

23 April 2018

Stacey Inglis
Contaminated Land Officer
Wrexham County Borough Council
16 Lord Street
Wrexham
LL11 1LG

Ref: EPG/2018/WCBC/Q2-L01

Dear Stacey

**Review of Contamination Assessment & Letter Report
Former Scrapyard, Llwyneinion**

We write further to your recent emails regarding the former scrapyard (referred to previously as the 'Legacy Car Dismantlers and Scrap Yard') at Esclusham Mill, Llwyneinion, hereafter referred to as 'the site'.

As discussed, it is understood that planning permission (Reference P/2016/0611) is being sought for development of the site in accordance with a drawing produced by Axis Architectural Services Limited entitled '*Site Plan as Proposed (Including Newt Mitigation Details)*', Drawing Reference CGP1/TMJ-04 (dated May 2016). Specifically, the development will comprise the following elements:

- A Wildflower Meadow;
- A Newt Mitigation Area; and
- 7 No. detached residential homes, complete with private gardens, garages and related infrastructure / areas of communal soft landscaping.

The residential houses are proposed for construction on the northern area of the site, accessed off Llwyneinion Road. The layout of the proposed residential development is presented in a drawing produced by Axis Architectural Services Limited entitled '*Proposed Residential Development*', Drawing Reference CGP1/TMJ-03 (Revision B, dated January 2018). The proposed residential development area will be hereafter referred to as the 'development platform'.

The site is located in an area with a long history of mineral excavation / quarrying and landfilling. The areas of landfilling are identified in a drawing produced by Wrexham County Borough Council (WCBC) entitled '*The Approximate Location of Former Waste Tips & Walwrn Borehole*', dated 13 November 2006. *Note: Cable Tip (Ref. H) is now known to extend further to the north-east than indicated in this drawing.*

To provide some background to EPG, our Technical Director (Steve Wilson) has authored much of the UK's gas guidance. Recent publications include;

- CLAIRE Technical Bulletin 16 – Complete Continuous Monitoring in Underfloor Voids (CLAIRE, December 2017);
- ICE, Environmental Geotechnics Publication – Piled Foundations and Pathways for Ground Gas Migration in the UK, November 2017;
- CIRIA Report C735 – Good Practice on the Testing and Verification of Protection Systems for Buildings Against Hazardous Ground Gases (CIRIA, 2014);
- CIRIA Report C748 – Guidance on the Use of Plastic Membranes as VOC Vapour Barriers (CIRIA, 2014);
- CLAIRE Research Bulletin 17 – A Pragmatic Approach to Ground Gas Risk Assessment (CLAIRE, November 2012);
- The Local Authority Guide to Ground Gas (Chartered Institute of Environmental Health, 2008); and
- CIRIA Report C665 – Assessing Risks Posed by Hazardous Ground Gases to Buildings (CIRIA, 2007).

In addition to the above, Steve sat on the steering group for the following British Standards:

- BS8485:2015. Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings; and
- BS8576:2013. Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds.

Reflecting EPG's extensive experience in the fields of gas and vapour intrusion risk assessment, WCBC have requested that we complete an independent review of the information submitted in relation to the proposed residential development on the northern portion of the site. Specifically, in addition to the afore referenced drawings, the following information has been provided to EPG for review:

- Smith Grant Environmental Consultancy LLP – Stage 1 and 2 Contamination Investigation & Assessment, Reference R2122-R01-v2, dated September 2015.
- Memorandum from the Contaminated Land Officer at Wrexham County Borough Council, Reference P20160611, entitled 'Legacy scrapyards Llwyneinion', dated 4 August 2016.
- Source Summary Table, Reference R2499-L20171201, 1 December 2017.
- Letter from Smith Grant Environmental Consultancy LLP dated 15 February 2018, Reference R2499-L20180215_Ground Gas Risk Assessment (Final).

It is EPG's first observation that WCBC need to be satisfied that the proposed development will be appropriate for its location and not pose an unacceptable risk. Current guidance is clear that local planning authorities should work with developers to find acceptable ways forward if there are concerns about land contamination. For example, planning permission can be granted subject to condition(s) and/or planning obligations can be sought in the light of the information currently available.

Ultimately, responsibility for securing a safe development rests with the developer and/or landowner. However, it is the remit of the Local Authority to ensure that all necessary steps are put in place via the planning process to ensure that a site has been remediated such that there are no ‘unacceptable risks’ which could result in the site being determined as ‘Contaminated Land’ as defined by Part 2A of the Environmental Protection Act 1990 and clarified by the Contaminated Land Statutory Guidance (DEFRA and the EA, April 2012).

Local authorities can use planning conditions, where the relevant tests are met, to ensure that development (other than that required to be carried out as part of an approved scheme of remediation) should not commence until the identified stages in delivering a remediation scheme have been discharged. These stages and the factors to consider in framing appropriate planning conditions include:

- Site characterisation – what is required, including what sort of survey, assessment and appraisal, by whom and how the work is to be presented;
- Submission of the remediation scheme – what it should include;
- Implementation of the approved remediation scheme – notification to the local planning authority of when the works will start, validation that the works have been carried out and reporting of any unexpected contamination; and
- Monitoring and maintenance – what is required and for how long.

Planning obligations could be used in a number of situations, for example:

- To ensure that any necessary offsite treatment works (e.g. the installation of gas-migration barriers) are put in place;
- To restrict the development or future use of the land concerned; or
- For payments to the local planning authority, for example, for on-going monitoring, maintenance, or as a bond to cover the contingency of future action triggered by the monitoring.

Reflecting the above, the structure of EPG’s review is as follows:

- Site and Surrounding Area Environmental Setting;
- Intrusive Works – Ground Conditions;
- Gas Monitoring;
- Assessment of Gas Risks;
- Contamination – Vapour Risks;
- EPG Comments; and
- Conclusions and Recommendations.

Site & Surrounding Area Environmental Setting:

The geology of the area comprises Glacial Till underlain by the Bettisfield Formation (Coal Measures). The Glacial Till is relatively thin in the area and has been extensively quarried for clay pipe and brick manufacture. There is also evidence to suggest shallow and deep workings within the underlying Coal Measures, with shafts known to be present to both the north and south of the proposed residential development platform.

In the 1950's/60's the residential development platform was subject to landfilling (Old Refuse Tip 1). This landfill continued extensively to the south of the site, beneath the areas of proposed Wildflower Meadow and Newt Mitigation. Old Refuse Tip 1 received domestic waste as deposited by the Local Authority. In the mid-1970's (1974 to 1975) the domestic waste to the south of the residential development platform was topped with industrial waste, in an area referred to as 'Cable Tip'. Cable Tip received industrial waste including; cabling (~50%), plastic, glass, polystyrene, paint, tar, drums and pharmaceutical waste. There is no evidence to suggest that Cable Tip extends beneath the area of proposed residential development, see *Intrusive Works – Ground Conditions*.

Following closure of Old Refuse Tip 1, the site was utilised for car dismantling and as a scrap yard. The site has subsequently been cleared, in preparation for residential development.

The surrounding area has a long history of mineral extraction / quarrying and subsequent landfilling. Landfills are present to immediate north (Old Refuse Tip 2), south (continuation of Old Refuse Tip 1 and Cable Tip) and west (various, see WCBC drawing dated 13 November 2006).

Intrusive Works – Ground Conditions:

One phase of intrusive works has been completed on site by Smith Grant (September 2015). The intrusive works comprised 12 No. trial pits and 3 No. cable percussive boreholes. Standpipe installations were constructed in each of the cable percussive boreholes, targeting the on-site landfill material and underlying (potentially reworked) Glacial Till (cohesive) geology. Bedrock was encountered at between 2.0mbgl (BH2) and 7.0mbgl (BH3).

Ground conditions typically comprised old domestic waste from the 1950's/60's (interbedded ashy sands and coarse clayey gravel with clinker, glass, brick and pottery – local plastic, rubber and newspaper) and colliery spoil (shale gravel with local inclusions of glass bottle). The thickness of the Made Ground was found to increase to the south of the site, where trial pits on the southern boundary often failed to prove the full depth of the fill material (>4m). To the north of the site TP1 and TP2 recorded 1.3m of Made Ground, underlain by sand. Consistent with Table 3.1 of The Local Authority Guide to Ground Gas (CIEH, 2008), domestic waste from the 1950's/60's is considered to have a 'low' to 'moderate' gas generation potential. Certainly, the descriptions of the waste (which do not indicate significant quantities of degradable material) are consistent with a mass which is likely to have a low gas generation potential ~50yrs after deposition. The colliery spoil will be capable of generating some carbon dioxide if infiltration of acidic water occurs, although generation rates will be low.

Gas Monitoring:

Smith Grant completed 6 No. gas monitoring events via the three installed boreholes. Of these visits 3 No. targeted low-pressure events (<1000mb). Consistently low methane concentrations were detected (<0.1%v/v). Slightly elevated carbon dioxide was recorded in BH3 (peak 11.8%v/v). This carbon dioxide may well be associated with the colliery spoil recorded in BH3, and consistent with this source flow rates have remained low (0.0l/hr).

Assessment of Gas Risks:

Smith Grant assessed the gas monitoring data collected for the site and concluded that the site should be classified as Characteristic Situation 2 (CS2) (i.e. Amber 1) in accordance with BS8485:2015 '*Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*'.

Smith Grant considered that the adoption of CS2 gas protection measures would also resolve risks associated with radon, noting that the site is located in an area where between 3% and 5% are affected by radon in excess of the specified Action Level such that BASIC radon protection measures are required.

Contamination – Vapour Risks:

During the intrusive works completed by Smith Grant, solvent odour was reported in TP8 (>2.5mbgl) and a TCP like odour was reported in TP9 at 2.5m depth. Both TP8 and TP9 are located on the southern boundary of the residential development platform. Smith Grant targeted 3 No. soil samples at the observed olfactory odour in TP8 and TP9, submitting these for analysis of Volatile Organic Compounds (VOC's) and Semi Volatile Organic Compounds (SVOC's), both with Tentatively Identified Compounds (TIC's). All three soil samples returned relatively low VOC and SVOC concentrations. No TIC's were identified. Smith Grant concluded that additional works were required in the proximity of TP8 and TP9, but that because of the depth of the contamination ~2.5m risks were unlikely to be significant and the CS2 gas protection measures were likely to prove sufficient to mitigate any associated residual risk.

EPG Comments:

Following submission of the Smith Grant report to WCBC a series of technical comments were raised by the Contaminated Land Officer at WCBC ((CLO) see 'Memorandum' dated 4 August 2016). Smith Grant responded to these queries in correspondence dated 15 February 2018. EPG has reviewed the queries raised by the CLO and the responses made by Smith Grant. The following tables summarise our observations and details our position as an independent reviewer of the information submitted as part of the proposed planning application.

CLO Query	EPG Independent Review
1. Investigation of Wildflower Meadow and Newt Mitigation Area	Outside scope of EPG's assessment.
2. Public right of way	Outside scope of EPG's Assessment
3. Former Mine Shaft	Smith Grant should confirm the stand-off between the known on-site shafts and the area of residential development. The stand-off should be determined taking into account the depth of the shafts and the likely zone of influence in the event of the shaft collapse occurring. The potential for other (as yet unknown) shafts should also be noted.
4. Number and spacing of gas monitoring locations.	In accordance with Table 5.1 of The Local Authority Guide to Ground Gas EPG consider that, for a 'Moderate' gas hazard (i.e. older domestic landfill) on a 'High' sensitivity end use site, gas monitoring bores should be spaced at between 25m and 50m, although wider spacings may be appropriate if justified against a robust CSM. The Conceptual Site Model (CSM) is critical and on this site a pictorial CSM is considered to be key. Whilst we concur that the main source of gas will be the landfill material beneath the site – there are potential credible off-site sources to the north, south and west. The old shafts and mine workings are also a potential source. To the north, the sand encountered in TP1 and TP2 below 1.3mbgl provides a potential pathway for gas migration from Old Refuse Tip 2 (located ~18m north). No gas monitoring has been completed to assess this migration pathway. The exploratory holes completed by Smith Grant to the south indicate that waste thicknesses may increase, potentially also becoming more onerous in the proximity of Cable Tip. No gas monitoring has been completed to investigate the potential implication of this on the southern boundary of the development platform, notably in the proximity of Plots 5 and 7. To the west of the site a number of further landfills are known to be present. It is unclear how the topography of the site, former railway cutting and the landfills themselves influence the potential for gas migration. The CSM should look to assess this, with monitoring bores located accordingly. Smith Grant should refer to Table 5.2 of The Local Authority Guide to Ground Gas, which provides recommendations for the spacing of monitoring boreholes to assess off-site gas migration sources.
5. Frequency of gas monitoring.	The gas monitoring completed by Smith Grant spans an approximate 5-week period between mid-May and mid-June 2016. Table 5.3 of The Local Authority Guide to Ground Gas recommends that for a 'Moderate' gas generation potential source and 'High' risk end use the idealized frequency of gas monitoring is 12 No. visits over a 6-month period. This period could be expedited via the use of continuous monitoring devices, subject to the units continuously collecting flow rate data.
6. Scrap yard surfacing	No comment.
7. Visual observations at surface	EPG agree with WCBC.
8. Asbestos, Cable Tip	Outside scope of EPG's assessment.
9. Controlled Waters	Outside scope of EPG's assessment.

10. TP8	The log sheets provided by Smith Grant for TP8 and TP9 are clear that the odour noted during the site investigation was solvent based, not hydrocarbon. We concur with Smith Grant and WCBC that additional intrusive works are required on this area of the site to determine the associated risk to human health. It should be noted that for solvent phase contamination the lack of any positively detected soil concentrations does not mean that associated vapour phase risks are low. It is recommended that intrusive works are completed to delineate the area of impact. It is considered important that these intrusive works include the installation of specific vapour wells and that vapour phase sampling is completed in order to assess the associated risk. We concur with WCBC that the gas membrane selected to mitigate risks associated with bulk gases and radon may not be sufficient to mitigate risks associated with VOC's. It is strongly recommended that reference is made to CIRIA Report C748 – Guidance on the Use of Plastic Membranes as VOC Membranes (2014) when assessing any vapour phase contamination on this portion of the site. Specifically, if VOC's are detected in the vapour phase, modelling should be completed to demonstrate that the membrane selected for adoption is appropriate, based on membrane specific and contaminant specific permeation rate laboratory testing.
11. TP9	
12. Gas Protection Mitigation	With regard to the recorded Soil Organic Matter concentrations (maximum 48%) we concur with Smith Grant that these are likely to be directly attributable to the ash, clinker and shale content noted generally in the Made Ground. Such material will not readily degrade and thus associated gas risks are considered to be low. Notwithstanding the above, noting the comments provided by EPG in response to Queries 4, 5 and 10/11 we concur with WCBC that the gas protection measures currently outlined for adoption cannot be approved until the uncertainty identified has been resolved.
13. Water Supply Pipes	Outside scope of EPG's assessment.
14. Gas Risk Assessment	The works completed by Smith Grant to date have not identified significant concentrations of permanent gases or large gas volumes in the ground. This gas regime is consistent with the ground conditions observed by Smith Grant. On this basis, EPG concur with Smith Grant that residential development is likely to prove feasible on the proposed development platform. Nevertheless, EPG concur with WCBC that a standalone Gas Risk Assessment should be completed for the site. As discussed in EPG's responses above, we consider that this document needs to provide a pictorial CSM and take into account all credible on-site and off-site gas sources. It is considered that additional intrusive works are likely to be required to inform this Gas Risk Assessment, specifically to reduce data uncertainty and increase data confidence, notably with respect to off-site sources and potential VOC risks. EPG consider that the above works could be completed post granting of Planning Permission for residential development, via a Condition which requires detailed Site Characterisation (in consultation with, and to the approval of, WCBC). This comment does not extend to the Wildflower Meadow or Newt Mitigation Area, which are beyond EPG's review remit and where no intrusive works have been completed to date as part of the proposed planning application.
15. Outline Remedial Strategy	Consistent with EPG's response to Item 14, it is considered that the requirement to provide a Remediation and Verification Strategy for the gas mitigation scheme on site could be conditioned as part of the planning process.

EPG Notes – In Direct Response to Smith Grant Correspondence Dated 15 February 2018	
Page 2, Para 1	Consistent with current UK guidance, the protection measures to all buildings proposed as part of the residential development should be passive. No active protection measures should be permitted. The Gas Risk Assessment recommended for completion will need to take into account the proposed foundation and floor slab construction of the residential properties. Vibro stone columns should not be permitted for adoption on this site. Ventilation calculations will be required for the vented void to demonstrate that it achieves 'very good' performance in accordance with BS8485:2015.
Page 3, Para 2	We do not concur with Smith Grant that the position of BH1, BH2 and BH3 will represent conditions at least 50m beyond the site boundary, in the POS. As discussed above (Item 4) EPG considers that additional gas monitoring locations are required to assess potential risks associated with off-site sources.
Page 3, Para 3	Due to the ground conditions encountered it is anticipated that some form of piled solution will be adopted for the proposed residential dwellings. Smith Grant need to thus clarify what 'large-scale earthworks' will be completed in order to investigate the heterogeneity of the Made Ground. In EPG's opinion, the excavation of local pile caps / ground beams would not constitute 'large-scale earthworks'.
Page 3, Para 5	CLAIRE Research Bulletin 17 is not appropriate for assessment of this site, noting that: • Credible sources of on-site and off-site gas have been identified, including landfills and coal workings; • The maximum depth of Made Ground most likely exceeds maximum 5m and/or average 3m, noting that a number of trial pits on the southern boundary of the site failed to prove the depth of the fill material; and • No forensic assessment of the Made Ground was completed to determine the content of the degradable organic matter and/or the TOC values of the constituent parts of the overall mass.
Page 5, Para 1 & 2	Smith Grant note the proximity of other landfills, to the north and west of the site. They note that these landfills are younger and potentially contain more degradable waste with a higher gas generation potential. However, they conclude that risks are low due to the absence of drift material and the composition of the bedrock. As discussed above (Item 4), TP1 and TP2 both encountered sandy drift material which could provide a pathway for gas migration from the off-site area of filling to the north. A pictorial CSM is required, to take into account all credible on-site and off-site gas sources. Where off-site gas sources are not considered to be credible the lines of evidence which support this decision needs to be fully justified. The pictorial CSM should comprise scaled geological cross sections.
Page 5, Para 5	Smith Grant need to confirm how exactly ' <i>any site preparatory works would be expected to remove any significant deposits of degradable organic matter</i> '. This statement needs to be justified on the basis of the development proposals (i.e. is there any proposed cut and fill, what are the foundation construction requirements, what 'large-scale earthworks' are proposed etc.). An earthworks balance assessment showing cut and fill contours is required to demonstrate the statement.
Page 5, Para 6	Please see EPG's previous response – vibro stone columns should not be adopted for use on this site.
Page 5, Para 7	All Permitted Development rights should be removed from the 7 No. proposed residential dwellings.

Conclusions and Recommendations:

In conclusion, EPG concur with Smith Grant that residential development is likely to prove feasible on the proposed development platform.

Nevertheless, EPG concur with WCBC that a standalone Gas Risk Assessment is required for the site. The letter report submitted by Smith Grant dated 15 February 2018 is not considered to provide a sufficiently robust assessment of gas / vapour risks, noting EPG's previous comments.

The Gas Risk Assessment needs to provide a pictorial CSM and take into account all credible on-site and off-site gas sources. Where off-site gas sources are not considered to be credible the lines of evidence which support this decision need to be fully justified. It is considered that additional intrusive works are likely to be required to reduce data uncertainty and increase data confidence, notably with respect to off-site gas sources and potential VOC risks.

EPG consider that the above works could be completed post granting of Planning Permission for the residential development, via a Condition which requires detailed Site Characterisation (in consultation with, and to the approval of, WCBC).

The requirement to provide a Remediation and Verification Strategy for the gas mitigation scheme on the residential development platform should also be conditioned as part of the planning process.

Permitted Development rights should be removed from the 7 No. proposed residential dwellings.

With respect to the existing Bush House property, it is unclear if this dwelling falls within the proposed development plans and planning remit. Consideration should be given to completing some internal space monitoring within this property, noting that Coal Authority records indicate a shaft to be present immediately beneath the dwelling.

We trust that this correspondence is acceptable. However, should you have any comments or queries please do not hesitate to contact us.

Yours sincerely



Steve Wilson
Technical Director
On behalf of The Environmental Protection Group Limited