

Your ref:

Our ref: ADJ/DJM/11517

Date: 27<sup>th</sup> January 2026

Mr. A. Scott  
Jones Homes (Yorkshire) Limited  
Green Bank House  
Cleckheaton  
West Yorkshire  
BD19 5LQ

**By Email Only**

Dear Andy

**Century View, Swallow Lane, Golcar, Phase 2 – Plot 18  
Validation Report No. 4445**

Michael D Joyce Associates LLP was commissioned by Jones Homes (Yorkshire) Limited to undertake validation testing and reporting in accordance with the remediation strategy for the site. This validation letter report covers the testing of the rear garden to Plot 18, and is in accordance with the Remediation Strategy for the site, "Remediation and Validation Strategy - Swallow Lane, Golcar, Phase 2 - Michael D Joyce Associates LLP Report No. 4112, Revision 1, April 2024". The inspection took place on 27<sup>th</sup> January 2026.

The requirement is for a clean cover system to Plots 17 to 21. The clean cover system should be validated in accordance with the "Verification Requirements for Cover Systems – Technical Guidance for Developers, Landowners and Consultants". This document has recently been issued by the Yorkshire and Humberside Pollution Advisory Council and adopted by Local Authorities in Yorkshire, Humberside and Lincolnshire. Where applicable, it should also be in accordance with the requirements of the NHBC as set out in Standards Extra 47 (June 2010) "Contaminated Land – Cover System Validation". Since manufactured and Greenfield sources are being used, the testing shall be at a rate of 1 sample per 250m<sup>3</sup> of topsoil and subsoil with a minimum of 3 No. samples of each. To date, 2 samples of both the topsoil and subsoil have been tested and found to be satisfactory. The findings were presented in Michael D Joyce Associates LLP's letter report Ref: ADJ/DJM/11459 dated 13<sup>th</sup> February 2025. A further sample of the topsoil and subsoil will be obtained in due course.

**Source of Materials**

The topsoil was imported by G. Morley from Ron Hull Junior Limited, Parkgate, Rotherham.

The subsoil comprised clean subsoil arisings from the site.

**Characterisation of Material**

It is essential that material is inert and suitable for its intended use. Sampling of materials 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* materials and the possibility of cross contamination.

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### **Certificates from Commercial Suppliers**

Where material is provided by a commercial company, certificates or other industry Quality Protocol compliance i.e. WRAP, will normally be accepted. Caution should be given to importing materials, specifically soils that have been recycled from demolition or skip waste as they could be contaminated.

### **Initial Screening**

A visual / olfactory inspection of the topsoil 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 materials i.e. bricks, brick ties, timber and glass etc).
- There are no visible signs of asbestos containing materials (ACM's).

### **Testing Schedule and 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 Michael D Joyce Associates LLP.

### **Suitability of Material**

Based on the characterisation of materials, they should be either deemed suitable or unsuitable. The soil concentrations should not exceed any of the following levels specified in the Remediation Statement.

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**Table 1: Maximum Permitted Concentrations****SOILS**

Analyte	Maximum Permitted Concentrations (mg/kg)
Arsenic (total)	37
Cadmium (total)	11
Chromium (VI)	6
Copper (total)	910
Lead (total)	200
Mercury (total)	40
Nickel (total)	130
Selenium (total)	250
Zinc (total)	3700
Phenols (total)	--
Naphthalene	2.3
Acenaphthylene	170
Acenaphthene	210
Fluorene	170
Phenanthrene	95
Anthracene	2400
Fluoranthene	280
Pyrene	620
Benzo (a) anthracene	7.2
Chrysene	15
Benzo (b) fluoranthene	2.6
Benzo (k) fluoranthene	77
Benzo (a) pyrene	2.2
Indeno (1,2,3 cd) pyrene	27
Dibenz (a,h) anthracene	0.24
Benzo (g,h,l) perylene	320
Asbestos	None

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## Reporting

The purpose of verification documentation is to provide transparent reasoning as to why the remediation, was required, a methodology about how it was to be undertaken and proof that the specified works have been undertaken so as 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. The report should be carried out by Michael D Joyce Associates LLP.

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

- Photographs of any stockpiles and quarantine areas.
- Proof that the depth of inert cover has been installed.
- Proof that the quality of the material to be used as inert cover.
- 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.

When hardstanding is proposed, the link between the potential contaminants in the soil and the end users will no longer exist. As such, no special precautions are necessary. If the Made Ground has been removed during site strip, a clean cover system is not required although some topsoil will be needed as a growing medium.

There was 500mm of topsoil and at least 100mm of subsoil to the rear garden of Plot 18. Photographs are attached. As such, the plot is validated.

Yours sincerely

**A D Joyce**

Photographs  
Standard Appendix B





**Plate 1 – Inspection pit to Plot 18**

**CENTURY VIEW, SWALLOW LANE, GOLCAR**

**Michael D Joyce Associates LLP**  
**Geotechnical and Geoenvironmental Consultants**

**Plate 1**



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**Plate 2 – Completed garden area to Plot 18**

**CENTURY VIEW, SWALLOW LANE, GOLCAR**

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**Plate 2**



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**Plate 3 – Completed garden area to Plot 18**

**CENTURY VIEW, SWALLOW LANE, GOLCAR**

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**Geotechnical and Geoenvironmental Consultants**

**Plate 3**



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1. **GENERAL.** The desk study and/or intrusive ground investigation is typically carried out in accordance with the Environment Agency's "Land Contamination Risk Management (LCRM) documents and the requirements of BS5930: 2015 and BS10175: 2011+A1: 2020. In relation to contamination the desk study is referred to as the preliminary investigation in BS10175 and the intrusive ground investigation is referred to as the Exploratory Investigation. This appendix briefly describes the nature of the work carried out and explains the standards against which contamination data has been assessed. The nature of any contamination investigation is such that only a small percentage of the ground, and therefore potential contamination, is sampled. Consequently variations in both ground conditions and contaminant levels can occur between any two sampling positions. The contamination investigation is designed to minimise such risks, but they cannot be eliminated.

2. **REVIEW OF CONTAMINATION ISSUES** – The National Planning Policy Framework (NPPF) and Part 2A of the Environmental Protection Act 1990 create a new regime for the identification and remediation of contaminated land. It introduced a definition of contaminated land described in Section 78A(2) of the Act of:

"any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that

- (a) significant harm is being caused or there is a significant possibility of such harm being caused; or
- (b) significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused:

Both Part 2A and the planning regime embrace the "suitable for use" approach. In the context of Part IIA, action is necessary only where there are unacceptable risks to health or to the environment, taking into account the current use of the land and its environmental setting.

For humans, significant harm is defined as "death, disease, serious injury". Specifically, disease is taken to mean an unhealthy condition of the body or part of it. "Significant possibility of significant harm" is described as health effects arising from the intake of a contaminant or other direct bodily contact with the contaminant where the intake or exposure is unacceptable. The assessment should also take into account the total intake from all sources, the relative contribution of the pollutant linkage in question, and the duration of intake or exposure. The various statutory definitions are given overleaf.

The presence of unnatural substances does not automatically constitute a risk unless there is a link or pathway between the contamination (the hazard) and the receptor (the target) be it humans, the environment or property. Therefore the assessment needs to determine whether a hazard is present and whether the necessary pathway exists the so-called "pollution linkage" or "conceptual site model".

The effect of any hazard on a site depends primarily on the site use and groundwater conditions since these determine who and what may be at risk and the routes by which they may be exposed to the hazard. Site uses can include allotments, domestic gardens on residential developments, amenity and recreational areas, public open space and industrial and commercial buildings. On any site, the potential contaminants have to be identified together with the potential receptors. The pathway for that contaminant to reach its target has then to be considered.

3. **PRELIMINARY INVESTIGATION.** The preliminary Phase I Geoenvironmental Assessment (desk study) report normally considers the following key sections:

Introduction	
The Site	Contaminated Land
Site History	Radon
Geology and Mining	Geoenvironmental Risk Assessment
Hydrogeology	Geotechnical Assessment
Groundsure Geo-Insight and Enviro-Insight	Ground Investigation (Recommendations)

The report will summarise the findings and also relate our opinions to the potential for a site to be geoenvironmentally impaired, at levels likely to warrant mitigation or further consideration appropriate to the current or future use. Findings are based on information obtained and described during the desk study and site inspection without intrusive ground investigation. It is possible that further information exists. The absence of indicators of impairment does not mean that such impairment does not exist. Additional investigation including intrusive methods can reduce the risks but cannot eliminate them and may not be cost effective. We can advise on the additional research opportunities, their cost and their possible impact on mitigating risk. Recommendations are normally given based on the redevelopment proposals for the site.

Type of Receptor	Description of harm that is to be regarded as significant harm	Conditions For There Being A Significant Possibility Of Significant Harm
1. Human beings	<p>Death, disease, serious injury, genetic mutation, birth defects or the impairment of reproductive functions.</p> <p>For these purposes, disease is to be taken to mean an unhealthy condition of the body or a part of it and can include, for example, cancer, liver dysfunction or extensive skin ailments. Mental dysfunction is included only insofar as it is attributable to the effects of a pollutant on the body of the person concerned.</p>	<p>If the amount of the pollutant in the pollutant linkage represents an unacceptable intake or direct bodily contact, assessed on the basis of relevant information on the toxicological properties of that pollutant.</p> <p>Such an assessment should take into account:</p> <ul style="list-style-type: none"> <li>• the likely total intake of, or exposure to, the substance or substances which form the pollutant, from all sources including that from the pollutant linkage in question;</li> <li>• the relative contribution of the pollutant linkage in question to the likely aggregate intake of, or exposure to, the relevant substance or substances; and</li> <li>• the duration of intake or exposure resulting from the pollutant linkage in question.</li> </ul> <p>The question of whether an intake or exposure is unacceptable is independent of the number of people who might experience or be affected by that intake or exposure.</p> <p>Toxicological properties should be taken to include carcinogenic, mutagenic, teratogenic, pathogenic, endocrine-disrupting and other similar properties.</p>
2. All other human health effects (particularly by way of explosion or fire)		<p>If the probability, or frequency, of significant harm of that description is unacceptable. The pollutant linkage might cause "significant harm which"</p> <ul style="list-style-type: none"> <li>• would be irreversible or incapable of being treated;</li> <li>• would affect a substantial number of people;</li> <li>• would result from a single incident such as a fire or an explosion; or</li> <li>• would be likely to result from a short-term (less than 24-hour) exposure to the pollutant.</li> </ul>
3. Any ecological system, or living organism forming part of such a system, within a location which is protected.	<p>For any protected location:</p> <ul style="list-style-type: none"> <li>• harm which results in an irreversible adverse change, or in some other substantial adverse change, in the functioning of the ecological system within any substantial part of that location; or</li> <li>• harm which affects any species of special interest within that location and which endangers the long-term maintenance of the population of that species at that location.</li> </ul>	<p>If either:</p> <ul style="list-style-type: none"> <li>• significant harm of that description is more likely than not to result from the pollutant linkage; or</li> <li>• there is a reasonable possibility of significant harm of that description being caused, and if that harm were to occur, it would result in such a degree of damage to features of special interest at the location in question that they would be beyond any practicable possibility of restoration.</li> </ul>
4. Property in the form of: <ul style="list-style-type: none"> <li>• crops, including timber;</li> <li>• produce grown domestically, or on allotments, for consumption;</li> <li>• livestock;</li> <li>• other owned or domesticated animals;</li> <li>• wild animals which are the subject of shooting or fishing rights.</li> </ul>	<p>For crops, a substantial diminution in yield or other substantial loss in the value resulting from death, disease or other physical damage. For domestic pets, death, serious disease or serious physical damage. For other property in this category, a substantial loss in its value resulting from death, disease or other serious physical damage.</p>	<p>If significant harm of that description is more likely than not to result from the pollutant linkage in question.</p>
5. Property in the form of buildings.	<p>Structural failure, substantial damage or substantial interference with any right of occupation.</p>	<p>If significant harm of that description is more likely than not to result from the pollutant linkage in question during the expected economic life of the building.</p>
6. Controlled waters.		

4. **INTRUSIVE INVESTIGATION.** BS10175 describes this as an exploratory investigation. Intrusive ground investigation is described in Standard Appendix A. During the investigation representative or indicative samples are obtained for testing by an accredited laboratory. The aim is to determine (with a degree of confidence appropriate to the objectives), the presence, concentration and distribution of contaminants in respect of those points investigated. The extent of any necessary intrusive investigation will depend on the size of the site and any hazards, either known or suspected.
5. **ASSESSMENT OF CONTAMINATION.** The assessment of contaminated land under the terms of Part II A of the Environmental Protection Act 1990 is based upon pollution linkage (source - pathway - receptor model) and the principles of the Environment Agency's "Contamination Land Risk Management" documentation.

DEFRA previously issued "Outcome of the Way Forward Exercise on Soil Guideline Values". This document was intended to provide guidance to determine if there is a Significant Possibility of Significant Harm (SPOSH) i.e. whether land meets the legal trigger of being contaminated land.

In the context of Part 2A, a risk assessor using an SGV would conclude the following (DEFRA, 2008).

- At a representative average soil concentration at or below an SGV, it is very unlikely that there will be a *significant possibility of significant harm (SPOSH)*.
- At a representative average soil concentration above an SGV, there *might* be a *significant possibility of significant harm* with the significance linked to the margin of exceedance, the duration and frequency of exposure, and other site-specific factors that the enforcing authority may wish to take into account. Further investigation and/or detailed evaluation will usually be required.

It should be stressed that where there is any uncertainty as to whether or not there is a SPOSH, it was the policy of this practice to adopt a conservative approach, particularly in the adoption of clean cover systems.

In April 2012, Defra both published new Statutory Guidance which forms a major part of their contaminated land regimes under Part 2A of the Environment Protection Act 1990. The regime provides a means of dealing with contaminated land which poses a significant risk to human health or the environment where there is no alternative solution. It also works alongside planning rules and building regulations to help ensure that affected land is made suitable for use when it is redeveloped.

Since the regime was introduced in 2000 there has been considerable uncertainty over how to decide when land is, and is not contaminated land on grounds of the legal test of *significant possibility of significant harm to human health or the environment*.

To help address this, one of the main changes set out in the new Statutory Guidance, is the introduction of a new four category test to help decide when land is, and is not, contaminated land on grounds of *significant possibility of significant harm to human health*. Under the new four category test:

- Category 1 describes land that is clearly contaminated land, for example because similar land is known to have caused significant harm in the past.
- Categories 2 and 3 cover less straightforward land where more detailed consideration is needed before the regulator can decide either: (a) that there is a strong case for regulatory action, in which case the land would be in Category 2 and be classified as contaminated land under Part 2A; or (b) that such a case does not exist, in which case the land would be in Category 3 and not be classified as contaminated land under Part 2A.
- Category 4 describes land that is clearly not contaminated land, as discussed below.

One of the main purposes of including the Categories in the Statutory Guidance is to provide a legal framework against which new technical tools can be developed by the land contamination sector to describe the Categories in more detail with regard to specific substances and/or situations.

The new Category 4 test is particularly important in terms of reducing uncertainty over when land is definitely not caught by the regime.

The new Statutory Guidance makes clear what land should be placed into Category 4, for example:

- (a) Land where no relevant contaminant linkage has been established.
- (b) Land where there are only normal levels of contaminants in soil (as explained in Section 3 of the guidance), unless there is a particular reason to consider otherwise. In other words land with normal background concentrations in the soil.

- (c) Land that has been excluded from the need for further inspection and assessment under Part 2A because contaminant levels do not exceed relevant generic assessment criteria in accordance with Section 3 of the guidance, or relevant technical tools or advice that may be developed in accordance with paragraph 3.30 of the guidance, e.g. Category 4 Screening Levels.
- (d) Land where estimated levels of exposure to contaminants in soil are likely to form only a small proportion of what a receptor might be exposed to anyway through other sources of environmental exposure (e.g. in relation to average estimated national levels of exposure to substances commonly found in the environment, to which receptors are likely to be exposed to in the normal course of their lives).

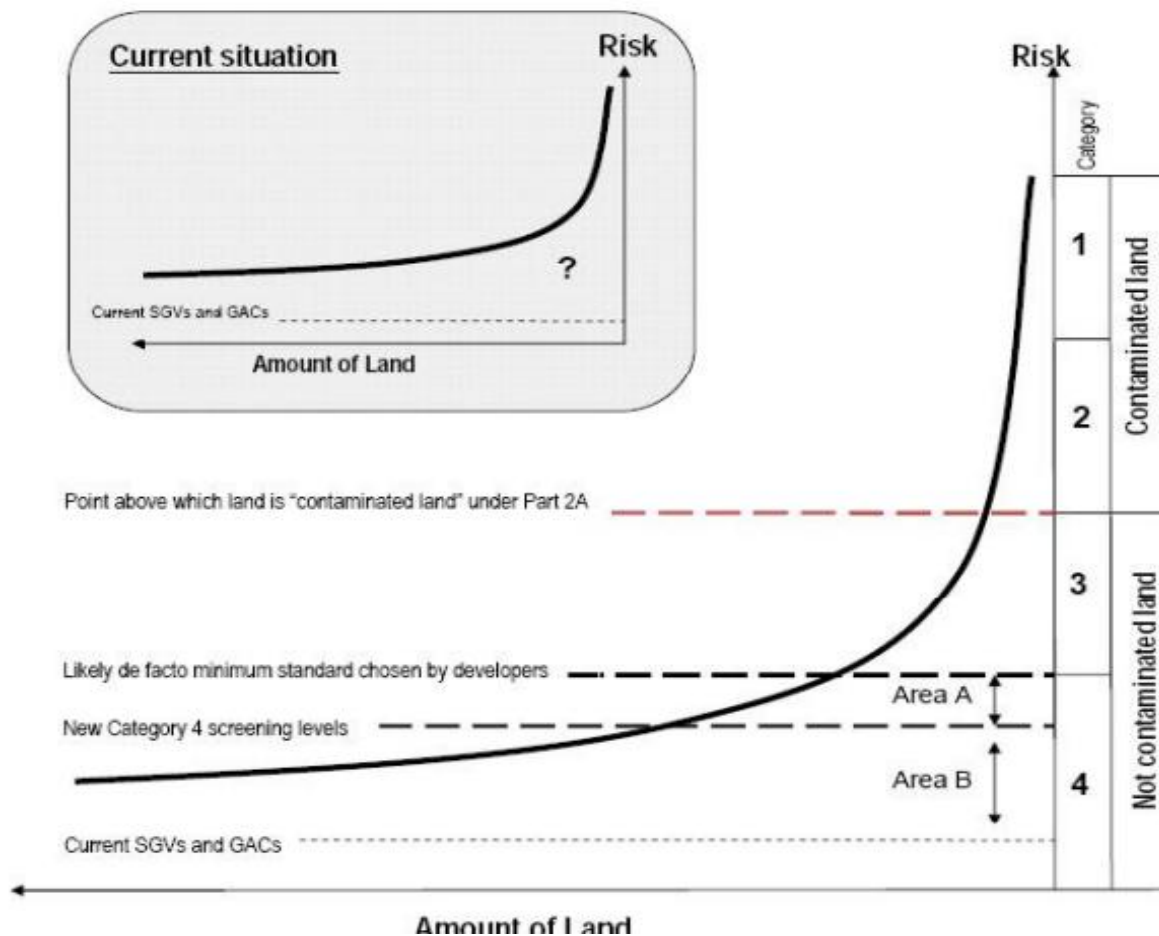
The guidance clarifies how generic assessment criteria (including the currently available SGVs/GACs) should and should not be used. It states that:

- 3.27 *It is common practice in contaminated land risk assessment to use “generic assessment criteria” (GACs) as screening tools in generic quantitative human health risk assessment to help assessors decide when land can be excluded from the need for further inspection and assessment, or when further work may be warranted.*
- 3.28 *Local authorities may use GACs and other technical tools to inform certain decisions under the Part 2A regime, provided: (i) they understand how they were derived and how they can be used appropriately; (ii) they have been produced in an objective, scientifically robust and expert manner by reputable organizations; and (iii) they are only used in a manner that is in accordance with Part 2A and this Guidance.*
- 3.29 *GACs relating to human health risk assessment represent cautious estimates of levels of contaminants in soil at which there is considered to be no risk to health or, at most, a minimal risk to health. With regard to such GACs:*
  - (a) They may be used to indicate when land is very unlikely to pose a significant possibility of significant harm to human health. This is on the basis that they are designed to estimate levels of contamination at which risks are likely to be negligible or minimal and far from posing a significant possibility of significant harm to human health.
  - (b) They should not be used as direct indicators of whether a significant possibility of significant harm to human health may exist. Also, the local authority should not view the degree by which GACs are exceeded (in itself) as being particularly relevant to this consideration, given that the degree of risk posed by land would normally depend on many factors other than simply the amount of contaminants in soil.
  - (c) They should not be seen as screening levels which describe the boundary between Categories 3 and 4 in terms of Section 4 (i.e. the two Categories in which land would not be contaminated land on grounds of risks to human health). In the very large majority of cases, these SGVs/GACs describe levels of contamination from which risks should be considered to be comfortably within Category 4.
  - (d) They should not be viewed as indicators of levels of contamination above which detailed risk assessment would automatically be required under Part 2A.
  - (e) They should not be used as generic remediation targets under the Part 2A regime. Nor should they be used in this way under the planning system, for example in relation to ensuring that land affected by contamination does not meet the Part 2A definition of contaminated land after it has been developed.

The way in which the new four category system is intended to operate and the place of the C4SLs within that system, was explained in detail in the Impact Assessment which accompanied the Statutory Guidance. Please note that although the detail of the Impact Assessment is included here to provide clarity on the job expected of C4SLs, the Statutory Guidance, itself, sets out the regime that needs to be delivered under Part 2A.

Paragraph 47 of the Impact Assessment describes the diagram in detail. Of particular relevance to this project is the description of the overall diagram (sub-paragraph a), description of category 4 (sub-paragraphs c (part iv) and h) and the description of how the monetised benefits of the new system will be realised (sub-paragraph h). These sub-paragraphs are reproduced below.

**Diagram showing the new Category 1-4 system (compared to current situation)**



The diagram above seeks to illustrate, in a simplified manner, broadly what the changes to the statutory guidance on significant possibility of significant harm to human health are intended to achieve. To explain:

- (a) The curved line and axes illustrate the spectrum of risk presented by land contamination. The idea is to show that a very large amount of land is low risk, and only a small amount of land would pose sufficient risk to be contaminated land in the legal sense. The axes and lines in the diagrams are not to scale, and they have been compressed for the purposes of illustration (in reality the risks on Category 1 land would probably be orders of magnitude above Category 4 risks, and vastly more land would be in Category 4 compared to the other Categories).
- (b) The smaller diagram summarizes the current situation. In the area below the SGV/GACs there is near certainty that land is not contaminated land, however, above the line there is increasing uncertainty. As explained above, currently remediation usually occurs to just below the SGV/GAC level because they are perceived as offering the only cast-iron guarantee of when land is definitely not contaminated land. Sometimes consultants are employed to justify remediating to levels above the SGV/GACs, however the further they go away from the SGV/GACs the more legal risk they and their clients are exposed to.
- (c) The new statutory guidance will end the current situation, and it would not be legally possible e.g. for individual regulators to ignore the changes being made. For example, as explained above, the new statutory guidance will specifically say:
  - (i) that Part 2A cannot be used to force remediation to below a point where it ceases to be contaminated land in the legal sense i.e. the Category 2/3 border in terms of the diagram), although responsible parties can choose to go further;
  - (ii) that SGV/GACs cannot be used as one size fits all remediation thresholds under either Part 2A of the planning system;
  - (iii) that normal background levels of contamination are not caught by Part 2A; and
  - (iv) that SGV/GACs are well into Category 4, sometimes by only a few times and sometimes by orders of magnitude. These changes and others also provide the legal backing for the development e.g. of Category 4 screening levels, as discussed below.
- (d) The new Category 1-4 system divides the spectrum of risk posed by contaminated land into four different categories, and the statutory guidance will explain how to decide when land falls into each Category. This is more sophisticated than the current statutory guidance, which in effect has only two categories (contaminated land or not) and does not explain how to decide which category land falls into. The new Category 1-4 system

reflects what assessors find when they investigate real sites i.e. some are clearly contaminated land (Category 1); some clearly are not (Category 4) and some are less-straightforward and need some level of detailed assessment before a decision can be taken as to whether or not they are contaminated land (Categories 2 and 3).

- (e) In the case of Category 2 and 3 sites, the regulator will have flexibility to take decisions within the parameters set by the new Guidance. There would be less flexibility for Category 2 and 3 sites that clearly pose either a high or low risk. However, the regulator will have considerable flexibility for sites closer to the Category 2/3 border to judge which side of the border a site would fall (e.g. taking account of their understanding of the risks, uncertainties and the interests of the local community). These are often complex decisions which need to be taken case-by-case given the many factors involved.
- (f) In the case of Categories 1 and 4 the regulator will have far less flexibility. For example, if a regulator claimed that a site matching the Category 1 description was not contaminated land, or that a site matching the Category 4 description was contaminated land, they would be acting directly against the statutory guidance which the Act requires that they follow, and decisions could be challenged (e.g. in a law court) with a high chance that the challenge would be successful. Among other things, the intention of doing this is to create far more legal certainty around when land is definitely not contaminated land in the legal sense. With the specific wording of the new statutory guidance, and the supporting tools such as the new Category 4 screening levels, it would be very difficult for a regulator e.g. to threaten landowners with the Part 2A regime, and if they tried to determine land as contaminated land they would be operating in direct opposition to the statutory guidance.
- (g) In the many consultation meetings held in developing the Category 1-4 system, all the developers, landowners and consultants we spoke to were strongly of the view that they would want to ensure their land is safely within Category 4 (even though in theory they could remediate to a level within Category 3 and still satisfy Part 2A and planning rules). They would do this for various reasons, including the fact that the flexibility granted to regulators in Categories 2 and 3 means that the further into Category 3 a site gets, the greater the risk that the regulator might decide it is in Category 2. Also they would want to be in Category 4 for reasons of marketability, future proofing etc. So developers and others would have a strong incentive to seek the regulatory certainty of being safely within Category 4. Thus, as far as development taking place under the planning system is concerned, Category 3 would, in effect, normally be a buffer which provides added reassurance that development falling within Category 4 will not be caught by the Part 2A regime.
- (h) The new statutory guidance will bring about a situation where the current SGV/GACs are replaced with more pragmatic (but still strongly precautionary) Category 4 screening levels (C4SLs) which will provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land. Above the C4SLs, in Area A on the diagram, there will be much stronger legal backing for experts to use their judgement to make sensible and precautionary decisions on when land should be considered to be towards the top end of Category 4, without fear that land may be caught as contaminated land. This recognizes that the generic C4SLs will not be able to describe the Category 3/4 border itself because they are generic and would therefore have to err on the side of caution whilst a detailed site specific assessment would be able to push further by looking at specific circumstances relating to a specific site.
- (i) The very large majority of the monetized benefits of the changes to the regime discussed in this Impact Assessment manifest themselves in Category 4, and in particular in Areas A and B on the diagram. The main effects of moving to the new system would include Low risk land falling within Area B (pre-development) on the diagram would no longer have to be remediated because it would fall below the new C4SLs. Similarly land which is in Area A pre-development would no longer need to be remediated if justified by a detailed site-specific assessment. For these sites the cost of remediation would be removed altogether. The cost of remediating land which is initially in Categories 3, 2 or 1 would fall because it would be remediated to the new C4SL levels (or somewhere within Area A if there has been a detailed assessment) rather than the SGV/GAC level. This will have the overall effect of reducing the cost of remediation, with the effect varying according to specific site circumstances, the type of remediation etc. Generally the cost of remediation would fall for many affected brownfield land sites. This would have the general effect of making such land more economically viable for development. It would also mean that some land that is not currently economically viable to develop becomes reduce pressure to develop Greenfield land in some cases. The C4SLs will also speed up regulatory decisions on the reuse of brownfield land by providing a simple remediation standard.

The C4SLs are intended as “*relevant technical tools*” (in relation to Paragraph 4.2.1(c)) provides to help local authorities and others when deciding to stop further assessment of a site, on the grounds that it falls within Category 4 (Human Health).

The Impact Assessment (IA), which accompanied the revised SG (Defra, 2012b) provides further information on the nature and potential role of the C4SLs. Paragraph 47(h) of the IA states that:

*“The new statutory guidance will bring about a situation where the current SGVs/GACs are replaced with more pragmatic (but still strongly precautionary) Category 4 screening levels (C4SLs) which will provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land”.*

A key distinction between the Soil Guideline Values (SGVs) and the C4SLs is the level of risk that they describe. As described by the Environment Agency (2009a):

*“SGVs are guidelines on the level of long-term human exposure to individual chemicals in soils that, unless stated otherwise, are tolerable or pose a minimal risk to human health”.*

C4SLs, therefore, should not be viewed as “SPOSH levels” and they should not be used as a legal trigger for the determination of land under Part 2A.

CL:AIRE (Contaminated Land: Application in Real Environments) has published “*Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination*”. In it a series of C4SLs were proposed as follows;

<b>Analyte</b>	<b>Residential (with home grown produce) (mg/kg)</b>	<b>Residential (without home grown produce) (mg/kg)</b>	<b>Allotments (mg/kg)</b>	<b>Commercial (mg/kg)</b>	<b>POS (mg/kg)</b>
Arsenic	37	40	49	640	79
Benzene	0.87	3.3	0.18	98	140
Benzo(a)Pyrene	5	5.3	5.7	77	10
Cadmium	22	150	3.9	410	880
Chromium (vi)	21	21	170	49	21
Lead	200	310	80	2300	630

Where C4SL’s are not available, Generic Assessment Criteria have been used as follows;

**Generic Assessment Criteria for Human Health Risk Assessment Comparison**

**METALS/CYANIDE**

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and based on 6% soil organic matter (SOM)

Values are expressed in mg/kg

	S4UL						C4SL						EA SGV			EIC/AGS/CL:AIRE or *ATRISKSOIL		
	Residential with homegrown produce	Residential without homegrown produce	Allotment	Commercial	POSresi	POSpark	Residential with homegrown produce	Residential without homegrown produce	Allotment	Commercial	POSresi	POSpark	Residential	Allotment	Commercial	Residential without consumption of homegrown produce	Allotment	Commercial
Antimony <sup>1</sup>																550	ND	7500
Arsenic (6% SOM)	37	40	43	640	79	170	37	40	49	640	79	170	32	43	640			
Barium <sup>1</sup>																1300	ND	22000
Beryllium (6% SOM)	1.7	1.7	35	12	2.2	63												
Boron (6% SOM)	290	11000	45	240000	21000	46000												
Cadmium (6% SOM)	11	85	1.9	190	120	560	22	150	3.9	410	220	880	10	1.8	230			
Chromium (III) (6% SOM)	910	910	18000	8600	1500	33000												
Chromium (VI) (6% SOM)	6	6	1.8	33	7.7	220	21	21	170	49	21	250						
Copper (6% SOM)	2400	7100	520	68000	12000	44000												
Cyanide (AtriskSoil)																34*	34*	34*
Lead (6% SOM)							200	310	80	2300	630	1300						
Nickel (6%SOM)	130	180	53	980	230	800												
Mercury (Elemental) (6% SOM)	1.2	1.2	21	58	16	30							1.0	26	26			
Mercury (Inorganic) (6% SOM)	40	56	19	1100	120	240							170	80	3600			
Mercury (Methyl) (6% SOM)	11	15	6	320	40	68							11	8	410			
Molybdenum <sup>1</sup>																670	ND	17000
Selenium (6% SOM)	250	430	88	12000	1100	1800							350	120	13000			
Vanadium (6% SOM)	410	1200	91	9000	2000	5000												
Zinc (6% SOM)	3700	40000	620	730000	81000	170000												

**Additional notes for EIC/AGS/CL:AIRE GAC**

<sup>1</sup> Due to the limitations in time and scope of the EIC/AGS/CL:AIRE project, plant uptake factors were not derived for metals and therefore the metals GAC have only been produced for residential without consumption of homegrown produce and commercial land-uses. Note that the derived GAC are not dependent on SOM.



Compound	S4UL		C4SL				EA SGV				EIC/AGS/CL:AIRE								
	Residential with homegrown produce	Residential without homegrown produce	Allotment	Commercial	POSresi	POSpark	Residential with homegrown produce	Residential without homegrown produce	Allotment	Commercial	POSresi	POSpark	Residential	Allotment	Commercial	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Allotment	Commercial
Benzene (1% SOM)	0.087	0.38	0.017	27	72	90													
Benzene (2.5% SOM)	0.17	0.7	0.034	47	72	100													
Benzene (6% SOM)	0.37	1.4	0.075	90	73	110	0.87	3.3	0.18	98	140	230	0.33	0.07	95				
Toluene (1% SOM)	130	880 (869)	22	56000 (869)	56000	87000 (869)													
Toluene (2.5% SOM)	290	1900	51	110000 (1920)	56000	95000 (1920)													
Toluene (6% SOM)	660	3900	120	180000 (4360)	56000	100000 (4360)							610	120	4.4x10 <sup>3</sup>				
Ethyl benzene (1% SOM)	47	83	16	5700 (518)	24000	17000 (518)													
Ethyl benzene (2.5% SOM)	110	190	39	13000 (1220)	24000	22000 (1220)													
Ethyl benzene (6% SOM)	260	440	91	27000 (2840)	25000	27000 (2840)							350	90	2.8x10 <sup>3</sup>				
o-xylene (1% SOM)	60	88	28	6600 (478)	41000	17000 (478)													
o-xylene (2.5% SOM)	140	210	67	15000 (1120)	42000	24000 (1120)													
o-xylene (6% SOM)	330	480	160	33000 (2620)	43000	33000 (2620)							250	160	2.6x10 <sup>3</sup>				
m-xylene (1% SOM)	59	82	31	6200 (625)	41000	17000 (625)													
m-xylene (2.5% SOM)	140	190	74	14000 (1470)	42000	24000 (1470)													
m-xylene (6% SOM)	320	450	170	31000 (3460)	43000	32000 (3469)							240	180	3.5x10 <sup>3</sup>				
p-xylene (1% SOM)	56	79	29	5900 (576)	41000	17000 (478)													
p-xylene (2.5% SOM)	130	180	69	14000 (1350)	42000	23000 (1350)													
p-xylene (6% SOM)	310	430	160	30000 (3170)	43000	31000 (3170)							230	160	3.2x10 <sup>3</sup>				
Methyl tert-butyl ether (1% SOM)																49	73	23	7900
Methyl tert-butyl ether (2.5% SOM)																84	120	44	13000
Methyl tert-butyl ether (6% SOM)																160	220	90	24000

#### Additional Notes for LQM/CIEH Generic Assessment Criteria

- For residential land use the inhalation of vapours indoors exposure pathway is the most significant exposure pathway for the lighter end aliphatic and aromatic fractions (up to aliphatic EC>12-16 and aromatic EC>10-12). The ingestion of soil and indoor dust and consumption of homegrown produce exposure pathways are the most significant for the higher end fractions (aliphatics EC>16-35 and EC>35-44; aromatics EC>12-16, EC16-21, EC>21-35, EC>35-44 and EC44-70).
- For the allotment land use the consumption of homegrown produce exposure pathway is the most significant for the aromatic and lighter end aliphatic fractions. The ingestion of soil and indoor dust is the most significant exposure pathway for the higher end aliphatics EC>12-16, EC>16-35 and EC35-44.
- For the commercial land use the indoor inhalation of vapour exposure pathway is a significant exposure pathway for the lighter end aliphatic and aromatic fractions (up to aliphatic EC>12-16 and aromatic EC>10-12).
- Background exposure represents a significant proportion of the total exposure for all fractions expect aromatic fractions EC>5-7 and EC>7-8 in all land uses.

#### Notes for SGVs

- Based on a sandy loam as defined in Environment Agency (2009b) and 6% SOM. At a lower SOM, SGVs may not be sufficient protective.
- Generic assessment criteria will vary according to SOM for all land uses.
- SGVs assume that free phase contamination is not present.
- SGVs based on a sub-surface soil to indoor air correction air correction factor of 10.
- SGV presented for Toluene Commercial based on the vapour saturation limit.
- SGV presented for Ethylbenzene Allotment and Xylene Allotment - in applying the rules for non-soil background, the inhalation background ADE is limited to being no larger than the contribution of the inhalation soil ADE.
- Exposure of all isomers of xylene should be considered together, because the HCV applied is based on intake of total xylene and not an individual isomer in isolation.

#### Notes for EIC/AGS/CL:AIRE Generic Assessment Criteria

- GAC have been derived for 4 generic land uses; residential with consumption of homegrown produce, residential without consumption of homegrown produce, allotments and commercial land-use.

## POLYAROMATIC HYDROCARBONS

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria for Polycyclic Aromatic Hydrocarbons will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	LQM/CIEH						C4SL					
	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark
Acenaphthene (1% SOM)	210	3000 (57)	34	84000 (57)	15000	29000						
Acenaphthene (2.5% SOM)	510	4700 (141)	85	97000 (141)	15000	30000						
Acenaphthene (6% SOM)	1100	6000 (336)	200	100000	15000	30000						
Acenaphthylene (1% SOM)	170	2900 (86.1)	28	83000 (86.1)	15000	29000						
Acenaphthylene (2.5% SOM)	420	4600 (212)	69	97000 (212)	15000	30000						
Acenaphthylene (6% SOM)	920	6000 (506)	160	100000	15000	30000						
Anthracene (1% SOM)	2400	31000 (1.17)	380	520000	74000	150000						
Anthracene (2.5% SOM)	5400	35000	950	540000	74000	150000						
Anthracene (6% SOM)	11000	37000	2200	540000	74000	150000						
Benz(a)anthracene (1% SOM)	7.2	11	2.9	170	29	49						
Benz(a)anthracene (2.5% SOM)	11	14	6.5	170	29	56						
Benz(a)anthracene (6% SOM)	13	15	13	180	29	62						
Benzo(a)pyrene (1% SOM)	2.2	3.2	0.97	35	5.7	11						
Benzo(a)pyrene (2.5% SOM)	2.7	3.2	2.0	35	5.7	12						
Benzo(a)pyrene (6% SOM)	3.0	3.2	3.5	36	5.7	13	5.0	5.3	5.7	77	10	21
Benzo(b)fluoranthene (1% SOM)	2.6	3.9	0.99	44	7.1	13						
Benzo(b)fluoranthene (2.5% SOM)	3.3	4.0	2.1	44	7.2	15						
Benzo(b)fluoranthene (6% SOM)	3.7	4.0	3.9	45	7.2	16						
Benzo(ghi)perylene (1% SOM)	320	360	290	3900	640	1400						
Benzo(ghi)perylene (2.5% SOM)	340	360	470	4000	640	1500						
Benzo(ghi)perylene (6% SOM)	350	360	640	4000	640	1600						
Benzo(k)fluoranthene (1% SOM)	77	110	37	1200	190	370						
Benzo(k)fluoranthene (2.5% SOM)	93	110	75	1200	190	410						
Benzo(k)fluoranthene (6% SOM)	100	110	130	1200	190	440						
Chrysene (1% SOM)	15	30	4.1	350	57	93						
Chrysene (2.5% SOM)	22	31	9.4	350	57	110						
Chrysene (6% SOM)	27	32	19	350	57	120						
Dibenzo(ah)anthracene (1% SOM)	0.24	0.31	0.14	3.5	0.57	1.1						
Dibenzo(ah)anthracene (2.5% SOM)	0.28	0.32	0.27	3.6	0.57	1.3						
Dibenzo(ah)anthracene (6% SOM)	0.3	0.32	0.43	3.6	0.58	1.4						
Fluoranthene (1% SOM)	280	1500	52	23000	3100	6300						
Fluoranthene (2.5% SOM)	560	1600	130	23000	3100	6300						
Fluoranthene (6% SOM)	890	1600	290	23000	3100	6400						
Fluorene (1% SOM)	170	2800 (30.9)	27	63000 (30.9)	9900	20000						
Fluorene (2.5% SOM)	400	3800 (76.5)	67	68000	9900	20000						
Fluorene (6% SOM)	860	4500 (183)	160	71000	9900	20000						
Indeno(123cd)pyrene (1% SOM)	27	45	9.5	500	82	150						
Indeno(123cd)pyrene (2.5% SOM)	36	46	21	510	82	170						
Indeno(123cd)pyrene (6% SOM)	41	46	39	510	82	180						
Naphthalene (1% SOM)	2.3	2.3	4.1	190 (76.4)	4900	1200 (76.4)						
Naphthalene (2.5% SOM)	5.6	5.6	10	460 (183)	4900	1900 (183)						
Naphthalene (6% SOM)	13	13	24	1100 (432)	4900	3000						
Phenanthrene (1% SOM)	95	1300 (36)	15	22000	3100	6200						
Phenanthrene (2.5% SOM)	220	1500	38	22000	3100	6200						
Phenanthrene (6% SOM)	440	1500	90	22000	3100	6300						
Pyrene (1% SOM)	620	3700	110	54000	7400	15000						
Pyrene (2.5% SOM)	1200	3800	270	54000	7400	15000						
Pyrene (6% SOM)	2000	3800	620	54000	7400	15000						
Coal Tar (BaP as surrogate mat)	0.79	1.2	0.32	15	2.2	4.4						
Coal Tar (BaP as surrogate mat)	0.98	1.2	0.67	15	2.2	4.7						
Coal Tar (BaP as surrogate mat)	1.1	1.2	1.2	15	2.2	4.9						

## CHLOROALCANES AND ALKANES

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	S4UL			EIC/AGS/CL:AIRE						
	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Allotment	Commercial
1,1-Dichloroethane (1% SOM)							2.4	2.5	9.2	280
1,1-Dichloroethane (2.5% SOM)							3.9	4.1	17	450
1,1-Dichloroethane (6% SOM)							7.4	7.7	35	850
1,2-Dichloroethane (1% SOM)	0.0071	0.0092	0.0046	0.67	29	21				
1,2-Dichloroethane (2.5% SOM)	0.011	0.013	0.0083	0.97	29	24				
1,2-Dichloroethane (6% SOM)	0.019	0.023	0.016	1.7	29	28				
1,1,1-Trichloroethane (1% SOM)	8.8	9	48	660	140000	57000 (1425)				
1,1,1-Trichloroethane (2.5% SOM)	18	18	110	1300	140000	76000 (2915)				
1,1,1-Trichloroethane (6% SOM)	39	40	240	3000	140000	100000 (6392)				
1,1,2-Trichloroethane (1% SOM)							0.6	0.88	0.28	94
1,1,2-Trichloroethane (2.5% SOM)							1.2	1.8	0.61	190
1,1,2-Trichloroethane (6% SOM)							2.7	3.9	1.4	400
1,1,1,2-Tetrachloroethane (1% SOM)	1.2	1.5	0.79	110	1400	1500				
1,1,1,2-Tetrachloroethane (2.5% SOM)	2.8	3.5	1.9	250	1400	1800				
1,1,1,2-Tetrachloroethane (6% SOM)	6.4	8.2	4.4	560	1400	2100				
1,1,2,2-Tetrachloroethane (1% SOM)	1.6	3.9	0.41	270	1400	1800				
1,1,2,2-Tetrachloroethane (2.5% SOM)	3.4	8.0	0.89	550	1400	2100				
1,1,2,2-Tetrachloroethane (6% SOM)	7.5	17	2.0	1100	1400	2300				
1,1-Dichloroethene (1% SOM)							0.23	0.23	2.8	26
1,1-Dichloroethene (2.5% SOM)							0.40	0.41	5.6	46
1,1-Dichloroethene (6% SOM)							0.82	0.82	12	92
Tetrachloroethene (1% SOM)	0.18	0.18	0.65	19	1400	810 (424)				
Tetrachloroethene (2.5% SOM)	0.39	0.40	1.5	42	1400	1100 (951)				
Tetrachloroethene (6% SOM)	0.9	0.92	3.6	95	1400	1500				
Tetrachloromethane (1% SOM)	0.026	0.026	0.45	2.9	890	190				
Tetrachloromethane (2.5% SOM)	0.056	0.056	1.0	6.3	920	270				
Tetrachloromethane (6% SOM)	0.13	0.13	2.4	14	950	400				
Trichloroethene (1% SOM)	0.016	0.017	0.041	1.2	120	70				
Trichloroethene (2.5% SOM)	0.034	0.036	0.091	2.6	120	91				
Trichloroethene (6% SOM)	0.075	0.080	0.21	5.7	120	120				
Trichloromethane (1% SOM)	0.91	1.2	0.42	99	2500	2600				
Trichloromethane (2.5% SOM)	1.7	2.1	0.83	170	2500	2800				
Trichloromethane (6% SOM)	3.4	4.3	1.7	350	2500	3100				
Vinyl Chloride (1% SOM)	0.00064	0.00077	0.00055	0.059	3.5	4.8				
Vinyl Chloride (2.5% SOM)	0.00087	0.0010	0.0010	0.077	3.5	5.0				
Vinyl Chloride (6% SOM)	0.0014	0.0015	0.0018	0.12	3.5	5.4				
Chloroethane (1% SOM)							8.3	8.4	110	960
Chloroethane (2.5% SOM)							11	11	200	1300
Chloroethane (6% SOM)							18	18	380	2100
1,2-Dichloropropane (1% SOM)							0.024	0.024	0.62	3.3
1,2-Dichloropropane (2.5% SOM)							0.042	0.042	1.2	5.9
1,2-Dichloropropane (6% SOM)							0.084	0.085	2.6	12
2-Chloronaphthalene (1% SOM)							3.7	3.8	40	390
2-Chloronaphthalene (2.5% SOM)							9.2	9.3	98	960
2-Chloronaphthalene (6% SOM)							22	22	230	2200
Bromodichloromethane (1% SOM)							0.016	0.019	0.016	2.1
Bromodichloromethane (2.5% SOM)							0.030	0.034	0.032	3.7
Bromodichloromethane (6% SOM)							0.061	0.07	0.068	7.6
Chloromethane (1% SOM)							0.0083	0.0085	0.066	1
Chloromethane (2.5% SOM)							0.0098	0.0099	0.13	1.2
Chloromethane (6% SOM)							18	18	380	2100

Compound	S4UL				EIC/AGS/CL:AIRE					
	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Allotment	Commercial
<i>cis</i> -1,2 Dichloroethene (2.5% SOM)							0.19	0.20	0.50	24
<i>cis</i> -1,2 Dichloroethene (6% SOM)							0.37	0.39	1.0	47
<i>trans</i> -1,2 Dichloroethene (1% SOM)							0.19	0.19	0.93	22
<i>trans</i> -1,2 Dichloroethene (2.5% SOM)							0.34	0.35	1.9	40
<i>trans</i> -1,2 Dichloroethene (6% SOM)							0.70	0.71	4.0	81
Dichloromethane (1% SOM)							0.58	2.1	0.1	270
Dichloromethane (2.5% SOM)							0.98	2.8	0.19	360
Dichloromethane (6% SOM)							1.7	4.5	0.34	560
Hexachloroethane (1% SOM)							0.2	0.22	0.27	22
Hexachloroethane (2.5% SOM)							0.48	0.54	0.67	53
Hexachloroethane (6% SOM)							1.1	1.3	1.6	120

**Notes for EIC/AGS/CL:AIRE Generic Assessment Criteria**

1 GAC have been derived for 4 generic land uses; residential with consumption of homegrown produce, residential without consumption of homegrown produce, allotments and commercial land-use.

**EXPLOSIVES**

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	S4UL					
	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark
RDX (1% SOM)	120	13000	17	210000	210000	210000
RDX (2.5% SOM)	250	13000	38	210000	26000	49000 (18.7)
RDX (6% SOM)	540	13000	85.0	210000	27000	53000
HMX (1% SOM)	5.7	6700	0.86	110000	13000	23000 (0.35)
HMX (2.5% SOM)	13	6700	1.9	110000	13000	23000 (0.39)
HMX (6% SOM)	26	6700	3.9	110000	13000	24000 (0.48)

## PESTICIDES

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	S4UL					
	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark
Aldrin (1% SOM)	5.7	7.3	3.2	170	18	30
Aldrin (2.5% SOM)	6.6	7.4	6.1	170	18	31
Aldrin (6% SOM)	7.1	7.5	9.6	170	18	31
Dieldrin (1% SOM)	0.97	7	0.17	170	18	30
Dieldrin (2.5% SOM)	2	7.3	0.41	170	18	30
Dieldrin (6% SOM)	3.5	7.4	0.96	170	18	31
Atrazine (1% SOM)	3.3	610	0.5	9300	1200	2300
Atrazine (2.5% SOM)	7.6	620	1.2	9400	1200	2400
Atrazine (6% SOM)	17.4	620	2.7	9400	1200	2400
Dichlorovos (1% SOM)	0.032	6.4	0.0049	140	16	26
Dichlorovos (2.5% SOM)	0.066	6.5	0.010	140	16	26
Dichlorovos (6% SOM)	0.14	6.6	0.022	140	16	27
Alpha-Endosulfan (1% SOM)	7.4	160 (0.003)	1.2	5600 (0.003)	1200	2400
Alpha-Endosulfan (2.5% SOM)	18	280 (0.007)	2.9	7400 (0.007)	1200	2400
Alpha-Endosulfan (6% SOM)	41	410 (0.016)	6.8	8400 (0.016)	1200	2500
Beta-Endosulfan (1% SOM)	7	190 (0.00007)	1.1	6300 (0.00007)	1200	2400
Beta-Endosulfan (2.5% SOM)	17	320 (0.0002)	2.7	7800 (0.0002)	1200	2400
Beta-Endosulfan (6% SOM)	39	440 (0.0004)	6.4	8700	1200	2500
Alpha-Hexachlorocyclohexanes (1)	0.23	6.9	0.035	170	24	47
Alpha-Hexachlorocyclohexanes (2)	0.55	9.2	0.087	180	24	48
Alpha-Hexachlorocyclohexanes (3)	1.2	11	0.21	180	24	48
Beta-Hexachlorocyclohexanes (1)	0.085	3.7	0.013	65	8.1	15
Beta-Hexachlorocyclohexanes (2)	0.2	3.8	0.032	65	8.1	15
Beta-Hexachlorocyclohexanes (3)	0.46	3.8	0.077	65	8.1	16
Gamma-Hexachlorocyclohexane	0.06	2.9	0.0092	67	8.2	14
Gamma-Hexachlorocyclohexane	0.14	3.3	0.023	69	8.2	15
Gamma-Hexachlorocyclohexane	0.33	3.5	0.054	70	8.2	15

## CHLOROBENZENES & METHYLBENZENES

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	S4UL				EIC/AGS/CL:AIRE					
	Residential with homegrown produce	Residential without homegrown produce	Allotment	Commercial	POSresi	POSpark	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Allotment	Commercial
Chlorobenzene (1% SOM)	0.46	0.46	5.9	56	11000	1300 (675)				
Chlorobenzene (2.5% SOM)	1.0	1.0	14	130	13000	2000 (1520)				
Chlorobenzene (6% SOM)	2.4	2.4	32	290	14000	2900				
1,2-Dichlorobenzene (1% SOM)	23	24	94	2000 (571)	90000	24000 (571)				
1,2-Dichlorobenzene (2.5% SOM)	55	57	230	4800 (1370)	95000	36000 (1370)				
1,2-Dichlorobenzene (6% SOM)	130	130	540	11000 (3240)	98000	51000 (3270)				
1,3-Dichlorobenzene (1% SOM)	0.40	0.44	0.25	30	300	390				
1,3-Dichlorobenzene (2.5% SOM)	1.0	1.1	0.6	73	300	440				
1,3-Dichlorobenzene (6% SOM)	2.3	2.5	1.5	170	300	470				
1,4-Dichlorobenzene (1% SOM)	61	61	15	4400 (224)	17000	36000 (224)				
1,4-Dichlorobenzene (2.5% SOM)	150	150	37	10000 (540)	17000	36000 (540)				
1,4-Dichlorobenzene (6% SOM)	350	350	88	25000 (1280)	17000	36000 (1280)				
1,2,3-Trichlorobenzene (1% SOM)	1.5	1.5	4.7	102	1800	770 (134)				
1,2,3-Trichlorobenzene (2.5% SOM)	3.6	3.7	12	250	1800	110 (330)				
1,2,3-Trichlorobenzene (6% SOM)	8.6	8.8	28	590	1800	1600 (789)				
1,2,4-Trichlorobenzene (1% SOM)	2.6	2.6	55	220	15000	1700 (318)				
1,2,4-Trichlorobenzene (2.5% SOM)	6.4	6.4	140	530	17000	2600 (786)				
1,2,4-Trichlorobenzene (6% SOM)	15	15	320	1300	19000	400 (1880)				
1,3,5-Trichlorobenzene (1% SOM)	0.33	0.33	4.7	23	1700	380 (36.7)				
1,3,5-Trichlorobenzene (2.5% SOM)	0.81	0.81	12	55	1700	580 (90.8)				
1,3,5-Trichlorobenzene (6% SOM)	1.9	1.9	28	130	1800	860 (217)				
1,2,3,4-Tetrachlorobenzene (1% SOM)	15	24	4.4	1700 (122)	830	1500 (122)				
1,2,3,4-Tetrachlorobenzene (2.5% SOM)	36	56	11	3080 (304)	830	1600				
1,2,3,4-Tetrachlorobenzene (6% SOM)	78	120	26	4400 (728)	830	1600				
1,2,3,5-Tetrachlorobenzene (1% SOM)	0.66	0.75	0.38	49 (39.4)	78	110 (39)				
1,2,3,5-Tetrachlorobenzene (2.5% SOM)	1.6	1.9	0.90	120 (98.1)	79	120				
1,2,3,5-Tetrachlorobenzene (6% SOM)	3.7	4.3	2.2	240 (235)	79	130				
1,2,4,5-Tetrachlorobenzene (1% SOM)	0.33	0.73	0.06	42 (19.7)	13	25				
1,2,4,5-Tetrachlorobenzene (2.5% SOM)	0.77	1.7	0.16	72 (49.1)	13	26				
1,2,4,5-Tetrachlorobenzene (6% SOM)	1.6	3.5	0.37	96	13	26				
Pentachlorobenzene (1% SOM)	5.8	19	1.2	640 (43.0)	100	190				
Pentachlorobenzene (2.5% SOM)	12	30	3.1	770 (107)	100	190				
Pentachlorobenzene (6% SOM)	22	38	7.0	830	100	190				
Hexachlorobenzene (1% SOM)	1.8 (0.20)	4.1 (0.20)	0.47	110 (0.20)	16	30				
Hexachlorobenzene (2.5% SOM)	3.3 (0.50)	5.7 (0.50)	1.1	120	16	30				
Hexachlorobenzene (6% SOM)	4.9	6.7 (1.2)	2.5	120	16	30				
1,2,4-Trimethylbenzene (1% SOM)							0.35	0.41	0.38	42
1,2,4-Trimethylbenzene (2.5% SOM)							0.85	0.99	0.93	99
1,2,4-Trimethylbenzene (6% SOM)							2	2.3	2.2	220
Isopropyl benzene (1% SOM)							11	12	32	1400
Isopropyl benzene (2.5% SOM)							27	28	79	3300
Isopropyl benzene (6% SOM)							64	67	190	7700
Propylbenzene (1% SOM)							34	40	34	4100
Propylbenzene (2.5% SOM)							82	97	83	9700
Propylbenzene (6% SOM)							190	230	200	21000
Styrene (1% SOM)							8.1	35	1.6	3300
Styrene (2.5% SOM)							19	78	3.7	6500
Styrene (6% SOM)							43	170	8.7	11000

## PHENOLS AND CHLOROPHENOLS

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	LQM/CIEH			EA SGV			EIC/AGS/CL:AIRE						
	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark	Residential	Allotment	Commercial	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	atm	Commercial
Phenol (1% SOM)	120	440 (460)	23	440 (26000)	440 (10000)	440 (7600)							
Phenol (2.5% SOM)	200	690	42	690 (30000)	690 (10000)	690 (8300)							
Phenol (6% SOM)	380	1200	83	1300 (34000)	1300 (10000)	1300 (9300)	420	280	3200 (38000)				
Chlorophenol (1% SOM)	0.87	94	0.13	3500	620	1100							
Chlorophenol (2.5% SOM)	2.0	150	0.30	4000	620	1100							
Chlorophenol (6% SOM)	4.5	210	0.70	4300	620	1100							
Pentachlorophenol (1% SOM)	0.22	27 (16.7)	0.03	400	60	110							
Pentachlorophenol (2.5% SOM)	0.52	29	0.08	400	60	120							
Pentachlorophenol (6% SOM)	1.2	31	0.19	400	60	120							
2,4-Dimethylphenol (1% SOM)										19	210	3	16000
2,4-Dimethylphenol (2.5% SOM)										43	410	7	24000
2,4-Dimethylphenol (6% SOM)										97	730	17	30000
Total Cresols (2-Methylphenol, 3-methylphenol, 4-methylphenol) (1% SOM)										80	3700	12	160000
Total Cresols (2-Methylphenol, 3-methylphenol, 4-methylphenol) (2.5% SOM)										180	5400	27	180000
Total Cresols (2-Methylphenol, 3-methylphenol, 4-methylphenol) (6% SOM)										400	6900	63	180000

## PHTHALATES

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	EIC/AGS/CL:AIRE			
	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Allotment	Commercial
Bis (2-ethylhexyl) phthalate (1%)	280	2700	47	85000
Bis (2-ethylhexyl) phthalate (2.5%)	610	2800	120	86000
Bis (2-ethylhexyl) phthalate (6%)	1100	2800	280	86000
Butyl benzyl phthalate (1% SOM)	1400	42000	220	940000
Butyl benzyl phthalate (2.5% SOM)	3300	44000	550	940000
Butyl benzyl phthalate (6% SOM)	7200	44000	1300	950000
Diethyl Phthalate (1% SOM)	120	1800	19	1500000
Diethyl Phthalate (2.5% SOM)	260	3500	41	2200000
Diethyl Phthalate (6% SOM)	570	6300	94	2900000
Di-n-butyl phthalate (1% SOM)	13	450	2	15000
Di-n-butyl phthalate (2.5% SOM)	31	450	5	15000
Di-n-butyl phthalate (6% SOM)	67	450	12	15000
Di-n-octyl phthalate (1% SOM)	2300	3400	940	89000
Di-n-octyl phthalate (2.5% SOM)	2800	3400	2100	89000
Di-n-octyl phthalate (6% SOM)	3100	3400	3900	89000

## OTHER ORGANICS

Based on sandy loam soil as defined in SR3 (Environment Agency, 2009) and 1%, 2.5% and 6% soil organic matter (SOM)

Generic assessment criteria will vary according to SOM for all land values

Values are expressed in mg/kg

GACs assume that free phase contamination is not present

GACs are based on sub-surface soil to indoor air correction factor of 1

Compound	S4UL			EIC/AGS/CL:AIRE						
	Residential with home grown produce	Residential without home grown produce	Allotment	Commercial	POSresi	POSpark	Residential with consumption of homegrown produce	Residential without consumption of homegrown produce	Allotment	Commercial
Carbon disulphide (1% SOM)	0.14	0.14	4.8	11	11000	1300				
Carbon disulphide (2.5% SOM)	0.29	0.29	10	22	11000	1900				
Carbon disulphide (6% SOM)	0.62	0.62	23	47	12000	2700				
Hexachloro-1,3-butadiene (1% S)	0.29	0.32	0.25	31	25	48				
Hexachloro-1,3-butadiene (2.5%)	0.70	0.78	0.61	66	25	50				
Hexachloro-1,3-butadiene (6% S)	1.6	1.8	1.4	120	25	51				
Tributyl tin oxide (1% SOM)							0.25	1.4	0.042	130
Tributyl tin oxide (2.5% SOM)							0.59	3.1	0.1	180
Tributyl tin oxide (6% SOM)							1.3	5.7	0.24	200
Biphenyl (1% SOM)							66	220	14	18000
Biphenyl (2.5% SOM)							160	500	35	33000
Biphenyl (6% SOM)							360	980	83	48000
2,4-Dinitrotoluene (1% SOM)							1.5	170	0.22	3700
2,4-Dinitrotoluene (2.5% SOM)							3.2	170	0.49	3700
2,4-Dinitrotoluene (6% SOM)							7.2	170	1.1	3800
2,6-Dinitrotoluene (1% SOM)							0.78	78	0.12	1900
2,6-Dinitrotoluene (2.5% SOM)							1.7	84	0.27	1900
2,6-Dinitrotoluene (6% SOM)							3.9	87	0.61	1900
Bromoform (1% SOM)							2.8	5.2	0.95	760
Bromoform (2.5% SOM)							5.9	11	2.1	1500
Bromoform (6% SOM)							13	23	4.6	3100

## 6. GEOENVIRONMENTAL RISK ASSESSMENT

- 6.1 **Potential Hazard Sources.** Ground contamination can occur through several causes, particularly from historical use of the site and is often linked to the processes of waste disposal, underground storage, open storage, process pipework, leaks, spillages, tanks, site filling and various other reasons. The contamination can either arise from site sources or be the result of migration from other sources off site.
- 6.2 **Potential Migratory Pathways.** The primary pathways are considered to be laterally or vertically downward through underlying strata or upward to the ground surface. Such pathways also provide the potential for contaminants to migrate towards local watercourses and groundwater.
- 6.3 **Potential Targets At Risk.** Potential environmental liabilities related to current legislation associated with contaminated land with regard to existing ownership and redevelopment are summarised.

The probability of a hazard, linked with its consequences, can be used to assess risk in accordance with the tables below for use in decision making.

### Consequence of Pollution Linkage

<b>Severe</b>	Damage to human health. Substantial pollution of controlled waters. Significant change in ecosystem population. Irreparable damage to property.
<b>Moderate</b>	Non-permanent damage to human health. Minor pollution of controlled waters. Change in ecosystem. Damage to property.
<b>Mild</b>	Short term health effects. Slight pollution of controlled waters. Slight effect on ecosystem. Minor repairable damage to property.
<b>Near Zero</b>	No noticeable effect on human health. No significant pollution to controlled waters. No measurable effect on ecosystem densities. Non-structural cosmetic damage to property.

### Decision Making

Probability of a hazard and an associated linkage	Consequences of a pollution linkage (hazard-pathway-target)			
	Severe	Moderate	Mild	Near Zero
High	High	High	Medium/low	Negligible
Medium	High	Medium	Low	Negligible
Low	High/medium	Medium/low	Low	Negligible
Unlikely	High/medium/low	Medium/low	Low	Negligible

Final overall risk is based on an assessment of probability of a hazard and its consequences. Risk categories are shown shaded in the table above and defined below.

Risk	Description
High	Site probably or certainly unsuitable for present use or environmental setting. Contamination probably or certainly present and likely to have an unacceptable impact on key targets. Urgent action needed.
Medium/ Moderate	Site may not be suitable for present use or environmental setting. Contamination may be present, and likely to have unacceptable impact on key targets. Action may be needed on the medium term.
Low	Site considered suitable for present use and environmental setting. Contamination may be present but unlikely to have unacceptable impacts on key targets. Action unlikely to be needed in present use.
Negligible	Site considered suitable for present use and environmental setting. Contamination may be present but unlikely to have unacceptable impacts on key targets. No action needed while site remains in present use.

The review of the information from the exploratory investigation may be such that a decision is made that there is no need for further investigation. Alternatively, it may be necessary to carry out a further main investigation.

The Environment Agency has set out guidance as to the classification of waste arising from construction sites in its document "The Definition of Waste" dated April 2006. This document outlines how waste is to be handled

The following activities are not regarded as a waste management activity requiring licencing.

- 1) Construction activities carried out for the purpose of producing a suitably engineered soil e.g. lime stabilisation, vibro-replacement and piling.
- 2) Uncontaminated materials produced on site (including excavated soils and materials from demolition) which can be reused without further treatment. Examples include site regrading and footing excavations.

These must be done in accordance with the Planning Permission. Demolition material must be used in accordance with the quality protocols for the production of aggregates from inert waste, subject to appropriate testing and the lack of any harmful constituents. Uses include pipe bedding, backfill and sub-base.

- 3) Contaminated soils can be moved on-site providing they do not require treatment or containment. There should be no risk to the environment i.e. non-leachable and in accordance with Planning Permission. Relevant activities can include site regrading and use of materials below clean cover systems, capping, buildings and hardstanding.

Where contaminated materials have to be placed in an engineered cell to prevent pollution, then this would be classed as landfilling and require PPC permits. Any material taken off site is considered to be waste. However, this is under review. If material is waste, then there is a duty of care including ensuring material is transported by a registered carrier. The destination of material leaving the site should be regularly checked and Waste Transfer Notes kept.

#### **Clean Cover Systems**

According to the Environment Agency's Remediation Position Statements of May 2006, the placement of a cover system using "clean" material is not treatment of waste. Consequently, no licensing/permitting position statements are applicable to this type of remediation. If the cover system uses 'waste materials' in its construction, waste management licensing exemption paragraph 9A may be applicable to its installation. If the installation of the proposed cover system does not meet the criteria for registration of this exemption, the activity may be regulated through a waste management site license.

### **7. WASTE ACCEPTANCE CRITERIA (WAC)**

The main objective of the Landfill Directive is to prevent or reduce as far as possible the negative effects of landfilling waste on the environment and on human health. It is intended to reduce the disposal of waste materials to landfills and to encourage more sustainable approaches to dealing with wastes. It bans the landfill of liquids and certain solid wastes, introduces requirements for the treatment of wastes prior to landfill and provides for the classification of landfills as sites for inert, hazardous or non-hazardous waste and prohibits co-disposal.

It sets out procedures for waste acceptance at landfills and the types of waste for each class of landfill as specified by Waste Acceptance Criteria (WAC). The WAC are predominantly lists of "limit values" for certain parameters obtained from standard leaching tests of wastes going to landfills. WAC are set out in the Landfill Directive itself. Full details can be found in the Environment Agency document "Waste Classification – Guidance on the classification and Assessment of Waste " Technical Guidance WM3 - 2015

## 8. MAIN REFERENCES

British Standards	BS3882: 2015 British Standard Specification for Topsoil BS5930: 2015+A1:2020 British Standard Code of Practice for Site Investigations BS8485: 2015 British Standard Code of Practice for the design and protective measures from methane and carbon dioxide ground gases for new buildings BS10175: 2011+A2:2017 British Standard Code of Practice for the Investigation of Potentially Contaminated Sites
BRE	Radon: Guidance on protective measures for new dwellings, BR211, 2015 Protective measures for housing on gas-contaminated land, BR414, 2015 Cover systems for land regeneration, 2004 Concrete in aggressive ground. Special Digest SD1, 3 <sup>rd</sup> Edition, 2005 Soakaway Design (DG365)
CIEH	The LQM / CIEH Generic Assessment Criteria for Human Health Risk Assessment (2 <sup>nd</sup> Edition)
CIRIA	Assessing risks posed by hazardous ground gases to buildings, CIRIA C665 Asbestos in Soil and Made Ground: a guide to understanding and managing risks, CIRIAC733, 2014 Good Practice on the testing and verification of protection systems for buildings against hazardous ground gases. C735:2014
CL:AIRE	Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, SP1010, 2013
DEFRA	Contaminated Land Report CLR 11, 2002 (7-10 withdrawn) R & D Publications TOX 1 – 12, 14, 16 – 25 R & D Publications SGV 1, 3, 4, 5, 7, 8, 9, 10, 15 and 16 (withdrawn) Improvements to Contaminated Land Guidance - “Outcome of the “Way Forward”, 2008 Exercise on Soil Guideline Values. July 2008 Guidance on the Legal Definition of Contaminated Land. July 2008 Simplification of the Contaminated Land Regime Impact Assessment No: Defra 1133
DETR	Circular 02/2000. Contaminated Land, 2000 Guidelines for Environmental Risk Assessment and Management, 2000
Environment Agency	Guidance for the Safe Development of Housing on Land Affected by Contamination, 2000  Protective measures for housing on gas-contaminated land Remediation Position Statements, May 2006 Guidance and monitoring of landfill leachate, groundwater and surface water Human health toxicological assessment of contaminants in soil (Science Report SC050021/SR2) 2008 Updated technical background in the CLEA model (Science Report SC0520021/SR3) Waste Classification – Guidance on the classification and Assessment of Waste - Technical Guidance WM3 (2015) Contaminated Land Risk Management (2021)
HMSO	Part 2A of the Environmental Protection Act Part 2A Statutory Guidance – April 2012 Contaminated Land (England) Regulations 2006 The Contaminated Land (England) (Amendment) Regulations 2012 The Water Act 2003 (Commencement No. 11) Order 2012
Institution of Civil Engineers	Contaminated Land: Investigation, Assessment and Remediation, 2 <sup>nd</sup> Edition
NHBC	Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present, 2007

This list is not intended to be exhaustive.