**T J BOOTH ASSOCIATES**

**CONSULTING CIVIL & GEOTECHNICAL ENGINEERS**

20A Eastgate St
Rochdale
Lancashire
OL16 1DH

*FAO Andrew Dearden,*
*H Bell & Sons Ltd,*
*33 Princess Street,*
*Rochdale,*
*OL12 0HA.*

Thursday, 25 May 2017
Ref: rep-tjba-HB&S-237 edenfield rd-phs II letter-020517 - Copy.docx

Subject**:** **Land adj 237 Edenfield Road, Rochdale.**
**Environmental Phase II Letter Report,**
**Results of soil chemical testing.**

Dear *Mr Dearden*,

***Background.***

Further to our recent instruction regarding a Phase II Environmental Audit at land adjacent to 237 Edenfield Road, Rochdale; please find attached the results and certification of the soil chemical testing, refer to appendix for laboratory certificates.

The site was subject to an approved planning application in October 2007 (ref No. *07/D49666*) for the erection of one pair of 3 storey semi-detached dwellings.

A Phase I Environmental Report was undertaken for the site by the LK Group Ltd, refer to separate report, ref: *CL-602-CL1697-01*. The report recommended:

- No gas risk and therefore no gas testing required.
- Basic contamination testing to soft landscaping areas include metals, PAH & inorganics, and hydrocarbons if identified.
- Sampling strategy to be agreed with the LPA before commencement.

Contact was made with RMBC Contaminated Land Officer, and due to the size/risk of the site, it was agreed that 4No. soil samples would suffice to categorise the risk identified in the LK Ltd PRA.

***Site Investigations.***

A site investigation in to the geo-environmental characteristics of the upper site soil was undertaken by T J Booth Associates on the 9th May 2017.

*Tel: 01706 868288*
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*e-mail: office@tjba.co.uk*

*Proprietor.*
*Timothy John Booth*
*BSc (Hons) C.Eng.C.Env. MICE*
*t/a T J Booth Associates*

*VAT Reg. N$^{o}$ 748 6510 09*

The site had been partially stripped to the footprint of the proposed dwellings revealing virgin CLAY at approximately 400mm depth. The existing upper soil remained to an approx 1.5m strip along the front boundary of the site, and in the position of the proposed garden areas to the centre/rear of the site.

In the area beneath the proposed dwellings excavated to CLAY, was a relic foundation running nominally parallel (N-S) through the centre of the site, and was founded approx 200 below the clay.

There was a driveway between the proposed dwellings and No.237 Edenfield Road, which continued behind the proposed garden areas to the S side of the site. This is to remain as a driveway.

The upper soil to the front of the site comprised a brown sandy rooty topsoil. The upper soil to the rear of the site comprised a brown/black sandy, occasionally clayey TOPSOIL, with occasional coal fragments & ash/clinker. 4No. soil samples (S1-4) were hand excavated for geochemical testing, refer to appendix for SI Plan.

Samples were sealed in 1kg white plastic snap top containers & amber and sent to Scientific Analysis Laboratories Ltd to be tested for a range of common contaminants. Suites were chosen in line with potential contaminants identified in the PRA. Each sample was tested for metals, speciated PAH, inorganics & sulphates, SOM, and asbestos screening.

On return the samples were assessed by TJ Booth Associates to common threshold comparison data specifically the Defra Category 4 Screening Levels (C4SL), then to EA/DEFRA SGV (2009) data, and LQM/CIEH GAC 2nd edition (2009) & erratum (2011) where available.

### *Results.*

Results indicated elevated contaminant levels in the following samples:

| Sample No | Contaminant |
|---|---|
| S2, S3, S4 | Lead |

### *Remediation Statement.*

There was no visual/olfactory evidence of contamination to the front of the site, and the soil sample from this area corroborated this. Thus the upper soil to the front of the site is considered clean and may remain below garden areas.

The topsoil to the rear of the site comprised ash/clinker and was darker, suggested potential contaminants, which was corroborated by recorded elevated levels of lead in the 3 soil samples in this location. The soil to the

rear of the site is considered contaminated and although it may remain below dwelling footprints, and permanent hardstandings such as pathways & driveways etc; is not suitable for use in a residential end use soft landscaping setting.

In these areas, the existing material should be removed a depth of 600mm from final finish levels and replaced with nominally 500mm subsoil & 100mm topsoil OR if final finish levels are within 600mm of the virgin CLAY (approx 400mm deep on site investigation), the soil should be removed to CLAY and required cover soil emplaced.

Imported soil should be tested and validated at ratios of 1:250m3 for subsoil & 1:50m3 for topsoil but not less than 3 samples of each. Soils should be tested for metals, speciated PAH, inorganics, sulphates, SOM, & asbestos screen. Testing suites should be analysed to common threshold comparison data specifically the Defra Category 4 Screening Levels (C4SL) where available, and to EA/DEFRA SGV (2009) data; and to LQM/CIEH GAC 2nd edition (2009) & erratum (2011) thereafter; for use in a residential end use setting.

Any contaminated material removed from site should be disposed of in a suitable landfill with receipts retained for the LPA contaminated land officer should they be required.

Should any suspected unidentified contamination be encountered throughout the construction phase of the development, the suspect area/s should be isolated, advice sought from a suitable qualified environmental professional, and the LPA informed.

The above remediation measures should be recorded and reported in a Validation Report for approval and final discharge of the environmental planning condition by the local planning authority.

We trust that the above clear, but should you require further advice please contact the undersigned.

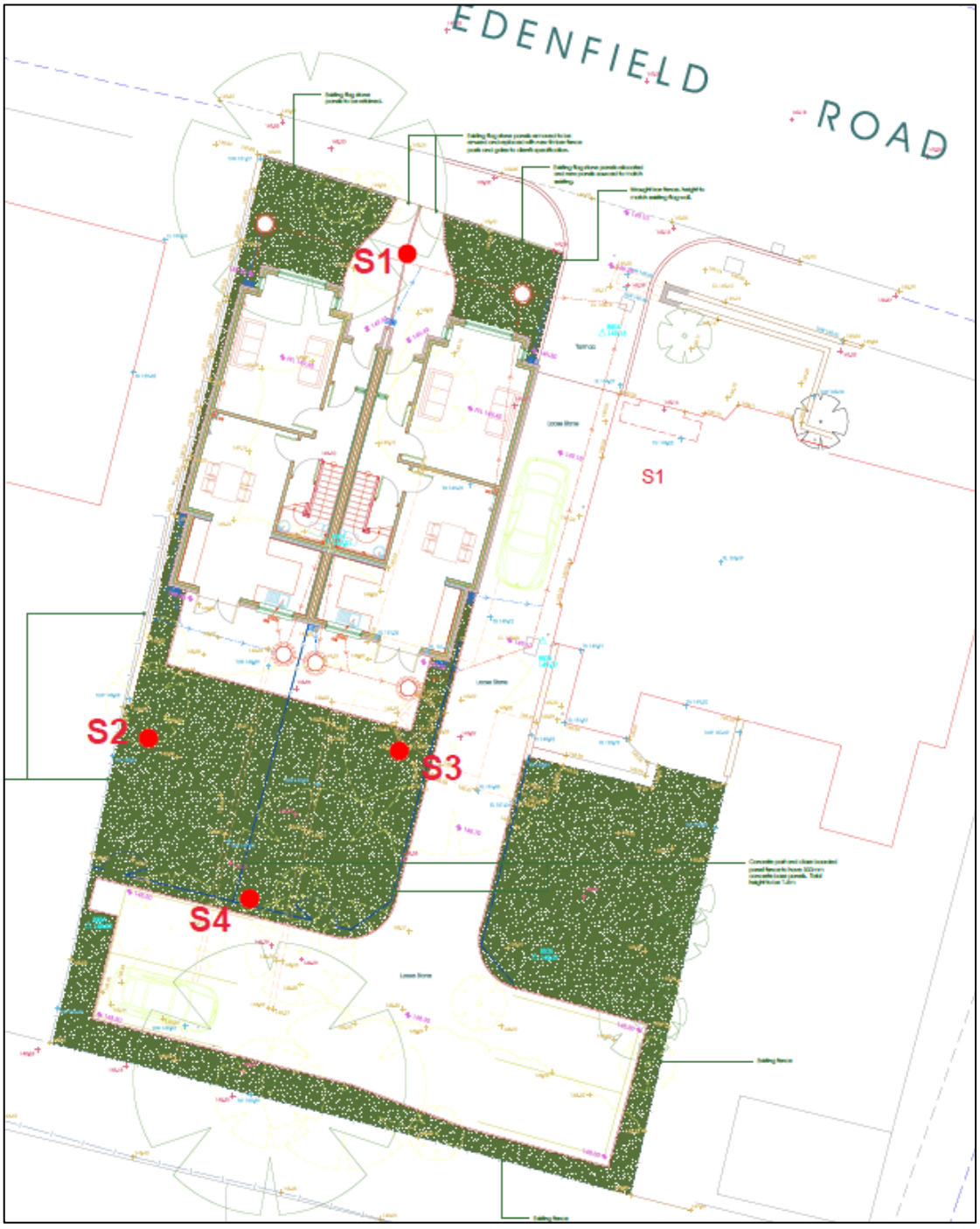
**Continued…**

Sincerely yours,

Daniel Slattery, BSc (Hons).
T J Booth Associates.

# Appendix.

## Site Investigation Plan/Proposed Plan.



**Continued…**

## Results of Soil Chemical Testing.

| | |
|---|---|
| ***Client / Site*** | ***H Bell & Sons Ltd*** |
| | ***237 Edenfield Road, Rochdale*** |
| ***Sampling Date*** | |

***Comparison of Contamination Test Results with Thresholds (mg/kg)***

| Contaminant | | No | Max | Mean | t 95 | RESIDENTIAL (with or without plant uptake) | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Pass/Fail | Comment |
| **METALS** | Arsenic as As, dry weight | 4 | 37 | 32.25 | 37 | 37 | PASS | |
| | Boron as B, hot water sol dw | 4 | 1 | 1 | 1 | 291 | PASS | |
| | Cadmium as Cd, dry weight | 4 | 1 | 1 | 1 | 22 | PASS | |
| | chromium as Cr(III) dry weight | 4 | 27.00 | 25.00 | 26.70 | 627 | PASS | |
| | Chromium as Cr(VI), dry weight | 4 | 1 | 1 | 1 | 21 | PASS | |
| | Copper, as Dry Weight | 4 | 110 | 72.5 | 103.1 | 2330 | PASS | |
| | Lead, as Dry Weight | 4 | 420 | 290 | 408 | 200 | FAIL | |
| | Mercury as Hg, dry weight | 4 | 1 | 1 | 1 | 1 | PASS | |
| | Nickel as Ni, dry weight | 4 | 27 | 24 | 26.55 | 130 | PASS | |
| | Selenium as Se, dry weight | 4 | 3 | 3 | 3 | 350 | PASS | |
| | Zinc as Zn, dry weight | 4 | 260 | 150 | 242 | 3750 | PASS | |
| **INORGANIC** | Cyanide (Total) | 4 | 1 | 1 | 1 | 2.5 | PASS | |
| | Sulphate (Total) as SO4 | 4 | 0.09 | 0.078 | 0.089 | 0.24 | PASS | |
| | Sulphide | 4 | 10 | 10 | 10 | 250 | PASS | |
| | pH | 4 | 7.7 | 7.15 | 7.64 | 6 to 8 | PASS | |
| | Sulphur (Elemental) | 4 | 500 | 500 | 500 | 100 | comment | |
| | Asbestos Identification | 4 | 0 | 0 | 0 | 0 | PASS | |
| **ORGANIC** | SOM | 4 | 6 | 6 | 6 | | | |
| PAH | acenaphthene | 4 | 0.52 | 0.463 | 0.511 | 1000 | PASS | |
| PAH | acenaphthylene | 4 | 0.18 | 0.103 | 0.17 | 850 | PASS | |
| PAH | anthracene | 4 | 0.85 | 0.748 | 0.832 | 9200 | PASS | |
| PAH | benz[a]anthracene | 4 | 2.3 | 1.975 | 2.27 | 5.9 | PASS | |
| PAH | benzo[a]pyrene | 4 | 1.8 | 1.475 | 1.77 | 5 | PASS | |
| PAH | benzo[b]flouranthene | 4 | 2.6 | 2.15 | 2.57 | 7 | PASS | |
| PAH | benzo[g,h,i]perylene | 4 | 0.86 | 0.735 | 0.853 | 47 | PASS | |
| PAH | benzo[k]flouranthene | 4 | 0.75 | 0.635 | 0.729 | 10 | PASS | |
| PAH | chrysene | 4 | 2.4 | 2.025 | 2.355 | 9.3 | PASS | |
| PAH | dibenz[ah]anthracene | 4 | 0.29 | 0.22 | 0.281 | 0.9 | PASS | |
| PAH | flouranthene | 4 | 4.5 | 4.1 | 4.485 | 670 | PASS | |
| PAH | flourene | 4 | 0.33 | 0.313 | 0.329 | 780 | PASS | |
| PAH | indeno[123-cd]pyrene | 4 | 0.82 | 0.705 | 0.816 | 4.2 | PASS | |
| PAH | napthalene | 4 | 0.93 | 0.503 | 0.864 | 8.7 | PASS | |
| PAH | phenanthrene | 4 | 3 | 2.825 | 2.985 | 380 | PASS | |
| PAH | pyrene | 4 | 3.8 | 3.35 | 3.755 | 1600 | PASS | |
| PAH | PAH (Total - SUM EPA16) | 4 | 26 | 22.25 | 25.55 | 1 | comment | |
| SVOC | phenol | 4 | 1 | 1 | 1 | 420 | PASS | |

GAC =LQM residential plant uptake & commercial 2009, BRE = Building Research Establishment, S = typ SNIFFER values, SOM=soil organic material, IC-ICRCL 87(withdrawn), LOD = limit of detection

**Continued…**

## Soil Testing Certificates, Sal Ltd.

CONCEPT LIFE SCIENCES
DELIVERING SCIENCE

Concept Life Sciences is a trading name of Scientific Analysis Laboratories registered in England and Wales (No 2514788)

# Concept Life Sciences

## Certificate of Analysis

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

**Report Number:** 652320-1

**Date of Report:** 25-May-2017

**Customer:** T J Booth Associates
20A Eastgate
Rochdale
OL16 1DH

**Customer Contact:** Mr Daniel Slattery

**Customer Job Reference:**
**Customer Purchase Order:** TJBA-090517-01
**Customer Site Reference:** H Bell & Sons, 237 Edenfield Rd
**Date Job Received at Concept:** 09-May-2017
**Date Analysis Started:** 10-May-2017
**Date Analysis Completed:** 24-May-2017

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.
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 Concept SOPs

UKAS TESTING
1549

Report checked and authorised by :
Stefan Kondziela
Project Manager

Issued by :
Stefan Kondziela
Project Manager

**Continued…**

Concept Reference: 652320
Project Site: H Bell & Sons, 237 Edenfield Rd
Customer Reference:

**Soil** Analysed as Soil
**ICRCL (Maxi)**

| | | | | | Concept Reference | 652320 001 | 652320 002 | 652320 003 | 652320 004 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Customer Sample Reference | S1 | S2 | S3 | S4 |
| | | | | | Date Sampled | 09-MAY-2017 | 09-MAY-2017 | 09-MAY-2017 | 09-MAY-2017 |
| Determinand | Method | Test Sample | LOD | Units | | | | | |
| Arsenic | T6 | A40 | 1 | mg/kg | | 37 | 37 | 26 | 29 |
| Boron (water-soluble) | T6 | AR | 1 | mg/kg | | <1 | <1 | <1 | <1 |
| Cadmium | T6 | A40 | 1 | mg/kg | | <1 | <1 | <1 | <1 |
| Chromium | T6 | A40 | 1 | mg/kg | | 27 | 25 | 23 | 25 |
| Chromium VI | T6 | AR | 1 | mg/kg | | <1 | <1 | <1 | <1 |
| Copper | T6 | A40 | 1 | mg/kg | | 54 | 110 | 64 | 62 |
| Lead | T6 | A40 | 1 | mg/kg | | 150 | 420 | 340 | 250 |
| Mercury | T6 | A40 | 1 | mg/kg | | <1 | <1 | <1 | <1 |
| Nickel | T6 | A40 | 1 | mg/kg | | 22 | 27 | 23 | 24 |
| Selenium | T6 | A40 | 3 | mg/kg | | <3 | <3 | <3 | <3 |
| Zinc | T6 | A40 | 1 | mg/kg | | 90 | 260 | 110 | 140 |
| Cyanide(free) | T4 | AR | 1 | mg/kg | | <1 | <1 | <1 | <1 |
| Cyanide(Total) | T4 | AR | 1 | mg/kg | | <1 | <1 | <1 | <1 |
| Phenols(Mono) | T4 | AR | 1 | mg/kg | | <1 | <1 | <1 | <1 |
| SO4(Total) | T6 | A40 | 0.01 | % | | 0.07 | 0.08 | 0.09 | 0.07 |
| Sulphide | T4 | AR | 10 | mg/kg | | <10 | <10 | <10 | <10 |
| Sulphur(Free) | T2 | AR | 500 | mg/kg | | <500 | <500 | <500 | <500 |
| Thiocyanate | T4 | A40 | 10 | mg/kg | | <10 | <10 | <10 | <10 |
| pH | T7 | A40 | | | | 6.7 | 6.9 | 7.3 | 7.7 |

Concept Reference: 652320
Project Site: H Bell & Sons, 237 Edenfield Rd
Customer Reference:

**Soil** Analysed as Soil
**Miscellaneous**

| | | | | | Concept Reference | 652320 001 | 652320 002 | 652320 003 | 652320 004 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Customer Sample Reference | S1 | S2 | S3 | S4 |
| | | | | | Date Sampled | 09-MAY-2017 | 09-MAY-2017 | 09-MAY-2017 | 09-MAY-2017 |
| Determinand | Method | Test Sample | LOD | Units | | | | | |
| Asbestos ID | T27 | AR | | | | N.D. | N.D. | N.D. | N.D. |
| Soil Organic Matter | T287 | A40 | 0.1 | % | | 6.6 | 8.7 | 8.3 | 6.7 |

**Continued…**

**Concept Reference:** 652320
**Project Site:** H Bell & Sons, 237 Edenfield Rd
**Customer Reference:**

**Soil** Analysed as Soil
**Total and Speciated USEPA16 PAH**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Concept Reference | 652320 001 | 652320 002 | 652320 003 | 652320 004 |
| | | | | Customer Sample Reference | S1 | S2 | S3 | S4 |
| | | | | Date Sampled | 09-MAY-2017 | 09-MAY-2017 | 09-MAY-2017 | 09-MAY-2017 |
| Determinand | Method | Test Sample | LOD | Units | | | | |
| Naphthalene | T149 | AR | 0.01 | mg/kg | 0.49 | 0.25 | 0.34 | 0.93 |
| Acenaphthylene | T149 | AR | 0.01 | mg/kg | 0.03 | 0.09 | 0.11 | 0.18 |
| Acenaphthene | T149 | AR | 0.01 | mg/kg | 0.52 | 0.45 | 0.46 | 0.42 |
| Fluorene | T149 | AR | 0.01 | mg/kg | 0.32 | 0.29 | 0.31 | 0.33 |
| Phenanthrene | T149 | AR | 0.01 | mg/kg | 3.0 | 2.6 | 2.8 | 2.9 |
| Anthracene | T149 | AR | 0.01 | mg/kg | 0.73 | 0.68 | 0.73 | 0.85 |
| Fluoranthene | T149 | AR | 0.01 | mg/kg | 3.9 | 3.6 | 4.4 | 4.5 |
| Pyrene | T149 | AR | 0.01 | mg/kg | 3.2 | 2.9 | 3.5 | 3.8 |
| Benzo(a)Anthracene | T149 | AR | 0.01 | mg/kg | 1.8 | 1.7 | 2.1 | 2.3 |
| Chrysene | T149 | AR | 0.01 | mg/kg | 1.9 | 1.7 | 2.1 | 2.4 |
| Benzo(b)fluoranthene | T149 | AR | 0.01 | mg/kg | 1.9 | 1.7 | 2.4 | 2.6 |
| Benzo(k)fluoranthene | T149 | AR | 0.01 | mg/kg | 0.61 | 0.58 | 0.60 | 0.75 |
| Benzo(b/k)Fluoranthene | T149 | AR | 0.01 | mg/kg | 2.5 | 2.3 | 3.0 | 3.3 |
| Benzo(a)Pyrene | T149 | AR | 0.01 | mg/kg | 1.3 | 1.2 | 1.6 | 1.8 |
| Indeno(123-cd)Pyrene | T149 | AR | 0.01 | mg/kg | 0.63 | 0.58 | 0.79 | 0.82 |
| Dibenzo(ah)Anthracene | T149 | AR | 0.01 | mg/kg | 0.19 | 0.17 | 0.23 | 0.29 |
| Benzo(ghi)Perylene | T149 | AR | 0.01 | mg/kg | 0.67 | 0.60 | 0.81 | 0.86 |
| PAH(total) | T149 | AR | 0.01 | mg/kg | 21 | 19 | 23 | 26 |

## Index to symbols used in 652320-1

| Value | Description |
|---|---|
| A40 | Assisted dried < 40C |
| AR | As Received |
| N.D. | Not Detected |
| S | Analysis was subcontracted |
| U | Analysis is UKAS accredited |
| N | Analysis is not UKAS accredited |

## Notes

These samples have been analysed exceeding recommended holding times. It is possible therefore that the results provided may be compromised.
Asbestos was subcontracted to REC Asbestos.

## Method Index

| Value | Description |
|---|---|
| T6 | ICP/OES |
| T4 | Colorimetry |
| T287 | Calc TOC/0.58 |
| T27 | PLM |
| T2 | Grav |
| T7 | Probe |
| T149 | GC/MS (SIR) |

## Accreditation Summary

| Determinand | Method | Test Sample | LOD | Units | Symbol | Concept References |
|---|---|---|---|---|---|---|
| Arsenic | T6 | A40 | 1 | mg/kg | SU | 001-004 |
| Boron (water-soluble) | T6 | AR | 1 | mg/kg | N | 001-004 |
| Cadmium | T6 | A40 | 1 | mg/kg | U | 001-004 |
| Chromium | T6 | A40 | 1 | mg/kg | U | 001-004 |
| Chromium VI | T6 | AR | 1 | mg/kg | N | 001-004 |
| Copper | T6 | A40 | 1 | mg/kg | U | 001-004 |
| Lead | T6 | A40 | 1 | mg/kg | U | 001-004 |

**Continued…**

| Determinand | Method | Test Sample | LOD | Units | Symbol | Concept References |
|---|---|---|---|---|---|---|
| Mercury | T6 | A40 | 1 | mg/kg | U | 001-004 |
| Nickel | T6 | A40 | 1 | mg/kg | U | 001-004 |
| Selenium | T6 | A40 | 3 | mg/kg | U | 001-004 |
| Zinc | T6 | A40 | 1 | mg/kg | U | 001-004 |
| Cyanide(free) | T4 | AR | 1 | mg/kg | U | 001-004 |
| Cyanide(Total) | T4 | AR | 1 | mg/kg | U | 001-004 |
| Phenols(Mono) | T4 | AR | 1 | mg/kg | U | 001-004 |
| SO4(Total) | T6 | A40 | 0.01 | % | N | 001-004 |
| Sulphide | T4 | AR | 10 | mg/kg | N | 001-004 |
| Sulphur(Free) | T2 | AR | 500 | mg/kg | N | 001-004 |
| Thiocyanate | T4 | A40 | 10 | mg/kg | N | 001-004 |
| pH | T7 | A40 | | | U | 001-004 |
| Naphthalene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Acenaphthylene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Acenaphthene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Fluorene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Phenanthrene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Anthracene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Fluoranthene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Pyrene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Benzo(a)Anthracene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Chrysene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Benzo(b)fluoranthene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Benzo(k)fluoranthene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Benzo(b/k)Fluoranthene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Benzo(a)Pyrene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Indeno(123-cd)Pyrene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Dibenzo(ah)Anthracene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Benzo(ghi)Perylene | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| PAH(total) | T149 | AR | 0.01 | mg/kg | U | 001-004 |
| Asbestos ID | T27 | AR | | | SU | 001-004 |
| Soil Organic Matter | T287 | A40 | 0.1 | % | N | 001-004 |

**Continued…**

## CIRIA (Report c665) Wilson and Card Classification.

***Modified Wilson and Card classification***

| | Characteristic situation (CIRIA R149) | Comparable classification in DETR *et al* (1999) | Risk classification | Gas screening value (GSV) ($CH_4$ or $CO_2$) (l/hr)[1] Threshold | Additional factors | Typical source of generation |
|---|---|---|---|---|---|---|
| | 1 | A | Very low risk | <0.07 | Typically methane <1 % and/or carbon dioxide <5 %. Otherwise consider increase to Situation 2 | Natural soils with low organic content<br>"Typical" made ground |
| | 2 | B | Low risk | <0.7 | Borehole air flow rate not to exceed 70l/hr. Otherwise consider increase to characteristic Situation 3 | Natural soil, high peat/organic content.<br>"Typical" made ground |
| | 3 | C | Moderate risk | <3.5 | | Old landfill, inert waste, mineworking flooded |
| | 4 | D | Moderate to high risk | <15 | Quantitative risk assessment required to evaluate scope of protective measures. | Mineworking – susceptible to flooding, completed landfill (WMP 26B criteria) |
| | 5 | E | High risk | <70 | | Mineworking unflooded inactive with shallow workings near surface |
| | 6 | F | Very high risk | >70 | | Recent landfill site |

**Notes on the use of Table 8.5**

1 Gas screening value: (Litres of gas/hour) is calculated by multiplying the maximum gas concentration (%) by the maximum measured borehole flow rate (l/hr) – see Glossary.

2 Site characterisation should be based on gas monitoring of concentrations and borehole flow rates for the minimum periods defined in Table 5.5.

3 Source of gas and generation potential/performance should be identified.

4 Soil gas investigation should be in accordance with guidance provided in Chapters 4 to 6.

5 If there is no detectable flow, use the limit of detection of the instrument.

6 The boundaries between the Partners in Technology classifications do not fit exactly with the boundaries for the CIRIA classification.

**Continued…**

## CIRIA (Report c665) Wilson and Card Protective Measures.

***Typical scope of gas protective measures***

| Characteristic situation | Residential building (not those which belong to Situation B)[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 *in situ* floor slab (suspended, non-suspended or raft) with at least 1200 g DPM and underfloor venting.<br>b. Beam and block or pre-cast concrete and 2000 g DPM/ reinforced gas membrane and underfloor venting.<br>All joints and penetrations sealed. | 1 to 2 | a) Reinforced concrete cast *in situ* floor slab (suspended, non-suspended or raft) with at least 1200 g DPM.<br>b) Beam and block or pre cast concrete slab and minimum 2000 g DPM/reinforced gas membrane.<br>c) Possibly underfloor venting or pressurisation in combination with a) and b) depending on use.<br>All joints and penetrations sealed. |
| 3 | 2 | All types of floor slab as above.<br>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.<br>All joints and penetrations sealed. Minimum 2000 g/ reinforced gas proof membrane and passively ventilated underfloor sub-space or positively pressurised underfloor sub-space |
| | 3 | All types of floor slab as above.<br>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.<br>All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility. |
| | 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 in-situ floor slab (suspended, non-suspended or raft).<br>All joints and penetrations sealed. Proprietary gas resistant membrane and passively ventilated or positively pressurised underfloor sub-space with monitoring facility.<br>In ground venting wells or barriers. |
| | 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 in-situ floor slab (suspended, non-suspended or raft).<br>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. |

**Note:**

1 For low rise traditional housing with ventilated clear underfloor void (ie Situation B. See Table 8.7, Box 8.4 and Section 8.3.2).