



Tier Environmental Ltd

Chadwick House, Warrington Road, Birchwood
Park, Warrington, WA3 6AE
01925 818 388

TECHNICAL NOTE

SYMMETRY PARK MERSEYSIDE (FORMER CRONTON COLLIERY) MINE GAS RISK ASSESSMENT

Client:	Tritax Symmetry Ltd	Version:	Final
Reference:	TE1163-TE-00-XX-TN-GE-003-V02	Author:	Eve Rowland
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1 Introduction

Tier Environmental were commissioned by Tritax Symmetry Ltd to conduct a Mine Gas Risk Assessment for the Former Cronton Colliery, located off Cronton Road (A5080), L35 1QR. The purpose of this report is to outline the risk associated to the site from mine gasses associated with the historic colliery.

This report should be read in conjunction with the Ground Investigation Report (report ref: TE1163GIR1.5, dated 29th March 2023) which outlines the overall ground gas risk assessment for the site. This Mine Gas Risk Assessment has been undertaken in accordance with the CL:AIRE document "Good Practice for Risk Assessment for Coal Mine Gas Emissions" published in October 2021.

2 Previous Site Ground Gas Risk Assessment

Ground gas monitoring installations were monitored on site on:

- 3 No. occasions between 2nd August 2019 and 30th August 2019; and,
- 6 No. occasions between 2nd September 2020 and 23rd November 2020.

The rationale behind this monitoring period was to determine the hazardous ground gas concentrations from a moderate risk source for a proposed commercial land use in accordance with CIRIA C665.

In accordance with CIRIA C665, the assessment of these results produced a maximum Gas Screening Value of 0.3276l/hr, derived using the maximum recorded carbon dioxide concentration of 15.6%v/v and the maximum steady flow rate of 2.1l/hr. Assessment of this gas screening value alone places the site in a Characteristic Situation 2 - low risk scenario in accordance with CIRIA C665 for **which ground gas protection measures will be required.**



Regrading works using site-won materials are proposed/undertaken beneath each unit to provide suitable development platforms.

Tier Environmental have also considered the risk from the outcropping coal seam and faulting system that underlies the site, targeting multiple boreholes above these features. After a thorough review of the conceptual site model, gas monitoring data and development plans, Tier Environmental are satisfied that a CS2 scenario across the Site will adequately protect the proposed development and future site users from hazardous ground gases.

3 Mine Gas Conceptual Site Model Summary

3.1 Ground Conditions Summary

From a conceptual site model perspective, the site is underlain in part by Made Ground generally comprising of colliery spoil with localised demolition rubble in the former colliery area of the site, and topsoil and subsoil in the agricultural land in the northwest of the site.

These in turn are generally underlain by cohesive, and locally granular, glacial Till Deposits.

The superficial deposits (Made Ground and Till) are underlain by bedrock of the Pennine Middle Coal Measures Formation in the west and the Kinnerton Sandstone Formation in the east of the site. These two formations are separated by the presence of a north-south trending normal fault with strata downthrown to the east.

The Coal Measures consist mainly of mudstone with bands of sandstone and occasional coal seams. Bedding was observed as very thinly laminated to medium bedded, dipping in the south-western direction.

3.2 Recorded Mine Entries

The site has 3 No. capped mine shafts on site. Coal Authority records indicate:

- Shaft 1 (southern shaft) was 4.57m in diameter and 220.4m deep. It was backfilled in 1969 and grouted and capped in 1984/5 by the National Coal Board.
- Shaft 2 (central shaft) was 6.40m in diameter and 519.1m deep. It was backfilled, grouted and capped in 1984/5 by the National Coal Board.
- Shaft 3 (northern shaft) was 6.40m in diameter and 485.3m deep. It was backfilled, grouted and capped in 1984/5 by the national coal board.

3.3 Recorded Mine Workings

Coal Authority records indicate deeper coal seams were worked between 85m and 558m bgl beneath the site.



3.4 Unrecorded Mine Workings

The Worsley Four Foot coal seam is known to outcrop within the western area of the site (beneath Units 2 and 4) with a dip of approximately 12° towards the southwest. There are no recorded workings within this seam but rotary boreholes have encountered evidence of workings, such as loss of flush.

Stabilisation works (drilling and grouting) of the Worsley Four Foot seam is currently ongoing. The contractor has confirmed that no elevated concentrations of methane or carbon dioxide have been recorded to date during these works.

3.5 Unrecorded Mine Entries/Bell Pits

Based on the evidence of unrecorded shallow mine workings within the Worsley Four Foot seam, unrecorded mine entry/entries associated with these workings must be present within the western area of the site.

3.6 Potential Mine Gas Sources

The main sources of mine gas are considered to be:

- Deep recorded workings between 85m and 558m bgl; and,
- Unrecorded shallow workings within the Worsley Four Foot seam.

3.7 Potential Mine Gas Pathways

The main migration pathways for potential mine gas migration are considered to be:

- 3 No. recorded mine entries, although the likelihood of gas migration to surface via these pathways is reduced due to the shafts being capped, ventilated and recent Coal Authority monitoring data suggests low levels of mine gas;
- Geological faults between the deep recorded workings and rockhead;
- Fractured bedrock above the shallow workings; and,
- Unrecorded mine entries associated with the Worsley Four Foot.

4 Discussion

The main drivers of gas migration at this site are considered to be:

- Rising groundwater within the mineworkings.
- Changes in barometric pressure.
- Thermal gradient variations.

The deep underground mining at Cronton Colliery ceased approximately 40 years ago and the shafts were infilled, capped and vent stacks installed.



It is understood that the associated deep groundwater pumping ceased and groundwater rebound is currently ongoing and monitored by the Coal Authority.

Coal Authority (CA) monitoring has shown that groundwater is approximately 40m bgl, meaning the recorded mine workings from 85m bgl and deeper will now be flooded. It is therefore considered that the flooded mine workings will limit the desorption of further mine gases once the water pressure exceeds the desorption pressure within the mine workings and will further limit the availability of oxygen and transport of gases.

The Coal Authority monitoring data for the 3 No. recorded shafts (presented in Appendix B) indicate that emissions of methane and carbon dioxide generally reduced circa 2014/15, possibly due to the flooding of the deep mine workings. It is considered that the risk of migration of mine gases via the 3 No. mine entries is low due to the shafts being infilled, capped and having permanent ventilation to atmosphere.

Within shallow boreholes monitored by Tier, varying water levels were recorded across the site, indicating that the groundwater observed within the shallow deposits consists of isolated groundwater.

There is a potential for periodic groundwater fluctuations within the shallow unrecorded workings within the Worsley Four Foot seam due to effects such as seasonal variations; this therefore represents a potential risk of gas migration due to groundwater pumping effects. The risk of ground gas migration is greatest from these shallow unrecorded workings underlying the site; most likely through fractures and faults within the bedrock and also along the subcrop/outcrop of the seam.

Stabilisation works (drilling and grouting) of the unrecorded workings within the shallow Worsley Four Foot seam beneath Unit 2 are ongoing. Similar works are proposed beneath Unit 4 during the enabling works for that unit. The stabilisation works will reduce the potential risk from mine gases as any voids and/or conduits will be infilled. A careful approach to the grouting works will be undertaken as it is possible that gas can be diverted out of workings, or that flows of acidic minewater that can cause generation of carbon dioxide can be diverted. The mine gas risk assessment has been produced with consideration given to the grouting plans.

Future landowners should also be aware of any future potential grouting in off-site connected workings, and this should be considered if reasonably foreseeable, although based on the subcrop/outcrop of the seam and the relatively isolated location of this development, this is likely to present a low risk.

Deoxygenated gas has also been observed during the monitoring period which is representative of mine gases from the oxidation of coal. This has also been noted as a risk to future site users.

It is also noted that the most common pathway into buildings post development on coal mine gas risk sites is via unsealed service entries into buildings. It is therefore recommended that the developer utilises a suitable expanding resin around all service entries.



A borehole decommissioning plan will be produced and implemented prior to the development to ensure that the boreholes do not act as conduits for mine gas flow.

Ground gas monitoring conducted by Tier across the site recorded a worst case maximum peak and steady concentration of carbon dioxide of 15.6% v/v at WS8 with a corresponding lowest peak and steady oxygen concentration of 0.2% v/v at WS9 during the second monitoring visit. A maximum peak concentration of methane of 1.4% v/v and a steady concentration of 0.4% v/v was reported at the site. A maximum carbon monoxide level of 18ppm, which is below the workplace long term exposure limit (30ppm) and a maximum hydrogen sulphide level of 1ppm was recorded. A maximum peak positive flow rate of 12.4l/hr has been reported at CP101, with a maximum steady flow rate of 2.1l/hr also reported at WS10. A maximum negative peak flow rate of -9.1l/hr has been reported at the site with a corresponding maximum steady negative flow rate of -1.5l/hr.

In accordance with CIRIA C665, the assessment of these results obtained to date produced a maximum Gas Screening Value of 0.3276l/hr, derived using the maximum recorded carbon dioxide concentration of 15.6%v/v and the maximum steady flow rate of 2.1l/hr. Assessment of this gas screening value alone places the Site in a Characteristic Situation 2 – low risk scenario in accordance with CIRIA C665 **for which ground gas protection measures will be required.**

Tier Environmental has reviewed the records of gas monitoring conducted on the shafts by the Coal Authority on circa 150 No. occasions between 2005 and 2023. Within the last 5 No. years of bi-monthly monitoring, the highest concentration of carbon dioxide has been recorded at 6.9%v/v in Shaft 3 on 12/01/2023 and the highest methane concentration has been recorded at 7%v/v in Shaft 3 on 06/03/2019.

The CS2 classification and associated required protection measures are therefore considered appropriate for the site based on the results of recent Coal Authority monitoring data.

5 Ground Gas Recommendations

Overall, Tier Environmental recommend that the gas protection measures in line with a Characteristic Situation 2 (as outlined in the Tier Ground Investigation Report) are implemented to adequately protect the site from future mine gas emissions within the proposed development, based on the following:

- The presence of the unrecorded shallow mine workings are/will be infilled during the stabilisation (drilling and grouting) works.
- Any unrecorded mine entries that are encountered during the regrading works and stabilisation works will be treated by either excavation and infilling and/or drill and grouting.
- The deeper coal seams (greater than 85m depth) that have been worked are understood to now be flooded.



- The Coal Authority will continue to monitor and manage the mine gas emissions from the 3 No. shaft vents.
- The ground gas and groundwater conditions recorded in both Tier Environmental site works and monitoring visits and Coal Authority monitoring visits.



APPENDIX A – FIGURES AND DRAWINGS



APPENDIX B – COAL AUTHORITY GROUND GAS MONITORING RECORDS