



Fulford Road, Havant

Remediation Strategy Report

Project No: 733845

Client: Mipa Paints Ltd

JANUARY 2019

Project No.:	733845
Report No.:	733845-2 (00)
Project Name:	Fulflood Road, Havant
Document Title	Remedial Strategy Report
Client:	Mipa Paints Ltd.
Engineer:	AKS Ward
Status:	Final

Author		A Watts BSc (Hons) FGS
Approved by		S Pond BSc CChem MRSC
Report Issue Date	18 January 2019	

DOCUMENT ISSUE RECORD

REVISION RECORD

Revision	Date	Description of revisions	Prepared by
00	18-01-2019	Final	AW

STRUCTURAL SOILS LIMITED
 The Old School
 Stillhouse Lane
 Bedminster
 BRISTOL
 BS3 4EB
 Tel: 0117 947 1000
 Email: ask@soils.co.uk
www.soils.co.uk

CONTENTS

1 INTRODUCTION.....	1
2 SITE DESCRIPTION.....	2
2.1 Location and Topography	
2.2 Previous Reports	
2.3 Proposed Development	
2.4 Scope and Objectives	
3 CONCEPTUAL SITE MODEL.....	5
3.1 Geology	
3.2 Hydrogeology and Hydrology	
3.3 Sources of Contamination	
3.4 Pathways	
3.5 Receptors	
3.6 Linkage Breaks	
4 REMEDIAL STRATEGY	8
4.1 Remedial Strategy	
5 REMEDIATION/CONSTRUCTION CONSIDERATIONS.....	12
5.1 General	
6 WASTE MANAGEMENT	15
6.1 Classification and Disposal	
7 VALIDATION REPORTING	16
7.1 Excavation Validation	
7.2 Imported soil validation	
7.3 Validation Statement / Report	
8 MONITORING AND DOCUMENTATION OF REMEDIATION WORKS	18
8.1 Contractor Responsibilities	
8.2 Geo-Environmental Consultant Responsibilities	
9 REFERENCES.....	19
APPENDIX A - PLANS AND DRAWINGS	I
(i) Site Location Plan	
(ii) Proposed Development & Drainage Layout Plan	
APPENDIX B - HUMAN HEALTH GENERIC ASSESSMENT CRITERIA FOR A COMMERCIAL END USE.....	II
(i) RSK Group Generic Assessment Criteria (GAC)	

1 INTRODUCTION

This report was produced by Structural Soils Ltd (SSL) on the instructions of PDP Architecture LLP (the Client's Planning Agent) on behalf of Mipa Paints Ltd (the Client) at the site of Fulflood Road, in Havant.

The purpose of the work was to set out an approach to the development of the site to manage the residual contamination risks which are present at the site which is to be developed as a warehouse, office and training school facility with associated loading areas, car parking and refuse storage (Ref: APP/15/01233).

SSL have undertaken previous ground investigations at this site, which are detailed in our reports 730438 of 2015 and 733845-1 (01) of November 2018 (see References). In addition, the Client has provided a number of full and partial desk study and ground investigation reports pertaining to the study site and the wider surroundings. The relevant findings from these were summarised in report 733845-1 (01) of November 2018.

The comments given in this report and the opinions expressed are based on the ground conditions encountered during all stages of intrusive site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been discovered by investigations and therefore could not be taken into account. In particular, it should be noted that there may be areas of asbestos containing made ground or hydrocarbon contamination not detected due to the limited nature of the investigation.

This report was prepared by SSL for the sole and exclusive use of Mipa Paints Ltd in response to particular instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded. No liability will be accepted after a period of 6 years from the date of the report.

2 SITE DESCRIPTION

2.1 Location and Topography

The site is located in a small industrial estate on Fulflood Road in Havant approximately 2 km north of the town centre (see Site Location Map in Appendix A). The British National Grid Reference of the site is SU 714 083. The site is set at an elevation of approximately 16 m above Ordnance Datum (AOD). At the time of these works access was gained via a set of gates off from the eastern corner of the site.

The site is rectangular in shape and measures approximately 95 m by 60 m in size (see Exploratory Hole Location Plan in Appendix A). The long axis of the site is aligned east-north-east to west-south-west. The site has been previously developed, but at the time of the works had a generally level surface comprised largely of unbound gravel with a few small remaining concrete slabs. Sporadic scrub vegetation was present and was particularly thick in the south-west of the site.

An area of gravel hardstanding is present across the centre of the site, which may have recently been used, since the demolition of the previous buildings. Two concrete slabs are located near the southern corner of the site. The large concrete slab is approximately 20 m long by 9 m wide whilst the small concrete slab is approximately 18 m long by 6 m wide. A third concrete slab is present near the western corner of the site adjacent to an apparently unused sliding steel gate which would have crossed Fulflood Road itself.

The site is secured to the south and west by a steel palisade fence whilst the north and east sides of the site are secured by heras and steel wire fencing.

The site is bordered to the north by Fulflood Road on the far side of which are a set of relatively modern industrial units occupied by and a number of businesses including vehicle service garages and a gym. To the east is a car park beyond which lies the current Mipa Paints factory building, whilst to the west of the site is a yard and buildings occupied by a vehicle hire business.

The site is bounded to the south by the channel of the Riders Lane stream, with water levels in the stream being approximately 4.5 m below ground level on the site. The difference in height is accommodated by a combination of a concrete retaining wall, and a steep earth bank below, both of which run the length of the boundary. The full height of the retaining wall is unknown but up to 2.2 m is exposed and it is anticipated that a similar height is present below ground level on the low side. The bank of the stream is heavily vegetated with scrub and numerous mature and semi-mature trees, including a number of poplars which are estimated to be 30 m tall.

The Riders Lane stream is a shallow and narrow channel which flows to the south-west, and at the start of the site works period at the end of a dry summer, flow was very low. Periods of heavy rain prior to the second and third monitoring visits generated some flow within the stream, which was turbid from mobile sediment.

Beyond the stream channel is a public footpath and the residential area around High Lawn Way.

At the time of the works two upstanding ground investigation monitoring standpipes were present from previous works undertaken by Soiltechnics (BH1 and DTS04). None of the earlier monitoring standpipes could be located.

2.2 Previous Reports

The following reports have been completed by a range of consultants which contain information relevant to the site.

- Entec Phase 1 Desk Study - July 2003
- Entec Phase 2 Site Investigation Report - August 2003
- Enviro Ground Investigation in Support of Planning Permission – October 2004 (Fragment)
- Enviro Southern Area Former Proctor & Gamble site, Havant – Remediation of hydrocarbon contamination letter report – April 2006
- Structural Soils Interpretive Report on Ground Investigation at Fulflood Road, Havant – September 2015
- Soiltechnics Ground Investigation Report on Proposed Industrial Development, Land adjacent to MIPA Paints Ltd, Fulflood Road, Havant, PO9 5AX - December 2016
- Structural Soils Interpretive Report on Ground Investigation, Fulflood Road, Havant – November 2018.

2.3 Proposed Development

The site is to be redeveloped with a new warehouse, office and training school facility for occupation by the client. On the ground floor the majority of the structure is large warehouses, but includes smaller rooms for toilets, offices and stores.

Externally the site is to be largely completed with impermeable hard landscaping, save for a thin strip of soft landscaping in the north-east of the site.

Surface water runoff is to be collected and discharged to the adjacent surface water course via an interceptor and a below ground attenuation tank.

2.4 Scope and Objectives

This RS covers the whole of the site, in order to address the risks associated with the identified risk of ground gas and to seek to reduce residual risks to controlled waters from as yet unidentified hydrocarbon contamination within the soils.

The objectives of this RS are to provide:

- details of the work to be conducted, specifically to set out an approach to the identification and management of potentially significant hydrocarbon contamination encountered by the works;
- set out outline commentary of the approach to ground gas protection for the new building. It is noted that detailed design of the gas protection measures,

including materials and implementation will be the responsibility of the successful Contractor bidding for the design and build contract;

- details of monitoring and mitigation measures; and
- identify the contents of the validation report.

The principal aim of the remediation at the site is to prevent the ingress of ground gas from the soils beneath the site into the future building, and to ensure that any significant and as yet unidentified hydrocarbon contamination encountered during the works is appropriately assessed and managed.

3 CONCEPTUAL SITE MODEL

3.1 Geology

The works undertaken at the site have shown the site to be underlain by wedge of made ground, which increases in thickness from the north towards the southwest and southeast, reaching a maximum behind the retaining wall along the south-eastern side of the site.

Some relict structures in the form of foundations, and potentially features from a former sewage treatment works are present within the made ground which has been proven up to 4.7 m below site levels. The thickness of the made ground in the north of the site is typically less than 1 m thick.

Natural soils in the north of the site below the made ground are represented by silty sands of the Bognor Sand Member which have been proven up to 2.1 m in thickness. These deposits thin toward the channel of the Riders Lane Stream and abut more variable Head Deposits which include some reworked Bognor Sand as well as probable lenses of sand, gravel and more organic clays.

Both the Bognor Sand and the Head Deposits are underlain by weathered clays of the London Clay Formation, with the surface of this strata having been encountered from approximately 3 m in the north of the site increasing to 6.5 m in the south around BH1 (SSL 2015).

3.2 Hydrogeology and Hydrology

The Bognor Sand Formation and the Head Deposits are classified as Secondary A aquifers, and groundwater beneath the site has been found to form a continuous body between these units and the overlying varying permeable made ground.

Movement of groundwater across the site is considered to be from north-east to southwest, and is expected to form recharge to the adjacent Rivers Lane Stream, although the existing retaining wall appears to form a restriction in this regard.

3.3 Sources of Contamination

The works undertaken to date have identified some indications of contamination within the soils on the site, but no coherent bulk mass of contamination. Groundwater analysis results indicate the presence of generally low level hydrocarbon impact and may suggest the presence of a soil source which has not been characterised by the works to date.

Indications of soil contamination from the latest phase of site works are detailed in Table 1 below and are thus far, principally restricted to the presence of hydrocarbon odours within the soils. Evidence of a sheen and mottling has only been identified in one location on the site (TP9). The potential remains for areas of as yet unidentified hydrocarbon contamination in the soils on the site, particularly in the south and west of the site.

Ground gas concentrations of methane and carbon dioxide in the unsaturated zone on the site are locally elevated and the gas regime is considered to fall within Characteristic Situation 2 (CS2) of BS8485:2015.

There is no evidence that the groundwater on the site is causing significant contamination of the adjacent Riders Lane Stream.

TABLE 1 : OLFATORY OR VISUAL INDICATIONS OF CONTAMINATION			
Location of contamination:	Hole(s) noted in:	Depth (m) (range):	Comments (e.g. staining, odours (inc strength), sheens, free product, etc):
Made ground	WS4	0.70	Asphalt odour
		2.90	Mild hydrocarbon odour
		3.20 – 4.00	Moderate hydrocarbon odour
	TP5	2.10 – 3.00	Possible asbestos containing cement
	TP9	3.00 – 3.90	Black staining emitting moderate hydrocarbon odour
	TP11	0.25 – 0.50	Possible asbestos containing cement
	TP14	0.55 – 0.80	Mild asphalt odour
Bognor Sand Member	TP2	1.10 – 1.50	Rare black staining emitting mild hydrocarbon odour.
Groundwater	TP9	3.60	Hydrocarbon sheen on groundwater.

3.4 Pathways

Ground gas migration from the ground into the new building will remain a valid pathway, particularly via any defects, cracks or construction joints in the ground slab, or around utility routes and services entry points.

No significant hydrocarbon contamination has been identified in the ground to date, but if present it would pose a risk to the Riders Lane Stream via migration in groundwater. Preferential pathways would be via existing services and/or their permeable surrounding material.

3.5 Receptors

3.5.1 End Users

In line with the methodology used for the earlier reports, the end users of the site are considered to be the principal receptors.

3.5.2 Controlled Waters

Shallow groundwater is present within the Bognor Sands Formation, but the Riders Lane Stream is the most sensitive receptor within the vicinity of the site.

3.6 Linkage Breaks

The initial CSM identified the following potentially complete pollutant linkages:

- Future site end users (employees and site maintenance workers) via ingress of ground gases into the building leading to inhalation or explosion; and
- Controlled waters – Riders Lane Stream – via lateral migration including leaching from disturbance of as yet unidentified contamination;

In order to break the source-pathway-receptor linkage associated with future users of the site, the development will need to incorporate measures to break the pathway for ground gas ingress into the buildings.

With regards to the residual risk from hydrocarbons to the adjacent Riders Lane Stream it is proposed a watching brief is implemented to ensure that any significant unexpected contamination encountered is assessed and if required, removed to ensure that risk to controlled waters are not increased.

4 REMEDIAL STRATEGY

The remedial strategy outlined below is based on the existing proposed site development. Should the proposed layout change or the site end use be altered, the proposed remedial options may require reassessment.

Remediation is a form of risk management, which aims to demonstrably disrupt the pollutant linkage between the source, pathway and receptor. Breaking the pollutant linkage can be done in a variety of ways; for example, reducing, destroying or otherwise modifying the source of the contamination, managing pathways through barriers or modification boundaries, and receptor protection by restricting or changing the land-use.

For ground gas this would consist of inclusion of engineered gas protection measures within the structure of the new building to provide an impermeable barrier to ingress from gas in the ground.

For hydrocarbon contamination this would consist of removal of any significantly contaminated soil (source material) identified during the works.

The following preliminary remedial strategy is recommended for the site, subject to final approval from the Regulatory Authorities such as the Contaminated Land Officer (CLO) or Environmental Health Officer (EHO).

4.1 Remedial Strategy

4.1.1 Ground Gas

The construction project is being let on a “Design and Build” basis by the Client, and accordingly detailed design, installation and validation of the gas protection measures will be the responsibility of the successful contractor. However, the following points are considered relevant for the designers.

It is understood that the building foundations are expected to be CFA bored piles and that the ground floor slab is a cast in-situ reinforced concrete suspended floor slab. It should be noted that suspended in this context refers to the transmittal of the floor load to the piles rather than the ground and does not indicate the presence of an underfloor free air void.

The building type is considered to be Type D as defined by BS8485, with the small internal rooms being considered Type C due to their reduced volume.

Ground gas protective measures within buildings include a combination of: structural barriers, ventilation systems and gas resistant membranes. Section 7 of BS8485 provides a point scoring system for ground gas protective measures, whereby different barriers (i.e. structural barriers, ventilation systems, and gas resistant membranes) are assigned different point scores. A combination of protective measures (minimum of 2 types) can be used to achieve a total minimum gas protection point score, the total minimum point score required is determined based on the building type (see Table 3 in BS8485) and the risk classification.

Considering the CS determined for the site (CS2) and the proposed buildings type (Type C) a minimum point score (see Table 4 in BS8485) of 2.5 will be required to achieve an adequate level of protection. As an example, the cast in-situ monolithic reinforced suspended floor slab with minimal penetrations (score of 1) and a proprietary gas resistant membrane (score of 2) would provide a total point score of 3, which would be considered adequate for the proposed development.

It should be noted that for membranes to achieve a point score greater than zero they should be:

- sufficiently impervious to methane and carbon dioxide
- capable after installation of providing a complete barrier to the entry of the relevant gas
- sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions
- sufficiently strong to withstand in-service stresses (e.g. due to ground settlement if placed below a floor slab)
- sufficiently strong to withstand the installation process and following construction activities until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, and dropping tools)
- chemically resistant to degradation by other contaminants that might be present
- verified in accordance with CIRIA C735.

A detailed design report (which this report is not) should be prepared for the proposed mitigation measures and should be provided to and agreed with the local authority and relevant warranty providers prior to construction works commencing. The design report should include a combination of the following:

- gas conceptualisation (severity of gas regime and sensitivity of land use)
- building and construction related details such as floor slab, wall construction, ground conditions and any complex detailing
- gas protection design sufficient to mitigate the gas risk and be practically installed given the building and construction related details. Likely to include venting calculations (if applicable), product specifications, installation methodology and installer qualifications/experience
- verification plan (prepared in accordance with CIRIA C735) to identify the verification tasks, frequency of such tasks and by whom they should be undertaken, regulatory requirement and contingency plans. The verification measures required will be dependent on a number of factors including the gas regime, the qualifications of the installers, the complexity of the design and the size of the development.

4.1.2 Unexpected Contamination

4.1.2.1 Contractors Watching Brief

Vigilance should be maintained during the groundworks phase of the investigation, particularly including inspection of the pile arisings and any excavation made for the loading bay access ramp, the sewer diversion and the new drainage, including the attenuation tank, for any evidence of unexpected contamination.

Should visual or olfactory evidence of hydrocarbon residues, asbestos, buried drums, interceptors, fuel storage tanks or any other unexpected hazards be discovered during site works, the site contractor should inform immediately the Site Manager who should contact the appointed Geo-Environmental Consultant.

As noted in Table 1, several areas of odours have previously been identified, and reportable hydrocarbon contamination would comprise any areas which exhibit;

- moderate to strong hydrocarbon odours in soils, and/or
- dark or blue staining; and/or
- evidence of free product (liquid oil or fuel) in soils, run-off or sitting on water accumulating in excavations or on the surface of the site.

Upon discovery of such potential contamination work should be postponed in the immediate area of the discovery and the area cordoned off. The discovery should be inspected, sampled and/or analysed by the appointed Geo-Environmental Consultant to assess the potential risk. Significant contamination considered to pose a risk of potential mobilisation of hydrocarbons to groundwater and the adjacent stream should be considered a source of contamination and should be removed. Storage tank contents and free product on collected water will have to be removed by suitable plant and potentially by a specialist contractor.

If larger quantities of asbestos cement or any Man-Made Mineral Fibre insulated pipe work, or unidentified insulation material is discovered during the redevelopment works, the principal site contractor should inform the Site Manager and contact the appointed Geo-Environmental Consultant. The principal site contractor should postpone work in the immediate area of the discovery until the Consultant arrives. The area should be cordoned off, though work may continue within other areas of the site, until the discovery has been inspected, sampled and/or analysed to assess the potential risk.

It is likely that should higher risk forms of asbestos be detected, any works in the affected area would be notifiable to the HSE, and would require completion by a licensed specialist asbestos contractor. Additional precautions, including air monitoring and additional dust suppression would likely be required.

4.1.2.2 Hydrocarbon Contaminated Soils

Following identification, any impacted contaminated soils deemed to pose a plausible risk of contamination to groundwater should be removed from the ground as far as reasonably practicable. This work should be supervised and documented by the appointed Geo-Environmental Consultant.

Soils from the excavation as well as its sides and floor will also be screened for volatile organic compounds (VOC) using a photo-ionisation detection (PID) and laboratory

testing of samples for speciated TPH (TPHCWG). The extent of any potential hotspot will be identified as those samples with a PID headspace reading of less than 30ppm and through the visual evidence of the presence of free product.

For health and safety and to avoid damage to neighbouring structures it is proposed that no excavation will be undertaken within 3 m of the existing foundation of the adjacent boundary wall to the southwest. Nor will any remedial excavation be undertaken within a zone extending 45 degrees into the site from the top of the rear face of the retaining wall, nor below the base of any footing for that retaining wall which runs along the boundary with the Riders Lane Stream. In addition, no remedial excavations will be undertaken within any tree protection zones created for the trees adjacent to the south-eastern boundary of the site.

Once the extent of any contamination has been reached, the sides and base of the excavation will be verified by using initially a PID followed by collection of samples from each of the four faces of the excavation at 5 m intervals and the base of the excavation at a rate of 1 per 25 m².

5 REMEDIATION/CONSTRUCTION CONSIDERATIONS

5.1 General

5.1.1 Storing and Stockpiling of Hydrocarbon Contaminated Soils

Stockpiling of potentially hydrocarbon contaminated material should be placed directly into a lined skip or placed on top of heavy duty plastic sheeting, surrounded by a soil bund covered with impermeable plastic sheeting. Methods should be employed to keep the stockpile as dry as possible by covering with impermeable sheeting and tapering the pile to ensure maximum runoff with removal of any waters within the bunded area to prevent over spilling of water from the bund with potential contamination. Stockpiles should be placed as far away as possible from nearby buildings and surrounded with heras fencing.

Surface water should be pumped from the bunds to prevent overflow, tested and discharged to sewer (with appropriate discharge consent) or tankered offsite as appropriate.

5.1.2 Storing and Stockpiling of Asbestos Contaminated Soils

Ideally, once asbestos contaminated soils have been excavated, they should be immediately removed from site. Should this not be possible it would be preferable to place the soils in lined skips which can be covered and protected from the elements. This would also prevent any excess run-off, should soils also be affected by hydrocarbon contamination.

The stockpiling of asbestos contaminated soils should be avoided where possible with affected soils being removed from site immediately after excavation. Should stockpiling of these soils be unavoidable then the following precautionary actions should be adhered to:

- a) The stockpile should be secured with heras fencing around its entire perimeter to prevent unauthorised access,
- b) In addition to fencing, the stockpile should be clearly signed as asbestos contaminated materials in order to prevent accidental use of the soils,
- c) The stockpile should be placed on suitable material (i.e. polythene sheeting, lapped up at the edges) to prevent migration or spreading of contaminants to the underlying soils,
- d) The stockpile should be covered with a polythene sheeting or tarpaulin material in order to suppress any dust which may arise from the soils, and
- e) While the stockpile is uncovered, for example during the initial stockpiling or during removal, the soils should be constantly wet down through the use of water spraying, although this may not be possible if the soils are also contaminated with hydrocarbons. In this case, a lined skip as described above, should be utilised.

All works on or affecting asbestos containing materials are subject to the Control of Asbestos Regulations 2012¹. Depending on the nature of the works, they may be classed as licensable under the Regulations and therefore must be carried out by a specialist asbestos contractor and licensed by the Health & Safety Executive. This normally applies to most work involving asbestos insulation, spray coatings or insulating board but can apply to work with other materials as well.

The site investigation works has not indicated the presence of asbestos materials that are licensable however the Contractor should be mindful that work is only classed as non-licensable if:

- a) *the exposure of employees to asbestos is sporadic and of low intensity (no exposure to asbestos will be sporadic and of low intensity if the concentration of asbestos in the air exceeds or is liable to exceed 0.6 fibres per cubic centimetre (f/cm^3), measured over a 10 minute period);*
- b) *it is clear from the risk assessment that the exposure of any employee to asbestos will not exceed the control limit (the control limit being 0.1 f/cm^3 , measured over a period of 4 hours); or*
- c) *the work involves:*
 - i. *short, non-continuous maintenance activities (works can only be considered short and non-continuous if any one person carries out work for less than one hour in a seven-day period and the total time spent by all workers on the work does not exceed a total of two hours);*
 - ii. *removal of materials in which the asbestos fibres are firmly linked in a matrix (these include asbestos cement, textured decorative coatings and paints and any article of bitumen, resin or rubber which contains asbestos where its thermal or acoustic properties are incidental to its main purpose, e.g. vinyl floor tiles, electric cables, roofing felt. It does not include thermal insulation / lagging, spray coating or asbestos insulating board);*
 - iii. *encapsulation or sealing of asbestos-containing materials which are in good condition; or*
 - iv. *air monitoring and control, and the collection and analysis of samples to ascertain whether a specific material contains asbestos.*

The Code of Asbestos Regulations 2012 provides guidance text for employers about work which disturbs, or is likely to disturb, asbestos, asbestos sampling and laboratory analysis. It also provides guidance on the specific duty to manage asbestos on the owners and/or those responsible for maintenance in non-domestic premises.

The Regulations set out your legal duties and the ACOP and guidance give practical advice on how to comply with those requirements. The Regulations give minimum standards for protecting employees from risks associated with exposure to asbestos.

5.1.3 Drains, Interceptors and Soakaways

Prior to redevelopment, these features, if encountered, should be emptied of all liquids/sludge and chemical analysis should be undertaken to determine an appropriate disposal method. Subject to regulatory authority agreement this may be by foul sewer

or, alternatively, by effluent tanker for offsite treatment/disposal. Collected water should not be disposed of via any ground surface, drain or surface watercourse without the appropriate regulatory consents to discharge. Drainage structures should then be broken out and excavated where necessary or grouted and sealed.

5.1.4 Dust Suppression and Wheel/Vehicle Washing

In dry windy weather or during dust generating works (e.g. crushing, stockpiling and soil movements), precautions should be taken to minimise dust generation by the use of water sprays and road sweepers. Haulage vehicles should be sheeted before leaving site. Additional precautions should be taken to minimise the potential (i.e. such as localised wheel washing) within any area noted as having asbestos fibres/identifiable pieces.

Ideally, haulage vehicles should be kept on hardstanding areas where possible. It would be prudent to use road sweepers to ensure that roads to and from the site are also kept clean, and preferentially the use of a wheel wash prior to vehicles leaving site.

If areas of greater asbestos impact are identified during the works, then wetting down of excavated soils during soil movements is essential to prevent the release of asbestos fibres.

All stockpiles of soil should be appropriately placed on hardstanding or suitable soft cover to prevent cross contamination. Soils should be covered with terram to prevent dust generation.

5.1.5 Noise and Vibration

All works should be carried out in accordance with the Environmental Protection Act 1990 (EPA 90) and BS 4142 1990 'Industrial noise affecting residential areas', and BS 5228 'Noise control on construction sites' (where applicable). Site noise and vibration requirements if specified within the planning consent should also be adhered to.

6 WASTE MANAGEMENT

6.1 Classification and Disposal

Any excavated excess spoil should always be classified prior to removal from site as required by 'Duty of Care' (Environmental Protection Act 1990) legislation. This means that material has to be given a proper description and waste classification prior to removal; consequently, details of the materials required for disposal, together with certificates of chemical analysis should be sent to a suitably licensed waste disposal contractor for classification and to confirm compliance with their license conditions.

It should be noted that since July 2005 the European Waste Catalogue definition has been required to determine whether hazardous materials are present. Contaminated Made Ground is usually classified as a Mirror Entry "17 05 03* soil and stones containing dangerous substances". Waste Acceptance Criteria (WAC) is then required for any material classified as Inert or Hazardous. There are no WAC limits for Non Hazardous materials.

A waste disposal log should be maintained by the main contractor. Copies of waste transfer logs, waste transfer tickets, waste consignment notes and landfill receipt tickets, should they be generated, should be provided to the appointed Geo-Environmental Consultant for inclusion in the validation report. A photographic log of the material excavated along with the base and sides of the excavation once complete should be kept and provided to appointed Geo-Environmental Consultant for the inclusion in the validation report.

Depending on the final nature of soil requiring removal from site, further laboratory testing may be required. The testing frequency for any waste soils should be confirmed with the landfill to ensure that their requirements are fulfilled.

7 VALIDATION REPORTING

All remedial works carried out on site will need to be validated and reported as highlighted below.

7.1 Excavation Validation

It is proposed that the base and sides of any excavations completed for the removal of hydrocarbon or other contamination should be visually inspected and sampled by a suitably qualified Geo-Environmental Engineer at a rate of 1 sample per 5m per wall and 1 sample per 25m² of base, and that a photographic log is made to ensure that all made ground materials or natural soils remaining appear clear of significant hydrocarbon contamination and should be included in the validation report.

Each sample from the sides and base of the excavations should be tested for the presence of TPH across the whole excavation, with the results compared to the RSK generic assessment criteria for commercial use, to ensure that no vapour risk would exist to the development from any residual hydrocarbon contamination.

A photographic record should be kept and material tracking should be undertaken and documented to be included in the validation report.

7.2 Imported Soil Validation

If imported subsoil and topsoil is required on the site, chemical analysis of the following determinants in soil should be undertaken to ensure that any imported material is suitable for use:

- Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium and zinc);
- pH and Soil Organic Matter (SOM);
- BTEX compounds;
- Total Petroleum Hydrocarbons (TPH) split into aliphatic and aromatic carbon bands;
- PAH split into the EPA Priority 16 substances;
- Asbestos screen; and
- Leachable metals (as above)

In line with current NHBC best practice, described in Guidance on Validation of Imported Topsoil and Retained/Re-used Topsoil (Updated June 2006); topsoil samples should be taken at a frequency of 1 test per 250m³. Subsoil should be sampled at a frequency of 1 test per 500m³.

Soil concentrations should be validated against the RSK Commercial GAC given in Appendix D for soil SOM concentrations specific to the imported material. In addition there should be no asbestos in the imported material.

Documentation should also be provided to include the name and origin of the supplier of imported materials.

7.3 Validation Statement / Report

A validation report should be produced by the appointed Geo-Environmental Consultant on completion of the construction works to be issued to the relevant authorities for comment. This document should include the following sections:

- Plans showing the positions and extents of any remediated areas;
- Site Photographs;
- The description of any remedial methods used;
- The results of soil validation sampling and analysis;
- Details of any waste disposal movements and waste transfer notes;
- Validation information for the gas protection measures to include photographs, inspection records, installers sign-off sheets and integrity testing as specified by the designers;
- Details of any imported topsoil or subsoil; and
- Details of consultations with regulatory authorities.

8 MONITORING AND DOCUMENTATION OF REMEDIATION WORKS

8.1 Contractor Responsibilities

The Contractor will be responsible for the implementation of this Remediation Methodology, site security and the health and safety of all site workers. The appointed ground works contractor should provide (and be responsible for) all the required equipment, including personal protective equipment, to implement the ground works. Method statements should also be provided for the different phases of site works. The contractor will also be responsible for any specialist air monitoring to be undertaken at the appropriate points during the works, as noted in Section 5.1.6.

Appropriate measures will be taken by the ground works contractor (i.e. in the form of temporary fencing and visual markers) around excavations that are left unattended for any period of time.

If no reportable contamination is identified during the groundworks phase, then the Contractor shall provide a declaration attesting to this fact.

8.2 Geo-Environmental Consultant Responsibilities

Excavation of any identified contaminated material should be monitored and documented by a suitably qualified Geo-Environmental Consultant. On-site visual observations should be backed up by the recovery of soil validation samples, in suitable containers, for chemical analysis to determine the suitability of remaining material.

We would therefore recommend that a Geo-Environmental Consultant be appointed to document the following items:

- Periodic inspection of pile arising and excavations on the scheme for potentially significant contamination;
- Removal of any significant unexpected contamination if encountered;
- Visual validation supported by sampling and testing of any remediated areas;
- Visual inspection of the installation of the gas protection measures (in addition to any independent 3rd party validation); and
- Production of a Post-Remediation Validation Report detailing the works carried out.

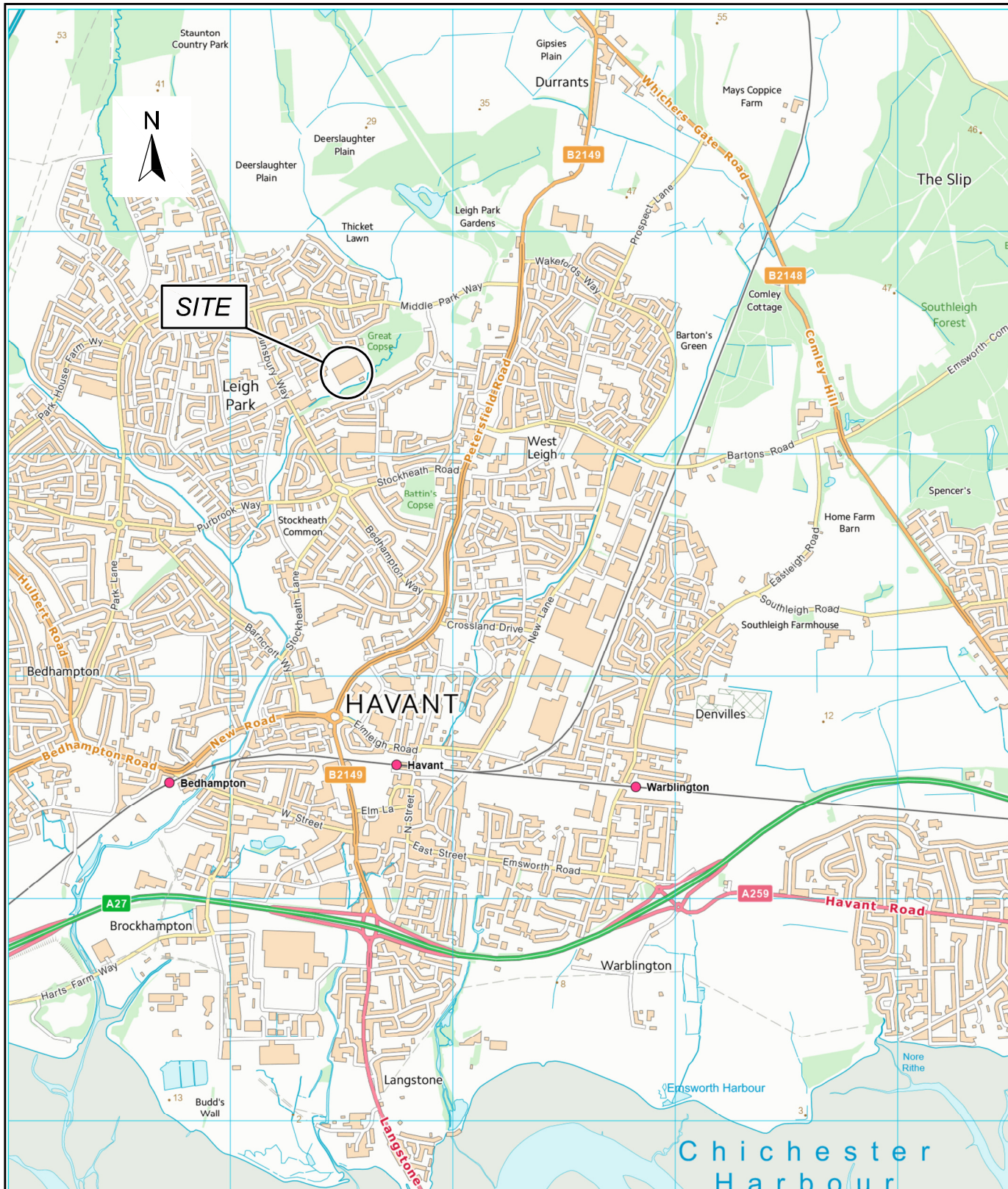
9 REFERENCES

- 9.1** Entec Uk Limited Phase 1 Desk Study, Proctor & Gamble Product Supply (Uk) Ltd, Havant - July 2003
- 9.2** Entec Uk Limited Phase 2 Site Investigation, Proctor & Gamble Product Supply (Uk) Ltd, Havant - August 2003
- 9.3** Enviros Consulting Ltd, Environmental Investigation to support planning application, former Procter & Gamble Site, Havant, DW018001A October 2004 (Fragment)
- 9.4** Enviros Consulting Ltd Letter Report - Southern Area Former Proctor & Gamble site, Havant - Remediation of hydrocarbon – April 2006
- 9.5** Structural Soils Ltd. Interpretive Report on Ground Investigation at Fulflood Road, Havant, 730438, September 2015
- 9.6** Soiltechnics Ltd. Ground Investigation Report, Proposed Industrial development, Land adjacent to MIPA Paints Limited, Fulflood Road, Havant, PO9 5AX, December 2016
- 9.7** Structural Soils Ltd. Interpretive Report on Ground Investigation, Fulflood Road, Havant, 733845-1 (01), November 2018.
- 9.8** R & D Publication CLR 11 (September 2004). *Model Procedures for the Management of Contaminated Land*. Environment Agency
- 9.9** CIRIA Report C665 *Assessing risks posed by hazardous ground gases to buildings*, London, 2007
- 9.10** BS 8485:2015 Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings
- 9.11** CIRIA Report C735 Good practice on the testing and verification of protection systems for buildings against hazardous ground gases, London, 2014
- 9.12** *The Control of Asbestos Regulations 2012*
- 9.13** Guidance on the Assessment and Classification of Waste, Environment Agency, WM3, First Edition 2015.

Landfill (England & Wales) Regulations 2002.

APPENDIX A - PLANS AND DRAWINGS

- (i) Site Location Plan
- (ii) Proposed Development & Drainage Layout Plan



Contains Ordnance Survey data © Crown copyright and database right 2013



STRUCTURAL SOILS

The Old School
Stillhouse Lane
Bedminster
Bristol BS3 4EB

Tel: 0117 947 1000
ask@soils.co.uk
www.soils.co.uk

CLIENT

Mipa Paints Ltd

PROJECT

Fulflood Road, Havant

TITLE

SITE LOCATION MAP

00	26.10.2018	-	NP	JE	-
REV.	DATE	DESCRIPTION	BY	CHD.	APR.
DIMENSION	SCALE	DRAWING STATUS			
m	1:25,000	-			

JOB NO

733845

GRID REF

SU 714 083

SCALE BAR



ORIGIN SIZE

A4

FIGURE

1

GENERAL NOTES

- This drawing is to be read in conjunction with all Engineer's, Architect's or relevant drawings and specifications.
- All dimensions and levels are to be checked on site by the contractor prior to preparing any working drawings or commencing on site.
- The contractor must ensure and will be held responsible for the overall stability of the building/structure/excavation at all stages of the work.
- All work by the contractor must be carried out in such a way that all requirements under the 'Health and Safety at Work Act' are satisfied.
- All work is to be carried out in compliance with the requirements of the relevant statutory authorities and regulations.
- Refer to General Notes Drawing WMP-AKSW-XX-XX-DR-C-00000

Architects Drawings:

This drawing has been created based on the following
pdp architecture llp Architects Drawings:

27974-TD200-208 Tender Drawings [Preliminary]



IDENTIFIES RISKS DURING THE CONSTRUCTION PROCESS ON THE DRAWINGS.

NOTE: The list below and notes on the drawing identify risks which are deemed to be unusual, abnormal, residual or unexpected to a competent contractor carrying out the works. These notes relate to risks which we have been unable to design out.

All information shown on this drawing is for Design and Build Tender purposes only and is subject to final design and co-ordination.

T02	Extent of permeable paving revised,	MDL	RJS	04.10.18
T01	Issued for Design and Build Tender	MDL	RJS	07.09.18
Rev.	Amendment	Drn	Chkd	Date

Drg. Status	Tender	Suitability	D2
-------------	--------	-------------	----

AKSWard[®]

CONSTRUCTION CONSULTANTS

116 High Street
The French Quarter
Southampton
SO14 2AA

Tel: 02380 235340
Fax: 02380 634294
e-mail: southampton@aksward.com
web: www.aksward.com

- London
- Hitchin
- Oxford
- Southampton

Client **MIPA Paints**

Project **Proposed Development
Fulford Road
Leigh Park**

Title **Drainage Layout**

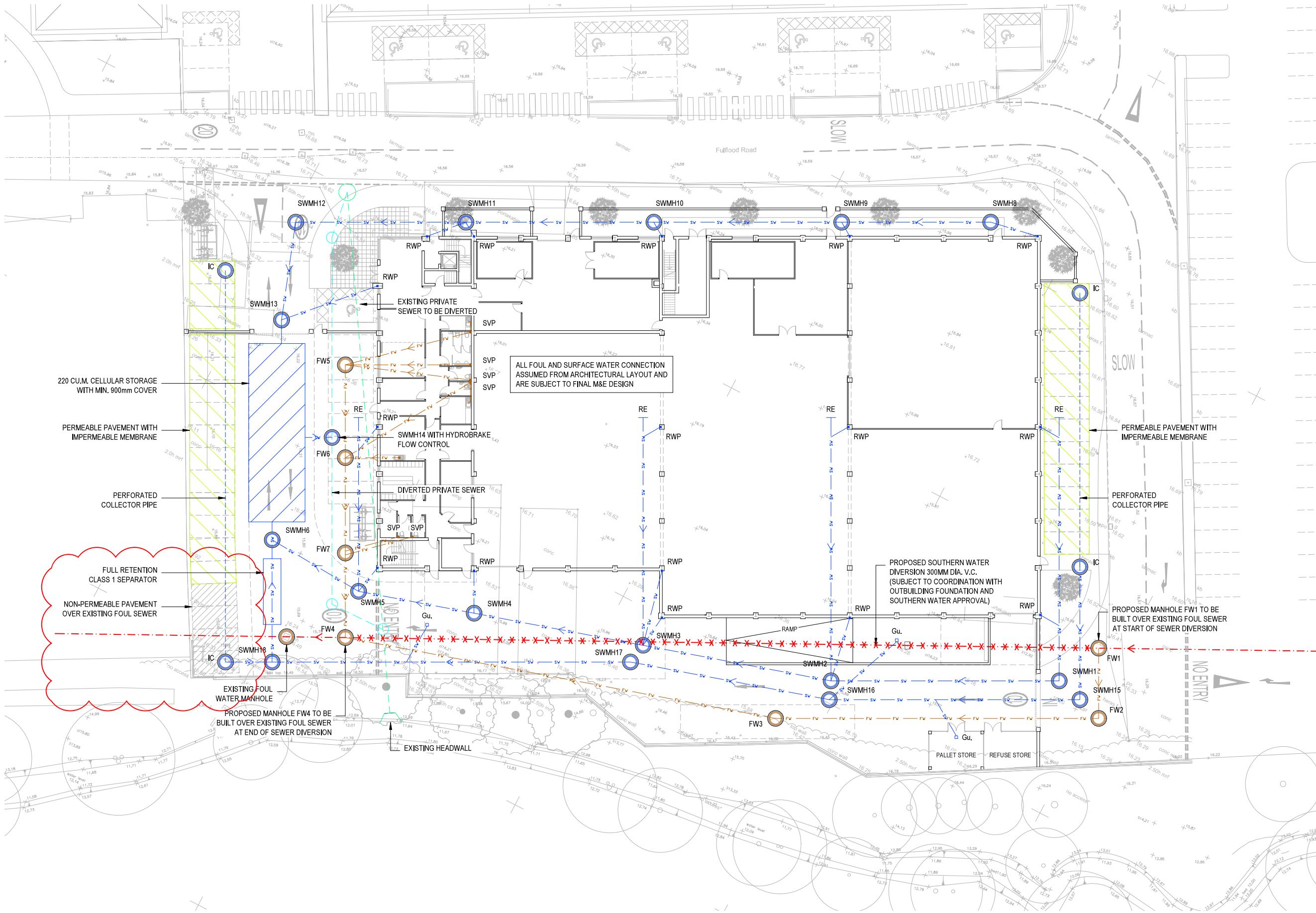
Reviewed Scheme RJS Date 30.08.18

Reviewed Final Date

Scales at A1 1:200 Project No. **S158024**

Project Ref. Originator Zone Level Type Role Drg No. Rev.

WMP AKSW XX XX DR C 92005 T02



APPENDIX B - HUMAN HEALTH GENERIC ASSESSMENT CRITERIA FOR A COMMERCIAL END USE

- (i) RSK Group Generic Assessment Criteria (GAC)

Generic assessment criteria for human health: commercial scenario

Background

RSK's generic assessment criteria (GAC) were initially prepared following the publication by the Environment Agency (EA) of soil guideline value (SGV) and toxicological (TOX) reports, and associated publications in 2009⁽¹⁾. RSK GAC were updated following the publication of GAC by LQM/CIEH in 2009⁽²⁾. RSK GAC are periodically revised when updated information on toxicological, land use or receptor parameters is published.

Updates to the RSK GAC

In 2014, the publication of Category 4 Screening Levels (C4SL)^(3,4), as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3)⁽⁵⁾ used in the generation of SGVs.

C4SL were published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010⁽³⁾). Where a C4SL has been published, the RSK GAC duplicates the C4SL published values using all input parameters within the SP1010 final project report⁽³⁾ and associated appendices⁽⁶⁾, and adopts them as GAC for these six substances.

For all other substances the only C4SL exposure modification relevant to a commercial end use are daily inhalation rates.

The RSK GAC have also been revised with updated toxicology published by LQM/CIEH in 2015⁽⁷⁾ or by the USEPA⁽¹⁴⁾, where a C4SL has not been published.

RSK GAC derivation for metals and organic compounds

Model selection

Soil assessment criteria (SAC) were calculated using the Contaminated Land Exposure Assessment (CLEA) tool v1.071, supporting EA guidance^(5,8,9) and revised exposure scenarios published for the C4SL⁽³⁾. The SAC are also termed GAC.

Pathway selection

In accordance with SR3⁽⁵⁾ the commercial scenario considers risks to a female worker who works from the age of 16 to 65 years. It should be noted that this end use is not suitable for a workplace nursery but may be appropriate for a sports centre or shopping centre where children are present. In accordance with Box 3.5, SR3⁽⁵⁾ the pathways considered for production of the SAC in the commercial scenario are

- direct soil and dust ingestion
- dermal contact with soil both indoors and outdoors
- indoor air inhalation from soil and vapour and outdoor inhalation of soil and vapour.

With respect to volatilisation, the CLEA model assumes a simple linear partitioning of a chemical in the soil between the sorbed, dissolved and vapour phase⁽⁹⁾. The upper boundaries of this partitioning are represented by the maximum aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA model estimates saturated soil concentrations where these limits are reached⁽⁹⁾. The CLEA software uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous- or vapour-based soil saturation limits. Model output cells are flagged red where the saturated soil concentration has been exceeded and the contribution of the indoor and outdoor vapour pathway to total exposure is greater than 10%. In this case, further consideration of the following is required⁽⁹⁾:

- Free phase contamination may be present.
- Exposure from the vapour pathways will be over-predicted by the model, as in reality the vapour phase concentration will not increase at concentrations above saturation limits
- Where the vapour pathway contribution is greater than 90%, it is unlikely the relevant health criteria value (HCV) will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Where the vapour pathway is the predominant pathway (contributes greater than 90% of exposure) or the only exposure route considered and the cell is highlighted red (SAC exceeds saturation limit), the risk based on the assumed conceptual model is likely to be negligible as the vapour risk is assumed to be tolerable at maximum possible soil concentrations. In such circumstances, the vapour pathway exposure should be considered based on the presence of free phase or non-aqueous phase liquid sources and the measured concentrations of volatile organic compounds (VOC) in the vapour phase. Screening could be considered based on setting the SAC as the modelled soil saturation limits. However, as stated within the CLEA handbook⁽⁹⁾, this is likely to not be practical in many cases because of the very low saturation limits and, in any case, is highly conservative.

It should also be noted that for mixtures of compounds, free phase may be present where soil (or groundwater) concentrations are well below saturation limits for individual compounds.

Where the vapour pathway is only one of the exposure pathways considered, an additional approach can then be utilised as detailed within Section 4.12 of the CLEA model handbook⁽⁹⁾, which explains how to calculate an effective assessment criterion manually.

SR3⁽⁵⁾ states that, as a general rule of thumb, it is recognised that estimating vapour phase concentrations from dissolved and sorbed phase contamination by petroleum hydrocarbons are at least a factor of ten higher than those likely to be measured on-site. RSK has therefore applied an empirical subsurface to indoor air correction factor of 10 into the CLEA model chemical database for all petroleum hydrocarbon fractions (including BTEX, trimethylbenzenes and the polycyclic aromatic hydrocarbons (PAH) naphthalene, acenaphthene and acenaphthylene) to reduce this conservatism.

Input selection

The most up-to-date published chemical and toxicological data was obtained from EA Report SC050021/SR7⁽¹⁰⁾, the EA TOX⁽¹⁾ reports, the C4SL SP1010 project report and associated appendices^(3,6), the 2015 LQM/CIEH report⁽⁷⁾ or the USEPA IRIS database⁽¹⁴⁾. Where a C4SL has been published, the RSK GAC have duplicated the C4SL published values using all input parameters within the SP1010 final project report⁽³⁾ and associated appendices⁽⁶⁾, and has

adopted them as GAC for these six substances. Toxicological and specific chemical parameters for 1,2,4-trimethylbenzene, methyl tertiary-butyl ether (MTBE), 1,1,2-trichloroethane, 1,1-dichloroethene, 1,2-dichloropropane, 2-chloronaphthalene, chloroethane, chloromethane, cis 1,2-dichloroethene, dichloromethane, hexachloroethane and trans 1,2-dichloroethene were obtained from the CL:AIRE Soil Generic Assessment Criteria report⁽¹¹⁾.

For TPH, aromatic hydrocarbons C₅–C₈ were not modelled, as this range comprises benzene (>EC5-EC7) and toluene (>EC7-EC8), which are modelled separately.

Physical parameters

For the commercial end use, the CLEA default pre-1970s three-storey office building was used. SR3⁽⁵⁾ notes this commercial building type to be the most conservative in terms of protection from vapour intrusion. The default input building parameters presented in Table 3.10 of SR3⁽⁵⁾ have been used.

The parameters for a sandy loam soil type were used in line with Table 4.4 of SR3⁽⁵⁾. This includes a value of 6% for the percentage of soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site-specific risk assessments for this SOM, RSK has produced an additional set of GAC for SOM of 1% and 2.5% for all substances using the CLEA tool.

Summary of modifications to the default CLEA SR3⁽⁵⁾ input parameters for a commercial land use

In summary, the RSK commercial GAC were produced using the default input parameters for soil properties, the air dispersion model, building properties and the vapour model detailed in SR3⁽⁵⁾. Modifications to the default SR3⁽⁵⁾ exposure scenarios based on the C4SL exposure scenarios⁽³⁾ are presented in Table 2 below. The sole modification to the default commercial input parameters is the updated inhalation rate.

The final selected GAC are presented by pathway in Table 3 with the combined GAC in Table 4.

Figure 1: Conceptual model for CLEA commercial scenario

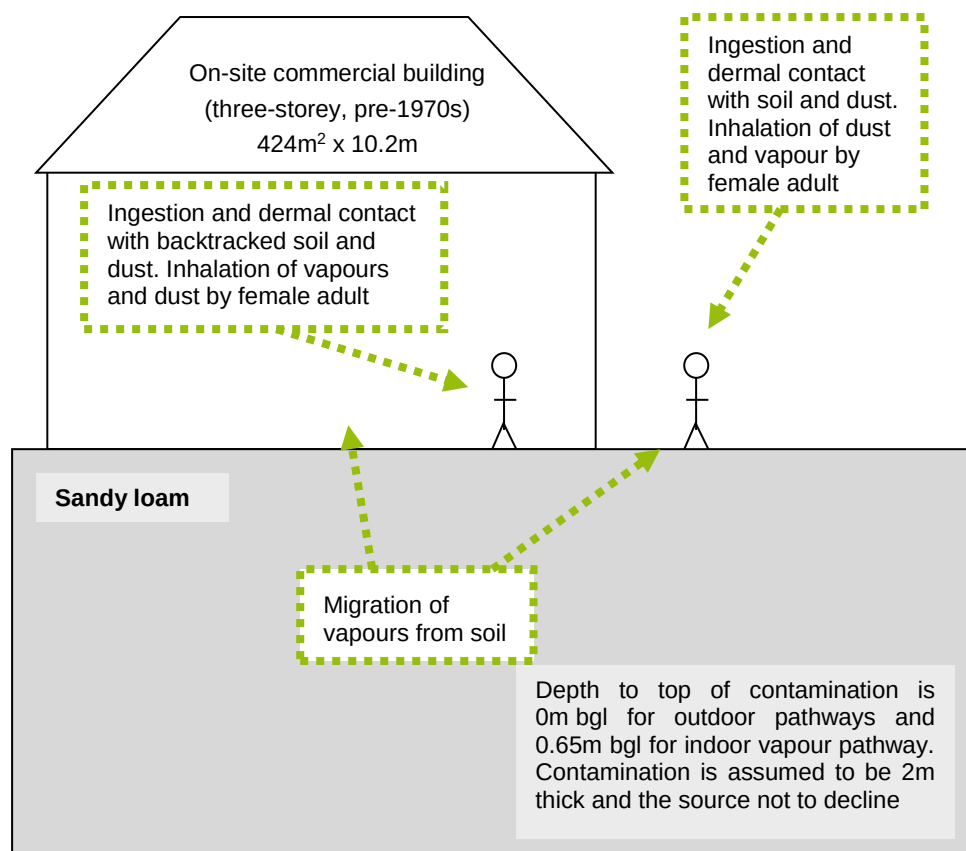


Table 1: Exposure assessment parameters for commercial scenario – inputs for CLEA model

Parameter	Value	Justification
Land use	Commercial	Chosen land use
Receptor	Female worker	Taken as female adult exposed over 49 years from age 16 to 65 years, Box 3.5, SR3 ⁽⁵⁾
Building	Office (pre-1970)	Key generic assumption given in Box 3.5, SR3 ⁽⁵⁾ . Pre-1970s three-storey office building chosen as it is the most conservative in terms of protection from vapour intrusion (Section 3.4.6, SR3 ⁽⁵⁾)
Soil type	Sandy loam	Most common UK soil type (Section 4.3.1, Table 4.4, SR3 ⁽⁵⁾)
Start age class (AC)	17	AC corresponding to key generic assumption that the critical receptor is a working female adult exposed over a 49-year period from age 16 to 65 years. Assumption given in Box 3.5, SR3 ⁽⁵⁾
End AC	17	
SOM (%)	6	Representative of sandy loam according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents' ⁽¹³⁾
	1	To provide SAC for sites where SOM < 6% as often observed by RSK
	2.5	
pH	7	Model default

Table 2: Commercial – modified receptor inputs

Parameter	Unit	Value	Justification
Inhalation rate (AC17)	m ³ day ⁻¹	15.7	Mean value USEPA, 2011 ⁽¹²⁾ ; Table 3.2, SP1010 ⁽³⁾

References

1. Environment Agency (2009), 'Science Reports SC050021 - SGV and TOX reports for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs'; 'Supplementary information for the derivation of SGV for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs', and 'Contaminants in soil: updated collation of toxicological data and intake values for humans: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs'. Available at: <https://www.gov.uk/government/publications/contaminants-in-soil-updated-collation-of-toxicological-data-and-intake-values-for-humans> and <https://www.gov.uk/government/publications/land-contamination-soil-guideline-values-sgvs> (accessed 4 February 2015)
2. Nathanial, C. P., McCaffrey, C., Ashmore, M., Cheng, Y., Gillet, A. G., Ogden, R. C. and Scott, D. (2009), *LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment*, second edition (Nottingham: Land Quality Press).
3. Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination', Revision 2, DEFRA research project SP1010.
4. Department for Environment, Food and Rural Affairs (Defra) (2014), 'SP1010: Development of Category 4 Screening Levels for assessment of land affected by contamination – Policy Companion Document', Revision 2.
5. Environment Agency (2009), *Science Report – SC050021/SR3. Updated technical background to the CLEA model* (Bristol: Environment Agency).
6. Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). 'Appendices C to H). DEFRA research project SP1010'.
7. Nathanial, C. P., McCaffrey, C., Gillet, A. G., Ogden, R. C. and Nathanial, J. F. (2015), *The LQM/CIEH S4ULs for Human Health Risk Assessment* (Nottingham: Land Quality Press).
8. Environment Agency (2009), *Human health toxicological assessment of contaminants in soil. Science Report – Final SC050021/SR2* (Bristol: Environment Agency).
9. Environment Agency (2009), *Science Report – SC050021/SR4 CLEA Software (version 1.05) Handbook* (Bristol: Environment Agency).
10. Environment Agency (2008), *Science Report SC050021/SR7. Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values* (Bristol: Environment Agency).
11. CL:AIRE (2010), *Soil Generic Assessment Criteria for Human Health Risk Assessment* (London: CL:AIRE).
12. USEPA (2011), *Exposure factors handbook*, EPA/600/R-090/052F (Washington, DC: Office of Research and Development).
13. Environment Agency (2009), 'Changes made to the CLEA framework documents after the three-month evaluation period in 2008', released January 2009.
14. USEPA (2010). Hydrogen cyanide and cyanide salts. Integrated Risk Information Systems (IRIS) Chemical Assessment Summary. September 2010. <https://www.epa.gov/iris> (accessed 9 December 2015)

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - COMMERCIAL



Table 3

Human health generic assessment criteria by pathway for commercial scenario

Compound	Notes	SAC appropriate to pathway SOM 1% (mg/kg)			Soil saturation limit (mg/kg)	SAC appropriate to pathway SOM 2.5% (mg/kg)			Soil saturation limit (mg/kg)	SAC appropriate to pathway SOM 6% (mg/kg)			Soil saturation limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Metals													
Arsenic	(a,b)	6.35E+02	1.25E+03	NR	NR	6.35E+02	1.25E+03	NR	NR	6.35E+02	1.25E+03	NR	NR
Cadmium	(a)	7.73E+02	8.57E+02	4.10E+02	NR	7.73E+02	8.57E+02	4.10E+02	NR	7.73E+02	8.57E+02	4.10E+02	NR
Chromium (III) - trivalent	(c)	3.31E+05	8.57E+03	NR	NR	3.31E+05	8.57E+03	NR	NR	3.31E+05	8.57E+03	NR	NR
Chromium (VI) - hexavalent	(a,d)	9.62E+02	4.91E+01	NR	NR	9.62E+02	4.91E+01	NR	NR	9.62E+02	4.91E+01	NR	NR
Copper		1.89E+05	8.96E+04	6.83E+04	NR	1.89E+05	8.96E+04	6.83E+04	NR	1.89E+05	8.96E+04	6.83E+04	NR
Lead	(a)	2.32E+03	NR	NR	NR	2.32E+03	NR	NR	NR	2.32E+03	NR	NR	NR
Elemental Mercury (Hg ⁰)	(d)	NR	1.54E+01	NR	4.31E+00	NR	3.26E+01	NR	1.07E+01	NR	5.80E+01	NR	2.58E+01
Inorganic Mercury (Hg ²⁺)		1.18E+03	1.97E+04	1.12E+03	NR	1.18E+03	1.97E+04	1.12E+03	NR	1.18E+03	1.97E+04	1.12E+03	NR
Methyl Mercury (Hg ⁴⁺)		3.38E+02	2.13E+03	2.92E+02	7.33E+01	3.38E+02	3.87E+03	3.11E+02	1.42E+02	3.38E+02	7.33E+03	3.23E+02	3.04E+02
Nickel	(d)	3.06E+03	9.83E+02	NR	NR	3.06E+03	9.83E+02	NR	NR	3.06E+03	9.83E+02	NR	NR
Selenium	(b)	1.23E+04	NR	NR	NR	1.23E+04	NR	NR	NR	1.23E+04	NR	NR	NR
Zinc	(b)	7.35E+05	1.97E+08	NR	NR	7.35E+05	1.97E+08	NR	NR	7.35E+05	1.97E+08	NR	NR
Cyanide (free)		6.56E+02	7.51E+04	6.53E+02	NR	6.56E+02	7.51E+04	6.53E+02	NR	6.56E+02	7.51E+04	6.53E+02	NR
Volatile Organic Compounds													
Benzene	(a)	1.09E+03	2.79E+01	2.72E+01	1.22E+03	1.09E+03	5.19E+01	4.96E+01	2.26E+03	1.09E+03	1.08E+02	9.80E+01	4.71E+03
Toluene		4.24E+05	6.49E+04	5.63E+04	8.69E+02	4.24E+05	1.43E+05	1.07E+05	1.92E+03	4.24E+05	3.24E+05	1.84E+05	4.36E+03
Ethylbenzene		1.91E+05	5.89E+03	5.71E+03	5.18E+02	1.91E+05	1.38E+04	1.28E+04	1.22E+03	1.91E+05	3.21E+04	2.75E+04	2.84E+03
Xylene - m		3.43E+05	6.26E+03	6.15E+03	6.25E+02	3.43E+05	1.47E+04	1.41E+04	1.47E+03	3.43E+05	3.44E+04	3.12E+04	3.46E+03
Xylene - o		3.43E+05	6.73E+03	6.60E+03	4.78E+02	3.43E+05	1.57E+04	1.50E+04	1.12E+03	3.43E+05	3.65E+04	3.30E+04	2.62E+03
Xylene - p		3.43E+05	6.03E+03	5.92E+03	5.76E+02	3.43E+05	1.41E+04	1.36E+04	1.35E+03	3.43E+05	3.28E+04	3.00E+04	3.17E+03
Total xylene		3.43E+05	6.03E+03	5.92E+03	6.25E+02	3.43E+05	1.41E+04	1.36E+04	1.47E+03	3.43E+05	3.28E+04	3.00E+04	3.46E+03
Methyl tertiary-Butyl ether (MTBE)		5.72E+05	7.58E+03	7.48E+03	2.04E+04	5.72E+05	1.23E+04	1.21E+04	3.31E+04	5.72E+05	2.34E+04	2.24E+04	6.27E+04
1,1,1,2-Tetrachloroethane		1.10E+04	1.09E+02	1.08E+02	2.60E+03	1.10E+04	2.53E+02	2.47E+02	6.02E+03	1.10E+04	5.88E+02	5.59E+02	1.40E+04
1,1,2,2-Tetrachloroethane		1.10E+04	2.81E+02	2.74E+02	2.67E+03	1.10E+04	5.75E+02	5.46E+02	5.46E+03	1.10E+04	1.26E+03	1.13E+03	1.20E+04
1,1,1-Trichloroethane		1.14E+06	6.60E+02	6.60E+02	1.43E+03	1.14E+06	1.35E+03	1.35E+03	2.92E+03	1.14E+06	2.96E+03	2.95E+03	6.39E+03
1,1,2 Trichloroethane		7.62E+03	9.02E+01	8.91E+01	4.03E+03	7.62E+03	1.84E+02	1.80E+02	8.21E+03	7.62E+03	4.02E+02	3.82E+02	1.80E+04
1,1-Dichloroethene		8.76E+04	2.43E+01	2.43E+01	2.23E+03	8.76E+04	4.30E+01	4.30E+01	3.94E+03	8.76E+04	8.68E+01	8.67E+01	7.94E+03
1,2-Dichloroethane		2.29E+02	6.73E-01	6.71E-01	3.41E+03	2.29E+02	9.71E-01	9.67E-01	4.91E+03	2.29E+02	1.67E+00	1.65E+00	8.43E+03
1,2,4-Trimethylbenzene		NR	3.29E+02	NR	4.74E+02	NR	6.41E+02	NR	1.16E+03	NR	1.04E+03	NR	2.76E+03
1,3,5-Trimethylbenzene	(e)	NR	NR	NR	2.30E+02	NR	NR	NR	5.52E+02	NR	NR	NR	1.30E+03
1,2-Dichloropropane		2.57E+04	3.14E+00	3.13E+00	1.19E+03	2.57E+04	5.54E+00	5.54E+00	2.11E+03	2.57E+04	1.11E+01	1.11E+01	4.24E+03
Carbon Tetrachloride (tetrachloromethane)		7.62E+03	2.87E+00	2.87E+00	1.52E+03	7.62E+03	6.29E+00	6.28E+00	3.32E+03	7.62E+03	1.43E+01	1.42E+01	7.54E+03
Chloroethane		NR	9.01E+02	NR	2.61E+03	NR	1.22E+03	NR	3.54E+03	NR	1.97E+03	NR	5.71E+03
Chloromethane		NR	9.54E-01	NR	1.91E+03	NR	1.11E+00	NR	2.24E+03	NR	1.49E+00	NR	2.99E+03
Cis 1,2 Dichloroethene		1.36E+01	NR	NR	3.94E+03	2.29E+01	NR	NR	6.61E+03	4.44E+01	NR	NR	1.29E+04
Dichloromethane		9.04E+03	2.63E+02	2.57E+02	7.27E+03	9.04E+03	3.50E+02	3.39E+02	9.68E+03	9.04E+03	5.53E+02	5.26E+02	1.53E+04
Tetrachloroethene		1.12E+04	1.86E+01	1.86E+01	4.24E+02	1.12E+04	4.17E+01	4.16E+01	9.51E+02	1.12E+04	9.57E+01	9.49E+01	2.18E+03
Trans 1,2 Dichloroethene		3.23E+04	2.07E+01	NR	3.42E+03	3.23E+04	3.74E+01	NR	6.17E+03	3.23E+04	7.63E+01	NR	1.26E+04
Trichloroethene		9.53E+02	1.23E+00	1.23E+00	1.54E+03	9.53E+02	2.58E+00	2.57E+00	3.22E+03	9.53E+02	5.72E+00	5.69E+00	7.14E+03
Vinyl Chloride (chloroethene)		2.67E+01	5.95E-02	5.94E-02	1.36E+03	2.67E+01	7.70E-02	7.67E-02	1.76E+03	2.67E+01	1.18E-01	1.17E-01	2.69E+03
Semi-Volatile Organic Compounds													
2-Chloronaphthalene		1.53E+05	3.71E+02	3.70E+02	1.14E+02	1.53E+05	9.07E+02	9.02E+02	2.80E+02	1.53E+05	2.13E+03	2.10E+03	6.69E+02
Acenaphthene		1.10E+05	2.75E+06	1.06E+05	5.70E+01	1.10E+05	5.36E+06	1.08E+05	1.41E+02	1.10E+05	8.83E+06	1.08E+05	3.36E+02
Acenaphthylene		1.10E+05	2.68E+06	1.05E+05	8.61E+01	1.10E+05	5.23E+06	1.07E+05	2.12E+02	1.10E+05	8.65E+06	1.08E+05	5.06E+02
Anthracene		5.49E+05	1.13E+07	5.23E+05	1.17E+00	5.49E+05	2.35E+07	5.36E+05	2.91E+00	5.49E+05	4.13E+07	5.42E+05	6.96E+00
Benzo(a)anthracene		2.84E+02	4.08E+02	1.67E+02	1.71E+00	2.84E+02	4.47E+02	1.74E+02	4.28E+00	2.84E+02	4.67E+02	1.76E+02	1.03E+01
Benzo(a)pyrene	(a)	7.68E+01	2.04E+02	5.58E+01	9.11E-01	7.68E+01	2.09E+02	5.61E+01	2.28E+00	7.68E+01	2.11E+02	5.63E+01	5.46E+00
Benzo(b)fluoranthene		7.13E+01	1.17E+02	4.43E+01	1.22E+00	7.13E+01	1.20E+02	4.47E+01	3.04E+00	7.13E+01	1.21E+02	4.49E+01	7.29E+00

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - COMMERCIAL



Table 3

Human health generic assessment criteria by pathway for commercial scenario

Compound	Notes	SAC appropriate to pathway SOM 1% (mg/kg)			Soil saturation limit (mg/kg)	SAC appropriate to pathway SOM 2.5% (mg/kg)			Soil saturation limit (mg/kg)	SAC appropriate to pathway SOM 6% (mg/kg)			Soil saturation limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Benzo(g,h,i)perylene		6.29E+03	1.05E+04	3.93E+03	1.54E-02	6.29E+03	1.06E+04	3.95E+03	3.85E-02	6.29E+03	1.07E+04	3.96E+03	9.23E-02
Benzo(k)fluoranthene		1.88E+03	3.11E+03	1.17E+03	6.87E-01	1.88E+03	3.17E+03	1.18E+03	1.72E+00	1.88E+03	3.21E+03	1.19E+03	4.12E+00
Chrysene		5.67E+02	8.89E+02	3.46E+02	4.40E-01	5.67E+02	9.25E+02	3.52E+02	1.10E+00	5.67E+02	9.47E+02	3.55E+02	2.64E+00
Dibenzo(a,h)anthracene		5.67E+00	9.32E+00	3.53E+00	3.93E-03	5.67E+00	9.52E+00	3.55E+00	9.82E-03	5.67E+00	9.64E+00	3.57E+00	2.36E-02
Fluoranthene		2.29E+04	1.89E+06	2.26E+04	1.89E+01	2.29E+04	2.72E+06	2.27E+04	4.73E+01	2.29E+04	3.32E+06	2.27E+04	1.13E+02
Fluorene		7.31E+04	4.55E+05	6.30E+04	3.09E+01	7.31E+04	1.06E+06	6.84E+04	7.65E+01	7.31E+04	2.24E+06	7.08E+04	1.83E+02
Hexachloroethane		2.09E+01	NR	NR	8.17E+00	4.98E+01	NR	NR	2.01E+01	1.11E+02	NR	NR	4.81E+01
Indeno(1,2,3-cd)pyrene		8.10E+02	1.31E+03	5.01E+02	6.13E-02	8.10E+02	1.35E+03	5.06E+02	1.53E-01	8.10E+02	1.37E+03	5.09E+02	3.68E-01
Naphthalene		3.64E+04	1.87E+03	1.78E+03	7.64E+01	3.64E+04	4.39E+03	3.92E+03	1.83E+02	3.64E+04	9.94E+03	7.81E+03	4.32E+02
Phenanthrene		2.28E+04	5.35E+05	2.19E+04	3.60E+01	2.28E+04	1.09E+06	2.24E+04	8.96E+01	2.28E+04	1.86E+06	2.25E+04	2.14E+02
Pyrene		5.49E+04	4.47E+06	5.42E+04	2.20E+00	5.49E+04	6.46E+06	5.44E+04	5.49E+00	5.49E+04	7.91E+06	5.45E+04	1.32E+01
Phenol		1.10E+06	2.65E+04	2.59E+04	2.42E+04	1.10E+06	3.04E+04	2.96E+04	3.81E+04	1.10E+06	3.46E+04	3.35E+04	7.03E+04

Total petroleum hydrocarbons

Aliphatic hydrocarbons EC5-EC6		4.77E+06	3.19E+03	3.19E+03	3.04E+02	4.77E+06	5.86E+03	5.86E+03	5.58E+02	4.77E+06	1.21E+04	1.21E+04	1.15E+03
Aliphatic hydrocarbons >EC6-EC8		4.77E+06	7.79E+03	7.78E+03	1.44E+02	4.77E+06	1.74E+04	1.74E+04	3.22E+02	4.77E+06	3.97E+04	3.96E+04	7.36E+02
Aliphatic hydrocarbons >EC8-EC10		9.53E+04	2.02E+03	2.00E+03	7.77E+01	9.53E+04	4.91E+03	4.85E+03	1.90E+02	9.53E+04	1.17E+04	1.13E+04	4.51E+02
Aliphatic hydrocarbons >EC10-EC12		9.53E+04	9.97E+03	9.69E+03	4.75E+01	9.53E+04	2.47E+04	2.29E+04	1.18E+02	9.53E+04	5.89E+04	4.73E+04	2.83E+02
Aliphatic hydrocarbons >EC12-EC16		9.53E+04	8.26E+04	5.88E+04	2.37E+01	9.53E+04	2.04E+05	8.17E+04	5.91E+01	9.53E+04	4.81E+05	9.02E+04	1.42E+02
Aliphatic hydrocarbons >EC16-EC35	(b)	1.58E+06	NR	NR	8.48E+00	1.75E+06	NR	NR	2.12E+01	1.83E+06	NR	NR	5.09E+01
Aliphatic hydrocarbons >EC35-EC44	(b)	1.58E+06	NR	NR	8.48E+00	1.75E+06	NR	NR	2.12E+01	1.83E+06	NR	NR	5.09E+01
Aromatic hydrocarbons >EC8-EC10		3.81E+04	3.55E+03	3.46E+03	6.13E+02	3.81E+04	8.66E+03	8.11E+03	1.50E+03	3.81E+04	2.05E+04	1.70E+04	3.58E+03
Aromatic hydrocarbons >EC10-EC12		3.81E+04	1.92E+04	1.62E+04	3.64E+02	3.81E+04	4.69E+04	2.79E+04	8.99E+02	3.81E+04	1.10E+05	3.42E+04	2.15E+03
Aromatic hydrocarbons >EC12-EC16		3.81E+04	2.02E+05	3.62E+04	1.69E+02	3.81E+04	4.76E+05	3.73E+04	4.19E+02	3.81E+04	1.03E+06	3.78E+04	1.00E+03
Aromatic hydrocarbons >EC16-EC21	(b)	2.84E+04	NR	NR	5.37E+01	2.83E+04	NR	NR	1.34E+02	2.84E+04	NR	NR	3.21E+02
Aromatic hydrocarbons >EC21-EC35	(b)	2.84E+04	NR	NR	4.83E+00	2.84E+04	NR	NR	1.21E+01	2.84E+04	NR	NR	2.90E+01
Aromatic hydrocarbons >EC35-EC44	(b)	2.84E+04	NR	NR	4.83E+00	2.84E+04	NR	NR	1.21E+01	2.84E+04	NR	NR	2.90E+01

Notes:

EC - equivalent carbon. GrAC - groundwater screening value. SAC - soil screening value.

The CLEA model output is colour coded depending upon whether the soil saturation limit has been exceeded.

	Calculated SAC exceeds soil saturation limit and may significantly affect the interpretation of any exceedances as the contribution of the indoor and outdoor vapour pathway to total exposure is >10%.
	Calculated SAC exceeds soil saturation limit but the exceedance will not affect the SAC significantly as the contribution of the indoor and outdoor vapour pathway to total exposure is <10%.
	Calculated SAC does not exceed the soil saturation limit.

The SAC for organic compounds are dependant upon soil organic matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs naphthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway (Section 10.1.1, SR3)

(a) SAC for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead are derived using the C4SL toxicology data.

(b) SAC for selenium should not include the inhalation pathway as no expert group HCV has been derived; aliphatic and aromatic hydrocarbons >EC16 should not include inhalation pathway due to their non-volatile nature and inhalation exposure being minimal (oral, dermal and inhalation exposure is compared to the oral HCV); arsenic should only be based on oral contribution (rather than combined) owing to the relative small contribution from inhalation in accordance with the SGV report. The Oral SAC should be adopted for zinc and benzo(a)pyrene.

(c) SAC for CrIII should be based on the lower of the oral and inhalation SAC (see LQM/CIEH 2015 Section 6.8)

(d) SAC for elemental mercury, chromium VI and nickel should be based on the inhalation pathway only.

(e) SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used.

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - COMMERCIAL



Table 4
Human Health Generic Assessment Criteria for Commercial Scenario

Compound	SAC for Soil SOM 1% (mg/kg)	SAC for Soil SOM 2.5% (mg/kg)	SAC for Soil SOM 6% (mg/kg)
Metals			
Arsenic	640	640	640
Cadmium	410	410	410
Chromium (III) - trivalent	8,600	8,600	8,600
Chromium (VI) - hexavalent	49	49	49
Copper	68,000	68,000	68,000
Lead	2,300	2,300	2,300
Elemental Mercury (Hg ⁰)	15 (4)	33 (11)	58 (26)
Inorganic Mercury (Hg ²⁺)	1,120	1,120	1,120
Methyl Mercury (Hg ⁴⁺)	290 (73)	310 (142)	320
Nickel	980	980	980
Selenium	12,000	12,000	12,000
Zinc	740,000	740,000	740,000
Cyanide (free)	650	650	650
Volatile Organic Compounds			
Benzene	27	50	98
Toluene	56,000 (869)	107,000 (1,916)	184,000 (4,357)
Ethylbenzene	6,000 (518)	13,000 (1,216)	27,000 (2,844)
Xylene - m	6,200 (625)	14,100 (1,474)	31,200 (3,457)
Xylene - o	6,600 (478)	15,000 (1,120)	33,000 (2,618)
Xylene - p	5,900 (576)	13,600 (1,353)	30,000 (3,167)
Total xylene	5,900 (625)	13,600 (1,474)	30,000 (3,457)
Methyl tertiary-Butyl ether (MTBE)	7,500	12,100	22,400
1,1,1,2-Tetrachloroethane	110	250	560
1,1,2,2-Tetrachloroethane	270	550	1,130
1,1,1-Trichloroethane	700	1,300	3,000
1,1,2 Trichloroethane	89	180	382
1,1-Dichloroethene	24	43	87
1,2-Dichloroethene	0.67	0.97	1.65
1,2,4-Trimethylbenzene	330	640	1,040
1,3,5-Trimethylbenzene	NR	NR	NR
1,2-Dichloropropane	3	6	11
Carbon Tetrachloride (tetrachloromethane)	2.9	6.3	14.2
Chloroethane	901	1,223	1,972
Chloromethane	1.0	1.1	1.5
Cis 1,2 Dichloroethene	14	23	44
Dichloromethane	257	339	526
Tetrachloroethene	20	40	90
Trichloroethene	1	3	6
Trans 1,2 Dichloroethene	21	37	76
Trichloroethene	1	3	6
Vinyl Chloride (chloroethene)	0.06	0.08	0.12
Semi-Volatile Organic Compounds			
2-Chloronaphthalene	370 (114)	902 (280)	2,098 (669)
Acenaphthene	110,000	110,000	110,000
Acenaphthylene	110,000	110,000	110,000
Anthracene	520,000	540,000	540,000
Benzo(a)anthracene	170	170	180
Benzo(a)pyrene	77	77	77
Benzo(b)fluoranthene	44	45	45
Benzo(g,h,i)perylene	3,900	3,900	4,000
Benzo(k)fluoranthene	1,200	1,200	1,200
Chrysene	350	350	350
Dibenzo(a,h)anthracene	3.5	3.6	3.6
Fluoranthene	23,000	23,000	23,000
Fluorene	63,000 (31)	68,000	71,000
Hexachloroethane	21 (8)	50 (20)	111 (48)
Indeno(1,2,3-cd)pyrene	500	510	510
Napthalene	1,800 (76)	3,900 (183)	7,800 (432)
Phenanthrene	22,000	22,000	23,000
Pyrene	54,000	54,000	54,000
Phenol	440*	690*	1,300*
Total Petroleum Hydrocarbons			
Aliphatic hydrocarbons EC ₅ -EC ₆	3,200 (304)	5,900 (558)	12,100 (1,150)
Aliphatic hydrocarbons >EC ₆ -EC ₈	7,800 (144)	17,400 (322)	39,600 (736)
Aliphatic hydrocarbons >EC ₈ -EC ₁₀	2,000 (78)	4,800 (190)	11,300 (451)
Aliphatic hydrocarbons >EC ₁₀ -EC ₁₂	9,700 (48)	22,900 (118)	47,300 (283)
Aliphatic hydrocarbons >EC ₁₂ -EC ₁₆	59,000 (24)	82,000 (59)	90,000 (142)
Aliphatic hydrocarbons >EC ₁₆ -EC ₃₅	1,000,000**	1,000,000**	1,000,000**
Aliphatic hydrocarbons >EC ₃₅ -EC ₄₄	1,000,000**	1,000,000**	1,000,000**
Aromatic hydrocarbons >EC ₈ -EC ₁₀	3,500 (613)	8,100 (1,503)	17,000 (3,580)
Aromatic hydrocarbons >EC ₁₀ -EC ₁₂	16,000 (364)	28,000 (899)	34,000 (2,150)
Aromatic hydrocarbons >EC ₁₂ -EC ₁₆	36,000 (169)	37,000	38,000
Aromatic hydrocarbons >EC ₁₆ -EC ₂₁	28,000	28,000	28,000
Aromatic hydrocarbons >EC ₂₁ -EC ₃₅	28,000	28,000	28,000
Aromatic hydrocarbons >EC ₃₅ -EC ₄₄	28,000	28,000	28,000
Minerals			
Asbestos	No asbestos detected with ID or <0.001% dry weight ¹		
Notes:			
* Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data.			
NR - SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used			
EC - equivalent carbon. GrAC - groundwater assessment criteria. SAC - soil assessment criteria.			
* The GAC for Phenol is based on a threshold which is protective of direct contact (SC050021/Phenol SGV report)			
** Denoted SAC calculated exceeds 100% contaminant, hence 100% (1,000,000mg/kg) has been taken as SAC			
The SAC for organic compounds are dependent on Soil Organic Matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.			
SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3.			
(VALUE IN BRACKETS)			
RSK has adopted an approach for petroleum hydrocarbons in accordance with LQM/CIEH whereby the concentration modelled for each petroleum hydrocarbon fraction has been tabulated as the SAC with the corresponding solubility or vapour saturation limits given in brackets.			