



ASBESTOS DETAILED QUANTITATIVE RISK ASSESSMENT FOR HOPWOOD HALL COLLEGE, ROCHDALE

TE1880-TE-00-XX-RP-GE-004-V01

VERSION 1

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FINAL

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1. INTRODUCTION

Tier Environmental was commissioned by Willmott Dixon to undertake an Asbestos Detailed Quantitative Risk Assessment (DQRA) report for an area of land referred to Hopwood Hall College, located at Rochdale Campus, St Mary's Gate, Rochdale OL12 6RY (the "site").

The title of this report is in accordance with that described in the Land Contamination Risk Management guidance (available at <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>) which has superseded CLR 11:

Stage 1:

- LCRM Tier 3 Detailed Quantitative Risk Assessment Report

1.1. Proposed Development

Under current proposals the development will comprise the partial demolition of the existing college buildings in the east of the site, with construction of the new proposed 4 No. storey college building in the north, a water tank and small ancillary building in the centre, and a substation in the northwest of the site. The remainder of the site will comprise car parking and soft landscaped areas, as presented in Appendix A. As such, in accordance with the 'Updated technical background to the CLEA model' (Environment Agency, 2009) and 'Suitable 4 Use Levels' (LQM / CIEH 2015) the proposed generic land use for this development is commercial, which is deemed to be the most appropriate due to the activities that are likely to be undertaken on site (educational) and the limited frequency and duration of time end users are likely to spend on site.

1.2. Background

The following previous reports have been prepared by Tier Environmental:

Tier Environmental have been produced the following reports in relation to the site:

- Preliminary Risk Assessment Report For Hopwood Hall College, Rochdale (Report ref: TE1880-TE-00-XX-RP-GE-001-V01 dated January 30th, 2025)
- Ground Investigation Report for Hopwood Hall, College, Rochdale (Report ref: TE1880-TE-00-XX-RP-002-V01 dated 5th February 2025)
- Coal Mining Risk Assessment For Hopwood Hall College, Rochdale (Report ref: TE1880-TE-00-XX-RP-GE-003-V01 dated 6th February 2025)

The conclusions of the risk assessments relevant to the objectives of this report are summarised below:

"The results of a generic quantitative human health risk assessment have determined the following:

- *Justification has been provided for screening measured soil concentrations of potential contaminants of concern against commercial / industrial GACs. No measured concentrations of potential contaminants of concern have been reported in excess of these GACs. Sensitivity analysis via comparison against POS Park GACs has reported a single measured concentration of benzo(a)pyrene in Made Ground in the northeast of the site. Overall, it is not considered that the site presents a risk from potential chemical contaminants of concern for the proposed areas of hardstanding, buildings or peripheral soft landscaping; however, it is recommended that additional, post-demolition, soil sampling and risk assessment is conducted in the vicinity of the proposed contoured landscaped area in the east of the site.*
- *Asbestos has been reported in the Made Ground across the site (in 56% of those samples analysed) at concentrations between <0.001% and 0.03% w/w (amosite and chrysotile - fibre bundles, ACM debris and locally, bitumen products)."*



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1.3. Objectives

Taking into account the proposed development of the Site, the objectives of this appraisal were:

- To reproduce the Revised Conceptual Site Model developed during the Tier Environmental LCRM Tier 1 & 2 Ground Investigation Report;
- To conduct an asbestos detailed risk assessment in accordance with CIRIA C733 in order to determine whether any residual risk remains for future land users;
- To assess whether the conclusions of this risk assessment eliminate the remediation requirements for a clean cover system, due to asbestos;
- Update the Conceptual Site Model based on the conclusions of the asbestos detailed quantitative risk assessment.

1.4. Assumptions

The following assumptions are made in this report:

- It is assumed that ground levels will not change significantly from those described in this report or as shown on proposed development drawings. If this is not the case, then amendments to the recommendations made in this report may be required.
- The ground investigation has been designed with due consideration of known or suspected constraints (including underground services and access constraints).
- Any references to observations of suspected asbestos-containing materials are for information only and should be verified by a suitably qualified asbestos specialist and/or confirmed by laboratory analysis.
- The use of the term 'Topsoil' within this report is based on a visual identification only and that these materials have not been classified in accordance with BS3882:2015.
- The use of the terms 'shallow' and 'deep' within this report assume *typically* between ground level to circa 5.00m below ground level (bgl) for 'shallow' and greater than 5.00m bgl regarded as 'deep';
- The comments and opinions presented in this report are based on the findings of the desk study, ground conditions encountered during intrusive investigation works performed by Tier Environmental and the results of tests carried out within one or more laboratories. There may be other conditions prevailing on the Site which have not been revealed by this investigation and which have not been taken into account by this report.
- Responsibility cannot be accepted for any conditions not revealed by this investigation. Any diagram or opinion on the possible configuration of the findings is conjectural and given for guidance only. Confirmation of intermediate ground conditions should be undertaken if deemed necessary.

This report has been prepared for the sole use of Wilmott Dixon. No other third party may rely upon or reproduce the contents of this report without the written approval of Tier Environmental. If any unauthorised third party comes into possession of this report, they rely on it entirely at their own risk and the authors do not owe them any Duty of Care or Skill.



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2. SITE DETAILS AND DESCRIPTION

Table 2.1 Current Site Overview.

Site name	Hopwood Hall College
Site address	Hopwood Hall College, Rochdale Campus, St Mary's Gate, Rochdale OL12 6RY. A site location plan is included as Drawing No. TE1880-TE-00-XX-DR-GE-001-V01 within Appendix A.
National Grid Reference (NGR)	389299 413363
Approximate Site area	1.75 ha
Site shape	The site is approximately triangular in shape
Current land use on the Site	The site currently comprises a college with a building of several storeys (including a basement/undercroft) present in the east of the site, and an asphalt surfaced car park across the majority of the remainder of the site and a drop off lane present along the northern and western boundaries. It is understood that an interceptor is present in the northeastern corner of the car park/drop off lane. Metal fencing around 2m height is present at the northern and western extent of the car park, with a brick retaining wall of between approx. 1.00m and 2.00m height present at the northern boundary of the drop off lane, marking the site boundary with College Road. A second brick retaining wall is present at the south of the car park, separating the car park from the river embankment which lies approx. 1.00m to 2.00m below the car park. No cracks or visible signs of stress were visible on either of the retaining walls. Limited soft landscaped areas are present, including a small, sloped grass verge in the northwest of the site, a grassed embankment between the car park/college buildings and the river in the south of the site, and as a grassed terraced area to the northeast of the building, which steps down to the basement floor level. The basement/undercroft area is accessible from the car park and is understood to comprise storage, waste disposal areas (bins/skips) and a plant room. The plant room contains the heating infrastructure for the building, including 2 no. oil tanks, both of which are understood to no longer be used with one understood to have been emptied via tanker (but not decommissioned) in the past couple of years. These oil tanks are present within a separate concrete bunded room, only accessible via locked ladder access. From the limited viewpoint accessible during the walkover, no spills or leakages were observed. An electric substation is present in the northeast of the site, to the northwest of the existing college building. Underground services are known to be present beneath the site, including electricity, gas, water and drainage. There is limited surface water drainage around the car park area, observed only to be present at the car park boundaries. Vehicular access for deliveries and disabled parking is present from College Road close to the centre north of the site, leading to the drop off lane, a small parking area and the basement/undercroft access. An access road for the main car park is present in the northwest of the site, with a smaller car park present to the west of this access road. This smaller car park is understood to be let out and was not accessible during the ground investigation. During college opening hours, pedestrian access is freely available. A hedge of approximately 1m height is present surrounding the northeastern soft landscaped area, with limited shrubs present elsewhere around site. Mature trees are present in the far northwest of the site, surrounding the smaller car park (it is understood that development is to be undertaken in this area). It should be noted that the car park in the northwest of the site and the terraced soft landscaping in the east of the site was not accessible during the walkover and are unlikely to be accessible for any ground investigation.
Surrounding land uses	The site is set within a mixed commercial and residential area, with Rochdale Town centre located approximately 500m northeast of the site.
General topography and ground levels	The main car park area of the site is generally level at around 119m AOD. However, College Road to the north of the site lies between approx. the same level as the site in the northeast (120m AOD) rising to around 1.0m higher than the site in the northwest (120m AOD), separated from the site by a brick retaining wall. Similarly, in the south of the site the highest level of the grassed banks of the River Roch lies between 0.5m to 1.00m below the car park level at around 118m AOD, separated by a brick retaining wall. Site levels between the existing building and St. Mary's Gate also vary, with grassed terraces leading from road level (120m AOD) in the northeast to 116m AOD in the centre east and back up to 120m AOD in the southeast. Again, a brick and concrete retaining wall was present at the site boundary (this area was not accessible during the walkover).



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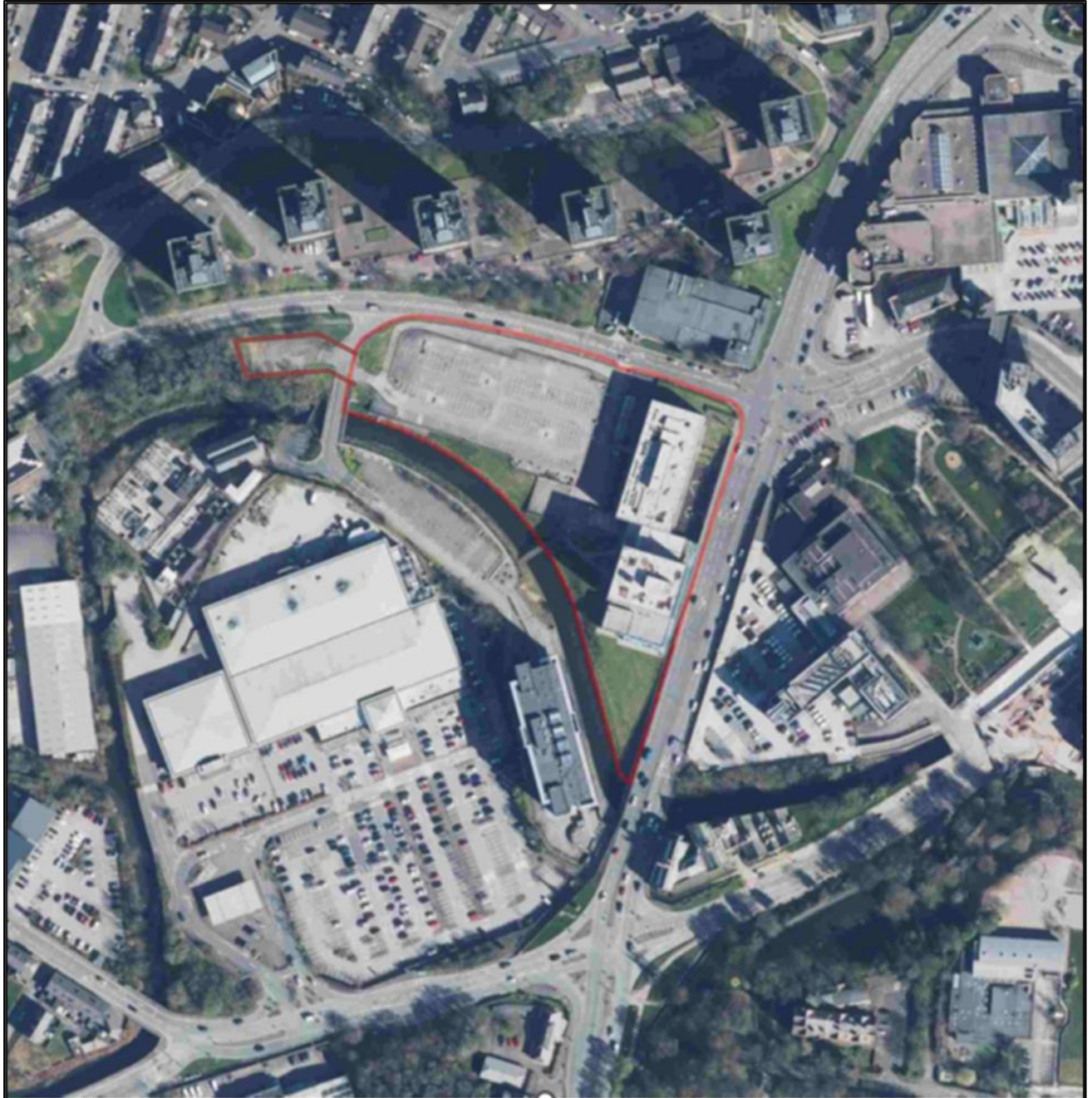
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An aerial photograph (from the Groundsure report included within the previous) of the Site and site boundary is shown below.

Figure 2.1 Recent Aerial Photograph from Groundsure





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3. CONCEPTUAL MODEL AND QUALITATIVE RISK ASSESSMENT OF POLLUTANT LINKAGES

The preliminary combined conceptual site model and conceptual exposure model, developed from the desk study information and presented in Section 6 of the Tier Environmental LCRM Tier 1 Preliminary Risk Assessment Report, was revised in light of the ground investigation and the chemical analysis results within the LCRM Tier 2 Ground Investigation Report. This Conceptual Site Model has been reproduced in Table 3.1, below.

A qualitative risk assessment was made of the likelihood of the linkage operating and its potential significance in accordance with CIRIA C552.

This Conceptual Site Model will be updated accordingly upon completion of the Asbestos Detailed Quantitative Risk Assessment included within this report.



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Table 3.1 Revised Assessment of Pollutant Linkages.

Source	Potential Contaminants of Concern	Pathway	Receptor	Consequence	Probability	Qualitative Risk Assessment
Localised concentrations of benzo(a)pyrene within the northeast of the site which exceeds Public Open Space (Park) land use (NOT commercial land use) GAC.	benzo(a)pyrene	Direct contact, dust inhalation and ingestion	Future site users (educational)	Medium	Low Likelihood	Moderate / Low Risk
			Adjacent site users (residential and commercial)	Medium	Unlikely	Low Risk
			Construction, site investigation, demolition and future maintenance workers	Medium	Unlikely	Low Risk
		Migration of mobile contaminants from Made Ground soils to adjacent sites along services and conduits	Adjacent site users (residential and commercial)	Medium	Unlikely	Low Risk
Widespread asbestos within the Made Ground, up to 0.03% w/w	Asbestos	(Dust migration and) dust inhalation	Future site users (educational)	Medium	Likely	Moderate Risk
			Adjacent site users (residential and commercial)	Medium	Low Likelihood	Moderate / Low Risk
			Construction, site investigation, demolition and future maintenance workers	Medium	Likely	Moderate Risk

For definition of the terms used in the qualitative risk assessment, please see Appendix B.



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4. ASBESTOS DETAILED QUANTITATIVE RISK ASSESSMENT

4.1. Objectives and Approach

Taking into account the planned future use of the Site, the objectives of this appraisal were to undertake a site specific human health risk assessment with regard to the concentration of identified asbestos, in line with the principals stated in C733.

As no robust method of producing an asbestos GAC is available or possible at present, quantitative risk assessments for asbestos-related soils need to characterise the nature and extent of asbestos contamination in soils. For this site, this is achieved through a clear evaluation of the future land use, including likely receptors and the type, form, condition and concentrations of asbestos in soils. From the characteristic value, it will be possible to estimate potential airborne fibre concentrations that may arise from such contamination and then use a range of risk assessment techniques which will enable lines of evidence to develop a realistic exposure scenario for the future commercial land use. This exposure scenario will also utilise in-built conservatism and predict likely cumulative exposures for the maximum period of time a typical landscape maintenance worker (the critical receptor due to length of time and exposure through digging activities) is likely to spend at the site. This exposure will finally allow us to evaluate the significance of the associated risks and whether the worst case occurrences of asbestos represent anything other than a minimal risk to the site users.

4.2. Asbestos Quantification Testing

In order to attempt to quantify the percentage of asbestos in any given soil sample, the following method is followed. The whole sample is tipped into a tray, weighed, dried, and weighed again. The sample is inspected under a x40 stereomicroscope, and any visible ACM or clumps of fibres are removed and weighed.

These fibres are inspected under a Polarising Light Microscope to confirm the presence and type of asbestos in the sample (a bulk ID). This will be reported even if only a small number of fibres are found, and then the full quantification method is implemented.

For fibre quantification the residual sample is sieved and the <5mm fraction is dispersed in water for an hour. Replicate aliquots (at least four) are then removed, filtered, and the filters mounted onto microscope slides for counting and measuring using Phase Contrast Optical Microscopy. These results are then converted to a % by weight and added to the % of ACM found in the initial part of the method.

Of the 18 No. Made Ground samples submitted for asbestos screening by Tier Environmental, 10 No. were reported to contain asbestos. At WS106 at 1.00m bgl comprising chrysotile and amosite fibre bundles (0.03% w/w), the highest reported concentration.

4.3. Concentration of Asbestos in Soils and Potential Fibre Release

There have been no direct airborne fibre concentration tests on the affected soils. Instead, the aim of this section of the risk assessment is to predict realistic airborne concentrations from the measured soil concentrations, backed up from published fibre release potential tests. The assessment has taken into account the potential for a future increase in fibre release as ACMs degrade in order to determine whether the measured concentrations are representative of the range of possible weather conditions and activities that could occur. The risk of the aforementioned further physical and chemical degradation of the chrysotile/amosite fibre bundles is considered to be unlikely; however, the potential for fibre release given the pre-existing nature of the fibres shall be considered.

Current risk models are based on airborne fibre concentrations and, in order to predict the potential fibre release from the soils at the site, information has been taken from the published literature. Addison et al. (1988) measured the release of airborne fibres from 'spiked' dry soils ('sandy',



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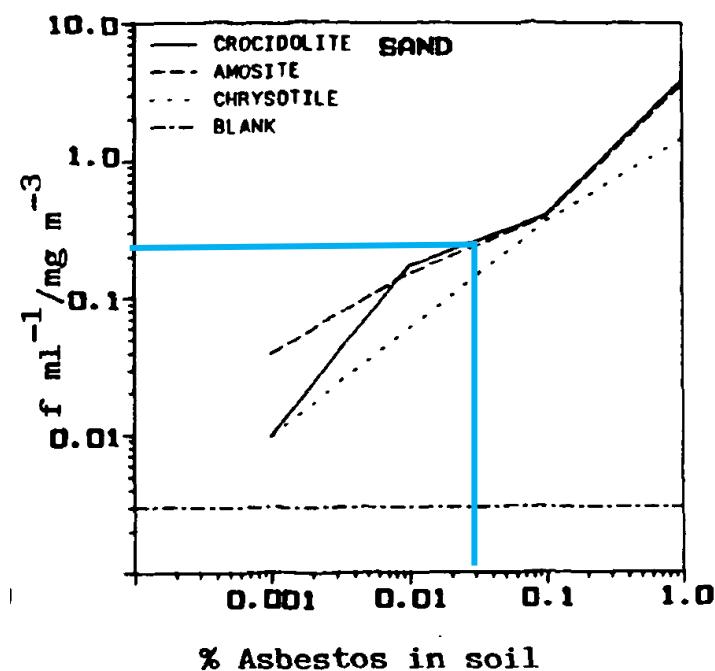
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“intermediate” and “clay”) containing between 0.001, 0.01, 0.1 and 1% free fibrous asbestos (3 types). The experiment used rotating drums to generate dust from dry soils and measured the dust concentrations in mg/m^3 and asbestos fibre concentrations in f/ml . The effects of soil moisture were also assessed. As a precautionary approach, the fibre release prediction has been taken to be sand (conservatively). Further conservatism is built in to these numbers, given that the laboratory experiments were very violent and produced much more dust/airborne fibre than would be expected from normal site activities during future commercial / educational use. When the correlation between normalised fibre concentrations in air and % of asbestos in soil is studied, it appears that the model also over-predicts the concentrations of fibre release at low concentrations (which provides further conservatism in the model).

Taking into account that background urban dust (PM10) is generally taken to be at concentrations of around $20 \mu\text{g}/\text{m}^3$; however, in line with example 13.3 in CIRIA C733, the concentration of soil dust during gardening activities (considered to be consistent with landscape maintenance works that may take place on Site) in dry and dusty conditions was estimated to be $100 \mu\text{g}/\text{m}^3$ ($0.1 \text{ mg}/\text{m}^3$) based on ambient urban dust levels and ART modelling of shovelling of dry powders.

Figure 7 from Addison et al (1988) has been used to estimate the normalised airborne respirable fibre concentration (f/ml) for amosite asbestos (based on the ‘worst-case’ asbestos type from asbestos screen results i.e. amosite) assuming a sand soil type. The maximum reported concentration is 0.03% w/w from WS106 at 1.00m bgl.

Figure 4.1 Variations in the Normalised Airborne Respirable Fibre Concentrations ($\text{f ml}^{-1}/\text{mg m}^{-3}$) in Relation to Bulk Asbestos Content (Sand Soils)
Reproduced from Figure 7 Addison et al (1988).



Taking the maximum reported chrysotile/amosite concentration reported in the soil and assuming worst case that it comprises solely amosite, the graph gives a normalised fibre concentrations of $0.22 \text{ f}/\text{ml mg}/\text{m}^3$ (shown in blue on Figure 4.1 above).

As such, when the value derived for amosite and the concentration of soil dust is taken into consideration then an airborne fibre concentration during such activities in a dry and dusty conditions has been estimated to be $0.022 \text{ f}/\text{ml}$ (Ci) and assumed to be insignificant at other times.



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The release of airborne asbestos is also strongly influenced by soil moisture content, with the addition of 5% moisture reducing potential airborne asbestos by 80% to 95%, with no fibres being detected at above 15% moisture content (as described on page 64 of CIRIA C733). The average moisture content of the samples obtained across the site was reported as 22.99%. It is not unreasonable to assume as a worst-case scenario that the soils could lose half of their natural moisture content, i.e. the soils drying out to c. 11.5% in the summer months, close to the surface. This has the effect of reducing the potential airborne asbestos (Ci) by a minimum of 80% which would equate to 0.0044 f/ml.

4.4. Exposure Scenario for the Critical Receptor

It has been conservatively assumed that worst case exposure would occur during digging and landscape maintenance activities.

Rochdale weather station is considered to be a relatively accurate representation of the average amount of days (24h) with precipitation during a month. The number of days when precipitation has surpassed 1mm per day (24h) it is defined as a day with precipitation. The rainfall data from 1991 – 2020 has been used as it accounts for more dry days per year and is taken from a large data set therefore is the more conservative value to use (as opposed to data from last year). Airborne asbestos fibres are only likely to be released when the ground conditions are dry and dusty. The number of dry days per year is used as an indicator for potential fibre release, however, although there was less than 1mm of rain reported on 194.25 days of the year this does not reflect the soil moisture content. It is estimated based on industry practice, that on 35% of the dry days each year the ground surface may be dry enough to allow fibre release in an outdoor environment therefore, a total of 68 days a year has been calculated for this Site.

Landscape maintenance workers are assumed, very conservatively, to conduct activities in landscaped areas under dry and dusty conditions for an average of 1 hour per day for 68 days per year (FiTi) consistent with the approach in example 13.3 in CIRIA C733.

In order to obtain a realistic but conservative estimate for the exposure scenario, it has been envisaged that a worst case commercial worker would be working adult with an exposure duration of 49 years.

Annual exposure is calculated in accordance with CIRIA C733:

$$Ei = Ci \times Fi \times Ti$$

Where Ei is annual exposure, Ci is the estimated concentration (f/ml) for the event, Fi is the frequency of the event per year, Ti is the period of time that the event lasts in hours.

Tier Environmental have at this point applied the SoBRA 'Calculation Sheet for risk from cumulative exposure to asbestos in air' (SoBRA 2021) and a copy of the sheet and the assumptions made is appended to this report.

A worst-case assumption has been made that all available 5 year age tranches have been applied for the number of days and hours and summarised above for a commercial worker from 15 years of age.



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4.5. Cumulative Exposure for the Described Worst Case Exposure Scenario

Mesothelioma Risk

The cumulative risk for mesothelioma is calculated as 0.48 per 100,000 over a lifetime of 80 years.

Lung Cancer Risk

The cumulative risk for lung cancer is calculated as 0.062 per 100,000 over a lifetime of 80 years.

Total Risk and Conclusion

This exposure-risk model can be used to investigate the significance of potential exposures in terms of likely ELCR. The ELCR of 1:100,000 is generally considered the limit of minimal risk; however, uncertainties need to be treated carefully if unrealistically cautious assessments are to be avoided.

The above mesothelioma and lung cancer risk calculations provides a total risk of 0.54 per 100,000 over a lifetime of 80 years with significant conservatism built into the model.

On this basis, it is considered that the reported concentrations of chrysotile and amosite asbestos within the Made Ground materials will present a minimal risk for the proposed commercial land use, including soft landscaped areas.



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5. UPDATED CONCEPTUAL MODEL AND QUALITATIVE RISK ASSESSMENT OF POLLUTANT LINKAGES

The conceptual site model and conceptual exposure model presented in Table 3.1 has been updated upon completion of the Asbestos Detailed Quantitative Risk Assessment and the conclusion reached in Section 4.5, above.

A qualitative risk assessment was made of the likelihood of the linkage operating and its potential significance in accordance with CIRIA C552. The updated CSM is presented in **Error! Reference source not found.**, below.



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Table 5.1 Revised Assessment of Pollutant Linkages.

Source	Potential Contaminants of Concern	Pathway	Receptor	Consequence	Probability	Qualitative Risk Assessment
Localised concentrations of benzo(a)pyrene within the northeast of the site which exceeds Public Open Space (Park) land use (NOT commercial land use) GAC.	Benzo(a)pyrene	Direct contact, dust inhalation and ingestion	Future site users (educational)	Medium	Low Likelihood	Moderate / Low Risk
			Adjacent site users (residential and commercial)	Medium	Unlikely	Low Risk
			Construction, site investigation, demolition and future maintenance workers	Medium	Unlikely	Low Risk
		Migration of mobile contaminants from Made Ground soils to adjacent sites along services and conduits	Adjacent site users (residential and commercial)	Medium	Unlikely	Low Risk

For definition of the terms used in the qualitative risk assessment, please see Appendix B.



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6. REGULATORY APPROVALS

The conclusions and recommendations presented above are considered reasonable based on the conclusions of the Asbestos Detailed Quantitative Risk Assessment. However, these cannot be guaranteed to gain regulatory approval and, therefore, the report should be passed to the appropriate regulatory authorities and/or other organisations for their comment and approval prior to undertaking any works on site.



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8. GLOSSARY OF TERMS

ACEC	Aggressive Chemical Environment for Concrete (classification)
aOD	Above Ordnance Datum
bgl	Below ground level
BGS	British Geological Survey
BRE	Building Research Establishment
CBR	California Bearing Ratio (test)
COMAH	Control of Major Accident Hazards (regulations)
Designated location	Site (and the ecosystem on that site) protected under national or international legislation. A potential ecological receptor to be considered as part of the assessment of land contamination. Example designated locations include SSSIs (q.v.), SACs (q.v.), national nature reserves, Ramsar sites and bird special protection areas.
DQA	Data Quality Assessment
DQO	Data Quality Objective
DQRA	Detailed Quantitative Risk Assessment
DWS	Drinking Water Standard
EQS	Environmental Quality Standard
GAC	Generic Assessment Criterion
GQA	General Quality Assessment (Environment Agency)
GSV	Gas Screening Value
HCV	Health Criteria Value
IPPC	Integrated Pollution Prevention and Control (regulations)
K _{ow}	Octanol-water partition coefficient
LEL	Lower Explosive Limit
LL	Liquid Limit
LoD	Limit of Detection (analytical)
LoQ	Limit of Quantification (analytical)
Mean Value Test	Statistical test (described in the CIEH Guidance) to estimate the mean value of a normally distributed population of data at a given level of confidence. Normally for contaminated land assessment, the 95th percentile (referred to as the 95%UCL or US95) is applied as a reasonable but conservative estimate of the mean concentration for comparison with the relevant assessment criteria.
Maximum Value Test	Statistical test (described in the CIEH Guidance) to identify whether an elevated concentration within a normally distributed data set forms part of the underlying population from which it has been sampled or whether it is an outlier (such as a localised area of contamination) that merits further consideration.
MC	Moisture Content
NGR	National Grid Reference
NIHHS	Notification of Installations Handling Hazardous Substances (regulations)
OS	Ordnance Survey
PI	Plasticity Index
PID	Photoionisation Detector
PL	Plastic Limit
ppm	Parts per million
ppmv	Parts per million by volume
QA	Quality Assurance
QC	Quality Control
SAC	Special Area of Conservation
SOM	Soil Organic Matter



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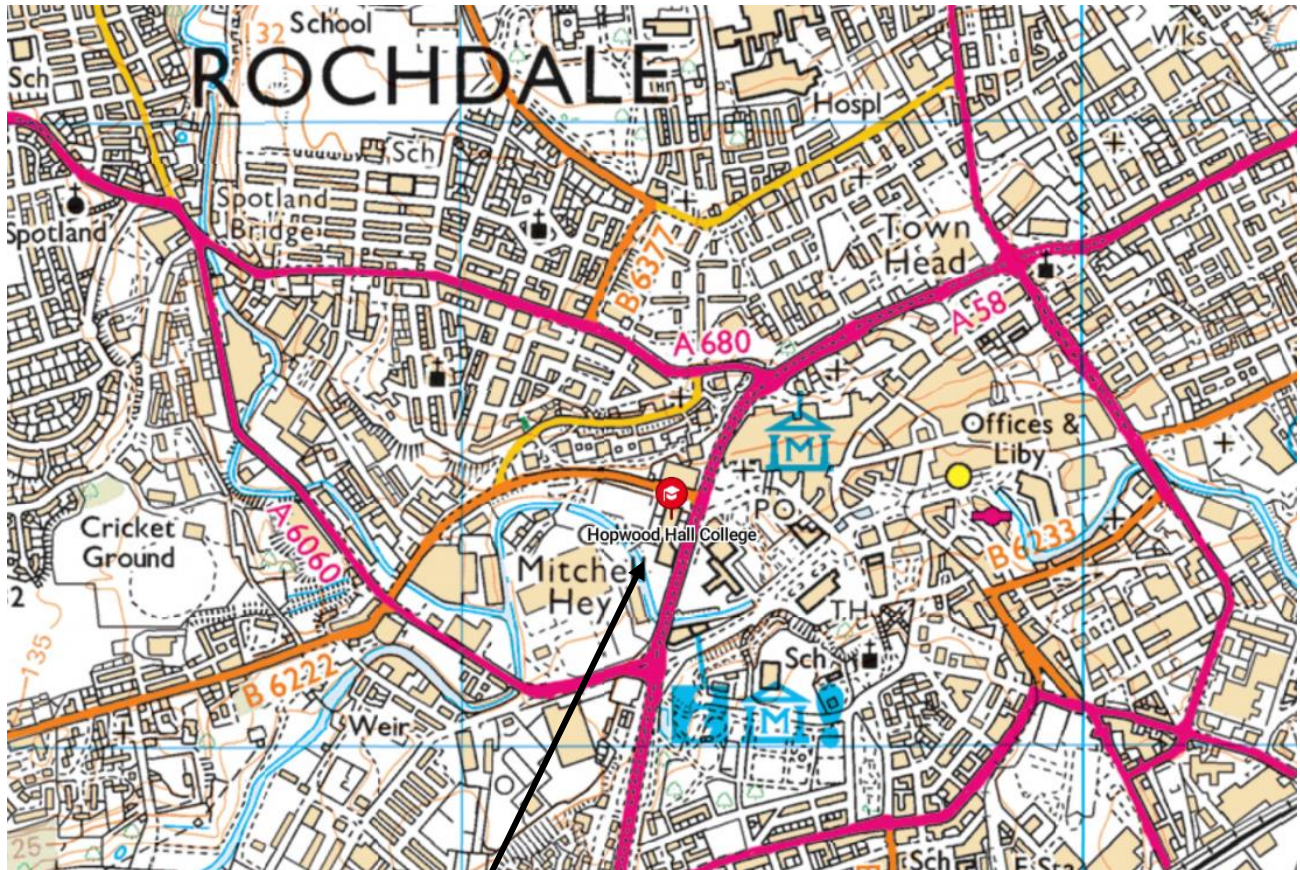
SPT	Standard Penetration Test
SPZ	Source Protection Zone
SSAC	Site-Specific Assessment Criterion
SSSI	Site of Special Scientific Interest
SVOC	Semi-Volatile Organic Compound
TEF	Toxicity Equivalent Factor
TPH	Total Petroleum Hydrocarbons
TWA	Time Weighted Average
US95	95 th percentile estimate of the true mean value of a data population (also known as 95%UCL).
VOC	Volatile Organic Compound

APPENDIX A - DRAWINGS



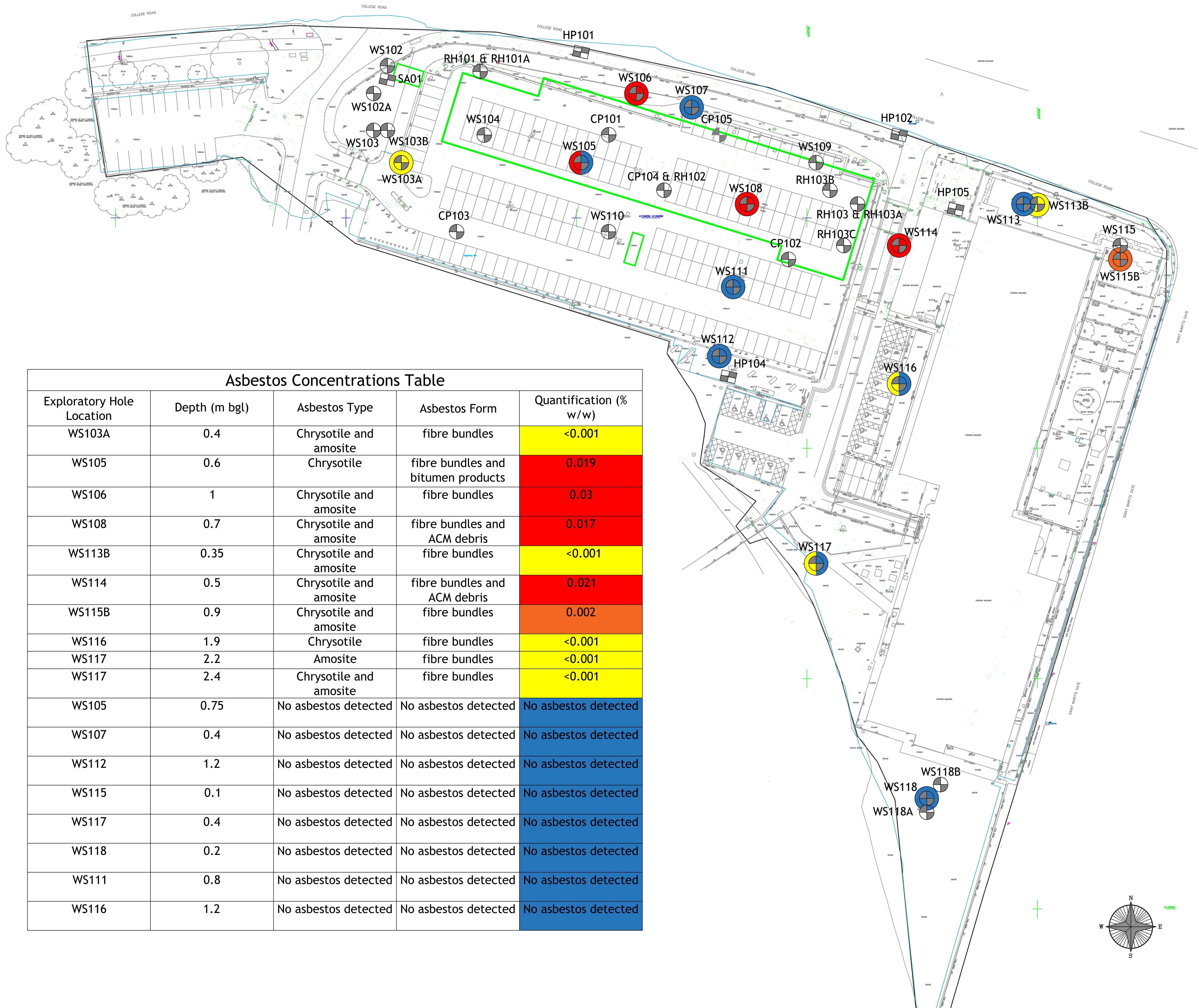
Contract Number:	TE1880
Contract:	Hopwood Hall College, Rochdale
Client:	Wilmott Dixon Construction

Site Location Plan



Site

Scale	NTS	
Drawn by	SE	Approved AR
Drawing Number	TE1880-TE-00-XX-DR-GE-001-V01	



Asbestos Concentrations Table

Exploratory Hole Location	Depth (m bgl)	Asbestos Type	Asbestos Form	Quantification (% w/w)
WS103A	0.4	Chrysotile and amosite	fibre bundles	<0.001
WS105	0.6	Chrysotile	fibre bundles and bitumen products	0.019
WS106	1	Chrysotile and amosite	fibre bundles	0.03
WS108	0.7	Chrysotile and amosite	fibre bundles and ACM debris	0.017
WS113B	0.35	Chrysotile and amosite	fibre bundles	<0.001
WS114	0.5	Chrysotile and amosite	fibre bundles and ACM debris	0.021
WS115B	0.9	Chrysotile and amosite	fibre bundles	0.002
WS116	1.9	Chrysotile	fibre bundles	<0.001
WS117	2.2	Amosite	fibre bundles	<0.001
WS117	2.4	Chrysotile and amosite	fibre bundles	<0.001
WS105	0.75	No asbestos detected	No asbestos detected	No asbestos detected
WS107	0.4	No asbestos detected	No asbestos detected	No asbestos detected
WS112	1.2	No asbestos detected	No asbestos detected	No asbestos detected
WS115	0.1	No asbestos detected	No asbestos detected	No asbestos detected
WS117	0.4	No asbestos detected	No asbestos detected	No asbestos detected
WS118	0.2	No asbestos detected	No asbestos detected	No asbestos detected
WS111	0.8	No asbestos detected	No asbestos detected	No asbestos detected
WS116	1.2	No asbestos detected	No asbestos detected	No asbestos detected

DO NOT SCALE

NOTES

- HAND DUG PIT LOCATION
- WINDOW SAMPLE LOCATION
- ROTARY BOREHOLE LOCATION
- CABLE PERCUSSION LOCATION
- SOAKAWAY LOCATION
- PROPOSED BUILDING OUTLINE

P1	28.01.2025	CS	ISSUED FOR INFORMATION	AR	AR
REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS: INFORMATION



Tier Environmental Ltd.
Unit 5 Office Village
Sandpiper Court
Chester Business Park
Chester | CH4
9QZ
t: 01925 818 388

CLIENT:
WILLMOTT DIXON CONSTRUCTION LIMITED

PROJECT:
HOPWOOD HALL COLLEGE ROCHDALE

TITLE:
ASBESTOS CONCENTRATIONS

SCALE & SIZE: NTS	CHECKED: AR	APPROVED: AR
CAD FILE: -	DESIGN/DRAWN: CS	DATE: 28/01/2025
PROJECT No: TE1880	DRAWING No: TE1880-TE-00-XX-DR-GE-013-V01	REV: P1

APPENDIX B - DEFINITIONS OF TERMS USED IN QUALITATIVE AND QUANTITATIVE RISK ASSESSMENTS

CIRIA C552 Terminology

For the qualitative and quantitative assessment of risks posed by potential pollutant linkages have been undertaken using the risk matrix adapted from CIRIA C552 and outlined in the table below.

	Category	Definition
Potential severity	Severe	Acute (short term) risk to human health, Major pollution of sensitive controlled waters, ecosystems or habitat. Catastrophic damage to buildings or property or crops.
	Medium	Chronic (Medium / long term) risk to human health Pollution of sensitive controlled waters, ecosystems or species, Significant damage to crops, buildings or structures
	Mild	Easily preventable permanent health effects on humans. Pollution of non-sensitive controlled waters. Minor damage to buildings or structures.
	Minor	Easily preventable non-permanent health effects on humans, or no effects. Minor, low level and localised contamination of on-site soil. Easily repairable damage to buildings or structures.
Probability of risk	High Likelihood	Pollutant linkage may be present, and the risk is almost certain to occur , or there is evidence of harm already occurring.
	Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term.
	Low Likelihood	Pollutant linkages may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
	Unlikely	Pollutant linkage may be present but the circumstances under which harm would occur are improbable.

		Potential Severity			
		Severe	Medium	Mild	Minor
Probability of risk	High Likelihood	Very high risk	High risk	Moderate risk	Moderate / low risk
	Likely	High risk	Moderate risk	Moderate / low risk	Low risk
	Low Likelihood	Moderate risk	Moderate / low risk	Low risk	Very low risk
	Unlikely	Moderate / low risk	Low risk	very low risk	Very low risk

APPENDIX C - COMPLYING WITH CONTROL OF ASBESTOS REGULATIONS 2012

Complying with Control of Asbestos Regulations (CAR): Risk Assessments, Licensing and Training

This appendix outlines CAR risk assessments and where they should be applied in relation to assessing and remediating brownfield sites. The information below details the different classifications of work with asbestos under CAR, summarises the legal requirements for asbestos awareness training for all involved in the investigation and management of asbestos containing soil (ACS), and details the potential requirements for suitable proficiency training relating specifically to ACS.

CAR RISK ASSESSMENTS

A CAR Risk Assessment is required for any work which may expose employees to asbestos. It is recommended that a precautionary approach is adopted if there is any doubt about risks associated with asbestos.

There are three main activities for potential asbestos exposure during work on brownfield sites:

- Site reconnaissance visits;
- Site investigation works; and
- Site remediation.

CAR risk assessments are needed at each stage but may be incorporated during the site investigation stage into the overarching health and safety risk assessments.

The CAR risk assessment must:

- Identify the type of asbestos to which employees are liable to be exposed, where possible, or assume it is present in different forms;
- Determine the type and extent of exposures to asbestos that may occur during the work
- Identify the steps to be taken to prevent exposure or reduce it to the lowest level reasonably practicable; and,
- Consider the effects of control measures that have been or will be taken.

The CAR risk assessment should include any information used to inform the risk assessment such as asbestos reports or desk study information. In the event that this information is not available, the assessor should be assumed that all forms of asbestos may be present on Site.

For all investigation and remediation of ACSs, a detailed written work plan should be produced and followed as detailed on the HSE website and in the CAR.

The CAR risk assessments for specific investigations or remediation projects, will determine whether or not work is 'licensable work' (LW), notifiable non-licensable work' (NNLW) or 'non-licensed work' (NLW). In addition, training requirements are also defined by the CAR risk assessment.

Some examples of control measures that apply during site reconnaissance, site investigation works, and site remediation are given below and should be applied depending on the asbestos risks identified for the Site at each stage of investigation:

- Avoiding stirring up dust;
- Cleaning footwear after site works;
- Removing and bagging any overalls for disposal/laundry;
- Respirators and hygiene facilities for high risk sites;
- Segregated welfare units;
- Wetting ground
- Minimising soil disturbances;
- Implementation or retention of capping/break layers;
- Implementation of awareness training;
- Air monitoring;
- Managing stockpiles;
- Area segregation;
- Wheel washing
- Road washing/cleaning

It is important to note that during Site reconnaissance visits, Site investigation works and Site remediation that asbestos should not be considered in isolation and control measures are likely to form part of a wider health and safety precautions.

Respiratory protective equipment (RPE)

RPE is the last line of defence and its requirement would be defined by the CAR risk assessment. HSE (2013b) advises that RPE should have an assigned protection factor of 20 or more for all work with asbestos. In certain instances, full face-piece, positive pressure respirators with a protection factor of 40 are necessary (to EN 12942:1998, TM3).

Suitable types of RPE for most **short** duration non-licensed asbestos work:

- Disposable respirator to standards EN149 (type FFP3) or EN1827 (type FMP3)
- Half mask respirator (to standard EN140) with P3 filter
- Semi-disposable respirator (to EN405) with P3 filter

These filters are not suitable for people with beards/stubble or for long or continuous use.

LICENSING

CAR defined certain types of activities involving asbestos as 'licensable work' (LW) or as 'notifiable non-licensable work' (NNLW). All other work would be 'non-licensable work' (NLW).

LW is defined as:

- work where exposure is not 'sporadic and low intensity'
- work where the risk assessment cannot demonstrate that the control limits (four hour and 10 minute limits) will not be exceeded
- work on asbestos coating
- work on AIB or insulation where risk assessment is either of first two points above or not of short duration (where short duration is defined for any work liable to disturb asbestos as taking less than two hours per week (including ancillary work) and no one person carries out that work for more than one hour').

NNLW includes work with:

- AIB or asbestos insulation of short duration that is not licensable
- fire-damaged asbestos cement or asbestos cement damaged so as to create significant dust and debris
- asbestos ropes, yarns, woven cloths in poor condition or handling cutting or breaking up the materials
- asbestos papers, felts and cardboard in poor condition, unencapsulated or not bound into another material.

Work with weathered asbestos cement, air monitoring and collecting samples of ACM in buildings would not normally be notifiable.

It is impossible to specify definitively what activities will and will not be licensable. This decision should be made as part of the CAR risk assessment. CAR is not primarily aimed at work with ACSs and there is little published information on airborne asbestos concentrations during work with ACSs. Nevertheless, CAR will require some remediation projects, and occasionally site investigations, to be LW. Investigations on other sites may involve NNLW. The decision as to whether work is LW or NNLW should be made during the CAR risk assessment by those in charge of the brownfield site investigations and remediation projects.

TRAINING REQUIREMENTS

Asbestos health and safety courses are offered by a number of providers in the UK. Training courses that include the problem of identifying ACMs in soil should be undertaken at regular intervals by those involved in the investigation, assessment and management of sites where ACs are known or suspected. It is the role of the employer to identify the level of training required for an employee based on their role, experience and duties. Reference to Regulation 10 of CAR should be referred to for more information on training requirements.

Recognising asbestos within soils is challenging due to the heterogeneity of such soils and the discolouration of asbestos by smeared soil. Specific training for ground workers should include understanding fibre release potential, potential control measures in the field, how to take representative ACSs safely, sample labelling and what analytical tests are available and when they should be implemented.

Health and safety training required under CAR includes asbestos awareness, non-licensable work (including notifiable non-licensable work) and licensable work with asbestos.

In addition to health and safety training, some staff involved in the technical identification on site of ACMs, sampling and analysis may require technical proficiency training (competency training).

Training vs. Competence

HSE (2005) identifies that 'training alone does not make people competent. Training must be consolidated by practical experience so that the person becomes confident, skilful and knowledgeable in practice on the job'. It is critical that ACS surveyors demonstrate competency with details of relevant field experience alongside training and examples of previous works/references.

**APPENDIX D - SOBRA CALCULATION SHEET FOR RISK FROM CUMULATIVE
EXPOSURE TO ASBESTOS IN AIR OUTPUT**

Calculation Sheet for risk from cumulative exposure to asbestos in air

Based on The quantitative risks of mesothelioma and lung cancer in relation to asbestos exposure, John T. Hodgson and Andrew Darnton, Ann Occup Hyg (2000) 44 (8): 565-601 , and personal communication with Andrew Darnton and should be read in conjunction with SoBRA's Discussion Paper on Guidelines for Airborne Concentrations of Asbestos Fibres in Ambient Air: Implications for Quantitative Risk Assessment (SoBRA, 2021)
© SoBRA, 2021

Default parameters

Asbestos type	Amosite
Mesothelioma model	Linear
Lung cancer model	Non-Linear
Lung cancer base risk population	All - population average
Receptor expected lifetime	Lifetime 80 years
Lung cancer age adjustment	Age adjustment based on Latency

Concentration in air

Assumes exposure to constant average asbestos exposure

	Amosite
Concentration in air	f/ml
	4.40E-03

Exposure over five year tranches

						Exposure over each 5 year tranche (Includes adjustment to occupational years (equal to 2000hrs of exposure per year))	X- Cumulative exposure in f/ml.yr =Concentration in air x Exposure time hrs per year x Time period /2000 (hrs in an occupational year) to top of age group
Age	Concentration in air	Exposure			Exposure time hrs per year		
0	f/ml	Days per year	Hours per day	Years (Actual)	hrs/year	f/ml.yr	X - Cumulative exposure in f/ml.yr
1	0-5	4.40E-03			0.00E+00	0.00E+00	0.00E+00
2	5-10	4.40E-03			0.00E+00	0.00E+00	0.00E+00
3	10-15	4.40E-03			0.00E+00	0.00E+00	0.00E+00
4	15-20	4.40E-03	68	5	6.80E+01	7.48E-04	7.48E-04
5	20-25	4.40E-03	68	5	6.80E+01	7.48E-04	1.50E-03
6	25-30	4.40E-03	68	5	6.80E+01	7.48E-04	2.24E-03
7	30-35	4.40E-03	68	5	6.80E+01	7.48E-04	2.99E-03
8	35-40	4.40E-03	68	5	6.80E+01	7.48E-04	3.74E-03
9	40-45	4.40E-03	68	5	6.80E+01	7.48E-04	4.49E-03
10	45-50	4.40E-03	68	5	6.80E+01	7.48E-04	5.24E-03
11	50-55	4.40E-03	68	5	6.80E+01	7.48E-04	5.98E-03
12	55-60	4.40E-03	68	5	6.80E+01	7.48E-04	6.73E-03

Mesothelioma Risk

$$P_M = A_{pl}X^r + A_{pr}X^t$$

P_M Percent excess mortality from Mesothelioma (in percent)
 A_{pl} Constant of proportionality for Pleural risk
 A_{pr} Constant of proportionality for peritoneal risk
 X Cumulative exposure in f/ml.yr
 r Pleural slope of exposure response (on a log-log scale)
 t Peritoneal slope of exposure response (on a log-log scale)

$$\hat{O}_M = \frac{(A_{pl}X^r + A_{pr}X^t)E_{adj}}{100}$$

O_M the observed meso deaths
 E_{adj} the expected mortality from all causes adjusted to an age at start of exposure of 30.

Risk estimate based on a 30 year old worker exposed for a five year period with cumulative exposure above.
Reference: Developing risk estimates consistent with Table 11 for extended exposures, Hodgson and Darnton 2000

Best Estimate		
Asbestos type	Amosite	Reference
A_{pl}	0.1	H&D 2000 Table 1 Mesothelioma risk expressed as percentage total expected mortality per f/ml.yr - Adjusted for age at first exposure.
r_{meso}	1	Linear model
A_{pr}	0.0006	H&D 2000 Table 8 Best estimate slope (r=0.75, t=2.1)
t	2.1	H&D 2000 Table 8 Best estimate slope (r=0.75, t=2.1)
Expected mortality from all causes adjusted to an age at start of exposure of 30	0.7	H&D 2000 p. 584 "Absolute risk estimates can therefore be derived from the PM value for a given exposure by multiplying by a factor of 0.7."

Age	Age adjustment Factor for mesothelioma risk Lifetime 80 years	Reference	P_M (%)*	Risk	Risk age adjusted assuming Lifetime 80 years
1	0-5	WATCH 2010 -2 Annex 3 - Contribution from a WATCH member following the February 2010 WATCH meeting (for 80 years). CIRIA C733 used for adjustment for ages 35+	0.0E+00	0.0E+00	0.0E+00
2	5-10		0.0E+00	0.0E+00	0.0E+00
3	10-15		0.0E+00	0.0E+00	0.0E+00
4	15-20		7.5E-05	5.2E-07	1.6E-06
5	20-25		7.5E-05	5.2E-07	1.1E-06
6	25-30		7.5E-05	5.2E-07	7.9E-07
7	30-35		7.5E-05	5.2E-07	5.2E-07
8	35-40		7.5E-05	5.2E-07	3.1E-07
9	40-45		7.5E-05	5.2E-07	2.1E-07
10	45-50		7.5E-05	5.2E-07	1.6E-07
11	50-55		7.5E-05	5.2E-07	1.0E-07
12	55-60		7.5E-05	5.2E-07	5.2E-08

* To get the contribution to the risk for the second period alone the risk due to the cumulative dose from the first period is subtracted... and so on.
Developing risk estimates consistent with Table 11 for extended periods, Hodgson and Darnton 2000

Cumulative risk	Amosite	Lifetime 80 years 4.8E-06
-----------------	---------	------------------------------

Lung Cancer

$$P_L = A_L X^r$$

P_L Percentage excess of expected lung cancer mortality
 A_L Constant of proportionality for lung cancer risk
 r Lung cancer slope of exposure response (on a log-log scale)
 X Cumulative exposure in f/ml.yr

$$\text{Predicted excess risk} = O_L - E_L = \frac{A_L X^r E_L}{100}$$

E_L Proportion of the specific population that will die of lung cancer between age 40-79

Risk estimate based on a 30 year old worker exposed for a five year period with cumulative exposure above.
Reference: Developing risk estimates consistent with Table 11 for extended exposures, Hodgson and Darnton 2000

Best Estimate		
	Amosite	Reference
A_L	1.6	H&D 2000 Table 10 Best (r=1.3)
r_lung	1.3	H&D 2000 Table 10 Best (r=1.3)
Proportion of the specific population that will die of lung cancer between age 40-79	0.033	Based on Average 2016-2018 populations statistics

0	Age	Age adjustment	Age adjustment reference	P _L (%)	Risk (age adjusted)
1	0-5	1	Developing risk estimates consistent with Table 11 for extended exposures, Hodgson and Darnton 2000	0.0E+00	0.0E+00
2	5-10	1		0.0E+00	0.0E+00
3	10-15	1		0.0E+00	0.0E+00
4	15-20	1		1.4E-04	4.5E-08
5	20-25	1		2.0E-04	6.6E-08
6	25-30	1		2.4E-04	7.7E-08
7	30-35	1		2.6E-04	8.5E-08
8	35-40	1		2.8E-04	9.2E-08
9	40-45	1		3.0E-04	9.8E-08
10	45-50	0.75		3.1E-04	7.7E-08
11	50-55	0.5		3.3E-04	5.4E-08
12	55-60	0.25		3.4E-04	2.8E-08

Cumulative risk	Amosite	6.2E-07
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Cumulative lifetime Risk Estimate

Asbestos type	Amosite		
Risk from Mesothelioma	Lifetime 80 years	Linear	4.8E-06
Risk from Lung Cancer	All - population average	Non-Linear	6.2E-07
TOTAL			5.4E-06

Limitations

This spreadsheet is offered as a free available resource by SoBRA to improve the consistency in, and adoption of , the use of the Hodgson and Darnton algorithms for estimating lifetime cancer risk for low level environmental exposures to airborne asbestos fibres. It has been developed by members of the SoBRA Asbestos-in-soil sub-group acting in a voluntary capacity, and constitutes the work of the individual authors, not those of their employers. Users of this spreadsheet must satisfy themselves that the content is appropriate for the intended use and no guarantee of suitability is made.