Castle Hill Quarry

784-B043634

Gas Screening Report

Environmental Permit Application

Castle Hill Quarry Co. Limited

April 2023

Document prepared on behalf of Tetra Tech Limited. Registered in England number: 01959704

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1.0 INRODUCTION

1.1 REPORT CONTEXT

1.1.1 This Environmental Permit Application has been prepared by Tetra Tech on behalf of the Operator, Castle Hill Quarry Co. Limited (CHQC) in connection to their existing quarry site called Castle Hill Quarry at Cannington, Bridgwater, TA5 2QF.

1.1.2 CHQC are seeking to gain a bespoke waste recovery permit for the permanent deposit of inert waste to land to facilitate the infilling and restoration at two specific areas within the quarry site following the extraction of mineral. Further details of these areas are provided in Section 2 of this document.

1.1.3 The objective of the Gas Screening Report is to assess the potential risk to sensitive receptors associated with gas.

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

1.1.5 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 (EA) 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 The wider Castle Hill Quarry site is located approximately 960m north west from the village centre of Cannington in Bridgwater. The current quarry site is centred at approximate National Grid Reference (NGR) ST 24562 40684 and comprises an active limestone quarry site which is extracted and processed on site to provide aggregates for the construction industry, carboniferous lime for agricultural use and limestone products to the animal feedstuffs industry.

2.2 This application relates to two extension areas at the quarry. The first area (known as 'Eastern Extension') is located to the south east of the existing quarry and is centred at approximate NGR ST 24834 40637. The second area (known as 'Old Golf Course Extension'), is located to the south of the Eastern Extension and is centred at approximate NGR ST 24834 40637. The location of both extension areas is shown on Drawing Number CHQC/B043634/PER/01.

2.3 Access to the site will be achieved by an access road off Combwich Road that runs in an east to west direction towards the existing quarry site and then south to the extension areas. The immediate surroundings of the site comprise predominantly of woodland and agricultural with commercial properties located to the immediate south of the proposed site.

2.4 A Scheduled Monument named 'Cynwit Castle' lies adjacent to the wider Castle Hill Quarry. A further Scheduled Monument named 'Settlement South East of Cannington Park' lies adjacent to the Eastern Extension area. The nearest residential properties, 1-2 Lime Kiln Cottages, lie approximately 30m southeast of the Old Golf Course Extension. These properties are in CHQC's ownership and rented to tenants.

2.5 Further details regarding the environmental setting of the site are provided in the Environmental Setting and Site Design (ESSD) report that has been prepared to support this application. A copy of the ESSD is provided as Appendix E of the Environmental Permit Application.

3.0 CONCEPTUAL GAS MODEL

3.1 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 gas from the infilling at the site.

3.2 SOURCE

3.2.1 The main potential source for this gas risk assessment is the waste that would be deposited at the site. The void will be infilled progressively and it is calculated that a volume of 119,000m^3 of waste will be required to restore the Eastern Extension Area and a volume of 550,000m^3 of waste will be required to restore the Old Golf Course Extension Area. This provides a total throughput of 669,000m^3.

3.2.2 When using a bulk density conversion factor of 1.5 tonnes/m^3 the total throughput equates to approximately 1,003,500 tonnes.

3.2.3 Permitted wastes accepted at the site will be strictly inert as classified under the Landfill Directive (1999/31/EC) and Council Decision (2003/33/EC) of 19th December 2002 *'establishing criteria and procedures for the acceptance of waste landfills'*.

3.2.4 Inert waste is defined in Article 2 of the Landfill Directive 1999/31/EC as follows:-

'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 and/or groundwater".

Table 1 lists those wastes that may be accepted at the site which do not require Waste Acceptance Criteria (WAC) testing under Council Decision (2003/33/EC), provided that they are inert and from a single source only (mixed loads from more than one site cannot be accepted without testing).

Table 1: Proposed Waste Types that Do Not Require WAC Testing

EWC Code	Description	Restriction
01	**WASTE RESULTING FROM EXPLORATION, MINING, QUARRYING AND PHYSICAL AND CHEMICAL TREATMENT OF MINERALS**	
01 01	**Wastes from mineral excavation**	
01 01 02	Waste glass-based fibrous materials	Restricted to waste overburden and interburden only
01 04	**Wastes from physical and chemical processing of non-metafillerous minerals**	
01 04 08	Waste gravel and crushed rocks other than those mentioned in 04 04 06	
01 04 09	Waste sand and clay	
10	**WASTES FROM THERMAL PROCESSES**	
10 12	**Wastes from manufacture of ceramic goods, bricks, tiles and construction products**	
10 12 08	Waste ceramics, brick, tiles and construction products (after thermal processing)	

17	**CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**	
17 01	**Concrete, bricks, tiles and ceramics**	
17 01 01	Concrete	
17 01 02	Bricks	
17 01 03	Tiles and ceramics	
17 01 07	Mixtures of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	Metal from reinforced concrete must have been removed.
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 09	Minerals only	Wastes from the treatment of waste aggregates that are otherwise naturally occurring minerals. Does not include fines from treatment of any non-hazardous waste or gypsum from recovered plasterboard.
20	**MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS**	
20 02	**Garden and park wastes (including cemetery waste)**	
20 02 02	Soil and stones	Only from garden and parks waste; excluding topsoil, peat.

3.2.5 In addition to the wastes that are listed in Table 1, CHQC propose to accept the waste codes listed in Table 2 below and will be subject to WAC testing as detailed in the Operating Techniques document (Appendix C of the Environmental Permit Application).

Table 2: Proposed Waste Types that Will Require WAC Testing

EWC Code	Description	Restriction
02	**WASTES FROM AGRICULTURE, HORTICULTURE, AQUACULTURE, FORESTRY, HUNTING AND FISHING, FOOD PREPARATION AND PROCESSING**	
02 04	**wastes from the preparation and processing of meat, fish and other foods of animal origin**	
02 04 01	Soil from cleaning and washing beet	
10	**WASTES FROM THERMAL PROCESSES**	
10 13	**Wastes from manufacture of cement, lime and plaster and articles and products made from them**	
10 13 14	Waste concrete	
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 12	Other wastes from mechanical treatment of wastes other than those mentioned in 19 12 12	Restricted to crushed bricks, tiles, concrete and ceramics only. Metal from reinforced concrete must be removed. Does not include fines from treatment of any non-hazardous waste or gypsum from recovered plasterboard.

3.2.6 Waste types for the construction of the Attenuation Layer will be restricted to the following waste codes in Table 3 below.

Table 3: Proposed Waste Types for Attenuation Layer Only

EWC Code	Description
17	**CONSTRUCTION AND DEMOLITION WASTES (Excluding EXCAVATED SOILS FROM CONTAMINATED SITES)**
17 05	**Soil (excluding excavated soil from contaminated sites) soil and dredging spoil**
17 05 04	Soil and stones other than those mentioned in 17 05 03*
20	**MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES INLCUDING SEPARATELY COLLECTED FRACTIONS**
20 02	**Garden and park wastes**
20 02 02	Soil and stones

**This specifically excludes excavated soil from contaminated sites.*

3.2.7 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 gas generation at the site, 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 gas. The potential for the generation of gas is therefore considered to be negligible.

3.2.8 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 gas.

3.2.9 Considering the above, it is determined unlikely that there will be any source of significant gas generation at the proposed site.

3.3 PATHWAYS

3.3.1 A number of potential pathways exist which would provide a link between the sensitive receptors and gas generated within the site. The EA'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 gas migration; and
- Direct release of combustion products to atmosphere e.g. from flares/engines.

3.3.2 The primary pathway for 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 engineered side slope liner.

3.3.3 The EA's Report 'Investigation and Quantification of Gas Produced from Landfilling of Inorganic Wastes' (August 2007) considers the potential for gas to migrate from an inorganic or low carbon site. The report acknowledges that inorganic waste does not generate substantial quantities of gas, and that there will generally be an insufficient pressure differential to drive the 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.

3.3.4 Furthermore, the waste will be deposited within a site that will benefit from an engineered attenuation layer that will be constructed with suitable waste materials that can achieve the required permeability and attenuation standards. Further details of the attenuation layer are provided in the ESSD (Appendix E of the Environmental Permit Application) . On completion of filling to final levels, the site will be capped with 1m of restoration soils comprising not less than 0.3m of topsoil.

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

3.4 RECEPTORS

3.4.1 The details of all receptors within 1km of the site are summarised in Table 4 below and are shown on Drawing Number CHQC/B043634/REC/01.

Table 4: Receptors Within 1km of The Site

ID	Receptor	Direction from Operational Area	Minimum Distance from the Permit Application Boundary (approx. m)
Domestic Dwellings			
1	1-2 Lime Kiln Cottages	SE	30
2	Residential properties adjacent to Moxhill Rhyne	N	830
3	Residential properties on Combwich Road	E	550
4	Residential properties adjacent to Bridgewater and Taunton College	E	530
5	Residential properties off Rodway	E	500
6	Residential Properties off Park Lane	SE	470
7	Residential properties in Cannington	SE	735
8	Properties off Sandy Lane	W	900
9	Property adjacent to Mr Valley Farm	NW	970
10	Putnell Cottages	NE	420
Commercial and Industrial Premises			
11	Perry Green Farms	S	25
12	Pet friends Pet Services	E	25

13	Henfields Country Retreat	S	310
14	Anode Feeds	E	270
15	Acorn Logs	E	640
16	ACB Automotive	E	650
17	Baker G R & Son and West Country Grain Marketing Ltd	E	750
18	Animal Management Unit	SE	820
19	Withiel Farm	S	685
20	Installed Events	S	840
21	Mr Valley Farm	N	680
22	Commercial Properties Withiel Dr	S	670
Recreational			
23	Cannington Cricket Club	SE	550
24	Cannington Playing Fields	E	640
25	Cannington Golf Course	SE	970
Schools / Hospitals / Shops/Amenities			
26	Bridgewater and Taunton College	E	640
27	National College for Nuclear, Southern Hub	SE	765
28	Construction Skills and Innovation Centre	SE	960
29	Brymore	SW	860
Protected Habitats			
30	Priority Habitat Deciduous Woodland	Adjacent	On Boundary
31	Priority Habitat Deciduous Woodland	NW	200
32	Priority Habitat Deciduous Woodland	NW	415
33	Priority Habitat Deciduous Woodland	W	625
34	Priority Habitat Deciduous Woodland	W	770
35	Priority Habitat Deciduous Woodland	SE	650
36	Priority Habitat Deciduous Woodland	SE	810
37	Priority Habitat Deciduous Woodland	SW	850
38	Priority Habitat Deciduous Woodland	SW	820
39	Priority Habitat Deciduous Woodland	SW	965
40	Priority Habitat Lowland Calcareous Woodland	NW	490
41	Priority Habitat Coastal and Floodplain Grazing Marsh	N	165
Nature and Heritage Conservation Sites – Local Wildlife Sites (LWS)			
42	Cannington Park	Adjacent	On Boundary
43	Putnell Moor	Adjacent	On Boundary
Protected Species			
44	European Eel Migratory Route	N	462
Surface Water e.g. rivers and streams			
45	Pond	E	70

46	Wild Moor Middle Rhyne	N	180
47	Putnell Rhyne	N	185
48	South Moor Main Brook	N	470
Groundwater (sensitivity)			
According to the Multi-Agency Geographic Information for the Countryside's (MAGIC) website, the site is not situated within a Groundwater Source Protection Zone. In addition, the MAGIC website indicates that the site is located on a Principal aquifer.			

4.0 GAS RISK ASSESSMENT

4.1 Landfill Technical Guidance Note 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.

4.2 The site is predicted to generate negligible quantities of gas due to the inert nature of the waste. 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 gas at the site.

4.2 ACCIDENTS AND OTHER CONSEQUENCES

4.1.2 The EA'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 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 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 fire; and
- Failure of leachate extraction system and the effect on gas extraction.

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

4.2 QUALITATIVE GAS RISK ASSESSMENT

4.2.1 The potential hazards that exist from gas are:-

- Toxicity (acute and chronic);
- Ecotoxicity;
- Fire and explosion;
- Asphyxiation; and
- Odour

4.2.2 The trace components of 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. EA 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 5.

Table 5: Qualitative Risk Assessment

Receptor	Hazard	Sensitivity of Receptor	Likelihood of Exposure
Occupiers of domestic dwellings and farmhouses listed in Table 4.	Odour, toxicity, asphyxiation	High	Very Unlikely
Workforce and customers in commercial and industrial properties listed in Table 4.	Odour, toxicity, asphyxiation	High	Very Unlikely
Recreational areas listed in Table 4.	Odour, toxicity, asphyxiation	High	Very Unlikely
Priority Habitats, Local Wildlife Sites, Designated Sites and agricultural land listed in Table 4.	Eco-toxicity	High	Very Unlikely

4.2.4 Table 6 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 EA document LFTGN03. Table 7 provides a justification of the 'likelihood' scores for each of the accident or failure scenarios set out in Table 6.

Table 6: 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, 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 7: 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 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 site which would arise from a failure in the operator's waste acceptance procedures.

4.2.6 As set out in the Operating Techniques (Appendix C of the Environmental Permit Application), there will be strict waste acceptance procedures in place to minimise the risk of non-compliant wastes being accepted. All site staff will be made aware of the procedures and the requirements of the company Environmental Management System. Furthermore, the Operating Techniques details the measures to be taken in the event that unauthorised waste is identified within a load.

4.2.7 As such, is it considered unlikely that biodegradable waste will be deposited within the site.

5.0 GAS MANAGEMENT AND MONITORING

5.1 GAS MANAGEMENT

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

5.2 GAS MONITORING

5.2.1 In accordance with the EA's 'Waste recovery plans and deposit for recovery permits' guidance, if an operator intends to deposit waste more than 2m below the surrounding the ground surface, they must monitor the waste for methane, carbon dioxide and oxygen. The atmospheric pressure must also be recorded when taking gas readings.

5.2.2 As such, in-waste monitoring boreholes will be installed in areas where waste deposits exceed 2m below the surrounding ground surface. The location of in-waste boreholes will be confirmed through the completion of site surveys which will confirm areas that comprise waste deposits that exceed 2m.

5.2.3 All in-waste boreholes will be monitored in accordance with the monitoring programme detailed in Table 8.

Table 8: Monitoring Programme

Parameter	Monitoring Frequency
Methane, carbon dioxide, oxygen, atmospheric pressure, differential pressure, temperature.	Monthly for 12 months (i.e., 12 data sets) then quarterly.

5.3 ACTION LEVELS

5.3.1 Action Levels will be set for each borehole following the completion of 12 months background monitoring. Limits will be set based on guidance set out in the Technical Guidance Note LFTGN03 and Industry Code of Practice for Perimeter Soil Gas Emissions.

6.0 CONCLUSION

6.1 The proposed waste types will be inert in nature and will not give rise to significant quantities of gas. The negligible quantities of 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 gas is therefore considered to be low.

6.2 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 site shall ensure that significant quantities of 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.

6.3 This Gas Screening Report has determined that the site will not give rise to significant quantities of 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, although this is not a requirement for waste recovery sites. It is considered that, with respect to gas, the site will be compliant with the requirements of the EA.

DRAWINGS

CHQC/B043634/PER/01 - Environmental Permit Boundary

CHQC/B043634/REC/01 – Receptor Plan