Eastwood & Partners
CONSULTING ENGINEERS

E P

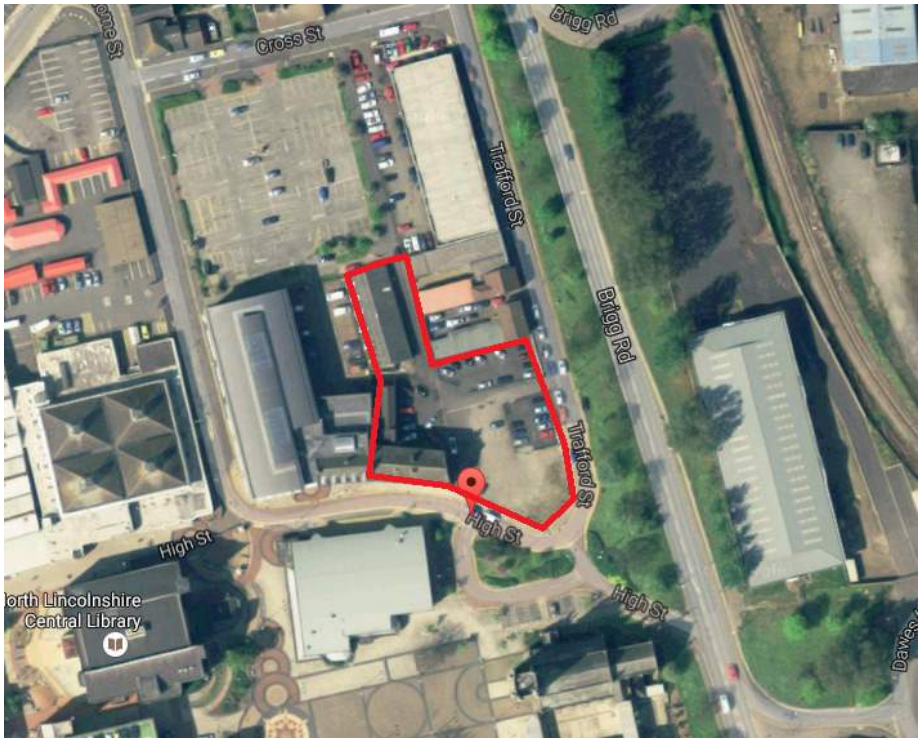
REMEDIATION IMPLEMENTATION PLAN

CHURCH SQUARE, SCUNTHORPE

FOR

NORTH LINCOLNSHIRE COUNCIL & RIDER LEVETT BUCKNALL

ISSUE 1



40380-004 **26 March 2017**

Eastwood & Partners, St Andrew's House, 23 Kingfield Road, Sheffield S11 9AS
Tel: 0114 255 4554 Fax: 0114 255 4330 mail@eastwoodandpartners.com www.eastwoodandpartners.com

REMEDIATION IMPLEMENTATION PLAN

CHURCH SQUARE, SCUNTHORPE

FOR

NORTH LINCOLNSHIRE COUNCIL & RIDER LEVETT BUCKNALL

ISSUE 1

Job No.	:	40380
Report Status	:	Final
Document Date	:	26 March 2017
Approved	:	[redacted]

P Richardson

Also at:- Suite 128, Centaur House, Ancells Business Park, Ancells Road, Fleet, Hampshire, GU51 3PD Tel: 01252 360580 Fax: 01252 360581

Directors: **P Richardson** BSc, CEng, MICE, MIStructE **S D Preston** BEng, CEng, FICE, FIStructE **N J Baines** BSc, CEng, MICE, MCIWEM
S R Ellis BEng, CEng, MIStructE, MICE **K R Pursall** BEng, CEng, MIStructE
C A Topliss BSc, CEnv, CSci, CGeol, SiLC, MICE, FGS **S J English** BEng, CEng, MIStructE **A R Priest** BEng
Senior Associates: **K Newsome** BSc, CEng, MICE, MIStructE **S J Mitchell** BSc, MSc, CEng, MEI, MCIBSE, MASHRAE **A Allison** BEng
M Young MA, CEng, MICE, MIStructE **C A Wood** BSc, CEng, MIStructE, MICE
Associates: **K Edwards** MSci, FGS **A J Kerslake** BEng **A G Marshall** BEng, CEng, MIStructE **C Hodge** EngTech, TMICE **P A Harrison** BEng, CEng, MIStructE
M P Chappell BEng, IEng, AMIStructE **P H Halberstadt** MEng, ACGI, CEng, MICE **M Dyson** BSc, CEng, MIStructE
Consultant: **J M Wood** BSc, CEng, MICE, FIStructE

Eastwood & Partners (Consulting Engineers) Limited Registered No 1835021

CONTENTS

APPENDICES

1.0 INTRODUCTION

This implementation plan has been produced by Eastwood & Partners (Consulting Engineers) Limited, on behalf of North Lincolnshire Council under the instruction of Rider Levett Bucknall, for an area of land to the west of Trafford Street in Scunthorpe. The purpose of this document is to detail the procedures for the implementation and subsequent verification of remedial works to deal with contamination found within the ground at the site.

This is to ensure that upon completion of the proposed office development, the site can be shown to be suitable for its intended use and that it will not pose unacceptable risks to future receptors. This therefore covers the protective procedures to be completed during the construction phases of the development. The proposed development comprises a 3 to 4 storey office extension to the existing council offices, and the construction of a separate three storey office building with associated areas of hard landscaping. No soft landscaping is to be included.

This document is a working publication and may need to be updated, in agreement with the relevant regulatory bodies, at any stage during development dependent on what is encountered. This document is also subject to the approval of the regulatory parties such as the Local Authority and any warranty provider. This version is Issue 1. Please contact Eastwood & Partners if you are unsure of the current issue.

2.0 RATIONALE FOR REMEDIAL WORKS

Eastwood & Partners undertook a Phase 1 and 2 site investigation in October 2016, and subsequent additional works in March 2017.

Historically, the site was occupied by terraced housing from the mid to late 1800s, with a number of the buildings being converted to commercial use in more recent years. The workshop in the north west was constructed during 1960s. No evidence of any fuel tanks being present on site has been found but at least one tank is recorded to have been present around 15 m west of the site. No records of what this tank contained are available, but it is recorded that a tank was slurry filled in 1968. The workshop building recently demolished was stated to have contained an above ground waste oil tank.

The ground conditions across the site generally comprise made ground to depths of between 0.5 and 1.5 m bgl, with fine natural medium dense sand below, which becomes dense below about 1.5 m to 2 m bgl. Stiff clay/mudstone with ironstone is present below about 3.5 m. Made ground was locally found to extend deeper in the north west, reaching a depth of 2.8 m.

No elevated levels of contamination have been recorded in relation to human health, but locally elevated concentrations of zinc have been recorded within the made ground which may present a potential risk to plant growth.

The conclusion of our site investigation report was that no remedial works are necessary to mitigate the risks to the health of future staff and visitors to the site. However, if any soft landscaping is proposed, a 300 mm capping layer/growing medium should be provided to mitigate against the potential uptake of zinc by root systems. Imported topsoil will be required.

No significant risk of landfill gas ingress was found, but basic radon precautions are required in the new buildings.

DS-3 AC-3 sulphate precautions are required in subsurface concrete structures which are in contact with the made ground.

3.0 REMEDIATION OBJECTIVES

The remedial objectives for this site are therefore:

1. To install basic radon precautions. This will be undertaken by a competent ground worker, and will comprise a suitable radon resistant membrane which is fully lapped and sealed across the floor slab and wall cavity to the external walls as per standard details. No further guidance is considered necessary within this document.

2. To ensure that 300 mm of clean, inert, physically suitable topsoil is present in any areas of soft landscaping.

3. Upon identification of any additional or unexpected contamination, a suitable strategy to determine any remedial action is to be in place.

4. To reduce the risks to construction workers, they should be made aware of the presence of elevated levels of contaminants within the materials to be excavated and ensure that the requisite working practices are adhered to. No further guidance with regards to this is considered necessary as part of this document.

5. Pipework which is suitably resistant to the ingress of mobile contaminants such as those recorded in the made ground on this site should be installed where they will be laid within the made ground. The results of the chemical testing will need to be forwarded to the Water company so that they can advise the level of protection that is required. All pipework is to be laid within trenches at the specified depth, which are to be backfilled with approved, inert material.

4.0 WORKING METHOD

Prior to starting construction, the existing buildings and hardstanding's must first be demolished. This is to be undertaken by a suitably qualified contractor.

During the works, procedures to protect site neighbours, the environment and amenity, and to control dust, noise and odours should be put in place by the contractor, in addition to the required site health and safety procedures that apply. Control of surface water runoff over areas of potentially contaminated ground should also be taken into consideration.

The procedures for implementation of the mitigation measures identified in Section 2, to ensure that the objectives detailed in Section 3 are met, are outlined in Sections 5 to 8. All remediation works are to be overseen by suitably experienced site staff. Periodic visits will be made by a suitably qualified independent consulting Engineer, to undertake the necessary verification works detailed. Further details of the activities to be overseen are provided within Section 6.2 and 7.

5.0 CAPPING MATERIALS

5.1 Sourcing of Material

There is currently no topsoil on the site. Therefore topsoil material will need to be imported to site to construct the capping layer, if any soft landscaping is to be included in the development. This should be from a source not expected to be contaminated and meet both physical and chemical criteria, as detailed in Sections 5.3 and 5.4.

Prior to importation, certification should be obtained from the supplier detailing the source site, its previous and current land use and relevant test results. A copy of this information should also be forwarded to the Engineer.

If no such information is available, the engineer will need to visit the source site and collect samples which will be submitted for testing to determine the suitability of the material for use within the development. Material which does not hold the relevant certification should not be brought to site.

5.2 On-site Stockpiling of Materials

On importation, if the materials cannot be placed directly into the soft landscaping areas, the capping materials should be stockpiled. Copies of the carrier's consignment notes should be retained with the documentation detailed in Section 5.5 and a copy forwarded to the Engineer. The soil should be stockpiled separately and away from areas designated for storing other materials or potential sources of contamination. Separate stockpiles should also be created for each different source. These should have a volume of no more than about 150 m^3 for topsoil. All stockpiles should be suitably quarantined and identified as such until deemed suitable for use.

The following soil handling procedures should also be adhered to:

- Topsoil and subsoil should not become mixed;
- Capping should not be laid during or immediately following heavy rain;
- Double handling of material should be avoided;
- Stockpiles should be shaped to shed water; and
- Over tracking by machinery used to place soils should be avoided.

5.3 Physical Requirements

Topsoil should have a maximum of 30% of fragments in excess of 2 mm, a maximum of 10% in excess of 20 mm and nothing greater than 50 mm. Topsoil should be free of fragments of glass and wire or other potentially hazardous foreign material which could cause traumatic injury. Significant quantities of extraneous material such as brick and concrete should also not be present within the topsoil.

In addition, all materials should be free from propagules of aggressive weeds and bulk vegetative growth, in order to ensure negligible risk of subsequent weed problems.

5.4 Chemical Requirements

In accordance with YAHPAC guidance (see Appendix 1), imported topsoil should meet the chemical requirements as set out in BS3882:2015 and it should undergo an initial screening ensure it meets the criteria set out in Key Point 2. A sampling ratio of one sample per 250 m^3 of material should be maintained for topsoil originating from a greenfield source. In addition, at least three samples should be tested for each topsoil source.

For a brownfield sourced material, the sampling rate should be increased to one sample per 100 m^3 with a minimum of six samples tested.

The screening and sampling is to be undertaken by a suitably qualified Geo-environmental Engineer and depending on the source or variability of imported material, the Engineer may, at their discretion, request additional testing to be undertaken. If constant sources are to be used for the topsoil and the results recorded are consistently low, consideration may be given to reducing the number of samples tested.

Testing should be carried out for the following general suite of contaminants:

Arsenic	Mercury	Zinc
Chromium (III & VI)	Nickel	Copper
Cadmium	Lead	Selenium
Speciated PAH	Asbestos	pH

The above suite of testing is applicable to Greenfield sourced materials. If the topsoil is from a brownfield source, fractionated TPH analysis should also be undertaken, together with any other testing deemed applicable by the Engineer depending on the history of the source site.

The results are to be compared with the current contaminated land assessment criteria for commercial development. Tables of all of the assessment concentrations applicable are within Appendix 2.

If any of these thresholds are exceeded the material shall be considered to be unsuitable unless further testing and risk assessment shows it to be satisfactory. All materials should be approved in writing by the Local Authority prior to importation to site.

5.5 Documentation

Each stockpile of material should be given a clear reference number and designated sheet recording the following:

- Identification reference (e.g. Stockpile A, B, C etc.)
- Material Type (e.g. Topsoil)
- Source site
- The carrier's consignment note reference numbers
- The approximate volume (amount of loads)
- Where the material is to be used.

Each entry shall be signed and dated by the Site Manager or their Assistant. A template forms Appendix 3. These sheets should be available for inspection by the Engineer, Local Authority staff and others involved with this development. A copy should also be given to the Engineer when verification visits (detailed in Section 6.2) are made.

6.0 INSTALLATION AND VERIFICATION OF CAPPING

A minimum of 300 mm of clean inert physically suitable topsoil is required in any soft landscaped areas where made ground is present.

6.1 Installation of the Capping

The capping installation should be undertaken by site staff in the following steps:

1. Establish the finished ground levels over each landscaped area and from this determine the required level of the underside of the capping layer.
2. Where present ground levels are above the level of the underside of the cap, re-grading of the ground is to be undertaken to accommodate the cap. This excavated material should be stockpiled on an impermeable surface until it can be re-used elsewhere on site. Failing this the material can be removed from site (see 4 below).
3. Where the present ground levels are below the underside of the capping layer, the ground level may be made up to the underside of the capping layer using material from 2 (above) or imported material where no suitable fill exists.
4. All arisings of made ground should be regarded as contaminated until proven otherwise. If they cannot be re-used on site below the capping layer or beneath areas of hardstanding, they are to be removed to a licensed waste management facility. The waste is to be taken by a registered waste carrier in accordance with the Waste Management Duty of Care Code of Practice. Copies of all waste transfer notices are to be retained.
5. Install all necessary service runs.

6 Check the level of the ground surface to ensure that it is at the correct level for the underside of the capping. Take digital photographs of the formation layer in all soft landscaping area. Photographs must include a reference level such as surveying staff or brick/block courses of adjacent structures.

7 Install 300 mm minimum depth of topsoil.

6.2 Verification of the Capping Installation

Upon completion of the capping, verification pits shall be dug by an independent engineer in order to measure the thickness of topsoil. One pit should be excavated per landscaped area, in a location of the engineers choosing. Each verification pit shall be photographed in accordance with the good practice guidelines set out within the YAHPAC guidance Appendix 1 page 9 (Appendix 1). The photograph will include reference of depth and location of the pit.

If the capping is deemed to be insufficient, the Site Manager will be informed and advised on how much more material is needed for the capping to be adequate. Verification of capping can only be carried out on areas where the capping has been completed. All landscaped areas which have had the capping layer completed will be digitally photographed by the engineer.

A verification report is to be produced by the Engineer, which includes:

- The documentation detailed in Section 5.5;
- The chemical test results for the samples taken from stockpiles of any imported topsoil and subsoil, and confirmation that the material is visually consistent with that tested or the chemical test results for samples taken once the capping has been placed;
- Confirmation of the capping thicknesses, including photographs of the verification pits with a scaled marker; and
- Confirmation of the physical suitability of the material.

The submission of verification reports is covered in Section 8.

7.0 AREAS OF UNEXPECTED CONTAMINATION

Although considered unlikely, there is the possibility that more significantly contaminated materials may be encountered within the made ground between the previously completed exploratory holes or that contained beneath the slab of the existing building. Any unusual, brightly coloured or significantly oily or odorous material should be considered in this category. Soils containing any amounts of material suspected of containing asbestos should also be included.

If unexpected contamination is found the following procedures should be adhered to:

1. All site works at the position of the suspected contamination should stop, and visual and olfactory observations of the condition of the ground and the extent of contamination should be made. Notification shall be given to an independent consultant and the NHBC (if appropriate) and Local Authority not later than 24 hours after discovery. Should the contamination be likely to affect controlled waters the Environment Agency should also be informed.
2. During the presence of a suitably qualified Engineer, investigation works shall commence to recover samples for testing and, using visual and olfactory observations of the condition of the ground, accurately delineate the area over which contaminated materials are present.
3. Should the Consultant deem it appropriate, the affected material may be excavated and placed in a separate stockpile on a suitable impermeable surface. This should be suitably quarantined with no addition to or removal of the stockpile while chemical analysis is being undertaken. Alternatively, the material should remain in-situ until laboratory test results have been obtained.
4. The testing suite will be determined by the Consultant on the basis of visual and olfactory observations.
5. Test results will be compared against current assessment criteria suitable for the future use of the area of the site affected.
6. If after testing the ground is found to be contaminated, the Local Authority (and NHBC if applicable) shall be informed. After consultation with the Local Authority, and if necessary the Environment Agency, materials should either be removed for disposal to a licensed waste management facility as detailed in Section 6.1, above, or remediated to agreed clean-up criteria.

A report will be prepared by the Engineer and submitted to the Local Authority and where groundwater may potentially have been impacted, the Environment Agency.

8.0 COMPLETION DOCUMENTATION

On completion of the verification works the appropriate verification documentation, detailing the works that have been completed in accordance with the agreed Implementation Plan, will be forwarded to the Local Authority and warranty provider. The verification report will include photographic records of the works, which are to be provided by site, and details of any site visits undertaken by the engineer.

Necessary changes to the agreed Implementation Plan, arising during the course of the works, are to be agreed in writing with the Local Authority and any warranty provider prior to being undertaken on site.

Appendix 1

YAHPAC Guidance – 'Verification Requirements for Cover Systems'

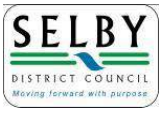
VERIFICATION REQUIREMENTS FOR COVER SYSTEMS

Technical Guidance for Developers, Landowners and Consultants

Yorkshire and Humberside Pollution Advisory Council

Version 3.2 – October 2014

The purpose of this guidance is to promote consistency and good practice for development on land affected by contamination. The local authorities in Yorkshire, Lincolnshire and the North East of England who have adopted this guidance are shown below:



Contents Page

Disclaimer

This guidance is intended to serve as an informative and helpful source of advice. It is intended to review this guidance annually, but readers must note that legislation, guidance and practical methods are inevitably subject to change and therefore should be aware of current UK policy and best practice. This note should be read in conjunction with prevailing legislation and guidance, as amended, whether mentioned here or not. Where legislation and documents are summarised this is for general advice and convenience, and must not be relied upon as a comprehensive or authoritative interpretation. Ultimately it is the responsibility of the person/company involved in the verification of land contamination to apply up-to-date working practices and requirements.

Acknowledgments

The author, Wakefield Council, would like to acknowledge the assistance provided by the following organisations: City of York Council, City of Lincoln Council, Leeds City Council and City of Sheffield Council. The author would also like to acknowledge Liverpool City Council's Contaminated Land Team, Coopers Consulting Engineers for allowing us to use their guidance document and photographs and WSP Environmental Ltd for also donating photographs.

Consultation

39 Local Authorities and 6 Environmental Consultants were consulted over a four week period in 2010 during the production of the initial guidance. At that time, consultation comments were considered by the review panel and a number of revisions were made to the guidance to reflect these comments. Given that no major changes have subsequently taken place, only Local Authorities were consulted during the production of this version [3.1] of the guidance.

Introduction

This guidance has been produced to help developers ensure that they can demonstrate that material brought onto a development site for gardens or areas of soft landscaping are suitable for use and do not present harm to people, the environment and/or property. It is intended to improve the quality of reports submitted to Local Authorities on this matter and to give contractors/consultants a point of reference to obtain approval for such work from their client. This guidance does not cover the geotechnical suitability of soils or material or chemical suitability that does not affect human health e.g. sulphates.

The verification of cover systems should be an integral part of the remediation project and agreed between developers and regulators at an early stage in the project.

There are some UK guidelines regarding verification, for example CLR 11[1] and the document on verification of remediation[2]. This guidance note should be considered as supplementary advice in conjunction with these documents.

This guidance relates to the remediation of land contamination by using cover systems; however, the verification of the quality of imported material is equally important in other situations, such as raising levels for flood prevention or general landscaping works. This guidance could also be used in such instances.

The Process of Verification

Implementation plans for remedial works should always be site specific. Where a cover system and potentially, excavation, is the main remedial method or a component of an overall site remediation, specific goals will need to be set that are linked directly to the risk management strategy for the site in question.

For cover and containment systems, verification will normally depend upon the provision of defensible measurements, observations and records. Critical factors to be considered are:

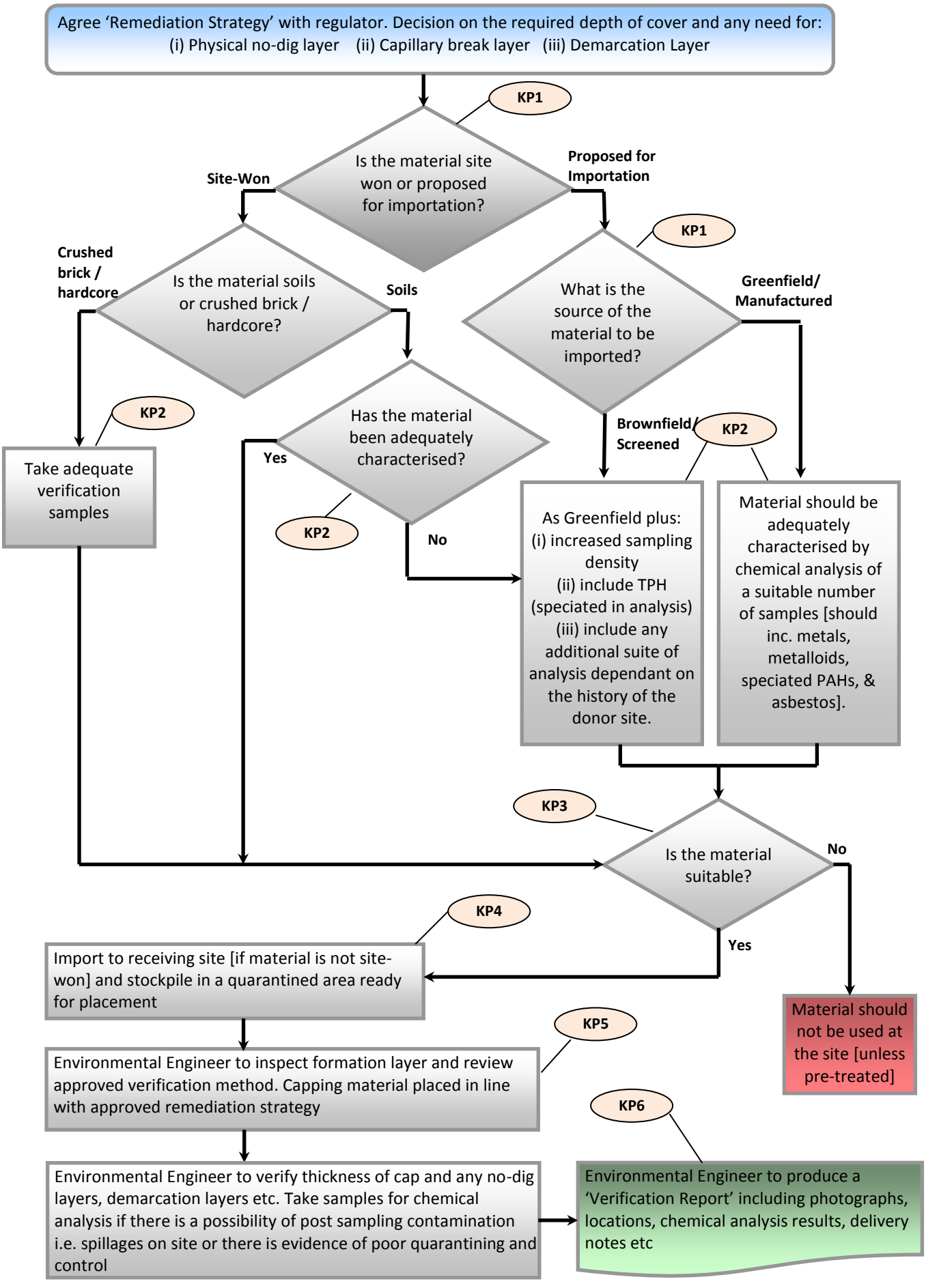
- What should be measured?
- When should they be measured?
- Where measurements need to be taken, what is the appropriate monitoring regime i.e. number and frequency of samples?
- Statistical constraints on sampling.

---

1 "Contaminated Land Report 11 - Model Procedures for the Management of Contaminated Land". Environment Agency, September 2004.

2 "Verification of Remediation of Contaminated Land. Environment Agency, 2010 [draft report].

Overview Flowchart



Key Points

KP1 Source of Material	Material can be sourced from site won material i.e. crushed brick /hardcore or site-won soils from existing open or landscaped areas. In the interest of sustainability, Local Authorities promote the use of such site-won material providing that they are suitable for the intended end use of the site. Alternatively, material can be sourced from other developments and commercial companies. Dependent on the source of the material it can be classified as either from a 'Greenfield/Manufactured' or 'Brownfield/Screened' source. Broadly speaking material can be classified as follows: Greenfield - if it can be demonstrated that it has not been developed and that no past contaminative uses have occurred at the site. Manufactured – from a commercial company who manufacture material by mixing or blending mineral soils (subsoil or sand) with an organic amendment (compost). Brownfield – material from a donor site that has previously been developed Screened – material from a company who deal with skip/demolition waste which is screened for unsuitable material i.e. bricks, wood, plastic etc.
KP2 Characterisation of Material	It is essential that material is inert and suitable for its intended use. Evidence of the source of the material should be provided to the Local Authority. What is required is a defensible method to ensure the verification proposals are site specific and that the level of sampling reflects the need to ensure that imported material are suitable for their intended use. **When Should this be Done?** Sampling of material should be undertaken as early as possible i.e. prior to placement [for site won material] and prior to importation [for imported material]. This is to avoid the costly exercise of re-excavating unsuitable material and the possibility of cross contamination. Where the assessor has confidence that the material is of sufficient quality (i.e. tested by supplier, used previously) it is acceptable to test the material on site but prior to placement. Although, if it is deemed unsuitable it would have to be either removed off site or pre-treated at the cost and time of the developer. **What about Certificates from Commercial Suppliers?** Where the material is provided by a commercial company, certificates or other industry Quality Protocol compliance i.e. WRAP, will normally be

accepted. This is on the proviso that it (i) relates to the actual material being imported to the site and the type and amount of analysis is in line with what is prescribed in Appendix 1a and (ii) the certificates are less than two months old.

Extreme caution should be given to importing material that has been recycled from demolition or skip waste as they could be easily be contaminated e.g. asbestos containing materials. [Please refer to questions you should be asking your supplier in Appendix 1b and include the responses in your report]

British Standard

Imported topsoils should be as specified in BS 3882:2007 as 'suitable for their intended purpose'. BS3882:2007 relates to nutrient content of topsoil and phytotoxic contamination and does not consider contaminants that pose a risk specifically to human health. Soils should be tested for contaminants that are considered to pose a risk to human health in addition to BS3882:2007 to ensure that they are suitable for their intended use.

Initial Screening

A visual / olfactory inspection of the material should be carried out by an Environmental Engineer to ensure that:

- it is a suitable growing medium
- it is free from obvious contamination i.e. staining / free product etc
- it has not come from areas where Japanese Knotweed or other invasive or injurious plants, as specified by the Environment Agency, are suspected to have been growing.
- it is not odorous (could be considered a statutory nuisance)
- it is free from unsuitable material i.e. bricks, brick ties, timber and glass etc)
- there are no visible signs of asbestos containing material (ACM's)

Testing Schedule & Number of Samples

Chemical testing will normally be required on any materials that are to be used as cover material, even where this includes first generation quarried material. This should be carried out by a suitably qualified Environmental Engineer.

Please refer to the Characterisation of Material Matrix in Appendix 1a which details the number of samples to be taken; the testing schedule to be utilised dependant on the nature and source of the material and the acceptance criteria to be used.

KP3 Suitability of Material	Based on the characterisation of material above, the material should be either deemed suitable or unsuitable. Obviously unsuitable material should not be used [unless it is treated to reduce levels of contaminants below agreed target levels i.e. bioremediation – this would have to be agreed and included within the Remediation Strategy] and an alternative source of material should be sought by the developer. If the material is considered suitable it can be imported [if not site won] and stockpiled in a suitably quarantined area [refer to KP4].
KP4 Stockpiling & Quarantining of Material	It is essential that the 'suitable' material is either placed in its intended area straight away i.e. soft / landscaped areas or stockpiled in a suitable quarantine area to prevent on-site contamination. In the event that an assessor finds material has been stored in an unsuitable area, samples should be taken to confirm that no cross contamination has occurred [including a visual/olfactory check of the material]. The material should then be suitably quarantined or placed at its intended location immediately.
KP5 Verification of Required Depth	In line with the agreed 'Remediation Strategy', it is important to establish that the required depth has been achieved and is consistent across the site. There are two main ways to achieve this: Depth testing in situ – small trial pit excavated to allow measurement of its depth by tape measure or measuring staff. Topographical surveys – accurate survey of the base and final formation layer height to establish the depth of cover. **Specific Local Authority Policy** Please check with the local Contaminated Land Officer to establish: • which type of method for testing depth is accepted; and • the number of verification areas per property, plot, landscaped area or garden area [some Local Authorities recommend at least 2 per plot] **Important Note:** Where demarcation, physical no-dig and capillary break layers exist they should be verified for their thickness and presence during the time of their installation. Details of the demarcation layer should be agreed with the Contaminated Land Officer prior to placement. This will include the design, type and strength of the geotextile separator or visual warning membrane. The verification of depth and confirmation of such layers should be carried out by a suitably qualified environmental engineer.
KP6 Reporting	The purpose of verification documentation is to provide transparent reasoning why the remediation was required, a methodology about how it was to be undertaken and proof that the specified works have been

undertaken and to provide confirmation that the site is 'suitable for its intended use'.

The document is utilised not only to satisfy conditions of planning permissions but also is to be kept on record by the Local Authority should queries be raised during the lifetime of the development and to confirm to future purchasers that the site is suitable for use. Therefore, the presence of good quality photographs is essential to prove beyond doubt that the remediation has been done as specified both by method and position.

It is also essential that other supporting documentation is included within a report e.g. laboratory analysis results, delivery tickets for material, certificates for imported material, trial pit logs etc. A checklist has been included in Appendix 2 to give an idea on what information should be recorded.

The reporting should be carried out by a suitably qualified Environmental Engineer.

To include details of any measures required to maintain the cover system integrity in the future e.g. successive construction phases (management plans) and longer term (restrictive covenants on title deeds).

Photographic Evidence for Validating the Depth of Cover

The Local Authority ideally would recommend the following programme of photographs to be taken of the placement of inert cover:

- Photographs of any stockpiles and quarantine areas
- Proof that the depth of inert cover has been installed
- Proof of the quality of the material to be used as inert cover
- Proof there is a geotextile separator and visual warning membranes if used between the made ground and suitable for use soils.
- Proof of the method of placement and different layers if appropriate
- Proof of the completed project
- Inclusion of geographic background features which will aid locating the photograph
- Inclusion of site identification boards within the photos which show the date, position taken i.e. corner of plot 3 and the site name.
- Inclusion of photographs of site stockpiles and quarantine areas.

The photographs have to prove beyond doubt that the images have been taken from the specific area stated.

Refer to Appendix 3 for examples of good photographic evidence.

Appendix 1a – Sampling & Testing Matrix

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,CrVI,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. SGV's, LQM or other similarly derived GAC's.
Crushed Hardcore, Stone, Brick	Minimum 1 per 1000m^3	Standard metals/metalloids (As above) PAH (16 USEPA speciation) Asbestos	
Greenfield/ Manufactured Soils	Minimum 3 or 1 per 250m^3 (whichever is greater)	Standard metals/metalloids (As above) PAH (16 USEPA speciation) Asbestos	
Brownfield/ Screened Soils	Minimum 6 or 1 per 100m^3 (whichever is greater)	Standard metals/ metalloids (As above) PAH (16 USEPA speciation) TPH (CWG banded) Asbestos Any additional analysis dependant on the history of the donor site.	

Appendix 1b – Questions to Ask Your Soil Supplier Relating to Soil Quality

- What is the source of the material (refer to KP1)?
- Will all of the material be coming from the same source?
- Are you satisfied that the material is a suitable growing medium for the proposed end use?
- Has the supplier used an appropriate sampling protocol to ensure a representative sample is analysed? What volume of soil is represented by the analysis and does it comply with Appendix 1a?
- Does the testing include analysis of contaminants identified in Appendix 1a?
- Does the laboratory conducting the analysis have UKAS and MCERTS accreditation for the tests they are carrying out?
- Can I have a copy of the whole analysts report and does it include an interpretive section?
- Will the provided certificate be dated within the last 2 months?

Appendix 2 – Checklist for Verification Reports

Example only. Not to be considered as typical minimum requirements. Additional information should be included for non cover systems aspects of the remediation i.e. gas protection measures etc.

Site Details	
Site Name / location	
Developer name	
Development use	
Plot No / description of landscaped area (inc plan of inspection areas)	
National Grid Reference	
Inspection visit date	
Supporting Evidence	
Description of remediation (as per agreed Remediation Method Statement including depths / thickness checks, topographical readings)	
Material tracking information (including way tickets etc)	
Name of groundwork's remediation contractor	
Name of supervising environmental consultant	
Site Specific chemical analysis results	
Verification Photographs (inc. remarks)	
Recommendations	
Pass / fail	
If material fail, how will this be managed i.e. removed, treated	
Detail any further remedial works and / or inspection	
Signed off	

Failure to provide any of the above information may prevent planning conditions from being discharged.

Appendix 3 – Examples of Good Quality Photographs

Photograph 1: Depth check of inert cover within area of public open space. Physical break layer and topsoil visible.

Photograph 2: Depth check of inert cover with Site & Location Information Board.

Photographs 3 & 4: Depth check of inert cover within areas of front gardens.

Photographs 5 and 6: Depth check of inert cover within rear gardens. Taut string line spans across excavation.

Photograph 7 shows the spatial location of the verification pit.

Photograph 8: Excavation within public open space and verification pit showing the presence of a remediation break layer at the base, a crushed sandstone inert fill overlain by topsoil.

Photographs 9 and 10: Inert crushed sandstone being delivered with remediation break layer visible in Photograph 10. The spatial area of the remediation can be observed from these photographs (old terrace housing in Photograph 9 and traffic lights in photograph 10).

Photographs 11 and 12 show the remediation of the rear garden, with a significant depth (1.0m) of inert cover. Remediation break layer visible at the base of the excavation. Photograph 11 has been stitched to form a panoramic photograph and hence there is slight distortion

Appendix 2

Table of Soil Assessment Values

Contaminant	Intended Land Use				
	Commercial/Industrial End Use (mg/kg)				
	Human Health	Phytoxicity			
		pH 5.0-5.5	pH 5.5-6.0	pH 6.0-6.5	pH >7.0
Arsenic	640	50			
Cadmium	190	3			
Chromium (III)	8600	400			
Chromium (VI)	33	-			
Lead	1100-6000	300			
Mercury	25.8	1			
Nickel	980	50	60	75	110
Selenium	12,000				
Copper	68,000	80	100	135	200
Zinc	730,000	200	200	200	300

Notes:

The assessment concentrations for arsenic, cadmium, chromium (III), chromium (VI), copper, nickel, mercury, selenium and zinc are taken from Nathanail, C.P., McCaffrey, C., Gillett, A.G., Ogden, R.C., and Nathanail, J.F., 2015, 'The LQM/CIEH S4ULs for Human Health Risk Assessment', Land Quality Press, Nottingham. These are also all based on a sandy loam soil and 6% soil organic matter.

The assessment concentration for lead is the Category 4 Screening Level produced by Contaminated Land; Applications in Real Environments (CL:AIRE) and outlined in Appendix H of their report SP1010.

The threshold value is not intended to be applied to individual sample results where materials are similar, as the levels of contaminants will have a natural variability across the site. The modified mean value should instead be compared with the threshold value.

The assessment values for phytotoxicity are levels at which plant growth is thought to be affected. These are taken from the maximum permissible and advisable concentrations in soil after application of soil sludge given in the '*The Code of Good Agricultural Practice for the Protection of Soil*', MAFF, 1998.

Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3153. All rights reserved.

Prepared	KDL	Checked	ECM	Date	26.10.16	Job No	40380

E•P Eastwood&Partners
CONSULTING ENGINEERS
St Andrew's House
23 Kingfield Road
Sheffield
S11 9AS
Tel: (0114) 2554554 Fax: (0114) 2554330

RIDER LEVETT BUCKNALL

CHURCH SQUARE, SCUNTHORPE

ASSESSMENT CRITERIA – COMMERCIAL

Organic Compounds	Intended Land Use Commercial (mg/kg)		
	1% SOM	2.5% SOM	6% SOM
Naphthalene	190 (76.4)[sol]	460 (183) [sol]	1100 (432) [sol]
Acenaphthene	84000 (57.0) [sol]	97000 (141) [sol]	100000
Acenaphthylene	83000 (86.1) [sol]	97000 (212) [sol]	100000
Fluorene	63000 (30.9) [sol]	68000	71000
Phenanthrene	22000	22000	23000
Anthracene	520000	540000	540000
Fluoranthene	23000	23000	23000
Pyrene	54000	54000	54000
Benzo(a)anthracene	170	170	180
Chrysene	350	350	350
Benzo(b)fluoranthene	44	44	45
Benzo(k)fluoranthene	1200	1200	1200
Benzo(a)pyrene	35	35	36
Dibenz(a,h)anthracene	3.5	3.6	3.6
Indeno(1,2,3-cd)pyrene	500	510	510
Benzo(g,h,i)perylene	3900	4000	4000
Phenol	760	1500	3200
Benzene	27	47	90
Toluene	56000 (869)[vap]	110000 (1920)[vap]	180000 (4360)[vap]
Ethylbenzene	5700 (518) [vap]	13000 (1220) [vap]	27000 (2840) [vap]
o-Xylene	6600 (478) [sol]	15000 (1120) [sol]	33000 (2620) [sol]
m-Xylene	6200 (625) [vap]	14000 (1470) [vap]	31000 (3460) [vap]
p-Xylene	5900 (576) [sol]	14000 (1350) [sol]	30000 (3170) [sol]

[sol] = S4ULs presented exceeds the solubility saturation limit, which is presented in brackets.
[vap] = S4ULs presented exceeds the vapour saturation limit, which is presented in brackets.

The assessment criteria for the sixteen polycyclic aromatic hydrocarbon (PAH) species covered under the USEPA test have been taken from Nathanail, C.P., McCaffrey, C., Gillett, A.G., Ogden, R.C., and Nathanail, J.F., 2015, 'The LQM/CIEH S4ULs for Human Health Risk Assessment', Land Quality Press, Nottingham.. These are also all based on a sandy loam soil and 6% soil organic matter. This is also the case for phenol at 1% and 2.5% SOM. These are also all based on a sandy loam soil.

The assessment values for phenol (6% SOM) and the BTEX compounds are the Soil Guideline Values derived by DEFRA and Environment Agency using the '*Contaminated Land Exposure Assessment'* model. These are outlined in the Environment Agency's Science Report series SC050021.

Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3153. All rights reserved.

Prepared	KDL	Checked	ECM	Date	26.10.16	Job No	40380

E•P Eastwood&Partners
CONSULTING ENGINEERS
St Andrew's House
23 Kingfield Road
Sheffield
S11 9AS
Tel: (0114) 2554554 Fax: (0114) 2554330

RIDER LEVETT BUCKNALL

CHURCH SQUARE, SCUNTHORPE

ASSESSMENT CRITERIA – COMMERCIAL

TPH Fraction	Intended Land Use Commercial (mg/kg)		
	1% SOM	2.5% SOM	6% SOM
Aliphatic EC 5-6	3200 (304)[sol]	5900 (558)[sol]	12000 (1150)[sol]
Aliphatic EC >6-8	7800 (144)[sol]	17000 (322)[sol]	40000 (736)[sol]
Aliphatic EC >8-10	2000 (78)[sol]	4800 (190)[vap]	11000 (451)[vap]
Aliphatic EC >10-12	9700 (48)[sol]	23000 (118)[vap]	47000 (283)[vap]
Aliphatic EC >12-16	59000 (24)[sol]	82000 (59)[sol]	90000 (142)[sol]
Aliphatic EC >16-35	1,600,000	1,700,000	1,800,000
Aliphatic EC >35-44	1,600,000	1,700,000	1,800,000
Aromatic EC 5-7 (benzene)	26000 (1220)[sol]	46000 (2260)[sol]	86000 (4710)[sol]
Aromatic EC >7-8 (toluene)	56000 (869)[vap]	110000 (1920) [sol]	180000 (4360)[vap]
Aromatic EC>8-10	3500 (613)[vap]	8100 (1500)[vap]	17000 (3580)[vap]
Aromatic EC >10-12	16000 (364)[sol]	28000 (899)[sol]	34000 (2150)[sol]
Aromatic EC >12-16	36000 (169)[sol]	37000	38000
Aromatic EC >16-21	28000	28000	28000
Aromatic EC >21-35	28000	28000	28000
Aromatic EC >35-44	28000	28000	28000
Aliphatic + Aromatic EC >44-70	28000	28000	28000

[sol] = S4ULs presented exceeds the solubility saturation limit, which is presented in brackets.
[vap] = S4ULs presented exceeds the vapour saturation limit, which is presented in brackets.

The assessment criteria for each of the petroleum hydrocarbon fractions have been taken from Nathanail, C.P., McCaffrey, C., Gillett, A.G., Ogden, R.C., and Nathanail, J.F., 2015, 'The LQM/CIEH S4ULs for Human Health Risk Assessment', Land Quality Press, Nottingham.. These are also all based on a sandy loam soil.

Within the Environment Agency Science Report P5-080/TR3, Askari, K. & Pollard, S., 2005 *'The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils'* it is stated that the assessment values should not be considered individually; instead the potential additive effects should be calculated. This is achieved by calculating an individual Hazard Quotient (HQ) for each fraction. The HQ is the proportion of the assessment concentration represented by the recorded concentration. The HQs are then added together to form a Hazard Index (HI) and where this exceeds unity a potential significant risk to human health may exist.

Where only a TPH screen is undertaken, the assessment value used should be taken as the most onerous value given for individual carbon bands, as described above. This should be the assessment for Aliphatic band EC>8-10, assuming a SOM value of 1%. The assessment value should therefore be taken as 2,100 mg/kg.

Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3153. All rights reserved.

Prepared	KDL	Checked	ECM	Date	26.10.16	Job No	40380

E•P Eastwood&Partners
CONSULTING ENGINEERS
St Andrew's House
23 Kingfield Road
Sheffield
S11 9AS
Tel: (0114) 2554554 Fax: (0114) 2554330

RIDER LEVETT BUCKNALL

CHURCH SQUARE, SCUNTHORPE

ASSESSMENT CRITERIA – COMMERCIAL

Appendix 3

Imported Material Documentation Form

Imported Soil Documentation Form

Stockpile Identification Reference	
Material Type	
Source Site	
Consignment Note Reference Numbers	
Volume of Stockpile (or number of loads)	
Areas which Material is to be used in	

Signed _____

Position_____

Date_____