (10,000mg/kg = Geomean of 13 samples from BH101, BH102, BH103, BH105, BH106 & VP101 - 103.
Unsaturated Zone Thickness below Source	0.00	0.00	0.00	0.00	0.00	Triangular	0.00	m	significant thickness of clean soils identified in vadose zone
Unsaturated Zone Hydraulic Conductivity	0.75	1.00	1.25	0.750	1.250	Triangular	1.00	m/day	Only relevant if significant thickness of clean soils identified in vadose zone
Soil pH	-	n/a	-					pH units	Used for reference purposes only
Depth to Groundwater	3.10	6.20	12.40	3.10	12.40	Triangular	7.23	m	Used for reference purposes only
Soil Source Thickness	3.10	6.20	12.40	3.10	12.40	Triangular	7.23		source for isolated exceedences only
Land Use Type for Infiltration	Hard-Standing								Depth of deepest soil exceedance at BH101 5.4m
%Age of Rainfall Infiltrating	0.08	0.10	0.13	0.08	0.13	Triangular	0.10	fraction	options to determined %infiltration.
Annual Rainfall (Long-term Average)	0.44	0.584	0.73	0.44	0.73	Triangular	0.58	m/yr	selected by default based on surface covering. Only over-type if justification can be provided.
Infiltration Rate	0.033	0.058	0.091	0.03	0.09		0.06	m/yr	Based on Met Office or other appropriate data
Aquifer Conditions (see Degradation Worksheets)	Aerobic								Greenwich gauging station 1971-2000 - Met Office
Decay Type - Unsaturated Zone	No Decay								Calculated from Rainfall and recharge rate
							2		For site specific degradation rates follow the guidance provided. For default rates an assessment of the likely aquifer type is required using the provided worksheet and the end choice entered here.
							0		See Database_COC sheet for degradation
									0 - No Decay, 1 - Decay. See Database_COC sheet for degradation Rates

Model Parameter	Minimum Value 5%	Expected Value 50%	Maximum Value 95%	Truncate Min	Truncate Max	Distribution Type	Stochastic Input	Units	Source/Comments
SATURATED ZONE PARAMETERS									
URS Corporation Ltd DRAFT									

MODEL MODE:	PROBABILISTIC	0.95
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Soil Type in Saturated Zone	Silty Sand							4	Soil Type Database sheet to define site	Select from list. Use Soil Type Database sheet to define site specific parameters if required.
Soil Type Description									groundwater bearing geological unit	Description of Main groundwater bearing geological unit
Organic Carbon - Saturated Zone	0.1	0.20	0.3	0.10	0.30	Triangular	0.20	%	Organic carbon should be adjusted for TPH content (10,000mg/kg = 1%) i.e. Actual TOC = measured TOC -	Site specific TOC results taken from soil samples from BH102A collected at 13.2m and 13.6m bgl in saturated zone.
Saturated Zone Dry Bulk Density	1.54	1.6200	1.7	1.54	1.70	Triangular	1.62	g/cm ³	selected soil type. User specified values can be	Default based on selected soil type. User specified values can be input and justified in the Soil Type Database. A summary of any adjustment should be entered here.
Hydraulic Conductivity	0.08	0.38	1.9	0.08	1.90	Triangular	0.79	m/day	Hydraulic Conductivity. If site specific values are available these may supersede literature	Calculated from the mean of slug test data from BH101, BH102, BH102A, BH103.
Hydraulic Gradient	0.0038	0.0075	0.0113	0.0038	0.0113	Triangular	0.0075	m/m	See note below on Hydraulic Gradient. Site specific gradients should be used wherever possible.	A gradient of 0.005 has been calculated for the site from monitoring wells screened in the Chalk and drift deposits in continuity with the Chalk. The gradient in the drift will be higher but cannot be measured with the current on site network. A gradient of 0.0075 has been assumed based on likely gradient over catchment to river.
Effective Porosity	0.15	0.20	0.25	0.150	0.250	Triangular	0.20	fraction	should be based on saturated geology type	Calculated based on porosity values from Fetter 1986
Aquifer Saturated Thickness	2.25	3.00	3.75	2.250	3.750	Triangular	3.00	m	specific data should be used wherever possible.	3m thickness based on BH102A where groundwater was encountered at 7m bgl and CLAY was encountered at 10m bgl.
Groundwater pH	-	7.59	-					pH units	Used for reference purposes only	Used for reference purposes only
Groundwater Eh	-	205.00	-					mV	Used for reference purposes only	Used for reference purposes only
Mixing Zone Thickness		3.00						m	for TPH. This value may be overwritten with site	Based on source term for TPH. This value may be overwritten with site specific data but must not exceed the saturated thickness. This value is generated for general information only
Groundwater Source Thickness		1.32						m	limited to thickness of 5m	Groundwater source limited to thickness of 20m. Source thickness can be input directly if required to minimise vertical dispersion from a groundwater source in the aquifer.
Groundwater Horizontal Velocity	0.002	0.014	0.086	0.002	0.086	Triangular	0.03	m/day	Calculated	Calculated values for general information
Dilution Factor in Aquifer		4.35						-	Used for sense check for assessing dilution of porewater concentrations within the aquifer underlying the site. Probabilistic output which can be reviewed once simulation has been run	
Decay Type - Saturated Zone	Default Decay							1	See Database_COC sheet for degradation	0 - No Decay, 1 - Decay. See Database_COC sheet for degradation Rates
Aquifer Conditions (see Degradation Worksheets)	Aerobic							2	For site specific degradation rates follow	For site specific degradation rates follow the guidance provided. For default rates an assessment of the likely aquifer type is required using the provided worksheet and the end choice entered here.
Decay Phase - Saturated Zone	All Phases								assumes all phases. For user specified this may be adjusted so	Default degradation assumes all phases. For user specified this may be adjusted so degradation only occurs in the dissolved phase. Note this applies to all contaminants so using a mixture of rates will require user specified values to be adjusted back in line with the retardation factor. This is not automated.

VERTICAL PATHWAY NOT CONSIDERED

Model Parameter	Minimum Value	Expected Value	Maximum Value	Truncate Min	Truncate Max	Distribution Type	Stochastic Input	Units	Source/Comments
UNDERLYING AQUIFER - STAGE 3 VERTICAL DEGRADATION CALCULATIONS									
Underlying Geology									groundwater bearing geological unit Description of Main groundwater bearing geological unit
Vertical Conductivity in Upper Aquifer								m/day	aquiclude. Default calculated as 1/10th
Vertical Gradient across aquifers								m/m	can be adjusted based on site data Default value of 1 but can be adjusted based on site data
Groundwater Vertical Velocity (Stage 3 vert)								m/year	on recharge or vertical permeability being 1/10th
Vertical Distance Through Saturated Aquifer								m	saturated aquifer in which vertical Thickness through saturated aquifer in which vertical degradation will occur (Stage 3 vertical model)

Model Parameter	Minimum Value	Expected Value	Maximum Value	Truncate Min	Truncate Max	Distribution Type	Stochastic Input	Units	Source/Comments
UNDERLYING AQUIFER - STAGE 3 VERTICAL DILUTION CALCULATIONS									
Lower Aquifer Horizontal Hydraulic Conductivity								m/day	data or literature value if site data not available Should be based on site data or literature value if site data not available
Lower Aquifer Horizontal Hydraulic Gradient								m/m	data or topographic information if site data Should be based on site data or topographic information if site data not available
Lower Aquifer Effective Thickness								m	low value to minimise potential for over This should be kept to a low value to minimise potential for over estimating dilution

SIMULATION PARAMETERS						Please refer to GW Horizontal Time worksheet for code for calculating breakthrough times for contaminants and if necessary to reset the Time slices below to default Note: If user specified time intervals are entered the breakthrough time element will not function.				
Time Periods	TIME SINCE RELEASE	TIME SINCE REMOVAL	PULSE CHECK	Benzene	LINK...	We have adopted the pragmatic approach that there is no feasible pathway for contaminants that theoretically take more than 10,000 years to migrate from source to point of compliance.				
Pulse Duration						For non-steady state assessments the risk assessor is required to select appropriate timescales for the contaminants of concern. For pulse source and declining source solutions these will need to be based on contaminant retarded velocity and compliance point distance. The timescales can be re-set for each contaminant and output graphs generated to present the data accordingly. The risk assessor should acknowledge that the summary tables may only be appropriate in detail for a number of contaminants at a time (since the peak concentration under these conditions will occur at different times and for different durations. This model is not programmed to adjust timescales for individual contaminants, however, a Time Interval Worksheet is provided as a guide to selecting appropriate time intervals based on the contaminant and solution being considered.				
Period 1	1					Example: Assume spill in 2006 for benzene. The contaminated soils were removed in 2008. Providing a soil source duration for a pulse of contamination of 2 years. The 2 year pulse is described on the Pathways sheet. The key contaminant of concern is benzene. Based on the site parameters and phys-chem parameters for benzene it is calculated that normal breakthrough at the receptor would take 2 years (Time interval 4 on Time intervals sheet). To create a breakthrough curve that covers the time before and after source removal the time intervals sheet suggests ranging the time intervals between 0.2 and 6 years. These time intervals are then copied over to column C as the model times and the results to the				
Period 2	2									
Period 3	5									
Period 4	10									
Period 5	50									
Period 6	100									

MODEL 2: MODEL INPUT PARAMETER SUMMARY



Navigation Page

0.0292

MODEL MODE:	PROBABILISTIC	0.95
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Period 7	1000					simulations reviewed.
Period 8	10000					

WATER BALANCE CHECK		Units	The local high point has been set at 700m southwest of the site on the boundary of the bolder clay at Foxholes. The area is hardstanding so infiltration has been set at 0.1.
Site Length	33	m	
Site Width	35	m	
Site Area	1155	m ²	
Groundwater Flow	0.62	m ³ /day	
Length of Catchment	700	m	
Area of Groundwater Catchment	24500	m ²	
Infiltration Rate	0.10	fraction	
Rainfall	0.584	m/year	
Adjustment Factor for flow not in main aquifer unit	0.20	-	
Total recharge	0.78	m ³ /day	
Recharge Factor	1.267	ratio	

Fraction of organic carbon
Site data is preferentially used.
If a literature value is required, the following sources will be considered:
P20, ConSim 2.02 manual, Barnes (2002).

Water/Air Filled Porosity Values
PSD and borehole log data used to classify soils to a USDA soil classification category
CLEA database values then selected by default.
These values may be over-written with user defined values if other reference is available

Infiltration
Total annual rainfall measured at the closest Met Office weather station, as listed on the Met Office Website (1971-2000 annual averages) will be used to estimate infiltration. 10 % or 25 % of the annual rainfall will be used in the QRA depending on the predicted end use. The 10% value can be associated with a run-off coefficient between 0.8 and 0.9, which is a range derived to represent a hard-standing area that is 70% or greater than the total site area. Therefore, this will be assigned to commercial and high-density residential end-uses. Low-density residential end-uses will be assigned a 25% infiltration rate.

Alternative rates will require further justification. Site specific recharge rates may be calculated using MORECS data (only appropriate where there is no hard standing).

Hydraulic Conductivity
Where the saturated pathway is a documented principal or secondary aquifer, the conductivity values listed in the major aquifer properties database (Allen et al, 1997) or the minor aquifer properties database (Jones et al, 2000) will be adopted where site specific data is unavailable. Where a classification of the saturated pathway is not available within these documents, a hydraulic conductivity value for the identified soil type or aquifer will be adopted from Fetter (1986).
Preference will be given to site derived data (eg slug tests) for shallow aquifers. Variability in permeability must be assessed for bedrock aquifers including preferential flow paths.

Hydraulic Gradient
The decision process for adopting the hydraulic gradient values on site are as follows: Plotting of URS obtained groundwater elevation monitoring data conducted at each site; Examining the relevant hydrogeological maps for each site where available to determine deeper aquifer gradients, and Examination of surface topography to determine the likely flow directions within the hydrological catchment of the site and, therefore, estimate the groundwater flow directions.

Effective Porosity
Where the main saturated pathway is a major or minor aquifer, the major aquifer properties database (Allen et al 1997) or the minor aquifer properties database (Jones et al, 2000) will be used to derive the effective porosity. Where no data is available, the effective porosity will be assumed to be equal to the specific yield and representative values will be adopted from those listed in Kruseman and de Ridder (1994, p 25, Table 3.1).

Aquifer Thickness
The aquifer thickness will be selected using the following data sources: Borehole log data, where the log data proves the aquifer thickness, the effective aquifer thickness' described in the major aquifer properties database (Allen et al, 1997) or the minor aquifer properties database (Jones et al, 2000). Where none of the above data are available the greatest saturated depth of water column present in the onsite boreholes will be used as the aquifer thickness,
Where none of the above data are available a default aquifer thickness of 5 m will be adopted.

Additional Notes for Site
Include any additional details regarding source/pathway/receptor assumptions and any additional observations about the data/CSM and whether specific conservative assumptions have been made in relation to the assessment.

MODEL 2: INPUT CONCENTRATIONS



Navigation Page

TPH:

Adjusted TPH Data Incorporated, Refer to TPH Review Sheets for detail

Order	Group	Determinand	Select	DWS / Freshwater	PhysChem	Reported Soil Conc	Model Soil Conc	Calculated Leachate Conc	Reported Leachate Conc	Model Leachate Conc	Product Conc	Reported GW Conc	Model GW Conc	SW Conc	Comments	List 1 or 2 substance	Solubility Limit	Soil Saturation Limit	Soil Source Zone (1, 2 or 3)	GW Source Zone (1, 2 or 3)
1.01	TPH 1	TPH (>EC5-7) aromatic (1)	Y	µg/l	Present	-	-	-	-	-	-	1.21E+03	1.21E+03	-		1	µg/l	mg/kg	1	1
1.02	TPH 1	TPH (>EC7-8) aromatic (1)	Y	7.00E+02	Present	-	-	-	-	-	-	3.92E+02	3.92E+02	-		1	1.30E+05	208.01	1	1
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	3.00E+02	Present	0.31	0.31	2.66E+01	-	-	-	1.96E+04	1.96E+04	-		1	6.50E+04	760.49	1	1
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	9.00E+01	Present	0.37	0.37	1.98E+01	-	-	-	4.82E+03	4.82E+03	-		1	2.50E+04	461.00	1	1
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	9.00E+01	Present	52.40	52.40	1.43E+03	-	-	-	2.12E+03	2.12E+03	-		1	5.80E+03	212.75	1	1
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	9.00E+01	Present	271.00	67.09	6.50E+02	-	-	-	6.17E+02	6.17E+02	-		1	6.50E+02	67.09	1	1
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	Present	641.00	6.07	6.60E+00	-	-	-	3.07E+02	6.60E+00	-		1	6.60E+00	6.07	1	1
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	1.50E+04	Present	0.02	0.02	2.22E+00	-	-	-	1.51E+03	1.51E+03	-		1	3.60E+04	328.95	1	1
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	1.50E+04	Present	0.15	0.15	4.64E+00	-	-	-	6.35E+03	5.40E+03	-		1	5.40E+03	172.21	1	1
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	3.00E+02	Present	0.38	0.38	1.67E+00	-	-	-	9.34E+03	4.30E+02	-		1	4.30E+02	97.48	1	1
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	3.00E+02	Present	0.55	0.55	3.11E-01	-	-	-	7.23E+03	3.40E+01	-		1	3.40E+01	59.87	1	1
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+02	Present	77.70	29.81	7.60E-01	-	-	-	1.95E+03	7.60E-01	-		1	7.60E-01	29.81	1	1
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	1.00E+01	Present	223.00	11.52	2.50E-03	-	-	-	7.42E+02	2.50E-03	-		1	2.50E-03	11.52	1	1
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	1.00E+01	Present	411.00	411.00	7.42E-03	-	-	-	7.66E+02	8.91E-02	-		1	8.91E-02	4937.03	1	1
1.2	TPH 1	TOTAL TPH (1)	Y	No Criterion	Present	1.68E+03	5.80E+02	2.14E+03	-	-	-	5.70E+04	3.61E+04	-		1	-	-	1	1
2	BTEX	Benzene	Y	1.00E+00	Present	0.00	0.00	3.68E+00	-	-	-	7.68E+02	7.68E+02	-		1	1.78E+06	1073.80	3	1
2.01	BTEX	Toluene	Y	7.00E+02	Present	0.01	0.01	7.07E+00	-	-	-	4.65E+02	4.65E+02	-		1	5.90E+05	943.31	1	1
2.02	BTEX	Ethylbenzene	Y	3.00E+02	Present	0.01	0.01	2.35E+00	-	-	-	3.76E+03	3.76E+03	-		1	1.69E+05	570.59	1	1
2.03	BTEX	Xylenes	Y	5.00E+02	Present	0.02	0.02	4.77E+00	-	-	-	1.24E+04	1.24E+04	-		1	2.00E+05	683.84	1	1
3	PAH	Acenaphthene	Y	2.20E+03	Present	20.90	20.90	1.21E+03	-	-	-	2.35E+00	2.35E+00	-		1	3.80E+03	65.38	2	1
3	PAH	Acenaphthylene	Y	1.00E+01	Present	1.76	1.76	1.32E+02	-	-	-	7.53E-01	7.53E-01	-		1	1.61E+04	215.36	2	1
3	PAH	Anthracene	Y	1.10E+04	Present	17.80	1.85	4.50E+01	-	-	-	1.43E+00	1.43E+00	-		1	4.50E+01	1.85	2	1
3	PAH	Benzo(a)anthracene	Y	2.90E-02	Present	23.40	2.15	3.80E+00	-	-	-	4.95E-01	4.95E-01	-		1	3.80E+00	2.15	2	1
3	PAH	Benzo(a)pyrene	Y	1.00E-02	Present	23.90	3.58	3.80E+00	-	-	-	3.59E-01	3.59E-01	-		1	3.80E+00	3.58	2	1
3	PAH	Benzo(b)fluoranthene	Y	2.50E-02	Present	26.70	1.53	2.00E+00	-	-	-	3.72E-02	3.72E-02	-		1	2.00E+00	1.53	2	1
3	PAH	Benzo(g,h,i)perylene	Y	2.50E-02	Present	13.70	0.79	2.60E-01	-	-	-	2.33E-02	2.33E-02	-		1	2.60E-01	0.79	2	1
3	PAH	Benzo(k)fluoranthene	Y	2.50E-02	Present	9.62	0.86	8.00E-01	-	-	-	4.31E-02	4.31E-02	-		1	8.00E-01	0.86	2	1
3	PAH	Chrysene	Y	2.90E+00	Present	17.30	0.80	2.00E+00	-	-	-	6.39E-01	6.39E-01	-		1	2.00E+00	0.80	2	1
3	PAH	Dibenzo(a,h)anthracene	Y	2.90E-03	Present	3.44	0.82	6.00E-01	-	-	-	-	-	-		1	6.00E-01	0.82	2	1
3	PAH	Fluoranthene	Y	2.00E-01	Present	55.60	30.58	2.30E+02	-	-	-	1.21E+00	1.21E+00	-		1	2.30E+02	30.58	2	1
3	PAH	Fluorene	Y	1.50E+03	Present	17.70	17.70	8.56E+02	-	-	-	5.51E+00	5.51E+00	-		1	1.90E+03	39.27	2	1
3	PAH	Indeno[1,2,3-cd]pyrene	Y	2.50E-02	Present	11.70	0.13	2.00E-01	-	-	-	2.16E-02	2.16E-02	-		1	2.00E-01	0.13	2	1
3	PAH	Naphthalene	Y	1.00E+00	Present	4.20	4.20	8.74E+02	-	-	-	5.60E+02	5.60E+02	-		1	1.90E+04	91.33	2	1
3	PAH	Phenanthrene	Y	1.00E+01	Present	62.70	44.23	1.10E+03	-	-	-	7.34E+00	7.34E+00	-		1	1.10E+03	44.23	2	1
3	PAH	Pyrene	Y	1.10E+03	Present	46.50	15.39	1.30E+02	-	-	-	2.11E+00	2.11E+00	-		1	1.30E+02	15.39	2	1
4	METALS	Arsenic	Y	1.00E+01		21.90	21.90	4.38E+01	-	-		-	-	-		2	1.70E+07	8501574.07	2	1
4	METALS	Boron	Y	1.00E+03		13.60	13.60	1.35E+03	-	-		-	-	-		2	5.50E+08	5550925.93	2	1
4	METALS	Cadmium	Y	5.00E+00		8.75E-01	0.88	8.74E+00	-	-		-	-	-		1	5.70E+08	57052777.78	2	1
4	METALS	Chromium III	Y	5.00E+01		31.10	31.10	6.48E+00	-	-		-	-	-		2	6.29E+08	3019258240.74	2	1
4	METALS	Cobalt	Y	1.10E+01		1.05E+01	10.50	2.33E+02	-	-		-	-	-		2	1.40E+07	631296.30	2	1
4	METALS	Copper	Y	2.00E+03		106.00	106.00	1.06E+03	-	-		-	-	-		2	8.00E+04	8007.41	2	1
4	METALS	Lead	Y	2.50E+01		128.00	128.00	3.56E+00	-	-		-	-	-		2	5.00E+01	1800.00	2	1
4	METALS	Molybdenum	Y	2.00E+01		0.29	0.29	1.46E+01	-	-		-	-	-		2	4.90E+05	9845.37	2	1
4	METALS	Nickel	Y	2.00E+01		37.50	37.50	7.50E+01	-	-		-	-	-		2	1.90E+05	95017.59	2	1
4	METALS	Tin	Y	2.20E+04		12.20	3.18	1.27E+01	-	-		-	-	-		2	1.27E+01	3.18	2	1
4	METALS	Zinc	Y	5.00E+03		230.00	230.00	6.04E+03	-	-		-	-	-		1	1.62E+07	617100.00	2	1



URS site-specific controlled waters risk assessment tool

designed on the principles and methodologies contained within EA Remedial Targets Methodology, 2006



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Version: CWRA, version 7.292min

Date: 13/07/2011

MODEL 2: PROBABILISTIC GROUNDWATER RESULTS

**MODEL 2: WATER RESULTS OUTPUT SUMMARY -
PROBABILISTIC OUTPUT BY TIME**

Navigation Page				RISK LEVEL		9.50E-01																								
Vert:	NO																													
Dil:	NO																													
									VERTICAL			Year: 1	Year: 2	Year: 5	Year: 10	Year: 50	Year: 100	Year: 1000	Year: 10000	Year: 1	Year: 2	Year: 5	Year: 10	Year: 50	Year: 100	Year: 1000	Year: 10000			
Order	Group	Determinand	Select	DWS / Freshwater	Solubility	Model GW Conc	Time for S/S	Simulated	HI	GWTC3	SIMULATED CONCENTRATION										CALCULATED HAZARD INDEX									
1.01	TPH 1	TPH (<EC5-7) aromatic (1)	Y	µg/l	µg/l	µg/l	Years	µg/l			µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	1.81E+01	1.81E+01	1.65E+00	1.80E+00	1.81E+00	1.81E+00	1.81E+00	1.81E+00	1.81E+00		
1.02	TPH 1	TPH (<EC7-8) aromatic (1)	Y	1.00E+01	1.80E+06	1.21E+03	6.66E+00	3.07E-02	2.89E+00	1.65E+01	1.80E+01	1.81E+01	1.81E+01	2.47E-01	2.47E-01	2.47E-01	2.47E-01	2.47E-01	2.47E-01	<0.01	2.89E-01	1.65E+00	1.80E+00	1.81E+00	1.81E+00	1.81E+00	1.81E+00	1.81E+00		
1.03	TPH 1	TPH (<EC8-10) aromatic (1)	Y	7.00E+02	1.30E+05	3.92E+02	8.48E+00	3.92E-07	2.21E-03	1.67E-01	2.46E-01	2.47E-01	2.47E-01	2.47E-01	2.47E-01	2.47E-01	2.47E-01	2.47E-01	2.47E-01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
1.04	TPH 1	TPH (<EC8-10) aromatic (1)	Y	3.00E+02	6.50E+04	1.96E+04	2.50E+01	1.96E-05	1.96E-05	1.02E-05	3.65E-05	4.19E-04	4.19E-04	4.19E-04	4.19E-04	4.19E-04	4.19E-04	4.19E-04	4.19E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
1.04	TPH 1	TPH (<EC10-12) aromatic (1)	Y	9.00E+01	2.50E+04	4.82E+03	1.70E+01	4.82E-06	4.82E-06	4.82E-06	4.82E-06	1.74E-03	1.74E-03	1.74E-03	1.74E-03	1.74E-03	1.74E-03	1.74E-03	1.74E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
1.05	TPH 1	TPH (<EC12-16) aromatic (1)	Y	9.00E+01	5.80E+03	2.12E+03	6.63E+01	2.12E-06	2.12E-06	2.12E-06	9.61E-07	1.05E-06	1.05E-06	1.05E-06	1.05E-06	1.05E-06	1.05E-06	1.05E-06	1.05E-06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
1.06	TPH 1	TPH (<EC16-21) aromatic (1)	Y	9.00E+01	6.50E+02	1.17E+02	1.80E+02	3.21E-07	3.21E-07	3.21E-07	4.21E-07	2.21E-07	2.21E-07	2.21E-07	2.21E-07	2.21E-07	2.21E-07	2.21E-07	2.21E-07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
1.07	TPH 1	TPH (<EC21-35) aromatic (1)	Y	9.00E+01	6.60E+00	6.60E+00	9.50E+02	2.32E-09	2.33E-09	2.32E-09	2.33E-09	2.33E-09	2.33E-09	2.33E-09	2.33E-09	2.33E-09	2.33E-09	2.33E-09	2.33E-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
1.08	TPH 1	TPH (<EC5-6) aliphatic (1)	Y	1.50E+04	3.60E+04	1.51E+03	1.63E+01	1.51E-06	1.51E-06	2.06E-05	4.67E-04	6.32E-04	6.32E-04	6.32E-04	6.32E-04	6.32E-04	6.32E-04	6.32E-04	6.32E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
1.09	TPH 1	TPH (<EC6-8) aliphatic (1)	Y	1.50E+04	5.40E+03	5.40E+03	3.44E+01	1.92E-06	1.93E-06	1.91E-06	1.92E-06	1.93E-06	1.93E-06	1.93E-06	1.93E-06	1.93E-06	1.93E-06	1.93E-06	1.93E-06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
1.1	TPH 1	TPH (<EC8-10) aliphatic (1)	Y	3.00E+02	4.30E+02	4.30E+02	1.18E+02	1.51E-07	1.52E-07	1.52E-07	1.52E-07	1.52E-07	1.52E-07	1.52E-07	1.52E-07	1.52E-07	1.52E-07	1.52E-07	1.52E-07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
1.11	TPH 1	TPH (<EC10-12) aliphatic (1)	Y	3.00E+02	3.40E+01	3.40E+01	4.37E+02	1.20E-08	1.20E-08	1.20E-08	1.20E-08	1.20E-08	1.20E-08	1.20E-08	1.20E-08	1.20E-08	1.20E-08	1.20E-08	1.20E-08	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
1.12	TPH 1	TPH (<EC12-16) aliphatic (1)	Y	3.00E+02	7.60E-01	7.60E-01	2.16E+03	2.67E-10	2.69E-10	2.69E-10	2.69E-10	2.69E-10	2.69E-10	2.69E-10	2.69E-10	2.69E-10	2.69E-10	2.69E-10	2.69E-10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
1.13	TPH 1	TPH (<EC16-21) aliphatic (1)	Y	1.00E+01	2.50E+03	2.50E+03	3.75E+04	8.79E-13	8.84E-13	8.84E-13	8.84E-13	8.84E-13	8.84E-13	8.84E-13	8.84E-13	8.84E-13	8.84E-13	8.84E-13	8.84E-13	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
1.14	TPH 1	TPH (<EC21-35) aliphatic (1)	Y	1.00E+01	8.91E-02	8.91E-02	2.27E+05	3.13E-11	3.15E-11	3.15E-11	3.15E-11	3.15E-11	3.15E-11	3.15E-11	3.15E-11	3.15E-11	3.15E-11	3.15E-11	3.15E-11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
1.2	TPH 1	TOTAL TPH (1)	Y	No Criterion		3.61E+04		3.08E-02	2.89E+00	1.67E+01	1.86E+01	1.87E+01	1.87E+01	1.87E+01	1.87E+01	1.87E+01	1.87E+01	1.87E+01	1.87E+01											
2	BTEX	Benztene	Y	1.00E+00	1.78E+06	1.68E+02	6.66E+00	1.86E-02	1.85E+00	1.80E+01	1.20E+01	1.20E+01	1.20E+01	1.20E+01	1.20E+01	1.20E+01	1.20E+01	1.20E+01	1.20E+01	1.86E-02	1.85E+00	1.08E+01	1.20E+01	1.20E+01	1.20E+01	1.20E+01	1.20E+01	1.20E+01		
2.01	BTEX	Toluene	Y	7.00E+02	5.90E+05	4.65E+02	8.47E+00	4.65E-07	2.93E+03	1.83E-01	2.63E-01	2.64E-01	2.64E-01	2.64E-01	2.64E-01	2.64E-01	2.64E-01	2.64E-01	2.64E-01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
2.02	BTEX	Ethylbenzene	Y	3.00E+02	1.69E+05	3.76E+03	1.36E+01	3.76E-06	4.81E-06	6.42E-02	3.47E-01	4.09E-01	4.09E-01	4.09E-01	4.09E-01	4.09E-01	4.09E-01	4.09E-01	4.09E-01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
2.03	BTEX	Xylenes	Y	5.00E+02	2.00E+05	1.24E+04	1.39E+01	1.24E-05	1.04E-05	1.48E-01	1.16E+00	1.43E+00	1.43E+00	1.43E+00	1.43E+00	1.43E+00	1.43E+00	1.43E+00	1.43E+00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
3	PAH	Acenaphthene	Y	2.20E+03	3.80E+03	2.35E+00	4.55E+01	2.35E-09	2.35E-09	2.35E-09	2.35E-09	1.69E-06	1.69E-06	1.69E-06	1.69E-06	1.69E-06	1.69E-06	1.69E-06	1.69E-06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
3	PAH	Acenaphthylene	Y	1.00E+01	1.61E+04	7.53E-01	4.01E+01	7.53E-10	7.53E-10	7.53E-10	1.93E-08	3.25E-06	3.25E-06	3.25E-06	3.25E-06	3.25E-06	3.25E-06	3.25E-06	3.25E-06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
3	PAH	Anthracene	Y	1.10E+04	4.50E+01	1.43E+00	1.20E+02	1.43E-09	1.43E-09	1.43E-09	1.43E-09	1.58E-06	5.16E-06	5.29E-06	5.29E-06	5.29E-06	5.29E-06	5.29E-06	5.29E-06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
3	PAH	Benzo(a)anthracene	Y	2.90E-02	3.80E+00	4.95E-01	7.45E+02	1.79E-10	1.79E-10	1.79E-10	1.79E-10	1.79E-10	1.77E-10	1.79E-10	1.79E-10	1.79E-10	1.79E-10	1.79E-10	1.79E-10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
3	PAH	Benzo(a)pyrene	Y	1.00E-02	3.80E+00	3.59E-01	9.62E+02	1.26E-10	1.27E-10	1.27E-10	1.27E-10	1.27E-10	1.27E-10	1.27E-10	1.27E-10	1.27E-10	1.27E-10	1.27E-10	1.27E-10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
3	PAH	Benzo(b)fluoranthene	Y	2.50E-02	2.00E+00	3.72E-02	8.83E+02	1.31E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11	1.32E-11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
3	PAH	Benzo(g,h,i)perylene	Y	2.50E-02	2.60E-01	2.33E-02	1.76E+03	8.19E-12	8.24E-12	8.24E-12	8.24E-12	8.24E-12	8.24E-12	8.24E-12	8.24E-12	8.24E-12	8.24E-12	8.24E-12	8.24E-12	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
3	PAH	Benzo(k)fluoranthene	Y	2.50E-02	8.00E-01	4.31E-02	1.05E+03	1.52E-11	1.52E-11	1.52E-11	1.52E-11	1.52E-11	1.52E-11	1.52E-11	1.52E-11	1.52E-11	1.52E-11	1.52E-11	1.52E-11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
3	PAH	Chrysene	Y	2.90E+00	2.00E+00	6.39E-01	6.16E+02	2.61E-10	2.61E-10	2.61E-10	2.61E-10	2.61E-10	2.45E-10	2.53E-10	2.53E-10	2.53E-10	2.53E-10	2.53E-10	2.53E-10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
3	PAH	Fluoranthene	Y	2.00E-01	2.30E+02	1.21E+00	2.64E+02	1.21E-09	1.21E-09	1.21E-09	1.21E-09	5.60E-10	6.30E-10	6.15E-09	8.15E-09	8.15E-09	8.15E-09	8.15E-09	8.15E-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
3	PAH	Fluorene	Y	1.50E+03	1.90E+03	5.91E+00	5.51E+00	5.51E-09	5.51E-09	5.51E-09	5.51E-09	7.39E-07	7.42E-07	7.42E-07	7.42E-07	7.42E-07	7.42E-07	7.42E-07	7.42E-07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
3	PAH	Indeno[1,2,3-cd]pyrene	Y	2.50E-02	2.00E-01	2.16E-02	7.90E+02	7.68E-12	7.68E-12	7.68E-12	7.68E-12	7.68E-12	7.68E-12	7.68E-12	7.68E-12	7.68E-12	7.68E-12	7.68E-12	7.68E-12	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
3	PAH	Naphthalene	Y	1.00E+00	1.90E+04	5.60E+02	2.42E+01	5.60E-07	5.60E-07	3.82E-03	1.92E-01	5.00E-01	5.00E-01	5.00E-01	5.00E-01	5.00E-01	5.00E-01	5.00E-01	5.00E-01	<0.01	<0.01	1.92E-01	5.00E-01	5.00E-01	5.00E-01	5.00E-01	5.00E-01			
3	PAH	Phenanthrene	Y	1.00E+01	1.10E+03	7.21E+00	1.06E+02	7.34E-09	7.34E-09	7.34E-09	7.34E-09	3.22E-06	8.79E-06	8.89E-06	8.89E-06	8.89E-06	8.89E-06	8.89E-06	8.89E-06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		
3	PAH	Pyrene	Y	1.10E+03	1.30E+02	2.11E+00	2.90E+02	2.11E-09	2.11E-09	2.11E-09	2.11E-09	2.11E-																		

MODEL 2: WATER RESULTS OUTPUT SUMMARY -
PROBABILISTIC OUTPUT BY TIME

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1.01	TPH 1	TPH (>EC5-7) aromatic (1)	Y	µg/l	µg/l	µg/l	IR	4.19E+03	7.31E+02	6.71E+02	6.69E+02	6.69E+02	6.69E+02	6.69E+02	µg/l	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

MODEL 2: WATER RESULTS OUTPUT SUMMARY -
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							Years	Years	Years	Years	Years	Years	Years	Years	Years	Years	Years	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µ

[illegible]

MODEL 2: WATER RESULTS OUTPUT SUMMARY -
PROBABILISTIC SUMMARY (SS @ CP)

Navigation Page																																
Vert:	NO	RISK LEVEL		9.50E-01																												
Dil:	NO																															
Order	Group	Determinand	Select	DWS / Freshwater	Solubility	Model GW Conc	SIMULATED CONCENTRATION														CALCULATED HAZARD INDEX											
							0.05	0.1	0.25	0.5	0.8	0.9	0.95	1	0.05	0.1	0.25	0.5	0.8	0.9	0.95	1										
1.01	TPH 1	TPH (>EC5-7) aromatic (1)	Y	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	
1.02	TPH 1	TPH (>EC7-8) aromatic (1)	Y	1.00E+01	1.80E+06	1.21E+03	3.10E-05	5.35E-04	3.04E-02	5.87E-01	5.29E+00	1.14E+01	1.81E+01	7.24E+01	<0.01	<0.01	<0.01	5.87E-02	5.29E-01	1.14E+00	1.81E+00	7.24E+00										
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	7.00E+02	1.30E+05	3.92E+02	9.36E-08	1.03E-07	2.65E-06	3.53E-04	1.72E-02	8.84E-02	2.47E-01	3.81E+00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	3.00E+02	6.50E+04	1.96E+04	4.31E-06	4.37E-06	4.55E-06	4.99E-06	6.79E-06	4.30E-05	4.19E-04	3.57E-02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	9.00E+01	2.50E+04	4.82E+03	1.06E-06	1.08E-06	1.14E-06	1.33E-06	3.14E-05	3.54E-04	1.74E-03	1.83E-01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	9.00E+01	5.80E+03	2.12E+03	4.63E-07	4.71E-07	4.87E-07	5.26E-07	6.32E-07	7.66E-07	1.05E-06	5.09E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	6.50E+02	6.17E+02	1.34E-07	1.37E-07	1.41E-07	1.52E-07	1.81E-07	2.14E-07	2.86E-07	8.29E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.08	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	6.60E+00	6.60E+00	1.44E-09	1.46E-09	1.51E-09	1.62E-09	1.89E-09	2.10E-09	2.33E-09	3.44E-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	1.50E+04	3.60E+04	1.51E+03	3.34E-07	3.40E-07	3.61E-07	4.24E-07	1.16E-05	1.66E-04	6.32E-04	1.24E-01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	1.50E+04	5.40E+03	5.40E+03	1.18E-06	1.20E-06	1.23E-06	1.33E-06	1.55E-06	1.73E-06	1.93E-06	3.69E-05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	3.00E+02	4.30E+02	4.30E+02	9.37E-08	9.53E-08	9.83E-08	1.06E-07	1.23E-07	1.37E-07	1.52E-07	2.24E-07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	3.00E+02	3.40E+01	3.40E+01	7.41E-09	7.54E-09	7.77E-09	8.36E-09	9.73E-09	1.08E-08	1.20E-08	1.77E-08	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+02	7.60E-01	7.60E-01	1.66E-10	1.68E-10	1.74E-10	1.87E-10	2.18E-10	2.42E-10	2.69E-10	3.96E-10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	1.00E+01	2.50E-03	2.50E-03	5.45E-13	5.54E-13	5.72E-13	6.15E-13	7.16E-13	7.97E-13	8.84E-13	1.30E-12	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	1.00E+01	8.91E-02	8.91E-02	1.94E-11	1.97E-11	2.04E-11	2.19E-11	2.55E-11	2.84E-11	3.15E-11	4.64E-11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
1.2	TPH 1	TOTAL TPH (1)	Y	No Criterion		3.61E+04	5.19E-05	5.84E-04	3.23E-02	5.97E-01	5.48E+00	1.14E+01	1.87E+01	7.25E+01																		
2	BTEX	Benzene	Y	1.00E+00	1.78E+06	7.68E+02	3.94E-05	4.83E-04	1.51E-02	3.71E-01	3.40E+00	7.56E+00	1.20E+01	3.85E+01	<0.01	<0.01	1.51E-02	3.71E-01	3.40E+00	7.56E+00	1.20E+01	3.85E+01										
2.01	BTEX	Toluene	Y	7.00E+02	5.90E+05	4.65E+02	1.09E-07	1.20E-07	2.09E-06	4.27E-04	2.35E-02	1.06E-01	2.64E-01	2.86E+00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
2.02	BTEX	Ethylbenzene	Y	3.00E+02	1.69E+05	3.76E+03	8.52E-07	8.92E-07	1.11E-06	1.30E-04	2.51E-02	1.14E-01	4.09E-01	1.87E+01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
2.03	BTEX	Xylenes	Y	5.00E+02	2.00E+05	1.24E+04	2.82E-06	2.96E-06	3.61E-06	3.97E-04	9.51E-02	3.78E-01	1.43E+00	2.27E+01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Acenaphthene	Y	2.20E+03	3.80E+03	2.35E+00	5.19E-10	5.29E-10	5.61E-10	6.62E-10	3.54E-08	2.90E-07	1.69E-06	8.52E-05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Acenaphthylene	Y	1.00E+01	1.61E+04	7.53E-01	1.68E-10	1.72E-10	1.88E-10	3.31E-10	9.97E-08	7.79E-07	3.25E-06	8.99E-05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Anthracene	Y	1.10E+04	4.50E+01	1.43E+00	3.18E-10	3.25E-10	3.54E-10	5.28E-10	1.60E-07	1.50E-06	5.29E-06	3.69E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Benzo(a)anthracene	Y	2.90E-02	3.80E+00	4.95E-01	1.08E-10	1.10E-10	1.13E-10	1.22E-10	1.42E-10	1.59E-10	1.79E-10	5.54E-10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Benzo(a)pyrene	Y	1.00E-02	3.80E+00	3.59E-01	7.82E-11	7.96E-11	8.21E-11	8.82E-11	1.03E-10	1.14E-10	1.27E-10	1.87E-10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Benzo(b)fluoranthene	Y	2.50E-02	2.00E+00	3.72E-02	8.11E-12	8.24E-12	8.51E-12	9.15E-12	1.07E-11	1.19E-11	1.32E-11	3.68E-11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Benzo(g,h,i)perylene	Y	2.50E-02	2.60E-01	2.33E-02	5.08E-12	5.16E-12	5.33E-12	5.73E-12	6.67E-12	7.42E-12	8.24E-12	1.21E-11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Benzo(k)fluoranthene	Y	2.50E-02	8.00E-01	4.31E-02	9.39E-12	9.55E-12	9.86E-12	1.06E-11	1.23E-11	1.37E-11	1.52E-11	2.24E-11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Chrysene	Y	2.90E+00	2.00E+00	6.39E-01	1.39E-10	1.42E-10	1.46E-10	1.58E-10	1.85E-10	2.11E-10	2.53E-10	1.13E-06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Fluoranthene	Y	2.00E-01	2.30E+02	1.21E+00	2.65E-10	2.69E-10	2.80E-10	3.06E-10	3.97E-10	9.49E-10	8.15E-09	1.20E-05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Fluorene	Y	1.50E+03	1.90E+03	5.51E+00	1.21E-09	1.23E-09	1.30E-09	1.47E-09	9.22E-09	1.64E-07	7.42E-07	1.24E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
3	PAH	Indeno[1,2,3-cd]pyrene	Y	2.50E-02	2.00E-01	2.16E-02	4.71E-12	4.79E-12	4.94E-12																							

MODEL 2: WATER RESULTS OUTPUT SUMMARY -
PROBABILISTIC SUMMARY (SS @ CP)

Navigation Page																												
Vert:	NO	RISK LEVEL 9.50E-01																										
Dil:	NO																											
Order	Group	Determinand	Select	DWS / Freshwater	Solubility	Model GW Conc	GWTC3 horizontal								GWTC4 Dilution	RISK LEVEL												
							0.05	0.1	0.25	0.5	0.8	0.9	0.95	1		Stage 3: 0.05	Stage 3: 0.1	Stage 3: 0.25	Stage 3: 0.5	Stage 3: 0.8	Stage 3: 0.9	Stage 3: 0.95	Stage 3: 1	Stage 4: Dilution				
1.01	TPH 1	TPH (>EC5-7) aromatic (1)	Y	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l													
1.02	TPH 1	TPH (>EC7-8) aromatic (1)	Y	1.00E+01	1.80E+06	1.21E+03	IR	IR	IR	2.06E+04	2.29E+03	1.06E+03	6.69E+02	1.67E+02														
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	3.00E+02	6.50E+04	1.96E+04	IR	IR	IR	IR	IR	IR	IR	IR														
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	9.00E+01	2.50E+04	4.82E+03	IR	IR	IR	IR	IR	IR	IR	IR														
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	9.00E+01	5.80E+03	2.12E+03	IR	IR	IR	IR	IR	IR	IR	IR														
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	9.00E+01	6.50E+02	6.17E+02	IR	IR	IR	IR	IR	IR	IR	IR														
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	6.60E+00	6.60E+00	IR	IR	IR	IR	IR	IR	IR	IR														
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	1.50E+04	3.60E+04	1.51E+03	IR	IR	IR	IR	IR	IR	IR	IR														
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	1.50E+04	5.40E+03	5.40E+03	IR	IR	IR	IR	IR	IR	IR	IR														
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	3.00E+02	4.30E+02	4.30E+02	IR	IR	IR	IR	IR	IR	IR	IR														
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	3.00E+02	3.40E+01	3.40E+01	IR	IR	IR	IR	IR	IR	IR	IR														
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+02	7.60E-01	7.60E-01	IR	IR	IR	IR	IR	IR	IR	IR														
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	1.00E+01	2.50E-03	2.50E-03	IR	IR	IR	IR	IR	IR	IR	IR														
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	1.00E+01	8.91E-02	8.91E-02	IR	IR	IR	IR	IR	IR	IR	IR														
1.2	TPH 1	TOTAL TPH (1)	Y	No Criterion		3.61E+04																						
2	BTEX	Benzene	Y	1.00E+00	1.78E+06	7.68E+02	IR	IR	5.10E+04	2.07E+03	2.26E+02	1.02E+02	6.37E+01	1.99E+01														
2.01	BTEX	Toluene	Y	7.00E+02	5.90E+05	4.65E+02	IR	IR	IR	IR	IR	IR	IR	IR														
2.02	BTEX	Ethylbenzene	Y	3.00E+02	1.69E+05	3.76E+03	IR	IR	IR	IR	IR	IR	IR	IR	6.04E+04													
2.03	BTEX	Xylenes	Y	5.00E+02	2.00E+05	1.24E+04	IR	IR	IR	IR	IR	IR	IR	IR	2.73E+05													
3	PAH	Acenaphthene	Y	2.20E+03	3.80E+03	2.35E+00	IR	IR	IR	IR	IR	IR	IR	IR														
3	PAH	Acenaphthylene	Y	1.00E+01	1.61E+04	7.53E-01	IR	IR	IR	IR	IR	IR	IR	IR														
3	PAH	Anthracene	Y	1.10E+04	4.50E+01	1.43E+00	IR	IR	IR	IR	IR	IR	IR	IR														
3	PAH	Benzo(a)anthracene	Y	2.90E-02	3.80E+00	4.95E-01	IR	IR	IR	IR	IR	IR	IR	IR														
3	PAH	Benzo(a)pyrene	Y	1.00E-02	3.80E+00	3.59E-01	IR	IR	IR	IR	IR	IR	IR	IR														
3	PAH	Benzo(b)fluoranthene	Y	2.50E-02	2.00E+00	3.72E-02	IR	IR	IR	IR	IR	IR	IR	IR														
3	PAH	Benzo(g,h,i)perylene	Y	2.50E-02	2.60E-01	2.33E-02	IR	IR	IR	IR	IR	IR	IR	IR														
3	PAH	Benzo(k)fluoranthene	Y	2.50E-02	8.00E-01	4.31E-02	IR	IR	IR	IR	IR	IR	IR	IR														
3	PAH	Chrysene	Y	2.90E+00	2.00E+00	6.39E-01	IR	IR	IR	IR	IR	IR	IR	IR														
3	PAH	Fluoranthene	Y	2.00E-01	2.30E+02	1.21E+00	IR	IR	IR	IR	IR	IR	IR	IR														
3	PAH	Fluorene	Y	1.50E+03	1.90E+03	5.51E+00	IR	IR	IR	IR	IR	IR	IR	IR														
3	PAH	Indeno[1,2,3-cd]pyrene	Y	2.50E-02	2.00E-01	2.16E-02	IR	IR	IR	IR	IR	IR	IR	IR														
3	PAH	Naphthalene	Y	1.00E+00	1.90E+04	5.60E+02	IR	IR	IR	IR	8.18E+03	2.48E+03	1.12E+03	1.03E+02														
3	PAH	Phenanthrene	Y	1.00E+01	1.10E+03	7.34E+00	IR	IR	IR	IR	IR	IR	IR	IR														
3	PAH	Pyrene	Y	1.10E+03	1.30E+02	2.11E+00	IR	IR	IR	IR	IR	IR	IR	IR														



URS site-specific controlled waters risk assessment tool

designed on the principles and methodologies contained within EA Remedial Targets Methodology, 2006



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Version: CWRA, version 7.292min

Date: 13/07/2011

MODEL 2 - PROBABILISTIC SOIL RESULTS

MODEL 2: SOIL RESULTS OUTPUT SUMMARY -
PROBABILISTIC OUTPUT BY TIME

Navigation Page												RISK LEVEL																			
Vert:	NO																														
Dil:	NO																														
Order	Group	Determinand	Select	DWS / Freshwater	Solubility	Soil Saturation Limit	Model Soil Conc	Receptor S/S time	VERTICAL			Year: 1	Year: 2	Year: 5	Year: 10	Year: 50	Year: 100	Year: 1000	Year: 10000	Year: 1	Year: 2	Year: 5	Year: 10	Year: 50	Year: 100	Year: 1000	Year: 10000				
									Simulated	HI	STC3	SIMULATED CONCENTRATION										CALCULATED HAZARD INDEX									
				µg/l	µg/l	mg/kg	mg/kg	Years	µg/l		mg/kg	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l												
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	3.00E+02	6.50E+04	7.60E+02	3.11E-01	2.50E+01				1.32E-08	1.32E-08	1.33E-08	5.00E-08	5.92E-07	5.92E-07	5.92E-07	5.92E-07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	9.00E+01	2.50E+04	4.61E+02	3.65E-01	4.70E+01				9.83E-09	9.83E-09	9.84E-09	1.13E-08	6.47E-06	6.47E-06	6.47E-06	6.47E-06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	9.00E+01	5.80E+03	2.13E+02	5.24E+01	6.63E+01				7.10E-07	7.10E-07	7.10E-07	7.10E-07	9.15E-07	9.15E-07	9.15E-07	9.15E-07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	9.00E+01	6.50E+02	6.71E+01	6.71E+01	1.80E+02				2.73E-07	2.73E-07	2.73E-07	2.73E-07	3.35E-07	3.35E-07	3.35E-07	3.35E-07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	6.60E+00	6.07E+00	6.07E+00	9.50E+02				2.77E-09	2.77E-09	2.77E-09	2.77E-09	2.77E-09	2.77E-09	2.77E-09	2.77E-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	1.50E+04	3.60E+04	3.29E+02	2.03E-02	1.63E+01				1.02E-09	1.03E-09	2.83E-08	6.81E-07	8.92E-07	8.92E-07	8.92E-07	8.92E-07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	1.50E+04	5.40E+03	1.72E+02	1.48E-01	3.44E+01				2.22E-09	2.22E-09	2.22E-09	2.22E-09	2.22E-09	2.22E-09	2.22E-09	2.22E-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	3.00E+02	4.30E+02	9.75E+01	3.78E-01	1.18E+02				8.20E-10	8.20E-10	8.20E-10	8.20E-10	8.20E-10	8.20E-10	8.20E-10	8.20E-10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	3.00E+02	3.40E+01	5.99E+01	5.47E-01	4.37E+02				1.54E-10	1.54E-10	1.54E-10	1.54E-10	1.54E-10	1.54E-10	1.54E-10	1.54E-10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+02	7.60E-01	2.98E+01	2.98E+01	2.16E+03				3.19E-10	3.19E-10	3.19E-10	3.19E-10	3.19E-10	3.19E-10	3.19E-10	3.19E-10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	1.00E+01	2.50E-03	1.15E+01	1.15E+01	3.75E+04				1.05E-12	1.05E-12	1.05E-12	1.05E-12	1.05E-12	1.05E-12	1.05E-12	1.05E-12	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	1.00E+01	8.91E-02	4.94E+03	4.11E+02	2.27E+05				3.68E-12	3.68E-12	3.68E-12	3.68E-12	3.68E-12	3.68E-12	3.68E-12	3.68E-12	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
1.2	TPH 1	TOTAL TPH (1)	Y	No Criterion			5.80E+02	-				9.93E-07	9.93E-07	1.08E-06	1.87E-06	1.71E-05	1.73E-05	1.75E-05	1.75E-05		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
2	BTEX	Benzene	Y	1.00E+00	1.78E+06	1.07E+03	2.22E-03	6.66E+00				3.63E-05	1.76E-03	1.06E-02	1.16E-02	1.16E-02	1.16E-02	1.16E-02	1.16E-02	<0.01	<0.01	1.06E-02	1.16E-02	1.16E-02	1.16E-02	1.16E-02	1.16E-02				
2.01	BTEX	Toluene	Y	7.00E+02	5.90E+05	9.43E+02	1.13E-02	8.47E+00				5.59E-09	4.96E-05	2.88E-03	4.17E-03	4.17E-03	4.17E-03	4.17E-03	4.17E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
2.02	BTEX	Ethylbenzene	Y	3.00E+02	1.69E+05	5.71E+02	7.92E-03	1.38E+01				1.16E-09	2.73E-09	3.97E-05	2.29E-04	2.69E-04	2.69E-04	2.69E-04	2.69E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
2.03	BTEX	Xylenes	Y	5.00E+02	2.00E+05	6.84E+02	1.63E-02	1.39E+01				2.34E-09	4.18E-09	5.84E-05	4.06E-04	5.24E-04	5.24E-04	5.24E-04	5.24E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Acenaphthene	Y	2.20E+03	3.80E+03	6.54E+01	2.09E+01	4.55E+01				5.86E-07	5.46E-07	5.49E-07	8.34E-07	7.95E-04	7.98E-04	7.98E-04	7.98E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Acenaphthylene	Y	1.00E+01	1.61E+04	2.15E+02	1.78E+00	4.01E+01				6.13E-08	6.03E-08	6.03E-08	3.06E-06	4.98E-04	4.98E-04	4.98E-04	4.98E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Anthracene	Y	1.10E+04	4.50E+01	1.85E+00	1.85E+00	1.20E+02				1.81E-08	1.77E-08	1.77E-08	4.29E-05	1.50E-04	1.55E-04	1.55E-04	1.55E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Benzo(a)anthracene	Y	2.90E-02	3.80E+00	2.15E+00	2.15E+00	7.45E+02				1.51E-09	1.41E-09	1.41E-09	1.41E-09	1.41E-09	1.41E-09	1.41E-09	1.41E-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Benzo(a)pyrene	Y	1.00E-02	3.80E+00	3.58E+00	3.58E+00	9.62E+02				1.51E-09	1.41E-09	1.41E-09	1.41E-09	1.41E-09	1.41E-09	1.41E-09	1.41E-09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Benzo(b)fluoranthene	Y	2.50E-02	2.00E+00	1.53E+00	1.53E+00	8.83E+02				7.95E-10	7.44E-10	7.44E-10	7.44E-10	7.44E-10	7.44E-10	7.44E-10	7.44E-10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Benzo(g,h,i)perylene	Y	2.50E-02	2.60E-01	7.91E-01	7.91E-01	1.76E+03				1.03E-10	9.67E-11	9.67E-11	9.67E-11	9.67E-11	9.67E-11	9.67E-11	9.67E-11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Benzo(k)fluoranthene	Y	2.50E-02	8.00E-01	8.64E-01	8.64E-01	1.05E+03				3.18E-10	2.97E-10	2.97E-10	2.97E-10	2.97E-10	2.97E-10	2.97E-10	2.97E-10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Chrysene	Y	2.90E+00	2.00E+00	8.03E-01	8.03E-01	6.16E+02				7.95E-10	7.49E-10	7.49E-10	7.49E-10	7.49E-10	7.49E-10	7.49E-10	7.49E-10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Dibenzo(a,h)anthracene	Y	2.90E-03	6.00E-01	8.16E-01	8.16E-01	1.18E+03				2.38E-10	2.23E-10	2.23E-10	2.23E-10	2.23E-10	2.23E-10	2.23E-10	2.23E-10	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Fluoranthene	Y	1.50E+03	1.90E+03	3.93E+01	1.77E+01	4.98E+01				3.99E-07	3.87E-07	3.85E-07	3.87E-07	1.09E-04	1.09E-04	1.09E-04	1.09E-04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Indeno[1,2,3-cd]pyrene	Y	2.50E-02	2.00E-01	1.27E-01	1.27E-01	7.90E+02				7.95E-11	7.44E-11	7.44E-11	7.44E-11	7.44E-11	7.44E-11	7.44E-11	7.44E-11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Naphthalene	Y	1.00E+00	1.90E+04	9.13E+01	4.42E+00	2.42E+01				4.08E-07	4.32E-07	5.27E-03	2.40E-01	7.06E-01	7.06E-01	7.06E-01	7.06E-01	<0.01	<0.01	2.40E-01	7.06E-01	7.06E-01	7.06E-01	7.06E-01					
3	PAH	Phenanthrene	Y	1.00E+01	1.10E+03	4.42E+01	4.42E+01	1.06E+02				4.41E-07	4.25E-07	4.25E-07	4.25E-07	4.21E-04	1.15E-03	1.15E-03	1.15E-03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
3	PAH	Pyrene	Y	1.10E+03	1.30E+02	1.54E+01	1.54E+01	2.90E+02				5.20E-08	4.98E-08	4.98E-08	4.98E-08	4.93E-08	2.67E-06	8.97E-05	8.97E-05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
4	METALS	Arsenic	Y	1.00E+01	1.70E+07	8.50E+06	2.19E+01	3.89E+04				1.76E-08	1.76E-08	1.76E-08	1.76E-08	1.76E-08	1.25E-07	7.10E+00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	7.10E-01					
4	METALS	Boron	Y	1.00E+03	5.50E+08	5.55E+06	1.36E+01	7.88E+02				5.43E-07	5.43E-07	5.43E-07	5.43E-07	7.75E-01	3.98E+01	4.77E+02	5.01E+02	<0.01	<0.01	<0.01	<0.01	<0.01	3.98E-02	4.77E-01	5.01E-01				
4	METALS	Cadmium	Y	5.00E+00	5.70E+08	5.71E+07	8.75E-01	7.79E+03				3.52E-09	3.52E-09	3.52E-09	3.52E-09	3.52E-09	3.52E-09	2.69E-01	3.09E+00	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5.39E-02	6.19E-01				
4	METALS	Chromium III	Y	5.00E+01	6.29E+08	3.02E+09	3.11E+01	3.67E+05				2.61E-09	2.61E-09	2.61E-09	2.61E-09	2.61E-09	2.61E-09	2.61E-09	4.25E-08	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				
4	METALS	Cobalt	Y	1.10E+01	1.40E+07	6.31E+05	1.05E+01	3.51E+03				9.38E-08	9.38E-08	9.38E-08	9.38E-08	5.08E-06	4.39E+01	8.61E+01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	3.96E+00	7.83E+00				
4	METALS	Copper	Y	2.00E+04	8.00E+04	8.01E+03	1.06E+02																								

Navigation Page																										
Vert:	NO	RISK LEVEL		9.5E-01																						
Dil:	NO																									
								Year: 1	Year: 2	Year: 5	Year: 10	Year: 50	Year: 100	Year: 1000	Year: 10000	TIME										
Order	Group	Determinand	Select	DWS / Freshwater	Solubility	Soil Saturation Limit	Model Soil Conc	STC3 horizontal								STC4 Dilution	Vertical	Stage 3: Year: 1	Stage 3: Year: 2	Stage 3: Year: 5	Stage 3: Year: 10	Stage 3: Year: 50	Stage 3: Year: 100	Stage 3: Year: 1000	Stage 3: Year: 10000	Stage 4 - Dilution
								mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	µg/l	6.50E+02	6.50E+04	7.60E+02	3.11E-01	IR	IR	IR	IR	IR	IR	IR	IR	IR									
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	3.00E+01	2.50E+04	2.50E+04	4.61E+02	3.65E-01	IR	IR	IR	IR	IR	IR	IR	IR	IR									
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	9.00E+01	5.80E+03	2.13E+02	5.24E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR									
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	9.00E+01	6.50E+02	6.71E+01	6.71E+01	6.71E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR									
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	6.60E+00	6.07E+00	6.07E+00	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR									
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	1.5E+04	3.60E+04	3.29E+02	2.03E-02	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR									
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	1.50E+04	5.40E+03	1.72E+02	1.48E-01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR									
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	3.00E+02	4.30E+02	9.75E+01	3.78E-01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR									
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	3.00E+02	3.40E+01	5.99E+01	5.47E-01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR									
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+02	7.60E-01	2.98E+01	2.98E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR									
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	1.00E+01	2.50E-03	1.15E+01	1.15E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR									
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	1.00E+01	8.91E-02	4.94E+03	4.11E-02	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR									
1.2	TPH 1	TOTAL TPH (1)	Y	No Criterion			5.80E+02																			
2	BTEX	Benzene	Y	1.00E+00	1.78E+06	1.07E+03	2.22E-03	IR	IR			2.09E-01	1.92E-01	1.92E-01	1.92E-01	1.92E-01	1.92E-01									
2.01	BTEX	Toluene	Y	7.00E+02	5.90E+05	9.43E+02	1.13E-02	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR									
2.02	BTEX	Ethylbenzene	Y	3.00E+02	1.69E+05	5.71E+02	7.92E-03	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR									
2.03	BTEX	Xylenes	Y	5.00E+02	2.00E+05	6.84E+02	1.83E-02	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR									
3	PAH	Acenaphthene	Y	2.20E+03	3.80E+03	6.54E+01	2.09E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR									
3	PAH	Acenaphthylene	Y	1.00E+01	1.61E+04	2.15E+02	1.76E+00	IR	IR																	

Navigation Page	
Vert:	NO
Dil:	NO

Distance 1	Distance 2	Distance 3	Distance 4	Distance 5	Distance 6	Distance 7	Distance 8	VERTICAL	Distance 1	Distance 2	Distance 3	Distance 4	Distance 5	Distance 6	Distance 7	Distance 8
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URS Corporation Ltd
DRAFT

[illegible]

0.05	0.10	0.25	0.50	0.80	0.90	0.95	1.00	0.05	0.10	0.25	0.50	0.80	0.90	0.95	1.00
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Soil Risk Summary - SS PERCENT

MODEL 2: SOIL RESULTS OUTPUT SUMMARY -
PROBABILISTIC SUMMARY (SS @ CP)

Navigation Page																																				
Vert:	NO																																			
Dil:	NO																		0.05	0.10	0.25	0.50	0.80	0.90	0.95	1.00	RISK LEVEL									
Order	Group	Determinand	Select	DWS / Freshwater	Solubility	Soil Saturation Limit	Model Soil Conc	STC3 horizontal								STC4 Dilution	0.05	0.1	0.25	0.5	0.8	0.9	0.95	1	Dilution											
			Y	µg/l	µg/l	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg																			
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	3.00E+02	6.50E+04	7.60E+02	3.11E-01	IR	IR	IR	IR	IR	IR	IR	IR	IR																				
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	9.00E+01	2.50E+04	4.61E+02	3.65E-01	IR	IR	IR	IR	IR	IR	IR	IR	IR																				
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	9.00E+01	5.80E+03	2.13E+02	5.24E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR																				
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	9.00E+01	6.50E+02	6.71E+01	6.71E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR																				
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	6.60E+00	6.07E+00	6.07E+00	IR	IR	IR	IR	IR	IR	IR	IR	IR																				
1.08	TPH 1	TPH (>EC5-8) aliphatic (1)	Y	1.50E+04	3.60E+04	3.29E+02	2.03E-02	IR	IR	IR	IR	IR	IR	IR	IR	IR																				
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	1.50E+04	5.40E+03	1.72E+02	1.48E-01	IR	IR	IR	IR	IR	IR	IR	IR	IR																				
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	3.00E+02	4.30E+02	9.75E+01	3.78E-01	IR	IR	IR	IR	IR	IR	IR	IR	IR																				
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	3.00E+02	3.40E+01	5.99E+01	5.47E-01	IR	IR	IR	IR	IR	IR	IR	IR	IR																				
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+02	7.60E-01	2.98E+01	2.98E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR																				
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	1.00E+01	2.50E-03	1.15E+01	1.15E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR																				
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	1.00E+01	8.91E-02	4.94E+03	4.11E+02	IR	IR	IR	IR	IR	IR	IR	IR	IR																				
1.2	TPH 1	TOTAL TPH (1)	Y	No Criterion			5.80E+02																													
2	BTEX	Benzene	Y	1.00E+00	1.78E+06	1.07E+03	2.22E-03	IR	IR	IR	IR	IR	IR	IR	IR	1.92E-01	3.30E-02																			
2.01	BTEX	Toluene	Y	7.00E+02	5.90E+05	9.43E+02	1.13E-02	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
2.02	BTEX	Ethylbenzene	Y	3.00E+02	1.69E+05	5.71E+02	7.92E-03	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
2.03	BTEX	Xylenes	Y	5.00E+02	2.00E+05	6.84E+02	1.63E-02	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
3	PAH	Acenaphthene	Y	2.20E+03	3.80E+03	6.54E+01	2.09E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
3	PAH	Acenaphthylene	Y	1.00E+01	1.61E+04	2.15E+02	1.76E+00	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
3	PAH	Anthracene	Y	1.10E+04	4.50E+01	1.85E+00	1.85E+00	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
3	PAH	Benzo(a)anthracene	Y	2.90E-02	3.80E+00	2.15E+00	2.15E+00	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
3	PAH	Benzo(a)pyrene	Y	1.00E-02	3.80E+00	3.58E+00	3.58E+00	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
3	PAH	Benzo(b)fluoranthene	Y	2.50E-02	2.00E+00	1.53E+00	1.53E+00	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
3	PAH	Benzo(g,h,i)perylene	Y	2.50E-02	2.60E-01	7.91E-01	7.91E-01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
3	PAH	Benzo(k)fluoranthene	Y	2.50E-02	8.00E-01	8.64E-01	8.64E-01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
3	PAH	Chrysene	Y	2.90E+00	2.00E+00	8.03E-01	8.03E-01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
3	PAH	Dibenzo(a,h)anthracene	Y	2.90E-03	6.00E-01	8.16E-01	8.16E-01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
3	PAH	Fluoranthene	Y	2.00E-01	2.30E+02	3.06E+01	3.06E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	2.74E+03																		
3	PAH	Fluorene	Y	1.50E+03	1.90E+03	3.93E+01	1.77E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
3	PAH	Indeno(1,2,3-cd)pyrene	Y	2.50E-02	2.00E-01	1.27E-01	1.27E-01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
3	PAH	Naphthalene	Y	1.00E+00	1.90E+04	9.13E+01	4.20E+00	IR	IR	IR	IR	IR	4.84E+01	1.39E+01	5.95E+00	3.50E-01																				
3	PAH	Phenanthrene	Y	1.00E+01	1.10E+03	4.42E+01	4.42E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR	3.78E+03																		
3	PAH	Pyrene	Y	1.10E+03	1.30E+02	1.54E+01	1.54E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
4	METALS	Arsenic	Y	1.00E+01	1.70E+07	8.50E+06	2.19E+01	IR	IR	IR	IR	IR	2.52E+02	5.78E+01	3.93E+01	3.08E+01	1.16E+01																			
4	METALS	Boron	Y	1.00E+03	5.50E+08	5.55E+06	1.36E+01	7.45E+01	6.84E+01	5.81E+01	4.69E+01	3.47E+01	3.00E+01	2.72E+01	1.66E+01																					
4	METALS	Cadmium	Y	5.00E+00	5.70E+08	5.71E+07	8.75E-01	8.27E+00	4.49E+00	3.37E+00	2.63E+00	1.89E+00	1.60E+00	1.41E+00	8.23E-01																					
4	METALS	Chromium III	Y	5.00E+01	6.29E+08	3.02E+09	3.11E+01	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
4	METALS	Cobalt	Y	1.10E+01	1.40E+07	6.31E+05	1.05E+01	3.78E+00	3.49E+00	2.91E+00	2.34E+00	1.74E+00	1.50E+00	1.34E+00	8.14E-01																					
4	METALS	Copper	Y	2.00E+03	8.00E+04	8.01E+03	1.06E+02	3.31E+03	1.80E+03	1.35E+03	1.05E+03	7.54E+02	6.41E+02	5.66E+02	3.29E+02																					
4	METALS	Lead	Y	2.50E+01	5.00E+01	1.80E+03	1.28E+02	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
4	METALS	Molybdenum	Y	2.00E+01	4.90E+05	9.85E+03	2.94E-01	2.97E+00	2.74E+00	2.32E+00	1.87E+00	1.38E+00	1.20E+00	1.08E+00	6.60E-01																					
4	METALS	Nickel	Y	2.00E+01	1.90E+05	9.50E+04	3.75E+01	IR	IR	IR	IR	5.05E+02	1.16E+02	7.85E+01	6.17E+01	2.32E+01																				
4	METALS	Tin	Y	2.20E+04	1.27E+01	3.18E+00	3.18E+00	IR	IR	IR	IR	IR	IR	IR	IR	IR	IR																			
4	METALS	Zinc	Y	5.00E+03	1.62E+07	6.17E+05	2.30E+02	1.43E+03	1.33E+03	1.11E+03	8.92E+02	6.66E+02	5.74E+02	5.15E+02	3.13E+02																					

MODEL 2 GROUNDWATER IN THE DRIFT SSTL SUMMARY

Navigation Page									SOIL - STC3				GROUNDWATER - GWTC3			
Vert:	NO	RISK LEVEL 9.50E-01														
Dil:	NO															
Order	Group	Determinand	Select	DWS / Freshwater	Solubility	Soil Saturation Limit	Max Soil Conc	Model GW Conc	50 m	75 m	100 m	250 m	50 m	75 m	100 m	250 m
				µg/l	µg/l	mg/kg	mg/kg	µg/l	mg/kg	mg/kg	mg/kg	mg/kg	µg/l	µg/l	µg/l	µg/l
1.01	TPH 1	TPH (>EC5-7) aromatic (1)	Y	1.00E+01	1.80E+06	1.12E+03	-	1.21E+03	-	-	-	-	6.69E+02	3.06E+03	1.05E+04	IR
1.02	TPH 1	TPH (>EC7-8) aromatic (1)	Y	7.00E+02	1.30E+05	2.08E+02	-	3.92E+02	-	-	-	-	IR	IR	IR	IR
1.03	TPH 1	TPH (>EC8-10) aromatic (1)	Y	3.00E+02	6.50E+04	7.60E+02	3.11E-01	1.96E+04	IR	IR	IR	IR	IR	IR	IR	IR
1.04	TPH 1	TPH (>EC10-12) aromatic (1)	Y	9.00E+01	2.50E+04	4.61E+02	3.65E-01	4.82E+03	IR	IR	IR	IR	IR	IR	IR	IR
1.05	TPH 1	TPH (>EC12-16) aromatic (1)	Y	9.00E+01	5.80E+03	2.13E+02	5.24E+01	2.12E+03	IR	IR	IR	IR	IR	IR	IR	IR
1.06	TPH 1	TPH (>EC16-21) aromatic (1)	Y	9.00E+01	6.50E+02	6.71E+01	6.71E+01	6.17E+02	IR	IR	IR	IR	IR	IR	IR	IR
1.07	TPH 1	TPH (>EC21-35) aromatic (1)	Y	9.00E+01	6.60E+00	6.07E+00	6.07E+00	6.60E+00	IR	IR	IR	IR	IR	IR	IR	IR
1.08	TPH 1	TPH (>EC5-6) aliphatic (1)	Y	1.50E+04	3.60E+04	3.29E+02	2.03E-02	1.51E+03	IR	IR	IR	IR	IR	IR	IR	IR
1.09	TPH 1	TPH (>EC6-8) aliphatic (1)	Y	1.50E+04	5.40E+03	1.72E+02	1.48E-01	5.40E+03	IR	IR	IR	IR	IR	IR	IR	IR
1.1	TPH 1	TPH (>EC8-10) aliphatic (1)	Y	3.00E+02	4.30E+02	9.75E+01	3.78E-01	4.30E+02	IR	IR	IR	IR	IR	IR	IR	IR
1.11	TPH 1	TPH (>EC10-12) aliphatic (1)	Y	3.00E+02	3.40E+01	5.99E+01	5.47E-01	3.40E+01	IR	IR	IR	IR	IR	IR	IR	IR
1.12	TPH 1	TPH (>EC12-16) aliphatic (1)	Y	3.00E+02	7.60E-01	2.98E+01	2.98E+01	7.60E-01	IR	IR	IR	IR	IR	IR	IR	IR
1.13	TPH 1	TPH (>EC16-21) aliphatic (1)	Y	1.00E+01	2.50E-03	1.15E+01	1.15E+01	2.50E-03	IR	IR	IR	IR	IR	IR	IR	IR
1.14	TPH 1	TPH (>EC21-35) aliphatic (1)	Y	1.00E+01	8.91E-02	4.94E+03	8.91E-02	8.91E-02	IR	IR	IR	IR	IR	IR	IR	IR
1.2	TPH 1	TOTAL TPH (1)	Y	No Criterion			5.80E+02	3.61E+04								
2	BTEX	Benzene	Y	1.00E+00	1.78E+06	1.07E+03	2.22E-03	7.68E+02	1.92E-01	IR	IR	IR	6.37E+01	2.91E+02	1.00E+03	IR
2.01	BTEX	Toluene	Y	7.00E+02	5.90E+05	9.43E+02	1.13E-02	4.65E+02	IR	IR	IR	IR	IR	IR	IR	IR
2.02	BTEX	Ethylbenzene	Y	3.00E+02	1.69E+05	5.71E+02	7.92E-03	3.76E+03	IR	IR	IR	IR	IR	IR	IR	IR
2.03	BTEX	Xylenes	Y	5.00E+02	2.00E+05	6.84E+02	1.63E-02	1.24E+04	IR	IR	IR	IR	IR	IR	IR	IR
3	PAH	Acenaphthene	Y	2.20E+03	3.80E+03	6.54E+01	2.09E+01	2.35E+00	IR	IR	IR	IR	IR	IR	IR	IR
3	PAH	Acenaphthylene	Y	1.00E+01	1.61E+04	2.15E+02	1.76E+00	7.53E-01	IR	IR	IR	IR	IR	IR	IR	IR
3	PAH	Anthracene	Y	1.10E+04	4.50E+01	1.85E+00	1.85E+00	1.43E+00	IR	IR	IR	IR	IR	IR	IR	IR
3	PAH	Benzo(a)anthracene	Y	2.90E-02	3.80E+00	2.15E+00	2.15E+00	4.95E-01	IR	IR	IR	IR	IR	IR	IR	IR
3	PAH	Benzo(a)pyrene	Y	1.00E-02	3.80E+00	3.58E+00	3.58E+00	3.59E-01	IR	IR	IR	IR	IR	IR	IR	IR
3	PAH	Benzo(b)fluoranthene	Y	2.50E-02	2.00E+00	1.53E+00	1.53E+00	3.72E-02	IR	IR	IR	IR	IR	IR	IR	IR
3	PAH	Benzo(g,h,i)perylene	Y	2.50E-02	2.60E-01	7.91E-01	7.91E-01	2.33E-02	IR	IR	IR	IR	IR	IR	IR	IR
3	PAH	Benzo(k)fluoranthene	Y	2.50E-02	8.00E-01	8.64E-01	8.64E-01	4.31E-02	IR	IR	IR	IR	IR	IR	IR	IR
3	PAH	Chrysene	Y	2.90E+00	2.00E+00	8.03E-01	8.03E-01	6.39E-01	IR	IR	IR	IR	IR	IR	IR	IR
3	PAH	Dibenzo(a,h)anthracene	Y	2.90E-03	6.00E-01	8.16E-01	8.16E-01	-	IR	IR	IR	IR	-	-	-	-
3	PAH	Fluoranthene	Y	2.00E-01	2.30E+02	3.06E+01	3.06E+01	1.21E+00	IR	IR	IR	IR	IR	IR	IR	IR
3	PAH	Fluorene	Y	1.50E+03	1.90E+03	3.93E+01	1.77E+01	5.51E+00	IR	IR	IR	IR	IR	IR	IR	IR
3	PAH	Indeno[1,2,3-cd]pyrene	Y	2.50E-02	2.00E-01	1.27E-01	1.27E-01	2.16E-02	IR	IR	IR	IR	IR	IR	IR	IR
3	PAH	Naphthalene	Y	1.00E+00	1.90E+04	9.13E+01	4.20E+00	5.60E+02	5.95E+00	4.51E+01	2.97E+02	IR	1.12E+03	1.17E+04	IR	IR
3	PAH	Phenanthrene	Y	1.00E+01	1.10E+03	4.42E+01	4.42E+01	7.34E+00	IR	IR	IR	IR	IR	IR	IR	IR
3	PAH	Pyrene	Y	1.10E+03	1.30E+02	1.54E+01	1.54E+01	2.11E+00	IR	IR	IR	IR	IR	IR	IR	IR
4	METALS	Arsenic	Y	1.00E+01	1.70E+07	8.50E+06	2.19E+01	-	3.08E+01	8.18E+01	2.40E+02	IR	-	-	-	-
4	METALS	Boron	Y	1.00E+03	5.50E+08	5.55E+06	1.36E+01	-	2.72E+01	3.29E+01	4.02E+01	9.18E+01	-	-	-	-
4	METALS	Cadmium	Y	5.00E+00	5.70E+08	5.71E+07	8.75E-01	-	1.41E+00	1.77E+00	2.38E+00	1.03E+01	-	-	-	-
4	METALS	Chromium III	Y	5.00E+01	6.29E+08	3.02E+09	3.11E+01	-	IR	IR	IR	IR	-	-	-	-
4	METALS	Cobalt	Y	1.10E+01	1.40E+07	6.31E+05	1.05E+01	-	1.34E+00	1.64E+00	2.04E+00	5.66E+00	-	-	-	-
4	METALS	Copper	Y	2.00E+03	8.00E+04	8.01E+03	1.06E+02	-	5.66E+02	7.09E+02	9.53E+02	4.13E+03	-	-	-	-
4	METALS	Lead	Y	2.50E+01	5.00E+01	1.80E+03	1.28E+02	-	IR	IR	IR	IR	-	-	-	-
4	METALS	Molybdenum	Y	2.00E+01	4.90E+05	9.85E+03	2.94E-01	-	1.08E+00	1.31E+00	1.61E+00	3.80E+00	-	-	-	-
4	METALS	Nickel	Y	2.00E+01	1.90E+05	9.50E+04	3.75E+01	-	6.17E+01	1.64E+02	4.79E+02	IR	-	-	-	-
4	METALS	Tin	Y	2.20E+04	1.27E+01	3.18E+00	3.18E+00	-	IR	IR	IR	IR	-	-	-	-
4	METALS	Zinc	Y	5.00E+03	1.62E+07	6.17E+05	2.30E+02	-	5.15E+02	6.30E+02	7.76E+02	2.02E+03	-	-	-	-

Appendix H - Stage 2 GAC Tables

TABLE 1
SOIL ANALYTICAL DATA with CPU and CW GAC

Stage2 Human Health GAC	Human Health CPU
Stage2 Controlled Waters GAC	Low loc <1% DWS
Sample Round	Hitchin October 2011 & February 2012
Site	Hitchin

					BH101	0.8	5.4	BH102	2.7	1	BH103	3.2	BH105	4.1	BH106	0.5	3.9	UP101	VP102	VP103	BH102A	13.2	13.6	5.7	BH106A	5
BTEX	Chem Class	Analyte	HH	CW	Units	27/09/2011	03/10/2011	27/09/2011	30/09/2011	27/09/2011	29/09/2011	27/09/2011	29/09/2011	28/09/2011	04/10/2011	28/09/2011	27/09/2011	26/09/2011	16/02/2012	16/02/2012	16/02/2012	14/02/2012	14/02/2012			
		BENZENE	2.73	0.000179	mg/kg	ND	ND	ND	ND	ND	ND	0.00222	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		TOLUENE	>Sat	(blank)	µg/l	ND	ND	NT	NT	NT	ND	ND	1.34	ND	ND	ND	NT	NT	NT	NT	NT	ND	ND	1	ND	ND
		ETHYLBENZENE	>Sat	0.282	mg/kg	ND	ND	ND	ND	ND	ND	ND	0.00792	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		M. P. XYLENE	>Sat	(blank)	µg/l	ND	ND	NT	NT	NT	ND	ND	2.53	ND	ND	ND	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND
	O. XYLENE	>Sat	(blank)	µg/l	ND	ND	NT	NT	NT	ND	ND	2.73	ND	ND	ND	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	
METAL TOT		TOTAL ARSENIC	NP	5	mg/kg	19.6	NT	NT	NT	21.9	NT	21.2	NT	13.9	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
		TOTAL BORON	NP	10	mg/kg	10.4	NT	NT	NT	10.7	NT	13.6	NT	9.31	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
		TOTAL CADMIUM	NP	0.5	mg/kg	0.751	NT	NT	NT	0.875	NT	0.779	NT	0.367	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
		TOTAL CHROMIUM	NP	65	mg/kg	31.1	NT	NT	NT	22.9	NT	22	NT	17.5	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
		TOTAL COBALT	NP	0.495	mg/kg	10.5	NT	NT	NT	7.58	NT	6.19	NT	5.63	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
		TOTAL COPPER	NP	1.1	mg/kg	18	NT	NT	NT	15	NT	106	NT	13.8	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
		TOTAL HEXAVALENT CHROMIUM	NP	0.902	mg/kg	ND	NT	NT	NT	ND	NT	ND	NT	ND	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
		TOTAL LEAD	NP	900	mg/kg	15.2	NT	NT	NT	24	NT	128	NT	37.1	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
		TOTAL MERCURY	NP	0.000703	mg/kg	ND	NT	NT	NT	ND	NT	ND	NT	ND	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
		TOTAL MOLYBDENUM	NP	1.4	mg/kg	0.217	NT	NT	NT	ND	NT	0.294	NT	ND	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
		TOTAL NICKEL	NP	10	mg/kg	37.5	NT	NT	NT	25.3	NT	25.3	NT	17.1	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
		TOTAL SELENIUM	NP	0.5	mg/kg	ND	NT	NT	NT	ND	NT	ND	NT	ND	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
		TOTAL TIN	NP	5500	mg/kg	ND	NT	NT	NT	0.817	NT	12.2	NT	0.89	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
		TOTAL ZINC	NP	190	mg/kg	81.3	NT	NT	NT	230	NT	200	NT	85.9	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
MISC		Total Organic Carbon	(blank)	(blank)	%	0.371	0.438	0.334	ND	0.746	0.288	2.09	ND	0.702	ND	1.23	0.766	1.87	ND	ND	ND	ND	ND	ND	ND	
PAH		Acenaphthene	>Sat	10.4	mg/kg	0.179	NT	NT	NT	0.0115	NT	5.89	NT	20.9	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		Acenaphthylene	>Sat	0.333	mg/kg	ND	NT	NT	NT	0.0609	NT	1.76	NT	1.29	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		Anthracene	>Sat	0.00113	mg/kg	0.09	NT	NT	NT	0.0667	NT	11.8	NT	17.8	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		BENZO A ANTHRACENE	>Sat	0.0045	mg/kg	0.0883	NT	NT	NT	0.432	NT	23.4	NT	14.8	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		BENZO A PYRENE	>Sat	0.00258	mg/kg	0.077	NT	NT	NT	0.554	NT	23.9	NT	13.6	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		BENZO B FLUORANTHENE	>Sat	0.00524	mg/kg	0.0938	NT	NT	NT	0.79	NT	26.7	NT	16.2	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		BENZO G H I PERYLENE	>Sat	0.0208	mg/kg	0.0489	NT	NT	NT	0.467	NT	13.7	NT	6.88	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		BENZO K FLUORANTHENE	>Sat	0.0074	mg/kg	0.0426	NT	NT	NT	0.339	NT	9.62	NT	5.79	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		Chrysene	>Sat	0.319	mg/kg	0.0748	NT	NT	NT	0.481	NT	17.3	NT	12.4	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		DIBENZ A H ANTHRACENE	>Sat	0.00108	mg/kg	ND	NT	NT	NT	0.0957	NT	3.44	NT	1.86	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		Fluoranthene	>Sat	0.00729	mg/kg	0.211	NT	NT	NT	0.851	NT	55.6	NT	53.9	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		Fluorene	>Sat	8.5	mg/kg	0.127	NT	NT	NT	0.0129	NT	6.7	NT	17.7	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		INDENO 1 2 3 CD PYRENE	>Sat	0.00436	mg/kg	0.0398	NT	NT	NT	0.358	NT	11.7	NT	5.78	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		Naphthalene	19.9	0.00318	mg/kg	ND	NT	NT	NT	0.0201	NT	3.08	NT	4.2	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		Phenanthrene	>Sat	0.992	mg/kg	0.298	NT	NT	NT	0.241	NT	35.6	NT	62.7	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		Pyrene	>Sat	35.7	mg/kg	0.168	NT	NT	NT	0.735	NT	46.5	NT	41.8	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
		TOTAL PAH	(blank)	(blank)	mg/kg	1.54	NT	NT	NT	5.52	NT	297	NT	297	NT	NT	NT	NT	NT	ND	ND	ND	ND	ND	ND	ND
RISKTPH		RISK TPH C6 C7 AROM	>Sat	0.000179	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		RISK TPH C7 C8 AROM	>Sat	0.0228	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		RISK TPH C8 C10 AROM	387	0.969	mg/kg	ND	ND	ND	ND	ND	ND	0.311	ND	0.252	ND	ND	ND	0.0285	0.0167	ND	ND	ND	ND	ND	ND	
		RISK TPH C10 C12 AROM	>Sat	0.456	mg/kg	0.0131	ND	ND	ND	ND	ND	0.301	ND	0.365	ND	ND	ND	0.0161	0.0107	ND	ND	ND	ND	ND	ND	ND
		RISK TPH C12 C16 AROM	>Sat	0.905	mg/kg	8.16	7.32	9.82	3.51	1.6	19.8	52.4	ND	16.5	2.92	3.6	1.41	36.7	1.61	3.63	0.993	42.5	56.7			
		RISK TPH C18 C21 AROM	>Sat	2.55	mg/kg	12.8	4.9	10.1	1.73	5.68	101	271	ND	65	2.58	35.7	2.27	115	ND	ND	ND	8.56	7.43			
		RISK TPH C21 C35 AROM	>Sat	22.7	mg/kg	32.1	7.07	43.8	0.692	28.1	175	641	ND	183	6.11	146	18.4	616	ND	ND	ND	ND	ND	ND	ND	
		RISK TPH C5 C6 ALI	369	60.1	mg/kg	ND	ND	ND	ND	ND	ND	0.0203	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		RISK TPH C6 C8 ALI	>Sat	160	mg/kg	0.0107	ND	ND	ND	ND	ND	0.148	ND	0.052	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		RISK TPH C8 C10 ALI	>Sat	19.5	mg/kg	0.0107	ND	ND	ND	ND	ND	0.357	ND	0.378	ND	ND	ND	0.0422	0.0155	ND	ND	ND	ND	ND	ND	
		RISK TPH C10 C12 ALI	>Sat	146	mg/kg	0.019	ND	ND	ND	ND	ND	0.451	ND	0.547	ND	ND	ND	0.0248	0.0167	ND	ND	ND	ND	ND	ND	
		RISK TPH C12 C16 ALI	>Sat	3230	mg/kg	7.25	17.6	23.3	6.66	2.48	77.7	24.5	7.29	8.93	2.57	8.07	2.46	13.8	18.6	40.7	8.37	61.6	76.4			
		RISK TPH C16 C21 ALI	>Sat	379000	mg/kg	5.31	7	11.9	6.37	2.87	223	44.1	5.6	21.6	2.15	15.8	2.73	27.3	5.48	5.49	4.95	7.82	9.73			
		RISK TPH C21 C35 ALI	>Sat	4550000	mg/kg	12.3	7.79	38.4	1.08	12.5	303	411	ND	126	6.64	117	16.1	359	ND	ND	ND	ND	ND	ND	ND	
		RISK TPH C35 C44 ALI	>Sat	345000	mg/kg	3.13	1.42	17.6	ND	2.43	86.8	160	ND	83.9	1.49	72.7	3.53	438	ND	ND	ND	ND	ND	ND	ND	
		TPH STAGE2 HI	1	(blank)	ratio	0.0012953	0.002373	0.0031076	0.0010055	0.0028922	0.003603	0.0080215	0.0009328	0.0048285	0.0005379	0.0012013	0.0004615	0.003436	0.0684712	0.086151084	0.0325799	0.1351167	0.1528949			
VOC		DIPE	42.9	0.00484	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		ETHANOL	(blank)	0.584	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		MTBE	685	0.00302	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		TAME	20.8	0.00517	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		TBA	3330	0.00164	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
		ETBE	65.1	0.00507	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

XX	Exceeds Human Health & Controlled Waters
XX	Exceeds Human Health Criteria
XX	Exceeds Controlled Waters Criteria

CSM / Assumptions:

Soil 1% SOM (0.58% TOC)
Soil properties for "sand"
Commercial site area 0.5ha
Soil gas ingress rates calculated by model
Infinite groundwater source at 1m.bgl for groundwater GAC
High density residential assume vapour exposure pathways only
CPU scenario modified from modelled commercial scenario by:
Building dimensions (l x w x h): 14m x 6.5m x 2.4m
Differential pressure: 2.6 pascals
Only vapour exposure pathways considered viable
Derived November 2010 using Human7.1 Issue9. MTF.

ND: Not detected above MDL
HH: Human Health
GAC: Generic Assessment Criteria
(blank): No criteria
NP: No pathway
>Sat: Unacceptable risk not achieved due to calculated saturation of vapour pathway
NT: Not tested

TABLE 2
SOIL ANALYTICAL DATA with HDR and CW GAC

Stage2 Human Health GAC	Human Health High Density Residential
Stage2 Controlled Waters GAC	Low foc <1% DWS
Sample Round	Hitchin October 2011 & February 2012
Site	Hitchin

					BH101		BH102		BH103		BH105		BH106		UP101	VP102	VP103	BH102A
					0.8	5.4	0.8	2.7	1	3.2	0.6	4.1	0.5	3.9	0.6	0.4	0.7	13.2
Chem Class	Analyte	HH	CW	Units	27/09/2011	03/10/2011	27/09/2011	30/09/2011	27/09/2011	29/09/2011	27/09/2011	29/09/2011	28/09/2011	04/10/2011	28/09/2011	27/09/2011	26/09/2011	16/02/2012
BTEX	BENZENE	0.0928	0.000179	mg/kg	ND	ND	ND	ND	ND	ND	0.00222	ND	ND	ND	ND	ND	ND	ND
	TOLUENE	>Sat	(blank)	µg/l	ND	ND	NT	NT	NT	ND	1.34	ND	ND	ND	NT	NT	NT	ND
	ETHYLBENZENE	60.1	0.282	mg/kg	ND	ND	ND	ND	ND	ND	0.00792	ND	ND	ND	ND	ND	ND	ND
	M P XYLENE	19.7	0.0288	mg/kg	ND	ND	ND	ND	ND	ND	0.0163	ND	ND	ND	ND	ND	ND	ND
	O XYLENE	21.1	0.0288	mg/kg	ND	ND	ND	ND	ND	ND	0.0139	ND	ND	ND	ND	ND	ND	ND
METALTOT	TOTAL ARSENIC	NP	5	mg/kg	19.6	NT	NT	NT	21.9	NT	21.2	NT	13.9	NT	NT	NT	NT	NT
	TOTAL BORON	NP	10	mg/kg	10.4	NT	NT	NT	10.7	NT	13.6	NT	9.31	NT	NT	NT	NT	NT
	TOTAL CADMIUM	NP	0.5	mg/kg	0.751	NT	NT	NT	0.875	NT	0.779	NT	0.367	NT	NT	NT	NT	NT
	TOTAL CHROMIUM	NP	65	mg/kg	31.1	NT	NT	NT	22.9	NT	22	NT	17.5	NT	NT	NT	NT	NT
	TOTAL COBALT	NP	0.495	mg/kg	10.5	NT	NT	NT	7.58	NT	6.19	NT	5.63	NT	NT	NT	NT	NT
	TOTAL COPPER	NP	1.1	mg/kg	18	NT	NT	NT	15	NT	106	NT	13.8	NT	NT	NT	NT	NT
	TOTAL HEXAVALENT CHROMIUM	NP	0.902	mg/kg	ND	NT	NT	NT	ND	NT	ND	NT	ND	NT	NT	NT	NT	NT
	TOTAL LEAD	NP	900	mg/kg	15.2	NT	NT	NT	24	NT	128	NT	37.1	NT	NT	NT	NT	NT
	TOTAL MERCURY	NP	0.000703	mg/kg	ND	NT	NT	NT	ND	NT	ND	NT	ND	NT	NT	NT	NT	NT
	TOTAL MOLYBDENUM	NP	1.4	mg/kg	0.217	NT	NT	NT	ND	NT	0.294	NT	ND	NT	NT	NT	NT	NT
	TOTAL NICKEL	NP	10	mg/kg	37.5	NT	NT	NT	25.4	NT	25.3	NT	17.1	NT	NT	NT	NT	NT
	TOTAL SELENIUM	NP	0.5	mg/kg	ND	NT	NT	NT	ND	NT	ND	NT	ND	NT	NT	NT	NT	NT
	TOTAL TIN	NP	5500	mg/kg	ND	NT	NT	NT	0.817	NT	12.2	NT	0.89	NT	NT	NT	NT	NT
	TOTAL ZINC	NP	190	mg/kg	81.3	NT	NT	NT	230	NT	200	NT	85.9	NT	NT	NT	NT	NT
MISC	Total Organic Carbon	(blank)	(blank)	%	0.371	0.438	0.334	ND	0.746	0.288	2.09	ND	0.702	ND	1.23	0.766	1.87	ND
PAH	Acenaphthene	>Sat	10.4	mg/kg	0.179	NT	NT	NT	0.0115	NT	5.89	NT	20.9	NT	NT	NT	NT	ND
	Acenaphthylene	>Sat	0.33	mg/kg	ND	NT	NT	NT	0.0609	NT	1.76	NT	1.29	NT	NT	NT	NT	ND
	Anthracene	>Sat	0.00113	mg/kg	0.09	NT	NT	NT	0.0667	NT	11.8	NT	17.8	NT	NT	NT	NT	ND
	BENZO A ANTHRACENE	>Sat	0.0045	mg/kg	0.0883	NT	NT	NT	0.432	NT	23.4	NT	14.8	NT	NT	NT	NT	ND
	BENZO A PYRENE	>Sat	0.00258	mg/kg	0.077	NT	NT	NT	0.554	NT	23.9	NT	13.6	NT	NT	NT	NT	ND
	BENZO B FLUORANTHENE	>Sat	0.00524	mg/kg	0.0938	NT	NT	NT	0.79	NT	26.7	NT	16.2	NT	NT	NT	NT	ND
	BENZO G H I PERYLENE	>Sat	0.0208	mg/kg	0.0489	NT	NT	NT	0.467	NT	13.7	NT	6.88	NT	NT	NT	NT	ND
	BENZO K FLUORANTHENE	>Sat	0.0074	mg/kg	0.0426	NT	NT	NT	0.339	NT	9.62	NT	5.79	NT	NT	NT	NT	ND
	Chrysene	>Sat	0.319	mg/kg	0.0748	NT	NT	NT	0.481	NT	17.3	NT	12.4	NT	NT	NT	NT	ND
	DIBENZ A H ANTHRACENE	>Sat	0.00108	mg/kg	ND	NT	NT	NT	0.0957	NT	3.44	NT	1.86	NT	NT	NT	NT	ND
	Fluoranthene	>Sat	0.00729	mg/kg	0.211	NT	NT	NT	0.851	NT	55.6	NT	53.9	NT	NT	NT	NT	ND
	Fluorene	>Sat	8.5	mg/kg	0.127	NT	NT	NT	0.0129	NT	6.7	NT	17.7	NT	NT	NT	NT	ND
	INDENO 1 2 3 CD PYRENE	>Sat	0.00436	mg/kg	0.0398	NT	NT	NT	0.358	NT	11.7	NT	5.78	NT	NT	NT	NT	ND
	Naphthalene	0.599	0.00318	mg/kg	ND	NT	NT	NT	0.0201	NT	3.08	NT	4.2	NT	NT	NT	NT	ND
	Phenanthrene	>Sat	0.992	mg/kg	0.298	NT	NT	NT	0.241	NT	35.6	NT	62.7	NT	NT	NT	NT	ND
	Pyrene	>Sat	35.7	mg/kg	0.168	NT	NT	NT	0.735	NT	46.5	NT	41.8	NT	NT	NT	NT	ND
	TOTAL PAH	(blank)	(blank)	mg/kg	1.54	NT	NT	NT	5.52	NT	297	NT	297	NT	NT	NT	NT	ND
RISKTPH	RISK TPH C6 C7 AROM	92	0.000179	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	RISK TPH C7 C8 AROM	222	0.0228	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	RISK TPH C8 C10 AROM	12.9	0.969	mg/kg	ND	ND	ND	ND	ND	ND	0.311	ND	0.252	ND	ND	ND	0.0285	0.0167
	RISK TPH C10 C12 AROM	70.6	0.456	mg/kg	0.0131	ND	ND	ND	ND	ND	0.301	ND	0.365	ND	ND	ND	0.0161	0.0107
	RISK TPH C12 C16 AROM	>Sat	0.905	mg/kg	8.16	7.32	9.82	3.51	1.6	19.8	52.4	ND	16.5	2.92	3.6	1.41	36.7	1.61
	RISK TPH C16 C21 AROM	>Sat	2.55	mg/kg	12.8	4.9	10.1	1.73	5.68	101	271	ND	65	2.58	35.7	2.27	115	ND
	RISK TPH C21 C35 AROM	>Sat	22.7	mg/kg	32.1	7.07	43.8	0.692	28.1	175	641	ND	183	6.11	146	18.4	616	ND
	RISK TPH C5 C6 ALI	14	60.1	mg/kg	ND	ND	ND	ND	ND	ND	0.0203	ND	ND	ND	ND	ND	ND	ND
	RISK TPH C6 C8 ALI	30.7	160	mg/kg	0.0107	ND	ND	ND	ND	ND	0.148	ND	0.052	ND	ND	ND	ND	ND
	RISK TPH C8 C10 ALI	7.46	19.5	mg/kg	0.0107	ND	ND	ND	ND	ND	0.357	ND	0.378	ND	ND	ND	0.0422	0.0155
	RISK TPH C10 C12 ALI	36.4	146	mg/kg	0.019	ND	ND	ND	ND	ND	0.451	ND	0.547	ND	ND	ND	0.0248	0.0167
	RISK TPH C12 C16 ALI	>Sat	3230	mg/kg	7.25	17.6	23.3	6.66	2.48	77.7	24.5	7.29	8.93	2.57	8.07	2.46	13.8	18.6
	RISK TPH C16 C21 ALI	>Sat	379000	mg/kg	5.31	7	11.9	6.37	2.87	223	44.1	5.6	21.6	2.15	15.8	2.73	27.3	5.48
	RISK TPH C21 C35 ALI	>Sat	4550000	mg/kg	12.3	7.79	38.4	1.08	12.5	303	411	ND	125	6.64	117	16.1	359	ND
	RISK TPH C35 C44 ALI	>Sat	345000	mg/kg	3.13	1.42	17.6	ND	2.43	86.8	160	ND	83.9	1.49	72.7	3.53	438	ND
	TPH STAGE2 HI	1	(blank)	ratio	0.038874	0.0712508	0.0933111	0.0301831	0.0617843	0.1081551	0.2406315	0.028008	0.1447994	0.016138	0.0360549	0.0138464	0.1030854	0.0684712
VOC	DIPE	1.52	0.00484	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	ETHANOL	(blank)	0.584	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	MTBE	23.5	0.00302	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	TAME	0.738	0.00517	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	TBA	111	0.00164	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	ETBE	2.31	0.00507	mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MISC CEN21	PH	(blank)	(blank)	pH Units	8.64	8.43	NT	NT	8.6	8.46	9.18	8.61	9.71	6.84	NT	NT	NT	NT
	CONDUCTIVITY	(blank)	(blank)	µS/cm	400	756	NT	NT	415	227	466	274	468	190	NT	NT	NT	NT

XX	Exceeds Human Health & Controlled Waters
XX	Exceeds Human Health Criteria
XX	Exceeds Controlled Waters Criteria

CSM / Assumptions:

Soil 1% SOM (0.58% TOC)

Soil properties for "sand"

Commercial site area 0.5ha

Soil gas ingress rates calculated by model

Infinite groundwater source at 1m.bgl for groundwater GAC

High density residential assume vapour exposure pathways only

CPU scenario modified from modelled commercial scenario by:

Building dimensions (l x w x h): 14m x 6.5m x 2.4m

Differential pressure: 2.6 pascals

Only vapour exposure pathways considered viable

Derived November 2010 using Human7.1 Issue9. MTF.

ND: Not detected above MDL

HH: Human Health

GAC: Generic Assessment Criteria

(blank): No criteria

NP: No pathway

>Sat: Unacceptable risk not achieved due to calculated saturation of vapour pathway

NT: Not tested

TABLE 2
SOIL ANALYTICAL DATA with HDR and CW GAC

Stage2 Human Health GAC	Human Health High Density Residential								
Stage2 Controlled Waters GAC	Low foc <1% DWS								
Sample Round	Hitchin October 2011 & February 2012								
Site	Hitchin								
					BH101			BH106A	
					0.8	13.6	5.7	1.5	5
Chem Class	Analyte	HH	CW	Units	27/09/2011	16/02/2012	16/02/2012	14/02/2012	14/02/2012
BTEX	BENZENE	0.0928	0.000179	mg/kg	ND	ND	ND	ND	ND
	TOLUENE	>Sat	(blank)	µg/l	ND	ND	ND	ND	ND
	ETHYLBENZENE	60.1	0.282	mg/kg	ND	ND	ND	ND	ND
	M P XYLENE	19.7	0.0288	mg/kg	ND	ND	ND	ND	ND
	O XYLENE	21.1	0.0288	mg/kg	ND	ND	ND	ND	ND
METALTOT	TOTAL ARSENIC	NP	5	mg/kg	19.6	NT	NT	NT	NT
	TOTAL BORON	NP	10	mg/kg	10.4	NT	NT	NT	NT
	TOTAL CADMIUM	NP	0.5	mg/kg	0.751	NT	NT	NT	NT
	TOTAL CHROMIUM	NP	65	mg/kg	31.1	NT	NT	NT	NT
	TOTAL COBALT	NP	0.495	mg/kg	10.5	NT	NT	NT	NT
	TOTAL COPPER	NP	1.1	mg/kg	18	NT	NT	NT	NT
	TOTAL HEXAVALENT CHROMIUM	NP	0.902	mg/kg	ND	NT	NT	NT	NT
	TOTAL LEAD	NP	900	mg/kg	15.2	NT	NT	NT	NT
	TOTAL MERCURY	NP	0.000703	mg/kg	ND	NT	NT	NT	NT
	TOTAL MOLYBDENUM	NP	1.4	mg/kg	0.217	NT	NT	NT	NT
	TOTAL NICKEL	NP	10	mg/kg	37.5	NT	NT	NT	NT
	TOTAL SELENIUM	NP	0.5	mg/kg	ND	NT	NT	NT	NT
	TOTAL TIN	NP	5500	mg/kg	ND	NT	NT	NT	NT
	TOTAL ZINC	NP	190	mg/kg	81.3	NT	NT	NT	NT
MISC	Total Organic Carbon	(blank)	(blank)	%	0.371	ND	ND	ND	ND
PAH	Acenaphthene	>Sat	10.4	mg/kg	0.179	ND	ND	ND	ND
	Acenaphthylene	>Sat	0.33	mg/kg	ND	ND	ND	ND	ND
	Anthracene	>Sat	0.00113	mg/kg	0.09	ND	ND	ND	ND
	BENZO A ANTHRACENE	>Sat	0.0045	mg/kg	0.0883	ND	ND	ND	ND
	BENZO A PYRENE	>Sat	0.00258	mg/kg	0.077	ND	ND	ND	ND
	BENZO B FLUORANTHENE	>Sat	0.00524	mg/kg	0.0938	ND	ND	ND	ND
	BENZO G H I PERYLENE	>Sat	0.0208	mg/kg	0.0489	ND	ND	ND	ND
	BENZO K FLUORANTHENE	>Sat	0.0074	mg/kg	0.0426	ND	ND	ND	ND
	Chrysene	>Sat	0.319	mg/kg	0.0748	ND	ND	ND	ND
	DIBENZ A H ANTHRACENE	>Sat	0.00108	mg/kg	ND	ND	ND	ND	ND
	Fluoranthene	>Sat	0.00729	mg/kg	0.211	ND	ND	ND	ND
	Fluorene	>Sat	8.5	mg/kg	0.127	ND	ND	ND	ND
	INDENO 1 2 3 CD PYRENE	>Sat	0.00436	mg/kg	0.0398	ND	ND	ND	ND
	Naphthalene	0.599	0.00318	mg/kg	ND	ND	ND	ND	ND
	Phenanthrene	>Sat	0.992	mg/kg	0.298	ND	ND	ND	ND
	Pyrene	>Sat	35.7	mg/kg	0.168	ND	ND	ND	ND
	TOTAL PAH	(blank)	(blank)	mg/kg	1.54	ND	ND	ND	ND
RISKTPH	RISK TPH C6 C7 AROM	92	0.000179	mg/kg	ND	ND	ND	ND	ND
	RISK TPH C7 C8 AROM	222	0.0228	mg/kg	ND	ND	ND	ND	ND
	RISK TPH C8 C10 AROM	12.9	0.969	mg/kg	ND	ND	ND	ND	ND
	RISK TPH C10 C12 AROM	70.6	0.456	mg/kg	0.0131	ND	ND	ND	ND
	RISK TPH C12 C16 AROM	>Sat	0.905	mg/kg	8.16	3.63	0.993	42.5	56.7
	RISK TPH C16 C21 AROM	>Sat	2.55	mg/kg	12.8	ND	ND	8.56	7.43
	RISK TPH C21 C35 AROM	>Sat	22.7	mg/kg	32.1	ND	ND	ND	ND
	RISK TPH C5 C6 ALI	14	60.1	mg/kg	ND	ND	ND	ND	ND
	RISK TPH C6 C8 ALI	30.7	160	mg/kg	0.0107	ND	ND	ND	ND
	RISK TPH C8 C10 ALI	7.46	19.5	mg/kg	0.0107	ND	ND	ND	ND
	RISK TPH C10 C12 ALI	36.4	146	mg/kg	0.019	ND	ND	ND	ND
	RISK TPH C12 C16 ALI	>Sat	3230	mg/kg	7.25	40.7	8.37	61.6	76.4
	RISK TPH C16 C21 ALI	>Sat	379000	mg/kg	5.31	5.49	4.95	7.82	9.73
	RISK TPH C21 C35 ALI	>Sat	4550000	mg/kg	12.3	ND	ND	ND	ND
	RISK TPH C35 C44 ALI	>Sat	345000	mg/kg	3.13	ND	ND	ND	ND
	TPH STAGE2 HI	1	(blank)	ratio	0.038874	0.086151084	0.0325799	0.1351167	0.1528949
VOC	DIPE	1.52	0.00484	mg/kg	ND	ND	ND	ND	ND
	ETHANOL	(blank)	0.584	mg/kg	ND	ND	ND	ND	ND
	MTBE	23.5	0.00302	mg/kg	ND	ND	ND	ND	ND
	TAME	0.738	0.00517	mg/kg	ND	ND	ND	ND	ND
	TBA	111	0.00164	mg/kg	ND	ND	ND	ND	ND
	ETBE	2.31	0.00507	mg/kg	ND	ND	ND	ND	ND
MISC CEN21	PH	(blank)	(blank)	pH Units	8.64	NT	NT	NT	NT
	CONDUCTIVITY	(blank)	(blank)	µS/cm	400	NT	NT	NT	NT

XX	Exceeds Human Health & Controlled Waters
XX	Exceeds Human Health Criteria
XX	Exceeds Controlled Waters Criteria

CSM / Assumptions:
Soil 1% SOM (0.58% TOC)
Soil properties for "sand"
Commercial site area 0.5ha
Soil gas ingress rates calculated by model
Infinite groundwater source at 1m.bgl for groundwater GAC
High density residential assume vapour exposure pathways only
CPU scenario modified from modelled commercial scenario by:
Building dimensions (l x w x h): 14m x 6.5m x 2.4m
Differential pressure: 2.6 pascals
Only vapour exposure pathways considered viable
Derived November 2010 using Human7.1 Issue9. MTF.

ND: Not detected above MDL
HH: Human Health
GAC: Generic Assessment Criteria
(blank): No criteria
NP: No pathway
>Sat: Unacceptable risk not achieved due to calculated saturation of vapour pathway
NT: Not tested

TABLE 3
GROUNDWATER ANALYTICAL DATA with CPU and DWS GAC

Stage2 Human Health	Human Health CPU
Stage2 Controlled Waters	DWS
Sample Round	Hitchin October 2011 & February 2012
Site	Hitchin

						BH101	BH101	BH102	BH102	BH102A	BH103	BH103	BH105	BH105A	BH106A				
						12/10/2011	27/02/2012	12/10/2011	27/02/2012	27/02/2012	12/10/2011	27/02/2012	12/10/2011	27/02/2012	27/02/2012				
Chem Class	Analyte	HH	CW	MDL	Units	W	W	W	W	W	W	W	W	W	W				
BTX	BENZENE	23500	1	1	µg/l	ND	ND	ND	1460	1100	ND	ND	ND	ND	ND				
	TOLUENE	>Sat	700	1	µg/l	ND	ND	465	150	ND	ND	ND	ND	ND	ND				
	ETHYLBENZENE	>Sat	300	1	µg/l	ND	ND	2350	3600	ND	ND	ND	ND	ND	ND				
	M P XYLENE	>Sat	500	1	µg/l	ND	ND	6480	9330	ND	ND	ND	ND	ND	ND				
	O XYLENE	>Sat	500	1	µg/l	ND	ND	2460	4380	ND	ND	ND	ND	ND	ND				
PAH	Acenaphthene	>Sat	2200	0.015	µg/l	ND	ND	ND	0.193	ND	ND	ND	NT	ND	ND				
	ACENAPHTHYLENE	>Sat	90	0.011	µg/l	ND	ND	ND	0.0456	ND	ND	ND	NT	ND	0.0125				
	Anthracene	>Sat	10000	0.015	µg/l	ND	ND	ND	0.0315	ND	ND	ND	NT	ND	0.0234				
	BENZO A ANTHRACENE	>Sat	0.029	0.017	µg/l	ND	ND	ND	ND	ND	ND	NT	0.0343	0.0679					
	BENZO A PYRENE	>Sat	0.01	0.009	µg/l	ND	ND	ND	ND	ND	ND	NT	0.04	0.0397					
	BENZO B FLUORANTHENE	>Sat	0.025	0.023	µg/l	ND	ND	ND	ND	ND	ND	NT	0.0322	0.0372					
	BENZO G H I PERYLENE	>Sat	0.025	0.016	µg/l	ND	ND	ND	ND	ND	ND	NT	0.0175	0.0233					
	BENZO K FLUORANTHENE	>Sat	0.025	0.027	µg/l	ND	ND	ND	ND	ND	ND	NT	0.0431	0.0408					
	CHRYSENE	>Sat	2.9	0.013	µg/l	ND	ND	ND	ND	ND	ND	NT	0.029	0.0567					
	DIBENZ A H ANTHRACENE	>Sat	0.0029	0.016	µg/l	ND	ND	ND	ND	ND	ND	NT	ND	ND					
	FLUORANTHENE	>Sat	0.2	0.017	µg/l	ND	ND	ND	0.0182	ND	ND	NT	0.0634	0.19					
	FLUORENE	>Sat	1500	0.014	µg/l	ND	ND	0.205	0.387	ND	ND	NT	ND	ND					
	INDENO 1 2 3 CD PYRENE	>Sat	0.025	0.014	µg/l	ND	ND	ND	ND	ND	ND	NT	0.0183	0.0216					
	NAPHTHALENE	16700	1	0.1	µg/l	ND	0.168	175	289	ND	ND	0.143	NT	ND	ND				
	PHENANTHRENE	>Sat	90	0.022	µg/l	ND	ND	ND	0.146	ND	ND	NT	ND	0.0295					
	Pyrene	>Sat	1100	0.015	µg/l	ND	ND	ND	0.0234	ND	ND	NT	0.0718	0.138					
VOC	DIPE	535000	120	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
	ETBE	733000	40	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
	ETHANOL	(blank)	11000000	50	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
	MTBE	7240000	30	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
	TAME	248000	140	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
	TBA	17400000	40	10	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND				
RISKTPH	RISK TPH C6 C7 AROM	>Sat	1	10	µg/l	ND	ND	1210	731	ND	ND	ND	ND	ND	ND				
	RISK TPH C7 C8 AROM	>Sat	700	10	µg/l	17	ND	392	131	ND	14	ND	ND	ND	ND				
	RISK TPH C8 C10 AROM	>Sat	300	10	µg/l	12	ND	13300	14500	ND	12	ND	ND	ND	ND				
	RISK TPH C10 C12 AROM	>Sat	90	10	µg/l	ND	ND	1010	934	ND	ND	ND	ND	ND	ND				
	RISK TPH C12 C16 AROM	>Sat	90	10	µg/l	ND	ND	143	306	ND	ND	ND	NT	ND	ND				
	RISK TPH C16 C21 AROM	>Sat	90	10	µg/l	ND	ND	ND	17	ND	ND	NT	ND	ND	ND				
	RISK TPH C21 C35 AROM	>Sat	90	10	µg/l	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND				
	RISK TPH C5 C6 ALI	>Sat	15000	10	µg/l	ND	ND	308	646	ND	ND	ND	ND	ND	ND				
	RISK TPH C6 C8 ALI	>Sat	15000	10	µg/l	ND	ND	697	1430	ND	ND	ND	ND	ND	ND				
	RISK TPH C8 C10 ALI	>Sat	300	10	µg/l	ND	ND	3220	3250	ND	ND	ND	ND	ND	ND				
	RISK TPH C10 C12 ALI	>Sat	300	10	µg/l	ND	ND	1510	1400	ND	ND	ND	ND	ND	ND				
	RISK TPH C12 C16 ALI	>Sat	300	10	µg/l	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND				
	RISK TPH C16 C21 ALI	>Sat	300	10	µg/l	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND				
	RISK TPH C21 C35 ALI	>Sat	300	10	µg/l	ND	ND	ND	ND	ND	ND	NT	ND	ND	ND				
TPH_STAGE2_HI						1	(blank)	10	ratio	0.0046193	0.0046095	0.1450797	0.1565586	0.0046095	0.0046192	0.0046095	0.0041197	0.0046095	0.0046095

XX	Exceeds Human Health & Controlled Waters
> X	Exceeds Human Health Criteria
XX	Exceeds Controlled Waters Criteria

CSM / Assumptions:

Soil 1% SOM (0.58% TOC)
Soil properties for "sand"
Commercial site area 0.5ha
Soil gas ingress rates calculated by model
Infinite groundwater source at 1m.bgl for groundwater GAC
High density residential assume vapour exposure pathways only
CPU scenario modified from modelled commercial scenario by:
Building dimensions (l x w x h): 14m x 6.5m x 2.4m
Differential pressure: 2.6 pascals
Only vapour exposure pathways considered viable
Derived November 2010 using Human7.1 Issue9. MTF.

TABLE 4
GROUNDWATER ANALYTICAL DATA WITH HDR GAC and DWS

Stage2 Human Health	Human Health High Density Residential
Stage2 Controlled Waters	DWS
Sample Round	Hitchin October 2011 & February 2012
Site	Hitchin

						BH101	BH101	BH102	BH102	BH102A	BH103	BH103	BH105	BH105A	BH106A
						12/10/2011	27/02/2012	12/10/2011	27/02/2012	27/02/2012	12/10/2011	27/02/2012	12/10/2011	27/02/2012	27/02/2012
Chem Class	Analyte	HH	CW	MDL	Units	W	W	W	W	W	W	W	W	W	W
BTX	BENZENE	1100	1	1	µg/l	ND	ND	ND	1460	1100	ND	ND	ND	ND	ND
	TOLUENE	>Sat	700	1	µg/l	ND	ND	ND	465	150	ND	ND	ND	ND	ND
	ETHYLBENZENE	173000	300	1	µg/l	ND	ND	ND	2350	3600	ND	ND	ND	ND	ND
	M P XYLENE	51600	500	1	µg/l	ND	ND	ND	6460	8330	ND	ND	ND	ND	ND
	O XYLENE	82100	500	1	µg/l	ND	ND	ND	2460	4380	ND	ND	ND	ND	ND
PAH	Acenaphthene	>Sat	2200	0.015	µg/l	ND	ND	ND	0.193	ND	ND	ND	NT	ND	ND
	ACENAPHTHYLENE	>Sat	90	0.011	µg/l	ND	ND	ND	0.0456	ND	ND	ND	NT	ND	0.0125
	Anthracene	>Sat	10000	0.015	µg/l	ND	ND	ND	0.0315	ND	ND	ND	NT	ND	0.0234
	BENZO A ANTHRACENE	>Sat	0.029	0.017	µg/l	ND	ND	ND	ND	ND	ND	ND	NT	ND	0.0343
	BENZO A PYRENE	>Sat	0.01	0.008	µg/l	ND	ND	ND	ND	ND	ND	ND	NT	ND	0.04
	BENZO B FLUORANTHENE	>Sat	0.025	0.023	µg/l	ND	ND	ND	ND	ND	ND	ND	NT	ND	0.0322
	BENZO G H I PERYLENE	>Sat	0.025	0.016	µg/l	ND	ND	ND	ND	ND	ND	ND	NT	0.0175	0.0233
	BENZO K FLUORANTHENE	>Sat	0.025	0.027	µg/l	ND	ND	ND	ND	ND	ND	ND	NT	0.0431	0.0408
	CHRYSENE	>Sat	2.9	0.013	µg/l	ND	ND	ND	ND	ND	ND	ND	NT	0.029	0.0567
	DIBENZ A H ANTHRACENE	>Sat	0.0029	0.016	µg/l	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
	FLUORANTHENE	>Sat	0.2	0.017	µg/l	ND	ND	ND	0.0182	ND	ND	ND	NT	0.0634	0.19
	FLOPIRENE	>Sat	1500	0.014	µg/l	ND	ND	ND	0.205	0.387	ND	ND	NT	ND	ND
	INDENO 1 2 3 CD PYRENE	>Sat	0.025	0.014	µg/l	ND	ND	ND	ND	ND	ND	ND	NT	0.0183	0.0216
	NAPHTHALENE	640	1	0.01	175	289	ND	0.168	175	289	ND	ND	0.143	NT	ND
	PHENANTHRENE	>Sat	90	0.022	µg/l	ND	ND	ND	ND	0.146	ND	ND	ND	NT	ND
Pyrene	>Sat	1100	0.015	µg/l	ND	ND	ND	ND	0.0234	ND	ND	ND	NT	0.0718	0.138
VOC	DIPE	25300	120	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	ETBE	34600	40	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	ETHANOL	(blank)	1100000	50	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	MTBE	331000	30	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	TAME	11700	140	1	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TBA	628000	40	10	µg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
RISKTPH	RISK_TPH_C6_C7_AROM	1090000	1	10	µg/l	ND	ND	1210	731	ND	ND	ND	ND	ND	ND
	RISK_TPH_C7_C8_AROM	>Sat	700	10	µg/l	17	ND	392	131	ND	14	ND	ND	ND	ND
	RISK_TPH_C8_C10_AROM	9630	300	10	µg/l	12	ND	13300	14500	ND	12	ND	ND	ND	ND
	RISK_TPH_C10_C12_AROM	>Sat	90	10	µg/l	ND	ND	1010	934	ND	ND	ND	ND	ND	ND
	RISK_TPH_C12_C16_AROM	>Sat	90	10	µg/l	ND	ND	143	306	ND	ND	ND	NT	ND	ND
	RISK_TPH_C16_C21_AROM	>Sat	90	10	µg/l	ND	ND	ND	17	ND	ND	ND	NT	ND	ND
	RISK_TPH_C21_C35_AROM	>Sat	90	10	µg/l	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
	RISK_TPH_C5_C6_ALI	10300	15000	10	µg/l	ND	ND	308	646	ND	ND	ND	ND	ND	ND
	RISK_TPH_C6_C8_ALI	>Sat	15000	10	µg/l	ND	ND	697	1430	ND	ND	ND	ND	ND	ND
	RISK_TPH_C8_C10_ALI	302	300	10	µg/l	ND	ND	3220	3250	ND	ND	ND	ND	ND	ND
	RISK_TPH_C10_C12_ALI	>Sat	300	10	µg/l	ND	ND	1510	1460	ND	ND	ND	ND	ND	ND
	RISK_TPH_C12_C16_ALI	>Sat	300	10	µg/l	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
	RISK_TPH_C16_C21_ALI	>Sat	300	10	µg/l	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
	RISK_TPH_C21_C35_ALI	>Sat	300	10	µg/l	ND	ND	ND	ND	ND	ND	ND	NT	ND	ND
	TPH_STAGE2_HI	1	(blank)	10	ratio	0.0986376	0.0046095	3.1001248	3.1800255	0.0046095	0.0986376	0.0046095	0.0041197	0.0046095	0.0046095

XX	Exceeds Human Health & Controlled Waters
XX	Exceeds Human Health Criteria
XX	Exceeds Controlled Waters Criteria

CSM / Assumptions:

Soil 1% SOM (0.58% TOC)

Soil properties for "sand"

Commercial site area 0.5ha

Soil gas ingress rates calculated by model

Infinite groundwater source at 1m.bgl for groundwater GAC

High density residential assume vapour exposure pathways only

CPU scenario modified from modelled commercial s

Building dimensions (l x w x h): 14m x 6.5m x 2.4m

Differential pressure: 2.6 pascals

Only vapour exposure pathways considered viable

Derived November 2010 using Human7.1 Issue9. M

Appendix I - Hydrogeological Data

Conductivity Tests and Datalogger Graphs

APPENDIX I
Hydraulic Conductivity Test Data

Shell Hitchin Service Station
Bedford Road
Hitchin. SG5 2TY
URS Project No. 46370079

Monitoring Well	Well Diameter (m)	Borehole Diameter (m)	Installed Screened Interval (m bgl)	Initial Depth to NAPL (m bgl)	Initial Depth to Water (m bgl)	Initial Depth to Base (m bgl)	Effective Screened Strata	Aquifer Test	Date of Test	Hydraulic Conductivity (m/s)	Hydraulic Conductivity (m/d)	Average Hydraulic Conductivity (m/d)
									Analysis	Bouwer Rice	Bouwer Rice	Bouwer Rice
BH101	0.05	0.2	6.0 - 9.0	ND	7.615	8.77	Silty Sand	Falling - 1	13/10/2011	1.70E-05	1.47E+00	1.91
								Rising - 1		6.10E-06	5.27E-01	
								Falling - 2		1.50E-05	1.30E+00	
								Rising - 2		2.30E-05	1.99E+00	
								Falling - 3		2.10E-05	1.81E+00	
								Rising - 3		2.00E-05	1.73E+00	
								Falling - 4		3.50E-05	3.02E+00	
								Rising - 4		4.00E-05	3.46E+00	
BH102	0.05	0.2	6.0 - 9.0	ND	7.32	7.98	Silty Sand	Falling - 1	13/10/2011	2.20E-06	1.90E-01	0.16
								Rising - 1		1.60E-06	1.38E-01	
								Falling - 2		1.80E-06	1.56E-01	
								Rising - 2		1.90E-06	1.64E-01	
								Falling - 3		1.00E-06	8.64E-02	
								Rising - 3		2.50E-06	2.16E-01	
BH103	0.05	0.2	6.0 - 9.0	ND	7.445	8.39	Silty Sand	Falling - 1	13/10/2011	3.30E-06	2.85E-01	0.15
								Rising - 1		5.50E-07	4.75E-02	
								Falling - 2		2.10E-06	1.81E-01	
								Rising - 2		7.80E-07	6.74E-02	
								Falling - 3		2.00E-06	1.73E-01	
								Rising - 3		1.90E-06	1.64E-01	
BH102A	0.05	0.2	11.5 - 13.5	ND	6.417	13.5	Silty Sand	Rising - 1	27/02/2012	5.39E-06	4.66E-01	0.43
								Rising - 2		4.90E-06	4.23E-01	
								Rising - 3		4.80E-06	4.15E-01	
BH105A	0.05	0.2	6.5 - 8.5	ND	6.572	8.5	Structureless Cream Chalk	Rising - 1	27/02/2012	2.79E-06	2.41E-01	0.30
								Rising - 2		4.00E-06	3.46E-01	
								Rising - 3		3.50E-06	3.02E-01	
BH106A	0.05	0.2	5.3 - 8.3	ND	6.547	8.3	Structureless White Chalk	Rising - 2	27/02/2012	8.50E-05	7.34E+00	7.95
								Rising - 3		9.90E-05	8.55E+00	

GEOMEAN OF DFIFT: 0.38
GEOMEAN OF CHALK: 1.54

WELL ID: BH102A Test 1 Rising Head Test

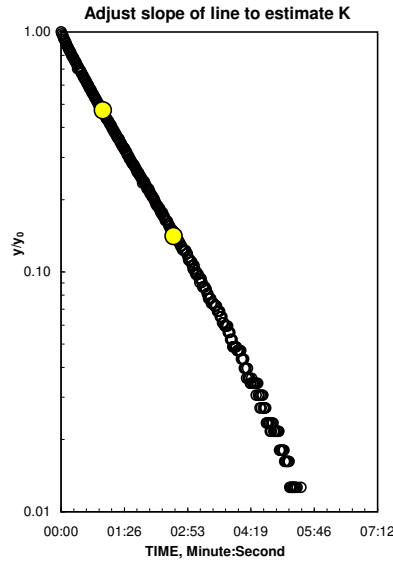
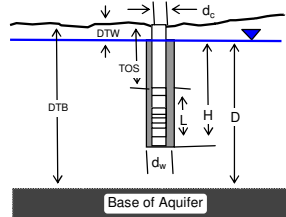
INPUT	
Construction:	
Casing dia. (d_c)	0.05 Meter
Annulus dia. (d_w)	0.2 Meter
Screen Length (L)	2.1 Meter
Depths to:	
water level (DTW)	6.423 Meter
top of screen (TOS)	11.5 Meter
Base of Aquifer (DTB)	13.6 Meter
Annular Fill:	
across screen --	Gravel
above screen --	Bentonite
Aquifer Material -- Stream Terrace Deposit, Fg	

COMPUTED	
L_{wetted}	2.1 Meter
D =	7.177 Meter
H =	7.177 Meter
L/r_w	21.00
y_0 -DISPLACEMENT =	0.56 Meter
y_0 -SLUG =	0.55 Meter
From look-up table using L/r_w	
Fully penetrate C =	1.767
$\ln(Re/r_w)$ =	2.928
Re =	6.14 Meter
Slope =	$0.005415 \log_{10}/\text{sec}$
$t_{90\%}$ recovery =	185 sec

Input is consistent.

K =	5.4E-06 Meter/Second
	0.46656

Local ID: Hitchin
Date: 27/02/2012
Time: 00:00



Reduced Data		
Entry	Time, Hr:Min:Sec	Water Level
1	0:00:00.0	63.72
2	0:00:08.0	63.79
3	0:00:16.0	63.84
4	0:00:24.0	63.89
5	0:00:32.0	63.92
6	0:00:40.0	63.96
7	0:00:48.0	63.99
8	0:00:56.0	64.02
9	0:01:04.0	64.04
10	0:01:12.0	64.06
11	0:01:20.0	64.08
12	0:01:28.0	64.10
13	0:01:36.0	64.12
14	0:01:44.0	64.13
15	0:01:52.0	64.15
16	0:02:00.0	64.16
17	0:02:08.0	64.17
18	0:02:16.0	64.18
19	0:02:24.0	64.19
20	0:02:32.0	64.20
21	0:02:40.0	64.20
22	0:02:48.0	64.21
23	0:02:56.0	64.22
24	0:03:04.0	64.22
25	0:03:12.0	64.23
26	0:03:20.0	64.23
27	0:03:28.0	64.24
28	0:03:36.0	64.24
29	0:03:44.0	64.24
30	0:03:52.0	64.25
31	0:04:00.0	64.25
32	0:04:08.0	64.25
33	0:04:16.0	64.26
34	0:04:24.0	64.26
35	0:04:32.0	64.26
36	0:04:40.0	64.26
37	0:04:48.0	64.26
38	0:04:56.0	64.27
39	0:05:04.0	64.27
40	0:05:12.0	64.27
41	0:05:20.0	64.27
42	0:05:28.0	64.27
43	0:05:36.0	64.27
44	0:05:44.0	64.27
45	0:05:52.0	64.28

REMARKS:

Bouwer and Rice analysis of slug test, WRR 1976

Aquifer is a gravel bed, underlying a clay formation and overlying highly weather chalk.

WELL ID: BH102A Test 2 Rising Head

INPUT	
Construction:	
Casing dia. (d_c)	0.05 Meter
Annulus dia. (d_w)	0.2 Meter
Screen Length (L)	2.1 Meter
Depths to:	
water level (DTW)	6.423 Meter
top of screen (TOS)	11.5 Meter
Base of Aquifer (DTB)	13.6 Meter
Annular Fill:	
across screen --	Gravel
above screen --	Bentonite
Aquifer Material -- Stream Terrace Deposit, Fg	

COMPUTED	
L_{wetted}	2.1 Meter
D =	7.177 Meter
H =	7.177 Meter
L/r_w	21.00
y_0 -DISPLACEMENT =	0.59 Meter
y_0 -SLUG =	0.55 Meter
From look-up table using L/r_w	

Fully penetrate C = 1.767
 $\ln(Re/r_w) = 2.928$
 $Re = 6.14$ Meter

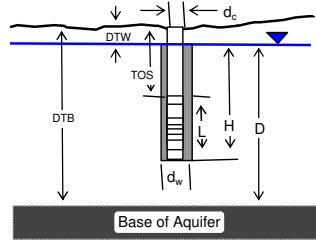
Slope = 0.004926 $\log_{10}/\text{sec}$
 $t_{90\% \text{ recovery}} = 203$ sec

Input is consistent.

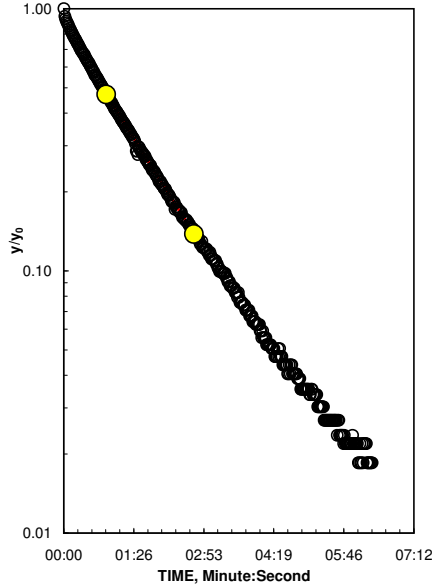
K = 4.9E-06 Meter/Second

0.42336

Local ID: Hitchin
Date: 27/02/2012
Time: 00:00



Adjust slope of line to estimate K



Reduced Data

Entry	Time, Hr:Min:Sec	Water Level
1	0:00:00.0	63.68
2	0:00:08.0	63.79
3	0:00:16.0	63.84
4	0:00:24.0	63.88
5	0:00:32.0	63.92
6	0:00:40.0	63.95
7	0:00:48.0	63.98
8	0:00:56.0	64.01
9	0:01:04.0	64.03
10	0:01:12.0	64.06
11	0:01:20.0	64.07
12	0:01:28.0	64.10
13	0:01:36.0	64.11
14	0:01:44.0	64.12
15	0:01:52.0	64.14
16	0:02:00.0	64.15
17	0:02:08.0	64.16
18	0:02:16.0	64.17
19	0:02:24.0	64.18
20	0:02:32.0	64.19
21	0:02:40.0	64.19
22	0:02:48.0	64.20
23	0:02:56.0	64.21
24	0:03:04.0	64.21
25	0:03:12.0	64.22
26	0:03:20.0	64.22
27	0:03:28.0	64.23
28	0:03:36.0	64.23
29	0:03:44.0	64.24
30	0:03:52.0	64.24
31	0:04:00.0	64.24
32	0:04:08.0	64.24
33	0:04:16.0	64.25
34	0:04:24.0	64.25
35	0:04:32.0	64.25
36	0:04:40.0	64.25
37	0:04:48.0	64.25
38	0:04:56.0	64.26
39	0:05:04.0	64.26
40	0:05:12.0	64.26
41	0:05:20.0	64.26
42	0:05:28.0	64.26
43	0:05:36.0	64.26
44	0:05:44.0	64.26
45	0:05:52.0	64.26

REMARKS:

Bouwer and Rice analysis of slug test, WRR 1976

Aquifer is a gravel bed, underlying a clay formation and overlying highly weather chalk.

WELL ID: BH102A Test 3 Rising Head Test

INPUT	
Construction:	
Casing dia. (d_c)	0.05 Meter
Annulus dia. (d_w)	0.2 Meter
Screen Length (L)	2.1 Meter
Depths to:	
water level (DTW)	6.423 Meter
top of screen (TOS)	11.5 Meter
Base of Aquifer (DTB)	13.6 Meter
Annular Fill:	
across screen --	Gravel
above screen --	Bentonite
Aquifer Material -- Stream Terrace Deposit, Fg	

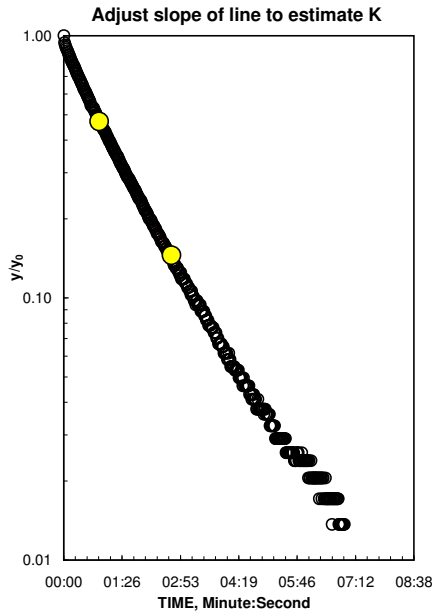
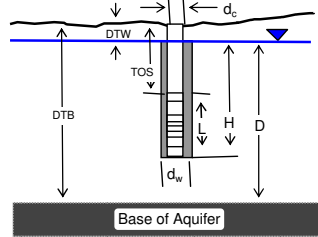
COMPUTED	
L_{wetted}	2.1 Meter
D =	7.177 Meter
H =	7.177 Meter
L/r_w	21.00
y_0 -DISPLACEMENT =	0.59 Meter
y_0 -SLUG =	0.55 Meter
From look-up table using L/r_w	
Fully penetrate C =	1.767
$\ln(Re/r_w)$ =	2.928
Re =	6.14 Meter
Slope =	0.00477 $\log_{10}/\text{sec}$
$t_{90\%}$ recovery =	210 sec

Input is consistent.

K = 4.8E-06 Meter/Second

0.41472

Local ID: Hitchin
Date: 27/02/2012
Time: 00:00



Reduced Data		
Entry	Time, Hr:Min:Sec	Water Level
1	0:00:00.0	63.69
2	0:00:09.0	63.79
3	0:00:18.0	63.85
4	0:00:27.0	63.90
5	0:00:36.0	63.94
6	0:00:45.0	63.97
7	0:00:54.0	64.01
8	0:01:03.0	64.03
9	0:01:12.0	64.06
10	0:01:21.0	64.08
11	0:01:30.0	64.10
12	0:01:39.0	64.12
13	0:01:48.0	64.13
14	0:01:57.0	64.15
15	0:02:06.0	64.16
16	0:02:15.0	64.17
17	0:02:24.0	64.18
18	0:02:33.0	64.19
19	0:02:42.0	64.20
20	0:02:51.0	64.20
21	0:03:00.0	64.21
22	0:03:09.0	64.22
23	0:03:18.0	64.22
24	0:03:27.0	64.23
25	0:03:36.0	64.23
26	0:03:45.0	64.23
27	0:03:54.0	64.24
28	0:04:03.0	64.24
29	0:04:12.0	64.25
30	0:04:21.0	64.25
31	0:04:30.0	64.25
32	0:04:39.0	64.25
33	0:04:48.0	64.26
34	0:04:57.0	64.26
35	0:05:06.0	64.26
36	0:05:15.0	64.26
37	0:05:24.0	64.26
38	0:05:33.0	64.26
39	0:05:42.0	64.26
40	0:05:51.0	64.26
41	0:06:00.0	64.26
42	0:06:09.0	64.27
43	0:06:18.0	64.27
44	0:06:27.0	64.27
45	0:06:36.0	64.27

REMARKS:

Bouwer and Rice analysis of slug test, WRR 1976

Aquifer is a gravel bed underlying a clay layer and overlying highly weathered chalk.

WELL ID: BH105A Test 1 Rising Head Test

INPUT	
Construction:	
Casing dia. (d_c)	0.06 Meter
Annulus dia. (d_w)	0.2 Meter
Screen Length (L)	2 Meter
Depths to:	
water level (DTW)	6.423 Meter
top of screen (TOS)	6.5 Meter
Base of Aquifer (DTB)	50 Meter
Annular Fill:	
across screen --	Gravel
above screen --	Bentonite
Aquifer Material -- Weathered Gabbro	

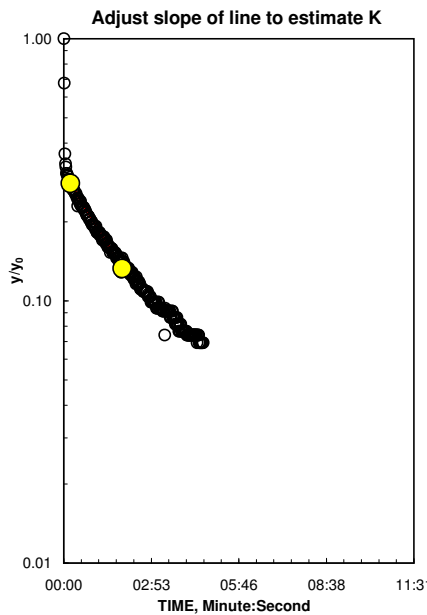
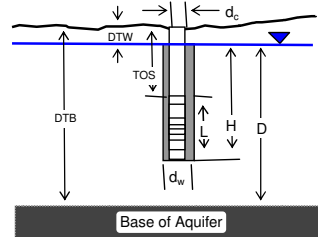
COMPUTED	
L_{wetted}	2 Meter
D =	43.577 Meter
H =	2.077 Meter
L/r_w	20.00
y_0 -DISPLACEMENT =	0.40 Meter
y_0 -SLUG =	0.38 Meter
From look-up table using L/r_w	
Partial penetrate A =	2.202
B =	0.345
$\ln(Re/r_w)$	1.735
Re =	1.86 Meter
Slope =	0.003161 $\log_{10}/\text{sec}$
$t_{90\%}$ recovery =	316 sec

Input is consistent.

K = 2.8E-06 Meter/Second

0.24192

Local ID: Hitchin
Date: 27/02/2012
Time: 00:00



Reduced Data

Entry	Time, Hr:Min:Sec	Water Level
1	0:00:00.0	63.98
2	0:00:11.0	64.26
3	0:00:22.0	64.28
4	0:00:33.0	64.28
5	0:00:44.0	64.29
6	0:00:55.0	64.30
7	0:01:06.0	64.31
8	0:01:17.0	64.31
9	0:01:28.0	64.32
10	0:01:39.0	64.32
11	0:01:50.0	64.32
12	0:02:01.0	64.33
13	0:02:12.0	64.33
14	0:02:23.0	64.33
15	0:02:34.0	64.34
16	0:02:45.0	64.34
17	0:02:56.0	64.34
18	0:03:07.0	64.34
19	0:03:18.0	64.34
20	0:03:29.0	64.34
21	0:03:40.0	64.35
22	0:03:51.0	64.35
23	0:04:02.0	64.35
24	0:04:13.0	64.35
25	0:04:24.0	64.35
26	0:04:35.0	64.35
27	0:04:46.0	0.00
28	0:04:57.0	0.00
29	0:05:08.0	0.00
30	0:05:19.0	0.00
31	0:05:30.0	0.00
32	0:05:41.0	0.00
33	0:05:52.0	0.00
34	0:06:03.0	0.00
35	0:06:14.0	0.00
36	0:06:25.0	0.00
37	0:06:36.0	0.00
38	0:06:47.0	0.00
39	0:06:58.0	0.00
40	0:07:09.0	0.00
41	0:07:20.0	0.00
42	0:07:31.0	0.00
43	0:07:42.0	0.00
44	0:07:53.0	0.00
45	0:08:04.0	0.00

REMARKS:

Bouwer and Rice analysis of slug test, WRR 1976

Effective casing diameter of 0.06m used oppose to actual diamter of 0.05m due to discrepancy in observed and actual displacement, which is attributed to the unconfined nature of the aquifer.
NOTE Geology is CHALK.

WELL ID: BH105A Test 2 Rising Head Test

INPUT	
Construction:	
Casing dia. (d_c)	0.07 Meter
Annulus dia. (d_w)	0.2 Meter
Screen Length (L)	2 Meter
Depths to:	
water level (DTW)	6.423 Meter
top of screen (TOS)	6.5 Meter
Base of Aquifer (DTB)	50 Meter
Annular Fill:	
across screen --	Gravel
above screen --	Bentonite
Aquifer Material -- Weathered Granite	

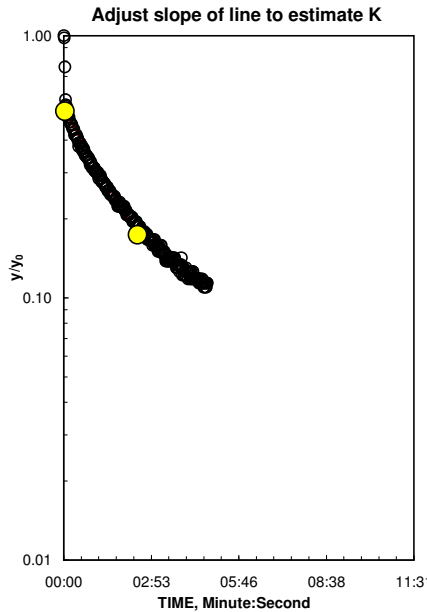
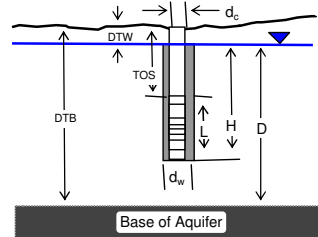
COMPUTED	
L_{wetted}	2 Meter
D =	43.577 Meter
H =	2.077 Meter
L/r_w =	20.00
y_0 -DISPLACEMENT =	0.25 Meter
y_0 -SLUG =	0.28 Meter
From look-up table using L/r_w	
Partial penetrate A =	2.202
B =	0.345
$\ln(Re/r_w)$ =	1.735
Re =	1.86 Meter
Slope =	0.003284 $\log_{10}/\text{sec}$
$t_{90\%}$ recovery =	305 sec

Input is consistent.

K = 0.000004 Meter/Second

0.3456

Local ID: Hitchin
Date: 27/02/2012
Time: 00:00



Reduced Data

Entry	Time, Hr:Min:Sec	Water Level
1	0:00:00.0	64.13
2	0:00:11.0	64.27
3	0:00:22.0	64.28
4	0:00:33.0	64.29
5	0:00:44.0	64.29
6	0:00:55.0	64.30
7	0:01:06.0	64.31
8	0:01:17.0	64.31
9	0:01:28.0	64.32
10	0:01:39.0	64.32
11	0:01:50.0	64.32
12	0:02:01.0	64.33
13	0:02:12.0	64.33
14	0:02:23.0	64.33
15	0:02:34.0	64.34
16	0:02:45.0	64.34
17	0:02:56.0	64.34
18	0:03:07.0	64.34
19	0:03:18.0	64.34
20	0:03:29.0	64.35
21	0:03:40.0	64.35
22	0:03:51.0	64.35
23	0:04:02.0	64.35
24	0:04:13.0	64.35
25	0:04:24.0	64.35
26	0:04:35.0	64.35
27	0:04:46.0	0.00
28	0:04:57.0	0.00
29	0:05:08.0	0.00
30	0:05:19.0	0.00
31	0:05:30.0	0.00
32	0:05:41.0	0.00
33	0:05:52.0	0.00
34	0:06:03.0	0.00
35	0:06:14.0	0.00
36	0:06:25.0	0.00
37	0:06:36.0	0.00
38	0:06:47.0	0.00
39	0:06:58.0	0.00
40	0:07:09.0	0.00
41	0:07:20.0	0.00
42	0:07:31.0	0.00
43	0:07:42.0	0.00
44	0:07:53.0	0.00
45	0:08:04.0	0.00

REMARKS:

Bouwer and Rice analysis of slug test, WRR 1976

Effective casing diameter of 0.07m used oppose to actual diamter of 0.05m due to discrepency in observed and actual displacement, which is attributed to the unconfined nature of the aquifer.
NOTE Geology is CHALK.

WELL ID: BH105A Test 3 Rising Head Test

INPUT	
Construction:	
Casing dia. (d_c)	0.06 Meter
Annulus dia. (d_w)	0.2 Meter
Screen Length (L)	2 Meter
Depths to:	
water level (DTW)	6.423 Meter
top of screen (TOS)	6.5 Meter
Base of Aquifer (DTB)	50 Meter
Annular Fill:	
across screen --	Gravel
above screen --	Bentonite
Aquifer Material -- Weathered Gabbro	

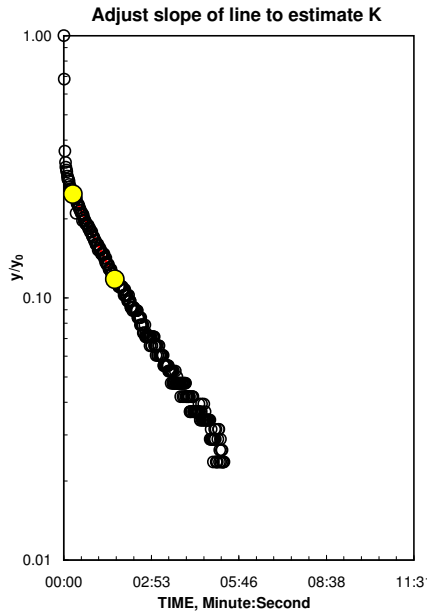
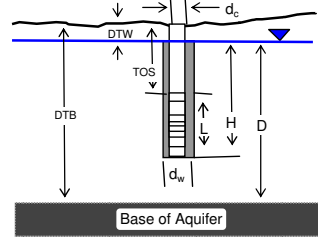
COMPUTED	
L_{wetted}	2 Meter
D =	43.577 Meter
H =	2.077 Meter
L/r_w	20.00
y_0 -DISPLACEMENT =	0.38 Meter
y_0 -SLUG =	0.38 Meter
From look-up table using L/r_w	
Partial penetrate A =	2.202
B =	0.345
$\ln(Re/r_w)$	1.735
Re =	1.86 Meter
Slope =	0.003898 $\log_{10}/\text{sec}$
$t_{90\%}$ recovery =	257 sec

Input is consistent.

K = 3.5E-06 Meter/Second

0.3024

Local ID: Hitchin
Date: 27/02/2012
Time: 00:00



Reduced Data

Entry	Time, Hr:Min:Sec	Water Level
1	0:00:00.0	64.00
2	0:00:11.0	64.28
3	0:00:22.0	64.29
4	0:00:33.0	64.30
5	0:00:44.0	64.31
6	0:00:55.0	64.31
7	0:01:06.0	64.32
8	0:01:17.0	64.32
9	0:01:28.0	64.33
10	0:01:39.0	64.34
11	0:01:50.0	64.34
12	0:02:01.0	64.34
13	0:02:12.0	64.35
14	0:02:23.0	64.35
15	0:02:34.0	64.35
16	0:02:45.0	64.35
17	0:02:56.0	64.35
18	0:03:07.0	64.36
19	0:03:18.0	64.36
20	0:03:29.0	64.36
21	0:03:40.0	64.36
22	0:03:51.0	64.36
23	0:04:02.0	64.36
24	0:04:13.0	64.37
25	0:04:24.0	64.37
26	0:04:35.0	64.37
27	0:04:46.0	64.37
28	0:04:57.0	64.37
29	0:05:08.0	64.37
30	0:05:19.0	0.00
31	0:05:30.0	0.00
32	0:05:41.0	0.00
33	0:05:52.0	0.00
34	0:06:03.0	0.00
35	0:06:14.0	0.00
36	0:06:25.0	0.00
37	0:06:36.0	0.00
38	0:06:47.0	0.00
39	0:06:58.0	0.00
40	0:07:09.0	0.00
41	0:07:20.0	0.00
42	0:07:31.0	0.00
43	0:07:42.0	0.00
44	0:07:53.0	0.00
45	0:08:04.0	0.00

REMARKS:

Bouwer and Rice analysis of slug test, WRR 1976

Effective casing diameter of 0.06m used oppose to actual diamter of 0.05m due to discrepency in observed and actual displacement, which is attributed to the unconfined nature of the aquifer.
NOTE Geology is CHALK.

WELL ID: BH106A Test 2 Rising Head Test

INPUT	
Construction:	
Casing dia. (d_c)	0.06 Meter
Annulus dia. (d_w)	0.2 Meter
Screen Length (L)	3 Meter
Depths to:	
water level (DTW)	6.547 Meter
top of screen (TOS)	5.3 Meter
Base of Aquifer (DTB)	50 Meter
Annular Fill:	
across screen --	Gravel
above screen --	Bentonite
Aquifer Material -- Stream Terrace Deposit, Fg	

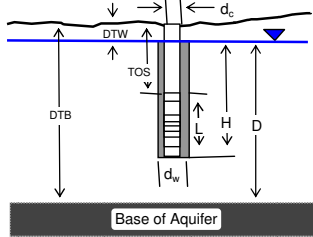
COMPUTED	
L_{wetted}	1.753 Meter
D =	43.453 Meter
H =	1.753 Meter
L/r_w	17.53
y_0 -DISPLACEMENT =	0.37 Meter
y_0 -SLUG =	0.38 Meter
From look-up table using L/r_w	
Partial penetrate A =	2.133
B =	0.329
$\ln(Re/r_w)$	1.617
Re =	1.65 Meter
Slope =	0.089226 $\log_{10}/\text{sec}$
$t_{90\%}$ recovery =	11 sec

Input is consistent.

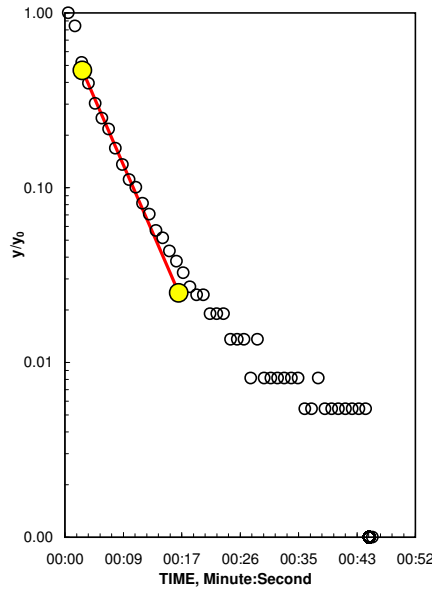
K = 0.000085 Meter/Second

7.344

Local ID: Hitchin
Date: 27/02/2012
Time: 00:00



Adjust slope of line to estimate K



Reduced Data

Entry	Time, Hr:Min:Sec	Water Level
1	0:00:00.0	64.02
2	0:00:01.0	64.08
3	0:00:02.0	64.20
4	0:00:03.0	64.24
5	0:00:04.0	64.28
6	0:00:05.0	64.30
7	0:00:06.0	64.31
8	0:00:07.0	64.33
9	0:00:08.0	64.34
10	0:00:09.0	64.35
11	0:00:10.0	64.35
12	0:00:11.0	64.36
13	0:00:12.0	64.36
14	0:00:13.0	64.37
15	0:00:14.0	64.37
16	0:00:15.0	64.37
17	0:00:16.0	64.38
18	0:00:17.0	64.38
19	0:00:18.0	64.38
20	0:00:19.0	64.38
21	0:00:20.0	64.38
22	0:00:21.0	64.38
23	0:00:22.0	64.38
24	0:00:23.0	64.38
25	0:00:24.0	64.39
26	0:00:25.0	64.39
27	0:00:26.0	64.39
28	0:00:27.0	64.39
29	0:00:28.0	64.39
30	0:00:29.0	64.39
31	0:00:30.0	64.39
32	0:00:31.0	64.39
33	0:00:32.0	64.39
34	0:00:33.0	64.39
35	0:00:34.0	64.39
36	0:00:35.0	64.39
37	0:00:36.0	64.39
38	0:00:37.0	64.39
39	0:00:38.0	64.39
40	0:00:39.0	64.39
41	0:00:40.0	64.39
42	0:00:41.0	64.39
43	0:00:42.0	64.39
44	0:00:43.0	64.39
45	0:00:44.0	64.39

REMARKS:

Bouwer and Rice analysis of slug test, WRR 1976

Effective casing diameter of 0.06m used oppose to actual diamter of 0.05m due to discrepency in observed and actual displacement, which is attributed to the unconfined nature of the aquifer.
NOTE Geology is CHALK.

WELL ID: BH106A Test 3 Rising Head Test

INPUT	
Construction:	
Casing dia. (d_c)	0.06 Meter
Annulus dia. (d_w)	0.2 Meter
Screen Length (L)	2.1 Meter
Depths to:	
water level (DTW)	6.547 Meter
top of screen (TOS)	11.5 Meter
Base of Aquifer (DTB)	50 Meter
Annular Fill:	
across screen --	Gravel
above screen --	Bentonite
Aquifer Material -- Stream Terrace Deposit, Fg	

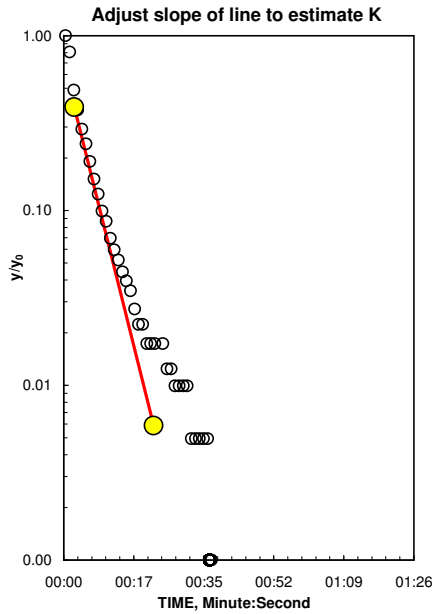
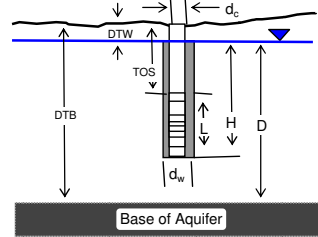
COMPUTED	
L_{wetted}	2.1 Meter
D =	43.453 Meter
H =	7.053 Meter
L/r_w	21.00
y_0 -DISPLACEMENT =	0.40 Meter
y_0 -SLUG =	0.38 Meter
From look-up table using L/r_w	
Partial penetrate A =	2.237
B =	0.354
$\ln(Re/r_w)$	2.154
Re =	2.83 Meter
Slope =	0.092899 $\log_{10}/\text{sec}$
$t_{90\%}$ recovery =	11 sec

Input is consistent.

K = 0.000099 Meter/Second

8.5536

Local ID: Hitchin
Date: 27/02/2012
Time: 00:00



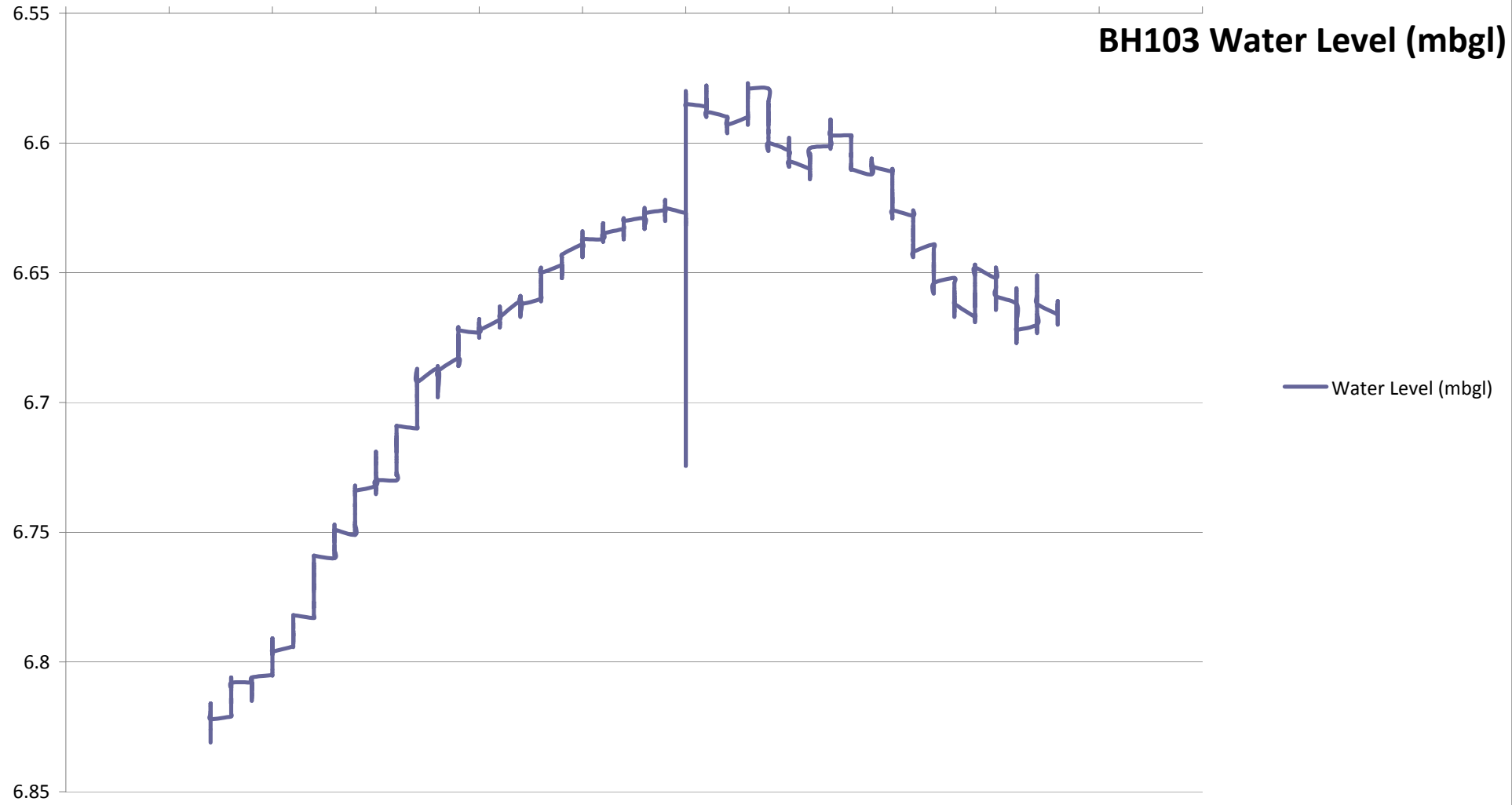
Reduced Data		
Entry	Time, Hr:Min:Sec	Water Level
1	0:00:00.0	64.81
2	0:00:01.0	64.73
3	0:00:02.0	64.60
4	0:00:03.0	64.56
5	0:00:04.0	64.52
6	0:00:05.0	64.50
7	0:00:06.0	64.48
8	0:00:07.0	64.47
9	0:00:08.0	64.45
10	0:00:09.0	64.44
11	0:00:10.0	64.44
12	0:00:11.0	64.43
13	0:00:12.0	64.43
14	0:00:13.0	64.43
15	0:00:14.0	64.42
16	0:00:15.0	64.42
17	0:00:16.0	64.42
18	0:00:17.0	64.42
19	0:00:18.0	64.41
20	0:00:19.0	64.41
21	0:00:20.0	64.41
22	0:00:21.0	64.41
23	0:00:22.0	64.41
24	0:00:24.0	64.41
25	0:00:25.0	64.41
26	0:00:26.0	64.41
27	0:00:27.0	64.41
28	0:00:28.0	64.41
29	0:00:29.0	64.41
30	0:00:30.0	64.41
31	0:00:31.0	64.41
32	0:00:32.0	64.41
33	0:00:33.0	64.41
34	0:00:34.0	64.41
35	0:00:35.0	64.41

REMARKS:

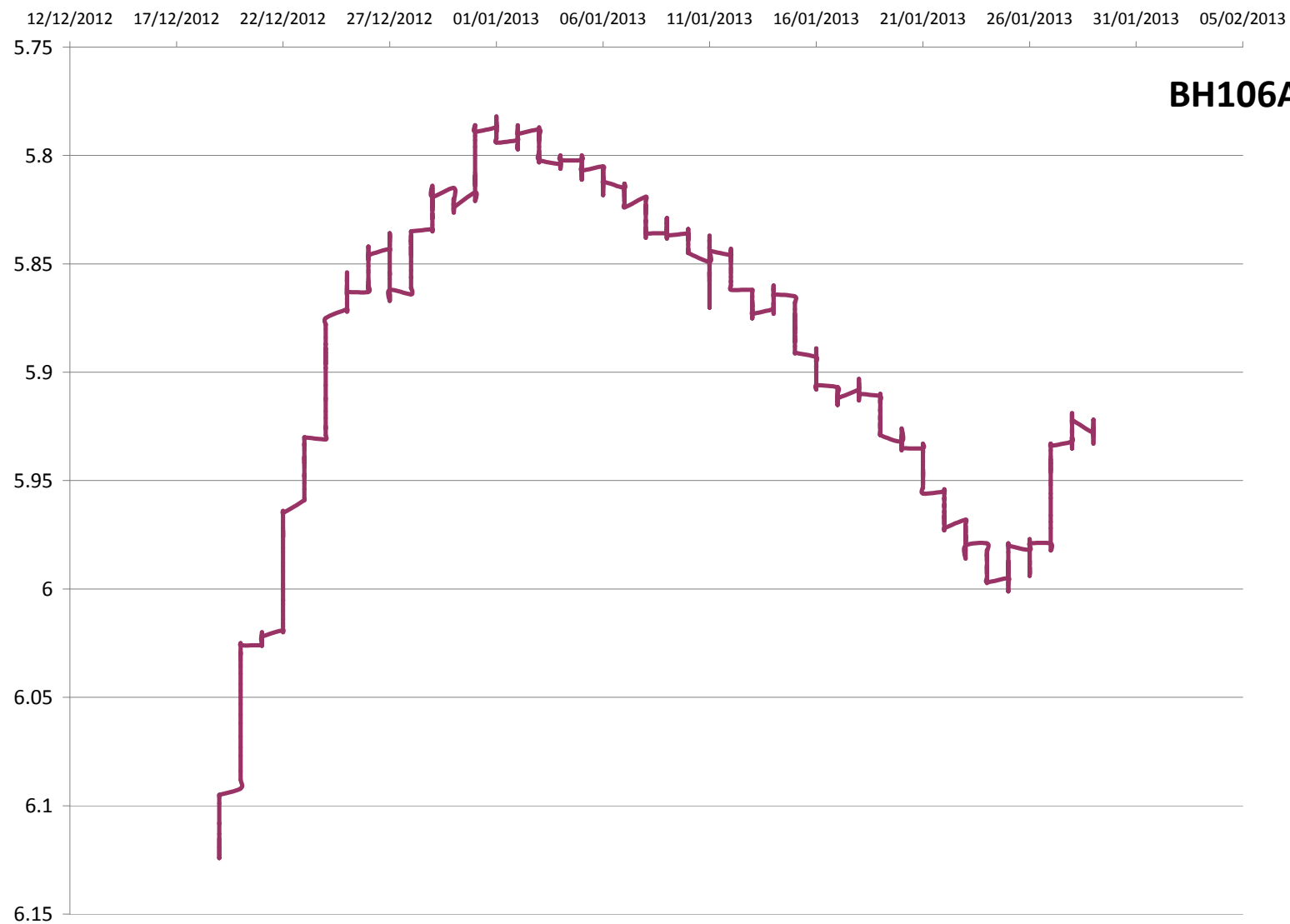
Bouwer and Rice analysis of slug test, WRR 1976

Effective casing diameter of 0.06m used oppose to actual diamter of 0.05m due to discrepency in observed and actual displacement, which is attributed to the unconfined nature of the aquifer.
NOTE Geology is CHALK.

12/12/201 17/12/201 22/12/201 27/12/201 01/01/201 06/01/201 11/01/201 16/01/201 21/01/201 26/01/201 31/01/201 05/02/201
2 2 2 2 3 3 3 3 3 3 3 3



BH106A Level (mbgl)



Compensated Level (m)