Remedial Method Statement

St Gabriel's, Manchester

Prepared for: McLaren Living
Issue 00

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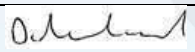
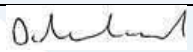
Checked by:	Daniel Freeland		19/01/2024
Approved by:	Daniel Freeland		19/01/2024

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1. INTRODUCTION

Concept Engineering Consultants (Concept) have been instructed by Arcadis on behalf of McLaren Living to provide a Remediation Method Statement (RMS) in respect to a proposed development at a site known as St Gabriels in Manchester.

In January 2022 RSK were commissioned to undertake a Preliminary Risk Assessment:

- RSK (2022). Preliminary Risk Assessment: St Gabriel's Development, Manchester (11671 R01 (01), 11/02/2022).

Between April and May 2023, Concept Site Investigations undertook ground investigations on the site and summarised the findings in the following report:

- Concept Site Investigations (2023). Ground Investigation Report- Factual, St Gabriels Manchester (23/3814-GIR-F01 Issue 01 31-08-2023)

The findings of the ground investigation were discussed further in the following report to provide an appraisal of the ground conditions and contamination:

- Concept Engineering Consultants (2023). Geo-environmental and Geotechnical Interpretative Report St Gabriel's, Manchester (23/3814-GIR-GIR, 30/11/2023)

The previously issued Preliminary Risk Assessment and Interpretative Report have partially discharged Condition 10 of planning permission 135278/FO/2022. This RMS provides further detail on the remediation measures required to full discharge Condition 10.

Asbestos fibres were identified in Made Ground in two locations. Concept have no liability in terms of their commission in relation to the management or treatment of asbestos. This material is to be removed in a controlled manner by an appointed qualified specialist.

This report has been prepared for Arcadis as instructed by McLaren Living. Any other party using the information in this report for any other purpose does so at their own risk and any duty of care to that party is excluded. Reasonable skill and care have been exercised in the preparation of this report in accordance with the technical requirements of the brief. Notwithstanding the efforts made by the professional team, it is possible that ground conditions other than those indicated in this report may exist at the site.

2. PLANNING BACKGROUND

2.1 Planning Context

In Planning Permission 135278/FO/2022 the following conditions relate to Contaminated Land:

'10) The development hereby approved shall be implemented in accordance with the submitted Phase I Preliminary Risk Assessment prepared by RSK Geosciences, dated February 2022 (Ref: 11671 RO1 (01), received by the City Council as Local Planning Authority on 25 October 2022. The Preliminary Risk Assessment shall conform to City Council's current guidance document (Planning Guidance in Relation to Ground Contamination).

In the event of the Preliminary Risk Assessment identifying risks which in the written opinion of the Local Planning Authority require further investigation, the development shall not commence until a scheme for the investigation of the site and the identification of remediation measures (the Site Investigation Proposal) has been submitted to and approved in writing by the City Council as local planning authority.

The measures for investigating the site identified in the Site Investigation Proposal shall be carried out, before the development commences and a report prepared outlining what measures, if any, are required to remediate the land (the Site Investigation Report and/or Remediation Strategy) which shall be submitted to and approved in writing by the City Council as local planning authority.

11) When the development commences, the development shall be carried out in accordance with a previously agreed Remediation Strategy and a Completion/Verification Report shall be submitted to and approved in writing by the City Council as local planning authority. No occupation of the development shall take place until the completion/verification report is submitted to and approved by the City Council as local planning authority.

In the event that ground contamination, groundwater contamination and/or ground gas, not previously identified, are found to be present on the site at any time before the development is occupied, then development shall cease and/or the development shall not be occupied until, a report outlining what measures, if any, are required to remediate the land (the Revised Remediation Strategy) is submitted to and approved in writing by the City Council as local planning authority and the development shall be carried out in accordance with the Revised Remediation Strategy, which shall take precedence over any Remediation Strategy or earlier Revised Remediation Strategy.

A factual and interpretative report prepared by Concept was accepted to partially discharge Condition 10. This RMS is intended to fully discharge Condition 10 and provides

a summary of the information that will be collected during the groundworks and presented in the Verification Report to Discharge Condition 11 of the above.

2.2 Development Proposal

A full description of the development proposal is as follows:

'Erection of part 4 storey, part 5 storey buildings, together with the refurbishment and restoration of existing buildings to form student accommodation (sui generis) together with associated landscaping, cycle parking, car parking and associated works following demolition of certain existing buildings'

3. CONTAMINATED LAND RISKS

The Concept 2023 Contaminated Land Risk Assessment summarised risks as follows

- Construction workers – **MODERATE TO LOW** mitigated as **LOW** with the appropriate use of PPE and implementation of CDM regulations
- Future site users – **HIGH** due to elevated PAH's and Heavy Metals if the site is considered for a residential use without planting of vegetable/ fruit for consumption and where there is no hard cover from roads/ buildings. Mitigated to **LOW** (assuming a capping layer is adopted in soft landscaped areas)
- Groundwater – **LOW**
- Surface Water – **VERY LOW**
- Onsite property/buildings and services –**LOW** (assuming barrier pipe is used in Made Ground)
- Offsite residents – **MODERATE TO LOW** mitigated as **LOW** with the appropriate management of risks during construction works
- Adjacent land/property– **LOW**

3.1 Risks to Human Health from Soil

3.1.1 Heavy Metals and PAHs

From the 2023 Ground Investigations by Concept there were 37 samples tested for Heavy Metals and PAH's. When compared to a residential without plant uptake land use there were samples with elevated metals as described further below:

• BH02 @ 0.30m, elevated Arsenic of 45 mg/kg (compared to 40 mg/kg) material described as dark brown mottle dark brown fine to coarse SAND and GRAVEL. Gravel comprises angular to subrounded fine to coarse brick, concrete and slag fragments.

• TP5 @ 0.40m, elevated Mercury of 5.2 mg/kg (compared to 1.2 mg/kg) material described as red and light grey sandy GRAVEL with high brick and concrete cobble content. Gravel comprises angular to subangular fine to coarse brick and concrete fragments. Sand is fine to medium.

• WS01 @ 0.25m, elevated Lead of 720 mg/kg (compared to 300 mg/kg) material described as dark grey very sandy GRAVEL with low brick cobble content and occasional glass and ceramic fragments. Gravel comprises angular to subangular fine to coarse brick and asphalt fragments. Sand is fine to coarse.

- WS01 @ 1.10m, elevated Lead of 310 mg/kg (compared to 300 mg/kg) material described as greyish brown slightly gravelly slightly sandy silty CLAY with occasional clinker and ceramic fragments. Gravel comprises angular to subangular fine to coarse brick and clinker fragments.

The table below provides further details of the locations where elevated PAH's were encountered.

Table 3.1: Review of Elevated PAH Results

	Benzo (a) Anthracene	Chrysene	Benzo [b] fluoranthene	Benzo [a] pyrene	Indeno (1,2,3-c,d)Pyrene	Dibenz (a,h) Anthracene
Target (mg/kg)	**11**	**30**	**3.9**	**3.1**	**45**	**0.31**
BH01 @ 1.00m Brown mottled grey slightly gravelly sandy CLAY. Gravel comprises angular to subrounded fine to coarse sandstone and brick fragments.	-	-	-	3.4	-	0.35
WS01 @ 0.25m Dark grey very sandy GRAVEL with low brick cobble content and occasional glass and ceramic fragments. Gravel comprises angular to subangular fine to coarse brick and asphalt fragments. Sand is fine to coarse.	-	-	-	-	-	0.35
WS02 @ 0.50m Grass over dark brown gravelly clayey fine to coarse SAND with frequent roots and rootlets. Gravel comprises angular to subrounded fine to coarse concrete, brick and sandstone fragments.	-	-	5.8	5.8	-	0.60
WS03 @ 0.20m Dark grey fine to coarse SAND and GRAVEL. Gravel comprises angular to subrounded fine to coarse granite, brick and concrete fragments.	-	-	9.5	8.7	-	1.2
WS04 @0.30m Dark brown fine to coarse SAND and GRAVEL with high brick cobble content and frequent pockets of ash. Gravel comprises angular to subangular fine to coarse granite, brick, concrete and slag fragments.	200	200	250	220	130	18
WS05 @ 0.50m Brown mottled grey slightly gravelly sandy CLAY. Gravel comprises angular to subrounded fine to coarse sandstone, mudstone, siltstone, coal and brick fragments.	-	-	6.6	6.2	-	0.53
WS07 @ 0.50m Greyish brown mottled very gravelly fine to coarse SAND with high brick cobble content. Gravel comprises angular to subangular fine to coarse brick, clinker, quartz and slate fragments.	-	-	8.6	7.8	-	-
WS08 @0.25m Grey and brown slightly gravelly slightly sandy silty CLAY with low brick cobble content. Gravel comprises angular to subrounded fine to coarse brick, clinker and chalk fragments. Sand is fine to coarse	19	-	37	34	-	3.9
WS08 @0.60m – As above	-	-	19	18	-	1.9
WS09 @ 1.00m Greyish brown very sandy clayey GRAVEL with high brick cobble content and occasional roots and rootlets. Gravel	-	-	15	13	-	1.5

	Benzo (a) Anthracene	Chrysene	Benzo [b] fluoranthene	Benzo [a] pyrene	Indeno (1,2,3-c,d)Pyrene	Dibenz (a,h) Anthracene
Target (mg/kg)	**11**	**30**	**3.9**	**3.1**	**45**	**0.31**
comprises angular to subangular fine to coarse brick and clinker fragments. Sand is fine to coarse.						
WS10 @ 0.20m Brown slightly gravelly slightly sandy silty CLAY with low sandstone and brick cobble content and occasional roots and rootlets. Gravel comprises angular to subangular fine to coarse sandstone, brick, slate and asphalt fragments. Sand is fine to coarse.	-	-	10	9.7	-	0.93
TP1 @ 0.15m Dark brown fine to coarse SAND and GRAVEL with frequent pockets of ash. Gravel comprises angular to subangular fine to coarse granite and brick fragments.	22	-	34	31	-	3.1
TP2 @ 0.30m Dark grey gravelly very clayey fine to coarse SAND with low brick and asphalt cobble content, occasional glass fragments and occasional roots and rootlets. Gravel comprises angular to subrounded fine to coarse quartzite, brick, charcoal and clinker fragments.	-	-	15	14	-	1.8

From a review of the locations in the table above they are distributed across the site. The PAH concentrations and soil descriptions, show that ash is the likely source of the highest PAH results in WS04. In the other locations the elevated PAH's are likely from materials in the Made Ground such as ash, clinker, charcoal and slag and possibly also from cross contamination from overlying asphalt.

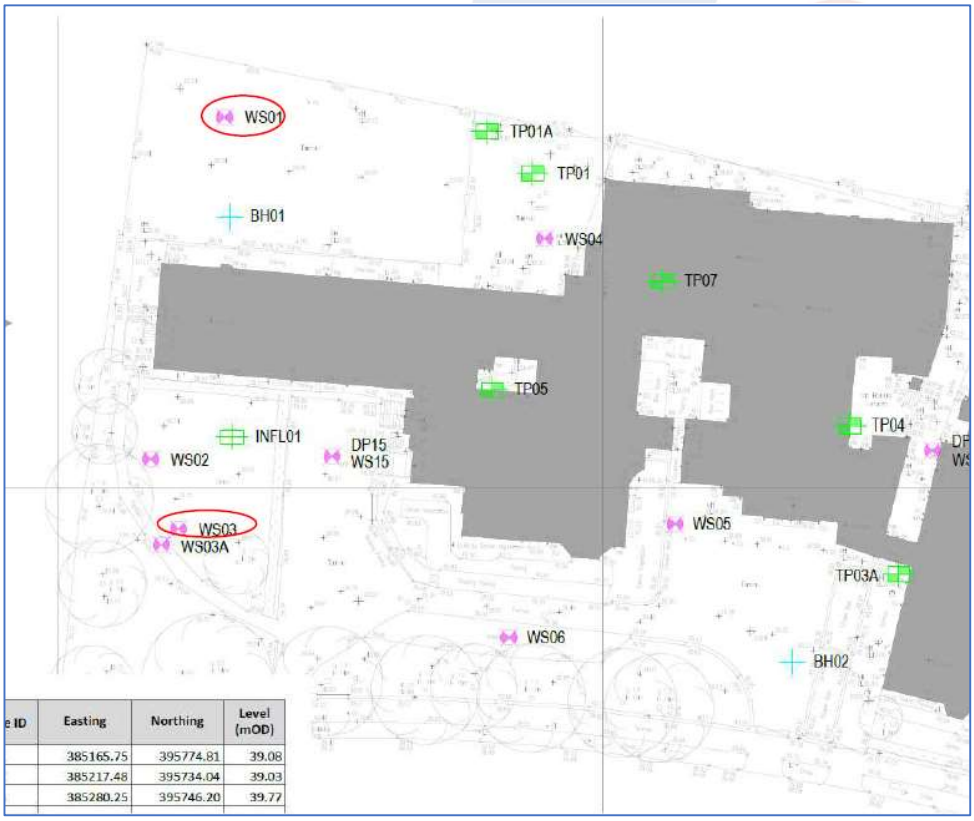
No further remediation is required for these contamination sources in areas beneath buildings or pavements as hardstanding will prevent the pathway to end site users. In soft landscaped areas it is recommended that a cover system is constructed to limit contamination pathways to end users.

3.1.2 Asbestos

From the 2023 Ground Investigations by Concept there were 37 samples screened for asbestos. Asbestos was detected in 2 of 37 samples which are summarised as follows:

- WS01 @ 0.25m Fibres/ clumps of Amosite – quantified as 0.001% – soils described as above.
- WS03 @ 0.20m Fibres/ clumps of Chrysotile – quantified as <0.001% – soils described as above.

Generally asbestos was identified in coarse grained Made Ground. The two locations where it was detected were in the west of the development area as circled in Figure 3.1.



e ID	Easting	Northing	Level (mOD)
	385165.75	395774.81	39.08
	385217.48	395734.04	39.03
	385280.25	395746.20	39.77

Figure 3.1 – 2023 Ground Investigation Locations with Asbestos Detection

3.2 Risk to Controlled Waters

There was no identified risk to controlled waters.

3.3 Risks to Human Health After the Development from Ground Gas and Vapours

From the 2022 RSK Desk Study Report - the property is not in a Radon Affected Area, as less than 1% of properties are above the action level. In accordance with the BR211 BRE publication, no radon protection measures are considered necessary.

From the Concept 2023 Geo-Environmental Interpretation:

The Ground Model demonstrated Bedrock underlying around 8.50m of Glacial Till. The Glacial Till was proven to be a 7.50m thick layer of low permeability clay with circa 1.00m of coarse grained material at the base. This clay will provide a barrier between upper Made Ground/ shallow Glacial Till and the underlying bedrock.

Gas/ Vapour monitoring demonstrated the following:

- Vapours or Methane were not detected in any of the installations
- There are elevated levels of carbon dioxide in the Bedrock (BH01, BH02 & BH03). The highest flow rates were also detected in these boreholes. These boreholes

were intended for groundwater monitoring, although gas monitoring has been undertaken and carbon dioxide has been recorded, there is no viable pathway for this to impact on the site. These results have therefore been discounted in relation to assessing the risk from ground gas.

- In WS02 and WS05 the monitoring installations targeted the Made Ground and Glacial Till respectively. In these two installations the water level was above the response zone and therefore this data is not representative of the ground gas regime at the site.
- In the remaining two locations the highest recorded flow rate was 0 litres per hour, The maximum CO2 result was 5.4% in the Made Ground and 10.7% in shallow Glacial Soils.

As detailed in Table 8.5 of CIRIA publication C665 – the site would be a very low risk (CS1) based on GSV values but as the CO2 levels are above 5% the site would be a CS2 low risk site where some gas protection measures would be required.

3.4 Risks to Plants and Landscaping

The remediation will comprise a capping layer in soft landscaped areas which will be used as a planting medium for plants and landscaping. This will limit the pathway to underlying soils that are elevated in PAH's and heavy metals.

3.5 Risk to Building Materials and Services

Soil and groundwater results when compared against the BRE Special Digest 1 (2005) demonstrated that concrete would require a DC1/ DC2 level of protection depending on the material type and the degree of exposure during construction.

When compared to limits from WRAS related to suitable pipe materials for water services, there were levels of hydrocarbons and PAH's which were in excess of the acceptable concentrations for PE and/ or PVC pipework and therefore it was deemed that barrier pipe would be required for new water supply pipework. This advice applies where existing soils are to be retained on site.

4. ACTIONS TO BE TAKEN DURING CONSTRUCTION

4.1 Verification Report

A Verification Report will be required to fully discharge Condition 11 of planning permission 135278/FO/2022. This will be issued on completion of the remediation defined in this RMS.

4.2 Remediation Scope

4.2.1 PAH's and Heavy Metals

No further remediation is required for these contamination sources in areas beneath buildings or pavements as hardstanding will prevent the pathways to end site users. In soft landscaped areas it is recommended that a cover system is constructed to limit contamination pathways to end users. The cover system should comprise 600mm of imported clean soils comprising topsoil and subsoil overlying a separation membrane.

4.2.2 Asbestos

During excavation in the vicinity of WS01 and WS03, control measures may be required to limit exposure to construction workers and members of the public. This will depend on the Contractors own risk assessments.

4.2.3 Ground Gas Protection

The assessment of risks from ground gas has identified that the site is a low gas risk site with a CS2 site characterisation in accordance with CIRIA guidance. In accordance with BS8485: 2015 it is assumed that protection will be provided using a combination of two or more measures comprising:

- the structural barrier of the floor slab, or of the basement slab and walls if a basement is present;
- ventilation measures; and
- gas resistant membrane.

At St Gabriels it is likely that the gas protection will be achieved with:

- Cast in situ monolithic reinforced ground bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations and well reinforced to control cracking
- Gas membrane.

The gas membrane is to meet the following requirements:

- Constructed from Virgin Polymer
- sufficiently impervious to gases with a methane gas transmission rate <40.0

ml/day/m2/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method);

- 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. settlement if placed below a floor slab);
- sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc);
- capable, after installation, of providing a complete barrier to the entry of the relevant gas; and
- Independently verified in accordance with CIRIA C735 [N1]

The final gas protection measures will be determined at the detailed design stage and a Verification Plan will be provided by the Contractor responsible for the installation of the membrane.

4.3 Unexpected Contamination

On any Brownfield Site there is a potential for encountering contamination that was not recorded during the site investigation works. It is recommended that a watching brief for the identification of unexpected contamination is included in the principal contractor's risk assessment. Should any conditions arise other than those identified previously, then the soils of concern should be assessed and the risks revaluated accordingly.

In addition general precautionary methods should be taken to limit direct exposure to soils and dust during the development for instance from unexpected contamination. This should include the use of appropriate PPE based on the findings of site investigations and dust control during earthworks.

Where unexpected contamination is encountered it is recommended that the Contractor appoint an environmental consultant to advise on further actions and to liaise with the Local Authority.

All records related to unexpected contamination are to be recorded in the Verification Report.

4.4 Management Of Materials

4.4.1 Concrete Protection

The final concrete design including protection from aggressive ground and waterproofing requirements will be undertaken during detailed design.

4.4.2 Water Pipe Materials

The Concept 2023 Contaminated Land Risk Assessment has identified that barrier pipe might be required for new water supply pipework in Made Ground. It is recommended that the Local Water Authority is consulted prior to ordering and placement of pipes so that any site specific requirements can be addressed.

4.4.3 Imported Materials

All materials imported to site will be sourced by the Groundworks Contractor and documentation on source and origin submitted to the Environmental Consultant to confirm acceptability.

The information provided by the Contractor shall be as follows:

- Location of source of material
- Records on quantities of materials to be imported and their final location on the site.
- Chemical data for the soil material as provided by the supplier. Where the supplier cannot provide this information then it should be arranged for independent testing of samples from the offsite source location.

Chemical data will need to include testing for the substances in Appendix A. When materials are imported to site further representative samples from material stockpiled prior to placement will be taken at a rate of 1 per 50 m^3 with at least 1 No. sample of each soil type from each supplier and in each imported area. These samples will be tested for the same contaminants as outlined above.

The results will be compared to soil guideline values based on a residential without plant uptake land use as provided in Appendix A.

4.4.4 Re-use of Soil

Where it is proposed to re-use site won material then this shall be tested from stockpiles prior to re-use at a rate of 1 per 20m^3 and/ or 1 sample per source and/ or at least 1 sample per landscaped area.

The results will be compared to soil guideline values based on a residential without plant uptake land use as provided in Appendix A.

4.4.5 Disposal Of Soil

Different waste streams will not be mixed. Where material is suspected of being contaminated then this will be stored separately to other wastes. Potentially contaminated materials will be stored on an impermeable base (i.e. polythene or similar) and covered.

Results on waste classification are provided in the 2023 Concept Geo-environmental Report. Further waste characterisation testing may be required depending on the locations and volumes of waste.

Prior to removal from site the receiving party will verify that the waste is acceptable for

disposal at their facility. Waste materials will be transported using approved waste carriers and all paperwork such as waste transfer notes and hazardous waste consignment notes will be completed.

4.5 Residual Risk on Completion of the Development

On completion of the remediation in accordance with this RMS, contamination sources will either be removed during excavations or pathways removed by the proposed 600mm cover system or by gas protection measures and therefore the final risk to end users is likely to be Very Low. This will be re-assessed on completion of the groundworks and summarised in the Verification Report.

APPENDIX A: Target Values for Imported Soils

Determinant	Residential Land Use Without Plant Uptake(mg/kg) 1% Organic matter For imported fill	Source
Asbestos	No Detection	-
Arsenic	40	S4UL/C4SL
Cadmium	85	S4UL/C4SL
Hexavalent Chromium	6.0	C4SL
Chromium	910	S4UL/C4SL
Copper	7100	S4UL/C4SL
Lead	300	S4UL/C4SL
Mercury	1.2	S4UL/C4SL
Nickel	180	S4UL/C4SL
Selenium	430	S4UL/C4SL
Zinc	40000	S4UL/C4SL
Boron (Total)	11000	S4UL/C4SL
Naphthalene	2.3	S4UL/C4SL
Acenaphthylene	2900	S4UL/C4SL
Acenaphthene	3000	S4UL/C4SL
Fluorene	2800	S4UL/C4SL
Phenanthrene	1300	S4UL/C4SL
Anthracene	31000	S4UL/C4SL
Fluoranthene	1500	S4UL/C4SL
Pyrene	3700	S4UL/C4SL
Benzo(a)anthracene	11	S4UL/C4SL
Chrysene	30	S4UL/C4SL
Benzo (b) fluoranthene	3.9	S4UL/C4SL
Benzo (k) fluoranthene	110	S4UL/C4SL
Benzo (a) pyrene	3.2	S4UL/C4SL
Indeno (1,2,3-cd) pyrene	45	S4UL/C4SL
Dibenzo(a,h) anthracene	0.31	S4UL/C4SL
Benzo[g,h,i]perylene	360	S4UL/C4SL
Benzene	0.38	C4SL
Toluene	880	S4UL/C4SL
Ethylbenzene	83	S4UL/C4SL
P & m xylene	79	S4UL/C4SL
Aliphatic >EC5 - EC6	42	S4UL/C4SL
Aliphatic >EC6 – EC8	100	S4UL/C4SL
Aliphatic >EC8 – EC10	27	S4UL/C4SL
Aliphatic >EC10 – EC12	130	S4UL/C4SL
Aliphatic >EC12 – EC16	1100	S4UL/C4SL
Aliphatic >EC16 – EC21	32000	S4UL/C4SL
Aliphatic >EC21 – EC35	32000	S4UL/C4SL
Aromatic >EC5 - EC7	370	S4UL/C4SL

Determinant	Residential Land Use Without Plant Uptake(mg/kg) 1% Organic matter For imported fill	Source
Aromatic >EC7 – EC8	860	S4UL/C4SL
Aromatic >EC8 – EC10	47	S4UL/C4SL
Aromatic >EC10 – EC12	250	S4UL/C4SL
Aromatic >EC12 – EC16	1800	S4UL/C4SL
Aromatic >EC16 – EC21	1900	S4UL/C4SL
Aromatic >EC21 – EC35	1900	S4UL/C4SL
Total PCBs	0.008	EIC

1. *C4SL* = SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document. March 2014. Department for Environment, Food and Rural Affairs.
2. S4UL = *LQM/CIEH S4ULs for Human Health Risk Assessment*, Land Quality Management Limited & Chartered Institute of Environmental Health, 2014.
3. EIC = January 2010 CL:AIRE "Soil Generic Assessment Criteria for Human Health Risk Assessment (ISBN 978-1-905046-20-01)

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