

Remediation Statement & Validation Proposal Sheets

To be approved by Kirklees Council

Project Reference: 22-110

Site: Proposed Residential Development – Land at Blue Hills Farm, Birkenshaw, BD11 2DU

Carried out by: Phil Brown



Section A - Site Investigation Works

This Remediation Statement should be read in conjunction with the following reports produced for this site:

- Ian Farmer Associates, 'Report on Preliminary Risk Assessment & Coal Mining Risk Assessment carried out at Blue Hills Farm, Birkenshaw, BD11 2DU' (Ref. 42251); prepared for Mr Carlton Ives, dated September 2018.
- Ian Farmer Associates, 'Ground Investigation Report carried out at Blue Hills Farm, Birkenshaw, BD11 2DU' (Ref. 4230244 Rev 01); prepared for Mr Carlton Ives, dated March 2021.

Section B - Summary of Site Investigation & Risk Assessments

Summary of Ground Conditions

Ian Farmer Associates (IFA) carried out ground investigations works at Blue Hills Farm, Birkenshaw, comprising 10 no. windowless sampling boreholes (WS01 to WS10), 6 no. open hole rotary boreholes (RO 01 to RO 06) and 5 no. machine excavated trial pits (TP01 to TP05).

A thin layer of topsoil was encountered at all locations, except WS01 and WS04. Topsoil varied in thickness from c.0.20m to c.0.40m below ground level (bgl) and generally comprised sandy gravelly clay, with some fragments of brick and plastic.

Made ground extended to depths up to c.2.00m bgl beneath the northern part of the site, generally comprised gravelly clay which was considered to represent re-worked colliery spoil and was considered consistent with a raised area of ground created by tipping from the historic colliery to the north of the site. The remaining exploratory holes, on the southeast part of the site, encountered made ground to depths in the range c.0.30m to c.0.90m bgl, comprising gravelly clay, which was considered to be consistent with re-worked weathered mudstone.

The exception to the above was WS01 and WS04 which were located within the car parking area on the western part of the site. The made ground below the car park ranged in depth from c.0.50m to c.1.20m bgl, and comprised a sandy, slightly clayey gravel including mudstone, limestone, ash, asphalt and clinker. In WS01, this initial granular made ground was underlain by a sandy, gravelly clay containing fine to coarse including brick, asphalt and mudstone. This material was not encountered elsewhere on site.

Superficial deposits generally comprised soft to stiff sandy gravelly clay varying in colour from brown to grey. The majority of the clay was considered to represent the weathering profile of the underlying coal measures bedrock. All trial pits and windowless sample boreholes were terminated within clay at depths ranging from c.2.20m to c.5.45m bgl. The base of the clay was proved at depths in the range c.4.00m to c.6.00m bgl in rotary open holes.

Mudstone and sandstone bedrock was encountered in rotary boreholes at depths in the range c.2.50m to c.6.00m bgl.

Contamination Risk Assessment

The results of the contamination testing undertaken as part of the IFA investigation returned elevated concentrations of PAH in the made ground beneath the western area of the site (WS01) within the existing car park. All other contamination test results were below referenced guidance values.

The report concluded that the elevated PAH contamination within WS01 was likely to be due anthropogenic material within made ground which included ash, and with regard to Human Health (proposed end users), it was recommended that the materials were removed and stockpiled separately either for re-use beneath areas of roadways and hardstanding or removed from site.

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Section B - Summary of Site Investigation & Risk Assessments (Cont'd)

Contamination Risk Assessment

It would appear that from the evidence of WS01 and WS04 that the made ground encountered below the existing car park to the western area of the site is significantly different to other made ground identified across the remainder of the site, comprising a sandy, clayey gravel of mudstone, limestone, brick, cement, ash, clinker and asphalt, and a soft, slightly sandy, gravelly clay with fine to coarse fragments of brick, asphalt and mudstone.

The contamination screening results for samples of made ground recovered from WS01 returned elevated levels of Benzo(a)pyrene (up to 6.32mg/kg), Benzo(b)fluoranthene (up to 7.76mg/kg) and Dibenzo(ah)anthracene (up to 0.52mg/kg) above the corresponding threshold concentrations of 2.7mg/kg, 3.3mg/kg and 0.28mg/kg respectively. It is considered that the concentrations recorded within WS01 are likely to be attributable to the ash and asphalt content within the made ground soils (both of which frequently contain elevated PAH species), especially as there was no visual and /or olfactory evidence of fuel / oil type contamination noted during the investigation works. As similar made ground soils have been identified within both WS01 and WS04, both below the existing car park, then at this stage, and without any further testing, it should be assumed that all of the made ground soils below the existing car park represent a potential risk to future end users, where exposure pathways are available.

However, it is understood that at this stage, the site has been divided into 2 Phases (as detailed on the attached plan), with Phase 1 encompassing the grassed fields to the east and Phase 2 encompassing the majority of the existing car park to the west / southwest. It is also understood that, at this time, Vistry Partnership only intend to develop Phase 1 (where no contamination was identified during the IFA investigation) and not the Phase 2 area. Furthermore, it is understood that the majority of the existing car park within Phase 2 is intended to remain as a car park.

Therefore, if the above is correct, with the exception of the 2 no. small hatched areas (Area A & Area B), on the attached plan, there does not appear to any specific remedial requirements with regard to the majority of the development within Phase 1 (excluding any coal mining related activities).

When considering Area A, the proposed Phase 1 development indicates that this area is below a proposed road / hardstanding area, and if this is the case, then the source-pathway-receptor pollutant linkage will not exist and the made ground can remain in-situ with no requirement to incorporate clean cover materials. If the proposed layout changes then a re-assessment of the potential risk would need to be carried out.

For Area B, it is felt that the most suitable remedial option available would be the installation of a robust clean cover system within this area, where made ground is present. At this stage, a minimum 600mm thick cover, with a suitable basal geotextile marker / separator, is recommended. When taking into account finished design levels, if no impacted made ground remains below proposed gardens / soft landscaping (i.e. has been completely removed), then no formal cover system should be required just an adequate depth of clean topsoil to act as a growing medium.

As noted previously, where buildings and areas of permanent hardstanding are proposed then the source-pathway-receptor pollutant linkage will not exist and the made ground can remain in-situ with no requirement to incorporate clean cover materials.

When considering the risks to any future maintenance or construction workforce, appropriate PPE should be provided to protect against the levels of potential contaminants recorded during these investigation works. Similarly, the results can also be used by the Main Contractor / Project Coordinator, when devising an adequate Site Health & Safety Plan, in accordance with current CDM Regulations. For further guidance reference should be made to the Health and Safety Executive (HSE) document EH40/2005 (2nd Edition, 2011) Workplace exposure limits.

It is also recommended that during the future site works as well as any other groundworks on this site, a 'watching brief' is maintained to confirm that there is no unknown or unforeseen ground contamination on this site.

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Section B - Summary of Site Investigation & Risk Assessments (Cont'd)

Hazardous Ground Gas Risk Assessment

The results of the IFA hazardous ground gas monitoring show no levels of Methane (CH₄) have been recorded. However detectable levels of Carbon Dioxide (CO₂) have been recorded, up to 6.1%v/v with associated depleted oxygen concentrations down to 8.8%v/v. Negligible flow rates of <0.1l/hr were recorded. The slightly elevated concentrations of CO₂ and reduced oxygen were encountered in WS06, located towards the southwest side of the site adjacent to the edge of the car park.

When considering these results, in accordance with CIRIA C665, the GSV for CO₂ does not exceed the assessment value of 0.78l/hr (Green Classification – NHBC Traffic light system), resulting in no gas protective measures being required for the proposed development. However, when considering the concentrations of CO₂ exceeds the action trigger level of 5%, the CIRIA 665 guidance recommends an increase in the characteristic situation by an order of 1 to take into account the gas concentrations recorded resulting in an increase to 'Amber 1 Classification', therefore ground gas protection measures will be required.

Further reference can be made to BS8485:2015+A1:2019 Code of practice for the design of protective measures: for methane and carbon dioxide ground gases for new buildings. In accordance with BS8485:2015+A1:2019 'Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings', the proposed development has been assessed as a Type A building (Table 3) and therefore the gas protection measures should meet a minimum gas protection score of **3.5 points** (Table 4).

It may be the case that, subject to a programme of further monitoring, a more detailed assessment of the gas regime below the site could be undertaken with a view to 'zoning' the site. However, at this time, until such an assessment is carried out and the results discussed and agreed with the Local Authority, it should be assumed all of the proposed plots will require gas protection for an Amber 1 Classification.

Section C - Remediation Strategy

Emplacement of a Suitable Clean Cover System

The IFA investigation identified that the made ground encountered in WS01 below the existing car park to the western area, comprising a sandy, clayey gravel of mudstone, limestone, brick, cement, ash, clinker and asphalt, and a soft, slightly sandy, gravelly clay with fine to coarse fragments of brick, asphalt and mudstone, returned elevated levels of Benzo(a)pyrene (up to 6.32mg/kg), Benzo(b)fluoranthene (up to 7.76mg/kg) and Dibenzo(ah)anthracene (up to 0.52mg/kg) above the corresponding threshold concentrations of 2.7mg/kg, 3.3mg/kg and 0.28mg/kg respectively.

It is considered that the concentrations recorded are likely to be attributable to the ash and asphalt content within the made ground soils (both of which frequently contain elevated PAH species), especially as there was no visual and / or olfactory evidence of fuel / oil type contamination noted during the investigation works. As similar made ground soils have been identified within both WS01 and WS04, both below the existing car park, then at this stage, and without any further testing, it should be assumed that all of the made ground soils below the existing car park represent a potential risk to future end users, where exposure pathways are available.

Based on the ground contamination risk assessment undertaken, remediation works will be required for this site, in order to remove several exposure pathways (*i.e. ingestion of soil and indoor dust, consumption of home grown produce and attached soil, dermal contact (indoor), dermal contact (outdoor), inhalation of dust (indoor) and inhalation of dust (outdoor)*) and break the established *source-pathway-receptor* pollutant linkage and negating the risks posed towards the future site end-users.

Taking into account the proposed 'phasing' of the site (as detailed on the attached plan), with the exception of 2 no. small, hatched areas (Area A & Area B) on the attached plan, there does not appear to any specific remedial requirements with regard to the majority of the development within Phase 1.

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Section C - Remediation Strategy (Cont'd)

Emplacement of a Suitable Clean Cover System (Cont'd)

With regard to the 2 no. hatched areas, Area A would appear to be located below an a proposed road / area of hardstanding, consequently, the source-pathway-receptor pollutant linkage will not exist and the made ground can remain in-situ with no requirement to incorporate clean cover materials.

For Area B, it is felt that the most suitable remedial option available would be the installation of a robust clean cover system where made ground is present. At this stage, a minimum 600mm thick cover, with a suitable basal geotextile marker / separator, is recommended. The use of cover systems reduces the hazards posed towards human health from ground contamination and provides a suitable medium for plant growth.

Alternatively, when considering the relatively small affected areas, and when taking into account finished design levels, if no impacted made ground remains below proposed gardens / soft landscaping (i.e. has been completely removed), then no formal cover system should be required just an adequate depth of clean topsoil to act as a growing medium. Where buildings and areas of permanent hardstanding are proposed then the source-pathway-receptor pollutant linkage will not exist and the made ground can remain in-situ with no requirement to incorporate clean cover materials.

Implementation of Gas Protection Measures

To achieve the required gas protection score, a combination of protection elements taken from Tables 5, 6 & 7 (contained within BS8485) should be implemented and installed by qualified and experienced specialist contractors.

Table 5 – Structural Barrier – Depending upon the foundation type, floor type and the quality of the design & construction, a number of points can be achieved, for example provision of an insitu cast reinforced concrete slab (ground bearing or suspended) will achieve between 0.5 & 1.5 points and a raft can achieve 1.5 points. It should be noted that a suspended block and beam floor will be achieve 0 points and therefore alternative measures from Tables 6 & 7 will need to be adopted (see below).

Table 6 – Ventilation Protection Measures – Where sub-floor ventilation is provided this should comprise either a min. 150mm clear void, void former blanket or gas drains, with ventilation from the sub-floor ventilation through the internal wall to the external wall using telescopic swan neck vents with air bricks providing 1500mm²/m run void ventilation spaced at maximum 2.0m centres will achieve 1.5 points. In addition, cross ventilation will need to be incorporated into sleeper walls / party walls.

Table 7 – Gas Resistant Membrane - The final element of the gas protection measures is the provision of a suitable gas resistant barrier membrane, which should comply with the criteria listed in Table 7. There is also the requirement for the verification of the gas barrier membrane installation, undertaken in accordance with CIRIA C735. The implementation of gas resistant barriers will achieve 2.0 points. Notes on the installation of gas barrier membranes is given below:

- The performance of the gas barrier membrane is dependent on the quality and design of the installation, and therefore guidance suggests that suitably experienced contractors should carry out the construction / installation of the gas barrier membrane.
- The gas barrier membrane will need to be installed in accordance with the manufacturer's details.
- Either, a blinding layer of soft sand should be applied to the floor construction, or the surface should be adequately cleaned, to prepare a smooth surface free from sharp debris.
- The membrane should be installed in a logical sequence across the footprints of the buildings, to achieve a minimum number of joints. A minimum overlap of 150mm is recommended where membranes sections are joined. A combination of thermal welding and butyl double-sided jointing tape can be used for joining membranes together. The top lapped edges, where the membrane has been jointed using double-sided jointing tape, should be further protected by the application of gas resistant self-adhesive membrane

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Section C - Remediation Strategy (Cont'd)

Implementation of Gas Protection Measures (Cont'd)

- Where steel stanchions and service entries / ducts penetrate the floor construction these should be suitably sealed, using a pre-formed top-hat or wrapped in gas resistant self-adhesive membrane. Where ducts are used to feed in services, the top of the duct and service should be appropriately sealed, using closed celled foam (Filiform or Filoseal), inside the duct and / or appropriate gas resistant products (i.e. gastite tape or GR SAM) wrapped around the duct and service.
- Following validation of the gas barrier membrane, it is the responsibility of the main contractor / groundworks contractor to protect the gas barrier membrane from damage by follow-on trades or during the construction of subsequent final floor layers, in order to maintain the integrity of the gas barrier membrane.

The design team should provide design drawings showing the proposed installation / construction of the protection measures to be adopted and also the specification of the chosen gas barrier membrane and associated products to be used. These should be provided to Arc Environmental Ltd a minimum of 1 month before site works commence and will be reviewed to ensure they meet the BS8485 guidance.

Section D - Validation of Remediation Strategy

Watching Brief and Removal of Any Excess Made Ground:

Validation of the site wide watching brief will be through documented written (site records) and photograph records by the Main Contractor. If no further areas of unknown or unforeseen contamination are encountered, the Main Contractor will provide written confirmation of this. These records will be included in the final Validation Report.

Following the excavation and removal of any excess made ground materials, confirmation of the complete removal or whether made ground remains below the future areas of soft landscaping and gardens will be carried out by Arc Environmental Ltd. This will determine whether the clean cover system is required. Waste transfer / Consignment notes (as applicable) should be supplied to confirm the correct disposal of any materials removed from site.

To ensure that all elements of this Remediation Statement are correctly implemented, Validation works resulting in a final Validation Report will be prepared by Arc Environmental Ltd, verifying that the remediation works have been completed. The validation works will comprise the following:

Complete Removal of Made Ground Soils

Where it is proposed to fully remove impacted made ground soils from below gardens / soft landscaping then the following validation will be required:

- Photographic evidence showing complete removal of the made ground soils (i.e., natural soils at formation).
- Plans (with levels) clearly showing areas where the made ground has been fully removed.
- Samples from the completed excavation(s) will be taken to allow validation laboratory testing to be undertaken. The results should be compared to appropriate and current Level 1 Risk Assessment Values for a *Residential* end-use, and at least 7 working days should be allowed between samples being taken and confirmation being provided by Arc Environmental Ltd that the remediation works have been satisfactorily completed, prior to excavations being backfilled (if necessary).
- During all the remedial works, care should be taken to avoid any potential cross-contamination. Consequently, plant should be cleaned following contact with impacted materials (i.e. buckets).

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Section D - Validation of Remediation Strategy (Cont'd):

Complete Removal of Made Ground Soils (Cont'd)

To confirm that all the made ground has been fully removed and that no residual contamination is present, representative samples of the resultant formation should be recovered and tested for, and verified against, the determinands listed within Table 2 on Page 6 of this Remediation Strategy. If any exceedances are recorded, then additional materials should be excavated, and additional samples recovered and tested. This process should be repeated until no exceedances are recorded.

The frequency of testing will be dependant upon the resultant formation area and should be discussed and agreed with Arc Environmental Ltd and the Local Authority at the time.

Emplacement of Clean Cover System

Where impacted made ground is present within any gardens / soft landscaping, then the following validation works will be required:

- Geographical location from which any imported clean cover material was sourced.
- Description and chemical analysis for the clean cover material brought to site.
- Confirmation of clean cover thickness – minimum 600mm with basal geotextile marker / separator.
- Photographic evidence – showing emplacement / confirming thickness and including a scale.
- Plans showing pertinent information relating to remediation.

Any topsoil and subsoil (either site-won and / or imported), for use in gardens and areas of soft landscaping should be suitably screened and tested for human health assessment prior to re-use / delivery, with these results sent to Arc Environmental Ltd, a minimum of 1 week before delivery to site. To confirm the suitability of these materials, validation testing will be required following emplacement and / or importation onto site in accordance with the YALPAG guidance.

The number of samples screened will be dependent upon the final volumes (re-use or imported) and also the origin of any imported materials. It is proposed to adopt the sampling frequency within Yorkshire and Lincolnshire Pollution Advisory Group (YALPAG) 'Verification Requirements for Cover Systems', Ver 4.1 May 2021, as detailed in Table 1 below.

Table 1 - Verification Requirements for Cover Systems, Ver 4.1 May 2021 - Sampling Frequency

Type	Number of Samples	Testing Schedule	Assessment Criteria
Virgin quarried material	1 or 2 depending on the type of stone utilised, to confirm the inert nature of the material.	Standard metals/metalloids (should include as a minimum As, Cd, Cr, Cr (VI), Cu, Hg, Ni, Pb, Se & Zn)	This needs to be agreed with the Local Authority. The Assessment criteria needs to be UK based, e.g. LQM, S4ULs, Defra C4SLs or other similarly derived GACs.
Crushed hardcore, stone, brick (excluding asphalt)	Minimum 1 per 500m ³ .	Standard metals/metalloids (as above) PAH (16 USEPA specification) Asbestos, total TPH. Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE).	
Greenfield soils / manufactured soils	Minimum 3. Dependant on source and receptor, between 1 per 50m ³ and 1 per 250m ³ (whichever is greater).	Standard metals/metalloids (as above) PAH (16 USEPA specification) Asbestos, pH and soil organic matter (SOM) (or calculated from total organic carbon (TOC)).	
Brownfield soils / screened soils	Minimum 6 Dependant on source and receptor, between 1 per 50m ³ and 1 per 100m ³ (whichever is greater).	Standard metals/metalloids (as above) PAH (16 USEPA specification) TPH (CWG banded) Asbestos, pH and SOM (or calculated from TOC). Any additional analysis dependant on the history of the donor site (e.g. phenol, total cyanide, BTEX, MTBE).	

(Table taken from the Verification Requirements for Cover Systems – Technical Guidance for Developers and Consultants – Yorkshire and Lincolnshire Pollution Advisory Group (YALPAG) May 2021)

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Section D - Validation of Remediation Strategy (Cont'd)

Emplacement of a Suitable Clean Cover System (Cont'd)

Prior to re-use / delivery, the Main Contractor will be responsible for providing screening results, to verify that they meet the criteria given in Table 2 below. These results should be passed onto Arc Environmental Ltd a minimum of 1 week prior to delivery and should not be more than 2 months old.

Table 2 - (Assessment Criteria for Cover Soils)

Analyte	Critical Conc. (Cc) mg/kg			Analyte	Critical Conc. (Cc) mg/kg		
					1% SOM	2.5% SOM	6% SOM
Metals/Metalloids				Speciated PAH's (Cont'd)	1% SOM	2.5% SOM	6% SOM
Arsenic	37 ⁽¹⁾			Benzo(a)anthracene	7.2 ⁽¹⁾	11 ⁽¹⁾	13 ⁽¹⁾
Cadmium	11 ⁽¹⁾			Benzo(a)pyrene	2.2 ⁽¹⁾	2.7 ⁽¹⁾	3.0 ⁽¹⁾
	pH 5.0-6.0	pH 6.0-7.0	pH >7.0	Benzo(b)fluoranthene	2.6 ⁽¹⁾	3.3 ⁽¹⁾	3.7 ⁽¹⁾
	3.0 ⁽⁵⁾	3.0 ⁽⁵⁾	3.0 ⁽⁵⁾	Benzo(ghi)perylene	320 ⁽¹⁾	340 ⁽¹⁾	350 ⁽¹⁾
Chromium III	910 ⁽¹⁾			Benzo(k)fluoranthene	77 ⁽¹⁾	93 ⁽¹⁾	100 ⁽¹⁾
	pH 5.0-6.0	pH 6.0-7.0	pH >7.0	Chrysene	15 ⁽¹⁾	22 ⁽¹⁾	27 ⁽¹⁾
	400-600 ⁽⁵⁾	400-600 ⁽⁵⁾	400-600 ⁽⁵⁾	Dibenz(ah)anthracene	0.24 ⁽¹⁾	0.28 ⁽¹⁾	0.3 ⁽¹⁾
Chromium VI	6 ⁽¹⁾			Fluoranthene	280 ⁽¹⁾	560 ⁽¹⁾	890 ⁽¹⁾
Copper	2,400 ⁽¹⁾			Fluorene	170 ⁽¹⁾	400 ⁽¹⁾	860 ⁽¹⁾
	pH <6.0	pH 6.0-7.0	pH >7.0	Indeno(123cd)pyrene	27 ⁽¹⁾	36 ⁽¹⁾	41 ⁽¹⁾
	<100 ⁽⁴⁾	<135 ⁽⁴⁾	<200 ⁽⁴⁾	Naphthalene	2.3 ⁽¹⁾	5.6 ⁽¹⁾	13 ⁽¹⁾
Lead	200 ⁽²⁾			Phenanthrene	95 ⁽¹⁾	220 ⁽¹⁾	440 ⁽¹⁾
Mercury	40 ⁽¹⁾			Pyrene	620 ⁽¹⁾	1,200 ⁽¹⁾	2,000 ⁽¹⁾
	pH 5.0-6.0	pH 6.0-7.0	pH >7.0	Speciated TPH	1% SOM	2.5% SOM	6% SOM
	1.0-1.5 ⁽⁵⁾	1.0-1.5 ⁽⁵⁾	1.0-1.5 ⁽⁵⁾	Aliphatic EC5-EC6	42 ⁽¹⁾	78 ⁽¹⁾	160 ⁽¹⁾
Nickel	180 ⁽¹⁾			Aliphatic EC6-EC8	100 ⁽¹⁾	230 ⁽¹⁾	530 ⁽¹⁾
	pH <6.0	pH 6.0-7.0	pH >7.0	Aliphatic EC8-EC10	27 ⁽¹⁾	65 ⁽¹⁾	150 ⁽¹⁾
	<60 ⁽⁴⁾	<75 ⁽⁴⁾	<110 ⁽⁴⁾	Aliphatic EC10-EC12	130 ⁽¹⁾	330 ⁽¹⁾	760 ⁽¹⁾
Selenium	250 ⁽¹⁾			Aliphatic EC12-EC16	1,100 ⁽¹⁾	2,400 ⁽¹⁾	4,300 ⁽¹⁾
	pH 5.0-6.0	pH 6.0-7.0	pH >7.0	Aliphatic EC16-EC35	65,000 ⁽¹⁾	92,000 ⁽¹⁾	110,000 ⁽¹⁾
	3.0-5.0 ⁽⁵⁾	3.0-5.0 ⁽⁵⁾	3.0-5.0 ⁽⁵⁾	Aliphatic EC35-EC44	65,000 ⁽¹⁾	92,000 ⁽¹⁾	110,000 ⁽¹⁾
Zinc	3,700 ⁽¹⁾			Aromatic EC5-EC7	70 ⁽¹⁾	140 ⁽¹⁾	300 ⁽¹⁾
	pH <6.0	pH 6.0-7.0	pH >7.0	Aromatic EC7-EC8	130 ⁽¹⁾	290 ⁽¹⁾	660 ⁽¹⁾
	<200 ⁽⁴⁾	<200 ⁽⁴⁾	<300 ⁽⁴⁾	Aromatic EC8-EC10	34 ⁽¹⁾	83 ⁽¹⁾	190 ⁽¹⁾
Cyanide	34 ⁽³⁾			Aromatic EC10-EC12	74 ⁽¹⁾	180 ⁽¹⁾	380 ⁽¹⁾
Asbestos	None Present			Aromatic EC12-EC16	140 ⁽¹⁾	330 ⁽¹⁾	660 ⁽¹⁾
Speciated PAH's	1% SOM	2.5% SOM	6% SOM	Aromatic EC16-EC21	260 ⁽¹⁾	540 ⁽¹⁾	930 ⁽¹⁾
Acenaphthene	210 ⁽¹⁾	510 ⁽¹⁾	1,100 ⁽¹⁾	Aromatic EC21-EC35	1,100 ⁽¹⁾	1,500 ⁽¹⁾	1,700 ⁽¹⁾
Acenaphthylene	170 ⁽¹⁾	420 ⁽¹⁾	920 ⁽¹⁾	Aromatic EC35-EC44	1,100 ⁽¹⁾	1,500 ⁽¹⁾	1,700 ⁽¹⁾
Anthracene	2,400 ⁽¹⁾	5,400 ⁽¹⁾	11,000 ⁽¹⁾				

⁽¹⁾ = LQM S4UL's (2014 & 2015) – Residential with home-grown produce, ⁽²⁾ = CL:AIRE C4SL's – Residential with home-grown produce, ⁽³⁾ = ATRISK^{SOIL} SSV, ⁽⁴⁾ = Potentially Phytotoxic Elements – BS3882:2015 & BS8601:2013, ⁽⁵⁾ = Sewage sludge in agriculture: code of practise for England, Wales and Northern Ireland (May 2018) – Potentially toxic elements limits in soils for arable farming and grassland. Note the TPH total should not exceed 1000mg / kg to avoid bringing potentially Hazardous Material on to site.

Unforeseen Contamination - it should be noted that if during the site strip / preparatory works any visual and / or olfactory evidence of unidentified or unforeseen potentially contaminated materials are identified then the site should notify Arc Environmental Ltd as soon as it is possible to allow for further sampling and screening to be undertaken. Details of the appropriate course of action undertaken to deal with these materials will be provided to the Local Authority, prior to carrying out any additional remediation works, if required.

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Section D - Validation of Remediation Strategy (Cont'd)

Validation of Gas Protection Measures

For this site, the implementation of Amber 1 protection measures must be witnessed, photographed and validated by an experienced and suitably qualified Engineer to ensure that all works are being completed in strict accordance with this Remediation Strategy, the proposed design details, BS8485 & CIRIA C735.

Each site visit should validate the construction and emplacement of each element of the gas protection measures within the proposed building, as well as confirming that all installation requirements have been met. Typical inspection should follow the criteria set out in CIRIA C735, and the procedure for inspection / validation of the gas / vapour protection measures is outlined on the following page:

- The verification of each inspection will be recorded visually using the proforma outlined in Appendix A5 of CIRIA C735 to verify that the works have been carried out in full accordance with the submitted design drawing and product specifications.
- The visual inspection will be accompanied by a full photographic record. The inspected / photographic record will include (as a minimum) the verification of the following construction details: -
- **Passive sub-floor dispersal ventilation:** Inspection of sub-floor ventilation, presence of cross ventilation in sleeper / party walls and installation of telescopic swan-neck vents.
- **External wall vents:** to assess the number and size of telescopic swan-neck vents and airbricks around the perimeter of the building, including spacing of side ventilation, and to assess that vents are free from debris and extend beneath the gas protection membrane into the passive sub-floor dispersal ventilation below the floor slab.
- **Construction of structural barrier:** confirmation of the construction of any insitu cast reinforced concrete slabs / rafts (not anticipated at this stage).
- **The underside of the gas barrier membrane:** to assess that no uneven / rough surfaces are present.
- **Gas / vapour barrier membrane type:** full product / manufacturers specification, gauge, colour, batch / roll number.
- **Gas / vapour barrier membrane condition:** to assess that there are no punctures, tears, rips or other defects to the membrane.
- **Joining tape:** to assess product type, brand, thickness, material, width and colour.
- **Lapping design:** to assess whether joints are lapped and sealed in accordance with the manufacturer's specifications (including double taping and correct overlapping)
- **Laps and sealed joints:** to assess double sided tape has been used and welds are undertaken correctly.
- **Service entries:** to assess whether service entries have been appropriately sealed i.e. assessing top hat arrangements with the use of Jubilee clips, use of GR SAM and sealing of ducts used for service feeds.

Section E - Action Items & Persons Responsible

- Completion of 'watching brief' – Main Contractor.
- Removal of excess made ground – Main Contractor
- Validation screening of exposed soils following removal of impacted materials – Arc Environmental Ltd
- Sourcing the necessary clean cover materials – Main Contractor.
- Provision of pre-delivery imported soil screening results – Main Contractor.
- Confirmation of suitability of imported soils. All validation screening will be assessed against the criteria included within Table 2 – Arc Environmental Ltd.
- Emplacement of clean cover materials – Main Contractor.
- Confirmation of the correct thickness, make up and suitability of clean cover placed within all gardens and soft landscaping – Arc Environmental Ltd.

Remediation Statement & Validation Proposal Sheets

To be approved by Kirklees Council

Project Reference: 22-110

Site: Proposed Residential Development – Land at Blue Hills Farm,
Birkenshaw, BD11 2DU

Carried out by: Phil Brown



Section E - Action Items & Persons Responsible (Cont'd)

- Collection and provision of all documentation relating to waste disposal: - as a minimum, provision of total volumes excavated and removed to tip, waste consignment / transfer notes, landfill tip receipts – Main Contractor.
- Construction & installation of gas protection measures – Main Contractor.
- Validation of installation of gas protection measures – Arc Environmental Ltd.
- Completion of final Validation Report incorporating all the above – Arc Environmental Ltd.

This document has been completed by Arc Environmental Ltd, for and on behalf of Vistry Partnership Yorkshire.

Signed

REDACTED

For and behalf of Arc Environmental Ltd.
Phil Brown
Associate Director

Date: 31st January 2023