

**SITE PROTECTION AND MONITORING PROGRAMME
FOR CHADWICH LANE QUARRY LANDFILL**

NOVEMBER 2022

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Summary

This document represents the design Site Protection and Monitoring Programme (SPMP) for Branton Lane South landfill site submitted to the Environment Agency as part of the Environmental Permit Application (the "Permit") authorising the operation of Chadwich Lane Quarry landfill (inert), (the "waste facility").

An Environmental Monitoring Programme for the site is presented in Section 3 and Appendices B to E. The results of routine monitoring will be collated into a Monitoring Report and sent to the Agency on the 31st of January each year. The Monitoring Report will also contain recommendations for changes to the Site Protection and Monitoring Programme (if any) to be formally agreed, in writing, by the Agency. The format of the Monitoring Report is given in Appendix E3.

The testing, inspection and maintenance programme for pollution prevention infrastructure at the site (the Infrastructure Monitoring Programme) has been designed as detailed in Section 4.4 and Appendix E2.

1.0 Introduction

The application for the Chadwich Lane Quarry landfill will be submitted to the Environment Agency in November 2022. All of the risk assessments including environmental management monitoring plans and detailed hydrogeological and landfill gas risk assessments are submitted with the application including the monitoring schedules.

The application was prepared by Enviroarm Ltd.

1.1 Site Location

The site is south-western fringe of Birmingham at National Grid reference SO 395448 276819 is the centre of the site and the site entrance is SO 396373 276818 see Figure 1 and Drawing ESID 1.

1.2 Details of Installation

The site is to be operated as an inert landfill site based on the information supplied in the Environmental Setting, Site Design Report and the Hydrogeological Risk Assessment, with the site located upon bedrock geology of the Wildmoor Sandstone of the Triassic Period.

The site investigations have confirmed that the site will operate with an engineered geological barrier and will have an unsaturated zone beneath the geological barrier.

2.0 Objectives

The objectives of this report are:

To design a monitoring programme for the installation to:

- ◆ Monitor the effectiveness of pollution prevention infrastructure and provide early warning of any release of polluting substances to ground or groundwater.
- ◆ To collect data on the condition of the ground at the installation to assist in the permit surrender process.
- ◆ To provide defensive monitoring at site boundaries for pollutant migration onto the site of the installation.
- ◆ To monitor the movement of pollutants in the ground and / or groundwater beneath the site of the installation.

To review and if necessary amend the inspection, testing and maintenance programme for pollution prevention infrastructure at the installation to ensure their continued integrity.

3.0 Site Investigation Programme

3.1 Investigation and Sampling Strategy

3.1.1 General

The initial site investigation was carried out as part of the Hydrogeological Risk Assessment and are on-going with additional data which will be forwarded to the Environment Agency prior to commencement of the operations.

The project team comprised of:

Chadwich Lane Quarry Limited	- Client Operator
Enviroarm Ltd	- Consultant/Agent, CQA Engineer and Monitoring
Enviroarm Limited	- Hydrogeological Consultants
PJ Hirons	- Specialist Drilling Contractor

The works involved the drilling for five boreholes to allow for groundwater to be sampled from the groundwater and to determine the depth of unsaturated zone and use of a natural geological barrier and as an engineered geological barrier and to undertake background site gas monitoring and to assess gas potential.

The boreholes were installed under full time Construction Quality Assurance Supervision and samples taken and submitted to a suitable laboratory for the groundwater testing and to report on the findings.

3.1.2 Constraints on Investigations

No underground tanks or sub surface infra structure has been identified in professional environmental risk assessments and detailed knowledge of the site history and the comprehensive Site Report, with the exception of the septic tank. Accordingly the seven permanent boreholes used for the Hydrogeological Risk Assessment are therefore deemed satisfactory for the remainder of the landfill operations.

No preferential pathways have been constructed as the boreholes were installed with adequate bentonite grout sealing to prevent potential surface pollution entering into the sub surface soils and groundwater, and no borehole was drilled into the former workings or sub surface structures.

3.1.3 Soil Investigation and Sampling Techniques and Protocols

Six boreholes were originally drilled but seven have been used as permanent monitoring points. The drilling was undertaken in accordance with BS5930:1999

Soil samples have been collected from the adjoining site and groundwater samples have been collected on a quarterly basis. All material samples were taken in accordance BS: 5930: 1999 Code of Practice for Site Investigations. All samples will be given a unique reference and placed in sealed sample bags before removal to the approved analysis laboratory and for specific testing by Enviroarm Limited personnel.

All the boreholes were logged.

3.1.4 Groundwater Investigation and Sampling Techniques and Protocols

Rotary drilling was undertaken using a purpose built drilling rig utilising a suitable end bit so that satisfactory cuttings were recovered.

Groundwater Observations

Groundwater when encountered was measured and recorded in the following manner:

- a. When water is first encountered the depth from ground level to the point of entry shall be recorded, together with the casing depth, and boring observations suspended for not more than 20 minutes, to allow the free static water level to develop. This shall be recorded, together with the time taken for this rise in water level to occur. If at the end of the period of 20 minutes the water is still rising, this shall be recorded together with the depth to water below ground level. Boring shall then be continued.
- b. An exception to the above is where groundwater occurs as a slow seepage in the boring. In this case, the point of entry of the seepage shall be recorded and boring continued.
- c. The same procedure shall be forwarded when further water entries are observed.
- d. Water levels shall be recorded at the beginning and end of each shift.
- e. On each occasion, when groundwater is recorded, the depth of the boring, the length of casing inserted in the boring and the time o'clock shall also be recorded.
- f. The Engineer may require boring to be left open for 24 hours after completion and the water level recorded at the end of this time.

Site Records

The Contractor has a record of all site operations recorded on a daily basis as indicated in the General Specification. The Daily Journal for the operations included in this particular portion of the specification shall include the following items.

Groundwater monitoring

It is essential to monitor groundwater from the boreholes for quality to assess the integrity of the performance of the site and to ensure that there is no impact on groundwater.

Boreholes are located both up and down hydraulic gradient. Borehole locations are presented on ESSD 10. Seven permanent monitoring boreholes are installed at the locations shown on ESSD 10.

It is recommended that the trigger levels are reviewed on an annual basis or as appropriate. If, for example, the trigger levels are exceeded on three consecutive times, then this should be highlighted and discussed within any annual review of monitoring data. Such an occurrence may be the result of contaminant breakthrough or a change in the up gradient groundwater quality.

The groundwater sampling regime is set out in Table 1

Table1: Groundwater Monitoring

Parameter	Closure/ Aftercare	
	Quarterly	Annually
Water Level	•	•
pH	•	•
Electrical conductivity 20°C	•	•
Ammoniacal nitrogen	•	•
Chloride	•	•
Sulphate	•	•
Alkalinity	•	•
Sodium	•	•
Potassium	•	•
Calcium	•	•
Magnesium	•	•
Iron	•	•
Manganese	•	•
Copper	•	•
Chromium	•	•
Lead	•	•
Nickel	•	•
Zinc	•	•
TPH	•	•
PAH	•	•
Phenol	•	•
Hazardous Substance Scan	Annual for first six years	Six Yearly

3.1.5 Soil-Gas and Vapour Investigation and Sampling Techniques and Protocols

Soil gas will be monitored at each location using an infra red gas analyser.
The following gases shall be monitored:

Table 2: Landfill Gas Monitoring

Determinands	Monitoring Frequencies	Units and Accuracies
Methane (CH ₄)	Quarterly	%v/v ±0.5%
Carbon Dioxide (CO ₂)	Quarterly	%v/v ±0.5%
Carbon Monoxide (CH ₄)	Quarterly	-
Oxygen (O ₂)	Quarterly	%v/v ±0.5%
Atmospheric Pressure	Quarterly	±1 mb
Differential pressure	Quarterly	±0.1 mb
Meteorological Data	Quarterly	-

3.1.6 Surface Water Investigation and Sampling Techniques and Protocols

Not applicable.

3.1.7 Infrastructure Investigation and Sampling Techniques and Protocols

Not required

3.2 Sample Locations

Sample locations were chosen with reference to the sources, pathways and receptors identified within the conceptual model for the site detailed in the approved ESSD.

Discussion of the selection, justification and design for each sample location with respect to individual zones for the site are given in the HRA and ESSD.

Table 3: Groundwater monitoring borehole locations

Perimeter	BH 5	Perimeter Up Hydraulic Gradient	Level and Quality
Perimeter	BH 4	Perimeter Down Hydraulic Gradient	Level and Quality
Perimeter	BH 3	Perimeter Down Hydraulic Gradient	Level and Quality

4.0 Monitoring Programme

4.1 Objectives of the Monitoring Programme

The objectives of the monitoring program are to ensure that the site has no impact on the surrounding environment.

4.1.1 Objectives of Environmental Monitoring Programme

It is essential to monitor groundwater adjacent to the site for quality to assess the integrity of the performance of the site and to ensure that there is no impact on groundwater and to ensure that pollution sources have no impact.

Boreholes are located both up and down hydraulic gradient. Borehole locations are presented on ESID 10 and background groundwater quality collected from these boreholes was used to set the agreed Compliance Limits. This has been based on six sets of data and then reviewed after one year.

Landfill gas is monitored off site and will be monitored from each phase internally to assess total gas production and potential for motive force movement. Gas monitoring is carried out at the perimeter to ensure that gas migration off site is not occurring. Trigger levels have been prepared for the external monitoring boreholes.

Annual soil samples and visual observation will be made next to the fuel tank location.

4.2 Environmental Monitoring Infrastructure

4.2.1 Location

ESSD 7 and ESSD 10 shows the location of monitoring points at the installation for gas and groundwater.

4.2.2 Groundwater monitoring

The completion details of each groundwater monitoring installation are contained in Appendix E1. Each monitoring point is finished with a lockable cover and is designed to prevent the ingress of surface water.

4.2.3 Soil Vapour Monitoring

Completion details of each soil vapour monitoring installation are contained in Appendix E1. Each installation is finished with a lockable cover and designed to prevent the ingress of surface water.

4.2.4 Procedure for the Inspection and Maintenance of Environmental Monitoring Infrastructure

All gas/groundwater monitoring boreholes will be routinely inspected to ensure that they are fit for purpose.

Any defects will be reported during the monitoring exercise and repairs will be implemented within one month of notification.

4.3 Environmental Monitoring Programme

4.3.1 Monitoring Frequency

The proposed environmental monitoring programme, including QA/QC checks is contained within the Permit and repeated in Appendix E1 and is summarised in Tables 1 and 2.

The proposed environmental monitoring programme, including QA/QC checks are presented at Appendix D. A proposed action plan for groundwater the site is detailed below.

Table 4: Proposed Action Plan in the Event of a Breached Trigger Concentration in Groundwater Monitoring Boreholes or elevated soil sample results

1.	The original sample will be re-tested for the determinand by the analytical laboratory within 10 days.
2.	In the event that the determinand remains elevated in the original sample, the borehole will be re-sampled within two weeks of receipt of the results and the sampling suite will be repeated. Results of the second analysis will be obtained as soon as possible and in any case within three weeks. The results of the re-sampling will be forwarded to the Agency.
3.	If the result of the second analysis also exceeds the trigger concentration, then the boreholes adjacent to the borehole in which the breach was recorded will be re-sampled weekly for a further two months. Analysis will be the same as for the monthly monitoring suite.
4.	Data from the boreholes will be reviewed by use of statistics and graphical presentation to establish the presence of any trends or patterns.
5.	Groundwater levels will be reviewed to establish flow direction in order to determine whether the site is the most likely cause of any change in groundwater quality.
6.	An inspection will be carried out to determine whether there has been any unusual activity or occurrence on the site that could account for the increase in the parameter exceeding the trigger concentration.
7.	If the laboratory results from the monthly monitoring show no indications of decline over the two month period, and the evidence indicates that the site is the most likely cause of the increase in levels, then a review of the hydrogeological risk assessment will be submitted to the Agency within one month of receipt of final monitoring data.

4.3.2 Sampling and Analysis Protocols

The protocols for analysis will remain the same as those to be used for the investigations to collect reference data detailed in Section 3.3 above and reproduced in Appendix C.

4.3.3 Personnel Issues

Personnel responsible for sampling, maintenance and inspection will be trained in environmental monitoring to an appropriate level to ensure compliance with the quality assurance and quality control plan. Roles and responsibilities for monitoring and ensuring adequate competence of staff are shown in Management Plan that accompanied the application.

4.4 Infrastructure Monitoring Programme

The existing inspection, testing and maintenance of pollution prevention infrastructure programme meets the objectives identified within Section 3 above and thus there are no changes to the EMS programme for the installation summarised within the Permit Application.

4.4.1 Personnel Issues

Personnel responsible for the inspection, testing and maintenance of pollution prevention infrastructure have been trained to an appropriate level to ensure compliance with the Infrastructure Monitoring Programme. Roles and responsibilities for undertaking the

Programme (including reporting) and ensuring adequate competence of staff, and have been audited by the Environment Agency on several occasions.

4.5 Assessment and Reporting Procedures

4.5.1 Assessment Procedure

A review will be undertaken of the monitoring data by a suitably experienced person, and will compare the data to the agreed trigger levels to ensure that then operations are having no impact on the environment. It is certain that the concentration at each environmental monitoring location will change for each monitoring round even if there are no anthropological influences (e.g. due to seasonal variations, sample and analytical uncertainty etc). Monitoring data should be assessed in a time series to determine the range of natural variation in pollutant concentrations. Values should be set that trigger more intensive monitoring and investigation if they are exceeded. The monitoring programme for the site should be assessed in the light of the data it produces. It is hoped that the frequency of monitoring would reduce as trends in pollutant concentrations are characterised and improvements to pollution prevention infrastructure (if necessary) are shown to have worked.

4.5.2 Reporting Procedure

Summaries of the monitoring data will be sent to the Agency on the 31st of January each year along with the results of the data assessment, and any recommendations for amendments to the Monitoring Programme.

The formats for standard and emergency reporting procedures have been agreed with the Environment Agency and are shown in Appendix E3 and emergency and breach information is set out as Schedule 6 Notification in the Permit.

4.5.3 Recording and Data Management

All hard copies of monitoring data are to be kept. All results are to be entered onto an electronic spreadsheet, such as Microsoft Excel or similar to allow for graphical and statistical analysis over time.

One of the purposes of the SPMP is to provide the operator with data to aid in the process of surrendering of a Permit. In order to surrender a Permit the operator must demonstrate to the Agency that the site is in a satisfactory state. A suitably designed monitoring programme should provide sufficient data to demonstrate satisfactory state without recourse to additional intrusive investigations. However this is encumbant upon suitable procedures to record such data, or summaries thereof.

5.0 Other Issues

Staff training and awareness of protection of groundwater, spillage procedures and emergency plans are part of the EMS procedures for the site and form part of the staff inductions and training.

6.0 Glossary

EMS Environmental Management System for NRS Waste Care Ltd

QA Quality Assurance

QC Quality Control

CQA Construction Quality Assurance

UKAS United Kingdom Accreditation Services

APPENDIX A: SEE ESSD

APPENDIX B

SAMPLING PROTOCOLS

Contents

B1 Groundwater

Samples will be collected using a baler or dedicated groundwater inertial pumps in individual boreholes, to avoid cross contamination with groundwater samples, and which will be cleaned or rinsed with the first sampling between successive wells. Three times the well volume will be purged prior to collecting samples wherever possible.

B2 Soil-gas and Vapours

Soil gas will be monitored at each location using an infra red gas analyser and a Flame Ionisation Detector.

The following gases shall be monitored:

Flammable gas (Methane) ppm 0-1000
Carbon Dioxide 0.1%
Oxygen 0.1%

Results shall be recorded as peak and steady state.

B3 Soil samples from near the fuel tank area will be collected in accordance with BS5930 and submitted for PAH, TPH and broad suite for Soil Guideline Values i.e. Pathfinder Suite

APPENDIX C

ANALYTICAL PROTOCOLS AND LABORATORY ACCREDITATION

All contained within the selected Laboratories publication:

APPENDIX D

QUALITY ASSURANCE AND QUALITY CONTROL

Contents

D1 Sampling and Analytical Quality Assurance and Quality Control Plan

Samples will be collected using a dedicated groundwater inertial pumps or balers in individual boreholes, to avoid cross contamination with groundwater samples, and which will be cleaned or rinsed with the first sampling between successive wells.

Appropriate protective equipment will be worn when handling groundwater. Samples will, where possible, be despatched to the laboratory on the same day, and in any event no later than the following day. Samples which are stored overnight will either be stored in a refrigerator or cool box. All samples will be analysed at the laboratory under UKAS accreditation.

The laboratory operates externally verified quality control procedures and checks on analytical work. These include spiked samples, blanks etc. On account of the large batches of samples that are processed by scientific laboratories under UKAS/NAMAS, the QA/QC checks implemented are efficient in identifying any quality control failures. Accordingly, it is not proposed to submit additional QC samples (sampling duplicates, field standards or field blanks) from the site, as this will only duplicate the controls already being implemented by the laboratory.

APPENDIX E

INSPECTION AND MONITORING PROTOCOLS

E1 Data Recording and Reporting Procedures

All hard copies of monitoring data are to be kept. All results are to be entered onto an electronic spreadsheet, such as Microsoft Excel or similar to allow for graphical and statistical analysis over time.

One of the purposes of the SPMP is to provide the operator with data to aid in the process of surrendering of a Permit. In order to surrender a Permit the operator must demonstrate to the Agency that the site is in a satisfactory state. A suitably designed monitoring programme should provide sufficient data to demonstrate satisfactory state without recourse to additional intrusive investigations. However this is encumbant upon suitable procedures to record such data, or summaries thereof.