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7th May 2021

Dear Dafydd,

RE: BRYN GLAS RHOS: UPDATED MINING GAS RISK ASSESSMENT

In reply to the comments by Angela Guy of WCBC, we have the following response. To address WCBC concerns we have attached:

- Original gas risk assessment, see Appendix A,
- Plan showing proposed development and location of borehole, see Figure 1,
- Cross Section through the development showing conceptual ground model, see Figure 2.

This report should be read in conjunction with Appendix A.

The proposed site layout confirms that the borehole was drilled close to the site entrance, as this was the only place it could be drilled, and is definitely not beneath the proposed plots. It was backfilled in its lower part by drill arisings, with a cement/ bentonite plug installed in the upper 2m to seal the borehole.

In addition, the cross section confirms that the water pressure on the base of the borehole is 230kN/m², which is equivalent to 23 tonnes per m². A considerable hydraulic head of water to resist any potential upward migration of gas, which is reiterated in the cross section.

The cross section confirms the presence of two layers of very low permeability clay, which would act as barriers to upward migration of gas, especially when combined with the very high hydraulic water pressures.

The cross section also shows the presence of permeable sand and gravel, which outcrops in the valley sides of the Afon Eitha. Consequently, should any gas migrate through the low permeability clay, it would vent in the valley sides.

In addition, since the initial gas risk assessment the foundations type has been changed from strip foundations, with underfloor venting to a raft foundation designed to span 3m and cantilever 1.5m at its edge. The raft foundations will also incorporate full radon protection measures.

We would therefore reiterate the findings of the original gas risk assessment that the risk is very low and has been reduced to negligible by the additional gas protection measures incorporated into the foundations.

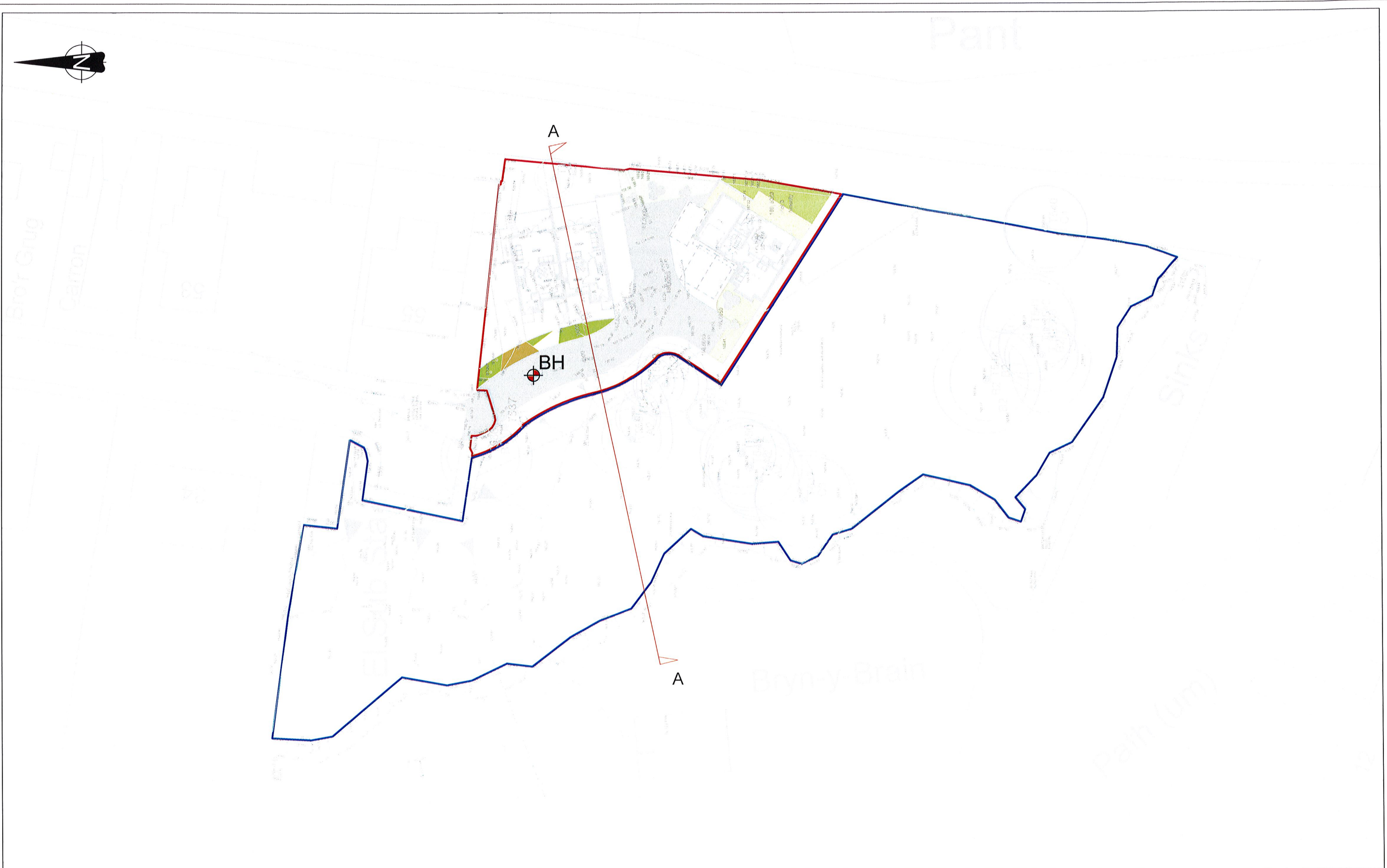
We trust this is satisfactory, should you have any queries please call Mike Scott on 01244 661361.

Yours sincerely



Mike Scott

FIGURES



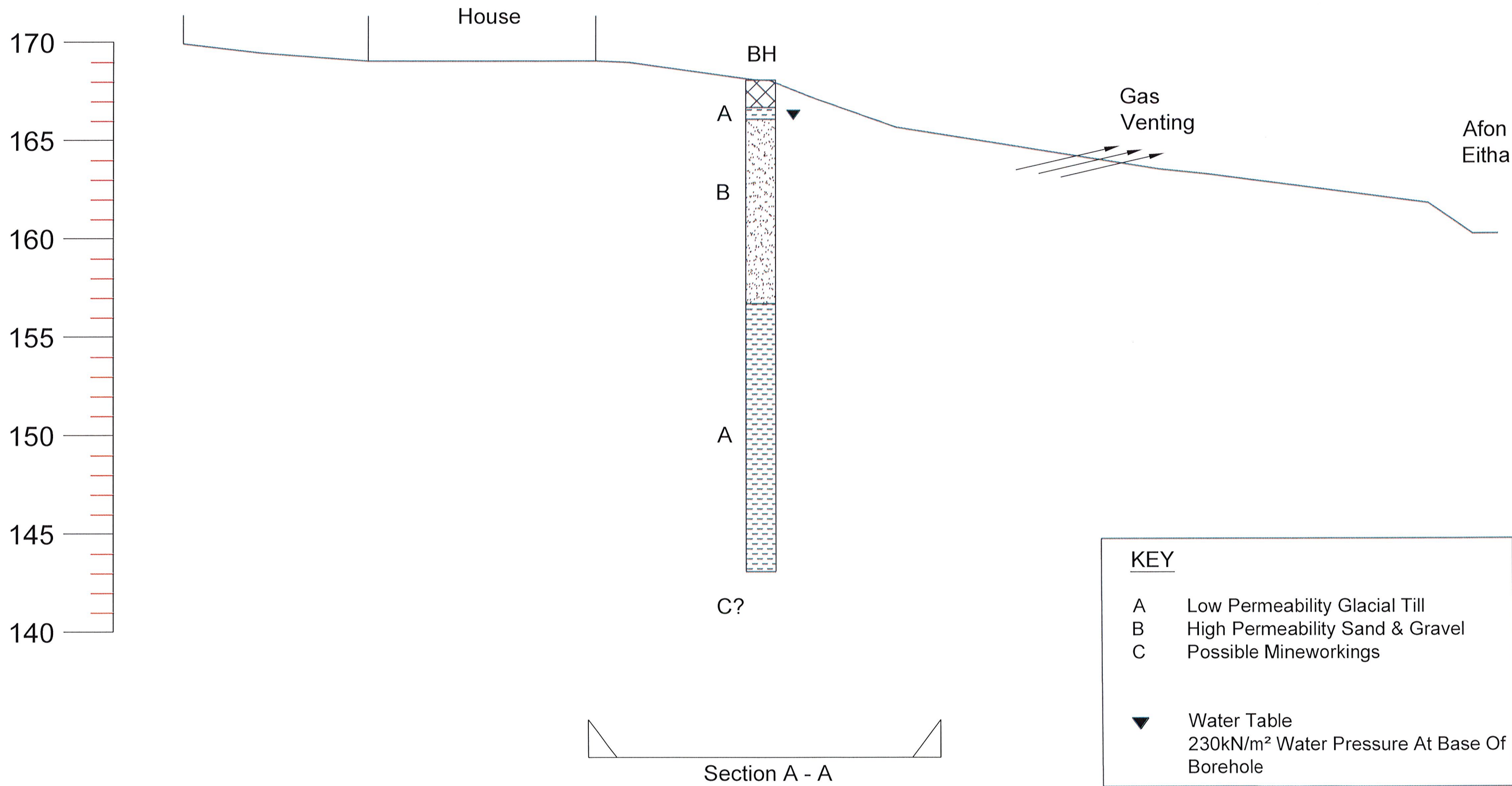
SCALE 1:500 @ A3

Legend

-  Cross Section
-  Borehole Location

Figure Title Plan

FIGURE 1



SCALE 1:200 @ A3

Figure Title

Section A - A

FIGURE 2

APPENDIX A

Original Gas Risk Assessment

Introduction

When GroundSolve Ltd (GSL) were appointed by the client, our commission was only to address the mining issues, which was issued on the 17th June 2020.

Subsequent to this we have been provided with the Planning Conditions, Reference RHO P2018/1047, which does not contain any conditions relating to contamination. Therefore, it is assumed that there are no landfills within 250m in the Local Authority database that could have initiated such a condition. Therefore, this letter only refers to the risk from Mine Gas.

A rationale method for classifying gassing sites in terms of the risk posed by the presence of gas should consider:

- The source of the gas,
- The generation potential of the source,
- The location of the source, and the presence of any natural geological barriers to migration,
- The borehole flow rate and estimated surface emission rate,
- Measures gas concentrations,
- Nature of the proposed development.

Geological Setting

Rhosllanerchrugog is in an area where rock head is generally at or close to surface and where numerous coal seams outcrop, which have been extensively worked for several hundred years. In addition, during the 1926 miners' strike most back gardens in Rhos were reported to have had a coal pit in the back gardens.

It is therefore surprising that this area has not got a serious problem with mine gas. However, with over 35 years of working in this area, undertaking gas monitoring and drilling for mine workings, and monitoring gas at the borehole no elevated gas levels have been recorded, which necessitate gas remedial measures to the development.

This does not even start to compare with the situation at this site, which is next to the Afon Eitha, with the Wrexham Planning Study and previous nearby boreholes confirming the superficial deposits have a thickness of around 20m. In fact, the borehole drilled on site proved 25m of superficial deposits before the contractor ran out of casing. This site is therefore in a glacial infilled channel, with a significant thickness of glacial till overlain by saturated water bearing sands and gravels.

The glacial till being deposited beneath advancing ice sheets, with the sand and gravel being deposited by meltwaters during retreat of the ice sheets.

Sources of Gas

The desk study identified a possible shaft on site. However, a detailed search involving excavation to natural ground failed to reveal any evidence of the shaft. This was not surprising, as the shaft pre dated 1850, and the source information was poor. In addition, the site strip did not encounter any colliery spoil, confirming that there were no mine shafts in the vicinity.

This shaft would have been the main conduit to surface should mine gas be present or an issue.

Generation Potential of the source

The generation potential of the source depends entirely on whether it was worked, I.e., if it hasn't been worked there is no generation potential. However, the borehole to investigate the possibility of shallow mine workings was drilled to a depth of 25m without encountering bedrock. The Coal Authority report claimed that the site had been underworked at an estimated depth of 17m, in 1872. However, it also recorded the same seam being worked at 54m beneath the site, which ties in with the background information. If the seam had been at 17m it would have been eroded by the glacial activity.

Due to the age of the workings, pre dating 1850 and the thickness of superficial deposits, it was concluded that the site had not been undermined at shallow depth.

Geological Barriers to migration

In any case, the borehole did not encounter any mine gas during drilling and recorded a considerable thickness of low permeable clay (glacial till), which would act as a significant barrier to any upward migration of mine gas. In addition, the clay was overlain by more permeable sand and gravel, which was saturated with water from a depth of 2m, providing a significant hydraulic head to resist any upward migration of mine gas.

A summary of the borehole is presented below:

Depth (m)	Strata
0.00 – 1.30	Made ground
1.30 – 2.00	Glacial Till
2.00 – 11.0	Sand and Gravel
11.0 – 25.0	Glacial Till

Groundwater was encountered as copious flows in the borehole, which encountered groundwater at a depth of 2m. Since the Afon Eitha was estimated to be some 9m below site level, it is considered likely that the groundwater is in hydraulic continuity with the river.

Consequently, any mine gas, if present would have to migrate upwards through at least 14m of low permeability clay. It would then enter highly permeable sand and gravel, which is saturated with water, providing a significant hydraulic head, which would act as a barrier to upward migration. However, there is a 9m slope in sand and gravel beneath the site leading down to the river, which would provide a means of any gas venting to atmosphere through the valley sides.

Gas Protection Measures

In our earlier reports it had been planned to provide conventional strip foundations. However, to address concerns from the Coal Authority there's have been changed to rafts.

The floor slab was to be provided with a beam and block construction, which would provide a ventilated void beneath the slab and include a 1,200gauge DPM incorporated into the construction.

When the foundations change to rafts then a radon sump will need to be incorporated into the construction.

Therefore, this will address the very low residual risk from possible mine gas.