



Client:

Halperns/Unimore Ltd
57-59 Leicester Road
Salford
M7 4DA

Architect/Consultant

Phase II Contaminated Land Risk Assessment

Texaco Fuel Station Bury Old Road, Prestwich

**January
2014**

**Site Ref: 5594/FSP-CLRA
v1.00**

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Phase II Contaminated Land Risk Assessment

1. Introduction

This report is an account of a Phase II Contaminated Land Risk Assessment carried out by GeoAssist Limited at the request of Halperns/Unimore Ltd as the potential purchasers of the site of the Texaco Fuel Station, Bury Old Road, Prestwich.

The work was commissioned following the receipt of instruction to proceed issued by Hilary Goldstein on behalf of the Client Halperns/Unimore Ltd on the 05th December 2013.

The purpose of this Phase II investigation is to provide information, following the conclusions of a Phase I report produced by others in March 2013, in order to ensure that the site is fully assessed in accordance with the methodology outlined in CLR11, satisfies the relevant requirements of the National Planning Policy Framework March 2012 and is suitable for the intended proposed land use. In this case, as a commercial development.

The approximate grid reference for the centre of the site is 382875, 402531 and the total area of the site is approximately 1300m². The area of the site scheduled for investigation is outlined with a solid red line on the site plan in Appendix A1 along with the layout plan for the site and the exploratory hole locations.

2. Description of the Site

The site is located on Bury Old Road in the suburban area of Prestwich, Bury and is accessed directly off Bury Old Road. The general topography of the site is relatively flat although a fall towards the rear (south west) of the site was noted. The site is roughly rectangular in shape and is currently in use as an active vehicle refuelling station with associated facilities such as carwash and shop. The vast majority of the site is covered by concrete hardstanding with associated positive drainage network flowing into interceptor separators. The concrete hardstanding was noted to be in a reasonable condition at the time of the fieldwork and the drainage free from detritus and free flowing. It is understood that the site is to be redeveloped into a commercial office building with associated car parking. The site is bounded by a mix of residential and retail property to the north, south and west and Bury Old Road to the east.

3. Intrusive Investigation

3.1 Exploratory Hole Programme

Five exploratory holes were completed to depth across the site by GeoAssist using windowless sampling techniques at the locations shown on the site plan in Appendix A1. Exploratory hole WS6 was terminated at 1.20m depth due to the presence of a concrete obstruction despite two attempts at excavating the inspection pit in this area. Exploratory holes WS4 and WS7 were abandoned due to the presence of services and obstructions at these locations. Hand excavated inspection pits were undertaken at each exploratory hole location in order to avoid services. The details of the strata in the exploratory holes were recorded by a suitably qualified Professional Engineer. Upon completion of the fieldwork exploratory holes WS1, WS3 and WS5 were converted to gas/groundwater monitoring standpipes.

All of the other exploratory holes were backfilled in order of excavation to prevent the establishment of any potential pollutant pathways.

All intrusive work was carried out in accordance with:

- § British standard 5930: 1999 Code of Practice for Site Investigations
- § British Standard 10175: 2011 where applicable
- § The Energy Institute code of safe practice for contractors working on filling stations March 2010

The fieldwork was completed on the 17/12/2013 and 18/12/2013 in mixed weather conditions.

3.2 Field Sampling and Testing

Representative samples were taken of all the strata encountered in the exploratory holes. Once exposed samples to be subjected to chemical analysis were immediately placed into a suitable container and stored in a cool dark sample box prior to submission to the laboratory in order to prevent alteration of the composition of the samples. In all cases 500ml wide necked amber glass jars were used with a teflon faced foamed polyethylene cap liner that offers excellent chemical resistance with the compressibility and sealing properties of polyethylene foam. These containers were filled with sample, sealed and delivered to the laboratory for testing. Samples for volatile compounds were placed into appropriate containers with a screw cap and pierceable septum as supplied by the testing laboratory specifically appropriate to the determinand. These containers were filled with sample sealed and delivered to the laboratory for testing. All other samples were stored in airtight containers and returned to the laboratory for examination and geotechnical testing where necessary. A photo ionisation detector (PID) was used to indicate the likelihood of the presence of volatile organic compounds during the fieldwork and in the laboratory. The results are indicated on the Borehole logs.

4. Laboratory Investigation

4.1 Contamination Testing

In total five soil samples were collected and subjected to elements of the suite of chemical testing as outlined below. All tests were conducted by Scientific Analysis Laboratories under UKAS Testing No 1549. The results of all the chemical analysis tests are given in Appendix B1.

Table 4.0 Analytical Determinands

Soils	
Arsenic	Acenaphthene
Boron (water-soluble)	Acenaphthylene
Cadmium	Anthracene
Chromium	Benzo(a)Anthracene
Chromium VI	Benzo(a)Pyrene
Copper	Benzo(b/k)Fluoranthene
Cyanide(Total)	Benzo(ghi)Perylene
Cyanide(free)	Chrysene
Lead	Dibenzo(ah)Anthracene
Mercury	Fluoranthene
Nickel	Fluorene
pH	Indeno(123-cd)Pyrene
Phenols(Mono)	Naphthalene
Selenium	Phenanthrene
SO4(Total)	Pyrene
Sulphide	
Sulphur(Free)	Speciated TPH (aromatic aliphatic)
Thiocyanate	PCB (7 congeners)
Zinc	

5. Subsurface Stratigraphy

The subsoil profile obtained from the exploratory holes consists of grass/topsoil and concrete made ground to depths between 0.20m to 0.90m underlain by made ground to depths ranging from 0.90m and 2.80m and overlying sand with silt/clay. Exploratory holes WS1 and WS8 penetrated concrete hard standing to 0.20 and 0.30m depth respectively. Underlying the concrete and elsewhere the Made Ground consists mainly of clay, sand and gravel with brick and concrete fragments and cinders in varying proportions. The made ground is variable in material constituents and ranges from very loose to dense in state of compaction.

Exploratory holes WS1, WS2, WS3 and WS8 penetrated a sandy Silt/Clay stratum at depths ranging from 1.30m to 2.80m. This sand Silt/Clay contained organic inclusions varied from 0.60m to 1.50m in thickness, from low to medium in strength and intermediate to high in plasticity.

All the exploratory holes completed to depth were terminated in silty Sand with irregular gravel horizons.

The silty sand varied from loose to medium dense in state of compaction and extended to at least 6.00m depth.

Bedrock was not encountered in any of the exploratory holes undertaken as part of this investigation.

Further details of the subsurface stratigraphy can be found in the exploratory hole log sheet which form appendix C1 to this report.

6. Groundwater

Seepage groundwater was encountered in exploratory holes WS1, WS3 and WS5 at depths between 4.60m and 4.90m depth during the course of the fieldwork. The ground water conditions entered on the exploratory hole logs are those observed at the time of the investigation and the water level may not have reached equilibrium with the surrounding water level prior to the record being taken. Standing groundwater levels will be subject to seasonal variation or changes in local drainage conditions and could be higher at certain times of the year particularly after periods of heavy rainfall. Subsequent monitoring of standpipe installations in the boreholes has confirmed that the depth to groundwater has varied between 4.20m and 4.50m across the site.

7. Ground Gas

An interim gas risk assessment has been produced for the site and is based on the results of 3 monitoring rounds taken up to and including 13/01/2014. The monitoring data obtained includes gas readings taken during a period of falling pressure at below 1000mb. Data to describe Methane (%v/v), Carbon Dioxide (%v/v), Oxygen (%v/v), Hydrogen Sulphide (ppm), Carbon Monoxide (ppm), barometric pressure, gas flow rate (l/s) and depth below ground level to groundwater (m) were collected using the same methodology during each monitoring occasion. A Photo Ionisation Detector was also used to indicate the presence of significant quantities of volatile organic compounds. No significant quantities of volatile organic compounds were noted during the monitoring. The data, and subsequent risk assessment, are deemed to be representative of the conditions within the ground beneath the site and indicate that, in this instance, the site is categorised as very low risk. The risks based upon the data obtained indicate that the proposed area for the new construction is defined as a Ciria C665 characteristic situation 1 (CS1) very low risk. Table 8.6 of C665 indicates that no special precautions are required for sites within characteristic situation 1. Further gas monitoring is required and an updated risk assessment will be produced upon completion of the additional monitoring.

The gas risk assessment forms appendix C2 to this report. Relevant extracts from Ciria C665 form appendix D1 to this report.

8. Part IIA Legislation

Part IIA of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a new regime for the control of specific threats to health or the environment from existing land contamination. In accordance with the Act and the statutory guidance document on The Contaminated Land (England) Regulations 2000, the definition of contaminated land is intended to embody the concept of risk assessment. Within the meaning of the Act, land is only "contaminated land" where it appears to the regulatory authority, by reason of substances within or under the land that

- § Significant harm is being caused or there is significant possibility of such harm being caused; or
- § Pollution of controlled waters is being, or is likely to be, caused.

The guidance defines "risk" as the combination of

- § The probability, or frequency, of occurrence of a defined hazard (for example, exposure of a property to a substance with the potential to cause harm); and
- § The magnitude (including the seriousness) of the consequences.

For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

- § A source, i.e. a substance that is capable of causing pollution or harm;
- § A receptor (or target). i.e. something which could be adversely affected by the contaminant; and
- § A pathway, i.e. a route by which the contaminant can reach the receptor.

If one of these elements is missing there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

8.1 Assessment Methodology

In order to assess the environmental risk posed by potential contaminants within the near surface soils GeoAssist Limited undertook an initial screen of the laboratory results using GeoAssist Limited Generic Assessment Criteria (GACs) as given as part of Appendix C2.

The GeoAssist Limited GACs are generated in consideration of the proposed end use of the site as Commercial Land. Contaminant concentrations below the GACs are considered not to warrant further risk assessment. Concentrations of potential contaminants above the GACs require further consideration of the potential pollutant linkages. It should be noted that exceedance of the GACs does not necessarily mean that the site requires remediation, although this is dependant on the nature, type and depth of the contaminant.

8.2 Soils

For assessment of the soil analysis results with regard to potential human health risks, GeoAssist Limited GACs are selected from the following sources:

CLEA Soil Guideline Values (SGVs). These values have been developed by the Department of the Environment, Food and Rural Affairs (DEFRA) and the Environment Agency (EA) using the Contaminated

Land Exposure Assessment (CLEA) Model, and are considered to be protective of human health (considered to be a potential receptor on site). To date, SGVs have been published for only a limited suite of contaminants, with SGVs derived for each contaminant for three different land use scenarios namely:

- § residential
- § allotments
- § commercial and industrial.

The proposed assessment of this site is as commercial land as this is considered to be the most appropriate land use scenario for the situation on site.

Chartered Institute of Environmental Health Generic Assessment Criteria (LQM CIEH GAC) have been used where available and where CLEA SGVs have not yet been published.

Where CLEA or LQIM CIEH GAC values are not available, Atkins At Risk GAC values have been selected as appropriate.

The CLEA guidelines state that for each contaminant, apart from lead, the upper 95th percentile of the mean measured concentration should be calculated where appropriate and this value should be compared to the applicable screening value (defined here as the GeoAssist Limited GACs).

For Lead impacts the geometric mean should be calculated and compared to the CLEA SGV.

The CLEA model states that, 'the contamination is assumed to be at or within 1 m of the surface (CLR10 page 10 now withdrawn).' It is considered that at depths greater than 1m, the probability of human exposure via the direct contact pathways are significantly reduced, leaving inhalation of volatile compounds as the dominant pathway. Typically, volatile compounds only significantly affect the indoor inhalation pathway.

8.3 Subsoil Deposits

No contaminants were identified at levels exceeding the GeoAssist Limited GACs or SGVs for a commercial end use from the investigation. A summary is presented below:

Table 8.3 Summary identified impacts.

Determinand	GAC (mg/kg) Residential	No of tests	No of samples exceeding SGV/GAC	Max Value (mg/kg)	Treat as a Hotspot	US95 Value or Geometric Mean (for Lead)	Further action required
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None

The assessment has not identified any potential risks to end users of the site from elevated levels of anthropogenic contamination within the ground on the site.

All documents relating to the removal, disposal and importation of soils should be retained and be available for inspection by the EA should it be requested.

The Results of all the chemical laboratory analytical tests form appendix C1 to this report and the analysis of the results forms appendix C2 to this report.

8.4 Discussion

The assessment of the chemical laboratory analytical tests has identified that the soils on this site are highly unlikely to pose a risk to the identified receptors when assessed in accordance with the current UK methodology. Consequently, the risk to end users from ground contamination is classified as low. This is especially true when consideration is given to the fact that the vast majority of the proposed scheme will effectively cap the site with hard landscaping and car park and include only very limited areas of soft landscaping.

The risk to construction workers is assessed to be low as a function of the low levels of determinands identified across the site, the age of this receptor group and the exposure durations of this group.

The risk to building and services from chemical attack is negligible and as such no special precautions are required to protect the building fabric or services entering the buildings.

The investigation has identified 3 underground fuel storage tanks known to be fitted with the latest highly accurate electronic measuring gauges which are monitored from the kiosk. A printout of the fuel tank net balances has been provided. This system enables the operator to immediately detect losses from the tanks via leakage thereby saving the operator both environmental damage costs and fuel loss costs. No fuel losses have been recorded. The tanks are located to the rear of the kiosk in the centre of the site and area easily identified by labels on manhole covers. The fuel tanks lie directly below the foundation line of the proposed new building and it is anticipated that the fuel tanks and associated infrastructure will need to be certified safe and removed from site. There are numerous specialist contractors that can assist with tank decommissioning and removal. Importation of geotechnically suitable materials will be required to infill the excavation following removal of the tanks. All documents relating to the removal, disposal and importation of soils should be retained and be available for inspection by the EA should it be requested.

9. Conceptual Model

The conceptual model as updated from the Phase I report based on the information and test results presented in this report including contamination sources, pathways and receptors is presented below.

Table 9.0 Amended Conceptual Site Model based on information presented within this report.

Potential Source / Hazard	Nature of Hazard (Risk Level to site given a commercial end use)	Contaminants Associated with Source	Potential Pathway	Potential Receptor
Previous ON SITE Land uses:				
1. Vehicle refuelling station with underground storage tanks	Ground contamination Low Risk	Hydrocarbons None Identified Exceeding GAC & SGV	Ingestion, Direct Contact, Inhalation	Site Users Controlled Waters Construction workers
	Gas from in-filled ground Very Low Risk	None	None	Site Users Future Buildings & Services
2. Residential vehicle storage garages	Ground contamination Low Risk	None Identified Exceeding GAC & SGV	Ingestion, Direct Contact, Inhalation	Site Users Controlled Waters Construction workers
	Gas from in-filled ground Very Low Risk	None	None	Site Users Future Buildings & Services
3. Made Ground	Ground contamination Low Risk	None Identified Exceeding GAC & SGV	Ingestion, Direct Contact, Inhalation	Site Users Controlled Waters Construction workers
	Gas from in-filled ground Very Low Risk	Low Levels of CO2 iden	None	Site Users Future Buildings & Services
Previous OFF SITE land uses within 250m as indicated by Historical Plans Including:				
4. Electrical Sub Station	Ground contamination Low Risk	PCBs (7 congeners) None Identified Exceeding GAC & SGV	Ingestion, Direct Contact,	Site Users Controlled Waters Construction workers
	Gas from in-filled ground Very Low Risk	None	None	Site Users Future Buildings & Services
5. Coal Workings	Ground contamination Low Risk	None	None	Site Users Services
	Mine Gas Very Low Risk	None	None	Future Buildings & Services

10. Conclusions

Evidence presented elsewhere within this report indicates that:

- § The subsoils on this site present a low risk to future site users when assessed in compliance with the current UK methodology.
- § The controlled waters (groundwater) beneath the site are unlikely to become impacted by the passage of water through the soils on the site.
- § The site is defined as a characteristic situation 1 in accordance with Ciria C665 and significant quantities of ground gases and or flows have not been identified during the monitoring period.
- § Photo Ionisation Detection has not identified any high levels of Volatile Organic Compounds from the ground across the site.
- § The site is highly unlikely to be defined as contaminated land within the context of part IIA.
- § The site is fit for the proposed commercial use.
- § The site, in its present condition, does not represent a significant risk to the environment and is unlikely to become an environmental liability in the future provided that the fuel tanks and associated infrastructure are certified safe and removed from site.

10.1 Supplementary Recommendations

- § It is recommended a watching brief by a suitably qualified person be maintained during any subsequent site preparation works. If during any site works suspected ground contamination, not previously identified, is found to be present on the site then an appropriate, suitably Qualified Person should inspect the site and prepare a report outlining what measures, if any, are required to remediate the land. The local planning authority should be informed.



Matthew Benson BSc
Geotechnical/ Environmental Engineer



Mark Richardson MSc CEng MICE
Technical Director

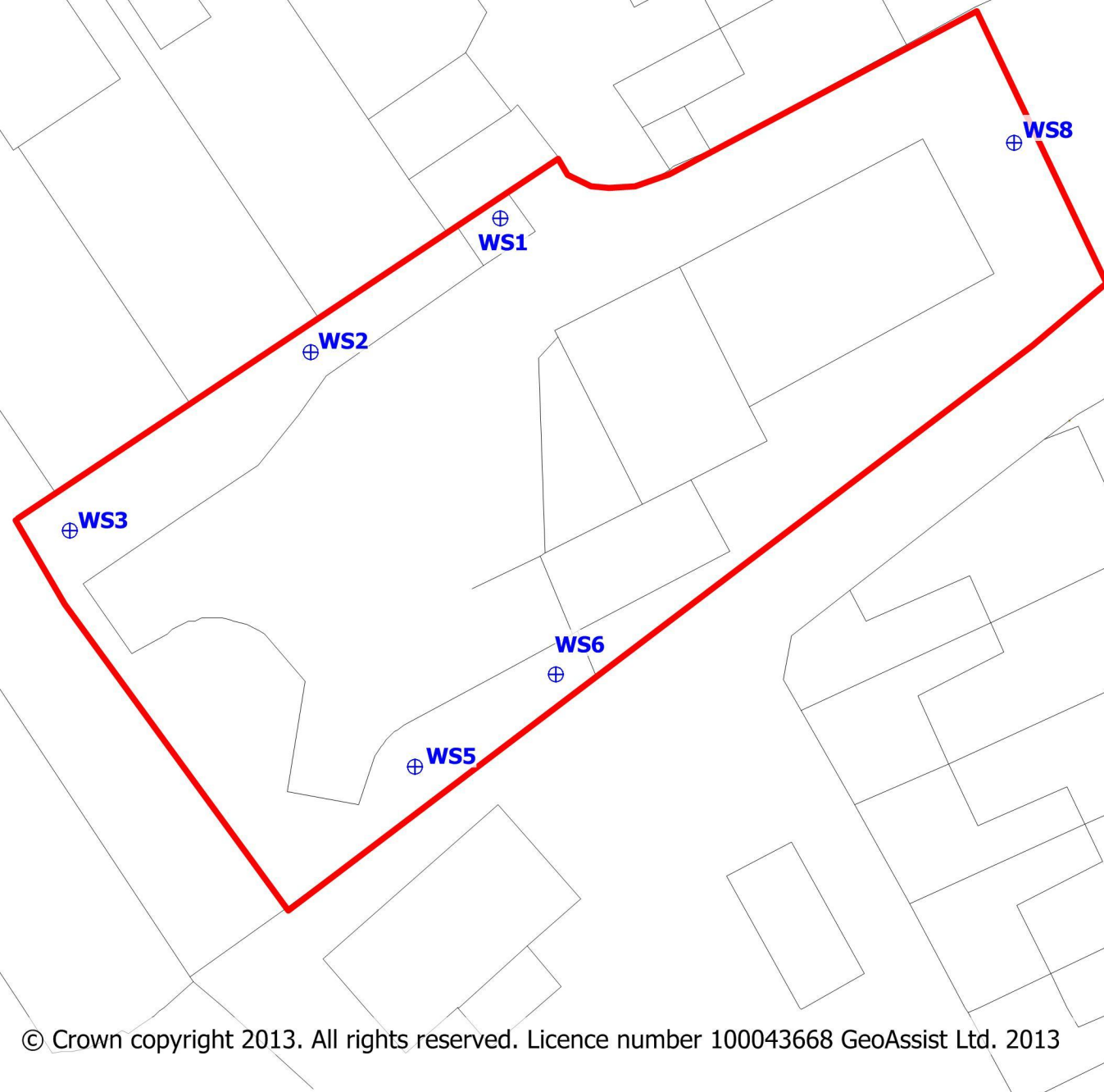
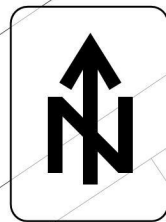
Field investigations have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions are, and can be, variable and have only been tested at isolated locations across the site. Therefore the potential exists for ground conditions to be encountered which are different to those considered in this report. Chemical analysis was conducted for a number of parameters based on an expert understanding of the historical and operational data available at the time and it should not be inferred or otherwise, that other chemical species are not present.

This report has been prepared by GeoAssist Limited with all reasonable professional skill, care and diligence within the terms of the contract with Halperns/Unimore Ltd. The report is confidential to Halperns/Unimore Ltd, their/the named persons advisors and bankers, and GeoAssist Limited accepts no responsibility of whatever nature to third parties to whom this report may be divulged. GeoAssist Limited owns the copyright in this report. All rights are reserved and unauthorised use is prohibited. Halperns/Unimore Ltd may use the report for their/her/his own purposes.

Appendix A

A1 Proposed Site Plan & Exploratory Hole Locations

GALv1.00



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GeoAssist Limited
Civil, Environmental & Geotechnical
Telephone: +44 (0) 161 480 8885 e-mail : info@geoassist.co.uk

A1 Exploratory Hole Plan

Site Name	Texaco Fuel Station
Location	Bury Old Road, Prestwich
GeoAssist Ref	5594FSP
Client	Halperns/Unimore Ltd
	57-59 Leicester Road Salford M7 4DA
Planning Consultant	
NGR (centre of site)	382875,402531
Production Date	Jan 2014
Survey Method	OSGB36 Data
Surveyor	M Benson
Status	V1.00
Base Survey	OSGB36



Appendix B

B1 Exploratory Hole Logs

B2 Gas Monitoring Results

Borehole No. **WS1**

PROJECT : Texaco Fuel Station
LOCATION : Bury Old Road, Prestwich

Sheet 1 of 1

EQUIPMENT:
Archway Dart Rig

Casing	
Dia. (mm)	Depth (m)
100	5.00

Ground Level :	m. AOD
Co-ordinates E	(m)
N	(m)
Dates 18/12/2013 to 18/12/2013	

Field Records	Samples/Tests			Drilling Foreman : M Walton STRATUM DESCRIPTION Engineer/Geologist :M Benson	Depth (Thick) (m)	Reduced Level (m AOD)	Strata Legend
	Depth from	(m) to	Sample Type & No				
PID = 3.4ppm	0.40	0.50	C1	CONCRETE	(0.20)		
				Brown clay, sand and gravel with brick fragments - MADE GROUND	0.20 (0.50)		
	0.90	1.00	C2	Dark brown/grey sand, gravel, brick and concrete fragments - MADE GROUND	0.70		
					(1.40)		
	1.30	1.40	D1		2.10		
					(0.70)		
Hand Vane at 3.20m =70Pa	3.20	3.30	D2	Firm brown medium strength gravelly sandy SILT/CLAY	2.80 (0.70)		
				Brown with occasional black silty fine to medium SAND	3.50		
				4.40	4.50		D3
18/12/2013: On completion of exploratory hole at 6.00m. Casing at 5.00m. Standing water level 4.90m. On withdrawal of casing gas/groundwater monitoring standpipe installed to 5.60m depth with response zone from 1.00m to 6.00m.				Borehole complete	6.00		

REMARKS : 18/12/2013: Inspection Pit excavated by hand to 1.00m to avoid services

Logged :	M Benson
----------	----------

Logged : M DENSON
Date : 18/12/2013

Date :	18/ 12/ 2013
Checked :	M Richardson

Date : 19/12/2013

Scale 1:25

Site Ref : 5594 FSP

GeoAssist Limited Consultant: Client: Halperns/Unimore Ltd	EXPLORATORY HOLE RECORD SHEET PROJECT : Texaco Fuel Station LOCATION : Bury Old Road, Prestwich					Borehole No. WS2 Sheet 1 of 1			
	EQUIPMENT: Archway Dart Rig			Casing Dia. (mm) Depth (m) 100 3.00		Ground Level : m. AOD Co-ordinates E (m) N (m) Dates 17/12/2013 to 17/12/2013			
	Field Records		Samples/Tests Depth (m) from to Sample Type & No Blow Count (N)/U		Drilling Foreman : M Walton STRATUM DESCRIPTION Engineer/Geologist : M Benson		Depth (Thick) (m)	Reduced Level (m AOD)	Strata Legend
PID = 0.4ppm		0.40 0.50	C1		Grass over TOPSOIL Grey cinders and ash - MADE GROUND Dark brown/grey sand, gravel, brick and concrete fragments - MADE GROUND		(0.20) 0.20 (0.10) 0.30		
Hand Vane at 2.80m =48kPa		0.90 1.00	C2				(1.70)		
		2.00 2.10	CP1	(3)	Very loose brown silty fine to medium SAND		2.00 (0.70)		
		2.80 2.90 3.00 3.10	D1 CP2	(6)	Firm brown medium strength SILT/CLAY with organic inclusions		2.70		
		3.50 3.60	CP3	(6)			(1.50)		
		4.00 4.10	CP4	(3)			4.20		
		4.50 4.60	CP5	(24)	Medium dense brown slightly gravelly silty fine to medium SAND				
		5.00 5.10	CP6	(21)			(1.80)		
		5.50 5.60	CP7	(18)					
17/12/2013: On completion of exploratory hole at 6.00m. Casing at 3.00m. On withdrawal of casing exploratory hole backfilled as per specification.		5.90 6.00	CP8	(21)	Borehole complete		6.00		
REMARKS : 17/12/2013: Inspection Pit excavated by hand to 1.00m to avoid services							Logged : M Benson Date : 17/12/2013 Checked : M Richardson Date : 19/12/2013 Site Ref : 5594 FSP		
Scale 1:25									

EXPLORATORY HOLE RECORD SHEET

Borehole No. **WS3**

Sheet 1 of 1

Consultant:

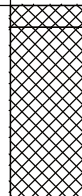
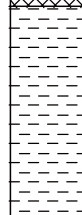
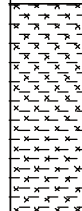
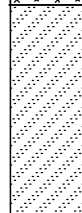
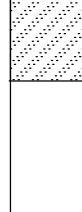
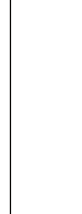
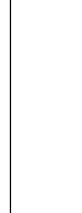
PROJECT : Texaco Fuel Station
LOCATION : Bury Old Road, Prestwich

Client:
Halperns/Unimore
Ltd

EQUIPMENT:
Archway Dart Rig

Casing	
Dia. (mm)	Depth (m)
100	5.00

Ground Level :	m. AOD
Co-ordinates E	(m)
N	(m)
Dates 17/12/2013 to 17/12/2013	

Field Records	Samples/Tests				Drilling Foreman : M Walton STRATUM DESCRIPTION Engineer/Geologist : M Benson	Depth (Thick) (m)	Reduced Level (m AOD)	Strata Legend
	Depth from	(m) to	Sample Type & No	Blow Count (N)/U				
PID = 0.5ppm	0.40	0.50	C1	(30)	Grass over TOPSOIL	(0.15)		
					Medium dense to dense dark brown/grey sand, gravel, brick and concrete fragments - MADE GROUND	0.15		
	1.00	1.10	C2 CP1 D1	(30)		(1.15)		
	1.50	1.60	CP2	(6)	Very loose to loose dark brown/grey gravelly clayey silty sand with brick fragments - MADE GROUND	1.30		
	2.00	2.10	CP3	(3)		(1.40)		
	2.30	2.40	D2	(3)				
2.80	2.90	D3	(3)	Firm brown medium strength SILT/CLAY with organic inclusions	2.70			
					3.00		3.10	CP4
Hand Vane at 2.80m =61kPa	3.50	3.60	CP5	(3)		(1.40)		
	4.00	4.10	CP6	(3)		4.10		
	4.50	4.60	CP7	(15)	Loose to medium dense brown silty fine to medium SAND, very silty in parts with gravel horizons			
						4.70		4.80
	5.00	5.10	CP8	(6)		(1.90)		
	5.30	5.40	D5	(6)				
						5.50		5.60
5.90	6.00	CP10	(6)		6.00			
17/12/2013: On completion of exploratory hole at 6.00m. Casing at 5.00m. Standing water level 4.60m. On withdrawal of casing gas/groundwater monitoring standpipe installed to 5.00m depth with response zone from 1.00m to 5.00m.					Borehole complete			

REMARKS : 17/12/2013: Inspection Pit excavated by hand to 1.00m to avoid services

Logged :	M Benson
Date :	17/12/2013

Checked : M Richardson
Date : 19/12/2013

Site Ref : 5594 FSP

Scale 1:25

EXPLORATORY HOLE RECORD SHEET

Borehole No. **WS5**

Sheet 1 of 1

Consultant:

PROJECT : Texaco Fuel Station
LOCATION : Bury Old Road, Prestwich

Client:
Halperns/Unimore
Ltd

EQUIPMENT:
Archway Dart Rig

Casing	
Dia. (mm)	Depth (m)
100	5.00

Ground Level :	m. AOD
Co-ordinates E	(m)
N	(m)
Dates 18/12/2013 to 18/12/2013	

Field Records	Samples/Tests			Drilling Foreman : M Walton STRATUM DESCRIPTION Engineer/Geologist : M Benson	Depth (Thick) (m)	Reduced Level (m AOD)	Strata Legend
	Depth from	(m) to	Sample Type & No				
PID = 0.5ppm							
				Grass over TOP SOIL	(0.20)		
	0.40	0.50	C1	Dark brown/grey clay, sand and gravel with brick fragments - MADE GROUND	0.20		
					(0.70)		
	0.90	1.00	C2		0.90		
	1.00	1.45	P1	Dark grey clayey silty fine to medium SAND	(0.70)		
	1.50	1.60	D1		1.60		
			Loose to medium dense brown silty fine to medium SAND				
	2.00	2.45	P2				
	2.10	2.20	D2				
	3.00	3.45	P3	(8)			
	4.00	4.45	P4	(10)	(4.40)		
	5.00	5.45	P5	(11)			

REMARKS : 18/12/2013: Inspection Pit excavated by hand to 1.00m to avoid services

Logged :	M Benson
----------	----------

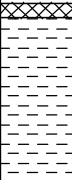
Logged : M DENSON
Date : 18/12/2013

Date :	18/ 12/ 2013
Checked :	M Richardson

Date : 19/12/2013

Scale 1:25

Site Ref : 5594 FSP

GeoAssist Limited Consultant: Client: Halperns/Unimore Ltd		EXPLORATORY HOLE RECORD SHEET PROJECT : Texaco Fuel Station LOCATION : Bury Old Road, Prestwich				Borehole No. WS6 Sheet 1 of 1			
		EQUIPMENT: Archway Dart Rig		Casing Dia. (mm) Depth (m)		Ground Level : m. AOD Co-ordinates E (m) N (m) Dates 18/12/2013 to 18/12/2013			
Field Records		Samples/Tests		Drilling Foreman : M Walton STRATUM DESCRIPTION Engineer/Geologist : M Benson		Depth (Thick) (m)	Reduced Level (m AOD)	Strata Legend	
		Depth (m) from to	Sample Type & No						Blow Count (N)/J
18/12/2013: On termination of two number inspection pits at 1.20m. Standing water level Nil. Exploratory holes backfilled as per specification.		0.40 0.50	C1		Grass over TOP SOIL Dark brown/grey sand, brick rubble - MADE GROUND		(0.10) 0.10		
		0.90 1.00	C2				(1.10)		
					CONCRETE OBSTRUCTION at 1.20m		1.20		
					Borehole complete				
REMARKS : 18/12/2013: Inspection Pit excavated by hand to 1.20m to avoid services. Exploratory hole terminated due to presence of concrete obstruction.						Logged : M Benson Date : 18/12/2013 Checked : M Richardson Date : 19/12/2013 Site Ref : 5594 FSP			
Scale 1:25									

GeoAssist Limited		EXPLORATORY HOLE RECORD SHEET				Borehole No. WS8	
		PROJECT : Texaco Fuel Station LOCATION : Bury Old Road, Prestwich				Sheet 1 of 1	
Consultant:		EQUIPMENT: Archway Dart Rig		Casing Dia. (mm) Depth (m) 100 3.00		Ground Level : m. AOD Co-ordinates E (m) N (m) Dates 18/12/2013 to 18/12/2013	
Client: Halperns/Unimore Ltd							
Field Records	Samples/Tests			Drilling Foreman : M Walton STRATUM DESCRIPTION Engineer/Geologist : M Benson	Depth (Thick) (m)	Reduced Level (m AOD)	Strata Legend
	Depth (m) from to	Sample Type & No	Blow Count (N)/J				
PID = 0.5ppm Hand Vane at 1.50m =27kPa Hand Vane at 2.40m =67kPa 18/12/2013: On completion of exploratory hole at 3.00m. Casing at 3.00m. On withdrawal of casing exploratory hole backfilled as per specification.	0.40 0.50	C1		CONCRETE	(0.30) 0.30		
	0.90 1.00	C2		Dark grey/brown clayey sand with brick and concrete fragments - MADE GROUND	(1.00) 1.30		
	1.50 1.60	D1		Soft brown low strength sandy SILT/CLAY	(0.40) 1.70		
	2.20 2.30	D2		Brown gravelly silty fine to medium SAND with firm red.brown silty clay band at 2.40 to 2.45m	(0.75) 2.45		
	2.40 2.50	D3		Brown with occasional black silty fine to medium SAND	(0.55) 3.00		
				Borehole complete			
REMARKS : 18/12/2013: Inspection Pit excavated by hand to 1.00m to avoid services					Logged : M Benson Date : 18/12/2013 Checked : M Richardson Date : 19/12/2013 Site Ref : 5594 FSP		
Scale 1:25							

Ground Gas Readings

[illegible]

NM = Not Measured

Factual Data Summary										Interpretation & Risk Assessment				
BH Ref.	Response zone/strata	Evidence of Gas contamination	No of Monitoring occasions	Max. Recorded Methane	Max. Recorded Carbon Dioxide (%)	Min. Oxygen (%)	*Max. Recorded Flow (l/hr)	Max Water Level (mbgl)	Atmospheric Pressure Range (mb)	Is Water Level within top 10% of the response zone?	Are readings considered representative	Explanation / Justification	Gas Screening Value (GSV)	Risk Classification & Characteristic Situation
WS1	1.00 to 5.50m / Made Ground & Sand	No	3	0.0	0.0	20.3	0.0	4.50	976 to 996	No	Yes		0.000	Very Low Risk Characteristic Situation 1
WS3	1.00 to 5.00m / Made Ground & Sand	No	3	0.1	0.8	19.5	0.5	4.20	976 to 995	No	Yes		0.004	Very Low Risk Characteristic Situation 1
WS5	1.00 to 5.00m / Made Ground & Sand	No	3	0.1	3.9	15.7	0.3	4.40	976 to 995	No	Yes		0.012	Very Low Risk Characteristic Situation 1
Worst Case	1.00 to 3.00m / Made Ground & Sand	No	3	0.1	3.9	15.7	0.5	4.20	976	No	Yes		0.020	Very Low Risk Characteristic Situation 1

* Where flow is recorded as 0.0 l/hr Limit of Detection of 0.1l/hr is applied for GSV calculation

** GSV indicates CS1 However CS2 applied as either Methane is greater than 1% v/v and / or Carbon Dioxide is greater than 5% v/v.

	Low Risk
	Moderate Risk
	High Risk

Instrument used:

Gas Risk Assessment in accordance with Ciria C665 & BS 8485: 2007

Foot notes from BS 8485 : 2007 Section 6.2 Site Characteristic Hazardous Gas Flow Rate Derivation.

NOTE 1 NHBC Report no.: 10627-R01 (04) [3] provides further guidance on chronic and acute risks.

As the risks being considered are of an acute nature (unlike with chemically contaminated soils, where chronic risks are usually the principal concern) any statistical treatment of the results should be carefully considered and clearly justified.

An interpretation of the dataset of the calculated, individual Q_{hg} values should be undertaken to arrive at a site characteristic hazardous gas flow rate Q_{hgs} for the site (or zone).

NOTE 2 There are numerous methods of statistical and graphical analysis of empirical data. The propriety of the approach will depend on site specific circumstances and the quality and quantity of data. No single method is prescribed within this code of practice.

NOTE 3 In some circumstances a consideration of maximum recorded gas concentrations obtained from any location on the site, along with the maximum recorded borehole gas flow rate from any location and any time period might be appropriate. In many circumstances this would result in an overly conservative assessment.

NOTE 4 It is generally more appropriate to consider concentrations and borehole gas flow rates on a location by location basis (this would be appropriate where there is a comprehensive dataset [see also 5.4]).

Appendix C

- C1 SAL Chemical Test Results**
- C2 Analysis of Results with Assessment Criteria**



Scientific Analysis Laboratories is a
limited company registered in England and
Wales (No 2514788) whose address is at
Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
Combrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 367738-1

Date of Report: 07-Jan-2014

Customer: Geoassist Ltd
Unit 4
Sheffield Street
Heaton Norris
Stockport
SK4 1RU

Customer Contact: Mr Mark Richardson

Customer Job Reference: Texaco Fuel Station 5594

Customer Site Reference: Prestwich

Date Job Received at SAL: 19-Dec-2013

Date Analysis Started: 23-Dec-2013

Date Analysis Completed: 07-Jan-2014

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22



1549

Report checked
and authorised by :
Chris Murphy
Project Manager

Issued by :
Chris Murphy
Project Manager

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Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Arsenic	T6	AR	1	mg/kg	U	001-005
Boron (water-soluble)	T6	AR	1	mg/kg	N	001-005
Cadmium	T6	AR	1	mg/kg	U	001-005
Chromium	T6	AR	1	mg/kg	U	001-005
Chromium VI	T6	AR	1	mg/kg	N	001-005
Copper	T6	AR	1	mg/kg	U	001-005
Cyanide(Total)	T4	AR	1	mg/kg	U	001-005
Cyanide(free)	T4	AR	1	mg/kg	U	001-005
Lead	T6	AR	1	mg/kg	U	001-005
Mercury	T6	AR	1	mg/kg	U	001-005
Nickel	T6	AR	1	mg/kg	U	001-005
pH	T7	AR			U	001-005
Phenols(Mono)	T4	AR	1	mg/kg	U	001-005
Selenium	T6	AR	3	mg/kg	U	001-005
SO4(Total)	T6	AR	0.01	%	N	001-005
Sulphide	T4	AR	10	mg/kg	N	001-005
Sulphur(Free)	T2	AR	500	mg/kg	N	001-005
Thiocyanate	T4	AR	10	mg/kg	N	001-005
Zinc	T6	AR	1	mg/kg	U	001-005
Naphthalene	T149	AR	0.01	mg/kg	U	001-005
Acenaphthylene	T149	AR	0.01	mg/kg	U	001-005
Acenaphthene	T149	AR	0.01	mg/kg	U	001-005
Fluorene	T149	AR	0.01	mg/kg	U	001-005
Phenanthrene	T149	AR	0.01	mg/kg	U	001-005
Anthracene	T149	AR	0.01	mg/kg	U	001-005
Fluoranthene	T149	AR	0.01	mg/kg	U	001-005
Pyrene	T149	AR	0.01	mg/kg	U	001-005
Benzo(a)Anthracene	T149	AR	0.01	mg/kg	U	001-005
Chrysene	T149	AR	0.01	mg/kg	U	001-005
Benzo(b,k)Fluoranthene	T149	AR	0.01	mg/kg	U	001-005
Benzo(a)Pyrene	T149	AR	0.01	mg/kg	U	001-005
Indeno(123-cd)Pyrene	T149	AR	0.01	mg/kg	U	001-005
Dibenzo(ah)Anthracene	T149	AR	0.01	mg/kg	U	001-005
Benzo(ghi)Perylene	T149	AR	0.01	mg/kg	U	001-005
PAH(total)	T149	AR	0.01	mg/kg	U	001-005
PCB BZ#28	T1	AR	0.05	µg/kg	U	001
PCB BZ#52	T1	AR	0.05	µg/kg	U	001
PCB BZ#101	T1	AR	0.05	µg/kg	U	001
PCB BZ#118	T1	AR	0.05	µg/kg	U	001
PCB BZ#138	T1	AR	0.05	µg/kg	U	001
PCB BZ#153	T1	AR	0.05	µg/kg	U	001
PCB BZ#180	T1	AR	0.05	µg/kg	U	001
TPH (C8-C10 aliphatic)	T8	AR	1	mg/kg	N	001-005
TPH (C10-C12 aliphatic)	T8	AR	1	mg/kg	N	001-005
TPH (C12-C16 aliphatic)	T8	AR	1	mg/kg	N	001-005
TPH (C16-C21 aliphatic)	T8	AR	1	mg/kg	N	001-005
TPH (C21-C35 aliphatic)	T8	AR	1	mg/kg	N	001-005
TPH (C8-C10 aromatic)	T8	AR	1	mg/kg	N	001-005
TPH (C10-C12 aromatic)	T8	AR	1	mg/kg	N	001-005
TPH (C12-C16 aromatic)	T8	AR	1	mg/kg	N	001-005
TPH (C16-C21 aromatic)	T8	AR	1	mg/kg	N	001-005
TPH (C21-C35 aromatic)	T8	AR	1	mg/kg	N	001-005



Human Health Risk Assessment Based on Generic Assessment Criteria

Site Reference: 5594 FSP
Project Site: Texaco Fuel Station
Project Location:
Client: 0
Consultant: 0

SAL Reference		367738 001	367738 002	367738 003	367738 004	367738 005
Customer Sample Ref:		WS1 C2	WS3 C2	WS5 C2	WS6 C2	WS8 C2
	SGV / GAC	41626	41626	41626	41626	41626
Determinand	Commercial					
Arsenic	640	8	12	6	21	25
Boron (water-soluble)	192000	1	1	1	1	1
Cadmium	348	1	1	1	1	1
Chromium	30400	20	11	10	27	18
Chromium VI	35	1	1	1	1	1
Copper	71700	36	61	20	55	60
Cyanide(Total)	34	1	1	1	1	1
Cyanide(free)	-	1	1	1	1	1
Lead	450	96	86	27	84	150
Mercury	3600	1	1	1	1	1
Nickel	1800	16	23	12	32	19
pH	-	11.4	8.6	7.9	8	7.8
Phenols(Mono)	1100000	1	1	1	1	1
Selenium	13000	3	3	3	3	3
SO4(Total)	-	0.01	0.01	0.01	0.01	0.01
Sulphide	-	10	10	10	10	10
Sulphur(Free)	-	500	500	500	500	500
Thiocyanate	-	10	10	10	10	10
Zinc	665000	81	88	40	83	99
Acenaphthene	85000	5.1	0.23	0.01	0.33	0.2
Acenaphthylene	84000	0.02	0.08	0.01	0.01	0.01
Anthracene	530000	5.3	0.39	0.01	0.36	1.3
Benzo(a)Anthracene	90	8.8	1.4	0.05	0.98	3.5
Benzo(a)Pyrene	14	8	1.5	0.04	0.94	2.9
Benzo(b/k)Fluoranthene	100	13	2.5	0.07	1.4	4.7
Benzo(ghi)Perylene	650	2.9	0.6	0.02	0.36	0.99
Chrysene	140	8.9	1.3	0.05	0.95	3.8
Dibenzo(ah)Anthracene	13	1.1	0.12	0.01	0.14	0.41
Fluoranthene	23000	24	2.8	0.09	2	7.6
Fluorene	64000	3	0.17	0.01	0.2	0.28
Indeno(123-cd)Pyrene	60	4	0.86	0.03	0.49	1.2
Naphthalene	200	0.52	0.14	0.01	0.16	0.07
Phenanthrene	22000	24	1.5	0.06	1.7	7.4
Pyrene	54000	19	2.5	0.09	1.9	7.7
PAH(total)	500	130	16	0.55	12	42
TPH (C6-C8 aliphatic)	-	0	0	0	0	0
TPH (C8-C10 aliphatic)	2100	1	1	1	1	1
TPH (C10-C12 aliphatic)	10000	6	1	1	1	1
TPH (C12-C16 aliphatic)	61000	5	2	1	1	4
TPH (C16-C21 aliphatic)	1600000	7	3	1	2	16
TPH (C21-C35 aliphatic)	1600000	34	6	3	3	100
TPH (C6-C7 aromatic)	-	0	0	0	0	0
TPH (C7-C8 aromatic)	-	0	0	0	0	0
TPH (C8-C10 aromatic)	3700	1	1	1	1	1
TPH (C10-C12 aromatic)	17000	3	2	1	2	4
TPH (C12-C16 aromatic)	36000	4	10	1	8	47
TPH (C16-C21 aromatic)	28000	10	24	2	22	690
TPH (C21-C35 aromatic)	28000	24	51	5	41	1400
PCB BZ#28	-	0.5	-	-	-	-
PCB BZ#52	-	1.1	-	-	-	-
PCB BZ#101	-	3	-	-	-	-
PCB BZ#118	-	2.5	-	-	-	-
PCB BZ#153	-	2.8	-	-	-	-
PCB BZ#138	-	2	-	-	-	-
PCB BZ#180	-	0.6	-	-	-	-
PCB (total)	240	12.5	-	-	-	-

All Units mg/kg unless otherwise stated

Indicates Exceedance of SGV or GAC

Appendix D
D1 Ciria C665 & BS 8485 :2007 Extract

Ciria C665 Extract

Characteristic situation	Residential building (Not low-rise traditional housing) ¹		Office/commercial/industrial development	
(From Table 8.5)	Number of levels of protection	Typical scope of protective measures	Number of levels of protection	Typical scope of protective measures
1	None	No special precautions	None	No special precautions
2	2	a) Reinforced concrete cast <i>in situ</i> floor slab (suspended, non-suspended or raft) with at least 1200 g DPM⁹ and underfloor venting b) Beam and block or pre-cast concrete and 2000 g DPM/ reinforced gas membrane and underfloor venting All joints and penetrations sealed.	1 to 2	a) Reinforced concrete cast <i>in situ</i> floor slab (suspended, non-suspended or raft) with at least 1200 g DPM⁹ b) Beam and block or pre cast concrete slab and minimum 2000 g DPM/reinforced gas membrane c) Possibly underfloor venting or pressurisation in combination with a) and b) depending on use All joints and penetrations sealed.
3	2	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space.	1 to 2	All types of floor slab as above. All joints and penetrations sealed. Minimum 2000 g/reinforced gas proof membrane and passively ventilated underfloor sub-space or positively pressurised underfloor sub-space
4	3	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated underfloor subspace or positively pressurised underfloor sub-space, oversite capping or blinding and in ground venting layer.	2 to 3	All types of floor slab as above. All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility.
5	4	Reinforced concrete cast in situ floor slab (suspended, non-suspended or raft).All joints and penetrations sealed. Proprietary gas resistant membrane and ventilated or positively pressurised underfloor sub-space, oversite capping and in ground venting layer and in ground venting wells or barriers.	3 to 4	Reinforced concrete cast <i>in-situ</i> floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility. In ground venting wells or barriers.
6	5	Not suitable unless gas regime is reduced first and quantitative risk assessment carried out to assess design of protection measures in conjunction with foundation design.	4 to 5	Reinforced concrete cast <i>in-situ</i> floor slab (suspended, non-suspended or raft). All joints and penetrations sealed. Proprietary gas resistant membrane and actively ventilated or positively pressurised underfloor sub-space with monitoring facility, with monitoring. In ground venting wells and reduction of gas regime.

Traffic light	Methane ¹		Carbon dioxide ¹	
	Typical maximum concentration ⁵ (% v/v)	Gas screening value (GSV) ^{2,4,6} (litres per hour)	Typical maximum concentration ⁵ (% v/v)	Gas screening value (GSV) ^{2,3,4,5} (litres per hour)
Green	1	0.16	5	0.78
Amber 1				
Amber 2				
Red	20	1.56	30	3.13

Traffic Light classification	Protection measures required
Green	Negligible gas regime identified and gas protection measures are not considered necessary.
Amber 1	Low to intermediate gas regime identified, which requires low-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to limit the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. Ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours.
Amber 2	Intermediate to high gas regime identified, which requires high-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to prevent the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. Membranes should always be fitted by a specialist contractor. As with Amber 1, ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours. Certification that these passive protection measures have been installed correctly should be provided.
Red	High gas regime identified. It is considered that standard residential housing would not normally be acceptable without a further Gas Risk Assessment and/or possible remedial mitigation measures to reduce and/or remove the source of gas.

BS 8485 : 2007 Extract

Table 2 Required gas protection by characteristic gas situation and type of building

Characteristic gas situation, CS	NHBC traffic light	Required gas protection			
		Non-managed property, e.g. private housing	Public building ^{A)}	Commercial buildings	Industrial buildings ^{B)}
1	Green	0	0	0	0
2	Amber 1	3	3	2	1 ^{C)}
3	Amber 2	4	3	2	2
4	Red	6 ^{D)}	5 ^{D)}	4	3
5			6 ^{E)}	5	4
6				7	6

Table 3 Solutions scores

PROTECTION ELEMENT/SYSTEM		SCORE	COMMENTS
a) Venting/dilution (see Annex A)			
Passive sub floor ventilation (venting layer can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc.) ^{A)}	Very good performance	2.5	<i>Ventilation performance in accordance with Annex A.</i>
	Good performance	1	<i>If passive ventilation is poor this is generally unacceptable and some form of active system will be required.</i>
Subfloor ventilation with active abstraction/pressurization (venting layer can be a clear void or formed using gravel, geocomposites, polystyrene void formers, etc.) ^{A)}		2.5	<i>There have to be robust management systems in place to ensure the continued maintenance of any ventilation system. Active ventilation can always be designed to meet good performance. Mechanically assisted systems come in two main forms: extraction and positive pressurization.</i>
Ventilated car park (basement or undercroft)		4	<i>Assumes car park is vented to deal with car exhaust fumes, designed to Building Regulations Document F [5] and IStructE guidance [6].</i>
b) Barriers			
Floor slabs			
Block and beam floor slab		0	<i>It is good practice to install ventilation in all foundation systems to effect pressure relief as a minimum. Breaches in floor slabs such as joints have to be effectively sealed against gas ingress in order to maintain these performances.</i>
Reinforced concrete ground bearing floor slab		0.5	
Reinforced concrete ground bearing foundation raft with limited service penetrations that are cast into slab		1.5	
Reinforced concrete cast in situ suspended slab with minimal service penetrations and water bars around all slab penetrations and at joints		1.5	
Fully tanked basement		2	
c) Membranes			
Taped and sealed membrane to reasonable levels of workmanship/in line with current good practice with validation ^{B), C)}		0.5	<i>The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation, and the integrity of joints.</i>
Proprietary gas resistant membrane to reasonable levels of workmanship/in line with current good practice under independent inspection (CQA) ^{B), C)}		1	
Proprietary gas resistant membrane installed to reasonable levels of workmanship/in line with current good practice under CQA with integrity testing and independent validation		2	
d) Monitoring and detection (not applicable to non-managed property, or in isolation)			
Intermittent monitoring using hand held equipment		0.5	<i>Where fitted, permanent monitoring systems ought to be installed in the underfloor venting/dilution system in the first instance but can also be provided within the occupied space as a fail safe.</i>
Permanent monitoring and alarm system ^{A)}	Installed in the underfloor venting/dilution system	2	
	Installed in the building	1	
e) Pathway intervention			
Pathway intervention		—	<i>This can consist of site protection measures for off-site or on-site sources (see Annex A).</i>
NOTE In practice the choice of materials might well rely on factors such as construction method and the risk of damage after installation. It is important to ensure that the chosen combination gives an appropriate level of protection			
^{A)} It is possible to test ventilation systems by installing monitoring probes for post installation validation.			
^{B)} If a 1 200 g DPM material is to function as a gas barrier it should be installed according to BRE 212 [8]/BRE 414 [9], being taped and sealed to all penetrations.			
^{C)} Polymeric Materials > 1 200 g can be used to improve confidence in the barrier. Remember that their gas resistance is little more than the standard 1 200 g (proportional to thickness) but their physical properties mean that they are more robust and resistant to site damage.			