Leicester Quarry Inert Landfill

Environmental Permit Application

Landfill Gas Screening Report

September 2019

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1.0 Introduction

1.1 Report Context

1.1.1 Mick George Limited (Mick George) has commissioned WYG to undertake a Landfill Gas Screening Report for the proposed landfill site at Leicester Quarry Inert Landfill in Ibstock, Leicestershire

1.1.2 The objective of the Landfill Gas Screening Report is to support the application of a bespoke waste disposal permit and to assess the potential risk to sensitive receptors associated with landfill gas.

1.1.3 The potential source of landfill gas (LFG), potential pathways through the geosphere and atmosphere by which LFG can migrate and the potential receptors are identified.

1.1.4 The proposed waste types, which would be accepted at the site, are inert in nature. Consequently, a quantitative gas risk assessment (for example using the Environment Agency's approved GasSim software) is not considered appropriate and has not been used. However, this qualitative gas risk assessment uses a number of sources of guidance, which include:-

- Environment Agency (2007), 'Potential Gas Production From Landfilling Of Inorganic Wastes', Report reference SC030144/SR, March 2007;
- Environment Agency (2007), 'Investigation And Quantification Of Gas Produced From Landfilling Of Inorganic Wastes' Report reference P1-516/2b, August 2007; and
- Environment Agency, Landfill Technical Guidance 03 (LFTGN03) 'Guidance on the Management of Landfill Gas', September 2004.

2.0 Site Description

2.1 Site Setting

2.1.1 The application site is situated at Leicester Quarry which is located approximately 735m south west from the village of Ellistown and is centred at approximate National Grid Reference (NGR) SK 441969, 310916. The site location and the environmental permit boundary is shown on Drawing Number MGL/A108671/PER/01.

2.1.2 Access to the site is achieved from an unnamed access road off Ellistown Terrace Road / Whitehill Road which is located to the east of the site. The immediate surroundings of the site comprise agricultural land to the north, east and south with a number of residential properties along Leicester Road (to the north) and Pretoria Road (to the south). The Ibstock Brickworks is situated to the west of the site any utilises clays that are extracted from the quarry for the manufacture of bricks.

2.2 Geology

2.2.1 According to the British Geological Survey's (BGS) 'Geology of Britain Viewer', the bedrock geology of the site comprises of various Mudstone and Siltstone members of the Mercian Mudstone group. The east of the site comprises mudstone of the Gunthorpe Member which was formed approximately 237 to 247 million years ago in the Triassic Period in a local environment that was previously dominated by hot deserts.

2.2.2 In terms of the western section of the site, the 'Geology of Britain Viewer' splits the site into two areas. The north western section of the site and a portion of the south west comprises mudstone of the Radcliffe Member which was formed approximately 242 to 247 million years ago in the Triassic Period. There is also a parcel of land to the south west of the site which comprises siltstone of the Tarporley Siltstone Formation. This sedimentary bedrock was formed approximately 242 to 250 million years ago in the Triassic Period in a local environmental that was previously dominated by lakes.

2.2.3 Superficial deposits are shown to be largely absent across the majority of the site with the exception of the northern and western area where the Oadby Member – Diamicton deposits are shown to be present. As the site is a quarry, any overburden has subsequently been removed and re-deposited in the excavation void space.

2.3 Hydrogeology

2.3.1 With reference to the Multi Agency Geographic Information for the Countryside's (MAGIC) website, the site is not situated within a Groundwater Source Protection Zone (GSPZ).

2.3.2 In terms of aquifers, the MAGIC website shows that the majority of the application site overlies a Secondary B aquifer with a section to the west that overlies an Undifferentiated Secondary aquifer. These aquifers are associated with "skerry" beds within the Mercia Mudstones.

2.4 Hydrology

2.4.1 According to the Flood Map for Planning Service (FMPS), the application site is not situated in an area at risk of flooding.

2.4.2 In terms of surface water features, there is a pool of water within the centre of the current quarry void at approximate NGR SK 41949 10919. This waterbody receives water from rainfall, surface water runoff and groundwater which is subsequently pumped into two settling ponds that are located to the north west of the quarry site. There is also a waterbody to the north of these settling ponds which receives flows from the settling ponds.

2.4.3 Another waterbody is situated to the west of the quarry site which receives recycled water from the adjacent Ibstock Brickworks.

2.4.4 Beyond the site boundary and Ibstock Brickworks, the River Sense is located approximately 850m north and runs in a west to east direction. There is also a stream that is located approximately 480m south west from the application site and runs in a north to south direction.

2.5 Ecology

2.5.1 A 'Nature and Heritage Conservation Screen' (EPR/GB3500KL/A001) was requested from the Environment Agency. The screen determines the presence of any site of nature and heritage conservation, or protected species or habitats that may be impacted by the proposal. A copy of the results is appended in the Environmental Risk Assessment (Appendix D of the Environmental Risk Assessment).

2.5.2 The results of the screen identified one local wildlife site (Ellistown Hedges) adjacent to Ibstock Brickworks, which lies approximately 200m to the east of the site.

3.0 Conceptual Landfill Gas Model

3.0.1 The source, pathway, receptor approach has been used to derive a conceptual model showing the proposed engineering arrangements and to assess the potential risks of landfill gas from the infilling at Leicester Quarry Inert Landfill.

3.1 Source

3.1.1 The main potential source for this gas risk assessment is the permanent deposit of waste to land at the Leicester Quarry Inert Landfill. However, the waste types that will be accepted will be inert which will therefore not give rise to significant levels of landfill gas. The definition of inert waste is provided in Regulation 35(2)(d) and Schedule 10 of the Environmental Permitting (England and Wales) Regulations 2010 (as amended) which states:-

'inert waste' means waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health. The total leachability and pollutant content and the ecotoxicity of its leachate are insignificant and, in particular, do not endanger the quality of any surface water or groundwater.'

3.1.2 Regulation 35(2)(d) of the Environmental Permitting Regulations provides a table of materials that can be assumed to be inert because of their nature and source. As a result, these materials can be accepted at an inert landfill site without testing. To meet the inert classification, only the wastes identified in Table 1 below will be accepted at the site without testing.

Table 1: Inert wastes which do not Require Testing

EWC Code	Description	Restriction
10	**WASTES FROM THERMAL PROCESSES**	
10 11	**Wastes from manufacture of glass and glass products**	
10 11 03	Waste glass-based fibrous materials	Only without organic binders
15	**WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED**	
15 01	**Packaging (including separately collected municipal packaging waste)**	
15 01 07	Glass packaging	
17	**CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**	

17 01	**Concrete, bricks, tiles and ceramics**	
17 01 01	Concrete	Selected C&D waste only*
17 01 02	Bricks	Selected C&D waste only*
17 01 03	Tiles and ceramics	Selected C&D waste only*
17 01 07	Mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	Selected C&D waste only*
17 02	**Wood, glass and plastic**	
17 02 02	Glass	
17 05	**Soil (including excavated soil from contaminated sites), stones and dredging spoil**	
17 05 04	Soil and stones other than those mentioned in 17 05 03 **	Excluding topsoil, peat; excluding soil and stones from contaminated sites
19	**WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE**	
19 12	**Wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified**	
19 12 05	Glass	
20	**MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS**	
20 01	**Separately collected fractions (Except 15 01)**	
20 01 02	Glass	Separately collected glass only
20 02	**Garden and park wastes (including cemetery waste)**	
20 02 02	Soil and stones**	Only from garden and parks waste; excluding topsoil, peat.

3.1.3 Landfill gas is produced by the biological degradation of organic components. Microbial processes degrade organic matter in the absence of oxygen and produce methane and carbon dioxide. In terms of landfill gas generation at Leicester Quarry Inert Landfill, no organic matter will be present and it is therefore considered that the inert waste materials deposited at the site will not give rise to significant quantities of landfill gas. The potential for the generation of landfill gas is therefore considered to be negligible.

3.1.4 The site will have strict waste acceptance procedures in place to ensure that only inert wastes are accepted at the site. This will minimise the risk of acceptance of non-conforming wastes, such as biodegradable wastes, which would have the potential to cause the generation of landfill gas.

3.1.5 Taking into account the above, it is considered unlikely that there will be any source of significant landfill gas generation at the site.

3.2 Pathways

3.2.1 A number of potential pathways exist which would provide a link between the sensitive receptors and landfill gas generated within the landfill site. The Environment Agency's guidance document LFTGN03 entitled 'Guidance on the Management of Landfill Gas' (September 2004) identifies the following generic potential pathways:-

- Direct release to atmosphere;
- Sub-surface migration, through the ground or along service ducts or pipelines;
- Indirect release to atmosphere e.g. from sub-surface landfill gas migration; and
- Direct release of combustion products to atmosphere e.g. from flares/engines.

3.2.2 It is considered that the primary pathway for landfill gas generated within the site would be vertically to atmosphere through unrestored areas of waste. Pathways that are considered to be less preferential would be vertically through the restored areas of the site or laterally through the boundary engineering.

3.2.3 The Environment Agency's Report 'Investigation and Quantification of Gas Produced from Landfilling of Inorganic Wastes' (August 2007) considers the potential for landfill gas to migrate from an inorganic or low carbon landfill site. The report acknowledges that inorganic waste does not generate substantial quantities of landfill gas, and that there will generally be an insufficient pressure differential to drive the landfill gas through low permeability waste. Thus, as there will be only inert wastes accepted and deposited, it is considered that there will be an insufficient driving pressure for the gas to create a viable pathway.

3.2.4 Furthermore, the waste will be deposited within the site which has a basal and side slope liners in place where required with a hydraulic permeability of less than 1 x $10m^{-7}m/s$ or equivalent. On completion of filling to final levels, the site will be capped with 1.2m of restoration soils comprising not less than 0.3m of topsoil. In accordance with the requirements of the Landfill Directive, an engineered cap (clay or plastic) is not required.

3.2.5 In addition to the limited potential for landfill gas migration due to the negligible quantities of organic/biodegradable waste which will be deposited, the proposed engineering design will further limit the potential for any viable pathways.

3.3 Receptors

3.3.1 LFTGN 03 'Guidance on the Management of Landfill Gas' details the process of prioritising receptors which is a qualitative process based on consideration of the estimated impact, the sensitivity of the receptor and the likelihood of exposure.

3.3.2 The details of all receptors within 1km of the waste operation boundary are summarised in **Error! Reference source not found.** below.

Table 2: Location of potential receptors in relation to the proposed activity

ID	Receptor	Direction from Operational Area	Minimum Distance from the Permit Application Boundary (approx. m)
Designated ecological habitats/sites of geological importance e.g. Ramsar, SAC, SPA, SSSI, LNR, NNR, LWS			
1	Ellistown Hedges (Local Wildlife Site)	E	50
2	Kelham Bridge Nature Reserve	NW	1,000
Domestic Dwellings			
3	St Christopher's Park Caravan Site	E	800
4	Residential area of Ellistown	NE, E	510
5	Ellistown Farm	SE	870
6	Pickering Grange Farm	S	400
7	Residential area of Ibstock	W	775
8	Residential area of Donington le Heath	N	915
9	Blackberry Farm	NW	535
10	The Retreat Bungalow	N	60
11	Residential properties on Leicester Road	N	20
12	Residential properties on Pretoria Road	SW	130
13	Residential area of Battram	S	930
14	Redholme Bungalow Farm	SW	940
15	Ibstock Grange	SW	815
Commercial and Industrial Premises			
16	South Leicester Industrial Estate	NE	410
17	Ibstock Brickworks	W	220
18	Ibstock Brickworks (Ellistown)	SE	1,000
Schools / Hospitals / Shops/Amenities			
19	Ellistown Community Primary School	E	575
20	Wesleyan Reform Church Ellistown	E	510
Highways or Minor Roads			
21	Leicester Road	N	65
22	Pretoria Road	S	30
23	Midland Road	NE	378
24	Whitehall Road	E	425
25	Ellistown Terrace Road	SE	505
Grade II Listed Buildings;			
26	Building at Pickering Grange Farm	SE	515
Priority Habitats			

27	Priority Habitat Inventory – Deciduous Woodland (Workmans Wood)	S	300
28	Priority Habitat Inventory – Deciduous Woodland	W	520
29	Priority Habitat Inventory – Deciduous Woodland	SE	440
30	Priority Habitat Inventory – Deciduous Woodland	SE	660
31	Priority Habitat Inventory – Deciduous Woodland	SE	835
32	Priority Habitat Inventory – Deciduous Woodland (Battram Wood)	S	935
Sensitive land uses e.g. farmland, allotments, commercial fish farms			
33	Arable farmland	S, E	Adjacent
Surface Water e.g. rivers and streams			
34	Settling ponds to the east of Ibstock Brickworks	W	50
35	Pond to the south east of Ibstock Brickworks	W	150
36	River Sense	N	850
Groundwater (sensitivity)			
According to the Multi-Agency Geographic Information for the Countryside's (MAGIC) website, the site is not located within a Groundwater Source Protection Zone. In terms of aquifers, the MAGIC website shows that the majority of the application site overlies a Secondary B aquifer with a section to the west that overlies an Undifferentiated Secondary aquifer. These are related to the skerry bands within the Mercia Mudstones			

3.4 Current Monitoring

3.4.1 Landfill gas monitoring is currently undertaken on a monthly basis at boreholes BH5 (1-3), BH6 (1-3), BH7 (1-3), BH8 (1-3) and BH9 (1-3). The location of these boreholes is shown on Drawing Number MGL/A108671/PER/02.

3.4.2 A copy of gas monitoring data is provided in Appendix A of this report.

3.4.3 The monitoring data in Appendix A indicates that the background concentrations of methane are negligible in all of the boreholes with the highest level recorded of 0.60% v/v in borehole BH7-(1) in July 2018. Monitoring data across the site indicates that methane is within the region of 0.0% to 0.60% v/v, with an overall average of 0.02% v/v.

3.4.4 The levels of carbon dioxide have been more variable, with a range from between 0.0% v/v to 5.7% v/v (recorded at borehole BH8-(2) in September 2018), with an overall average of 0.60% v/v.

3.4.5 Concentrations of oxygen recorded during the monitoring period were at or close to normal atmospheric levels.

3.5 Environmental Assessment Levels (EALs)

3.5.1 For the sub-surface migration of landfill gas, Technical Guidance Note LFTGN03 'Guidance on the Management of Landfill Gas' considers that an appropriate environmental benchmark for

methane and carbon dioxide is 1% and 1.5% by volume above background respectively.

3.5.2 In terms of compliance levels for carbon dioxide, industry guidance document 'Perimeter soil gas emissions criteria and associated management' (January 2011) states:-

'Carbon dioxide is a poor choice of gas to regulate emissions from landfills because there are alternative sources in the sub-surface. Because emission based regulation of a gas generated naturally in the environment at concentrations 0 -20% is not logical, carbon dioxide should not be used for regulating the sub-surface strata outside a landfill unless there is a site specific high risk receptor nearby, such as an underground confined space....'

'An alternative to regulating on compliance limits is to regulate on the reaction to exceeding a carbon dioxide action level'.

3.5.3 This is also addressed in the Environment Agency's Position Statement 'Industry code of practice on perimeter soil gas' (August 2011) which states:-

'We will require operators to set action levels as part of their gas management plan and to monitor perimeter boreholes and assess carbon dioxide concentrations against the action level to prompt investigatory action and inform regular reviews of the conceptual model'.

3.5.4 The above document considers that for background Carbon Dioxide concentrations between 0 to 20% by volume, it is appropriate in this circumstance to set limits in accordance with the ICoP and therefore Carbon Dioxide action levels have been proposed based on monitoring data obtained to date. The site specific EALs for methane and carbon dioxide are shown in Table 3 below.

3.5.5 The industry guidance document 'Perimeter soil gas emissions criteria and associated management' (January 2011) states for:-

For every well the action level will be 1% carbon dioxide above the highest carbon dioxide concentration if the highest carbon dioxide concentration is less than 5%;

For every well the action level will be 2% carbon dioxide above the highest carbon dioxide concentration if the highest carbon dioxide concentration is between 5 - 10%; and

For every well the action level will be 3% carbon dioxide above the highest carbon dioxide concentration if the highest carbon dioxide concentration is between 10 - 20%.

3.1.1 This means that for each borehole an action level should be calculated separately as follows:-

- All boreholes apart from BH8-(2) should have an action level 1% above the highest monitoring level; and
- BH8-(2) should have an action level 2% above the highest monitoring level.

3.5.6 For Methane, as the majority of the boreholes show levels of 0.0% v/v, it is appropriate to assign an EAL of 1.0% respectively to the existing background levels as is consistent with the ICoP, with an action level for methane of 0.5% v/v above background.

Table 3: Site Specific EALs for Methane and Carbon Dioxide

Monitoring Location	Parameter	Proposed Compliance Level (v/v%)	Monitoring Frequency	Proposed Action Level (v/v%)
All Locations	Methane	0.5	Quarterly	1.0
BH9-(1)	Carbon Dioxide	None		1.90
BH9-(2)				2.60
BH9-(3)				1.80
BH5-(1)				1.30
BH5-(2)				1.70
BH5-(3)				2.40
BH6-(1)				1.90
BH6-(2)				1.80
BH6-(3)				1.90
BH7-(1)				2.10
BH7-(2)				1.50
BH7-(3)				1.30
BH8-(1)				1.50
BH8-(2)				7.70
BH8-(3)				2.90

3.5.7 The above EALs are based on a small data set and we suggest these are updated following the completion of 12 months background monitoring and that this is implemented through a pre-operational condition within the Environmental Permit.

4.0 Landfill Gas Assessment Risk

4.0.1 LFTGN03 provides guidance on the level of risk assessment that is considered appropriate for different types of sites and states that Tier 1 Hazard Identification and Risk Screening should be sufficient to deal with most of the risks from inert sites. However, this is also dependent on the level of risk and uncertainty specific to the site.

4.0.2 The infilling at Leicester Quarry Inert Landfill is predicted to generate negligible quantities of landfill gas due to the inert nature of the waste accepted and deposited at the site. Furthermore, the operator's detailed waste acceptance procedures and Environmental Management Plan will ensure that only inert waste is deposited at the site, thus removing any uncertainty with respect to the potential for the deposition of non-inert wastes. Taking these factors into consideration, it is concluded that the overall level of risk associated with the site is low. A qualitative risk assessment is therefore considered appropriate in order to determine the level of risk from landfill gas at the site.

4.1 Accidents and Their Consequences

4.1.1 The Environment Agency's guidance (LFTGN03) requires a number of accident and failure scenarios to be assessed in order to quantify the impact of given events. The reliability of landfill gas control measures and site engineering should be assessed in the risk assessment and the main hazards that could lead to accidental emissions should be identified. LFTGN03 provides examples of general categories of accidents that may potentially affect landfill gas control:-

- Loss of containment e.g. leakage, liner failure, spillage;
- Loss of collection and/or treatment capability e.g. failure of pipework, control system, etc;
- Explosions and fires e.g. deep seated landfill fire; and
- Failure of leachate extraction system and the effect on landfill gas extraction.

4.1.2 These scenarios have been assessed as part of the gas risk screening process.

4.2 Qualitative Landfill Gas Risk Assessment

4.2.1 The potential hazards that exist from landfill gas are:

- Toxicity (acute and chronic);

- Ecotoxicity;
- Fire and explosion;
- Asphyxiation; and
- Odour.

4.2.2 The trace components of landfill gas pose an odour and toxicity risk whilst the bulk gases pose a risk of explosion and asphyxiation, although carbon dioxide is also toxic and should be considered in the assessment of toxicity. Explosion and asphyxiation risk is generally related to sub-surface migration and accumulations in enclosed spaces, such as residential or commercial properties, or underground services. Environment Agency document LFTGN03 states that whilst this is more difficult to quantify, for the risk screening stage, the impact assessment should be based on:-

- The presence of potential pathways and site specific receptors; and
- A qualitative assessment of the severity of the consequences.

4.2.3 The qualitative assessment for each receptor is provided in Table 4.

Table 4: Qualitative Risk Assessment

Receptor	Hazard	Sensitivity of Receptor	Likelihood of Exposure
Occupiers of domestic dwellings and farmhouses listed in Table 2.	Odour, toxicity, asphyxiation	High	Very Unlikely
Workforce in commercial and industrial properties listed in Table 2.	Odour, toxicity, asphyxiation	High	Very Unlikely
Schools and shops listed in Table 2.	Odour, toxicity, asphyxiation	High	Very Unlikely
Surrounding Footpaths	Odour, toxicity, asphyxiation	High	Very Unlikely
Priority Habitats, Ellistown Hedges Local Wildlife Site and agricultural land listed in Table 2.	Eco-toxicity	Low	Very Unlikely

4.2.4 Table 4 details the qualitative risk assessment which has been undertaken for the accident and failure scenarios using the risk assessment process and scoring system set out within Environment Agency document LFTGN03. Table 6 provides a justification of the 'likelihood' scores for each of the accident or failure scenarios set out in Table 5.

Table 5: Qualitative Risk Assessment for Accident and Failure Scenarios

Accident/Failure Scenario	Likelihood	Severity of Consequence	Score	Magnitude of Risk
Loss of containment (e.g. leakage, liner failure, spillage)	Extremely unlikely (1)	Minor (1)	1	Insignificant
Explosions and fires	Very Unlikely (2)	Significant (3)	6	Insignificant
Biodegradable Waste Input	Unlikely (3)	Significant (3)	9	Acceptable

Table 6: Justification for assigned 'likelihood' scores

Accident/Failure Scenario	Justification for 'likelihood' score
Loss of containment (e.g. leakage, liner failure, spillage)	The site will be engineered to a high standard and the landfill containment system will be subject to Construction Quality Assurance (CQA) supervision and testing. It is therefore extremely unlikely that the containment system will fail or leak.
Explosions and fires	The proposed waste types are inert in nature and therefore will not be combustible or explosive. Waste acceptance procedures will ensure that potentially flammable or explosive materials are not accepted at the site.
Biodegradable waste input	The proposed waste types are inert in nature. However, all wastes entering the site will be subject to detailed waste acceptance procedures. Wastes will only be accepted onto the site if they comply with the list of wastes included in the permit. Basic characterisation will ensure that the waste is suitable for acceptance at the regulated facility however if there is uncertainty regarding the acceptance of wastes at the site, testing may be required. No wastes will be accepted onto the site if there is uncertainty as to its source, conformance with the conditions in the permit and/or its suitability for the intended use. Consequently, it is considered unlikely that biodegradable waste will be accepted at the site.

4.2.5 The results of the qualitative risk assessment show that the most significant accident /failure scenario is the acceptance of biodegradable waste into the landfill site which would arise from a failure in the operator's waste acceptance procedures. The waste acceptance procedures are set out within the Operating Techniques document (Appendix B of the Environmental Permit Application).

4.2.6 These procedures are in line with EA requirements and all staff will be aware of the procedures and the requirements of the site's Environmental Management System. Furthermore, there is a documented procedure within the Operating Techniques document which details the measures to be taken in the event that unauthorised waste is identified within a load. It is therefore unlikely that biodegradable waste will be deposited within the landfill site.

5.0 Gas Management Plan

5.1 Control Measures

5.1.1 Negligible quantities of landfill gas are predicted to be generated from the Leicester Quarry Inert Landfill and no active gas management is therefore proposed within the site. The negligible quantities of landfill gas generated would vent passively to atmosphere from the body of waste.

5.2 Landfill Gas Monitoring Plan

5.2.1 The landfill gas monitoring is carried out in accordance with the procedures set out in the Environment Agency's Guidance document LFTGN03 'Guidance on the Management of Landfill Gas'. The proposed monitoring programme is detailed in Table 7.

Table 7: Monitoring Programme

Parameter	Monitoring Frequency
Methane, carbon dioxide, oxygen, meteorological data, atmospheric pressure, differential pressure, temperature.	Quarterly.

5.3 Compliance Levels

5.3.1 Compliance Levels have been set for each current borehole, based on guidance set out in Environment Agency Technical Guidance Note 03 (LFTGN03). These Compliance Levels are detailed within Table 3 above and are based on concentrations of 1% above the background levels for methane.

5.3.2 This Landfill Gas Risk Screening Report has demonstrated that the potential for high concentrations of landfill gas is low. However, an appropriate Action Plan is required in the unlikely event that Action Levels set for each borehole are exceeded. Action Levels have been set at a level which enables the site management to take timely and appropriate action, so that Compliance Levels are not exceeded. Further actions are however documented, in the event that both Action Levels and Compliance Levels are exceeded. The following sections set out the proposed Action Plan for the infilling of the site.

5.4 Action Plan

<u>Methane</u>

5.4.1 Action Levels for methane have been set as 0.5% above background, which give Mick George the opportunity to take timely and appropriate action in order to avoid the Compliance Levels

being exceeded. In the event of methane or flammable gas being recorded within the perimeter monitoring boreholes at concentrations exceeding 0.5% by volume, the following action will be taken:-

- The Landfill Manager will be informed; and
- The Landfill Manager will assess the risk and may increase the frequency of landfill gas monitoring to determine whether there is an increasing trend in gas concentrations. The Manager may inform the Environment Agency if the trend is considered to be rising.

5.4.2 In the event of methane or flammable gas being detected within the perimeter boreholes at concentrations exceeding 1.0% methane by volume, the following action will be taken:-

- The Landfill Manager will be informed;
- The Landfill Manager will assess the risk and may increase the frequency of landfill gas monitoring to determine whether there is an increasing trend in gas concentrations. The Manager may inform the Environment Agency if the trend is considered to be rising;
- The Landfill Manager will make an assessment of whether any receptors are potentially at risk from elevated methane concentrations and if this is considered likely, the need for receptor monitoring will be determined;
- Daily monitoring of the perimeter boreholes will be undertaken until concentrations of methane recorded in the boreholes fall below 1% by volume (20% LEL) and the Landfill Site Manager determines that the normal frequency of monitoring can be resumed; and
- In the unlikely event that methane (flammable gas) concentrations continue to remain elevated, the Landfill Site Manager will determine if remedial action is required. Any action taken will be agreed with the Environment Agency and recorded in the Site Diary.

<u>Carbon Dioxide</u>

5.4.3 Action Levels for Carbon Dioxide have been set for the current boreholes in Table 3, which currently equate to the highest background concentration (% v/v) recorded during the pre-operational phase plus a variable amount above background.

5.4.4 In the event of Carbon Dioxide being recorded within the perimeter monitoring boreholes at concentrations exceeding the Action Levels specified in Table 3, the following action will be taken:-

- The Landfill Manager will be informed; and
- The Landfill Manager will assess the risk and may increase the frequency of landfill gas monitoring to determine whether there is an increasing trend in gas concentrations. The Manager may inform the Environment Agency if the trend is considered to be rising.

5.5 In Waste Boreholes

5.5.1 In accordance with LFTGN03 in-waste landfill gas monitoring infrastructure will be installed within each completed cell or phase of filling. The locations of the in waste boreholes are shown on Drawing Number MGL/A108671/PER/03 which is attached to the permit application documentation.

5.5.2 In-waste landfill gas monitoring will be carried out in accordance with the procedures set out in LFTGN03. The proposed monitoring programme is detailed in Table 8 below.

Table 8: Monitoring Programme

Parameter	Monitoring Frequency
Methane, carbon dioxide, oxygen, meteorological data, atmospheric pressure, differential pressure, temperature.	Quarterly

6.0 Conclusion

6.0.1 The proposed waste types will be inert in nature and will not give rise to significant quantities of landfill gas. The negligible quantities of landfill gas generated are unlikely to be under significant pressure which will minimise the likelihood of gas migration. Furthermore, the site will be engineered with a low permeability clay side slope and basal liner, which will further reduce the risk of lateral gas migration. The risk to nearby sensitive receptors associated with the generation and migration of landfill gas is therefore considered to be low.

6.0.2 Background landfill gas monitoring has been undertaken during the pre-operational phase of the site. The results of the monitoring show that negligible concentrations of methane and low to slightly elevated background concentrations of carbon dioxide in one location are recorded within the perimeter monitoring boreholes. These results have been used to set both Action Levels and Compliance Levels for the site.

6.0.3 Detailed waste acceptance criteria will be used to ensure that only inert wastes are accepted at the site. This will prevent unauthorised wastes being accepted. The absence of biodegradable material within the landfill site shall ensure that significant quantities of landfill gas are not produced within the site from waste and the risk to receptors remains low. Furthermore, this shall ensure that odour nuisance, vegetation stress and global atmospheric damage are also avoided.

6.0.4 This Landfill Gas Screening Report has determined that the site will not give rise to significant quantities of landfill gas due to the inert nature of the proposed waste types. The site will be engineered in accordance with the requirements of the Landfill Directive 1999/31/EC. It is considered that, with respect to landfill gas, the site will be compliant with the requirements of the Landfill Directive.

Drawings

MGL/A108671/PER/01 - Site Location and Environmental Permit Boundary

MGL/A108671/PER/02 - External Borehole Location Plan

MGL/A108671/PER/03 - In-Waste Borehole locations

Appendices

Appendix A – Gas Monitoring Data

Leicester Quarry Gas Monitoring

								Minimum	Maximum	Average
BH9-(1)	**Units**	**Mar**	**April**	**May**	**June**	**July**	**Sept**			
O_2	% /Vol	20.6	20.4	20.5	20.7	17.2	20.2	17.20	20.70	19.93
CH_4	% /Vol	0.0	0.0	0.0	0.0	0.0	0.1	0.00	0.10	0.02
CO_2	% /Vol	0.0	0.1	0.2	0.0	0.9	0.4	0.00	0.90	0.27
Differential Pressure	mbar	0.01	0.07	0.01	0.03	0.01	0.10		**Action Level**	1.90
Pressure	mbar	1007	1004	1018	1024	1005	999			
BH9-(2)	Units	**Mar**	**April**	**May**	**June**	**July**	**Sept**			
O_2	% /Vol	20.5	20.1	20.4	20.6	17.4	18.5	17.40	20.60	19.58
CH_4	% /Vol	0.0	0.0	0.1	0.0	0.0	0.0	0.00	0.10	0.02
CO_2	% /Vol	0.1	0.5	0.1	0.2	0.6	1.6	0.10	1.60	0.52
Differential Pressure	mbar	0.00	0.15	0.05	0.01	-0.04	0.02		**Action Level**	2.60
BH9-(3)	Units	**Mar**	**April**	**May**	**June**	**July**	**Sept**			
O_2	% /Vol	20.1	19.8	20.7	19.8	17.6	20.0	17.60	20.70	19.67
CH_4	% /Vol	0.0	0.0	0.0	0.0	0.0	0.1	0.00	0.10	0.02
CO_2	% /Vol	0.4	0.8	0.0	0.6	0.3	0.3	0.00	0.80	0.40
Differential Pressure	mbar	0.08	0.1	0.1	0.15	0.01	0.02		**Action Level**	1.80
BH5-(1)	Units	**Mar**	**April**	**May**	**June**	**July**	**Sept**			
O_2	% /Vol				20.6	17.6	20.0	17.60	20.6	19.40
CH_4	% /Vol				0.0	0.0	0.0	0.00	0.0	0.00
CO_2	% /Vol				0	0.3	0.1	0.00	0.3	0.13
Differential Pressure	mbar				0.00	0.00	0.0		**Action Level**	1.3
BH5-(2)	Units	**Mar**	**April**	**May**	**June**	**July**	**Sept**			
O_2	% /Vol				20.5	18.1	20.5	18.10	20.5	19.70
CH_4	% /Vol				0.0	0.0	0.0	0.00	0.0	0.00
CO_2	% /Vol				0.0	0.7	0.0	0.00	0.7	0.23
Differential Pressure	mbar				0.09	-0.09	0.05		**Action Level**	1.70
BH5-(3)	Units	**Mar**	**April**	**May**	**June**	**July**	**Sept**			
O_2	% /Vol				20.1	18.0	18.6	18.00	20.1	18.90
CH_4	% /Vol				0.0	0.0	0.0	0.00	0.0	0.00
CO_2	% /Vol				0.2	1.1	1.4	0.20	1.4	0.90
Differential Pressure	mbar				0.11	-0.05	0.05		**Action Level**	2.40
BH6-(1)	Units	**Mar**	**April**	**May**	**June**	**July**	**Sept**			
O_2	% /Vol				20.4	16.5	18.5	16.50	20.4	18.47
CH_4	% /Vol				0.0	0.0	0.0	0.00	0.0	0.00
CO_2	% /Vol				0.1	0.9	0.4	0.10	0.9	0.47
Differential Pressure	mbar				0.00	0.13	0.05		**Action Level**	1.90
BH6-(2)	Units	**Mar**	**April**	**May**	**June**	**July**	**Sept**			
O_2	% /Vol				20.6	15.7	15.1	15.10	20.60	17.13
CH_4	% /Vol				0.0	0.0	0.0	0.00	0.00	0.00
CO_2	% /Vol				0	0.7	0.8	0.00	0.80	0.50
Differential Pressure	mbar				0.00	0.09	0.0		**Action Level**	1.80
BH6-(3)	Units	**Mar**	**April**	**May**	**June**	**July**	**Sept**			
O_2	% /Vol				20.5	17.7	13.6	13.60	20.50	17.27
CH_4	% /Vol				0.0	0.0	0.0	0.00	0.00	0.00
CO_2	% /Vol				0.1	0.4	0.9	0.10	0.90	0.47
Differential Pressure	mbar				0.12	0.12	0.0		**Action Level**	1.90
BH7-(1)	Units	**Mar**	**April**	**May**	**June**	**July**	**Sept**			
O_2	% /Vol				19.3	15.5	20.0	15.50	20.00	18.27
CH_4	% /Vol				0.0	0.6	0.0	0.00	0.60	0.20
CO_2	% /Vol				1.1	0.8	0.1	0.10	1.10	0.67
Differential Pressure	mbar				0.00	0.00	0.0		**Action Level**	2.10
BH7-(2)	Units	**Mar**	**April**	**May**	**June**	**July**	**Sept**			
O_2	% /Vol				20	17.6	20.40	17.60	20.40	19.33
CH_4	% /Vol				0.0	0.0	0.00	0.00	0.00	0.00
CO_2	% /Vol				0.5	0.3	0.00	0.00	0.50	0.27
Differential Pressure	mbar				0.05	-0.06	0.03		**Action Level**	1.50

BH7-(3)	Units	Mar	April	May	June	July	Sept			
O_2	% /Vol				20.4	17.5	20.60	17.50	20.60	19.50
CH_4	% /Vol				0.0	0.0	0.00	0.00	0.00	0.00
CO_2	% /Vol				0.1	0.3	0.00	0.00	0.30	0.13
Differential Pressure	mbar				0.09	-0.01	0.02		**Action Level**	1.30

BH8-(1)	Units	Mar	April	May	June	July	Sept			
O_2	% /Vol				20.1	19.7	20.30	19.70	20.30	20.03
CH_4	% /Vol				0.0	0.0	0.00	0.00	0.00	0.00
CO_2	% /Vol				0.3	0.5	0.10	0.10	0.50	0.30
Differential Pressure	mbar				0.01	0.01	0.03	Action Level		1.50

BH8-(2)	Units	Mar	April	May	June	July	Sept			
O_2	% /Vol				19.7	19.4	10.0	10.00	19.70	16.37
CH_4	% /Vol				0.0	0.0	0.1	0.00	0.10	0.03
CO_2	% /Vol				0.8	0.7	5.7	0.70	5.70	2.40
Differential Pressure	mbar				0.00	0.00	0.10	Action Level		7.70

BH8-(3)	Units	Mar	April	May	June	July	Sept			
O_2	% /Vol				18.5	18.2	19.4	18.20	19.40	18.70
CH_4	% /Vol				0.0	0.0	0.0	0.00	0.00	0.00
CO_2	% /Vol				1.9	1.4	0.9	0.90	1.90	1.40
Differential Pressure	mbar				0.05	0.01	0.10	Action Level		2.90