BYRNELOOBY

AN ayesa COMPANY

Technology | Engineering | Consulting

Edwin Richards Quarry – Soil Treatment Centre

Technical Standards and BAT Assessment

Waste Recycling Group (Central) Limited

Report No. K0182-BLA-R-ENV-00004
September 2023
Revision 02

Document Control

Project: Edwin Richards Quarry

Document: Technical Standards and BAT Assessment

Client: Waste Recycling Group (Central) Limited

Report Number: K0182-BLA-R-ENV-00004

Document Checking:

Revision	Revision/ Review Date	Details of Issue	Authorised		
			Prepared By	Checked By	Approved By
01	22 December 2022	Final issued	Claire Finney	John Baxter	John Baxter
02	September 2023	Final Reissued	Claire Finney	John Baxter	John Baxter
Disclaimer: Please note that this report is based on specific information, instructions, and information from our Client and should not be relied upon by third parties.					

www.byrnelooby.com

www.ayesa.com/en

Contents

1 Introduction

1.1 Overview

ByrneLooby UK Partners Limited (ByrneLooby) was commissioned by Waste Recycling Group (Central) Limited (WRG) to prepare an application to vary the Environmental Permit reference EPR/HP3632RP to:

- Allow additional 30,000 tonnes per annum to be accepted at the facility and increase overall throughput to 180,000 tonnes per annum inclusive of either hazardous and/or non-hazardous waste.
- Remove the split of hazardous / non-hazardous waste treated at the facility from 89,998 tpa for hazardous waste and 60,002 tpa for non-hazardous waste to 180,000 tonnes per annum inclusive of either hazardous and/or non- hazardous waste. The amended ratio relates to the list of wastes in Table S2.2 and S2.3 of the permit (physical treatment of wastes and wastes for treatment in the bioremediation process respectively). This will impact the following listed activities:
    - AR1 S5.3A(1)(a)(ii) Physical treatment of hazardous waste
    - AR2 S5.3A(1)(a)(ii) Asbestos removal from soils
    - AR3 S5.4A(1)(a)(ii) Physical treatment of non-hazardous waste
    - AR4 S5.3 A(1)(a)(i) Bioremediation of hazardous waste for disposal
    - AR5 S5.3 A(1)(a)(i) Bioremediation of hazardous waste for recovery
    - AR6 S5.4A(1)(a)(i) Bioremediation of non-hazardous waste for disposal
    - AR7 S5.4A(1)(b)(i) Bioremediation of non-hazardous waste for recovery
- Addition of new soil treatment pad for biological treatment and soil washing.
- Addition of a point source emission to air to Table S3.1 to account for the biofilter from the new soil treatment area.
- Addition of soil washing activity for the soil washing of soils contaminated with heavy metals comprising the following listed activities and waste operations to be subject to the 180,000 tonnes per annum inclusive of either hazardous and/or non-hazardous waste.
    - S5.3 A(1)(a)(ii) – recovery of hazardous waste with a capacity exceeding 10 tonnes per day involving physico-chemical treatment via soil washing.
    - S5.3 A(1)(a)(ii) – disposal of hazardous waste with a capacity exceeding 10 tonnes per day involving physico-chemical treatment via soil washing.

  Associated waste operations will be:
    - Treatment of non-hazardous waste soils by soil washing for recovery.
- Amendment to Table S1.1 Activity AR8 regarding the temporary external storage of hazardous soils to increase amount to 20,000 tonnes to include soils contaminated with

heavy metals (10,000 tonnes) and activities associated soil washing activity references in the limits of specified activity and waste types.

- Allow the use of a mechanical screener for the pre-screening of soils containing asbestos.
- Remove pre-operational condition 1 as listed in Table S1.3 of the Permit.
- Undertake mechanical screening of non-hazardous soils in the area currently used for storage of non-hazardous soils. It is proposed to use this area for storage and screening of non-hazardous soils. Screening is already regulated under activity reference AR3 physical treatment of non-hazardous waste.
- Amend drawing reference in Table S3.3 of the Permit to remove reference to plan 100993 – Asbestos DWG1 dated January 2018 and replace with reference to an Emissions Monitoring Plan.

The new soil treatment area will be able to treat 30,000 tonnes. Soil will be stored on an impermeable surface with sealed drainage. It is occupied by an area of hard standing within the current permit boundary and will use the existing access road from Portway Road. The location of the new soil treatment area is shown on the Site Layout Plan. The operations proposed for the new soil treatment area are identical to those already approved at the Site through existing planning consents and an environmental permit. The Site Permit Boundary is shown on drawing reference K0182.1.002 and remains unchanged as part of this application.

1.2 Report objectives

This Technical Standards and Best Available Techniques (BAT) Assessment has been prepared to support the Permit Variation Application for the Soil Treatment Centre (STC) at Edwin Richards Quarry. References has been made to following guidance:

- Environment Agency: Chemical waste: appropriate measures for permitted facilities. 18 November 2020
- Best available techniques (BAT) conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament and of the Council. 10 August 2018.
- Environment Agency. Sector Guidance Note SGN5.06 Guidance for the recovery and disposal of hazardous and non-hazardous waste. Issue 5. May 2013.
- DEFRA: Industrial emissions Directive EPR Guidance on Part A installations. February 2013.

The structure of this report follows the Chemical Waste: appropriate measures for permitted facilities.

A Best Available Techniques assessment has been undertaken in accordance with Best available techniques (BAT) conclusions for waste treatment, under Directive 2010/75/EU of the European Parliament and of the Council. 10 August 2018. This is provided at Section 9. This demonstrates that the Site and proposed changes meet or will meet BAT. Not all aspects of BAT are applicable to the facility.

2 General Management Appropriate Measures

2.1 Management system

BAT 1 of BAT Conclusions provides a list of features required to be incorporated into an environmental management system. Section 2 of the appropriate measures guidance specifies the required management system features. The Operator is committed to managing its activities in an environmentally responsible manner and has an Environmental Management System (EMS) recognised to industry standards. The EMS includes Environmental and Operations Manual Procedures specific to the Soil Treatment Centre.

Operations and Maintenance

The EMS includes an Operation Manual which provides procedures to control operations on Site, a maintenance regime for all plant and equipment and procedures for monitoring emissions and impacts. Procedures should be audited at regular intervals, and this is carried out in accordance with the EMS.

Accidents / Incidents / Non-conformance

The Operation Manual and EMS sets out the Accident Management Plan and procedures for incident reporting and investigation.

2.2 Staff competence

Competence and Training

Section 2.2 of the appropriate measures' guidance requires the site to be operated by an adequate number of staff with appropriate qualifications and competence. All staff will have clearly defined roles and responsibilities. A training record will be kept up to date as part of the EMS.

Initial waste acceptance queries and pre-acceptance checks including arranging and analysis of additional testing are undertaken by the Sites On-Site Chemist. The on-site laboratory is currently in the process of becoming accredited to MCERTS.

All analysis for proposed soil inputs and chemical analysis from validation sampling and reception testing is reviewed by the Operators compliance team on a daily basis which comprises chemists with a minimum degree level in chemistry. This process is overseen and audited by a chartered chemist with the following qualifications.

- BSc Pure and Applied Chemistry
- PhD Electrochemistry, Liverpool University
- Chartered Chemist, Member Royal Society of Chemistry (CChem, MRSC)

- Specialist in Land Condition (SiLC)

Due to the nature of the waste types accepted at the facility only appropriately trained staff can handle and/or transfer soils. The EMS contains the training records for all on site staff.

2.3 Accident management plan

The Site has a formal structured Accident Management Plan (AMP) as part of their Environmental Management System addressing the requirements of Section 2.3 of appropriate measures guidance.

Accident management requires a review of 3 key components:

- Identification of the hazards posed by the facility/activity.
- Assessment of the risks (hazard x probability) of accidents / incidents and their possible consequences; and
- Implementation of measures to reduce the risk of accidents and contingency plans for any accidents that do occur.

Procedures are in place to address accidents / incidents and/or abnormal operations, along with reporting lines internally and externally, and timeframes for making reports or notifications. The relevant permit conditions for reporting requirements for accidental releases due to spillages or abnormal operating conditions will apply to the facility.

The operator will maintain the Accident Management Plan (AMP) which is subject to review by the regulator.

The AMP as part of the Environmental Management System is subject to periodic review for potential accidents, incidents and their consequences.

2.4 Accident prevention measures

Section 2.4 of the appropriate measures' guidance requires measures to be taken, where appropriate, to prevent events that may lead to an accident.

There are a number of different potentially polluting substances stored on site / may be stored on Site including:

- Nutrients (inorganics)
- Diesel
- Process water prior to treatment

- Incompatible wastes
- Emergency firefighting water.

Nutrients (inorganics) are stored in sealed and waterproof plastic 600kg bags on pallets located on an impermeable surface with sealed drainage.

Nutrients are stored adjacent to the bioremediation area(s).

Diesel is stored in accordance with the Oil Storage Regulations which requires all to be stored within a double skinned and bunded to 110% capacity container located on impermeable hardstanding.

Process water is stored within tanks adjacent to the treatment areas which are bunded to 110% of the tank volume and located on hardstanding. The proposed additional tank will be located adjacent to the current tank with the same storage containment.

Wastes are segregated on acceptance dependent on the contaminants present.

Spill kits are located within the Site Office. In the event of the spillage of polluting materials, immediate action will be taken to contain the spillage. The spillage will be reported to the Site Manager, who will assess the situation and decide upon the most appropriate course of action. If the spillage cannot be contained, specialist contractors will be employed.

The action taken will depend upon the size of the spillage, the location of the spillage in relation to sensitive receptors and the nature of the spilled material.

The Site surface, buildings, roofed areas, fixed / temporary bays and containers are visually inspected at least weekly to ensure continuing integrity and fitness for purpose. The inspection and any necessary maintenance required will be recorded. In the event that any damage breaches the integrity of the engineered containment so that it no longer meets the required standards, necessary remedial work will be completed as soon as practicable.

WRG carries out a programme of Planned Preventative Maintenance (PPM). The drainage system at the site is subject to weekly visual inspections to ensure effective operation and integrity of the system. This includes inspection and maintenance of associated equipment (i.e., pumps and air/water separators) and infrastructure (pipes, bunds, concrete hard standing). Maintenance will be undertaken to ensure the effective operation and defects will be rectified as soon as possible.

It is considered there is no potential increase from the proposed activities for accidents and abnormal operation that is not currently managed.

Accident Preventative Measures are included in the AMP which forms part of the Environmental Management System and is subject to periodic review for potential accidents, incidents and their consequences.

Due to the nature of the waste types accepted at the facility, comprising contaminated soils and the nature of treatment in biopiles, a Fire Prevention Plan is not required for the Site. Procedures are in place for self-combustion management procedures for a 30 m3 waste wood stockpile stored on Site.

Procedures in the event of a fire form part of the Sites Emergency Procedures.

2.5 Contingency plan and procedures

The Site has a Contingency Plan detailing procedures for permit compliance in the event of on-site maintenance, shut down or in the event of an accident. This comprises the above accident preventative measures to ensure critical infrastructure and plant are adequately maintained and appropriate spare parts are held. A list of approved suppliers is maintained.

2.6 Plant decommissioning

The Site has a decommissioning plan which includes the following information:

- Site Plans showing drainage pipes and vessels.
- Methods for removal of the treatment pads and Soil Treatment building.
- Soil testing methodology on removal of site infrastructure.
- Clearing of deposited residues, waste and any contamination resulting from the waste treatment activities.

3 Waste pre-acceptance, acceptance and tracking

3.1 Waste Pre-acceptance – initial enquiry

Reference has been made to appropriate measures for pre-acceptance procedures where applicable.

Pre-acceptance procedures are in place at the Site to ensure that prior to acceptance any waste is assessed for suitability for waste treatment operations at the Site. This includes the procedures for collecting information about waste input, waste sampling and characterisation.

On initial pre-acceptance queries the Operator requests the following information as part of the pre-acceptance enquiry:

- Details of the waste producer including organisation name, address and contact details.
- Source of the waste and any specific processes that created the waste.
- Information on the nature and variability of the waste.

The Operator provides a full set of terms and conditions for pre-acceptance to the Waste Producer including:

- Maximum soil contaminant concentrations for reuse of material in the restoration area or disposal within the landfill (re-use criteria).
- Limitations on physical and chemical characteristics of the soils (fraction sizes, pH, moisture content, asbestos fibres); and
- Statement that soils containing tars, free oils and high moisture content will not be accepted.

A technical assessment of the waste is undertaken by the Operator based on chemical analysis provided by the waste producer to confirm whether the waste meets the acceptance criteria and can be treated to meet the reuse criteria. If the waste meets the acceptance criteria and is confirmed as treatable, the Operator will issue an authorisation number which allows the acceptance of the waste from the Waste Producer pending on site pre-acceptance assessment .

Where there is insufficient information to adequately characterise the waste or determine whether it can be treated, the Operator will attend the proposed source Site to undertake a pre-acceptance assessment. This will include a visual inspection of the material and if possible, obtain further information about the waste description).

Where pre-acceptance soil analysis is required, the waste will be tested in accordance with a general suite of analysis for soils which are adapted by the project manager based on: the client waste description; the history of the soils; and the chemical data. Sampling of the waste will be undertaken by a suitably technically competent person. Detail on location and method of

sampling, the number of samples, the degree of consolidation and the preservation techniques will be included as a minimum.

Samples will be clearly labelled to enable the sample to be tracked and any hazardous properties identified. Testing is undertaken at a UKAS/MCRETS accredited laboratory using accredited methods.

On receipt of the soil analysis a technical assessment will be made by the Operators compliance team which comprises chemists with a minimum degree level in chemistry to confirm the material meets the requirements for treatment and meets the acceptance criteria as specified in the Environmental Permit. This process is overseen and audited by a chartered chemist.

All records pertaining to pre-acceptance assessment are kept on site for a minimum of 3 years.

3.2 Waste Acceptance Assessment - Soil Reception Area

Reference has been made to appropriate measure requirements for acceptance procedures when waste arrives at the installation (where applicable).

On arrival at the Soil Treatment Centre all waste will be weighed at the weighbridge and all appropriate documentation is to be provided. This will include: the authorisation number provided in the initial enquiry stage; a written description of the waste to include physical and chemical composition; hazardous characteristics and handling precautions; and information of the waste producer and process.

The waste will be directed to a designated soil reception area dependent on the contaminants. Soil contaminated with asbestos will be transferred to the designated soil reception area which comprises the southern part of the asbestos storage areas. All waste awaiting its pre-acceptance assessment is deposited on the impermeable external pad with a sealed drainage system. Soils contaminated with hydrocarbons only will be transferred to the soil reception area which comprises the northern section of the biopile area.

The pre-acceptance assessment at the soil reception area will be overseen by the Soil Treatment Centre Manager and will comprise the following:

A visual inspection to allow the following to be assessed prior to acceptance:

1. Presence of untreatable and hazardous materials (e.g., tars, clinker, asbestos insulation etc.) in the contaminated soil.
2. Presence of excessive litter/debris in the contaminated soil.
3. Compliance with the previously supplied chemical/physical analysis information (supplied by waste producer).
4. Potential for the waste to behave as a liquid or have free water/oil in the waste.

Following the visual inspection sampling is undertaken on soils using composite sampling methods described in BS812. Sampling of the soil the chemical analysis of soils generally takes 5-7 days to complete, therefore limited storage times are required. Materials will be placed into treatment as soon as practicable from the receipt of chemical analysis and formal acceptance of the waste.

The range of contaminants for analysis will be based upon the original contaminating substances. A copy of the analysis shall be checked by the Compliance Team for verification against the waste producer analysis. In the event there is a non-conformity e.g., the chemical data shows inconsistencies against the data originally provided by the client or the waste is deemed by the Operator to not be as classified, then further action will be taken by the Soil Treatment Centre manager prior to any formal acceptance. The waste will only be formally accepted on site after the initial reception analysis is received, it meets acceptance criteria and its treatability to meet reuse criteria has been confirmed.

All documentation provided by the driver, along with the chemical analysis results and details of deposit location will be maintained on the waste tracking system. In the event that the waste does not meet the acceptance criteria and is not treatable, the waste will be rejected in accordance with the Site Waste Rejection Procedures. The external pad therefore also forms a quarantine area role, as the soils have not yet been formally accepted whilst they are awaiting the pre-acceptance assessment. The areas to the south of the asbestos storage are designated for quarantine.

The measures to be undertaken for the assessment of data and inspection of waste received at the Soil Treatment Centre are outlined in the Operators Soil Reception Procedures (STC-FO02).

All wastes are accepted at the installation in accordance with general BAT requirements which reiterates the procedures carried out as part of the pre-acceptance initial enquiry stage ensuring:

- all assessment of waste is undertaken by a suitably qualified person.
- all testing undertaken at suitably accredited (MCERTS/UKAS) laboratories.
- all waste is adequately validated through chemical analysis; and
- suitable checks are undertaken to ensure the defined method of treatment is determined prior to its acceptance on Site.

3.3 Waste tracking

Reference has been made to appropriate measures for waste tracking.

All waste accepted at the Site is tracked during the entire process from pre-acceptance, acceptance and storage. On pre-acceptance all documentation including producer / comprising waste code, hazardous properties and chemical analysis are stored documentation provided by

the driver, along with the chemical analysis results and details of deposit location will be maintained on the waste tracking system. All soils are tracked using the waste tracking system to their designated storage area and during the entire treatment process. The biopiles, asbestos treatment and soil wash plant are managed using a system of lots which allows the waste to be trackable from the point of origin to its location on the treatment pad.

4 Waste storage, segregation and handling

Reference has been made to appropriate measures waste storage, segregation and handling where applicable.

4.1 Temporary storage of hazardous soils

The soil storage area for hazardous soils is to increase by 10,000 tonnes per annum to 20,000 tonnes in total to account for the soils containing heavy metals that are to be accepted for soil washing. The hazardous soil storage pad comprises a kerbed impermeable surface with sealed drainage. This storage area provides temporary storage for soils awaiting treatment. The soils awaiting treatment will be stored separately dependent on contaminants pending transfer into the Soil Treatment Building or Soil wash area for treatment. This is located to the west of the Soil Treatment Building. Dust controls are in place and currently utilised on the pad comprising the dust cannons. The location of the temporary hazardous soils storage area is centrally located to the Site away from sensitive receptors.

There are 3 storage bays within the Soil Treatment Building. All bays are clearly marked and signed detailing the quantity and hazardous characteristics of the wastes stored therein. Storage Bays 1 to 3 provide storage for soils containing 'asbestos only' or 'asbestos and hydrocarbons'. The use of different bays ensures segregation of wastes that require further bioremediation treatment after hand picking is completed. Bay 1 to 3 has a storage capacity of 3,750m^3 or 6,000t assuming a dry density of 1.6t/m^3.

4.2 Storage of Non-hazardous Soils

On receipt of validation testing that confirms the soil meets re-use criteria, it is transferred to the non-hazardous soils storage area, disposed in the adjacent landfill void or reused on site as restoration soils. The treated soils are stored externally in the event they are not transferred directly to void or the restoration area. The location of the non-hazardous soils storage and treatment area is centrally located to the Site away from sensitive receptors.

4.3 Handling of wastes

Special handling procedures are in place for the handling of contaminated soils:

- Procedures for soils containing asbestos.
- Procedures for soils hazardous for hydrocarbons or metals

Due to the nature of the waste types accepted at the facility only appropriately trained staff can handle and/or transfer soils.

5 Waste treatment

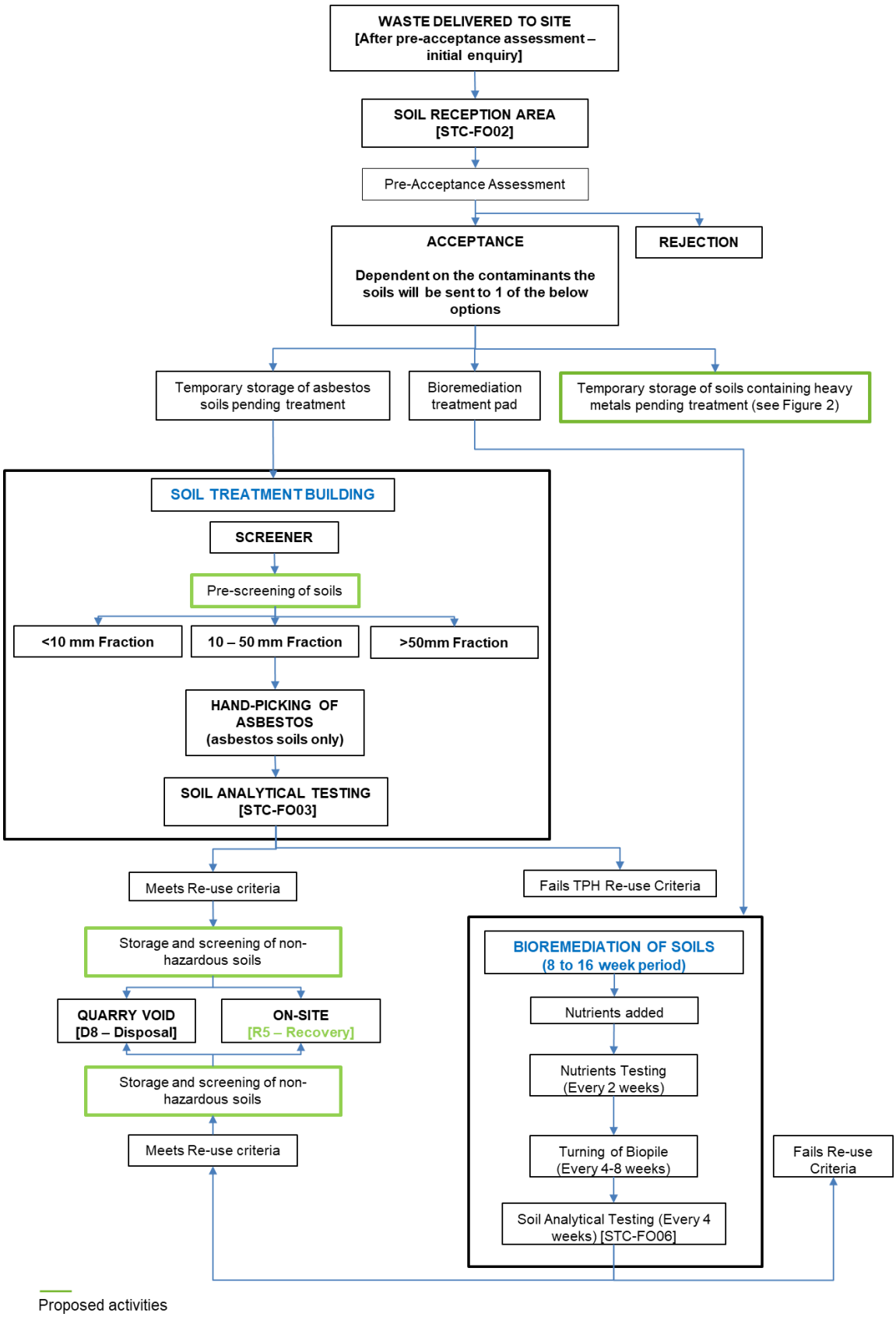
Reference has been made to appropriate measures for waste treatment, where applicable.

Annual production/treatment (tonnes per year) from soil washing, bioremediation plant & physico chemical treatment of hazardous waste and treatment of non-hazardous waste is required to be reported on an annual basis in accordance with Table S4.2 of the permit.

5.1 Activities on Site

A process flow diagram is provided at Figure 1. The activities shown in green are those to be regularised by the permit submission.

Figure 1 Process flow diagram



5.1.1 Hand-picking of soils containing asbestos

Hand-picking of small asbestos fragments is undertaken by suitably trained operatives. The asbestos fragments are placed in individual polythene bags directly adjacent to each operative. When full the picking line conveyor is stopped and the sealed bag placed into a second bag. The double bagged asbestos is placed in a designated container which will not exceed 10 tonnes.

On completion of hand-picking, the waste soils are deposited into a stockpile in designated bays within the building. Each of the bays provides storage of material post hand picking awaiting compliance testing prior to further onward treatment or disposal.

There are 3 bays within the Soil Treatment Building. All bays are clearly marked and signed detailing the quantity and hazardous characteristics of the wastes stored therein. Storage Bays 1 to 3 provide storage for soils containing 'asbestos only' or 'asbestos and hydrocarbons'. The use of different bays ensures segregation of wastes that require further bioremediation treatment after hand picking is completed. Bay 1 to 3 has a storage capacity of 3,750m^3 or 6,000t assuming a dry density of 1.6t/m^3.

5.1.2 Bioremediation of soils containing hydrocarbons

The process description of the treatment activity is described below in accordance with indicative BAT requirements for treatment – general principles, where applicable. No changes to the bioremediation process are proposed as part of this application.

Soils accepted for biological treatment contain the following contaminants:

- range of petroleum hydrocarbons (petrol, heating fuel, diesel, used oils, crude oil etc.).
- polycyclic Aromatic Hydrocarbons (PAHs).
- creosote.
- phenols; and
- chlorinated Solvents and other Volatile Organic Compounds (VOCs).

The biological treatment process typically is between 8 to 16 weeks dependent on the contaminants present in the soil. To enable biodegradation to occur the following parameters are monitored and manipulated:

- pH
- temperature,
- moisture content,
- oxygen level
- nutrient concentrations

Biodegradation is optimised by maintaining a temperature of 30 and 40°C in the biopiles to ensure the mesophilic microflora are predominately stimulated. Bioremediation of soils is undertaken on a kerbed treatment pad comprising concrete and tarmac hardstanding. The treatment pad has an appropriate fall to allow all process water to be collected in a precast concrete covered gully which ultimately drains to the southern corner of the pad to be pumped out and either recirculated back into the biopile or discharged to the on-site foul water drainage system. A system of perforated aeration pipes run horizontally along the base of the biopile treatment pad. This allows effective control of the waste oxygen levels and moisture content in the waste to maintain aerobic conditions.

Soils once accepted at the Soil Treatment Centre are transferred to the biopile treatment area via dump truck and/or excavator. The soils are arranged into biopiles with the most recent soils placed to the north of the biopile area for treatment and the south representing soils at completion.

The stages of the bioremediation process are detailed below:

1. Initial Placement: The soil is placed on the treatment pad by a dump truck where an excavator will form the biopile.

2. Addition of Nutrients: Based on the contaminants present within the soil, nutrients are added to facilitate the biological degradation of the hydrocarbon compounds.

3. Chemical Analysis – Approximately every 4 weeks the soil is tested to analyse the contaminant concentrations to determine whether the biological treatment of the soil is adequately reducing the hazardous contaminants to non-hazardous concentrations. Additional nutrients and/or organic inputs may be added to expedite the process.

4. Nutrients testing – Every 2-4 weeks the soil is tested to analyse the levels of nutrients within the soil to ensure that there is sufficient inorganic and organic material to facilitate the biodegradation process. This is supported by the chemical analysis of the soil for contaminant concentrations. Soils are tested in accordance with procedure STC-F006-Soil Analysis.

5. De-compaction of the soil – Every 4-8 weeks the biopile will be turned to facilitate enhanced aeration of the soil.

6. Validation testing: Once the soil meets the re-use criteria, the soil is removed from the treatment pad and transferred to the non-hazardous soils storage area or directly to the non-hazardous landfill void on site.

The biopiles are managed using a system of lots which allows the waste to be trackable from the point of origin to its location on the treatment pad.

5.2 Proposed activities

5.2.1 Additional soil treatment area

The additional soil treatment area will be used for either the treatment of soils containing hydrocarbons or soil washing as discussed in further detail in Section 5.2.4). Soils containing hydrocarbons using the methodology, equipment and infrastructure as currently employed on Site and as summarised in Section 5.1.2. The new soil treatment area will be able to treat up to 30,000 tonnes at any one time. The new soil treatment area is to provide an increased capacity for the Site to treat soils containing hydrocarbons and soils containing heavy metals dependent on contract. The soil treatment area location is shown on the Site Layout Plan.

5.2.2 Pre-screening of soils containing asbestos

All soils containing asbestos accepted on site will then be pre-screened within the building to allow the removal of oversized fractions which have the potential to damage the picking station and fines that can conceal smaller bound asbestos debris. Screening of hazardous soils is currently permitted by activity reference AR1 however this is restricted to the list of wastes in Table S2.2 only.

The pre-screening will increase the efficiency of the soil processing and will not result in airborne asbestos fibres above existing levels. It will also significantly decrease the timescales for picking thereby significantly reducing exhaust emissions from mobile plant.

A permanently installed dust suppression system is present in the Soil Treatment Building and can be operated when required. Surfactant is added to the suppression system as a precautionary measure in the unlikely event of amphibole asbestos fibres being present (Amphibole fibres are hydrophobic (unlike chrysotile fibres) and this makes the fibres more difficult to remove from airborne suspension or likewise immobilise them on soil surfaces with water alone). In addition to the installed dust suppression system there are mobile atomisers and dust cannons. Dust suppression of stockpiles is proposed prior to screening.

Only soils with a moisture content >15% are to be pre-screened. Generally, soil moisture content is ~20% or above on received soils. Soils are dampened down where required to ensure moisture content is maintained. This further limits any potential for liberation of fibres through handling/treatment.

Waste Soil containing >0.1% w/w asbestos is classified as hazardous waste. The Operator restricts asbestos in soil to less than 0.1% w/w for chrysotile fibrous asbestos and 0.01% w/w for other forms of fibrous asbestos below the hazardous limit. This is to limit the potential for airborne respirable asbestos fibres which is limited to 0.01 fibres/ml. This concentration was determined as the concentration at where the generation of elevated levels of asbestos fibres was highly unlikely in laboratory conditions. Air monitoring will be undertaken to monitor any asbestos fibre emissions and dust suppression measures are available to ensure fibre generation is never above the air quality target of 0.01f/ml. Monitoring has confirmed that the airborne asbestos emissions

have never exceeded the WHO air quality guidance levels of <0.0005f/ml externally, with only a small number of occasions where it is marginally above the <0.0005f/ml within the building which is several orders of magnitude below the <0.01f/ml permit threshold in all locations prior to mitigation measures being employed. The monitoring data is presented in the Asbestos Emissions Report provided at Appendix A.

5.2.3 Screening of non-hazardous soils

The STC can accept non-hazardous soils that require treatment limited to screening. This is also applicable to soils that have been treated via handpicking, pre-screening and/or soil washing or bioremediation. The screening of non-hazardous soils will allow the removal of any oversize or contaminants as well as separating the sol into different size fractions. The screening of non-hazardous soils is permitted under activity reference AR3 of the Permit which allows the Physical treatment consisting of sorting, separation, screening and crushing of non-hazardous waste.

The screening of non-hazardous soils is undertaken in the location currently utilised for the temporary storage of non-hazardous waste following treatment prior to further treatment on site or off-site disposal. This is regulated under activity reference AR11 allowing the temporary storage of non-hazardous waste prior to treatment on site under activities AR3, AR6 and AR7 of the Permit comprising physical treatment and bioremediation for disposal or recovery. It is proposed that this area is utilised for the screening of non-hazardous soils and for temporary storage.

The location of the screening of non-hazardous soils is shown on the Site Layout Plan.

5.2.4 Soil washing of soils contaminated with metals

The Operator proposes to operate a soil washing activity. The soil washing activity is a mobile unit sited on an impermeable surface with a sealed drainage system (to sealed sump) which is the proposed new soil treatment area when not utilised for bioremediation. The soil wash plant is to be intermittently located on the new bioremediation pad area based on the contract arrangements. The duration of treatment is likely to be 6-8 weeks for each batch.

Soil washing will be contract dependent and therefore the activity will operate intermittently.

Soils will be stockpiled to a sufficient volume to justify the mobilisation of a soil wash plant. The stockpile may require screening to ensure that meets the particle size requirements of the soil washing feed hopper. The feed hopper will be loaded with soil, feeding into a course material washer (log washer) where the stone / sand is subjected to severe attrition. At this point any lightweight inclusions are floated over the trash screen. The scrubbed soils are conveyed on to the rinsing screen and the sand washed out, the clean gravel then travels up a conveyor directly onto the tracked screener. The dirty water containing the sand and silt is then pumped to the water treatment system for further processing.

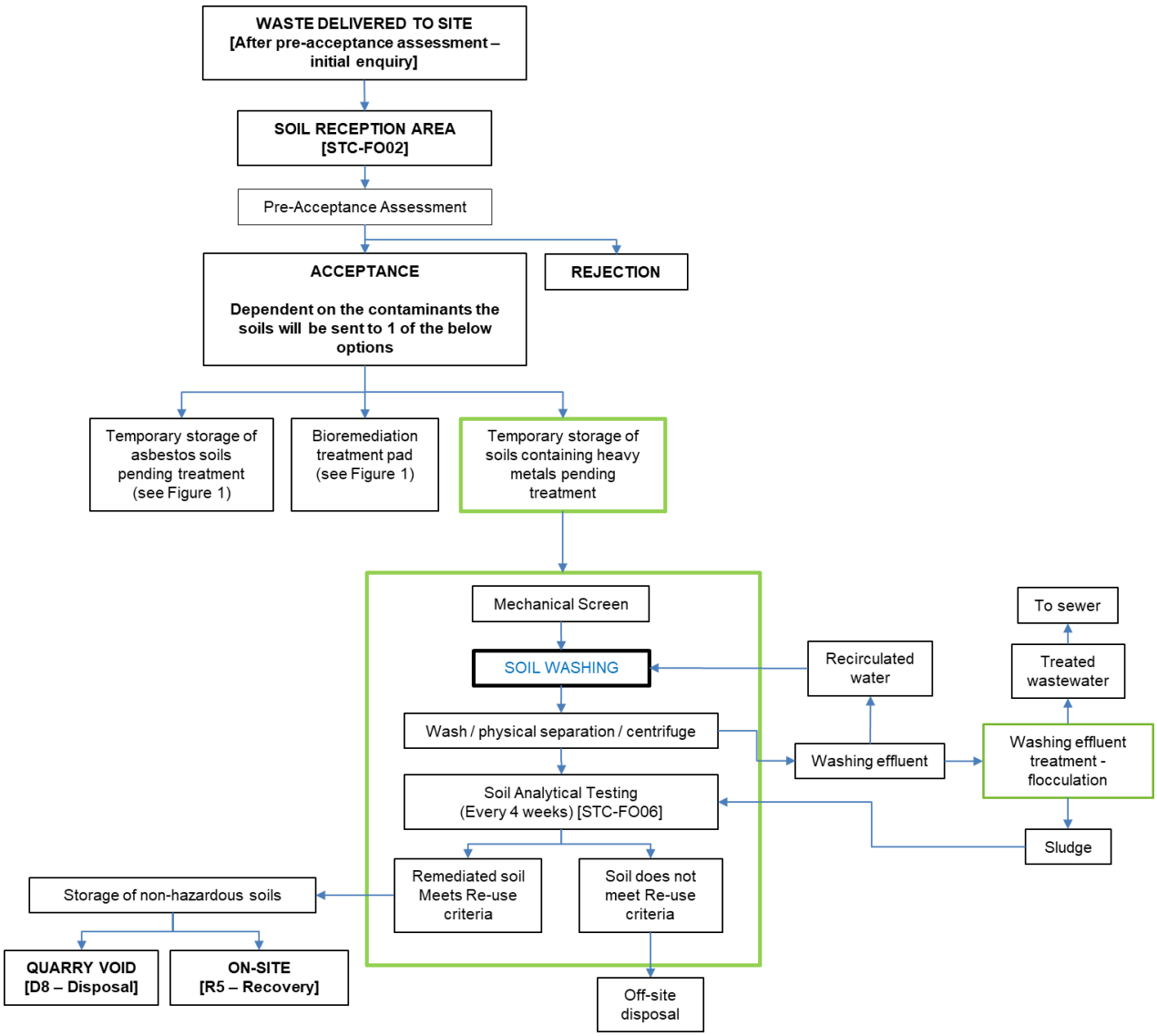
The process separates the material into three defined size fractions (i.e., gravel/sand/silt). Analysis of these fractions is undertaken post-treatment with the expectation from previous experience that

the silt fraction is most likely to accumulate any hazardous metals. Material fractions that meet the reuse criteria within the adjacent quarry backfill will be reused. Fractions that are not suitable will be sent off-site for compliant disposal.

At the completion of soil washing there is likely to be a surplus of c. 40m3 of process water to dispose. Contaminated water will then be passed through the onsite water treatment plant to treat any residual contaminants that exceed the foul sewer consent levels. Samples will be taken prior to disposal to foul sewer in accordance with the consent.

A process flow diagram for the soil washing activity is provided at Figure 2.

Figure 2 Soil washing process flow diagram



5.2.5 Treatment of soil washing process water

The process waster is treated by the water treatment plant, this water is mixed with flocculant and allowed to separate in the bespoke lamella system. The clean overflow water then passes into the clean water tank where it is stored ready to be pumped under pressure back to the log-washer unit for washing again. The thickened sludge that has settled in the lamella thickener is then pumped to the centrifuge for further processing.

The thickened sludge is then mixed with flocculant again and fed into the centrifuge where high G-Force separates solid from liquid, the liquid phase is returned to the water treatment plant for use again whilst the solid is conveyed out of the machine to a stockpiling auger. If it is not possible to reuse the process water then it will be discharged to sewer after treatment using the effluent treatment plant located next to the biotreatment equipment.

5.3 Residual waste management

Residual waste streams are anticipated to comprise asbestos fragments removed during the hand-picking operation, and any untreatable contaminated process water which is required to be sent off site.

Additional residual wastes may comprise small volumes of contaminants removed from the soil after treatment.

All wastes are recorded in the computerised waste tracking system:

- Detailing the volume of waste that has been treated.
- The volume of treatment residues and their weight.

Residues are managed in accordance with a residues management plan which is discussed in Section 8.4.

6 Emissions control

6.1 Point Source emissions to air

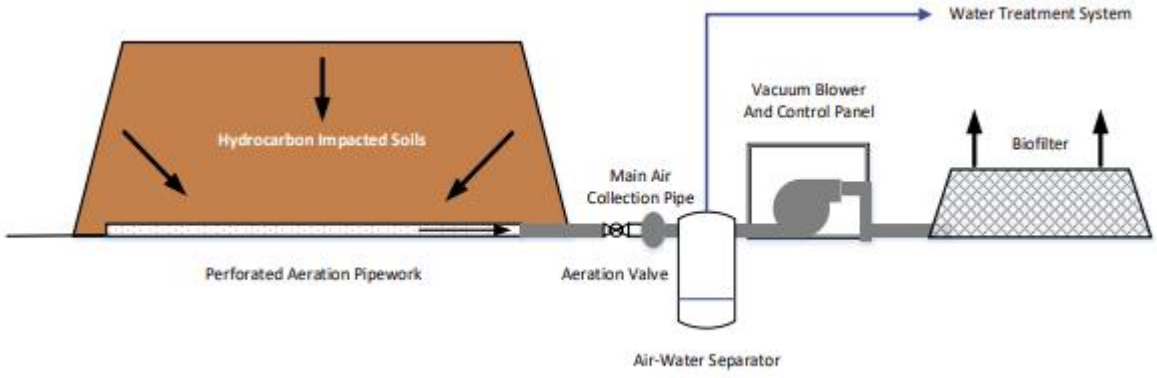
Reference has been made to appropriate measures for point source emissions to air.

6.1.1 Biopile Air Extraction System and Biofilters

Point source emissions to air comprise the current biofilter (A1) and the proposed biofilter (A2). The biopile Air Extraction System comprises a network of perforated aeration pipes installed beneath the waste biopiles which are linked to a high performance vacuum blower system. The Air Extraction System has been designed and installed to account for full occupation of the bioremediation area. The blower is located within an insulated secure shipping container. Air/water separators are fitted within the collection system to remove liquid from the process air extracted from the biopile. The process water is pumped from the separators via an automated pump with automatic level detection system to a process water tank for primary settlement prior to discharge to foul sewer. The new soil treatment area will install a similar air extraction system.

The exhaust of the air extraction system is connected to a biofilter to capture and treat the degradation products and reduce particulate and odour emissions. The new biofilter will comprise a wood medium filter consistent with the current biofilter on Site. The biofilter(s) medium have exhaust holes to allow gaseous emissions to be released. Airflow will be diverted to all parts of the biofilter bed(s) as required. The large area will ensure a low rate of air flow through the biofilter media with a large surface area to intercept and/or treat particulates and odours.

Figure 3 Biopile Air / Water Flow Diagram



The emissions monitoring programme for the biofilters is provided in the Emissions Management and Monitoring Plan in place for the Site and summarised in Section 7.1. Emission Monitoring Points are shown on Drawing Reference: K0182.2.003.

6.2 Fugitive Emissions to air (including odour)

Reference has been made to indicative BAT requirements for the control of fugitive emissions to air.

6.2.1 VOCs

The contaminated soils to be biologically treated have the potential for the release of VOCs. The biopiles are subject to extraction ventilation when operational or meteorological conditions require it. The potential for VOC release during biopile remediation will be low. The additional biotreatment area will comprise the same extraction ventilation system as the current biotreatment area therefore VOCs are considered not to be an issue as all extracted air is treated via a biofilter.

6.2.2 Asbestos Fibres

Waste Soil containing >0.1% w/w asbestos is classified as hazardous waste. The site is permitted to accept waste soils containing mixed forms of asbestos with soil fibre concentrations <0.01% w/w and chrysotile asbestos with soil fibre concentrations <0.1% w/w. The application of these soil asbestos fibre limits is to remove the potential for airborne emissions of asbestos fibres. Asbestos air monitoring is currently undertaken at 4 locations at the Site in accordance with Table S3.3 of the Permit and the data assessed against the method detection limit of 0.01 fibres/ml (HSE clearance limit). The sampling methodology follows HSG 248 Asbestos: *The analysts guide for sampling, analysis and clearance procedures*.

Data collected by the Operator from ambient air monitoring and personal monitoring confirms that the reception and handling of soil containing asbestos fibres that meet the Permit limits does not result in liberation of fibres at concentrations exceeding 0.01 fibres/ml. The monitoring data reported was below the limit of detection on all occasions. Current monitoring undertaken within the Soil Treatment building has shown that fibres are not detected >0.01f/ml or for the majority of the time >0.0005f/ml (depending on the occlusion of slides from combustion plant emissions). The pre-acceptance procedures and monitoring undertaken to date demonstrates that there are no diffuse emissions of airborne asbestos fibres that could pose excess cancer risk to receptors at the permit boundary. A report containing the asbestos monitoring data is provided at Appendix A.

Current additional dust management and suppression measures comprise an automated dust suppression system that directs a fine mist at a specific point or activity over a wide space. Surfactant is added as a precautionary measure in the unlikely event of amphibole asbestos fibres being present (Amphibole fibres are hydrophobic (unlike chrysotile fibres) and this makes the fibres more difficult to remove from airborne suspension or likewise immobilise them on soil surfaces with water alone). Low levels of surfactant are added to water (1 part surfactant to 15 parts water) which is applied to the soil surface only. This mitigation measure is present for use but has not been shown to have been required within the asbestos shed due to the strict acceptance criteria and efficiency of pre-acceptance procedures employed at site.

An Emissions Management and Monitoring Plan for the monitoring and management of dust, PM10 and asbestos fibres details the procedures for the monitoring of asbestos fibres and the

management controls in place at the Site to ensure asbestos fibres are adequately controlled and have no potential for release.

6.2.3 Particulates

Only soils with a moisture content >15% are to be pre-screened. Generally, soil moisture content is ~20% or above on received soils. Soils are dampened down when required prior to pre-screening. This further limits any potential for liberation of fibres through handling / treatment.

A Fugitive Emissions Management Plan for Dust is provided in support of this application (Report Reference: K0182-BLA-R-ENV-00005). The Fugitive Emissions Management Plan for Dust contains monitoring and management procedures for ensuring particulates are adequately controlled and have no potential for escaping site. In addition, management and monitoring of particulates (PM10) is also specified in the Emissions Management and Monitoring Plan. Fugitive emissions to air from particulates are controlled by dust suppression measures employed on Site comprising dust cannons to ensure the moisture content is maintained during storage.

Emission Monitoring Points are shown on Drawing Reference: K0182.2.003.

6.2.4 Odour Emissions

Reference has been made to indicative BAT requirements for odour control where applicable. The contaminated soils accepted on site may contain odorous organic substances due to the presence of aromatic hydrocarbons such as diesel range organics, PAHs, and phenols. An Odour Management Plan is provided in support of this application (Report Ref: K0182-BLA-R-ENV-00006).

The sector guidance note refers to the two main sources of odour, point source emissions and fugitive emissions. The activities undertaken at the Soil Treatment Centre that are considered to provide the potential for odour emissions are:

- Delivery of waste to site and initial pre-acceptance assessment.
- Transfer of soils to appropriate storage area.
- Screening of soils.
- Storage and transfer of residual material; and
- The bioremediation process comprising the initial placement, aeration and turning.

The air extraction system draws air from the biopile where it is subsequently treated in the biofilter to remove VOCs prior to emission. Strict waste acceptance procedures are in place to ensure that no non-conforming materials are accepted which may contain malodorous waste. Any potentially odorous soils accepted will be subject to pre-determined handling requirements arranged as part of the pre-acceptance assessment. Operational controls during the bioremediation process are in place to ensure no turning of the biopiles is undertaken during high winds. It is understood that there is no distinguishable odour unless a person is standing in the

immediate vicinity of the biopiles under treatment. The Operator does not propose to accept soil with an average TPH concentration above 3%.

The operational controls utilised for the control of asbestos soils in the Soil Treatment Building also mitigate against the potential release of odour. This includes preventing unnecessary agitation of the material to avoid potential odour emissions.

VOCs are monitored weekly using a handheld calibrated Photo Ionisation Detector (PID) at the biotreatment areas and biofilters as detailed in the Emissions Management and Monitoring Plan.

Emission Monitoring Points are shown on Drawing Reference: K0182.2.003.

6.3 Noise and Vibration

Reference has been made to appropriate measures for emissions of noise and vibration where applicable. The appropriate measures require the operator to consider and reduce the impacts associated with noise and vibration and ensure potential sources of noise are away from sensitive receptors and boundaries. The Soil Treatment Centre is within the larger Edwin Richards Quarry complex comprising a non-hazardous landfill.

The most likely sources of noise and vibration would be fans, pumps and motors, mobile plant along with general noise associated with vehicle movement or movement e.g., movement of soils pre- and post-treatment.

A Noise Impact Assessment was undertaken in September 2022 Report Ref: R22.0905/DRK. The NIA reported that the additional activities does not result in increased noise and vibration at the Site. The Site is subject to a comprehensive Noise Management Plan (NMP - Amec Document Ref: 33012rr726i1) dated October 2016 produced to discharge Condition 13 of planning consent (DC/14/57744). A Noise and Vibration Management Plan (Report Ref: K0182-BLA-R-ENV-00007) was prepared in support of this application and revised to incorporate the additional activities at the Site.

Noise Control Measures are provided in Section 2.2 of the NMP.

6.4 Point source emissions to water and sewer

Reference has been made to appropriate measures for point source emissions to water and sewer.

The volume of effluent generated by the activities on Site is limited by prioritising the reuse and recirculation of process water.

The following principles are to be applied to control emissions to water:

- water use should be minimised and wastewater be reused where possible.
- contamination risk of process or surface water should be minimised

- Where any potentially harmful materials are used, measures should be taken to prevent them entering the water circuit.

6.4.1 Point source emissions to water

There are no direct releases off-site other than via the engineered surface water drainage system. Which accepts uncontaminated site source water from roofs and other non-operational areas. All collected surface water drains to settlement tanks located to the southeast of the Site. The water from the tanks is reused in the processes where possible. Water from the tanks if required can be pumped to a combined sewer outfall located to the east of the tanks. In the event the pump was unable to perform, water from the settlement tank can drain to the surface water sewer under a surface water discharge consent. Surface water volume and quality is monitored in accordance with the Environment Permit. The surface water drainage system has cut-off values that can be isolated in the event of a spill or contamination.

The air/water separator allows for the collection of the process water from the biopiles from the extracted air. Collected water is automatically pumped from the separators (using a level detection system) to a process water tank for primary settlement via sand and carbon filters. The new soil treatment area will have an identical process water collection and treatment system as shown on drawing reference: 2956-02-02 entitled 'Proposed General Arrangement' with the installation of a second primary settlement tank. This will discharge to sewer.

6.4.2 Point source emissions to sewer

All areas within the Soil Treatment Centre where soil is stored or treated, including the Soil Treatment Building, have sealed drainage systems and impermeable hardstanding to collect the process water.

Any accumulated water within the building is pumped from the drainage sump to the primary settlement tank. The tank is fitted with high level alarms to ensure it does not overfill. The proposed external storage area for soils containing asbestos will comprises a geotextile clay liner and kerbing to ensure all process water is collected and sent to a pumping chamber. This process water is either recirculated where possible or discharged off-site to foul sewer after treatment.

The treated water discharges to foul sewer near entrance to Portway Road and is regularly sampled to ensure compliance with the trade effluent consent and the Environmental Permit. The drainage plan (drawing ref: Figure 1. Drainage Plan) is provided with this document.

Process water from the biopiles is collected from the treatment pads via appropriate falls to allow all process water to be collected in a precast concrete covered gully which ultimately is pumped out and either recirculated back into the biopile or discharged to the on-site foul water drainage system. Treatment comprises two 50m^3 storage tank, sediment settlement/oil water separator

tanks and carbon/sand filters prior to discharge. The treatment system will remove the majority of suspended solids, any free phase hydrocarbons as well as dissolved hydrocarbons.

The wash water from soil washing containing the sand / silt will be pumped through a hydra cyclone where the silt is separated before the sand is dewatered and stockpiled adjacent to the plant. The water containing the washed silt fines from the overflow of the cyclone will be pumped to the water treatment plant, this is mixed with flocculant and allowed to separate in the bespoke lamella system. The clean overflow water then passes into the clean water tank where it is stored ready to be pumped under pressure back to the log-washer unit for washing again. The thickened sludge that has settled in the lamella thickener will then be pumped to the centrifuge for further processing.

The thickened sludge is then mixed with flocculant again and fed into the centrifuge where high G-Force separates solid from liquid, the liquid phase will be returned to the water treatment plant for use again whilst the solid is conveyed out of the machine to a stockpiling auger.

Provectus Soils Management, who under contract with WRG operate the Soil Treatment Facility, has submitted a separate trade effluent consent application solely for the Soil Treatment Facility. The trade effluent consent application proposes a reduction in volume to 100 m^3/day. The effluent discharge will comprise process water from bioremediation post treatment and soil wash water post treatment.

In accordance with Agency guidance 'Surface water pollution risk assessment for your environmental permit' an assessment was undertaken based on additional process water to be added from the soil washing activity. The discharge for conservativism was based on the cumulative chemical analysis of the effluent from the bioremediation process and from soil wash water data taken from a Provectus Site after treatment. The assessment was undertaken on effluent based on the following assumptions/information:

- Current chemical analysis of the effluent from the Site to determine average and maximum concentrations and soil wash water data post treatment taken from a Provectus Site.
- average and maximum effluent flow rates were calculated based on the maximum daily discharge limit of 100 m^3/day proposed in the trade effluent consent application.
- the effluent discharge flows to and is treated at Severn Trent Ray Hall Sewage Treatment Works which uses biological sand filtration treatment before discharge to the River Tame.
- sewage treatment reduction factors were taken from the Agency spreadsheet for filtration.
- Q95 is taken from Bescot upstream of Ray Hall STW which is 1.5590 m^3/s.
- background concentration is conservatively assumed to be 50% of the EQS in polluted water.

The assessment showed all substances passed Test 3 of the screening tool.

Provectus Soils Management, who under contract with WRG operate the Soil Treatment Facility, has submitted a separate trade effluent consent application solely for the Soil Treatment Facility. The trade effluent consent application proposes a reduction in volume to 100 m^3/day and maximum flow rate of 2 litres/second.

The Operator carries out an ongoing inspection and maintenance programme for all infrastructure associated with the Soil Treatment Centre. External and internal drainage is inspected no less frequently than annually. All process water collected is treated through the water treatment plant for reuse within the biopiles or soil wash plant. Only excess process water will be discharged to foul sewer once treated to within the limits specified in the trade effluent consent.

The Site is not within a Groundwater Source Protection Zone. There are no major surface watercourses within 500 m of the Site. The closest surface water feature is the Dudley Canal located approximately 1.2km to the southwest of the site running in a south easterly direction. The historical quality of the canal has been classified as Grade A for chemistry and Grade C for biology. There are no groundwater abstraction licences within 2 km of the site. There are no point source emissions of hazardous or non-hazardous substances to groundwater e.g., soakaways, nor is there a direct connection to the surface water or sewer systems where effluent could be discharged deliberately or accidentally.

There is sufficient capacity within the above ground process water storage tanks adjacent to the biopile areas (110% of total volume of liquid stored on site) to contain the liquid if one of the tanks or vessels were to fail and all liquid contained within was to discharge.

There is no link to external drainage.

6.5 Fugitive emissions to land and water

Reference has been made to appropriate measures for control of potential fugitive emissions to land and water to make sure they do not cause pollution. This comprises pollution containment measures. In accordance with appropriate measures all subsurface structures, sumps, surfaces and above ground tanks containing liquids are adequately designed to ensure they are impermeable and/or bunded.

Impermeable surfacing comprises either steel reinforced concrete or engineered tarmac pads with sealed drainage. All areas are bunded and have drainage runs to allow all process water to collected.

Ongoing inspection and maintenance procedures are in place to ensure structural integrity of all sub-surface structures, site surfacing and any containment facilities.

A spillage response plan is in place for the Site and forms part of the EMS.

7 Emissions Monitoring

Reference has been made to appropriate measures for emissions monitoring and limit where applicable.

Emissions Monitoring at the facility is undertaken in accordance with Schedule 3 of the Environmental Permit and with the Sites Emissions Management and Monitoring Plan. An emissions inventory of point source emissions to air and water (including emissions to sewer) is kept and updated for the facility.

The EMMP provides procedures for the prevention, control and monitoring of dust, PM10 and asbestos fibres. Schedule 3 of the Permit places monitoring requirements on point source emissions to air (biofilter), point source emissions to sewer and process monitoring (hand-picking of asbestos soils, biofilter and internal to the biopile during bioremediation).

7.1 Point source emissions to air – monitoring

7.1.1 Biofilter

The releases from the biofilters consists of low level volatile organic compounds (VOCs), carbon dioxide and water vapour. Monitoring of the emissions from the biofilter will be undertaken on a monthly basis for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), and Polycyclic Aromatic Hydrocarbons (PAHs). Emission benchmarks provided in Table 3.13 of S5.06 specify values of 2-5 mg/m^3 based on high-risk substances such as benzene, vinyl chloride and 1, 2-dichloroethane. The monitoring data shows that the concentrations of VOCs are at or below the limit of detection and under the benchmark value. Compliance with this requirement is demonstrated by the monthly biofilter monitoring and regular VOCs monitoring results at the site.

There are no detectable emissions of airborne asbestos from the screening and hand picking of asbestos above either 0.0005f/ml or 0.01f/ml depending on the use of scanning electron microscopy (SEM) or phase contrast optical microscopy (PCOM) for the analysis of air sample filters. Limits of 0.1 fibre/ml for asbestos and 5 mg/m^3 for particulate matter are proposed in accordance with Table 6.3 of BAT Conclusions for Waste Treatment. It is proposed to carry on asbestos fibre sampling from four locations only with a reduction to weekly if agreed with the Environment Agency.

As required by the BAT Conclusions for Waste Treatment for biological treatment of waste six-monthly monitoring will be undertaken for H_2S or NH_3. The emission level values as specified in Table 6.7 will apply.

Monitoring for point source emissions to air is provided in the Emissions Management and Monitoring Plan.

Table 1 Extract from BAT conclusions

Table 6.7

BAT-associated emission levels (BAT-AELs) for channelled NH_3, odour, dust and TVOC emissions to air from the biological treatment of waste

Parameter	Unit	BAT-AEL (Average over the sampling period)	Waste treatment process
NH_3 (1) (2)	mg/Nm³	0,3-20	All biological treatments of waste
Odour concentration (1) (2)	ou_E/Nm³	200-1 000	
Dust	mg/Nm³	2-5	Mechanical biological treatment of waste
TVOC	mg/Nm³	5-40 (3)	

(1) Either the BAT-AEL for NH_3 or the BAT-AEL for the odour concentration applies.
(2) This BAT-AEL does not apply to the treatment of waste mainly composed of manure.
(3) The lower end of the range can be achieved by using thermal oxidation.

The associated monitoring is given in BAT 8.

7.2 Point source emissions to sewer – monitoring

Process water is monitored in accordance with the trade effluent consent and the Environmental Permit. The process water is monitored for the following substances monthly: pH, Suspended Solids, COD, Ammoniacal Nitrogen, Sulphides, Sulphate , Soluble Methane, Chromium, Copper, Lead, Nickel, Zinc, Phosphorus, MCPP, Visible Oil & Grease & Ammonia Load.

8 Process Efficiency

Reference has been made to appropriate measures for process efficiency where applicable.

The Facility is required to monitor and review the annual quantity of water, energy and raw materials used and the amount of residues and wastewater produced. In accordance with Table S4.3 of the Permit water and energy usage is required to be assessed and reported on an annual basis.

8.1 Energy efficiency

Energy consumption on Site is limited to the following:

- Mobile plant – combination of diesel and hybrid (diesel/electrical).
- Blower fan(s) – electrical
- Pumps - electrical
- Lighting and welfare – electrical and LPG (heaters)

The Operator will produce a report annually on energy consumption at the facility. Energy specification and consumption of each unit operation for the soil treatment equipment will be described within the STC Operations Manual. Annual energy audits will be undertaken as part of the EMS. Areas where new technology provides an opportunity for energy reduction will be identified and incorporated into the EMS.

To ensure energy efficiency all plant and equipment will be operated and maintained accordingly to maximise energy efficiency. This will include turning off process equipment when not in use. Consideration will be given to the energy efficiency of any new equipment. Staff will be trained in energy saving techniques including the closing of windows and doors as well as ensuring air condition or heating is kept as low as possible. Measures will be employed on Site to limit the amount of energy or heated water used wastefully.

8.1.1 Further energy efficient requirements

The Energy Plan for the Site is reviewed annually as part of the EMS. As part of the review the replacement of more polluting energy sources with greener energy sources is considered. Proactive measures to replace more polluting energy resources to less polluting energy sources are proposed through the use of hybrid mobile plant and hydrogenated vegetable oil (HVO) within the Soil Treatment Building rather than diesel. The screening of soils prior to asbestos picking has resulted in an approximate threefold increase in the throughput of the asbestos treatment rate for the amount of fuel use.

It is considered that the proposed activities will not pose an additional energy requirement above the energy already consumed on site. The changes proposed in the asbestos shed have significantly reduced fuel use on site due to the more efficient treatment method and reduced timescales for plant to be operational.

8.2 Raw materials

The Operator is committed to the following measures:

- Reduce the use of chemicals and raw materials.
- Substitute with materials presenting lower risks to the environment; and,
- Understand the fate of by-products and contaminants and their environmental impact.

Selection of the following types of raw materials should be considered:

- Nutrients (inorganics).
- Sustainable use of water; and
- Fuel Oils

Inorganic nutrients, such as ammonium nitrate are segregated for storage in sealed waterproof plastic 600 kg bags stored on pallets which are located on an impermeable surface with sealed drainage. The addition rates and nutrient types are commercially sensitive and are provided in the Soil Treatment Centre Operations Manual.

The Operator maintains a list of raw materials and their properties with associated procedures to control the specification of those types of raw materials which have the main potential to cause an adverse environmental impact. Quality assurance procedures are in place to ensure the quality of the raw materials being used is maintained. An annual review of alternative raw materials is carried out with regard to environmental impact and best available techniques. The operator maintains contact with the supplier of the chemicals (BASF) to keep them aware and to allow recommendations for the use or otherwise of key components in the biotreatment process.

8.3 Water use

Reference has been made to indicative BAT requirements for water efficiency.

Water used at the Site is primarily from a mains supply. Where possible water is re-used from process water stored on the on-site process tank(s). This includes the process water extracted from the biopiles which can be recirculated back into the biopiles where required.

The dust suppression system is proposed to be altered from a mobile ‘Dust Cannon’ atomiser to a system installed on top of the bay walls with a control panel. This will be connected to a proposed

external water tank with a mains water connection. This will allow the application of the dust suppression system on individual bays rather than the application to the entire building. This proposal will limit the water usage of the dust suppression system by only utilising the hoses in the areas required.

Auditing of the water use is carried out on Site. Water is re-used on site where appropriate. The process water collected from the biopiles is recirculated back into the soil where possible with the remaining water transferred for settlement. All activities are undertaken on impermeable surface with sealed drainage to minimise the risk of contamination of surface waters and groundwaters. It is unlikely water consumption can be reduced in the process without compromising the operational effectiveness of the soil treatment.

8.4 Waste minimisation, recovery and disposal

Appropriate measures requires Operators to instigate effective waste management practices throughout the day-to-day operation of their activities. This should include:

- minimises the generation of residues from waste treatment.
- optimises the reuse, regeneration, recycling or energy recovery of residues, including packaging.
- makes sure you properly dispose of residues where recovery is technically or economically impractical.

8.4.1 Waste Minimisation

A small quantity of waste is produced on site which includes paper, plastic and general packaging and small fragments of metal from the engineering workshop. Waste minimisation through recycling and reuse is applied where possible. As discussed previously waste process water is recirculated where possible into the biopiles. The Site does produce a small amount of hazardous waste including a small proportion of waste oil, batteries and solvents which are segregated, labelled and stored in secure containers prior to disposal off-site by a licenced contractor. The manually picked asbestos fragments are stored in a secure container (as discussed in Section 2).

The Site has a Residues Management Plan which forms part of the EMS. The process of waste minimisation will be reviewed on at least an annual basis.

8.4.2 Waste Reuse, Recovery, Recycling or Disposal

Waste is removed from site by 3rd Party contractors. A review of the best environmental management options for the waste streams generated will be carried out annually. A review of waste streams currently taken to landfill will be carried out every 2 years to explore viable alternatives. Records will be maintained to monitor the following characteristics of waste produced at site in addition to the Duty of Care where applicable:

- quantity nature and origin of the waste.
- the physical description of the waste.
- a description of the composition of the waste.
- any relevant hazardous properties (hazard and risk phrases).
- European Waste Catalogue code.
- handling precautions and substances with which it cannot be mixed; and
- disposal routes for each waste category.

9 BAT Assessment of BAT Conclusions for Waste Treatment

BAT Assessment	Description	Comments
GENERAL BAT CONCLUSIONS		
Overall environmental performance		
BAT 1	In order to improve the overall environmental performance, BAT is to implement and adhere to an environmental management system (EMS) that incorporates features listed in I -XV	The Operator has an accredited EMS (ISO 14001) comprising the features listed in BAT 1 I-XV. The Operator has an Environmental Policy in place which states the commitment to legal compliance and continuous improvement. The EMS includes documented management procedures for all activities undertaken at the Site.
BAT 2	In order to improve the overall environmental performance of the plant, BAT is to use all of the techniques given in a – g a) Waste characterisation and pre-acceptance procedure s b) Waste acceptance procedures c) Waste tracking system d) Output quality management system e) Waste segregation f) Waste compatibility g) Sorting incoming waste	The Site has formal waste pre-acceptance, acceptance procedures as detailed in Section 3. Waste acceptance procedures ensures all waste streams are segregated based on whether they are hazardous or non-hazardous and the contaminants present. Wastes are stored dependent on their contamination with dedicated storage areas provided for each separate waste stream. The Site operates a waste tracking system tracks the waste streams from pre-acceptance to output. Output quality is ensured by rigorous testing to ensure that the soil meets the re-use criteria. This chemical testing, continual on-site monitoring and laboratory testing throughout treatment until final output.
BAT 3	In order to facilitate the reduction of emissions to water and air, BAT is to establish and to maintain an inventory of wastewater and waste gas streams, as part of the environmental management system (see BAT 1)	Process water is monitored in accordance with the trade effluent consent. The process water is monitored for the following substances monthly: pH, Temperature, Suspended Solids, COD, Ammoniacal Nitrogen, Sulphides, Sulphate , Soluble Methane, Chromium, Copper, Lead, Nickel, Zinc, Phosphorus, MCPP, Visible Oil & Grease, Ammonia Load. In addition, asbestos fibres in water are monitored periodically. The wastewater samples are sent to an accredited laboratory for testing.. All monitoring undertaken on the point source emission to sewer is undertaken by an UKAS accredited laboratory. All monitoring is undertaken in accordance with EN standards where available or ISO, national or international

BAT Assessment	Description	Comments
		standards where required and Environment Agency online guidance 'Monitoring emissions to air, land and water (MCERTS)' dated 4 April 2023. The results are reviewed on receipt of the laboratory analysis to ensure compliance with the trade effluent consent For emissions to air the biofilter point source emissions are monitored monthly in accordance with Table S3.1 of the Permit for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), and Polycyclic Aromatic Hydrocarbons (PAHs). The limits of 0.1 fibre/ml for asbestos and 5 mg/m3 for particulate matter are proposed in accordance with Table 6.3 of BAT Conclusions for Waste Treatment. The analysis will form an inventory of the waste gas stream. The results are reviewed on receipt of the analysis to inform biofilter effectiveness. The biofilter testing is undertaken by a third party consultant. Monitoring is undertaken in accordance with Environment Agency Technical Guidance Note M8: Monitoring Ambient Air Version 2 dated May 2011 as required by Table S3.1 (or any subsequent guidance) and Environment Agency online guidance 'Monitoring emissions to air, land and water (MCERTS)' dated 4 April 2023. The results are reviewed on receipt of the analysis to ensure compliance with the Permit limits. It is proposed to carry out asbestos fibre sampling monthly with a reduction to quarterly if agreed with the Environment Agency. All monitoring is undertaken in accordance with the Environmental Permit and/or trade effluent consent. As required by the Permit the monitoring data for emissions to air is and will be reported annually to the Environment Agency. All records of monitoring results are kept to form the emissions inventory as part of the EMS.
BAT 4	In order to reduce the environmental risk associated with the storage of waste, BAT is to use all of the techniques given in a. - d. a) Optimised storage location	The Soil Treatment Facility has been designed for optimal waste handling, storage and treatment, Waste is stored pre and post treatment in designated storage areas with maximum capacities applied. The Site has adequate capacity for treatment and

BAT Assessment	Description	Comments
	b) Adequate storage capacity c) Safe storage capacity d) Separate area for storage and handling of packaged hazardous waste	storage which is managed via the waste tracking system. Wastes stored are part of the waste tracking system allowing tonnages and storage durations to be monitored at all times. This is an integral part of the business due to the variability in contracts of waste soil and therefore ensuring there is adequate storage capacity at the facility. Hand-picked asbestos is double bagged and stored in a designated area.
BAT 5	In order to reduce the environmental risk associated with the handling and transfer of waste, BAT is to set up and implement handling and transfer procedures.	Special handling and transfer procedures are in place for the handling of contaminated soils:· • Procedures for soils containing asbestos . • Procedures for soils hazardous for hydrocarbons. • Procedures for soils hazardous for heavy metals Due to the nature of the waste types accepted at the facility only appropriately trained staff can handle and/or transfer soils. Procedures are regularly reviewed and updated where necessary. Further detail is provided in Section 4 of this report.
Monitoring		
BAT 6	For relevant emissions to water as identified by the inventory of waste water streams (see BAT 3), BAT is to monitor key process parameters (e.g., waste water flow, pH, temperature, conductivity, BOD) at key locations (e.g., at the inlet and/or outlet of the pre-treatment, at the inlet to the final treatment, at the point where the emission leaves the installation).	Process water is monitored pre-treatment and prior to discharge in accordance with the trade effluent consent and subject to the limits as specified in the consent. The process water is monitored for the following substances on a monthly basis: flow, temperature, pH, Suspended Solids, COD, Ammoniacal Nitrogen, Sulphides, Sulphate , Soluble Methane, Chromium, Copper, Lead, Nickel, Zinc, Phosphorus, MCPP, Visible Oil & Grease, Ammonia Load. Asbestos fibres are periodically monitored in the process water. The wastewater samples are sent to an accredited laboratory for testing. The results are reviewed on receipt of the laboratory analysis to ensure compliance with the trade effluent consent. A review of waste water stream composition will be undertaken annually as required by the EMS.

BAT Assessment	Description	Comments
BAT 7	BAT is to monitor emissions to water with at least the frequency given below, and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality	Not applicable. All monitoring undertaken on the point source emission to sewer is undertaken by an UKAS accredited laboratory. All monitoring is undertaken in accordance with EN standards where available or ISO, national or international standards where required and Environment Agency online guidance 'Monitoring emissions to air, land and water (MCERTS)' dated 4 April 2023.
BAT 8	BAT is to monitor channelled emissions to air with at least the frequency given below, and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.	The Site has the following point source emissions to air: Biofilter (A1) and Biofilter (A2). Monitoring of the emissions from the biofilters will be undertaken on a monthly basis for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), and Polycyclic Aromatic Hydrocarbons (PAHs) in accordance with the Emissions Monitoring and Management Plan and the Environmental Permit. The biofilter testing is undertaken by a third party consultant. Monitoring is undertaken in accordance with Environment Agency Technical Guidance Note M8: Monitoring Ambient Air Version 2 dated May 2011 as required by Table S3.1 (or any subsequent guidance) and Environment Agency online guidance 'Monitoring emissions to air, land and water (MCERTS)' dated 4 April 2023.
BAT 9	BAT is to monitor diffuse emissions of organic compounds to air from the regeneration of spent solvents, the decontamination of equipment containing POPs with solvents, and the physico-chemical treatment of solvents for the recovery of their calorific value, at least once per year using one or a combination of the techniques given in below: measurement, emissions factors, mass balance.	Not applicable.
BAT 10	BAT is to periodically monitor odour emissions.	Off-site olfactory monitoring will also be carried out with reference to the protocol in Appendix 1 of the Environment Agency H4 Odour Management Guidance. Monitoring procedures are detailed in Section 6.2 of the Sites Odour Management Plan (Report Ref: K0182-BLA-R-ENV-00006).
BAT 11	BAT is to monitor the annual consumption of water, energy and raw materials as well as the annual generation of residues and waste water, with a frequency of at least once per year	In accordance with Table S4.3 of the Permit water and energy usage is required to be assessed and reported on an annual basis. Internal audits are undertaken in accordance with the EMS.

BAT Assessment	Description	Comments
Emissions to air		
BAT 12	In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to set up, implement and regularly review an odour management plan, as part of the environmental management system (see BAT 1)	The Site has an Odour Management Plan) which forms part of the Environmental Permit Operating Techniques. The OMP has been updated in support of this variation application (Report Ref: K0182-BLA-R-ENV-00006). The OMP is subject to regular review as part of the EMS. Any amendments required to the OMP will be agreed with the Agency.
BAT 13	In order to prevent or, where that is not practicable, to reduce odour emissions, BAT is to use one or a combination of the techniques given in a. – c. a) Minimising residence times b) Using chemical treatment c) Optimising aerobic treatment	Residence times for storage are limited as wastes are stored solely prior to treatment. Moisture content is maintained to ensure optimal conditions for treatment. During treatment the wastes are subject to the air extraction system to control any potential odour emissions. All emissions are abated through the air extraction system which is connected to the biofilter to capture and treat the degradation products and reduce particulate and odour emissions.
BAT 14	In order to prevent or, where that is not practicable, to reduce diffuse emissions to air, in particular of dust, organic compounds and odour, BAT is to use an appropriate combination of the techniques given in a. – h. a) minimising the number of potential diffuse emission sources b) selection and use of high integrity equipment c) corrosion prevention d) containment, collection and treatment of diffuse emissions e) dampening f) maintenance g) cleaning of waste treatment and storage areas h) leak detection and repair programme	The Site has a Fugitive Emissions Management Plan which forms part of the Environmental Permit operating techniques. The FEMP has been updated in support of this variation application (Report Ref: K0182-BLA-R-ENV-00005). The FEMP is subject to regular review as part of the EMS. Any changes to the FEMP will be agreed with the Agency. The FEMP contains procedures for minimising the potential for diffuse emissions to air and management procedures for controlling any diffuse emissions to air associated with the waste treatment activities and waste storage. In addition, the Site also has an Emissions Management and Monitoring Plan in place for the prevention and control of dust, PM10 and asbestos fibres. Monitoring requirements are set out in Schedule 3 of the permit and in the Emissions Management and Monitoring Plan.

BAT Assessment	Description	Comments
		Plant, equipment and infrastructure are subject to regular inspection and maintenance programme in accordance with the EMS. The Operator utilises the following controls to limit diffuse emissions to air from the Site activities: 1. Comprehensive pre-acceptance restrictions on soils to be accepted at the Site. Restrictions on asbestos fibres in soils containing asbestos accepted at the facility to less than 0.1% w/w for free chrysotile fibrous asbestos and <0.01 %w/w for mixed forms of fibrous asbestos. This is to limit the potential for airborne respirable asbestos fibres which is limited to 0.01 fibres/ml. This concentration was determined as the concentration where the generation of elevated levels of asbestos fibres was considered to be highly unlikely in laboratory conditions. Waste acceptance procedures are therefore designed to eliminate respirable asbestos fibre emissions by ensuring no friable asbestos or asbestos fibres are present in accepted wastes at concentrations that would result in any significant airborne release above 'ambient background' level. 2. Only soils with a moisture content >15% are to be pre-screened. Generally, soil moisture content is ~20% or above on received soils. Soils are dampened down where required to ensure moisture content is kept at the optimal level with a maximum of 30%. This further limit any potential for liberation of fibres through handling/treatment. 3. The pre-screening of soils containing asbestos is to be undertaken in the Soil Treatment building. 4. Conveyor belt heights used on the screener will be set at the lowest height level to limit the drop height of material after screener. The deposit point from the picking station is used as one of the monitoring points to ensure the method does not result in asbestos fibres emissions. 5. A permanently installed dust suppression system is present in the Soil Treatment Building and can be operated when required. Surfactant is added to the

BAT Assessment	Description	Comments
		suppression system as a precautionary measure in the unlikely event of amphibole asbestos fibres being present (Amphibole fibres are hydrophobic (unlike chrysotile fibres) and this makes the fibres more difficult to remove from airborne suspension or likewise immobilise them on soil surfaces with water alone). In addition to the installed dust suppression system there are mobile atomisers and dust cannons. Dust suppression of stockpiles is proposed prior to screening. 6. The soil wash plant results in the mixing of soil to create a process slurry that is subsequently treated. As a 'wet' process this effectively mitigates dust risks. 7. The Sites Management System contains maintenance procedures for all mobile and fixed plant, infrastructure, and equipment. 8. Regular cleaning of all operational areas, plant and equipment 9. All equipment and ductwork are subject to regular inspections in accordance with the manufacturer's recommendations and repairs made as necessary. 10. Comprehensive monitoring regime in place for dust, PM10, asbestos fibres as specified in the Permit and the Emissions Management and Monitoring Plan. This comprises a monitoring regime
BAT 15	BAT is to use flaring only for safety reasons or for non-routine operating conditions (e.g., start-ups, shutdowns) by using both of the techniques given in a. – b. a) Correct plant design b) Plant management	Not applicable
BAT 16	In order to reduce emissions to air from flares when flaring is unavoidable, BAT is to use both of the techniques given in a. – b. a) Correct design of flaring devices b) Monitoring and recording as part of flare management	Not applicable
Noise and vibrations		
BAT 17	In order to prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to set up, implement and regularly review a noise and vibration management plan, as part of	A Noise Impact Assessment (NIA) was undertaken by Noise and Vibration Consultants (NVC) Limited in August 2022. The NIA shows noise and vibration will not be an issue beyond the Site boundary.

BAT Assessment	Description	Comments
	the environmental management system (see BAT 1), that includes all of the elements contained in I – IV. I. Protocol containing actions / timelines II. Protocol for conducting noise and vibration monitoring. III. Protocol for response to identified noise and vibration events e.g., complaints IV. A noise and vibration reduction programme	A Noise and Vibration Management Plan forms part of the Environmental Permit Operating Techniques. The NMP has been updated in support of this variation application (Report Ref: K0182-BLA-R-ENV-00007). This comprises the procedures for control and reducing noise and vibration from the activities undertaken at the Site. The NMP is subject to regular review as part of the EMS. Any changes to the NMP will be agreed with the Environment Agency. As part of the EMS the plant, infrastructure and equipment used on Site is subject to routine audits and replacements. Consideration is given to the reduction of noise and vibration with the replacement of plant and equipment i.e., replacement of diesel plant to electric. Section 7.2 of the NMP contains noise monitoring procedures. The NMP contains a complaints procedure which requires the actions to be undertaken in the event of a noise complaints including identification of the source, investigation into noise including monitoring, actions taken to rectify the noise issue (i.e. operational or equipment replacement for example).
BAT 18	In order to prevent or, where that is not practicable, to reduce noise and vibration emissions, BAT is to use one or a combination of the techniques given in a. – e. a) Appropriate location of equipment and buildings b) Operational measures c) Low-noise equipment d) Noise and vibration control equipment e) Noise attenuation	A Noise and Vibration Management Plan forms part of the Environmental Permit Operating Techniques. The NMP has been updated in support of this variation application (Report Ref: K0182-BLA-R-ENV-00007). This comprises the procedures for control and reducing noise and vibration from the activities undertaken at the Site. Prior to any activities undertaken at the Soil Treatment Facility Noise Impact Assessments (NIA) were used to inform appropriate locations of equipment and buildings, requirements for any acoustic insulation or enclosures and inform the operational measures required for the control of noise and vibration. A NIA was undertaken for the proposed activities at the Site as part of this application and provided an additional recommendation to install an acoustic screen along the

BAT Assessment	Description	Comments
		southern, southeast and southwest boundary of the proposed soil treatment area to a height of 5 m. Currently utilised noise and vibration control measures are detailed in Section 6 of the NMP.
Emissions to water		
BAT 19	In order to optimise water consumption, to reduce the volume of waste water generated and to prevent or, where that is not practicable, to reduce emissions to soil and water, BAT is to use an appropriate combination of the techniques given in a. – i. a) Water management b) Water recirculation c) Impermeable surface d) Techniques to reduce the likelihood and impact of overflows and failures from tanks and vessels e) Roofing of waste storage and treatment areas f) Segregation of water streams g) Adequate drainage infrastructure h) Design and maintenance provisions for detection and repair of leaks i) Appropriate buffer storage capacity	The following procedures and techniques are utilised at the Site to optimise water consumption and reduce the volume of waste water generated. • Reuse / recirculation of all waste water where possible, particularly the soil wash plant. • The Site treatment and storage areas comprise either bunded impermeable concrete hardstanding with drainage run or geotextile clay liners to facilitate the collection of all process water. • The drainage systems are subject to maintenance and inspection procedures to allow detection and repair of any leaks. • Wastes stored pending treatment are sheeted where appropriate, with consideration given to maintaining moisture content at a maximum of~30%. • All waste streams are stored separately. • Process water utilised in the bioremediation areas and soil washing are recirculated into the treatment process. Only process water that may not be recirculated is discharged to sewer after appropriate treatment. The effluent discharged is limited to the volume specified in the trade effluent consent. As the bioremediation activities are water intensive, optimising process water is integral in ensuring the treatment processes are financially viable. • The Site has the adequate capacity on Site to prevent run off as areas for waste storage and treatment is located on impermeable surfacing.
BAT 20	In order to reduce emissions to water, BAT is to treat waste water using an appropriate combination of techniques i.e., primary, physico-chemical and/or biological treatment.	Collected process water from bioremediation in the drainage sumps is pumped from the separators (using a level detection system) to a process water tank for primary settlement via sand and carbon filters. Process water from the soil washing activity the water will be pumped through a hydra cyclone where the silt is separated before the sand is dewatered and stockpiled

BAT Assessment	Description	Comments
		adjacent to the plant. The water containing the washed silt fines from the overflow of the cyclone will be pumped to the water treatment plant, mixed with flocculant and allowed to separate in the bespoke lamella system. The thickened sludge that has settled in the lamella thickener will then be pumped to the centrifuge for further processing. The thickened sludge is then mixed with flocculant again and fed into the centrifuge where high G-Force separates solid from liquid, the liquid phase will be returned to the water treatment plant for use again whilst the solid is conveyed out of the machine to a stockpiling auger. Interceptors are also in place on site surface water drainage system prior to release to foul sewer under Trade Effluent Discharge Consent.
Emissions from accidents and incidents		
BAT 21	In order to prevent or limit the environmental consequences of accidents and incidents, BAT is to use all of the techniques given in a. – c., as part of the accident management plan (see BAT 1) a) Protection measures b) Management of incidental / accidental emissions c) Incident / accident registration and assessment system	The Site has a formal structured Accident Management Plan (AMP) as part of their Environmental Management System addressing the requirements of Section 2.3 of appropriate measures guidance. Accident management requires a review of 3 key components: • Identification of the hazards posed by the facility/activity; • Assessment of the risks (hazard x probability) of accidents / incidents and their possible consequences; and • Implementation of measures to reduce the risk of accidents and contingency plans for any accidents that do occur. Procedures are in place to address accidents / incidents and/or abnormal operations, along with reporting lines internally and externally, and timeframes for making reports or notifications.
Material efficiency		
BAT 22	In order to use materials efficiently, BAT is to substitute materials with waste.	Waste wood is accepted at the Site for use in the bioremediation process to substitute non-waste wood that would otherwise be used. Any oversize waste wood is used for feedstock of the biofilters.

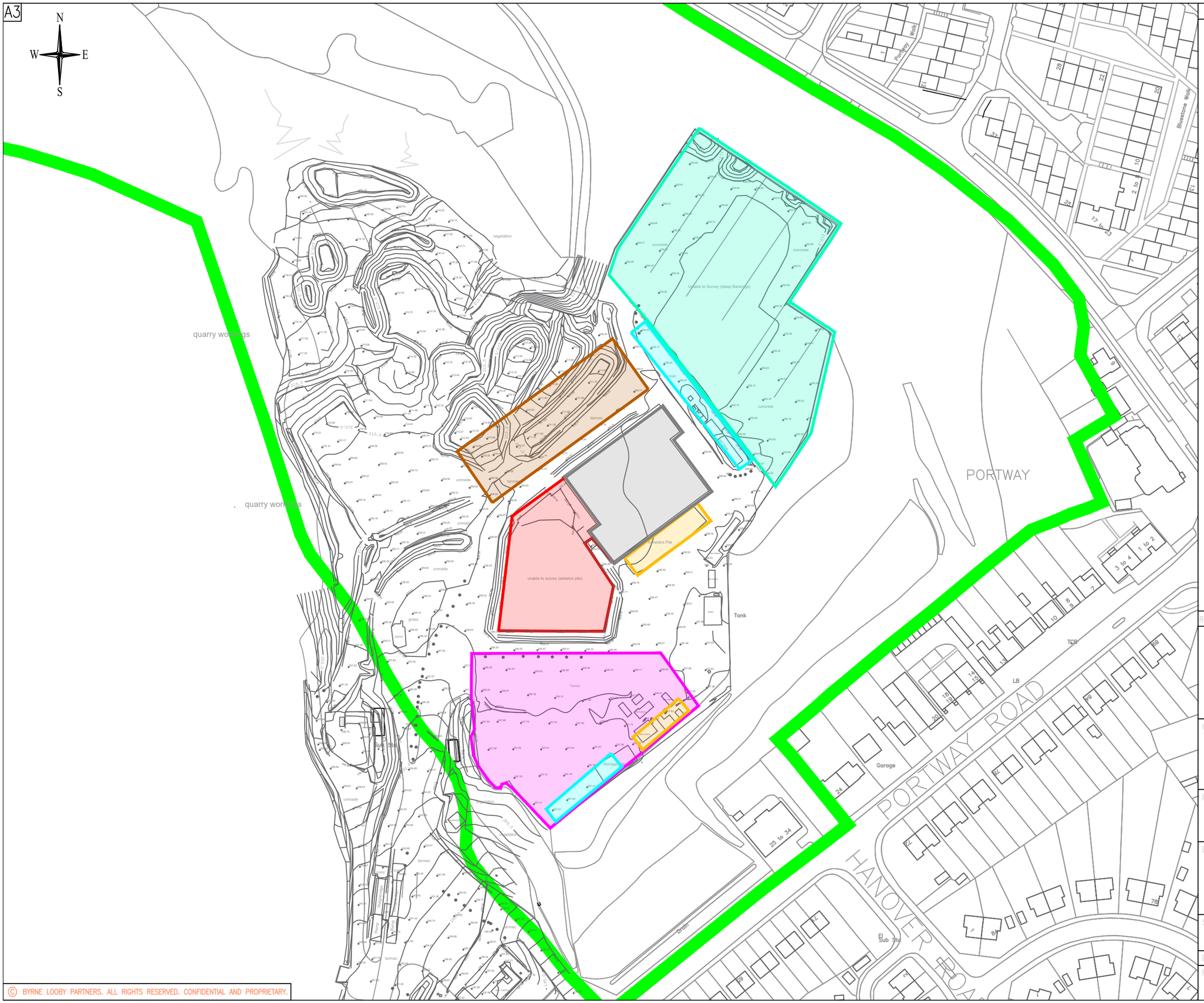
BAT Assessment	Description	Comments
Energy efficiency		
BAT 23	In order to use energy efficiently, BAT is to use both of the techniques given below. a) energy efficiency plan b) energy balance record	Energy and fuel used is recorded. Review of energy use and the potential for savings is one of the Objectives and Targets in the EMS. Energy usage is reported to the Environment Agency on an annual basis in accordance with Table S4.3 of the Permit.
Reuse of packaging		
BAT 24	In order to reduce the quantity of waste sent for disposal, BAT is to maximise the reuse of packaging, as part of the residues management plan (see BAT 1).	Drums, IBC's, containers and pallets are reused where possible for the collection and storage of low volume hazardous wastes.
General BAT conclusions for the mechanical treatment of waste		
BAT 25	In order to reduce emissions to air of dust, and of particulate-bound metals, PCDD/F and dioxin like PCBs, BAT is to apply BAT 14d and to use one or a combination of the techniques given below: a) Cyclone b) Fabric Filter c) Wet Scrubbing d) Injection of water into the shredder	Not applicable. The BAT reference document (BREF) specifies BAT 25 is specific to air collection and treatment systems for shredding plant.
BAT 26 - 28	BAT conclusions for the mechanical treatment in shredders of metal waste	Not applicable.
BAT 29 - 30	BAT conclusions for the treatment of WEEE containing VFCs and/or VHCs	Not applicable.
BAT 31	BAT conclusions for the mechanical treatment of waste with calorific value	Not applicable.
BAT 32	BAT conclusions for the mechanical treatment of WEEE containing mercury	Not applicable.
General BAT conclusions for the biological treatment of waste		

BAT Assessment	Description	Comments
BAT 33	In order to reduce odour emissions and to improve the overall environmental performance, BAT is to select the waste input.	All wastes accepted or to be accepted at the STC are subject to rigorous pre-acceptance testing to ensure the wastes are suitable for treatment. Testing is dependent on the type of contaminants present.
BAT 34	In order to reduce channelled emissions to air of dust, organic compounds and odorous compounds, including H2S and NH3, BAT is to use one or a combination of the techniques given below: Adsorption, Biofilter, Fabric Filter, Thermal Oxidation, Wet Scrubbing	An air extraction system in installed at each bioremediation area which comprises perforated pipes that extract air from the biopile and discharge emissions via a woodchip medium biofilter. The biofilter medium has exhaust holes to allow gaseous emissions to be released. Monitoring of the emissions from the biofilters will be undertaken on a monthly basis for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), and Polycyclic Aromatic Hydrocarbons (PAHs) in accordance with the Emissions Monitoring and Management Plan and the Environmental Permit.
BAT 35	In order to reduce the generation of waste water and to reduce water usage, BAT is to use all of the techniques given below: segregation of water streams, water recirculation and minimisation of the generation of leachate .	Process water utilised in the bioremediation areas are recirculated into the treatment process where possible. Only process water that may not be recirculated (i.e., content of impurities are too high) is discharged to sewer after treatment. The effluent discharged is limited to the volume specified in the trade effluent consent. As the bioremediation process can be water intensive when ensuring the moisture content is kept at a maximum of 30%, optimising process water is integral in ensuring the treatment processes are financially viable. Moisture content is maintained in the bioremediation process to ensure aerobic conditions.
BAT conclusions for the aerobic treatment of waste		
BAT 36	In order to reduce emissions to air and to improve the overall environmental performance, BAT is to monitor and/or control the key waste and process parameters.	Monitoring is undertaken during the entire pre-acceptance, acceptance and treatment of waste at the STC. This ensures the suitability and treatability of the waste types.
BAT 37	In order to reduce diffuse emissions to air of dust, odour and bioaerosols from open-air treatment steps, BAT is to use one or both of the techniques given below: use of semipermeable	The bioremediation area biopiles are subject to an air extraction system comprising perforated aeration pipes located beneath the waste to extract air from the biopiles. This allows effective control of the waste oxygen levels and moisture content in the

BAT Assessment	Description	Comments
	membrane covers, adaptation of operations to the meteorological conditions	waste to maintain aerobic conditions. This reduces the potential for anaerobic conditions to develop which can cause odorous emissions. Dust suppression is utilised also to ensure the moisture content is maintained up to 30 during bioremediation. Moisture content is kept at optimal levels to maintain aerobic conditions. For externally stored wastes including the temporarily stored soils containing asbestos, dust suppression is utilised. The Site has a Fugitive Emissions Management Plan in place for the prevention and control of dust, PM10 and asbestos fibres. In addition, the Site also has an Emissions Management and Monitoring Plan in place detailing the monitoring of dust, PM10 and asbestos fibres. Monitoring requirements are set out in Schedule 3 of the permit and in the Emissions Management and Monitoring Plan.
BAT 38	BAT conclusions for the anaerobic treatment of waste.	Not applicable.
BAT 39	BAT conclusions for the mechanical biological treatment (MBT) of waste.	Not applicable.
BAT 40	In order to improve the overall environmental performance, BAT is to monitor the waste input as part of the waste pre-acceptance and acceptance procedures (see BAT 2).	See response to BAT 2 and BAT 33.
BAT 41	In order to reduce emissions of dust, organic compounds and NH3 to air, BAT is to apply BAT 14d and to use one or a combination of the techniques given below: adsorption, biofilter, fabric filter, wet scrubbing	See response to BAT 34.
BAT 42 - 44	BAT conclusions for the treatment of waste oil	Not applicable.
BAT 45	BAT conclusions for the physico-chemical treatment of waste with calorific value	Not applicable.
BAT 46 - 47	BAT conclusions for the regeneration of spent solvents	Not applicable.

BAT Assessment	Description	Comments
BAT 48 - 49	BAT conclusions for the thermal treatment of spent activated carbon, waste catalysts and excavated contaminated soil	Not applicable.
BAT conclusions for the water washing of excavated contaminated soil		
BAT 50	In order to reduce emissions of dust and organic compounds to air from the storage, handling, and washing steps, BAT is to apply BAT 14d and to use one or a combination of the techniques given below: adsorption, fabric filter and wet scrubbing	Hydrocarbons will not be present in soil to be washed unless pre-treatment is initially applied from the biopile on site. PID monitoring of key points on soil wash plants have not revealed elevated concentrations of volatile hydrocarbons. Dust suppression is utilised on site although the soil washing process is not considered to create fugitive emissions of dust due to the nature of the process which utilises water reducing any potential for emissions. Strict dust control measures are in place at the Site and further details are provided in the FEMP.
BAT 51	BAT conclusions for the decontamination of equipment containing PCBs	Not applicable.
BAT 52 - 53	BAT conclusions for the treatment of water-based liquid waste	Not applicable.

A3



GENERAL NOTES

1. SURVEY INFORMATION SUPPLIED BY THE WASTE RECYCLING GROUP .
2. DO NOT SCALE
3. ALL DIMENSIONS ARE IN MILLIMETRES AND ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM
4. ANY ANOMALIES ON THIS DRAWING ARE TO BE BROUGHT TO THE ATTENTION OF BYRNE LOOBY

KEY

- PERMIT BOUNDARY
- NON–HAZARDOUS SOIL STORAGE AND SCREENING AREA
- BIOLOGICAL TREATMENT AREA
- BIOFILTERS
- HAZARDOUS SOILS STORAGE AREA
- BIOLOGICAL TREATMENT AREA/SOIL WASHING AREA
- WATER TREATMENT PLANTS
- SOIL TREATMENT BUILDING

Rev	Date	Description	By	Chk	App

BYRNELOOBY

WWW.BYRNELOOBY.COM

IRELAND | UK | UAE | BAHRAIN | KSA

CLIENT

waste recycling group

PROJECT

EDWIN RICHARDS QUARRY
SOIL TREATMENT CENTRE

DRAWING TITLE

SITE LAYOUT PLAN

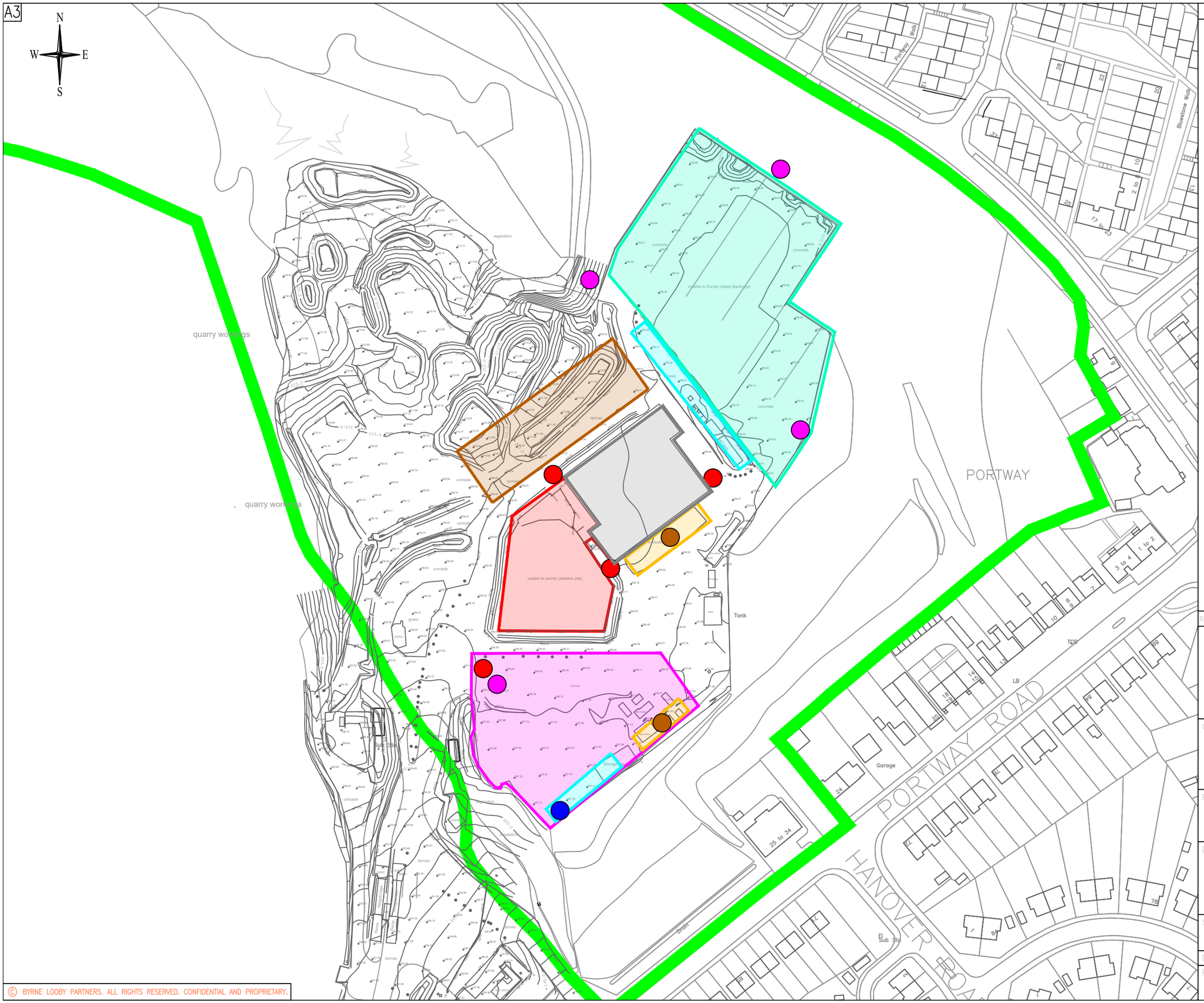
STATUS

FINAL

Date: 20.06.23	Scale: 1:1500	Drawn: JM	Chk: JW	App: JW

Project No:	Drg. No:	Rev:
K0182	K0182.2.002	01

A3



GENERAL NOTES

1. SURVEY INFORMATION SUPPLIED BY THE WASTE RECYCLING GROUP .
2. DO NOT SCALE
3. ALL DIMENSIONS ARE IN MILLIMETRES AND ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM
4. ANY ANOMALIES ON THIS DRAWING ARE TO BE BROUGHT TO THE ATTENTION OF BYRNE LOOBY

KEY

- PERMIT BOUNDARY
- NON–HAZARDOUS SOIL STORAGE AND SCREENING AREA
- BIOLOGICAL TREATMENT AREA
- BIOFILTERS
- HAZARDOUS SOILS STORAGE AREA
- BIOLOGICAL TREATMENT AREA/SOIL WASHING AREA
- WATER TREATMENT PLANTS
- SOIL TREATMENT BUILDING
- AIR SAMPLING: ASBESTOS/PM10
- AIR SAMPLING: TPH/BTEX/PAH'S
- AIR SAMPLING: DUST/NOISE/ODOUR
- WATER SAMPLING: SEVERN TRENT

Rev	Date	Description	By	Chk	App

BYRNELOOBY

WWW.BYRNELOOBY.COM

IRELAND | UK | UAE | BAHRAIN | KSA

CLIENT

waste recycling group

PROJECT

EDWIN RICHARDS QUARRY
SOIL TREATMENT CENTRE

DRAWING TITLE

EMMISIONS MONITORING PLAN

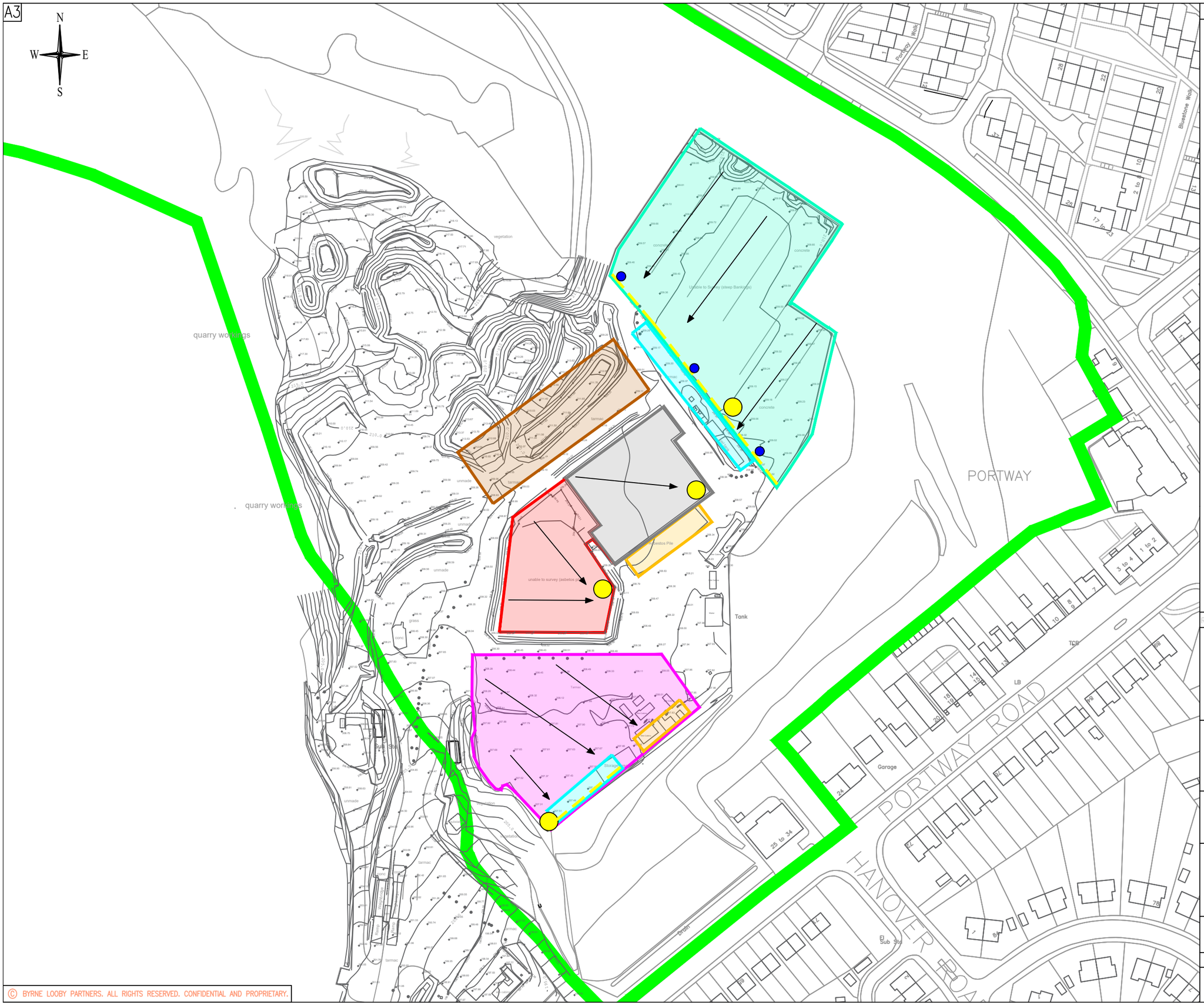
STATUS

FINAL

Date: 20.06.23	Scale: 1:1500	Drawn: JM	Chk: JW	App: JW

Project No:	Drg. No:	Rev:
K0182	K0182.2.003	01

A3



GENERAL NOTES

1. SURVEY INFORMATION SUPPLIED BY THE WASTE RECYCLING GROUP .
2. DO NOT SCALE
3. ALL DIMENSIONS ARE IN MILLIMETRES AND ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM
4. ANY ANOMALIES ON THIS DRAWING ARE TO BE BROUGHT TO THE ATTENTION OF BYRNE LOOBY

KEY

- PERMIT BOUNDARY
- NON–HAZARDOUS SOIL STORAGE AND SCREENING AREA
- BIOLOGICAL TREATMENT AREA
- BIOFILTERS
- HAZARDOUS SOILS STORAGE AREA
- BIOLOGICAL TREATMENT AREA/SOIL WASHING AREA
- WATER TREATMENT PLANTS
- SOIL TREATMENT BUILDING
- PUMPING CHAMBERS
- DRAINAGE GULLY
- DRAINAGE DIRECTION
- SURFACE WATER DRAINAGE PIPE

Rev	Date	Description	By	Chk	App

BYRNELOOBY

WWW.BYRNELOOBY.COM

IRELAND | UK | UAE | BAHRAIN | KSA

CLIENT

waste recycling GROUP

PROJECT

EDWIN RICHARDS QUARRY
SOIL TREATMENT CENTRE

DRAWING TITLE

DRAINAGE PLAN

STATUS

FINAL

Date: 20.06.23	Scale: 1:1500	Drawn: JM	Chk: JW	App: JW

Project No:	Drg. No:	Rev:
K0182	K0182.2.004	01

Appendix A – Asbestos Emissions Report

Asbestos Emissions Report

RRMG/AER/001

FCC Environment Ltd

Asbestos Emissions Report
Soil Treatment Facilities at Maw Green and Rowley Regis

14 December 2022

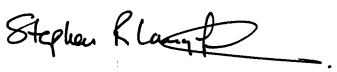
PROVECTUS

www.provectusgroup.com

Project Quality Assurance
Information Sheet

Report Type	:	Asbestos Emissions Report
Site Location	:	Soil Treatment Facilities at Maw Green and Rowley Regis
Report Number	:	RRMG/AER/001
Report Status	:	Issue 1
Report Date	:	14 December 2022
Prepared for	:	FCC Environment Ltd
Prepared by	:	Provectus Soils Management Limited Regent House Bath Avenue Wolverhampton West Midlands WV1 4EG

Compiled by	:	Jonathan Owens Operations Director



Authorised by	:	Steve Langford Managing Director

TABLE OF CONTENTS

APPENDICES

1 INTRODUCTION

1.1 Background

This report provides details of the emissions from the use of a soil screener to pre-treat soils containing bound asbestos debris at two separate soil treatment facilities located at Rowley Regis in the West Midlands and Maw Green, near Crewe in Cheshire.

The aim of the report was to demonstrate the air quality during the screening of soils and subsequent hand picking. This monitoring data also validates the effectiveness of the pre-acceptance criteria for asbestos content which are designed to prevent elevated airborne asbestos emissions.

To allow the screening of soils with asbestos debris, a mobile treatment license was deployed by Provectus for a 12 month period on both sites (Appendix A). The aim of the MTL deployment was to monitor emissions and provide a dataset for review by the Environment Agency who have previously been unable to assess the actual emissions from the process. This is due to the relatively recent introduction of this approach onto long term installations which has been undertaken for many years with Environment Agency approval under a mobile treatment license.

The data set will validate the initial emissions from the soil screening and establish if the screening process increases concentrations of airborne asbestos and the effectiveness of any abatement measures on emissions.

There is a need in the construction industry for a compliant and cost effective treatment and disposal option for soils with visible asbestos. There is no cost effective or robust treatment recovery option for asbestos and therefore once removed from soil it requires ultimate disposal in hazardous landfill.

This report uses methods that are implemented as standard in the land remediation industry to facilitate the minimisation of the amount of asbestos impacted waste that requires hazardous landfill disposal. This aim is aligned with the requirements of the waste hierarchy and landfill directive to reduce minimise waste/reduce waste volumes, reduce its hazardous nature, facilitate its handling, and enhance its recovery.

1.2 Information Sources

The following data sources were used in the preparation of this report:

- CL: AIRE, 2016. Control of Asbestos Regulations 2012 - Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials: Industry guidance. CL: AIRE, London August 2016.
- Managing and working with asbestos. Control of Asbestos Regulations 2012. Approved Code of Practice and Guidance (L143). HSE 2013
- A Tiered Approach for the Assessment of the Human Health Risks of Asbestos in Soils. Frank A. Swartjes and Peter C. Tromp. *Soil & Sediment Contamination*, 17:137–149, 2008
- Guidance on the classification and assessment of waste. Technical Guidance WM3 (v1.2.GB). Environment Agency October 2021.
- Chemical Waste: Appropriate Measures for Permitted Facilities. Environment Agency, 18 November 2020.
- Asbestos in soil: A pan European Perspective. NICOLE 2021 (Appendix B)
- Asbestos Monitoring Data (Appendix C to E)
- World Health Organization. Regional Office for Europe. (2000). Air quality guidelines for Europe, 2nd ed. World Health Organization

2 ASBESTOS IN SOIL TREATMENT APPROACH

2.1 Background

The overall aim for the physico-chemical treatment method proposed is to receive hazardous asbestos impacted soils that can be treated effectively to ultimately recover soil with a non-hazardous classification; this would then result in the disposal of a minimised volume of asbestos to an off-site hazardous waste landfill.

The treatable waste streams would be limited to soils that are hazardous due to the presence of bound asbestos fragments but do not contain either hazardous concentrations of asbestos fibres, or fibre concentrations that could generate airborne fibres at concentrations above the permit threshold limit of 0.01f/ml.

The overall approach has the aim to allow the soil screening and subsequent treatment to be undertaken whilst achieving the World Health Organisation air quality target for asbestos of <0.0005f/ml.

2.2 Waste Acceptance Criteria

2.2.1 Establishing Asbestos Concentration Criteria for Soil

Our previous experience on other land remediation projects involving asbestos in soil has shown that the airborne emissions are always below the detection limit of 0.01f/ml. However, the data set that this experience covers is insufficient to demonstrate any correlation between asbestos type, concentration in soil and expected emissions to air of asbestos fibres.

For summarising the anticipated emissions and developing our methods of work over many years we regularly review peer reviewed studies of large data sets. To present this relationship we have included a graph from a published article[1] which summarised over 1,000 separate data sets that measured the concentration of asbestos in soils and the corresponding measured concentrations of asbestos in air. This was taken from the journal article published by Swartjes and Trompe as referenced in Section 1.2.

The data presented is from worst case scenarios of using a blower to dry soil with known concentrations of different types of asbestos: serpentine (chrysotile) or amphibole. The air was sampled to assess the concentration of airborne asbestos fibres.

- [1] A Tiered Approach for the Assessment of the Human Health Risks of Asbestos in Soils. Frank A. Swartjes and Peter C. Tromp. *Soil & Sediment Contamination*, 17:137–149, 2008

The Dutch study used fibre equivalents rather than fibre count as they weighted the fibres based upon the expected risk to human health as follows:

- 1 chrysotile fibre, length >5 μm: equivalence factor 1;
- 1 chrysotile fibre, length <5 μm: equivalence factor 0.1;
- 1 amphibole fibre, length >5 μm: equivalence factor 10;
- 1 amphibole fibre, length <5 μm: equivalence factor 1.

The study compared the results to the Dutch the following human health quality criteria in air; these were defined as yearly average values:

- Negligible Risk level: 1,000 fibre equivalents/m^3air;
- Maximum Permissible Risk level: 100,000 fibre equivalents/m^3air.

The study resulted in the data plotted in the graph below.

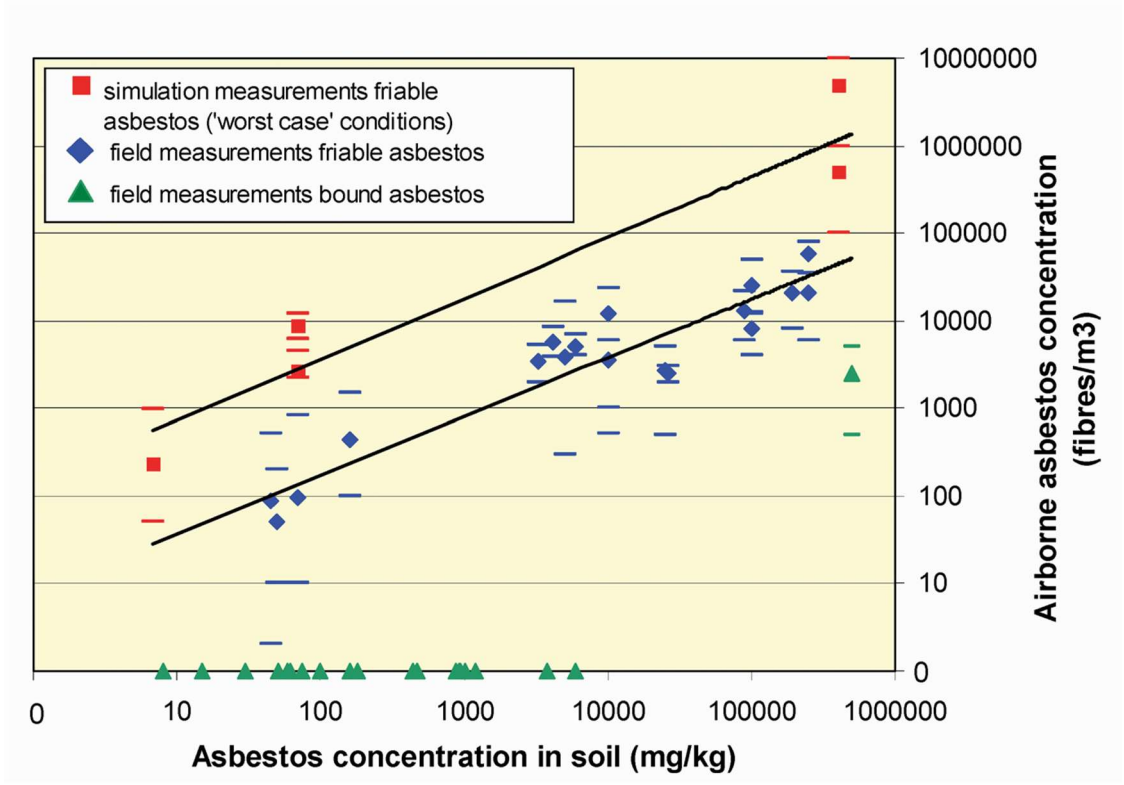


Figure 1. Relationship of Airborne Asbestos Concentration and Soil Concentrations (source: Frank A. Swartjes and Peter C. Tromp, 2008).

The interpretation of the data concluded that for less contaminated soils with bound asbestos (less than 10,000 mg/kg soil (1%)) no airborne asbestos fibres were found. For less contaminated soils with friable asbestos materials (less than 100 mg/kg soil (0.01%)) the Maximal Permissible Risk (MPR) risk level in the air is never exceeded and the

Negligible Risk (NR) level in the air is hardly exceeded. The same conclusion holds in case of activities such as digging, dumping, and sifting.

The report then presents data to confirm the: reduction in asbestos fibre concentrations at the receptor with increased distance from the source; and decreased fibre release with increased soil humidity. The report concludes with describing different tiers of assessment and modelling of human health risks from asbestos in soil.

In the Dutch context the tier one intervention value for asbestos regardless of type is stated as 100mg/kg (**0.01%**). This is unless it is proven that the asbestos is bound and then the criteria stated is 1,000mg/kg (**0.1%**) and if this criteria is met then exposure to asbestos is deemed impossible or unlikely and human health risks can be excluded. There are a number of other criteria relating to the depth of asbestos in soils, vegetation cover, moisture content (sediments) etc but for the purpose of this document we have based this proposal on the basis that no mitigation of emissions will need to be undertaken.

2.2.2 Agreed Asbestos Acceptance Criteria

In order to determine if soils are suitable for treatment, they need to meet a number of pre-acceptance conditions. This ensures that untreatable soils or soils which would result in unacceptable emissions are not accepted. The criteria used is the levels described in Section 2.2.2.

The asbestos criteria in the FCC EPR for the Edwin Richards Quarry site (ref: EPR/HP3632RP) are included in Table S2.4 Permitted waste types and quantities for handpicking of asbestos waste and are as follows:

- Soil and stones containing hazardous substances (CONTAINS IDENTIFIABLE PIECES OF BONDED ASBESTOS (any particle of a size that can be identified as potentially being asbestos by a competent person if examined by the naked eye))
- Asbestos in unbound fibrous form (FREE CHRYSOTILE FIBROUS ASBESTOS IN THE SOIL MUST BE **<0.1%** w/w. OTHER FORMS OR MIXED FORMS OF FIBROUS ASBESTOS IN THE SOIL MUST BE **<0.01%** w/w)

2.2.3 Formal Acceptance or Rejection of Soils

If a visual inspection of the soil confirms that there are no apparent reasons for immediate rejection, then soils will be stockpiled in a quarantine area and subject to formal soil sampling and analysis at a MCERTs accredited laboratory.

As soon as reception testing has been completed the soils will either be formally accepted or rejected subject to the acceptance criteria described later in this document.

2.3 Overview of Soil Treatment Approach involving Screening

An overview of the approach for managing soils with visible asbestos is provided in Figure 2. The overall approach aims to recover soils for subsequent disposal as non-hazardous waste and dispose of a small amount of asbestos as hazardous waste.

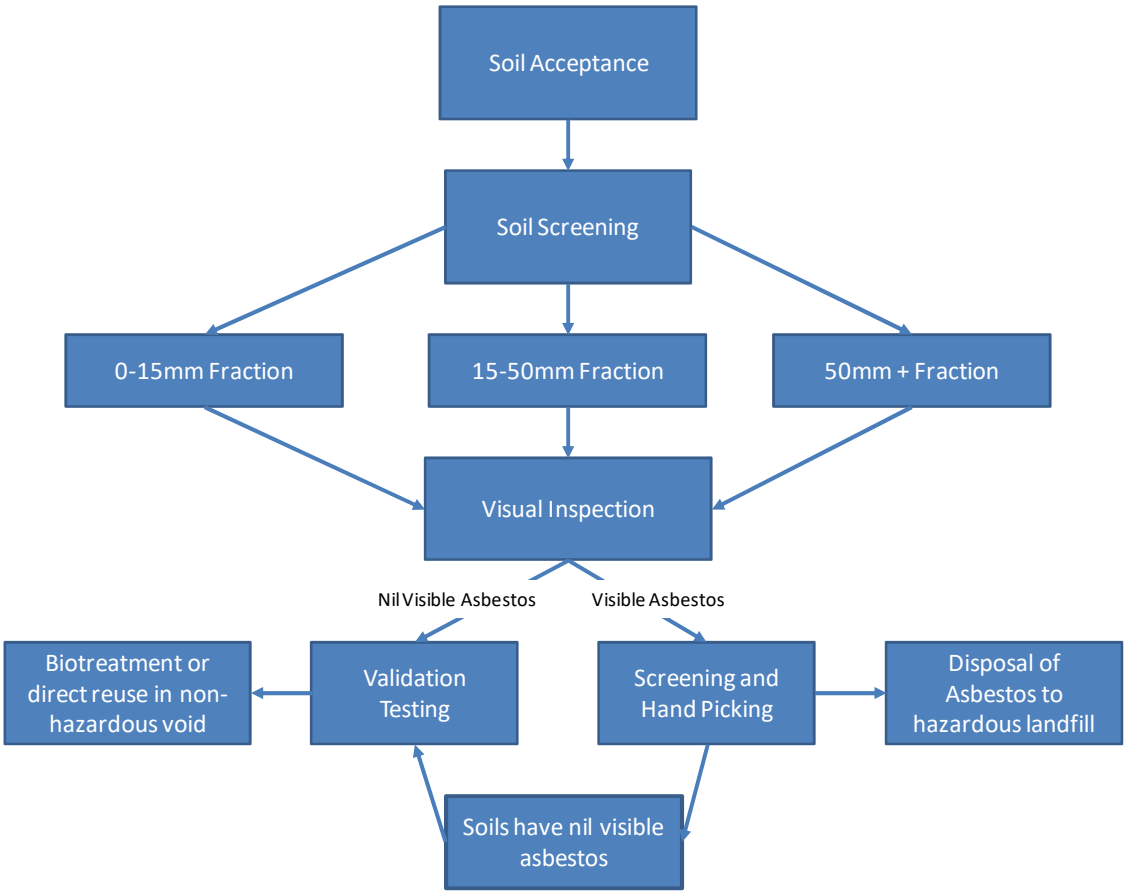


Figure 2. Soil Treatment Overview

3 ASBESTOS EMISSIONS FROM CONTAMINATED SOIL

3.1 Introduction

The main area of concern we would anticipate from any external regulator is the potential for emissions of asbestos fibres as a result of the acceptance and processing of contaminated soil at the treatment site.

3.1.1 Licensing of Soil Screening

Provectus hold a Mobile Treatment License ref: EA/EPR/EB3636AK/A001 (EAWML 105284). This environmental permit is deployed on a site by site basis where soil and groundwater treatment is undertaken on a client's development site.

3.2 Airborne Asbestos Monitoring Data from Storage of Soils and Hand Picking

As a minimum the monitoring of asbestos in air at the site requires the use of methods described in HSG248[2] and Technical Guidance Document M17[3]. From July 2021, a modified version of the method to reduce the reported detection limit from <0.01f/ml as stated in the installation permit held by FCC to <0.0005f/ml which is the WHO air quality guidance for Europe that is deemed to be a threshold at which no excess carcinogenic risk is present. This requires the volume of air that is filtered in the sample to increase from 480l to 1440l, a threefold increase.

3.3 Soil Screening Approach

The soil screener commenced operation on the 27 June 2022 under the MTL deployment at Rowley Regis and 15 August 2022 at Maw Green (Appendix A).

The soil screener has been run using three different configurations. The first one described in Section 3.3.1. The two different configurations at Rowley Regis inside the building were to establish the emissions from using covers on an enclosed screener and under negative pressure from a ducted HEPA filter.

The second configuration was to screen soils using an uncovered screener inside the building as this was the approach that was approved by the Environment Agency for the mobile treatment license deployment.

The third configuration at the Maw Green site was to undertake the uncovered screening externally and monitor the asbestos fibre concentrations in air in accordance with the mobile treatment license deployment.

[2] Asbestos: The Analysts Guide, HSG248 (2nd Edition) May 2021

[3] TGN M17. Monitoring Particulate Matter in Ambient Air around Waste Facilities. Environment Agency Ver 2 July 2013.

3.3.1 Use of Covered Screener with HEPA Filter

The screener deck and arms of the screener were enclosed to prevent dust emissions during the screening of soil. These covered areas were linked with a piping system to a HEPA filter (Aerial AMH 100 Industrial HEPA Air Scrubber). The HEPA filter has a capacity of 1,600m3/hr to ensure that the internal area of the hopper and screening decks were fully contained as well as ensuring the air flow from around the screener is directed through the HEPA filter. A schematic drawing of the screener with covers is shown in Figure 3.

Figure 3. Areas of Covering on Soil Screener

Figure 4. Covers on screener, note the asbestos monitoring pump located under the sheet on the screener deck

3.3.2 Use of uncovered soil screener with continuous dust suppression

During the w/c 22 August the covers on the soil screener and HEPA filter were removed (Figure 5). The uncovered screener deck was monitored directly from 22 August to 25 August 2022. Screening from the additional points inside the building continued from 22 August 2022 onwards whilst the screening and hand picking of soils was undertaken (Figure 6).

3.3.3 Use of uncovered soil screener with continuous dust suppression

During the w/c 22 August the covers on the soil screener and HEPA filter were removed (Figure 5). The uncovered screener deck was monitored directly from 22 August to 25 August 2022. Screening from the additional points inside the building continued from 22 August 2022 onwards whilst the screening and hand picking of soils was undertaken (Figure 6).

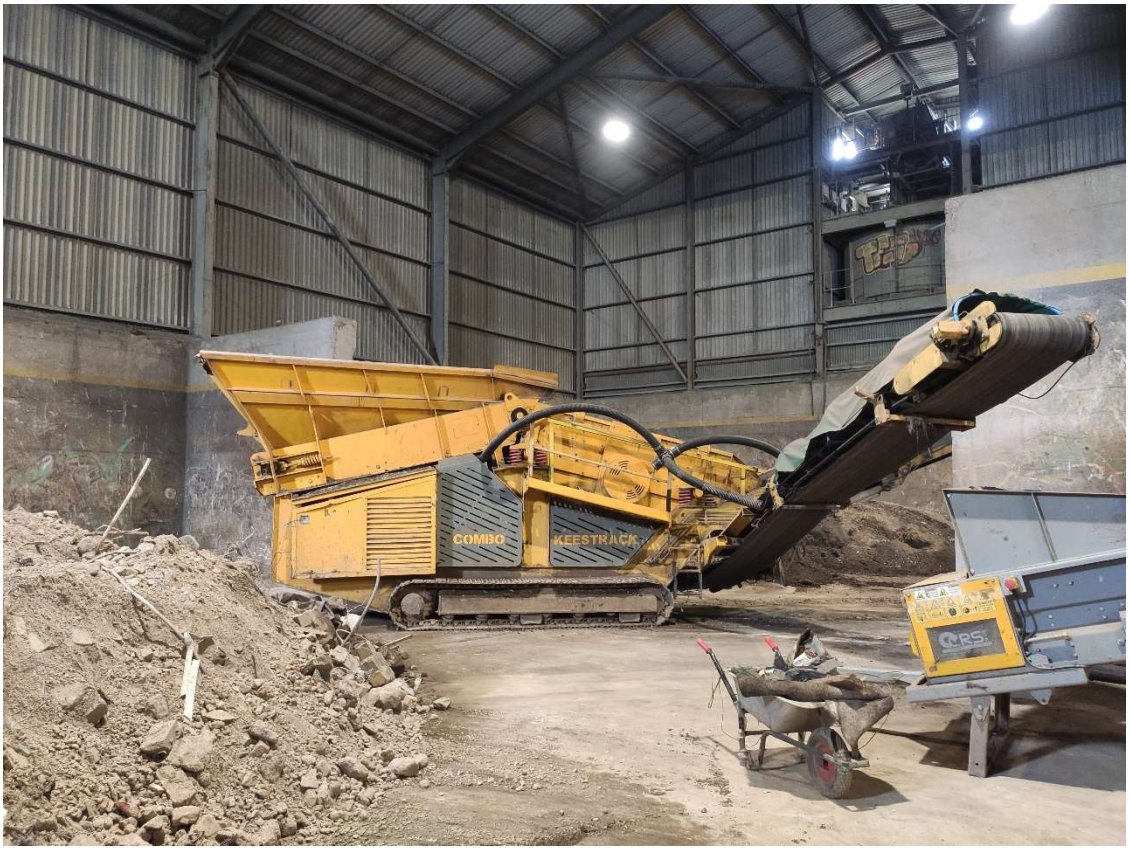


Figure 5. Uncovered soil screener inside asbestos building (Rowley Regis)

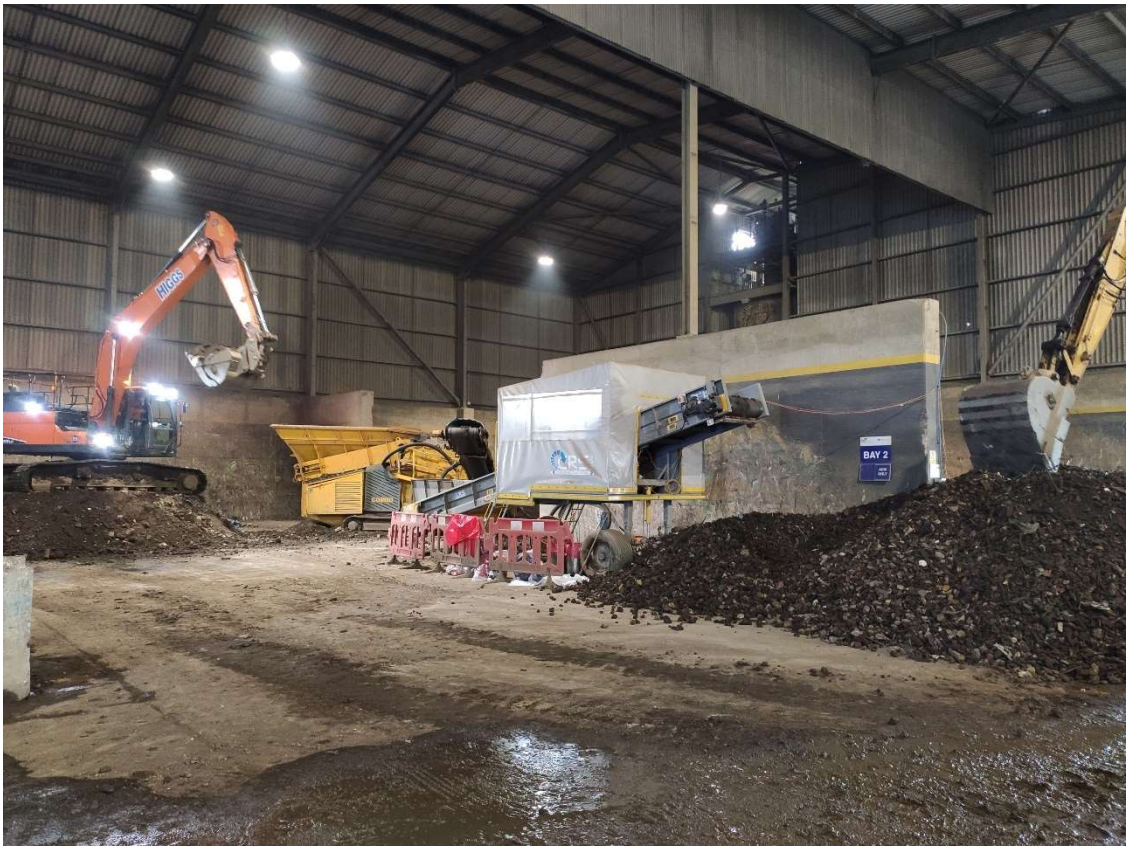


Figure 6. Soil screening and hand picking of soil (Rowley Regis)

Figure 7. Soil Screening and hand picking of soil (Maw Green)

3.4 Monitoring Locations (Rowley Regis)

To review the effectiveness of the screener covers and HEPA filter, air samples were obtained over between 27 June 2022 to 6 July 2022 from below the screener cover whilst soils were being screened.

Monitoring undertaken until 7 July 2022 was undertaken with one sample inside the building and 3 locations externally when soils were placed on the soil storage pad. The external soils were uncovered from 7 July to 22 July.

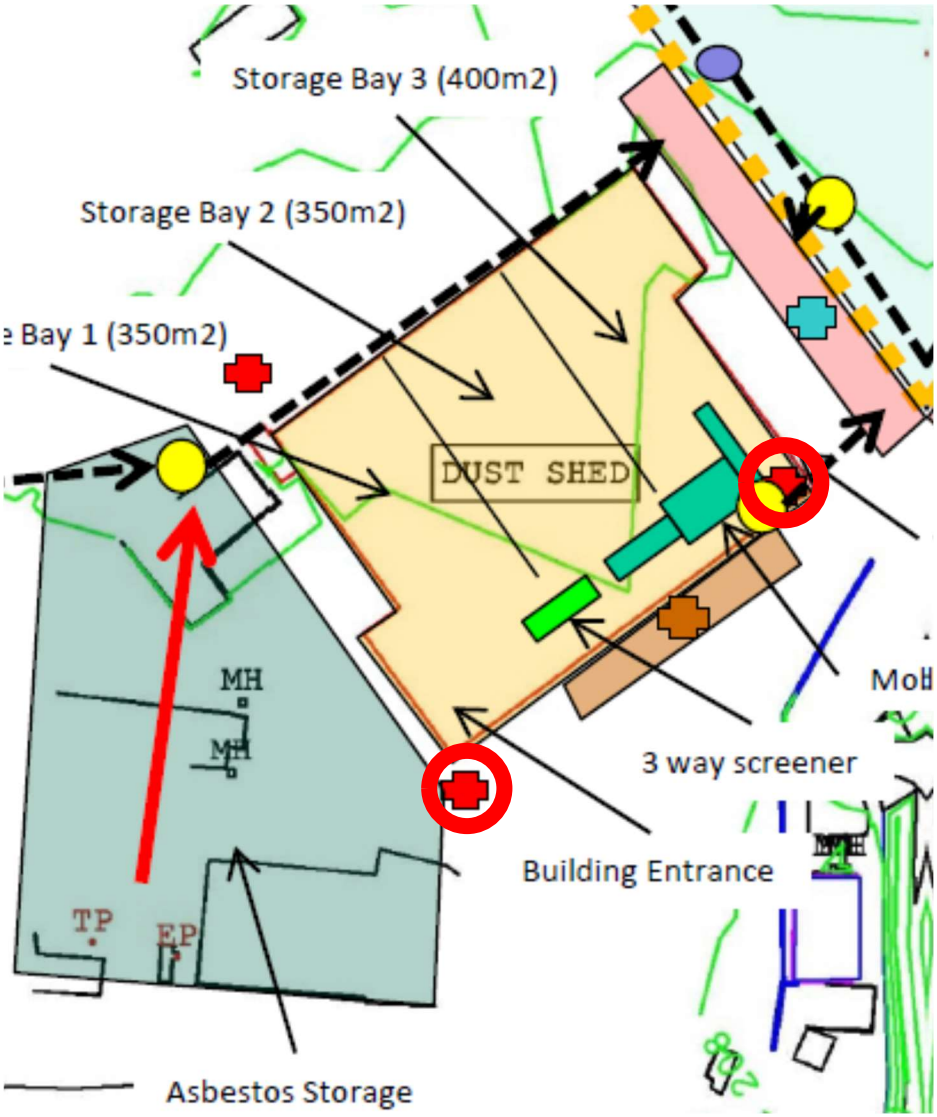


Figure 8. Initial Sampling Locations (circled in red)

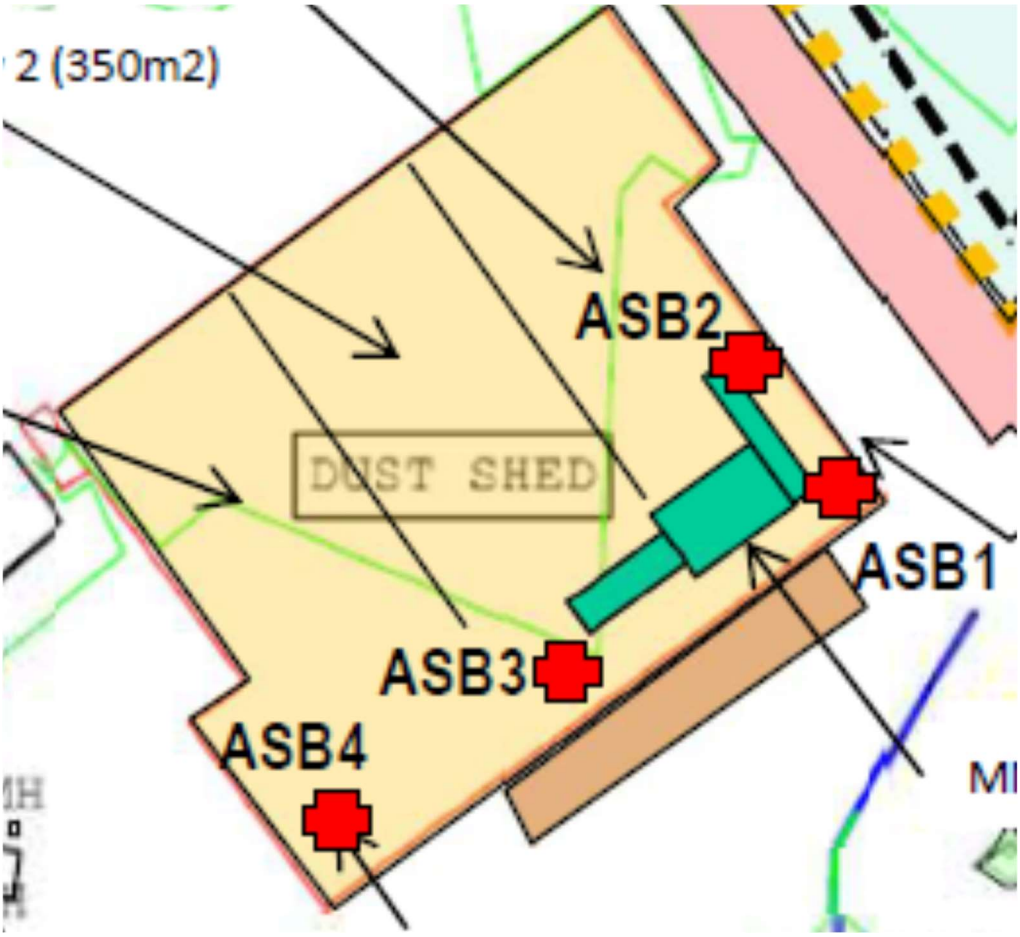


Figure 9. Internal Monitoring Locations 1-4 Sampling Locations (in red)

3.5 Monitoring Locations (Maw Green)

To review the emissions from the soil screener and picking stations, air samples were obtained from 15 August to review the effect of screening soil and compare these results with the pre-operational screening results. The monitoring locations are taken from the mobile treatment deployment application.

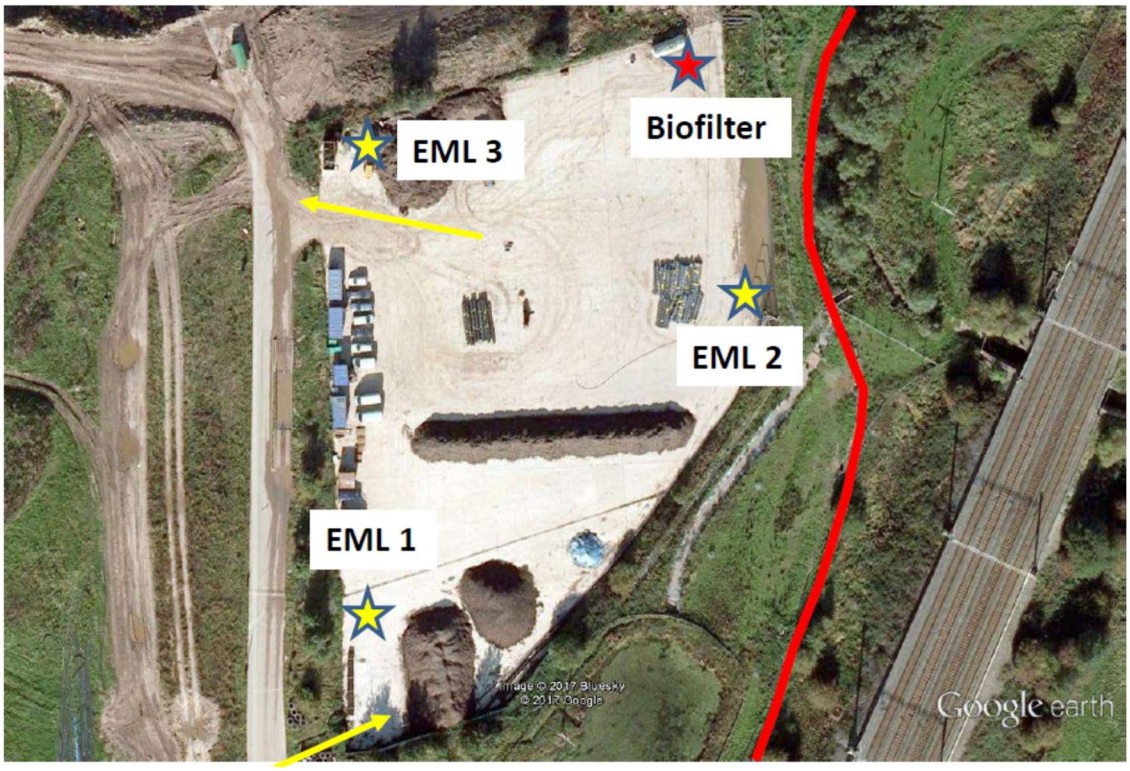


Figure 10. Environmental Monitoring Locations 1-3 Sampling Locations

4 ASBESTOS EMISSIONS RESULTS

4.1 Introduction

The following section provides a summary of the results obtained from the different screener configurations.

Prior to the use of a screener the asbestos monitoring results from 2018 through to the 15 June 2022 was undertaken to monitor emissions from uncovered storage of ACM in soils and hand picking from inside the asbestos building.

All monitoring that was undertaken demonstrated that the airborne asbestos fibre concentrations were below the permit threshold of <0.01f/ml.

4.1.1 Soil screener with cover and HEPA filter (Rowley Regis)

The monitoring was undertaken from 27 June until 22 August to provide a 4 week data set on asbestos emissions.

The screener deck of the screener under a cover with the HEPA filter operational was monitored between 27/06/22 – 06/07/22. This ceased due to the results having a maximum concentration of 0.0005f/ml and equivalent to the method detection limit.

All monitoring was undertaken using the monitoring points shown in Figure 8 up to the 06/07/22. Between 07/07/22 and 12/08/22 the sampling points were as per the points described in Table S3.3 of the Rowley Regis permit. Asbestos DWG3/Rev1 dated October 2020. This included one internal monitoring location next to the screening and picking operation but accidentally omitted the further internal locations shown on drawing 100993 – Asbestos DWG1 dated January 2018.

From 13/08/22, the sampling points have been as per 100993 – Asbestos DWG1 dated January 2018 (Figure 8). Soils treated after the initial storage bays inside the building were emptied have been from lorries delivered into the building from external sites. Some limited soil inputs from the external storage area commenced on 20/09/22 to supplement soils stored within the building (results to follow).

A summary of the results are provided in Table 1.

4.1.2 Soil screener uncovered and with continuous misting abatement (Rowley Regis)

The use of an uncovered screener with dust suppression in the form of mobile atomisers and dust cannons was described in the MTL deployment.

The screener was uncovered on 22 August 2022, predominantly due to the number of blockages that were observed to occur with the enclosed screener that prevented a longer term assessment of emissions from a contained screener than the initial c.4 weeks. The continual blockages posed additional health and safety risks to personal as well as causing damage to the conveyor belts and other equipment.

The sampling points shown in Figure 9 were used to monitor the screening and hand picking operation as shown in Figure 6. Monitoring of the uncovered screener deck was implemented between 22/08/22 – 25/08/22 (4 days) and 30/08/22 - 21/09/22 (17 days) and were below the method detection limit – although this detection limit varied with the presence of exhaust particulates from the screener within the building.

All the results are summarised in Table 1.

4.1.3 External soil screener uncovered and with continuous misting abatement (Maw Green)

The three sampling points were monitored from 15 August 2022 with the latest results from 04/11/22 included. On the spreadsheet in Appendix E prior to the laboratory certificate there is a summary of the activity on site corresponding to the sampling date.

All the results are summarised in Table 2.

Table 1. Summary of Asbestos Monitoring Results

Asbestos Treatment Description	Date Range	Number of Internal Monitoring Points	Number of External Monitoring Points	Detection Limit (f/ml)	Maximum Concentrations (f/ml)	Permit Threshold (f/ml)
Storage and Hand Picking	08/05/18 - 05/07/21	4	-	<0.01	<0.01	<0.01
Storage and Hand Picking	09/07/22 - 17/06/22	4	-	<0.0005	0.0007	<0.01
Covered Screener/HEPA and Hand Picking	27/06/22 - 06/07/22	1	1	<0.0005	0.0007	<0.01
Screener Deck inside cover	27/06/2022 – 06/07/22	1	-	<0.0005	0.0006	<0.01
Covered Screener/HEPA and Hand Picking	07/07/22 - 12/08/22	1	3	<0.0005	0.0007	<0.01
Covered Screener/HEPA and Hand Picking	13/08/22 - 19/08/22	4		<0.0005	<0.0005	<0.01
Uncovered Screener and Hand Picking	22/08/2022 – 21/09/22	4	3	<0.0005/<0.002*	0.0009/<0.002*	<0.01
Uncovered Screener Deck	22/08/22 - 24/08/22, 30/08/22 - 02/09/22, 05/09/22 – 08/09/22	1	-	<0.0005 - <0.0061*	<0.0061*	<0.01

*Indicates detection limit due to occluded slides from combustion residues from operating mobile plant

Table 2. Summary of Asbestos Monitoring Results

Asbestos Treatment Description	Date Range	Number of External Monitoring Results	Detection Limit (f/ml)	Maximum Concentrations (f/ml)	Permit Threshold (f/ml)
Reception of soils/background	15/08/22 – 06/09/22	16-	<0.0005	<0.0005	<0.01
Uncovered Screener and Hand Picking	07/09/22 – 04/11/22	120	<0.0005	0.0006	<0.01
Control Test (no activity)	27/10/22	1	<0.0005	<0.0005	<0.01

4.2 Summary

Prior to the MTL deployment, it was established that the storage of soils and hand picking of asbestos debris does not result in airborne asbestos concentrations above the permit threshold of <0.01f/ml at the Rowley Regis site.

The method detection limit was reduced to <0.0005f/ml in July 2021 and the results from the monitoring during hand picking works did not exceed this detection limit.

The following is a summary of the results obtained from the different scenarios implemented and monitored.

1. Hand picking only without screening inside the building at Rowley Regis resulted in monitored concentrations in air ranging from <0.0005f/ml to a maximum of 0.0007f/ml
2. The use of a covered screener with HEPA filter inside the building at Rowley Regis resulted in monitored concentrations in air ranging from <0.0005f/ml to a maximum of 0.0007f/ml
3. The use of an uncovered screener inside the building at Rowley Regis resulted in monitored concentrations in air ranging from <0.0005f/ml to a maximum of 0.0009f/ml
4. The use of an uncovered screener externally at Maw Green resulted in monitored concentrations in air ranging from <0.0005f/ml to a maximum of 0.0006f/ml

Whilst not an objective of this report, there was no increase in the asbestos content of the soil resulting from soil screening which correlates with historical data from physical treatment of soils with asbestos. The screening resulted in no detrimental impact to soil quality or its ability for recovery.

4.3 Conclusion

- The waste acceptance criteria have proven to be entirely efficient at preventing the release of unacceptable asbestos fibres during soil screening
- The air quality targets described in the FCC permit for asbestos were achieved irrespective of the processing or abatement method implemented
- The covering of the screener and use of a HEPA filter resulted in operational problems due to the need to unblock the screener arms and change HEPA filters. This significantly slowed down the processing of soils, increased exhaust emissions,

the potential for harm to operatives due to restricted working areas whilst providing no benefit to air quality from asbestos concentrations.

- There were no emissions that required abatement other than the precautionary use of boundary dust suppression using water and propriety asbestos surfactant solution dispersed via an atomiser system
- Due to the use of a temporary diesel powered screener inside a building at Rowley Regis increased the occlusion of slides due to the diesel combustion emissions. This issue can be resolved through the use of an exhaust abatement system or procurement of an electric screener for dedicated use within the building
- There is no discernible difference in asbestos emissions between the several different scenarios (hand picking/screening etc) inside buildings or externally based upon the monitoring results
- The soil screening does not result in elevated airborne asbestos concentrations and poses no risk of exceeding the normal EA permit threshold of <0.01f/ml

4.4 Proposed Soil Processing Approach

The following approach is therefore proposed from a review of the monitoring data to date:

- Continue to use the existing waste acceptance criteria that are designed to support a risk elimination approach
- Continue to implement a reassurance boundary dust suppression system via atomisers fed by a water and surfactant solution as this provides secondary abatement for general fugitive dust emissions
- The use of an uncovered screener with dust suppression atomisers (mixed with asbestos specific surfactant) to ensure that low reporting limits of <0.0005f/ml can be achieved consistently
- Continue to monitor to reporting limits of <0.0005f/ml to ensure that there is sufficient visibility on airborne asbestos concentrations below the permit threshold of <0.01f/ml.

APPENDICES

APPENDIX A. MTL DEPLOYMENT

Provectus Remediation Ltd
Regent House
Bath Avenue
Wolverhampton
West Midlands
WV1 4EG

Our ref: EB3636AK/W0028

Date: 15/07/2022

Dear Mr Jon Owens

Environmental Permitting (England and Wales) Regulations 2016

Deployment ref: EB3636AK/W0028
Permit holder: Provectus Remediation Ltd
Location of the deployment: Maw Green Landfill, Maw Green Road, Maw Green, Crewe, CW1 5NG,

Following assessment of your deployment notification reference number EB3636AK/W0028 I can confirm that we have agreed your deployment form and you may now start to operate.

You have up to 12 months to notify us that your deployment activities are commencing. Once notified your deployment lasts for 52 weeks. If you wish to continue beyond this 52 week period you can request an extension up to a maximum of 12 months or submit a new deployment application for a further 12 month extension. Please see section 4.1 of the Land and groundwater remediation deployment form guidance.

You must comply with your permit and carry out the activities in accordance with the requirements of the agreed deployment form and further information;

- Supporting Document: Environmental Monitoring Location Plan
  from Jon Owens received on 15/07/2022 at 11:45

You must seek written permission from us if any of the details provided in the deployment form change.

This approval letter is associated with the mobile plant permitting regime only. As the operator, it is your responsibility to agree other authorisations, for example, planning permission, remedial strategy, abstraction or discharge consents with the relevant regulatory authority.

Please note that operating under your Mobile Plant Permit / Mobile Treatment Licence does not imply that the remediation processes used will be suitable for meeting any remediation objectives specified. These issues must be considered separately by the developer/consultant and our local area Groundwater and Contaminated Land team. These

must be defined in the site remedial strategy which sets out the remediation options to reduce or control the risks from pollution linkages associated with the site as a whole. You may need to carry out further remediation if an unacceptable risk to the environment remains at the site.

Please notify us at least seven days prior to starting the remediation activities, at psc@environment-agency.gov.uk & GMMCLandandWater@environment-agency.gov.uk

If you have any queries about this matter please contact us by telephone on 03708 506 506 or email us at enquiries@environment-agency.gov.uk quoting your deployment application reference EB3636AK/W0028.

Yours faithfully

Maria Gibbons,
Team Leader,
National Permitting Service

The Company Director and/or Secretary
Provectus Remediation Ltd
9 Kingsdale Business Centre
Regina Road
Chelmsford
Essex
CM1 1PE

Our ref: EB3636AK/W0027

Date: 6th May 2022

Dear Sir or Madam,

Environmental Permitting (England and Wales) Regulations 2016

Deployment ref: EB3636AK/W0027
Permit holder: Provectus Remediation Ltd
Location of the deployment: Edwin Richards Quarry, Portway Road, Rowley Regis, B65 9DS,

Following assessment of your deployment notification reference number EB3636AK/W0027 I can confirm that we have agreed your deployment form and you may now start to operate.

This deployment lasts for one year from the date the activity starts on site. If you wish to continue beyond this one year period you must re-notify.

You must comply with your permit and carry out the activities in accordance with the requirements of the agreed deployment form and

- further information (Ref: Appendix A – Location of Soil Screening updated Drawing & Monitoring) received by us on 04/05/2022

You must seek written permission from us if any of the details provided in the deployment form change.

This approval letter is associated with the mobile plant permitting regime only. As the operator, it is your responsibility to agree other authorisations, for example, planning permission, remedial strategy, abstraction or discharge consents with the relevant regulatory authority.

Please note that operating under your Mobile Plant Permit / Mobile Treatment Licence does not imply that the remediation processes used will be suitable for meeting any remediation objectives specified. These issues must be considered separately by the developer/consultant and our local area Groundwater and Contaminated Land team. These must be defined in the site remedial strategy which sets out the remediation options to reduce or control the risks from pollution linkages associated with the site as a whole. You may need to carry out further remediation if an unacceptable risk to the environment remains at the site.

Please notify us at least seven days prior to starting the remediation activities, at psc@environment-agency.gov.uk & WMDEPR@environment-agency.gov.uk

If you have any queries about this matter please contact us by telephone on 03708 506 506 or email us at enquiries@environment-agency.gov.uk quoting your deployment application reference EB3636AK/W0027.

Yours faithfully

Grant Wilson
Team Leader,
National Permitting Service

APPENDIX B. NICOLE – ASBESTOS: A PAN EUROPEAN PERSPECTIVE

ASBESTOS IN SOIL

A pan european perspective

Demolition earthworks | AECOM

ASBESTOS IN SOIL

A pan european perspective

NICOLE

Network for Industrially Co-ordinated Sustainable Land Management in Europe

ASBESTOS IN SOIL - A PAN EUROPEAN PERSPECTIVE

Foreword

There are common themes and good practice running throughout Europe with respect to the management of asbestos in soil, although many variations in approach exist.

As with other contaminants, the assessment and management of asbestos risks should follow a risk based assessment approach (source-pathway-receptor analysis) with selection of appropriate remediation following a suitable remedial options appraisal.

However, many decisions regarding the remediation and management of asbestos in soils are based on stakeholder perception and a subjective or emotive response (i.e. hazard based rather than risk-based).

As demonstrated in this report there are few European countries with clear standards and detailed guidance. This document provides an overview of best practice in the industry with a pan European perspective and with some case studies to illustrate typical responses to asbestos in soils impacts.

Contents

Asbestos warning sign | AECOM

1 Introduction

Asbestos is a common and challenging contaminant in soil; a legacy of widespread historic use in buildings and poor historic control of construction waste, building demolition, and re-use of crushed demolition aggregate as made ground.

Hazard, risk perception and acceptance can vary widely amongst stakeholders and the management of asbestos in soil can vary widely as a result.

Differing stakeholder positions on risk acceptance or risk avoidance (zero tolerance) can have a significant impact on project designs, programmes, and costs, and there is little harmonisation in approach across Europe.

Asbestos in soils is increasingly recognised by those involved in the management of brownfield

Degraded asbestos debris in soil | AECOM

Visual detection of asbestos during remediation | NTP

land regeneration as a potentially high-cost, risk-driven issue, and this publication seeks to: provide a pan-European perspective; identifying opportunities for harmonisation; improve awareness and understanding; and promote greater consistency.

The content of this publication reflects the work of the NICOLE Asbestos Working Group from 2017 to 2021.

The aims of the NICOLE Working Group were to:
Compare and contrast current industry approaches, regulatory positions and quality and availability of existing guidance in European Countries as an initial "baselining" exercise to help identify significant differences and opportunities for harmonisation.

Improve awareness and understanding in managing the risks of asbestos in soil (considering its occurrence both on its own and as a co-contaminant with other pollutants) by advocating a pragmatic approach and promoting greater consistency where possible.

These aims were to be achieved by:

1. Collating information on, and benchmarking of, current methods, standards and guidance for the characterisation, risk assessment, remediation and regulation of asbestos in soils that are currently adopted by industry and regulators in European Countries;
2. Identifying how asbestos contaminated soils (including those also contaminated with other pollutants) are currently remediated in different countries, considering different treatment technologies and the availability (or otherwise) of appropriate disposal/ treatment facilities;
3. Identify existing research efforts into characterisation, risk assessment and remediation, and identify research opportunities that could support a sustainable pragmatic approach; and
4. Identifying case studies that support and improve confidence in risk management decisions and in developing best practice.

2 NICOLE Survey of Members

To establish a baseline of current legislation, guidance and practice in European countries, a detailed survey was issued to NICOLE and Common Forum members in 2018. Three years on and very little has changed. The survey comprised 70 questions covering 6 topic areas.

These were:

1. Legislative provision and regulatory position
2. Good practice industry guidance
3. Laboratory methods
4. Waste classification, handling and disposal
5. Remediation options
6. Research and innovation

12 responses were received for 6 countries.

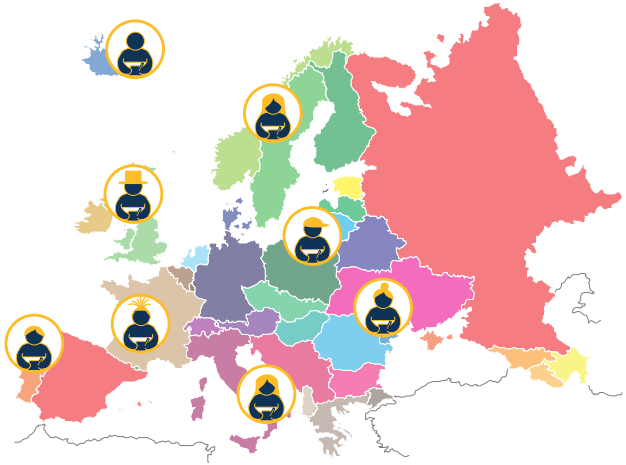


Figure 2.1 NICOLE Network Survey of members

3 Legislative and Regulatory Positions

One potential harmonising factor is EU Directive 2009/148/EC, on the protection of workers from the risks related to exposure to asbestos at work, that sets out occupational health and safety requirements for work involving asbestos. However, even with this in place, the control limits for asbestos in air vary considerably across Europe, ranging from the Directive Control Limit of 0.1f/ml in the UK to 0.002f/ml in The Netherlands (50x lower). No country has specific legal provision solely addressing exposure to asbestos in soil, although it is increasingly recognised that disturbance of asbestos containing soil is an activity that is captured by existing asbestos-specific occupational regulations relating to work in buildings (e.g. maintenance, refurbishment and demolition).

Asbestos cement fragments in soil | AECOM

Country	Occupational exposure limit (f/ml 8hr TWA)
EU limit value (2009/148/EC)	0.1 (100,000f/m^3)
UK	0.1
France	0.01
Italy	0.01
Germany	0.001
Netherlands	0.002 (with intention to reduce to 0.0003)

Table 3.1 Occupational exposure limit

Presence of AiS guidance. Detailed sampling and testing protocols. Air and soil guidelines. Regular testing

Absence of AiS guidance. Reliance on OSH and waste regulations. No regular testing

There is a stark divergence between those countries with detailed regulatory guidance on the risk management of asbestos in soil and those countries with no specific regulatory guidance for asbestos in soil. It was discussed at the NICOLE workshop in Warsaw in November 2019 that asbestos is considered to be an emerging soil contaminant in Germany, and in many Eastern European countries, even though in other countries it has been recognised as a contaminant of concern for decades. Where detailed gui-dance is in place, it is largely based on the research of RIVM and TNO published between 2003-2008.

The only European regulatory guidance levels for asbestos in soil are those published by the Dutch, Belgian and Italian authorities. The Dutch and Belgian authorities adopt a Tiered approach and use the same Tier 1 value, but importantly use different definitions for those values.

Dutch Tier 1 Intervention value = 100mg/kg (sum of chrysotile+10x amphibole as measured by NEN 5707)

Flanders Tier 1 Intervention value = 100mg/kg (sum of fixed + x10 loose fibres (all asbestos types) as measured by TEM)

4 Industry Good Practice

It is only common among a small number of European Countries to test made ground soil samples for asbestos as part of a normal site investigation. Sampling is either carried out using typical practice adopted for contaminated land or using detailed prescriptive practice specific to asbestos (such as for the Netherlands and Belgium). Guidance on sampling strategies, sample plans, laboratory test methods, and requirements for site staff competency/qualifications is mixed, with no common approach across the countries surveyed.

When suspected asbestos is observed in the soil there is a legal requirement under workplace regulations to put in place procedures to manage the associated risks. If suspected asbestos is found onsite during site investigation or remediation works, the general procedure is to stop work, make the work area safe and temporarily vacate the area until the risk assessment and method statements for the work can be revised. Actions can include the use of dust suppression, asbestos survey of the area, confirmatory laboratory testing of the identified material, and use of Licensed contractors to remove the asbestos. Work should only ever continue if safe methods of work can be put in place.

Signing of an asbestos impacted area | NTP

Guidance Questions	Belgium (Flanders)	Belgium (Wallonia)	France	Italy	Portugal	Spain	UK
Is the testing of brownfield sites for asbestos commonplace?	yes	yes	no	yes	yes	not	yes
Is guidance available for the risk management of asbestos in soil?	yes	yes	yes	no	no	no	yes
Does the guidance fill a gap in regulatory guidance?	yes	no	yes	no	no	no	yes
Is the guidance entirely country specific?	no	no	yes	yes	no	no	yes
Does the guidance advocate a tiered approach?	yes	no	no	no	no	no	yes
Does guidance include method on soil sampling if asbestos is present?	yes	yes	no	yes	no	no	yes
Does the guidance recommend air testing during site-based activities?	no	no	yes	yes	yes	no	yes
Does the guidance advocate health and safety precautions during sitebased activities?	yes	yes	yes	yes	yes	yes	yes
Does the guidance advocate a guideline for asbestos in soil?	yes	yes	no	no	no	no	no
Is there any guidance on how to assess risk from asbestos fibres being present in water?	no	no	no	no	no	no	no

Table 4.1 Summary of questionnaire responses on good practice guidance

5 Approaches to Ground Investigation

Some of the specific aspects of ground investigation identified in the survey included:

The importance of desk study and site walkover to establish the likelihood of asbestos being present.
Sampling strategies — can be targeted or random/ systematic.

Sampling approach — size and frequency. Dutch, Belgian, and SoBRA guidance require/advocate the use of much larger sample sizes that typically used for other soil contaminants. The Dutch and Belgian guidance also specify sample frequency, e.g. 1 sample per 50 m^3 or 1 per 1000 m^2.

Activity based sampling is occasionally used. This is in essence what the RIVM/TNO guidance was based on, what is described in US EPA guidance,

Asbestos sampling activities in Belgium | AECOM

and what is advocated in SoBRA guidance to better understand the likelihood of asbestos fibres becoming airborne as a result of soil disturbance.

Other ground condition factors are important to risk, including soil type, vegetation or other surface cover, and moisture content.

Asbestos sampling activities in Belgium | AECOM

Differing views exist as to whether ground investigation falls under occupational regulations for work with asbestos (as per in buildings).

Requirement for suitably trained/experienced staff. For example, Dutch guidance requires specific certification and accreditation for inspection and sampling of soils.

Asbestos was found to be present in up to 20% of made ground samples according to SoBRA research in the UK based on 150,000 soil samples submitted to UK laboratories between 2015 and 2018.

6 Detecting asbestos in soil

Asbestos sampling activity in UK | AECOM

The conceptual understanding of the spatial distribution of asbestos is fundamental to the design of an investigation and the interpretation of the results. Is it a delineable area subject to asbestos disposal? Is it dispersed fragments across a wide area? What is the likelihood of detecting the asbestos using your sampling strategy?

Grid Size	Probability of detecting one ACM fragment	Sample size as a proportion of grid square
100	1 in 100,000	0.01%
50	1 in 10,000	0.04%
10	1 in 1000	1%

Table 6.1 Probability of detecting asbestos based on a soil sample size of 1 litre

The reliability of the site investigation is a function of:

- Sample size
- Sample density

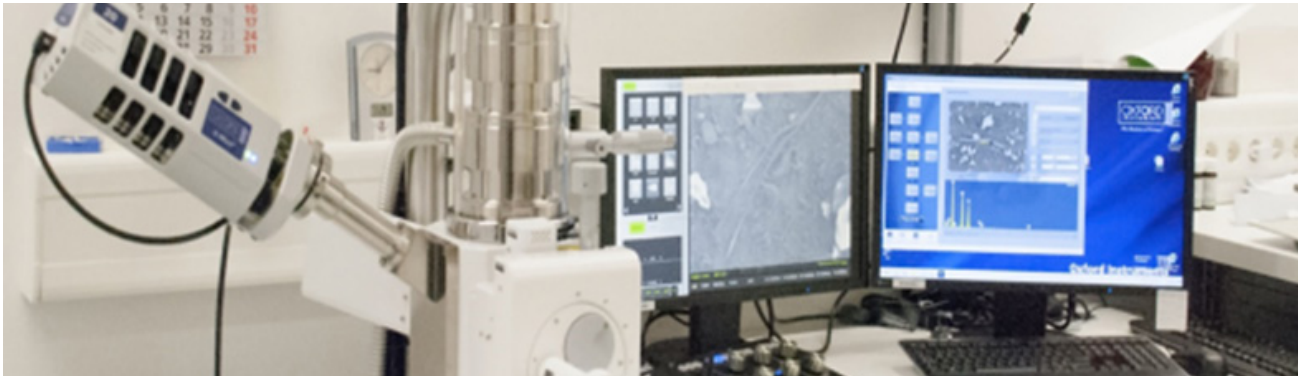
As noted previously the Dutch and Belgian authorities, and SoBRA in the UK, advocate taking larger samples for asbestos compared to typical size of soil samples taken for other contaminant testing because of the greater uncertainties involved in sampling for asbestos in soil.

The theoretical probability of detecting a small area of isolated asbestos fragments in soil can be extremely low. If random fragments are found in soil the probability of more unidentified fragments being present in the soil can be high.

Samples taken in The Netherlands | NTP

7 Laboratory Methods

Electron microscope



Laboratory methods vary widely across Europe. Some countries have very detailed analytical methods that are embedded in the regulatory guidance (for example the Netherlands and NEN Standard 5707). Other countries such as the UK have a mixture of methods published by regulatory bodies (HSE for HSG248) and industry bodies (SCA Blue Book Method*).

Current European Standards specifically for quantifying asbestos in soil include: NEN 5707 (The Netherlands) SCA Blue Book Method (UK)*

** Withdrawn in October 2020 due to concerns over validation triggered by AISS results*

The methods that are available vary depending on the regulatory context and purpose of the test.

The three most common purposes are:

1. Bulk analysis for the presence of asbestos (driven by occupational regulation)
2. Air monitoring (also driven by occupational regulation)
3. Gravimetric quantification for waste classification

The reliability of laboratory test methods can be better understood by studying the inter-laboratory proficiency schemes, such as those provided by the UK Health & Safety Laboratory schemes (including AISS) **[link]**

Detailed standards for quantification in soil are the least common and also tend to have the greatest variability. When a single standard method is not mandated by regulation, interlaboratory variability can be high. Each laboratory undertaking the often multi-stage analytical process slightly differently—be it in the sample preparation, the mass of sub-sample analysed, the magnification of the microscope used, the type of microscopic method (PLM, PCOM, SEM, TEM), the assumed composition of man-made asbestos products, or the fibre counting rules employed.

8 Waste Classification, Handling and Disposal

The classification, handling and disposal of asbestos and soil impacted asbestos waste is addressed by the EU Waste Framework Directive (2008/98/EC) and is potentially the most harmonised aspect of dealing with asbestos in soil across Europe as a result.

All European countries adopt the 0.1% hazardous waste threshold.

Soil that contains identifiable pieces of asbestos containing material (i.e. any particle of a size that can be identified as potentially being asbestos by a competent person if examined by the naked eye), then the soil is regarded as hazardous waste.

Collection of asbestos fragments should be done using double bagged, be labelled asbestos waste,

Double bagging of asbestos waste in UK | Ramboll

Double bagging of asbestos waste in UK | Ramboll

and shipped using the correct waste transfer documentation.

Large asbestos sheets can be wrapped in 1000 gauge polythene sheeting, labelled as above and placed in an enclosed and locked skip.

The transport of asbestos impacted soils can be either in enclosed containers or in sheeted lorries by a licensed waste carrier.
It is important to note that in accordance with the waste hierarchy, the volume of hazardous waste should be reduced by physical separation of visible asbestos from residual soils (if feasible).

9 Approaches to Risk Assessment

Motor-powered breathing system | NTP

The most established approaches to risk assessment for asbestos in soil in Europe are the frameworks developed by VROM (now IenW) and OVAM, and with the latter OVAM framework being highly influenced by the earlier VROM framework. Further steps to better understand the potential fibre release of asbestos from the affected land are introduced by the US EPA framework that advocates activity-based sampling, and UK good practice that advocates the better understanding of dust and asbestos fibre release from soil disturbance.

Published research on which the frameworks are based is limited, and dated—the research that

forms the basis of the VROM framework dates from the 1990s, and a core piece of research advocated in the UK guidance dates from the 1980s.

Whilst individual frameworks vary in the detail, and the data requirements for those frameworks vary (see section on Ground Investigation), there is a common theme to the frameworks that is illustrated in the diagram below.

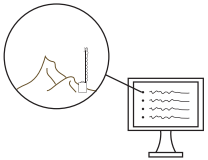
Tier	Tier 1	Tier 2	Tier 3	Tier 4
Data	Basic soil characterisation 	Differentiation in asbestos form and type 	Respirable fibre content in soil. Particle size fraction of interest 	Site-specific fibre-release data 
Criteria	Generic assessment criteria (not asbestos type specific)	Generic assessment criteria for asbestos types and/or forms	Generic assessment criteria for respirable fibre content	Site-specific assessment criteria

Figure 9.1 Common theme in frameworks

Hobmoor School – Birmingham, UK | Google Maps

Ramboll was commissioned by Balfour Beatty Construction Limited to develop and implement an asbestos remediation strategy to enable the construction of a new school.

Previously developed as industrial land, the historic review and site visit established significant volumes of demolition rubble from prefabricated buildings across the site. The proposed development included landscaping, sports areas and

Frequently occurring fragments of asbestos cement and AIB were discovered

Asbestos finds | Ramboll

earthworks reprofiling. This meant significant cut and fill works across the site with soil containing demolition rubble.

Asbestos Containing Material (ACM) was encountered during site clearance, so a specialist survey contractor was commissioned for soil sampling and perimeter air monitoring. The asbestos detected in this survey was asbestos cement (chrysotile), asbestos insulation board (amosite) and found in the topsoil till a depth of 1,00-1,50 meters. The pollutant linkages identified during construction and operation were potential exposure to free fibres from friable materials from the asbestos cement and insulation board.

The remedial options appraisal included:

- Dig contaminated soil and dump on site in vegetation strip; costs over £800 000,
- Hand pick asbestos material, capping with imported top soil (0,3 meters) and install a marker layer between clean top soil and contaminated soil underneath; costs approximately £500 000,
- Assess the risks of in situ reusing the top soil.

Pockets of asbestos covered much of the site at depths up to 5m.

Asbestos finds—hand picking | Ramboll

Processing plant | Ramboll

Based on the options appraisal a bespoke methodology was developed and a comprehensive worldwide review of asbestos legislation and guidelines was undertaken. The final remediation strategy designed comprised of:

1. Hand picking of asbestos cement and asbestos insulation board fragments,
2. Trommel sieving of soil on a 14 mm mesh,
3. Air monitoring for fibres across the perimeter of the site and in the "Control Zone",
4. Works carried out by a licensed contractor with a HSE approved asbestos methodology.

A dust and fibre release experiment was designed to estimate the potential fibre release during school operation, which could be released by soil derived indoor dust. This was done by simulating a realistic and real time situation. For this a 12 m^3 sealed enclosure was built into the school with an air lock entry. The soil in the sealed enclosure was vigorously disturbed to generate dust. The indoor air was monitored and sampled. The samples were tested with Phase Contrast Optical Microscopy (PCOM) analyses.

The remediation delivered a screened top soil which was suitable for re-use in the landscape area

Indoor air experiment | Ramboll

without requirement of a cover layer. The worst case activities were simulated and tested and concluded no residual fibres and low residual risks. All air monitoring results were below detection limit of the standard HSE method i.e. <0.01 f/ml during the earthworks. And the air testing experiment (samples repeatedly disturbed) did not generate airborne fibre concentrations above limit of detection of the standard HSE method (<0.01 f/ml).

The new school is in place and the landscaping offers a nice area around it.

Before and after construction | Ramboll

10 Risk-Based Soil Guidelines

There are few published guideline values for asbestos in soil in Europe. Those that are published are summarised below:

Country/ Region	Guideline Value	Additional Information
The Netherlands	Tier 1: 100mg/kg Tier 2: 1000mg/kg (non-friable) or 100mg/kg friable Tier 3: 10mg/kg respirable fibres	Soil Remediation Circular 2013 Annex 3. Concentrations defined as the sum of chrysotile + x10 amphibole and as the average dry weight concentration over a maximum spatial unit of 1000m2. Samples to be taken and analysed as per SIKB Protocol 2018 and NEN 5707.
Italy	1000mg/kg	D.Lgs 152/06. Analysis required to be either SEM for asbestos content <1% or DRX/FTIR for asbestos contents >1%.
Belgium/ Flanders	100mg/kg	Phase 1—minimum of two 10 litre sieved soil samples per 1000m2 of unpaved ground. If concentration < 100mg/kg or >70cm bgl, no action required. If >100mg/kg, further site-specific inspection (Phase 2) required. Concentrations defined as the sum of fixed fibres + x10 loose fibres.
Belgium/ Wallonia	100mg/kg	Concentrations defined as the sum of bonded fibres + x10 unbound fibres. If concentration is > 100mg/kg but <500mg/kg it is acceptable to use soil beneath 1m clean soil + geotextile.
Belgium/ Brussels	100mg/kg Intervention Value 80mg/kg Remediation Value	If the results obtained for a sample exceed the intervention standard for asbestos or if there is a question of pollution (in the sense of art. 3 25° of the Soil Ordinance), a detailed soil survey must be carried out.

Table 10.1 Published guidelines in Europe

11 Approaches to Risk Management

Risk perception and stakeholder acceptance of a risk-based approach to asbestos is potentially a far stronger driver of intervention than for many other soil contaminants. Zero tolerance or an abundance of caution towards asbestos can drive remediation towards "non-detect" solutions.

There are well established risk assessment decision frameworks available, for example the Australian, US EPA, Dutch, and Belgian approaches. What is not well understood is how often those frameworks are used past "Tier 1".

Is the challenge to prove the worth of the more detailed risk assessment Tiers? Is the scientific evidence sufficient to be able to persuade stakeholders that the risk is acceptable? Does the retention of asbestos-containing soils on-site leave constraints on land-use that is not cost-beneficial? Detailed risk assessment has its place and can be valuable in situations where it is not possible and not sustainable to remove the asbestos entirely. This is illustrated in the decision flowchart on the next page.

The difference in the prescriptive nature and detail of frameworks for individual countries and the sustainability of the output from those frameworks is worth further consideration.

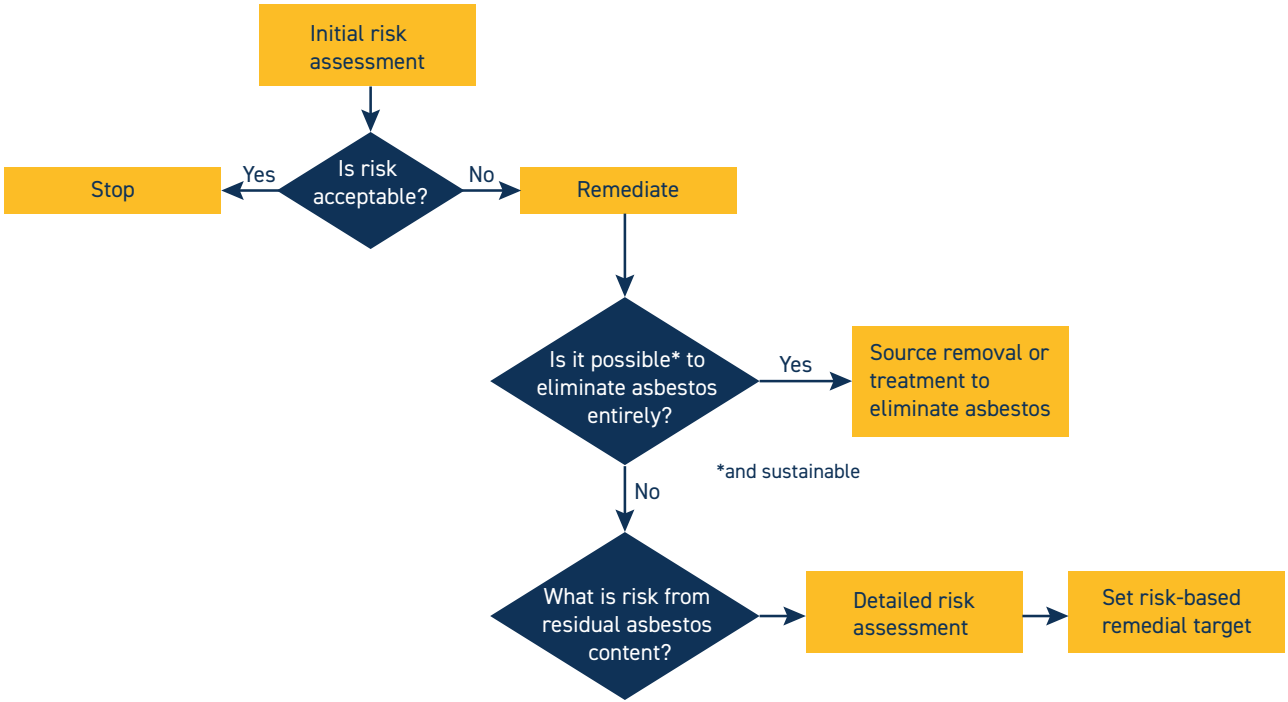


Figure 11.1 Approaches to Risk Management

12 Research and Innovation

Little innovation was specifically identified by the respondents to the questionnaire. A literature review of the most recent developments (within a 5 year time window) in the fields of analytical methodologies, remediation technologies and survey studies has been carried out for NICOLE through the analysis of scientific publications hosted at all the Web of Science databases [Link].

Asbestos investigations have historically focused on commercial asbestos fibers, which were commonly defined in regulations as chrysotile, crocidolite, amosite, tremolite, actinolite, and anthophyllite. Investigations now include other types of elongate mineral particles such as winchite and richterite (van Orden, 2018).

The most common analytical methods for asbestos analysis are polarised light microscopy (PLM), phase contract optical microscopy (PCOM) and electron microscopy (either scanning (SEM) or transmission (TEM).

Cossio et al (2018) improved the sensitivity and precision and enhanced the productivity of a Scanning Electron Microscopy with Energy Dispersive Spectrometry (SEMEDS) methodology for the analysis of asbestos in a natural confining matrix and also with a very low asbestos content.

Wroble et al (2017) compared different soil sampling and analytical methods for asbestos quantification in order develop a toolbox for better assessment in order to overcome the difficulties that exist in the detection of asbestos at low concentrations and its correspondent extrapolation from soil concentrations to air concentra-

tions. Sampling was performed using two distinct methods: traditional discrete ("grab") and incremental sampling methodology (ISM). Analysis was carried out using PLM, TEM and a combination of these two methods were used. Using a Fluidized Bed Asbestos Segregator (FBAS) followed by TEM analysis resulted in the detection of asbestos at locations that were not detected using other analytical methods.

Fibre counting by automated image analysis using fluorescence microscopy has been evaluated by Alexandrov et al (2015). There is the potential from this for faster analysis and less human error, but whilst good validation for medium to high fibre concentrations was achieved, for lower fibre concentrations it was less accurate.

In the last 5 years just a few articles mentioned innovative or upgraded technologies for the asbestos treatment in contaminated sites, mostly considering biological treatment.

Mohanty et al. (2018) examined whether environmentally relevant concentrations of siderophores (exudates from bacteria and fungi that facilitate iron mobilisation and uptake) could alter chrysotile toxicity. Iron removal by siderophores decreased the carcinogenicity of the fibres, the fungal exudates being more effective than those from the bacteria. However, the authors stated that this approach should be more deeply explored in order to develop a viable strategy to manage asbestos-contaminated sites. Native bacteria and fungi from asbestos mines in India (Aspergillus tubingenesis and Coemansia reverse) have

also reportedly been used to detoxify asbestos (Bhattacharya et al. 2015 & 2016).

Gonneau et al. (2017) evaluated the capacity of crop cultivar and grasses for the phytoremediation of soils containing asbestos from natural and anthropogenic causes. The presence of asbestos caused less or no impact on the plant growth when compared to other factors such as the presence of heavy metals or lack of nutrients.

Valouma et al. (2016) used a combined treatment of oxalic acid dihydrate with silicates (tetraethoxysilane and pure water glass (potassium silicate)) to achieve total destruction of chrysotile. Oxalic acid leaching followed by the tetraethoxysilane addition was more appropriate for cases of glushinskite recovery; while an Oxalic acid leaching followed by water glass managed to encapsulate the asbestos fibers, which might be a valid option for onsite asbestos detoxification.

A small number of commercial companies have developed innovative solutions to asbestos remediation:

- An Italian company offers an innovative remediation technology that uses microwave energy to convert asbestos waste to an inert material. The technology involves a movable reactor that can heat the asbestos and produce a reusable inert material [Link].
- A Japanese company Sagasiki offers 'ND Lock', a solidification solution based on calcium polysulphide (CaSx) formulation. The treatment involves a crystallization and decomposition process. Numerous applications relating to asbestos treatment are given on their website.

13 Remediation Options

The most common remediation approach in many countries is still to “dig and dump” (i.e. excavate and dispose to an off-site landfill). A question is whether this is a sustainable approach? The risk is removed by removing the hazard (i.e. the source) but does the context of site use permit a lower impact solution?

The trigger for remediation is also different between countries. For example, mandatory testing for microscopic fibres in soil whenever a construction activity takes place versus action only if visible asbestos waste is encountered. In France, all road asphalt has to be tested for the presence of asbestos as part of any road improvement scheme.

From the questionnaire responses it is clear that there is substantial variation in remediation

Typical remediation earthworks activities in UK | AECOM

Damping down of stockpiled material with water spray | AECOM

triggers, in what restrictions and requirements the identified presence of asbestos introduces, and in the remediation standards enforced. Even if the value of the remediation standard appears at face value to be the same (for example for The Netherlands and Belgium), the detailed definition of that value is different.

What is generally recognised in the questionnaire responses is that the presence of asbestos in the ground can have a significant effect on land use and costs for remediation (either in the cost for remediating the asbestos itself as a risk and remediation driver, or in the additional cost for remediating a different risk driving contaminant because of the co-presence of asbestos).

There are a number of remediation options to consider, some more established than others. From a risk management perspective these options can be grouped as follows:

Monitor
- Risk assessment
- Monitoring strategy

Institutional Controls
- Land-use management
- Signs
- Fencing
- Permit control
- Land-use restrictions

Traditional Remediation Methods
- Excavation and disposal offsite
- In-situ containment (cover system)
- Hand-picking (ground or belt)
- Tilling
- Mechanical screening

Emerging/Innovative/ Alternative Methods
- Mechanical screening (advanced)
- Soil washing
- Vitrification
- ABCOV (acid destruction)
- Microwave destruction
- Modified low temperature thermal desorption
- Soil fungi
- Fine grinding
- Physical stabilisation
- Phytoremediation

The following scheme (next page) presents the risk management based considerations for the remedial options.

What is the context for the decision?	What is the risk characterisation?	Remediation options	Considerations for remediation options
Management of current situation (land condition and use)	Negligible risk and no regulatory driver for further action/intervention	Monitor	Monitoring locations and monitoring frequency Type of monitoring (realtime/continuous or spot monitoring, time duration, dust and/or fibres) Limit of detection and sensitivity of method (e.g. differentiation of fibre types and fibre sizes)
Regulatory intervention	Low risk - potential to manage risk without extensive remedial action	Institutional control	Is control of use/access of area practicable and achievable? Does it require reassurance boundary monitoring? Fencing, signage, specific PPE/RPE requirements
Preparation for site divestment/acquisition	Higher risk - requires more detailed consideration of remediation options	Remove	Can it be treated and re-used on-site? Can it be treated to reduce volume requiring disposal? Can it be treated to reduce handling/ transportation risk?
Preparation for site for new use		Cover	What level/degree of soil disturbance does this need to protect against? Durability. What ground access constraints are present which may restrict/constrain installation of cover (type, extent)?
Construction activity requiring asbestos containing soil to be excavated and/or constructed on		Ex-situ treatment	Treatment type - physical separation, chemical destruction, stabilisation. What is the required post-treatment specification for the material? What is the treatment capable of achieving?
		In-situ treatment	Treatment type - physical separation, chemical destruction, stabilisation. What is the required post-treatment specification for the material? What is the treatment capable of achieving?

Figure 14.2 Example of a Risk Management Decision Flowchart

John F Hunt demolished and remediated this former 44-acre foundry / iron works site in Ipswich. The mixed-use site also held two historic landfills containing inert and 'difficult' waste.

Part of the works involved the management of 35,000 m^3 of previously unidentified fibrous asbestos in soil. This unforeseen event had not been budgeted for and could have potentially rendered the project unviable. John F Hunt worked quickly and pragmatically with the client's consultants and regulators to agree a solution to enable the re-use of materials on site, making the necessary adjustments to the remedial design and Materials Management Plan.

An innovative process engineered approach of complex sorting and cement stabilisation of the

Futura Business Park – Ipswich, UK | John F Hunt

All forms of asbestos were discovered including crocidolite lagging.

Pockets of asbestos covered much of the site at depths up to 5m.

Asbestos finds | John F Hunt

soil was agreed with the regulators to derive site won engineered fill that was suitable for use.

Due to the nature of the asbestos, the remediation works were undertaken as Licensed Asbestos Works managed by John F Hunt.

Contaminated soil was fed into a three-way screener. The oversize material off the screener was proven to be suitable for re-use. The mid-size component was passed to an 'asbestos picking station' where six operatives hand removed visible asbestos products; in some instance the material was passed though the picking station twice to ensure the re-use criteria of <0.1% asbestos (w/w) was achieved. Fine material coming off the screener was passed to a mill unit where

2% cement was added. The stabilised fines were fed onto a stacking conveyor with misting sprays that deposited the material directly into the excavation.

Throughout the works the air was monitored by an independent Asbestos Analyst to demonstrate that the control measures were suitable.

The processed soil was tested to show compliance with the Remediation Strategy, following which it was placed and compacted to form a development platform 1.5m below the finished site level.

John F Hunt were able to successfully treat 65,000 tonnes of asbestos contaminated soil using innovative techniques that ultimately saved the client over £10,000,000 in disposal costs.

Processing plant | John F Hunt

A number of innovations in remediation have either been proposed and/or implemented by remediation specialists, as exemplified in some of the case studies included in this document and the listing of potential options on page 37. Innovation does not have to be a completely new technology, and can include the innovative use of an existing technology.

Examples of this include the use of:

- Cement impregnated geotextiles for cover systems (see photographs to the right)
- Low temperature driers or thermal desorption units to extract loose fibres by drying + extraction of airborne fibres
- Mechanical screening (dry and/or wet)

Installation of surface barrier geotextile | Curtis Barrier Intl

A comprehensive review of remediation technologies is provided in a report by Bureau KLB for the Dutch Ministry for Infrastructure and Water Management published in 2018. This was driven by the need to reduce the unsustainable volume of asbestos contaminated soils being disposed to landfill in the Netherlands.

Mechanical screening of excavated soil | AECOM

Remedial objectives can shape option choices. For example:

Remove ACM fragments and re-use remaining soil at depth on-site	Physical separation of ACMs using hand picking or mechanical screening?
Remove asbestos fibres and re-use remaining soil at surface on-site	Physical separation of fibres by soil washing or drying + vacuum extraction?
Treat soil + asbestos so that material is suitable for re-use	Stabilisation or fibre destruction technology?
Re-use on-site is not possible/ acceptable	Off-site disposal—can pre-treatment reduce cost by minimising hazardous waste volume?

Figure 13.1 Examples of choices for different Remedial objectives

Factors to consider in remedial selection can include:

- Types of asbestos present
- Levels of asbestos present
- Area / volume of impacted soil
- Timescales
- Client risk perception / avoid land blight
- Sustainability
- Presence of other contamination
- Current and/or proposed land-use
- Site location (and proximity to receptors)
- Occupational health constraints
- Remediation standard required
- Other requirements for soil (e.g. geotechnical)

Removing asbestos contaminated soil | NTP

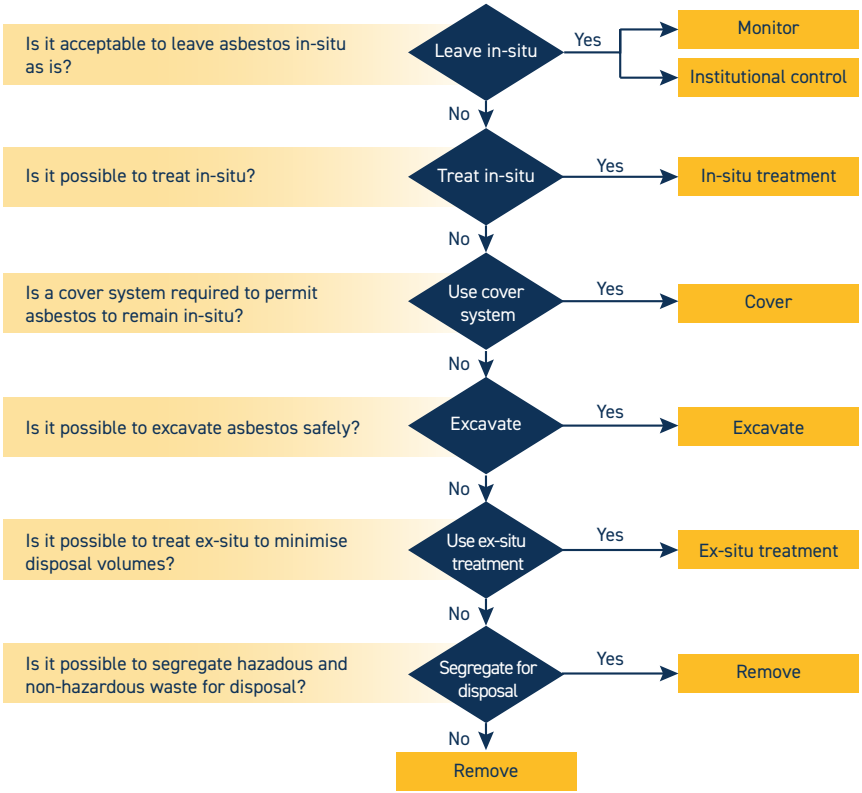


Figure 13.2 Example of a Remediation Decision Flowchart

14 Sustainable Remediation

Trommel screening of excavated soil | McAuliffe

Asbestos in soil remediation options should be considered in accordance with sustainable remediation frameworks (e.g. SuRF). Does the remediation approach represent the best solution when considering environmental, economic and social factors as agreed with stakeholders? How can successful remediation best be achieved with minimal environmental impact? What remedial solution delivers the greatest cost-benefit? Does the selected approach transfer impacts to future generations?

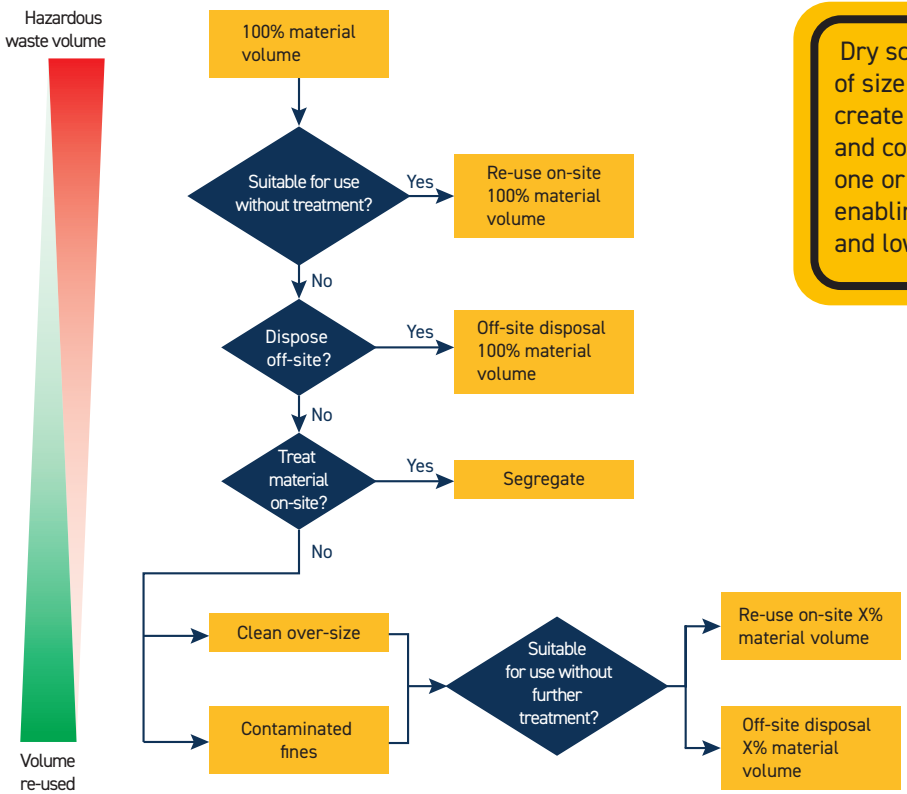
A simple example is the consideration of on-site physical separation to maximise the re-use of

Belt-picking station | McAuliffe


Hand picking of asbestos fragments on a belt | McAuliffe

material on-site and minimise off-site waste disposal. One way of viewing this is via a decision flowchart such as the examples on the following pages which illustrate the decision process and disposal volume reduction created by the adoption of mechanical separation treatment techniques. The use and sequencing of the material screening techniques will be influenced by a number of factors including:

- Cost of treatment versus cost of disposal
- Particle size distribution of material
- Remediation standard



Dry screening and separation of size fractions could create clean size-fractions and concentrate asbestos in one or more size fractions, enabling re-use of some material and lowering disposal volumes

Figure 14.1 An example of a treatment decision process for dry screening as a sustainable option

AECOM developed a remediation and excavated materials management strategy for the redevelopment of a former car part manufacturing facility located in the UK.

The presence of soil contaminants necessitated a remediation and earthworks strategy that had sustainability at its core: maximising reuse of site-won material, and minimising off-site disposal whist at the same time providing a safe development platform. The remediation strategy sought to first treat organic-based contamination through ex-situ bioremediation. Alongside the remediation works, an excavated materials management plan (MMP) was developed under the CL:AIRE Definition of Waste: Development Industry Code of Practice (Code of Practice) to support the earthworks design. Demolition of the former buildings and hard standing occurred alongside the soil remediation under separate contract by a third party. Four stockpiles of screened demolition materials (approx. 26,500 m^3) were prepared for re-use. However, these materials were subsequently found to contain a proportion of asbestos containing materials (ACM) which had in places also contaminated the ground as the stockpiles had been moved around by the contractor.

Asbestos finds | AECOM

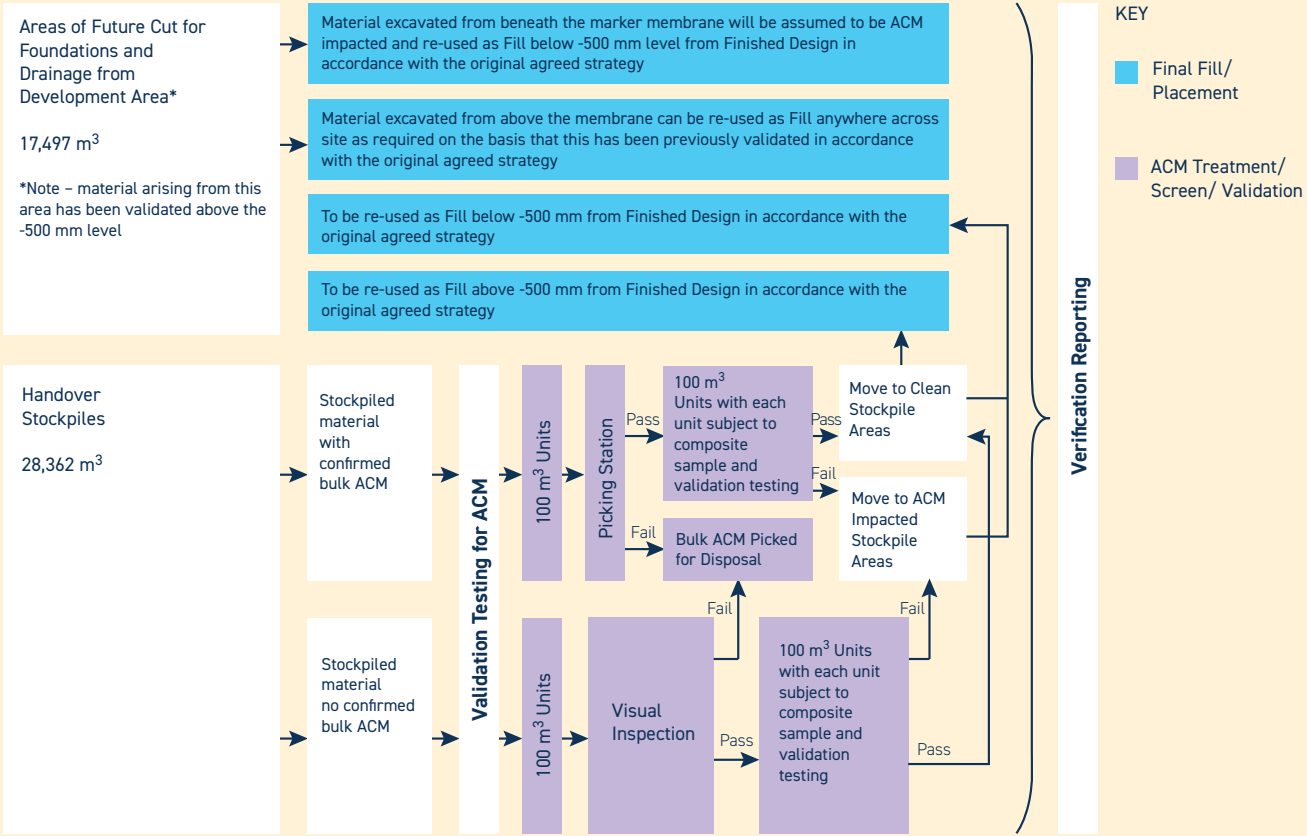


Figure C2.1 Material Management Flowchart

In order for the stockpiled materials to be re-used as part of the consented design a revised strategy was required to ensure the appropriate and safe re-use of these materials. AECOM prepared a detailed assessment on the levels of ACM and asbestos free fibres recorded in the materials and also quantified the level of risk posed by the materials. The soil re-use strategy was developed in accordance with the Control of Asbestos Regulations (2012) and the HSE Approved Code of Practice for managing and working with asbestos (ACoP L143) and gained regulatory agreement.

The strategy developed for the areas of impacted ground centred on a minimum of 500mm validated clean cover being placed below finished design level with the installation of a geotextile marker membrane at the interface of the clean cover and existing ground level. The strategy also made provision for selected 6F2 (UK highway's grade of aggregate) stockpiles impacted with asbestos to be

Installation of the cover system | AECOM

treated through mechanical screening, sorting and hand picking to generate screened material that met agreed validation criteria (<0.001% asbestos). The mechanical screening successfully separating the larger size fractions that were free of asbestos from the smaller size fractions where the asbestos tended to be. The treated larger size fractions could then be recrushed to produce graded material suitable for use in the development without restriction. Stockpiles that were not treated were tracked and used in dedicated areas of the development under 500mm of clean cover with geotextile marker membrane. In areas where soils containing ACM were placed beneath cover, the strategy set out the principles and expectations for a future site management strategy that would need to be adopted upon completion.

The approach taken at this site ensured that the excavated and site-won materials were managed sustainably on site, minimising potential off-site disposal and material import consistent with the original design aspirations and expectations attached to the planning consent.

15 Opportunities for Harmonisation

There are opportunities for and benefits of harmonisation:

- The advocacy of sustainable approaches to risk management
- Greater recognition of the cost-benefit of waste minimisation using ex-situ or in-situ techniques
- A common understanding of risk and a risk-based, proportionate, response to asbestos in soil

There are also barriers to harmonisation that ultimately will limit the degree of harmonisation that is possible. For example:

- Different national legislation and regulatory guidance
- Differing risk perception and/or prioritisation
- Differing scale of issue
- Differing scientific opinion

Figure 15.1 Harmonised approach

16 Concluding Remarks

The problem of asbestos contaminated soil is a common one across Europe, albeit to varying degrees and largely linked to the historic use and management of asbestos in construction and demolition of buildings. It is a recognised challenge for the risk management of existing land use and the re-purposing of brownfield land in some but not all European countries. As result there are well established guidance and procedures in place in some countries and an absence in others. The variability in approaches is marked, with highly detailed and prescriptive regulator-driven guidance in countries such as The Netherlands and Belgium, and less prescriptive industry-led guidance in the UK.

The opportunities for harmonisation across countries are few—certainly in the short-term, and this is driven by the different legislature and regulatory guidance in each country and the large differences in investigation approaches across European countries that have guidance in place. It is also evident that the approaches in countries are not all entirely risk-based. For example, the requirement to remove all visible fragments of asbestos in soil in Italy irrespective of the soil standard in Italy of 1000 mg/kg (which is the EU hazardous waste limit for asbestos). For many countries it is still the case that no risk-based guidance exists for asbestos in soil, and in those countries (unless gross asbestos contamination is identified) the consideration of low or trace levels of asbestos in soil is not a default consideration in site investigation design and land management.

There is therefore a place for advocating good practice in investigation, in risk assessment, and in

remediation, employing the best science and utilising the most sustainable remediation options. This is relevant both for European countries where regulation and guidance is currently absent, and for European countries where guidance is in place.

The pace of change in asbestos regulation and guidance is slow and there are opportunities to learn from countries outside of Europe, for example the work of the US EPA in the USA and the work of the Australasian Land and Groundwater Association (ALGA) and BRANZ Ltd in Australia and New Zealand.

CONTENT DISCLAIMER:
This publication does not necessarily represent the opinions of all NICOLE members.

Acknowledgements

NICOLE gratefully acknowledges the co-authors of this publication—Simon Cole (AECOM), Phil Studds (Ramboll) and Tomas Albergaria (Instituto Superior de Engenharia do Porto) - and the other members of the Asbestos in Soil Working Group - Jean-Louis Seveque (AquaTerraSana) and Caroline Dionisi (EDF)

The co-authors gratefully acknowledge the review and constructive feedback on the early drafts of this publication by their colleagues at AECOM and Ramboll, and the patience of the NICOLE Steering Group.

Acronyms and Abbreviations

ACM Asbestos containing material

AIB Asbestos insulation board

AISS UK Health and Safety Laboratory (HSL) Proficiency Testing for Asbestos in https://www.hsl.gov.uk/proficiency-testing-schemes/aiss

DRX X-ray diffraction

f/ml a unit of measurement for air (asbestos fibres per millilitre of air sampled)

f/m^3 a unit of measurement for air (asbestos fibres per cubic metre of air sampled)

FTIR Fourier transform infrared spectrometry

HSE UK Health and Safety Executive https://www.hse.gov.uk/

OVAM Public waste agency of Flanders https://www.ovam.be/

PCOM Phase-contrast optical microscopy (alternative acronym used is PCM)

PLM Polarised light microscopy

RIVM Netherlands National Institute for Public Health and the Environment https://www.rivm.nl/en

SCA UK Standing Committee of Analysts
http://standingcommitteeofanalysts.co.uk/

SEM Scanning electron microscopy

SoBRA UK Society of Brownfield Risk Assessment https://sobra.org.uk/

SuRF Sustainable Remediation Forum https://www.sustainableremediation.org/
and https://www.claire.co.uk/projects-and-initiatives/surf-uk

TEM Transmission electron microscopy

TNO Netherlands Organisation for Applied Scientific Research
https://www.tno.nl/en/

VROM Former Netherlands Ministry of Housing, Spatial Planning and the Environment (since 2010 with the Ministry of Infrastructure and the Environment)

US EPA United States Environmental Protection Agency https://www.epa.gov/

Bibliography (1)

Addison, J., Davies, L.S.T., Robertson, A., Wiley, R.J., (1988). *The release of dispersed asbestos fibres from soils*, IOM Research Report TM/88/14, Institute of Occupational Medicine

Alexandrov, M., Ichida, E., Nishimura, T., Aoki, K., Ishida, T., Hirota, R., Ikeda, T., Kawasaki, T., & Kuroda, A. (2014). Development of an automated asbestos counting software based on fluorescence microscopy. *Environmental Monitoring and Assessment*, *187*(1).

Australian Government Comcare (2013). *Asbestos Innovation Fund Research Stream Closure Report for Innovative and cost effective health and safety field tool for the risk assessment of land that is potentially contaminated by asbestos*

Bhattacharya, S., John, P. J., & Ledwani, L. (2015). Bacterial Weathering of Asbestos. *Silicon*, *7*(4), 419–431.

Bhattacharya, S., John, P. J., & Ledwani, L. (2016). Fungal weathering of asbestos in semi arid regions of India. *Ecotoxicology and Environmental Safety*, *124*, 186–192.

CIRIA (2016). *Asbestos in soil and made ground good practice site guide*. C765 [Link]

CIRIA (2014). *Asbestos in soil and made ground: a guide to understanding and managing risks*. C733 [Link]

Cossio, R., Albonico, C., Zanella, A., Fraterrigo-Garofalo, S., Avataneo, C., Compagnoni, R., & Turci, F. (2018). Innovative unattended SEM-EDS analysis for asbestos fiber quantification. *Talanta*, *190*, 158–166.

Gonneau, C., Miller, K., Mohanty, S. K., Xu, R., Hwang, W.-T., Willenbring, J. K., & Casper, B. B. (2017). Framework for assessment and phytoremediation of asbestos-contaminated sites. *Environmental Science and Pollution Research*, *24*(33), 25912–25922.

Bibliography (2)

HSE (2021). *Asbestos: The Analysts' guide for sampling, analysis and clearance procedures (2nd ed.)*. HSG248, Health and Safety Executive. UK [Link]

IBN (2020). *Management of Asbestos in Soils - An All-Ireland Guidance Document*. Ireland Brownfield Network, Asbestos in Soils Good Practice Subgroup. [Link]

Januch, J., Brattin, W., Woodbury, L., & Berry, D. (2013). Evaluation of a fluidized bed asbestos segregator preparation method for the analysis of low-levels of asbestos in soil and other solid media. *Analytical Methods*, *5*(7), 1658.

Kumar, A., & Maiti, S. K. (2014). Effect of Organic Manures on the Growth ofCymbopogon citratusandChrysopogon zizanioidesfor the Phytoremediation of Chromite-Asbestos Mine Waste: A Pot Scale Experiment. *International Journal of Phytoremediation*, *17*(5), 437–447.

Kumar, A., T., & Maiti, S. K. (2019). Phytoremediation of chromite-asbestos mine waste using aromatic grasses and organic manures. *Journal of Biotechnology*, *305*.

Le Blansch, K., den Boeft, K., Tempelman, J. (2018). *On the lookout for practicable sustainable options for asbestos waste treatment: A technical, sustainability and market assessment*. Bureau KLB

Legislative Decree April 3rd, 2006, n. 152, Environmental Regulations. *Norme in materia ambientale*. pubblicato sulla G.U. 88 del 14 aprile 2006. Italy

Mohanty, S. K., Gonneau, C., Salamatipour, A., Pietrofesa, R. A., Casper, B., Christofidou-Solomidou, M., & Willenbring, J. K. (2018). Siderophore-mediated iron removal from chrysotile: Implications for asbestos toxicity reduction and bioremediation. *Journal of Hazardous Materials*, *341*, 290–296.

Bibliography (3)

OVAM (2020). *Code of good practice asbestos for descriptive soil investigation*. [Link]

OVAM (2020). Guideline *strategy 8* asbestos for Phase I investigations. [Link]

OVAM (2020). *Procedure for Phase I investigations*. [Link]

OVAM (2019). Code of good practice asbestos, use of soil material. [Link]

Pawełczyk, A., Bożek, F., Grabas, K., & Chęcmanowski, J. (2017). Chemical elimination of the harmful properties of asbestos from military facilities. *Waste Management*, *61*, 377–385.

Society of Brownfield Risk Assessment: SoBRA (2020). *Asbestos in Soil Sub-Group Discussion Papers (2015-2020)*. available at [Link]

SIKB (2018), Ground-level inspection and sampling of asbestos in soil, Protocol 2018, Version 6.0, 1 February 2018 available at https://www.sikb.nl/doc/BRL2000/Protocol_2018_v6_0_20180201.pdf

Standing Committee of Analysts (2017). *The quantification of asbestos in soil, Methods for the Examination of Waters and Associated Materials*. [withdrawn in October 2020] [Link]

Swartjes, F. A., & Tromp, P. C. (2008). A Tiered Approach for the Assessment of the Human Health Risks of Asbestos in Soils. *Soil and Sediment Contamination: An International Journal*, *17*(2), 137–149.

United States Environmental Protection Agency: Asbestos Committee of the Technical Review Workgroup of the Office of Solid Waste and Emergency Response (2008). *Framework for*

Bibliography (4)

Investigating Asbestos-Contaminated Superfund Sites. OSWER Directive 9200.0-68, September 2008. [Link]

Valouma, A., Verganelaki, A., Maravelaki-Kalaitzaki, P., & Gidarakos, E. (2016). Chrysotile asbestos detoxification with a combined treatment of oxalic acid and silicates producing amorphous silica and biomaterial. *Journal of Hazardous Materials*, *305*, 164–170.

Van Orden, D. R. (2018). Identification and analysis of ambient EMPs. *Toxicology and Applied Pharmacology*, *361*, 21–26.

VROM/ Ministry of Infrastructure and Environment (2013). *Soil Remediation Circular per 1 July 2013, annex 3* (stcrt-2013-16675). The Hague: Staatscourant. [Link] Soil Remediation Circular PDF Free Download. (n.d.). [Link]

Wroble, J., Frederick, T., Frame, A., & Vallero, D. (2017). Comparison of soil sampling and analytical methods for asbestos at the Sumas Mountain Asbestos Site—Working towards a toolbox for better assessment. *PLOS ONE*, *12*(7).

Yamani, M. E., Boulanger, G., Nerrière-Catelinois, E., Paillat, A., Modelon, H., Soyez, A., Paquet, F., Binet, S., Paris, C., & Brochard, P. (2012). Revision of French Occupational Exposure Limits of Asbestos and Recommendation of Measurement Method: Can the Dimensional Characteristics of the Asbestos Fibers (Long, Thin, Short) Be Taken Into Account? *Critical Reviews in Environmental Science and Technology*, *42*(14), 1441–1484.

Colofon

NICOLE Working Group Asbestos:

Chair:	Simon Cole, AECOM, UK
Members:	Caroline Dionisi, EDF, France Jean-Louis Sévèque, AquaTerra, France Phil Studds, Ramboll, UK Tomás Albergaria, ISEP, Portugal
Review:	Elze-Lia Visser, NICOLE, The Netherlands
Design & lay-out:	Just Josi, The Netherlands
Issued:	June 2021
Copyright:	NICOLE

NICOLE is a leading forum on industrially co-ordinated sustainable land management in Europe, promoting co-operation between industry, academia and service providers on the development and application of sustainable technologies. The overall objective of NICOLE is to pro-actively enable European industry to identify, assess and manage industrially contaminated land efficiently, cost-effectively, and within a framework of sustainability.
Further information: www.NICOLE.org

APPENDIX C. ASBESTOS MONITORING DATA: COVERED SCREENER AND HEPA FILTER DATA: ROWLEY REGIS

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S26545a

DATE OF ISSUE: 11.07.22

DATE ANALYSIS REQUESTED: 05.07.22

DATE ANALYSIS COMPLETED: 08.07.22

SAMPLES: Ten airborne dust samples each supplied as two half gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each pair of half membrane filters is ashed in a low temperature plasma asher. The combined residue from each pair is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

UKAS TESTING
0374

CONTRACT NO: S26545a
DATE OF ISSUE: 11.07.22

RESULTS:

Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
*ERQ ASB 1 (27/06/22)	1440	12	300	0.0020	1 / <0.0005*	4.5 / 0.0007	4 / 0.0007	2.5/ <0.0005*
ERQ outside (27/06/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
*ERQ ASB 1 (28/06/22)	1440	11	300	0.0018	3 / 0.0005	0 / <0.0005*	5 / 0.0008	3 / 0.0005
ERQ outside (28/06/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
*ERQ ASB 1 (29/06/22)	1440	6.5	300	0.0011	4 / 0.0007	2.5/ <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ outside (29/06/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
*ERQ ASB 1 (30/06/22)	1440	6	300	0.0010	1 / <0.0005*	0 / <0.0005*	3 / 0.0005	2 / <0.0005*
ERQ outside (30/06/22)	1440	1	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
*ERQ ASB 1 (01/07/22)	1440	3	300	0.0005	1 / <0.0005*	0 / <0.0005*	2 / <0.0005*	0 / <0.0005*
ERQ outside (01/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S26545a
DATE OF ISSUE: 11.07.22

COMMENTS:

Asbestos fibres were detected during the analysis of all of the ERQ ASB 1 samples and sample ERQ Outside 30/06/22. No asbestos fibres were detected on any of the other samples.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

Each sample supplied for analysis comprised two half membrane filters. These were combined during plasma ashing to form single samples with combined sample volumes of 1440 litres.

The ERQ ASB 1 samples (marked with *) were too dusty to be analysed as received. Following plasma ashing, the residue from each of the dusty samples was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on the entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for the samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S26732a

DATE OF ISSUE: 19.07.22

DATE ANALYSIS REQUESTED: 13.07.22

DATE ANALYSIS COMPLETED: 18.07.22

SAMPLES: Fourteen airborne dust samples each supplied as two half gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each pair of half membrane filters is ashed in a low temperature plasma asher. The combined residue from each pair is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S26732a
DATE OF ISSUE: 19.07.22

RESULTS:

Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
ERQ ASB 1 (04/07/22)	1440	1.5	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1.5 /<0.0005*
ERQ outside (04/07/22)	1440	1.5	150	<0.0005*	1.5 /<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 1 (05/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ outside (05/07/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 1 (06/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ outside (06/07/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
*ERQ ASB 1 (07/07/22)	1440	4	300	0.0007	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	3 / 0.0005
ERQ ASB 2 (07/07/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 3 (07/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (07/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 1 (08/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 2 (08/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (08/07/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 4 (08/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S26732a
DATE OF ISSUE: 19.07.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of sample numbers ERQ Outside 04.07.22 and ERQ ASB 1 07.07.22. No asbestos fibres were detected on any of the other samples.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

Each sample supplied for analysis comprised two half membrane filters. These were combined during plasma ashing to form single samples with combined sample volumes of 1440 litres.

The ERQ ASB 1 sample (marked with *) was too dusty to be analysed as received. Following plasma ashing, the residue from the dusty sample was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on the entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for the samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S26905

DATE OF ISSUE: 28.07.22

DATE ANALYSIS REQUESTED: 21.07.22

DATE ANALYSIS COMPLETED: 27.07.22

SAMPLES: Twenty airborne dust samples each supplied as two half gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each pair of half membrane filters is ashed in a low temperature plasma asher. The combined residue from each pair is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S26905
DATE OF ISSUE: 28.07.22

RESULTS:
Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
*ERQ ASB 1 (11/07/22)	1440	9	600	0.0015	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	8 / 0.0013
ERQ ASB 2 (11/07/22)	1440	2	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (11/07/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*	1 / <0.0005*
ERQ ASB 4 (11/07/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
*ERQ ASB 1 (12/07/22)	1440	5	600	0.0008	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*	4 / 0.0007
ERQ ASB 2 (12/07/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
ERQ ASB 3 (12/07/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
ERQ ASB 4 (12/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
*ERQ ASB 1 (13/07/22)	1440	2	600	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
ERQ ASB 2 (13/07/22)	1440	2	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 3 (13/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (13/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
*ERQ ASB 1 (14/07/22)	1440	1	600	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 2 (14/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (14/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (14/07/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*	1 / <0.0005*
*ERQ ASB 1 (15/07/22)	1440	4	600	0.0007	2 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
ERQ ASB 2 (15/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (15/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (15/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S26905
DATE OF ISSUE: 28.07.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of four of the twenty samples supplied for this analysis. No asbestos fibres were detected on any of the other samples.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

Each sample supplied for analysis comprised two half membrane filters. These were combined during plasma ashing to form single samples with combined sample volumes of 1440 litres.

The samples (marked with *) were too dusty to be analysed as received. Following plasma ashing, the residue from each of the dusty samples was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on the entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for the samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27044

DATE OF ISSUE: 03.08.22

DATE ANALYSIS REQUESTED: 29.07.22

DATE ANALYSIS COMPLETED: 02.08.22

SAMPLES: Twenty airborne dust samples each supplied as two half gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each pair of half membrane filters is ashed in a low temperature plasma asher. The combined residue from each pair is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

CONTRACT NO: S27044
DATE OF ISSUE: 03.08.22

RESULTS:
Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
*ERQ ASB 1 (18/07/22)	1440	2	600	<0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*	0 / <0.0005*
ERQ ASB 2 (18/07/22)	1440	1.5	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*	0.5 /<0.0005*
ERQ ASB 3 (18/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (18/07/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*
*ERQ ASB 1 (19/07/22)	1440	4	600	0.0007	0 / <0.0005*	0 / <0.0005*	4 / 0.0007	0 / <0.0005*
ERQ ASB 2 (19/07/22)	1440	1	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (19/07/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
ERQ ASB 4 (19/07/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
*ERQ ASB 1 (20/07/22)	1440	3	300	0.0005	0 / <0.0005*	1 / <0.0005*	1 / <0.0005*	1 / <0.0005*
ERQ ASB 2 (20/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (20/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (20/07/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
*ERQ ASB 1 (21/07/22)	1440	2	300	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 2 (21/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (21/07/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 4 (21/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 1 (22/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 2 (22/07/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 3 (22/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (22/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27044
DATE OF ISSUE: 03.08.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of three of the twenty samples supplied for this analysis. No asbestos fibres were detected on any of the other samples.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

Each sample supplied for analysis comprised two half membrane filters. These were combined during plasma ashing to form single samples with combined sample volumes of 1440 litres.

The samples (marked with *) were too dusty to be analysed as received. Following plasma ashing, the residue from each of the dusty samples was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on the entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for the samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27272

DATE OF ISSUE: 17.08.22

DATE ANALYSIS REQUESTED: 11.08.22

DATE ANALYSIS COMPLETED: 16.08.22

SAMPLES: Twenty airborne dust samples each supplied as two half gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each pair of half membrane filters is ashed in a low temperature plasma asher. The combined residue from each pair is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

UKAS TESTING
0374

CONTRACT NO: S27272
DATE OF ISSUE: 17.08.22

RESULTS:
Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
ERQ ASB 1 (25/07/22)	1440	1	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 2 (25/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 /<0.0005*
ERQ ASB 3 (25/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (25/07/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*	0 / <0.0005*
ERQ ASB 1 (26/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / 0.0007	0 / <0.0005*
ERQ ASB 2 (26/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (26/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (26/07/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 1 (27/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 2 (27/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (27/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (27/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 1 (28/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 2 (28/07/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 3 (28/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (28/07/22)	1440	1.5	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0.5 /<0.0005*
ERQ ASB 1 (29/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 2 (29/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (29/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (29/07/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27272
DATE OF ISSUE: 17.08.22

COMMENTS:

Single asbestos fibres were detected during the analysis of two of the twenty samples supplied for this analysis. No asbestos fibres were detected on any of the other samples.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

Each sample supplied for analysis comprised two half membrane filters. These were combined during plasma ashing to form single samples with combined sample volumes of 1440 litres.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for the samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....

S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27326

DATE OF ISSUE: 23.08.22

DATE ANALYSIS REQUESTED: 15.08.22

DATE ANALYSIS COMPLETED: 23.08.22

SAMPLES: Twenty airborne dust samples each supplied as two half gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each pair of half membrane filters is ashed in a low temperature plasma asher. The combined residue from each pair is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

CONTRACT NO: S27326
DATE OF ISSUE: 23.08.22

RESULTS:
Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
ERQ ASB 1 (01/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 2 (01/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (01/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (01/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 1 (02/08/22)	1440	3	150	0.0005	0 / <0.0005*	0 / <0.0005*	0 / 0.0007	3 / 0.0005
ERQ ASB 2 (02/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (02/08/22)	1440	1.5	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0.5 /<0.0005*
ERQ ASB 4 (02/08/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 1 (03/08/22)	1440	2	150	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 2 (03/08/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 3 (03/08/22)	1440	1	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (03/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 1 (04/08/22)	1440	1	150	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 2 (04/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (04/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (04/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
*ERQ ASB 1 (05/08/22)	1440	13.5	600	0.0022	0 / <0.0005*	4 / 0.0007	1 / <0.0005*	8.5 / 0.0014
ERQ ASB 2 (05/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (05/08/22)	1440	2	150	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 4 (05/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27326
DATE OF ISSUE: 23.08.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of six of the twenty samples supplied for this analysis. No asbestos fibres were detected in any of the other samples.

*Sample number ERQ ASB 1 (05/08/22) was too dusty to be analysed as received. Following plasma ashing, the residue from this sample was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on the entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

Each sample supplied for analysis comprised two half membrane filters. These were combined during plasma ashing to form single samples with combined sample volumes of 1440 litres.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for the samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27368

DATE OF ISSUE: 25.08.22

DATE ANALYSIS REQUESTED: 17.08.22

DATE ANALYSIS COMPLETED: 24.08.22

SAMPLES: Twenty airborne dust samples each supplied as two half gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each pair of half membrane filters is ashed in a low temperature plasma asher. The combined residue from each pair is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

UKAS TESTING
0374

CONTRACT NO: S27368
DATE OF ISSUE: 25.08.22

RESULTS:
Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
*ERQ ASB 1 (08/08/22)	1440	3.5	600	0.0005	0.5 /<0.0005*	0 / <0.0005*	1 / <0.0005*	2 / <0.0005*
*ERQ ASB 2 (08/08/22)	1440	1	300	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (08/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (08/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
*ERQ ASB 1 (09/08/22)	1440	10	600	0.0016	1 / <0.0005*	1 / <0.0005*	0 / <0.0005*	8 / 0.0013
*ERQ ASB 2 (09/08/22)	1440	3	300	0.0005	2 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
*ERQ ASB 3 (09/08/22)	1440	2	300	<0.0005*	1 / <0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (09/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
*ERQ ASB 1 (10/08/22)	1440	5	1200	0.0008	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	4 / 0.0007
ERQ ASB 2 (10/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (10/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (10/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
*ERQ ASB 1 (11/08/22)	1440	1.5	300	<0.0005*	0 / <0.0005*	1.5 /<0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 2 (11/08/22)	1440	1	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (11/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (11/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
*ERQ ASB 1 (12/08/22)	1440	5	1200	0.0005	1 / <0.0005*	1 / <0.0005*	1 / <0.0005*	2 / <0.0005*
ERQ ASB 2 (12/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (12/08/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
ERQ ASB 4 (12/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27368
DATE OF ISSUE: 25.08.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of nine of the twenty samples supplied for this analysis.

*These samples were too dusty to be analysed as received. Following plasma ashing, the residue from each sample was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on each entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

Each sample supplied for analysis comprised two half membrane filters. These were combined during plasma ashing to form single samples with combined sample volumes of 1440 litres.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for the samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27684

DATE OF ISSUE: 12.09.22

DATE ANALYSIS REQUESTED: 05.09.22

DATE ANALYSIS COMPLETED: 09.09.22

SAMPLES: Twenty airborne dust samples each supplied as two half gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each pair of half membrane filters is ashed in a low temperature plasma asher. The combined residue from each pair is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

CONTRACT NO: S27684
DATE OF ISSUE: 12.09.22

RESULTS:

Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
*ERQ ASB 1 (15/08/22)	1440	7	600	0.0011	1 / <0.0005*	0 / <0.0005*	1 / <0.0005*	5 / 0.0008
ERQ ASB 2 (15/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (15/08/22)	1440	1	150	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (15/08/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
*ERQ ASB 1 (16/08/22)	1440	5.5	600	0.0009	0.5 /<0.0005*	0 / <0.0005*	0 / <0.0005*	5 / 0.0008
ERQ ASB 2 (16/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (16/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (16/08/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
*ERQ ASB 1 (17/08/22)	1440	9.5	600	0.0016	1 / <0.0005*	1 / <0.0005*	0 / <0.0005*	7.5 / 0.0012
ERQ ASB 2 (17/08/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 3 (17/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (17/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
*ERQ ASB 1 (18/08/22)	1440	2	600	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 2 (18/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 3 (18/08/22)	1440	1	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 4 (18/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
*ERQ ASB 1 (19/08/22)	1440	1	600	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 2 (19/08/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
ERQ ASB 3 (19/08/22)	1440	2	150	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 4 (19/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27684
DATE OF ISSUE: 12.09.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of eight of the twenty samples supplied for this analysis.

*These samples were too dusty to be analysed as received. Following plasma ashing, the residue from each sample was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on each entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

Some of the samples supplied for analysis comprised two half membrane filters. These were combined during plasma ashing to form single samples with combined sample volumes of 1440 litres.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for any samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S26545b

DATE OF ISSUE: 11.07.22

DATE ANALYSIS REQUESTED: 05.07.22

DATE ANALYSIS COMPLETED: 08.07.22

SAMPLES: Five airborne dust samples each supplied as two half gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each pair of half membrane filters is ashed in a low temperature plasma asher. The combined residue from each pair is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S26545b
DATE OF ISSUE: 11.07.22

RESULTS:

Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
ERQ Screener (27/06/22)	1440	5.5	300	0.0009	1 / <0.0005*	0 / <0.0005*	2.5 /<0.0005*	2 / <0.0005*
ERQ Screener (28/06/22)	1440	11	300	0.0018	2 / <0.0005*	0 / <0.0005*	8 / 0.0013	1 / <0.0005*
ERQ Screener (29/06/22)	1440	7.5	300	0.0012	3 / 0.0005	0 / <0.0005*	4.5 / 0.0007	0 / <0.0005*
ERQ Screener (30/06/22)	1440	2	300	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ Screener (01/07/22)	1440	4.5	300	0.0007	3.5 / 0.0006	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S26545b
DATE OF ISSUE: 11.07.22

COMMENTS:

Small numbers of amphibole asbestos fibres were detected during the analysis of all five samples.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

Each sample supplied for analysis comprised two half membrane filters. These were combined during plasma ashing to form single samples with combined sample volumes of 1440 litres.

These samples were too dusty to be analysed as received. Following plasma ashing, the residue from each of the dusty samples was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on the entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for the samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S26732b

DATE OF ISSUE: 19.07.22

DATE ANALYSIS REQUESTED: 13.07.22

DATE ANALYSIS COMPLETED: 18.07.22

SAMPLES: Three airborne dust samples each supplied as two half gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each pair of half membrane filters is ashed in a low temperature plasma asher. The combined residue from each pair is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S26732b
DATE OF ISSUE: 19.07.22

RESULTS:

Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
ERQ Screener (04/07/22)	1440	0	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ Screener (05/07/22)	1440	1.5	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1.5 /<0.0005*
ERQ Screener (06/07/22)	1440	1	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S26732b
DATE OF ISSUE: 19.07.22

COMMENTS:

No asbestos fibres were detected during the analysis of any of these samples.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

Each sample supplied for analysis comprised two half membrane filters. These were combined during plasma ashing to form single samples with combined sample volumes of 1440 litres.

These samples were too dusty to be analysed as received. Following plasma ashing, the residue from each of the dusty samples was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on the entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for the samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

APPENDIX D. ASBESTOS MONITORING DATA: UNCOVERED SCREENER: ROWLEY REGUS

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27685

DATE OF ISSUE: 12.09.22

DATE ANALYSIS REQUESTED: 05.09.22

DATE ANALYSIS COMPLETED: 12.09.22

SAMPLES: Twenty airborne dust samples each supplied on gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S27685
DATE OF ISSUE: 12.09.22

RESULTS:

Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
*ERQ SCREENER (22/08/22)	1440	2.5	1200	<0.0010*	1 / <0.0010*	0 / <0.0010*	0 / <0.0010*	1.5 /<0.0010*
*ERQ SCREENER (23/08/22)	1440	1	1200	<0.0010*	0 / <0.0010*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
*ERQ SCREENER (24/08/22)	1440	4.5	1200	0.0059	0 / <0.0040*	0.5 /<0.0040*	0 / <0.0040*	4 / 0.0052
*ERQ SCREENER (25/08/22)	1440	4	1200	0.0013	0 / <0.0010*	1 / <0.0010*	0 / <0.0010*	3 / 0.0010
*ERQ ASB 1 (22/08/22)	1440	1	1200	<0.0010*	0/ <0.0010*	0 / <0.0010*	0 / <0.0010*	1 / <0.0010*
*ERQ ASB 2 (22/08/22)	1440	8	600	0.0013	1 / <0.0005*	1 / <0.0005*	0 / <0.0005*	6 / 0.0010
*ERQ ASB 3 (22/08/22)	1440	6	300	0.0010	1 / <0.0005*	2 / <0.0005*	0 / <0.0005*	3 / 0.0005
*ERQ ASB 4 (22/08/22)	1440	3	300	0.0005	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	3 / 0.0005
*ERQ ASB 1 (23/08/22)	1440	23	1200	0.0038	3 / 0.0005	2.5 /<0.0005*	0 / <0.0005*	17.5 /0.0029
*ERQ ASB 2 (23/08/22)	1440	17.5	600	0.0029	0 / <0.0005*	5.5 / 0.0009	3 / 0.0005	9 / 0.0015
*ERQ ASB 3 (23/08/22)	1440	13	600	0.0021	1 / <0.0005*	2 / <0.0005*	1 / <0.0005*	9 / 0.0015
*ERQ ASB 4 (23/08/22)	1440	3.5	300	0.0006	2.5 /<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
*ERQ ASB 1 (24/08/22)	1440	2	600	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	1 / <0.0005*
*ERQ ASB 2 (24/08/22)	1440	5	600	0.0008	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	4 / 0.0007
*ERQ ASB 3 (24/08/22)	1440	3.5	300	0.0006	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	2.5 /<0.0005*
ERQ ASB 4 (24/08/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
*ERQ ASB 1 (25/08/22)	1440	5	600	0.0008	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	5 / 0.0008
*ERQ ASB 2 (25/08/22)	1440	7	600	0.0011	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	7 / 0.0011
ERQ ASB 3 (25/08/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
ERQ ASB 4 (25/08/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27685
DATE OF ISSUE: 12.09.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of twelve of the twenty samples supplied for this analysis.

*These samples were too dusty to be analysed as received. Following plasma ashing, the residue from each sample was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on each entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for any samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27805

DATE OF ISSUE: 16.09.22

DATE ANALYSIS REQUESTED: 12.09.22

DATE ANALYSIS COMPLETED: 16.09.22

SAMPLES: Twenty airborne dust samples each supplied on gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S27805
DATE OF ISSUE: 16.09.22

RESULTS:

Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
ERQ ASB 1 (30/08/22)	1440	1	600	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 2 (30/08/22)	1440	2	600	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 3 (30/08/22)	1440	3	1200	0.0020	0 / <0.0020*	0 / <0.0020*	0 / <0.0020*	3 / 0.0020
ERQ ASB 4 (30/08/22)	1440	3	1200	0.0020	1 / <0.0020*	0 / <0.0020*	0 / <0.0020*	2 / <0.0020*
ERQ ASB 1 (31/08/22)	1440	6.5	1200	0.0021	1 / <0.0010*	2 / <0.0010*	0.5 /<0.0010*	3 / 0.0010
ERQ ASB 2 (31/08/22)	1440	4.5	1200	0.0007	0 / <0.0005*	1.5 /<0.0005*	0 / <0.0005*	3 / <0.0005*
ERQ ASB 3 (31/08/22)	1440	5	1200	0.0008	1 / <0.0005*	1 / <0.0005*	0 / <0.0005*	3 / 0.0005
ERQ ASB 4 (31/08/22)	1440	11	1200	0.0018	2 / <0.0005*	0 / <0.0005*	1 / <0.0005*	8 / 0.0013*
ERQ ASB 1 (01/09/22)	1440	4	1200	0.0007	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	4 / 0.0007
ERQ ASB 2 (01/09/22)	1440	6	600	0.0010	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	5 / 0.0008
ERQ ASB 3 (01/09/22)	1440	9	1200	0.0015	1 / <0.0005*	1 / <0.0005*	0 / <0.0005*	7 / 0.0011
ERQ ASB 4 (01/09/22)	1440	6	1200	0.0010	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	5 / 0.0008
ERQ ASB 1 (02/09/22)	1440	1	600	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 2 (02/09/22)	1440	4	1200	0.0007	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	3 / 0.0005
ERQ ASB 3 (02/09/22)	1440	2	1200	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
ERQ ASB 4 (02/09/22)	1440	3	1200	0.0005	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	3 / 0.0005
ERQ SCREENER (30/08/22)	1440	2	1200	<0.0039*	1 / <0.0039*	0 / <0.0039*	0 / <0.0039*	1 / <0.0039*
ERQ SCREENER (31/08/22)	1440	2	1200	<0.0061*	0 / <0.0061*	0 / <0.0061*	0 / <0.0061*	2 / <0.0061*
ERQ SCREENER (01/09/22)	1440	5	1200	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	5 / <0.0005*
ERQ SCREENER (02/09/22)	1440	1.5	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27805
DATE OF ISSUE: 16.09.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of twelve of the twenty samples supplied for this analysis.

All of these samples were too dusty to be analysed as received. Following plasma ashing, the residue from each sample was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on each entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for any samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27956

DATE OF ISSUE: 23.09.22

DATE ANALYSIS REQUESTED: 20.09.22

DATE ANALYSIS COMPLETED: 23.09.22

SAMPLES: Twenty airborne dust samples each supplied on gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S27956
DATE OF ISSUE: 23.09.22

RESULTS:

Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
^ERQ SCREENER (05/09/22)	1440	3	300	0.0005	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	3 / 0.0005
^ERQ SCREENER (06/09/22)	1440	1	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
^ERQ SCREENER (07/09/22)	1440	2	300	<0.0005*	1 / <0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^ERQ SCREENER (08/09/22)	1440	3.5	300	0.0006	1.5 <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
^ERQ ASB 1 (05/09/22)	1440	1	300	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^ERQ ASB 2 (05/09/22)	1440	1	600	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^ERQ ASB 3 (05/09/22)	1440	2	600	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
^ERQ ASB 4 (05/09/22)	1440	6	1200	0.0010	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	5 / 0.0008
^ERQ ASB 1 (06/09/22)	1440	7	1200	0.0011	0 / <0.0005*	3 / 0.0005	0 / <0.0005*	4 / 0.0007
^ERQ ASB 2 (06/09/22)	1440	2.5	600	<0.0005*	1.5 /<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
^ERQ ASB 3 (06/09/22)	1440	3	600	0.0005	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	3 / 0.0005
ERQ ASB 4 (06/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
^ERQ ASB 1 (07/09/22)	1440	3	300	0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
^ERQ ASB 2 (07/09/22)	1440	1	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
^ERQ ASB 3 (07/09/22)	1440	0	600	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^ERQ ASB 4 (07/09/22)	1440	0	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^ERQ ASB 1 (08/09/22)	1440	2	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*	1 / <0.0005*
^ERQ ASB 2 (08/09/22)	1440	0	600	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^ERQ ASB 3 (08/09/22)	1440	0	600	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^ERQ ASB 4 (08/09/22)	1440	1	600	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27956
DATE OF ISSUE: 23.09.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of eight of the twenty samples supplied for this analysis.

^ Samples were too dusty to be analysed as received. Following plasma ashing, the residue from each sample was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on each entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for any samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27685

DATE OF ISSUE: 12.09.22

DATE ANALYSIS REQUESTED: 05.09.22

DATE ANALYSIS COMPLETED: 12.09.22

SAMPLES: Twenty airborne dust samples each supplied on gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S27685
DATE OF ISSUE: 12.09.22

RESULTS:

Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
*ERQ SCREENER (22/08/22)	1440	2.5	1200	<0.0010*	1 / <0.0010*	0 / <0.0010*	0 / <0.0010*	1.5 /<0.0010*
*ERQ SCREENER (23/08/22)	1440	1	1200	<0.0010*	0 / <0.0010*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
*ERQ SCREENER (24/08/22)	1440	4.5	1200	0.0059	0 / <0.0040*	0.5 /<0.0040*	0 / <0.0040*	4 / 0.0052
*ERQ SCREENER (25/08/22)	1440	4	1200	0.0013	0 / <0.0010*	1 / <0.0010*	0 / <0.0010*	3 / 0.0010
*ERQ ASB 1 (22/08/22)	1440	1	1200	<0.0010*	0/ <0.0010*	0 / <0.0010*	0 / <0.0010*	1 / <0.0010*
*ERQ ASB 2 (22/08/22)	1440	8	600	0.0013	1 / <0.0005*	1 / <0.0005*	0 / <0.0005*	6 / 0.0010
*ERQ ASB 3 (22/08/22)	1440	6	300	0.0010	1 / <0.0005*	2 / <0.0005*	0 / <0.0005*	3 / 0.0005
*ERQ ASB 4 (22/08/22)	1440	3	300	0.0005	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	3 / 0.0005
*ERQ ASB 1 (23/08/22)	1440	23	1200	0.0038	3 / 0.0005	2.5 /<0.0005*	0 / <0.0005*	17.5 /0.0029
*ERQ ASB 2 (23/08/22)	1440	17.5	600	0.0029	0 / <0.0005*	5.5 / 0.0009	3 / 0.0005	9 / 0.0015
*ERQ ASB 3 (23/08/22)	1440	13	600	0.0021	1 / <0.0005*	2 / <0.0005*	1 / <0.0005*	9 / 0.0015
*ERQ ASB 4 (23/08/22)	1440	3.5	300	0.0006	2.5 /<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
*ERQ ASB 1 (24/08/22)	1440	2	600	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	1 / <0.0005*
*ERQ ASB 2 (24/08/22)	1440	5	600	0.0008	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	4 / 0.0007
*ERQ ASB 3 (24/08/22)	1440	3.5	300	0.0006	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	2.5 /<0.0005*
ERQ ASB 4 (24/08/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
*ERQ ASB 1 (25/08/22)	1440	5	600	0.0008	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	5 / 0.0008
*ERQ ASB 2 (25/08/22)	1440	7	600	0.0011	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	7 / 0.0011
ERQ ASB 3 (25/08/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
ERQ ASB 4 (25/08/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27685
DATE OF ISSUE: 12.09.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of twelve of the twenty samples supplied for this analysis.

*These samples were too dusty to be analysed as received. Following plasma ashing, the residue from each sample was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on each entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for any samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27805

DATE OF ISSUE: 16.09.22

DATE ANALYSIS REQUESTED: 12.09.22

DATE ANALYSIS COMPLETED: 16.09.22

SAMPLES: Twenty airborne dust samples each supplied on gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S27805
DATE OF ISSUE: 16.09.22

RESULTS:

Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
ERQ ASB 1 (30/08/22)	1440	1	600	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ ASB 2 (30/08/22)	1440	2	600	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 3 (30/08/22)	1440	3	1200	0.0020	0 / <0.0020*	0 / <0.0020*	0 / <0.0020*	3 / 0.0020
ERQ ASB 4 (30/08/22)	1440	3	1200	0.0020	1 / <0.0020*	0 / <0.0020*	0 / <0.0020*	2 / <0.0020*
ERQ ASB 1 (31/08/22)	1440	6.5	1200	0.0021	1 / <0.0010*	2 / <0.0010*	0.5 /<0.0010*	3 / 0.0010
ERQ ASB 2 (31/08/22)	1440	4.5	1200	0.0007	0 / <0.0005*	1.5 /<0.0005*	0 / <0.0005*	3 / <0.0005*
ERQ ASB 3 (31/08/22)	1440	5	1200	0.0008	1 / <0.0005*	1 / <0.0005*	0 / <0.0005*	3 / 0.0005
ERQ ASB 4 (31/08/22)	1440	11	1200	0.0018	2 / <0.0005*	0 / <0.0005*	1 / <0.0005*	8 / 0.0013*
ERQ ASB 1 (01/09/22)	1440	4	1200	0.0007	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	4 / 0.0007
ERQ ASB 2 (01/09/22)	1440	6	600	0.0010	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	5 / 0.0008
ERQ ASB 3 (01/09/22)	1440	9	1200	0.0015	1 / <0.0005*	1 / <0.0005*	0 / <0.0005*	7 / 0.0011
ERQ ASB 4 (01/09/22)	1440	6	1200	0.0010	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	5 / 0.0008
ERQ ASB 1 (02/09/22)	1440	1	600	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ ASB 2 (02/09/22)	1440	4	1200	0.0007	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	3 / 0.0005
ERQ ASB 3 (02/09/22)	1440	2	1200	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
ERQ ASB 4 (02/09/22)	1440	3	1200	0.0005	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	3 / 0.0005
ERQ SCREENER (30/08/22)	1440	2	1200	<0.0039*	1 / <0.0039*	0 / <0.0039*	0 / <0.0039*	1 / <0.0039*
ERQ SCREENER (31/08/22)	1440	2	1200	<0.0061*	0 / <0.0061*	0 / <0.0061*	0 / <0.0061*	2 / <0.0061*
ERQ SCREENER (01/09/22)	1440	5	1200	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	5 / <0.0005*
ERQ SCREENER (02/09/22)	1440	1.5	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27805
DATE OF ISSUE: 16.09.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of twelve of the twenty samples supplied for this analysis.

All of these samples were too dusty to be analysed as received. Following plasma ashing, the residue from each sample was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on each entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for any samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27956

DATE OF ISSUE: 23.09.22

DATE ANALYSIS REQUESTED: 20.09.22

DATE ANALYSIS COMPLETED: 23.09.22

SAMPLES: Twenty airborne dust samples each supplied on gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S27956
DATE OF ISSUE: 23.09.22

RESULTS:

Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
^ERQ SCREENER (05/09/22)	1440	3	300	0.0005	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	3 / 0.0005
^ERQ SCREENER (06/09/22)	1440	1	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
^ERQ SCREENER (07/09/22)	1440	2	300	<0.0005*	1 / <0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^ERQ SCREENER (08/09/22)	1440	3.5	300	0.0006	1.5 <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
^ERQ ASB 1 (05/09/22)	1440	1	300	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^ERQ ASB 2 (05/09/22)	1440	1	600	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^ERQ ASB 3 (05/09/22)	1440	2	600	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
^ERQ ASB 4 (05/09/22)	1440	6	1200	0.0010	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	5 / 0.0008
^ERQ ASB 1 (06/09/22)	1440	7	1200	0.0011	0 / <0.0005*	3 / 0.0005	0 / <0.0005*	4 / 0.0007
^ERQ ASB 2 (06/09/22)	1440	2.5	600	<0.0005*	1.5 /<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
^ERQ ASB 3 (06/09/22)	1440	3	600	0.0005	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	3 / 0.0005
ERQ ASB 4 (06/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
^ERQ ASB 1 (07/09/22)	1440	3	300	0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
^ERQ ASB 2 (07/09/22)	1440	1	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
^ERQ ASB 3 (07/09/22)	1440	0	600	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^ERQ ASB 4 (07/09/22)	1440	0	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^ERQ ASB 1 (08/09/22)	1440	2	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*	1 / <0.0005*
^ERQ ASB 2 (08/09/22)	1440	0	600	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^ERQ ASB 3 (08/09/22)	1440	0	600	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^ERQ ASB 4 (08/09/22)	1440	1	600	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27956
DATE OF ISSUE: 23.09.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of eight of the twenty samples supplied for this analysis.

^ Samples were too dusty to be analysed as received. Following plasma ashing, the residue from each sample was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on each entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for any samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S28156

DATE OF ISSUE: 04.10.22

DATE ANALYSIS REQUESTED: 28.09.22

DATE ANALYSIS COMPLETED: 03.10.22

SAMPLES: Twenty airborne dust samples each supplied on gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

RESULTS:

Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
ERQ Inside 1 (12/09/22)	1440	0	150	0.0005	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ Outside 2 (12/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ Outside 3 (12/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ Outside 4 (12/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ Inside 1 (13/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ Outside 2 (13/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ Outside 3 (13/09/22)	1440	1	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ Outside 4 (13/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ INT 1 (14/09/22)	1440	2	150	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ EXT 2 (14/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ EXT 3 (14/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ EXT 4 (14/09/22)	1440	2	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*
ERQ INT 1 (15/09/22)	1440	4	150	0.0007	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	4 / 0.0007
ERQ EXT 2 (15/09/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
ERQ EXT 3 (15/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ EXT 4 (15/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
^ERQ INT 1 (16/09/22)	1440	4	300	0.0007	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*	3 / 0.0005
ERQ EXT 2 (16/09/22)	1440	4.5	150	0.0007	1 / <0.0005*	1 / <0.0005*	0.5/ <0.0005*	2 / <0.0005*
ERQ EXT 3 (16/09/22)	1440	1	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 /<0.0005*	0 / <0.0005*
ERQ EXT 4 (16/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S28156
DATE OF ISSUE: 04.10.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of five of the twenty samples supplied for this analysis.

^ This sample was too dusty to be analysed as received. Following plasma ashing, the residue from each sample is made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension used to prepare a filter suitable for analysis. This dilution factor is taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on each entire original sample. This aspect of the work is outside the scope of our UKAS accreditation.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for any samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S28231

DATE OF ISSUE: 06.10.22

DATE ANALYSIS REQUESTED: 03.10.22

DATE ANALYSIS COMPLETED: 05.10.22

SAMPLES: Sixteen airborne dust samples each supplied on a gridded MCE membrane filter.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S28231
DATE OF ISSUE: 06.10.22

RESULTS:

Client Ref: PO – RR151

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
^ERQ SHED 1 (20/09/22)	1440	3	300	0.0005	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
ERQ SHED 2 (20/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ SHED 3 (20/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ SHED 4 (20/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ SHED 1 (21/09/22)	1440	3.5	150	0.0006	2 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1.5 /<0.0005*
ERQ SHED 2 (21/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ SHED 3 (21/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ SHED 4 (21/09/22)	1440	0.5	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0.5 /<0.0005*
ERQ SHED 1 (22/09/22)	1440	2	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ SHED 2 (22/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*
ERQ SHED 3 (22/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ERQ SHED 4 (22/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ SHED 1 (23/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ SHED 2 (23/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ SHED 3 (23/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ERQ SHED 4 (23/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S28231
DATE OF ISSUE: 06.10.22

COMMENTS:

Small numbers of amphibole asbestos fibres were detected during the analysis of three of the sixteen samples supplied for this analysis.

^ This sample was too dusty to be analysed as received. Following plasma ashing, the residue from each sample is made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension used to prepare a filter suitable for analysis. This dilution factor is taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on each entire original sample. This aspect of the work is outside the scope of our UKAS accreditation. Any organic fibres present on the original samples would be destroyed during plasma ashing.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for any samples that required dilution.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

APPENDIX E. ASBESTOS MONITORING DATA: UNCOVERED SCREENER: MAW GREEN

Maw Green

Asbestos Monitoring Results

Date	Sample Name	Sample Location/Activity	Asbestos Analyst	Volume (l)	Number of Pumps Used	Maximum Concentration of Asbestos Fibres - Amphibole (f/ml)	Maximum Concentration of Asbestos Fibres - Chrysotile (f/r	Detection Limit (f/ml)
15/08/2022	ASB MG	Reception tipping	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
16/08/2022	ASB MG	Reception tipping	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
17/08/2022	ASB MG	Reception tipping	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
18/08/2022	ASB MG	Backgorund Monitoring - no activity on site	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
19/08/2022	ASB MG	Reception tipping	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
22/08/2022	ASB MG	Reception tipping	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
23/08/2022	ASB MG	Reception tipping	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
24/08/2022	ASB MG	Reception tipping	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
25/08/2022	ASB MG	Backgorund Monitoring - no activity on site	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
26/08/2022	ASB MG	Backgorund Monitoring - no activity on site	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
30/08/2022	ASB MG	Backgorund Monitoring - no activity on site	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
31/08/2022	ASB MG	Reception tipping	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
01/09/2022	ASB MG	Reception tipping	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
02/09/2022	ASB MG	Reception tipping	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
05/09/2022	ASB MG	Reception tipping	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
06/09/2022	ASB MG	Reception tipping	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
07/09/2022	MGSCR-1	Screening	IOM	1440	2	1 / <0.0005	0 / <0.0005	0.0005
07/09/2022	MGSCR-2	Screening	IOM	1440	2	1 / <0.0005	0 / <0.0005	0.0005
07/09/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
08/09/2022	MGSCR-1	Screening	IOM	1440	2	3.5 / 0.0006	0 / <0.0005	0.0005
08/09/2022	MGSCR-2	Screening	IOM	1440	2	2 / <0.0005	0 / <0.0005	0.0005
08/09/2022	MGSCR-3	Screening	IOM	1440	2	1 / <0.0005	0 / <0.0005	0.0005
09/09/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
09/09/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
09/09/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
12/09/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
12/09/2022	MGSCR-2	Screening	IOM	1440	2	1 / <0.0005	0 / <0.0005	0.0005
12/09/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
13/09/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
13/09/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
13/09/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
13/09/2022	MG PS-1	Picking Station	IOM	1440	2	0 / <0.0005	1 / <0.0005	0.0005
14/09/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
14/09/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
14/09/2022	MGSCR-3	Screening	IOM	1440	2	1 / <0.0005	0 / <0.0005	0.0005
15/09/2022	MGSCR-1	Screening	IOM	1440	2	1 / <0.0005	0 / <0.0005	0.0005
15/09/2022	MGSCR-2	Screening	IOM	1440	2	1 / <0.0005	0 / <0.0005	0.0005
15/09/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
16/09/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
16/09/2022	MGSCR-2	Screening	IOM	1440	2	1 / <0.0005	0 / <0.0005	0.0005
16/09/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
20/09/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
20/09/2022	MGSCR-2	Screening	IOM	1440	2	1 / <0.0005	0 / <0.0005	0.0005
20/09/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
21/09/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
21/09/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
21/09/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
22/09/2022	MGSCR-1	Screening	IOM	1440	2	1 / <0.0005	0 / <0.0005	0.0005
22/09/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
22/09/2022	MGSCR-3	Screening	IOM	1440	2	1 / <0.0005	0 / <0.0005	0.0005
23/09/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
23/09/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
23/09/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
26/09/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
26/09/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
26/09/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
27/09/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
27/09/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
27/09/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
28/09/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
28/09/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
28/09/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
29/09/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
29/09/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
29/09/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
30/09/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
30/09/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
30/09/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
03/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
03/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
03/10/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
04/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
04/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
04/10/2022	MGSCR-3	Screening	IOM	1440	2	3 / 0.0005	0 / <0.0005	0.0005
06/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005

Maw Green

Asbestos Monitoring Results

Date	Sample Name	Sample Location/Activity	Asbestos Analyst	Volume (l)	Number of Pumps Used	Maximum Concentration of Asbestos Fibres - Amphibole (f/ml)	Maximum Concentration of Asbestos Fibres - Chrysotile (f/r	Detection Limit (f/ml)
06/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
06/10/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
06/10/2022	MG PS -1	Picking Station	IOM	1440	2	2 / <0.0005	0 / <0.0005	0.0005
07/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
07/10/2022	MGSCR-2	Screening	IOM	1440	2	2 / <0.0005	0 / <0.0005	0.0005
07/10/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
11/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
11/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
11/10/2022	MGSCR-3	Screening	IOM	1440	2	1 / <0.0005	0 / <0.0005	0.0005
12/10/2022	MGSCR-1	Screening	IOM	1440	2	1 / <0.0005	0 / <0.0005	0.0005
12/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
12/10/2022	MGSCR-3	Screening	IOM	1440	2	2 / <0.0005	1 / <0.0005	0.0005
13/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
13/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
13/10/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
13/10/2022	MG PS-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
14/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
14/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	1 / <0.0005	0.0005
14/10/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
17/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
17/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
17/10/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
18/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
18/10/2022	MGSCR-2	Screening	IOM	1440	2	1 / <0.0005	0 / <0.0005	0.0005
18/10/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
19/10/2022	MGSCR-1	Screening	IOM	1440	2	1 / <0.0005	0 / <0.0005	0.0005
19/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
19/10/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
20/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
20/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
20/10/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
21/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
21/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
21/10/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
24/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
24/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
24/10/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
25/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
25/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
25/10/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
26/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
26/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
26/10/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
27/10/2022	MG Cont	Control Test	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
28/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
28/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
28/10/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
31/10/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
31/10/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
31/10/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
01/11/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
01/11/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
01/11/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
02/11/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
02/11/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
02/11/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
03/11/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
03/11/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
03/11/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	1 / <0.0005	0.0005
04/11/2022	MGSCR-1	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
04/11/2022	MGSCR-2	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005
04/11/2022	MGSCR-3	Screening	IOM	1440	2	0 / <0.0005	0 / <0.0005	0.0005

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27510

DATE OF ISSUE: 31.08.22

DATE ANALYSIS REQUESTED: 24.08.22

DATE ANALYSIS COMPLETED: 30.08.22

SAMPLES: Five airborne dust samples each supplied as two half gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each pair of half membrane filters is ashed in a low temperature plasma asher. The combined residue from each pair is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S27510
DATE OF ISSUE: 31.08.22

RESULTS:

Client Ref: PO – MG184

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
ASB MG (15/08/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ASB MG (16/08/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ASB MG (17/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ASB MG (18/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ASB MG (19/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27510
DATE OF ISSUE: 31.08.22

COMMENTS:

No asbestos fibres were detected during the analysis of any of these samples.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

Each sample supplied for analysis comprised two half membrane filters. These were combined during plasma ashing to form single samples with combined sample volumes of 1440 litres.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27631

DATE OF ISSUE: 05.09.22

DATE ANALYSIS REQUESTED: 01.09.22

DATE ANALYSIS COMPLETED: 05.09.22

SAMPLES: Five airborne dust samples each supplied as two half gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each pair of half membrane filters is ashed in a low temperature plasma asher. The combined residue from each pair is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

UKAS TESTING
0374

CONTRACT NO: S27631
DATE OF ISSUE: 05.09.22

RESULTS:

Client Ref: PO – MG184

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
ASB MG (22/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ASB MG (23/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ASB MG (24/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ASB MG (25/08/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ASB MG (26/08/22)	1440	2.5	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	2.5 /<0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27631
DATE OF ISSUE: 05.09.22

COMMENTS:

No asbestos fibres were detected during the analysis of any of these samples.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

Each sample supplied for analysis comprised two half membrane filters. These were combined during plasma ashing to form single samples with combined sample volumes of 1440 litres.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27729

DATE OF ISSUE: 13.09.22

DATE ANALYSIS REQUESTED: 07.09.22

DATE ANALYSIS COMPLETED: 13.09.22

SAMPLES: Four airborne dust samples each supplied as two half gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each pair of half membrane filters is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S27729
DATE OF ISSUE: 13.09.22

RESULTS:

Client Ref: PO – MG184

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
ASB MG (30/08/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
ASB MG (31/08/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ASB MG (01/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*
ASB MG (02/09/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27729
DATE OF ISSUE: 13.09.22

COMMENTS:

No asbestos fibres were detected during the analysis of any of these samples.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

Each sample supplied for analysis comprised two half membrane filters. These were combined during plasma ashing to form single samples with combined sample volumes of 1440 litres.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27808

DATE OF ISSUE: 19.09.22

DATE ANALYSIS REQUESTED: 12.09.22

DATE ANALYSIS COMPLETED: 16.09.22

SAMPLES: Eleven airborne dust samples each supplied on whole gridded or as two half gridded MCE membrane filters.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S27805
DATE OF ISSUE: 19.09.22

RESULTS:

Client Ref: PO – MG184

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
ASB MG (05/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
ASB MG (06/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
(1)MG SCR-01 (07/09/22)	1440	1	300	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02 (07/09/22)	1440	1	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
(1)MG SCR-03 (07/09/22)	1440	1	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
(1)MG SCR-01 (08/09/22)	1440	6.5	300	0.0011	3.5 / 0.0006	0 / <0.0005*	3 / <0.0005	0 / <0.0005*
MG SCR-02 (08/09/22)	1440	3	150	0.0005	2 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
(1)MG SCR-03 (08/09/22)	1440	2	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-01 (09/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02 (09/09/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
MG SCR-03 (09/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27808
DATE OF ISSUE: 19.09.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of five of the eleven samples supplied for this analysis.

(1)These samples were too dusty to be analysed as received. Following plasma ashing, the residue from each sample was made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension was used to prepare a filter suitable for analysis. This dilution factor was taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on each entire original sample. This aspect of the work was outside the scope of our UKAS accreditation.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for any samples that required dilution.

Sample numbers ASB MG 05&06/09/22 supplied for analysis comprised two half membrane filters. These were combined during plasma ashing to form single samples with combined sample volumes of 1440 litres.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: Steve Clark
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S27958

DATE OF ISSUE: 27.09.22

DATE ANALYSIS REQUESTED: 20.09.22

DATE ANALYSIS COMPLETED: 26.09.22

SAMPLES: Sixteen airborne dust samples each supplied on a gridded MCE membrane filter.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org
Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org
IOM CONSULTING LIMITED, registered in Scotland No. SC205670

CONTRACT NO: S27958
DATE OF ISSUE: 27.09.22

RESULTS:

Client Ref: PO – MG184

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
MG SCR-01(12/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(12/09/22)	1440	1	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(12/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-01(13/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(13/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(13/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG PS-01(13/09/22)	1440	3	150	0.0005	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	2 / <0.0005*
MG SCR-01(14/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(14/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-03(14/09/22)	1440	1	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-01(15/09/22)	1440	1	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(15/09/22)	1440	2	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-03(15/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-01(16/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(16/09/22)	1440	3	150	0.0005	1 / <0.0005*	0 / <0.0005*	1 / <0.0005*	1 / <0.0005*
MG SCR-03(16/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S27958
DATE OF ISSUE: 27.09.22

COMMENTS:

Single asbestos fibres were detected during the analysis of six of the sixteen samples supplied for this analysis.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: Steve Clark
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S28093

DATE OF ISSUE: 28.09.22

DATE ANALYSIS REQUESTED: 26.09.22

DATE ANALYSIS COMPLETED: 28.09.22

SAMPLES: Twelve airborne dust samples each supplied on a gridded MCE membrane filter.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S28093
DATE OF ISSUE: 28.09.22

RESULTS:

Client Ref: PO – MG184

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
MG SCR-01(20/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(20/09/22)	1440	2	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*
MG SCR-03(20/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-01(21/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(21/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-03(21/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-01(22/09/22)	1440	1	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(22/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(22/09/22)	1440	2	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-01(23/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-02(23/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(23/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S28093
DATE OF ISSUE: 28.09.22

COMMENTS:

Single asbestos fibres were detected during the analysis of three of the twelve samples supplied for this analysis.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S28297

DATE OF ISSUE: 11.10.22

DATE ANALYSIS REQUESTED: 05.10.22

DATE ANALYSIS COMPLETED: 10.10.22

SAMPLES: Fifteen airborne dust samples each supplied on a gridded MCE membrane filter.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S28297
DATE OF ISSUE: 11.10.22

RESULTS:

Client Ref: PO – MG184

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
MG SCR-01(26/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(26/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(26/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-01(27/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-02(27/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(27/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-01(28/09/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-02(28/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(28/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-01(29/09/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
MG SCR-02(29/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(29/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-01(30/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(30/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(30/09/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S28297
DATE OF ISSUE: 11.10.22

COMMENTS:

No asbestos fibres were detected during the analysis of any of the samples supplied for this analysis.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S28333

DATE OF ISSUE: 18.10.22

DATE ANALYSIS REQUESTED: 10.10.22

DATE ANALYSIS COMPLETED: 17.10.22

SAMPLES: Thirteen airborne dust samples each supplied on a gridded MCE membrane filter.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S28333
DATE OF ISSUE: 18.10.22

RESULTS:

Client Ref: PO – MG184

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
MG SCR-01(03/10/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
MG SCR-02(03/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(03/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-01(04/10/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-02(04/10/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
MG SCR-03(04/10/22)	1440	3	150	0.0005	3 / 0.0005	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-01(06/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(06/10/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*
MG SCR-03(06/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG PS-01(06/10/22)	1440	2	150	<0.0005*	2 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^MG SCR-01(07/10/22)	1440	0	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^MG SCR-02(07/10/22)	1440	3	300	0.0005	2 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-03(07/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S28333
DATE OF ISSUE: 18.10.22

COMMENTS:

Small numbers of amphibole asbestos fibres were detected during the analysis of three of the thirteen samples supplied for this analysis.

^ These samples were too dusty to be analysed as received. Following plasma ashing, the residue from each sample is made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension used to prepare a filter suitable for analysis. This dilution factor is taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on each entire original sample. This aspect of the work is outside the scope of our UKAS accreditation. Any organic fibres present on the original samples would be destroyed during plasma ashing.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for any samples that required dilution.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S28532

DATE OF ISSUE: 24.10.22

DATE ANALYSIS REQUESTED: 18.10.22

DATE ANALYSIS COMPLETED: 24.10.22

SAMPLES: Thirteen airborne dust samples each supplied on a gridded MCE membrane filter.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S28532
DATE OF ISSUE: 24.10.22

RESULTS:

Client Ref: PO – MG184

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
MG SCR-01(11/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(11/10/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
MG SCR-03(11/10/22)	1440	2	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
^MG SCR-01(12/10/22)	1440	3	300	0.0005	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
^MG SCR-02(12/10/22)	1440	1	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*
^MG SCR-03(12/10/22)	1440	5	300	0.0008	2 / <0.0005*	1 / <0.0005*	0 / <0.0005*	2 / <0.0005*
MG SCR-01(13/10/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*
MG SCR-02(13/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(13/10/22)	1440	2.5	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	2.5 /<0.0005*	0 / <0.0005*
MG PS-01(13/10/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*
MG SCR-01(14/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(14/10/22)	1440	1	150	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(14/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S28532
DATE OF ISSUE: 24.10.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of four of the thirteen samples supplied for this analysis.

^ These samples were too dusty to be analysed as received. Following plasma ashing, the residue from each sample is made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension used to prepare a filter suitable for analysis. This dilution factor is taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on each entire original sample. This aspect of the work is outside the scope of our UKAS accreditation. Any organic fibres present on the original samples would be destroyed during plasma ashing.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for any samples that required dilution.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S28722

DATE OF ISSUE: 29.10.22

DATE ANALYSIS REQUESTED: 26.10.22

DATE ANALYSIS COMPLETED: 29.10.22

SAMPLES: Fifteen airborne dust samples each supplied on a gridded MCE membrane filter.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S28722
DATE OF ISSUE: 29.10.22

RESULTS:

Client Ref: PO – MG184

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
MG SCR-01(17/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(17/10/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*
MG SCR-03(17/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^MG SCR-01(18/10/22)	1440	1	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-02(18/10/22)	1440	1	150	<0.0005*	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^MG SCR-03(18/10/22)	1440	0	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
^MG SCR-01(19/10/22)	1440	4	600	0.0007	1 / <0.0005*	0 / <0.0005*	0 / <0.0005*	3 / 0.0005
^MG SCR-02(19/10/22)	1440	0	300	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(19/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-01(20/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(20/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(20/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-01(21/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(21/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(21/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S28722
DATE OF ISSUE: 29.10.22

COMMENTS:

Small numbers of asbestos fibres were detected during the analysis of two of the fifteen samples supplied for this analysis.

^ These samples were too dusty to be analysed as received. Following plasma ashing, the residue from each sample is made up in solution using a measured amount of filtered distilled water and an aliquot of the resultant suspension used to prepare a filter suitable for analysis. This dilution factor is taken into account when calculating the results therefore the fibre concentrations reported above reflect the level of fibres on each entire original sample. This aspect of the work is outside the scope of our UKAS accreditation. Any organic fibres present on the original samples would be destroyed during plasma ashing.

At the client's request, a greater number of screen areas than that used for our standard analysis were analysed in order to achieve a lower limit of detection for any samples that required dilution.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY: .....
S Clark
Head of Mineralogy

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S28877

DATE OF ISSUE: 08.11.22

DATE ANALYSIS REQUESTED: 02.11.22

DATE ANALYSIS COMPLETED: 07.11.22

SAMPLES: Thirteen airborne dust samples each supplied on a gridded MCE membrane filter.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S28877
DATE OF ISSUE: 08.11.22

RESULTS:

Client Ref: PO – MG184

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
MG SCR-01(24/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(24/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(24/10/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-01(25/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(25/10/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-03(25/10/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-01(26/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(26/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(26/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG Cont(27/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-01(28/10/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-02(28/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(28/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S28877
DATE OF ISSUE: 08.11.22

COMMENTS:

No asbestos fibres were detected during the analysis of any of the samples supplied for this analysis.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

K. Parsons-Hewes

AUTHORISED BY: ……

K Parsons-Hewes
Senior Laboratory Analyst

working for a healthy and sustainable world

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: Provectus Soils Management
Regent House
Bath Avenue
Wolverhampton
WV1 4EG

CONTRACT NO: S29003

DATE OF ISSUE: 15.11.22

DATE ANALYSIS REQUESTED: 08.11.22

DATE ANALYSIS COMPLETED: 15.11.22

SAMPLES: Fifteen airborne dust samples each supplied on a gridded MCE membrane filter.

ANALYSIS REQUESTED: Fibre Counting using Scanning Electron Microscopy (SEM) with fibre identification by Energy Dispersive X-ray Spectroscopy (EDXS)

METHOD:

Each membrane filter is ashed in a low temperature plasma asher. The residue is recovered using filtered, distilled water and filtered through a 25mm, 0.4µm pore size polycarbonate filter. A portion of each polycarbonate filter is excised and mounted on a 13mm aluminium stub, coated with gold and examined by SEM. Each filter is searched systematically at 2000X magnification until an area of 1mm^2 has been examined or 50 whole fibres found. All respirable fibres (aspect ratio >3:1, length >5µm and diameter <3µm and including fibres in contact with particles >3µm diameter) detected are analysed by EDXS and identified as closely as possible, by comparing morphology and composition with standard reference materials. Fibre counting rules based on those of ISO14966:2019 were used.

The method used for analysis is documented in IOM instruction manual No.1 and is based on **International Standards Organisation (2019), International Standard 14966, Ambient Air: Determination of numerical concentration of inorganic fibrous particles - Scanning electron microscopy method.**

www.iom-world.org

Registered Address: Research Avenue North, Riccarton, Edinburgh, EH14 4AP, United Kingdom
Tel: 0131 449 8000 Fax: 0131 449 8084 Email: iom@iom-world.org

IOM CONSULTING LIMITED, registered in Scotland No. SC205670

UKAS TESTING
0374

CONTRACT NO: S29003
DATE OF ISSUE: 15.11.22

RESULTS:

Client Ref: PO – MG184

Sample No.	Volume (l)	(1) No. of Resp. Fibres Found	(1) No. of Fields Searched	Total Fibres *Fibre Conc^{n} (fml^{-1})*	AMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	CMX Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	MMMF *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*	NAM Fibre *No. of Resp. Fibres/ Fibre Conc^{n} (fml^{-1})*
MG SCR-01(31/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(31/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(31/10/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-01(01/11/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(01/11/22)	1440	2	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	2 / <0.0005*
MG SCR-03(01/11/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-01(02/11/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(02/11/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-03(02/11/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-01(03/11/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(03/11/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-03(03/11/22)	1440	2	150	<0.0005*	0 / <0.0005*	1 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-01(04/11/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*
MG SCR-02(04/11/22)	1440	1	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	1 / <0.0005*
MG SCR-03(04/11/22)	1440	0	150	<0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*	0 / <0.0005*

AMX-Amphibole Asbestos **CMX-**Chrysotile Asbestos **MMMF-**Machine Made Mineral Fibres **NAM-**Non Asbestos Mineral

*** DETECTION LIMIT**

When no fibres of a given type are detected, the fibre concentration can be reported as less than the concentration equivalent to three fibres (the one sided upper 95% confidence limit of the Poisson distribution). Therefore, when 0, 1 or 2 fibres are detected, 2.99 is used in the calculation of fibre concentrations. It expresses the 95% confidence detection limit for airborne fibre concentrations. When a volume of 1440 litres is used the 95% confidence limit is 0.0005 fml^{-1} for the number of fields searched.

CONTRACT NO: S29003
DATE OF ISSUE: 15.11.22

COMMENTS:

A single chrysotile asbestos fibre was detected on sample MG SCR-03(03/11/22). No asbestos fibres were detected during the analysis of any of the other samples.

Any organic fibres present on the original samples would be destroyed during plasma ashing.

(1) UKAS accreditation for this work is limited to results obtained directly from the analysis. Calculated results based on sampling information provided by the client are out with the scope of this accreditation.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

IOM Consulting cannot accept responsibility for samples sent for analysis that have been incorrectly collected or despatched.

AUTHORISED BY:

S Clark
Head of Mineralogy

STC – WI 011 – PROCESSING OF SOILS WITH VISIBLE ASBESTOS DEBRIS

DRAFT FOR PERMIT APPLICATION

Author:	Jon Owens - STCM	**Approved By:**	Steve Langford - MD
Distribution:	Z/QMS/Work Instructions - STC		

Document Changes

Revision No:	Summary of Changes	Date
3	Changes for permit variation application to increase storage and screen soils prior to hand picking.	08.04.19

Definitions and Abbreviations

ACM – Asbestos Containing Materials
NNLW – Notifiable non-licensed works

Introduction

This procedure relates to the measures to be undertaken for the removal of visible ACM fragments from soil received at the site. The purpose of the removal of asbestos debris would be to allow further treatment of soils by biotreatment or to stockpile processed soils for disposal in the non-hazardous void.

Principle of Operation

The general principle of the operation is to receive and treat soils at the site with visible asbestos fragments that would be classified as hazardous waste under Environment Agency guidance WM3.

The aim of the processing works would be to remove visible fragments from the soil to facilitate direct reuse in the adjacent non-hazardous void or for further biotreatment to reduce hydrocarbons to concentrations suitable for reuse in the adjacent non-hazardous void.

Pre-acceptance checks and analysis of the received soil and processed soil will ensure that no unsuitable soil is received at the facility either for treatment, or disposal in the non-hazardous void. Air monitoring during the soil processing works will ensure the protection of site workers and surrounding receptors.

The works would be notified to the HSE as notifiable non-licensed works (NNLW) on the basis that ACMs are potentially broken/degraded and require effective management to ensure the protection of workers and surrounding receptors. No licensed works are proposed for treating soils at the site.

Procedure

Analysis for soils impacted with visible asbestos fragments would be reviewed prior to any offer to accept at the Edwin Richards Quarry. Waste acceptance limits for asbestos fibres in soils would be 0.1% for serpentine asbestos (chrysotile) and 0.01% for amphibole asbestos types. Site visits will be undertaken and any supplementary analysis undertaken to comply with STC-

WI 002 and STC – WI 003 to ensure that soils are suitable for treatment using the available methodology at the site.

Should any non-compliant wastes be encountered the standard rejection procedure should be implemented. In the event that the works to reject waste would constitute licensed asbestos works in accordance with HSE guidance, the standard notification would be made and works would cease until the non-compliant waste is removed.

Soils would be received at the site and placed on to the external asbestos storage area. Soils will be visually inspected to ensure non-compliant materials (e.g. insulation products) are not present, sampled and covered with a tarpaulin to ensure control of any potential emissions during the reception analysis phase. The reception analysis will be reviewed and only soils that are deemed to have no potential to generate asbestos fibres above the detection limit of <0.01f/ml will be formally accepted. Soils that have the potential to generate airborne asbestos fibres, i.e. they exceed the asbestos fibre acceptance criteria or contain non-compliant products (e.g lagging, asbestos insulation board etc) will be rejected and removed from site.

Stockpiled soils will be transferred into the asbestos building by dumper and loaded onto a three way screen with a fines, mid range and oversize separation system. The mid range fraction will be loaded directly onto the picking station with asbestos operatives removing visible fragments and double bagging prior to storage in a locked skip. The fines and oversize will be visually inspected prior to storage in the internal storage bays for validation testing. If visually identifiable asbestos is present in the fines or overzsize fraction these will be loaded onto the picking station for picking prior to validation testing.

The locked asbestos skip will be removed from site when full and taken to a hazardous landfill for disposal.

All personnel will enter and leave the building via the designated decontamination facility.

Plant/Equipment to be Used:

- Tarpaulins
- Asbestos air monitoring equipment
- 360 excavator
- Front loading dumper
- 3 way screener
- Picking station
- Decontamination Unit

Plant/Operator Certification Required:

- CPCS/CSCS Cards
- Asbestos Awareness

Summary of Known or Suspected Hazards (either construction, physical or contamination hazards identified):

- The stored soil from a variety of sources will contain low levels of ACM debris and asbestos fibre concentrations lower than the waste acceptance limits previously described. The potential for airborne asbestos fibres being generated is considered extremely low.
- The potential routes of asbestos exposure are by inhalation of dust.
- Potential exposure to plant exhaust gases from undertaking the works inside a building are mitigated by having large entrance and exit openings that allow continuous ventilation of the building

- Construction hazards (slips, trips and falls on uneven ground, machinery)
- Physical hazards associated with moving equipment & machinery.

General Description of Work

- Soils received will be covered with tarpaulins whilst awaiting reception analysis
- Reception analysis to be reviewed prior to any transfer of soil into the asbestos processing building
- All screening and hand picking works to be undertaken with background air monitoring to confirm if asbestos fibres are being generated
- Enter clean end of decontamination unit and pick up disposable overalls/overshoes (if used) and disposable RPE if used
- Don PPE and where required RPE (as specified) prior to entering designated area of site via dirty exit of decontamination unit
- Excavate stockpiled soils in a controlled manner with handpicking of debris into waste asbestos sack directly where possible. Where required, use the surfactant spray if any asbestiform materials appear dry/friable. Place double bagged ACM debris in the dedicated lockable skip at the end of each work period.
- Wipe all tools, etc. with a dampened cloth.
- Place used damp rags in a waste sack and seal.
- At the edge of the work area, clean the outside of all waste sacks and seal.
- Wipe off boots and face mask (if worn) with a cloth and bucket provided.
- Disposable overalls (turned inside out), gloves and where required, any used disposable respirators in asbestos waste bag. Seal the clear bag.
- Once soils have nil visible asbestos and are chemically approved as suitable for further treatment or reuse, remove from the building as required
- Ambient asbestos monitoring in air to be undertaken daily during screening/hand picking works. Works must cease to allow damping down measures to be implemented if fibre concentrations exceed **0.01f/cm3**.

Site Manager to conduct a visual inspection of work areas and transit routes. If a satisfactory level of cleanliness has been achieved they shall complete an interim sign off in the site diary.

Personal Protection

PPE:

- Hi-Visibility vest/jacket
- Hard Hat
- Protective boots (steel toecap/midsole)
- Disposable overalls: Type 5 (BS EN ISO 13982-1)
- Disposable overshoes where required
- Disposable gloves

RPE:

- disposable respirator to standards EN149 (type FFP3) or EN1827 (type
- FMP3);
- half or full mask respirator (to standard EN140) with P3 filter; or semi-disposable respirator (to EN405) with P3 filter. Masks would be positive or

negative pressure depending on face fit requirements. Should negative pressure masks be used then a break every hour of continuous use should be undertaken.

Also:

- Surfactant spay (e.g. Idenden Dampstrip Asbestos Penetrant 30-330 or similar)
- First Aid Kit
- Mobile Phone

Emergency Procedures

Personnel injury/overexposure:

Remove to fresh air and provide first aid procedures as required; Contact Emergency services if accident/injuries warrants; Decontaminate personnel if required (remove overalls and PPE, wash hands and forearms).

Fire or Explosion:

Evacuate the work area and summon local Fire Brigade. Do not attempt to fight fire. Remain upwind of smoke in safe area. Follow existing Site Procedures.

Decontamination Procedure

Personnel: 1) Remove disposable contaminated clothing and discard in the designated waste container.
2) Wash hands/face/forearms prior to leaving decontamination unit.

Site Rules

- **NO SMOKING**, No eating, drinking, or chewing of gum.
- Wear protective equipment specified above.
- Utilise good personal hygiene habits – wash hands and exposed skin with soap and water prior to leaving site.
- Remove and dispose of contaminated clothing as described above before leaving the working area.

The safe working procedures detailed in this method statement must be adhered to.

DECLARATION

I have read, understood and will comply with the requirements of this Safety Method Statement			
Name	Work Position	Signature	Date

Technology | Engineering | Consulting

BYRNELOOBY

AN ayesa COMPANY

www.byrnelooby.com
www.ayesa.com/en/

Email: info@byrnelooby.com