Appendix 1

Drawings

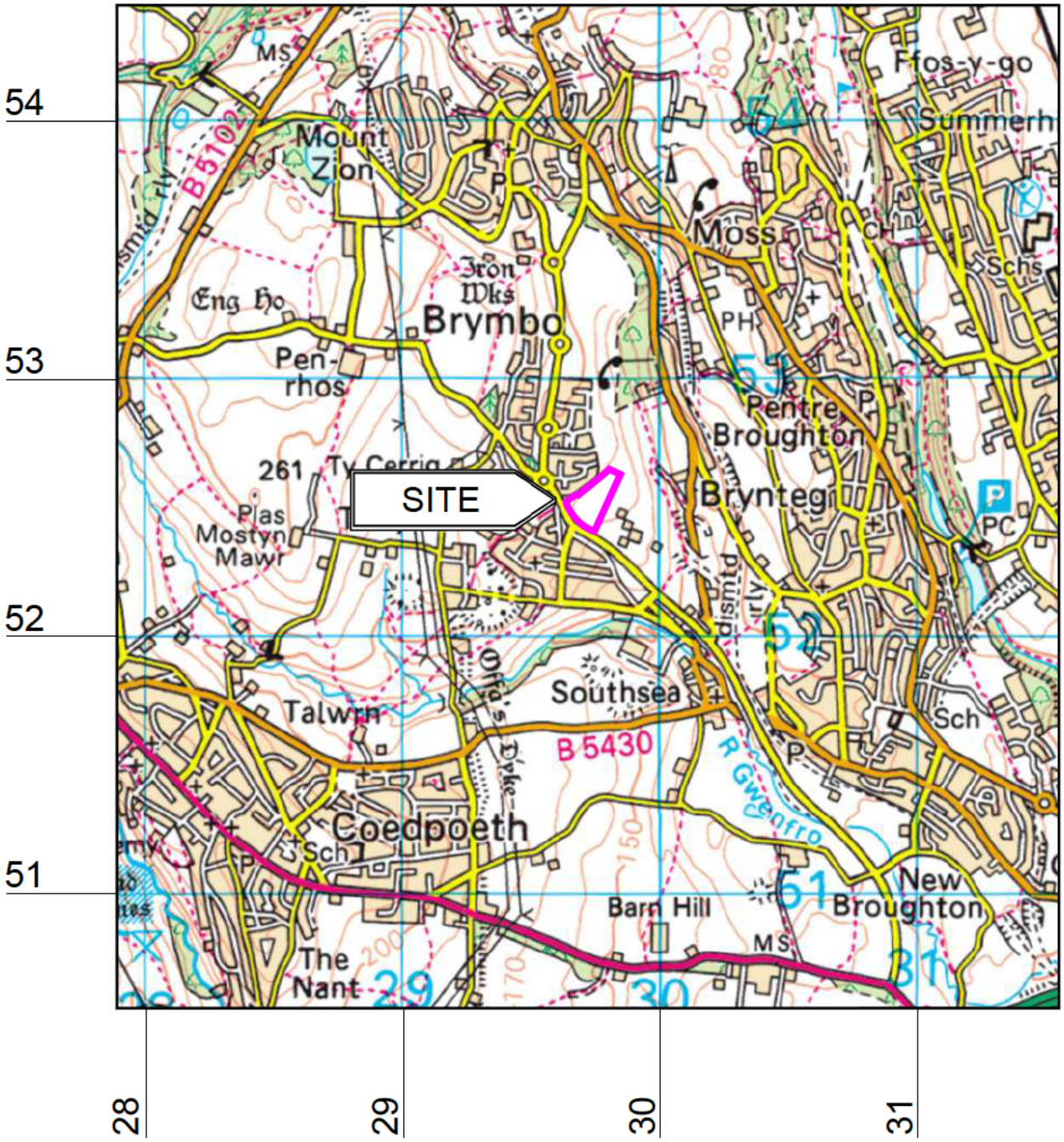
Reference	Rev	Title
7565/L1	-	Site Location Plan
7565/BPRP	-	Build Phase Remediation and Validation Plan
7565-LRH-GS2A-RF-02	-	Typical Gas Precaution Detail – Stiff Raft

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Email: admin@coopers.co.uk
Web: http://coopers.co.uk

SCALE	1:25000@A4	Heritage Way, Brymbo, Wrexham.	
DATE	21.07.21		
DRAWN	OS	SITE LOCATION PLAN	
CHEK'D	BH	Drg No:	7565 / L1

NORTH

National Grid reference of the proposed site.	SJ 297 525



0 200 400 600 800 1000 1500 2000

SCALEBAR (m)

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DO NOT SCALE

KEY

(All positions are approximate unless otherwise stated)

Plots proposed for Characteristic Situation 2 Gas Mitigation Measures in accordance with Coopers Typical Gas Mitigation Detail, referenced 7565/LRH/GS2A/RF/02.

Development boundary (taken from ref. b)

Imported soils require chemical testing to confirm suitability for use in accordance with Coopers Build Phase Remediation and Validation Strategy (ref. Note c).

NORTH

RHODFA FLODEUOG

BLOOM AVENUE

INGOT CLOSE
CLOS INGOT

22 to 33

BRYN GWENFRO

College Heights

Posts

Sports F

This drawing is to be read in conjunction with the following:-

a) DXF File, ref. '2019-03-19_ST16882 TOPO SURVEY LAGOON AREA PART1 DRAFT', received by Coopers on 25 November 2020.

b) Taylor Wimpey, Site Layout, Heritage Way, Brymbo, ref. 20069-01, rev. E, dated 13 January 2021.

c) Coopers Build Phase Remediation and Validation Strategy, referenced 7565bprs.

THIS DRAWING SHOULD ONLY BE PRINTED IN COLOUR

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Client: Taylor Wimpey

Project: Parc Brymbo, Wrexham.

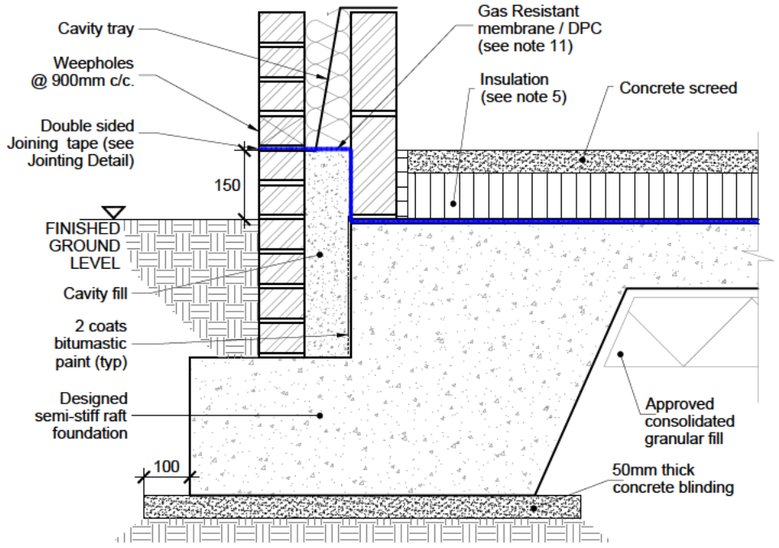
Title: BUILD PHASE REMEDIAITON PLAN

DRAWING NUMBER	SCALE at A1	1:500	
7565 / BPRP	DATE	21.01.21	REVISION
	DRAWN	AH	-
	CHECKED	BH	

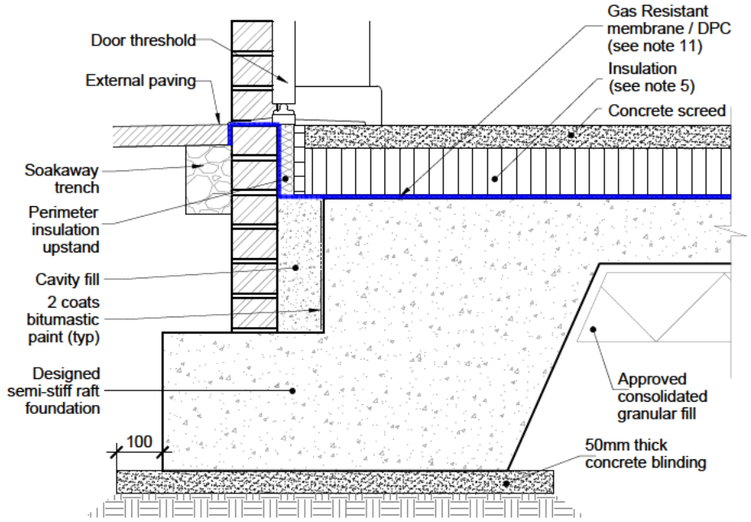
0 5 10 15 20 25 30 35 40 45 50
SCALEBAR (m)

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THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE RELEVANT HOUSE TYPE DRAWINGS, FOUNDATION PLAN & SCHEDULE AND THE SITE SPECIFIC GROUND GAS & SITE INVESTIGATION REPORTS



SLAB EDGE DETAIL AT EXTERNAL WALL

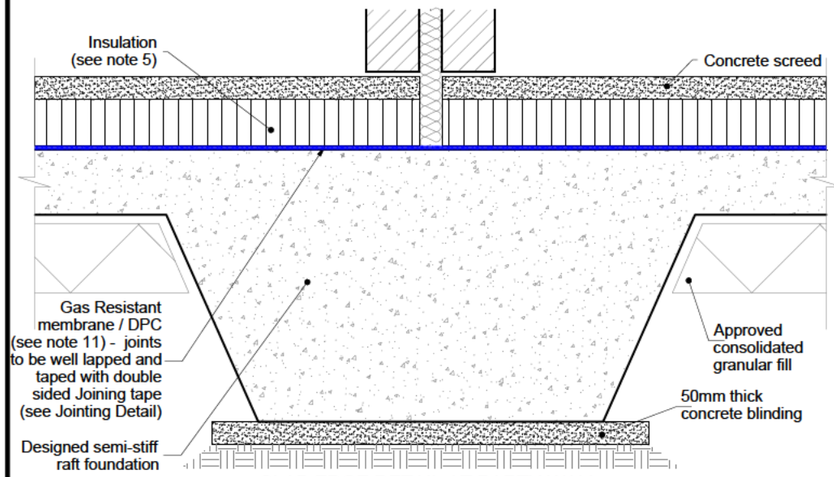


ACCESSIBLE THRESHOLD DETAIL - GROUND FALLING AWAY FROM DWELLING

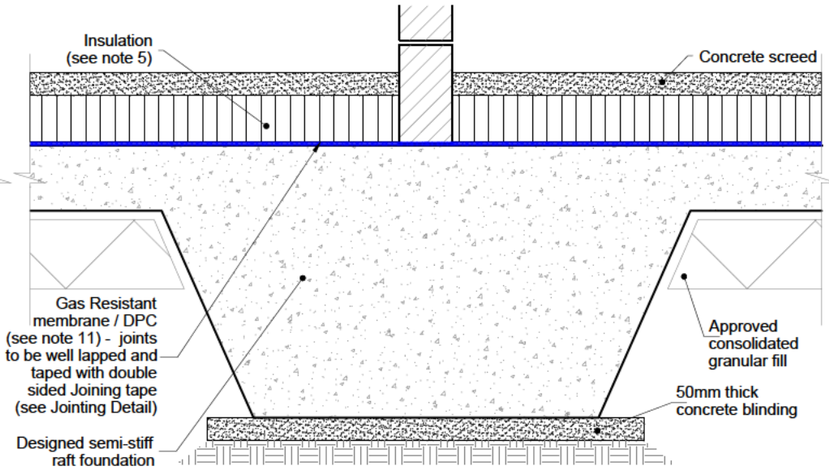
NOTES

1. Coopers take no responsibility for the inappropriate use of this detail on a development. The drawing is specifically designed in accordance with findings and recommendations of ground gas monitoring.
2. Coopers drawing is in accordance with current guidance with respect to design of measures and specification of membranes for the adequate protection of dwellings from the ingress of harmful ground gases. The details contained on this drawing are generic and for guidance purposes only. Any proposed amendments to the detail due to variations on specific house types should be referred back to Coopers for review and approval prior to implementation on site.
3. This drawing was prepared for the purpose stated. New products, improved practices and legislation may necessitate an alteration to this drawing in whole or in part after its submission. It is recommended that this drawing is referred to Coopers for reappraisal no later than one year from the date on this drawing. Continued use of this drawing beyond this date is at the Developers own risk.
4. Refer to Foundation Drawing for suspended slab drawing for relevant house types.
5. Refer to insulation details on specific house type slab drawings.
6. For details of proposed foundations refer to Coopers Foundation Plan and house type specific foundation details.
7. Characteristic Situation is defined in CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings'. Suitability of mitigation measures in accordance with BS8485:2015+A1:2019.
8. All gas membranes should be installed to the manufacturer's guidelines and recommendations. Special care must be taken to ensure that the gas membrane is not snagged, torn, punctured, stretched or in any way damaged during construction. All damaged areas of the gas membrane must be replaced or repaired to manufacturers recommendations.
9. Joints between sheets of gas membrane should be well lapped (150mm min) and taped between sheets with a jointing tape in accordance with the manufacturer's recommendations.
10. All service entry points should be fitted with pre-formed gas resistant top hats. Tophats should be sealed to the pipe and gas membrane using jointing tape and fixed to the pipe with a jubilee clip.
11. The gas membrane should be a multi-layer, laminated, reinforced LDPE membrane with a central shield layer of aluminium foil. This membrane must have a low permeability to carbon dioxide and methane and also acts as a damp proof membrane as well as a barrier to radon gas. **The specification of the gas membrane should be submitted to Coopers for approval prior to use.**

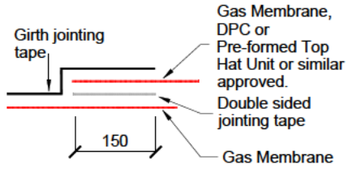
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SLAB EDGE DETAIL AT PARTY WALL



SLAB EDGE DETAIL AT INTERNAL WALL



JOINTING DETAIL

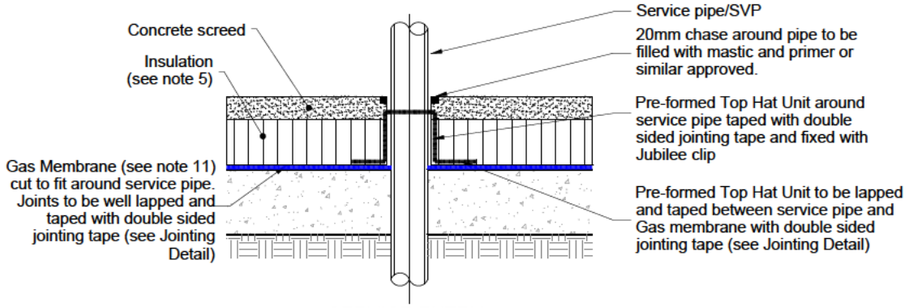
CDM HIGH RISK ASSESSMENT

FOR ALL RISKS REFER TO DESIGN RISK ASSESSMENT

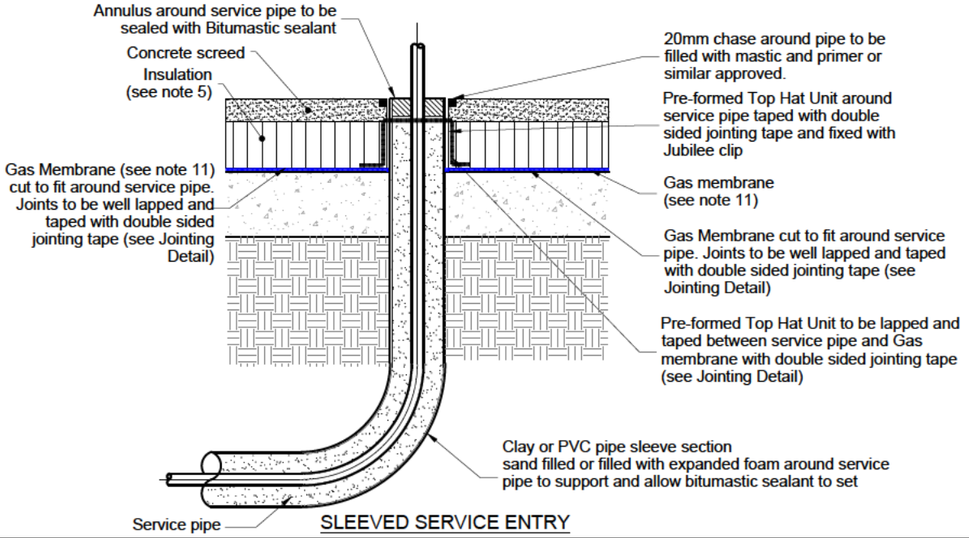
INSTALLATION, INSPECTION AND TESTING

1. A Ciria C735 compliant verification strategy is likely to be required, subject to approval by the Local Authority and NHBC.

FOR GUIDANCE PURPOSES ONLY



SERVICE ENTRY



SLEEVED SERVICE ENTRY

This typical detail is provided as a guide for construction. House type specific variations are required to account for slopes on garage floor slabs, stepped slab levels, full building level access, party wall temporary shuttering, corner unit construction, cloaking units around doors, piers, and other similar specific considerations. We would advocate the contractors hold pre-construction discussions with Coopers (and the verification consultants if another consultant) on the approaches and considerations for specific house type construction prior to commencing installation. Should variations be constructed without prior consent these will be deemed by Coopers as a defect and not suitable for construction or approval by us or third parties.

REVISIONS

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Web: http://coopers.co.uk

CLIENT

Taylor Wimpey

PROJECT

Parc Brymbo, Wrexham.

TITLE

Typical Gas Precaution Detail to Semi-stiff Raft for Characteristic Situation 2 Including Service Entry Details

DRAWN BY	AH
DATE	21.01.21
SCALE(S)	NTS

DRAWING NUMBER REVISION

7565/LRH/GS2A/RF/02 -

Appendix 2

Gas Mitigation Verification Reports

- Gas Membrane Validation Report for Plots 1 to 3, dated 08 July 2022.
- Gas Membrane Validation Report for Plots 4, 5, and 63, dated 08 July 2022.
- Gas Membrane Validation Report for Plots 6 to 8, dated 06 July 2022.
- Gas Membrane Validation Report for Plots 9, 10 and 31, dated 02 August 2022.
- Gas Membrane Validation Report for Plots 11, 12 and 30, dated 28 July 2022.
- Gas Membrane Validation Report for Plots 13 to 15, dated 22 July 2024.
- Gas Membrane Validation Report for Plots 16 and 17, dated 22 July 2024.
- Gas Membrane Validation Report for Plots 18 to 22, dated 22 July 2024.
- Gas Membrane Validation Report for Plots 23 to 26, dated 22 July 2024.
- Gas Membrane Validation Report for Plots 27 to 29, dated 22 July 2024.
- Gas Membrane Validation Report for Plots 32, 52 and 53, dated 28 July 2024.
- Gas Membrane Validation Report for Plots 33 to 35, dated 2 August 2024.
- Gas Membrane Validation Report for Plots 36 and 37, dated 22 July 2024.
- Gas Membrane Validation Report for Plots 38 to 43, dated 22 July 2024.
- Gas Membrane Validation Report for Plots 44 to 46, dated 22 July 2024.
- Gas Membrane Validation Report for Plots 47 and 48, dated 22 July 2024.
- Gas Membrane Validation Report for Plots 49 to 51, dated 28 July 2024.
- Gas Membrane Validation Report for Plots 54 to 59, dated 06 July 2024.
- Gas Membrane Validation Report for Plots 60 to 62, dated 08 July 2024.
- Gas Membrane Validation Report for Plots 64 to 66, dated 08 July 2024.
- Gas Membrane Validation Report for Plots 67 to 70, dated 06 July 2024.

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Document Verification

Project Title	"*Coed Issa*" Parc Brymbo, Wrexham
Project Number	7565
Document Title	Gas Membrane Validation Report for Plots 1-3
Document Number	7565gval_Plots 1-3
This document is not to be used for contractual or engineering purposes unless the document verification sheet is signed where indicated by the approver of the document.	

Prepared by

[redacted]

S Thomas
BSc (Hons), MSc

Checked and Approved

[redacted]

M Wall
BSc (Hons), FGS

Document Revision

Report Reference	Date	Description	Prepared	Checked and Approved
7565gval_Plots 1-3	08/07/2022	Gas Membrane Validation Report for Plots 1-3	S Thomas	M Wall

THE BRITISH VERIFICATION COUNCIL · GROUND GAS PROTECTION SYSTEMS · B V C

This report has been prepared for and on behalf of our client, in accordance with the terms and conditions of the appointment agreement with Coopers. Other than where specifically allowed for in the said appointment agreement, any other party using this report for any purpose whatsoever does so at their own risk and any duty of care to that party is specifically excluded.

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GAS MEMBRANE VALIDATION REPORT FOR PLOTS 1-3

Developer	Taylor Wimpey North-West
Site Name	"*Coed Issa*" Parc Brymbo, Wrexham
NHBC Site Reference	ENGPROJ/274367
Date of Report:	8th July 2022

Gas Mitigation Requirements

The assessments of the ground gas risk were initially drawn up for this site by Smith Grant (SG) LLP in 2007, with the completion report SG produced reviewed and enclosed within a report by Wardell Armstrong, dated November 2018. The previous assessments by SG identified that prior to remediation this parcel of the site was unaffected by hazardous ground gases. However, due to the absence of post remediation gas monitoring and the potential risks of gas emissions from previous coal mining beneath the site, all properties should be constructed with Characteristic Situation 2 (CS2) mitigation measures, as highlighted within Coopers report reference 7565bprs. The CS2 mitigation measures (following BS8485:2015+A1:2019) will therefore be installed on all of the proposed integral floor slabs to semi-stiff raft constructions.

The gas mitigation designs were shown on Coopers Drawing No. 7565/LRH/GS2A/RF/02. The gas mitigation measures were proposed to include a proprietary aluminium foil LDPE gas membrane, compliant with BS8485:2015+A1:2019. Underlying the gas membrane is the designated raft foundation. The insulation was proposed to overlay the gas membrane separating the membrane from the concrete screed to act as protection boards and limit risks of concrete corrosive attack to the membrane. The approved gas membrane types and associated tapes are listed in Table 1 (below).

For all the plots designated as CS2, the following proprietary gas membrane will have been heat sealed and used with associated products as appropriate.

Table 1: Approved Gas Membrane and Ancillary Products.

PRODUCT	MANAFACTURER	PRODUCT NAME
Gas Membrane	Visqueen	Gas Barrier
Detailing Strip	Visqueen	Detailing Strip (or Pro Detailing Strip)

Gas Mitigation Design Details

Coopers provided typical gas mitigation details for the proposed gas mitigation measures:

- Typical Gas Precaution Detail to Semi-Stiff Raft Foundation for Characteristic Situation 2 - *Drawing 7565/LRH/GS2A/RFSS/02.*

Additionally, Coopers have provided construction details for complex aspects of membrane installation:

- Gas Membrane Corner Detail - *2019-SD-GM-CU*
- Dual Service Entry Detail – *2019-SD-GM-DSE*
- Door Threshold Detail – *2019-SD-GM-DT_RevA*
- Service Entry Detail - *2019-SD-GM-SE*
- Party Wall Detail – *2019-PW-GM-SS*

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Plot Specific Verification Requirements

All plots are to be inspected and verified by Coopers, in accordance with CIRIA C735. The inspection criteria for each plot are as follows:

Inspection Criteria	Detailed Inspection Notes
1. Product Verification	*Confirmation that suitable products have been installed to consist of photographs of product types (manufacturer/name), labels on packaging and delivery tickets. Gas Membrane **AND** tapes*
2. General Condition	*The membrane is to be inspected to ensure there are no tears, punctures or rips. Take photographs of full plot status for each plot being inspected.*
3. Membrane Subgrade	*Commonly either insulation or sand blinding, check no gravel or other items with the potential to puncture when weight is applied.*
4. Jointing/Welds	*Checking the overlaps between membranes are correctly sealed, with correct tapes with sufficient overlaps or a good quality heat sealed weld if this method being utilised. Take photographs of at least one jointing section per plot being inspected to show sufficient overlap and use of tapes.*
5. Creases/folds	*Care must be taken to ensure that creases & folds within the membrane do not span over the jointing sections (bridging) as this provides an unacceptable gas pathway.*
6. Service Entry Points	*Verification of the presence of preformed tophats sealed to the pipe and membrane. If service entries are constructed using detailing strip or equivalent product then ensure adequate seal is achieved. Ensure installation is carried out in accordance with manufacturers guidance. Take photographs of all tophat installations.*
7. Corner Sections	*Not cut and folded where punctures are present but concealed with tapes. Either formed with Detailing Strip or preformed corner units.*
8. Reinforcement Spacers	*Use of metal spacers/ties with potential to puncture the membrane would only be permitted with protection board.*
9. Membrane Dirt/Debris	*Whilst we appreciate the membranes are constructed on a real-world construction site, the membrane must be free of debris such as stones or mortar that would be liable to damage the membrane when weight is applied through subsequent construction. Whilst mud is inevitable on the membrane it must be kept to a minimal level to allow the membrane to be inspected and defects disclosed. If the membrane is not visible due to the amount of mud then it will be failed and need to be cleaned for reinspection.*
10. Puncture Repairs	*Punctures are relatively common and occasional damage with proper repair is not considered to be indicative of defective workmanship. All punctures require a patch that spans the damaged section by at least 150mm on each side.*
11. Party Walls	*The use of temporary blockwork for shuttering commonly involves placing the gas membrane above the blocks for the initial concrete pour. When this is removed we advocate placing the membrane back to run flat through the party wall to allow this to be sealed and inspected on the subsequent plot. Alternative approaches are available but the membrane must not be cut and patched after the second plot is cast (due to additional damage, difficult repairs, and lack of inspection at this stage). Also if robust details adopted the membrane will need to drop through the cavity.*
12. Door Thresholds	*Care is required in relation to gas membrane positions through the wall cavity to the external wall around the door thresholds, closing the cavity, and protection beneath any sills. The use of preformed cloaking units and/or detailing strip protection would be recommended.*
13. Wall Cavity Inspection	*Confirming that proprietary gas membrane or gas DPC spans the external walls. Check for rips across cavity. Check for jointing detail of gas resistant DPC or membrane across cavity to main membrane. Take photographs for all plots inspected.*
14. Internal Garage	*One of the most common problems/defects in construction occur for internal garages where the membrane positions need to account for variations in proposed slab level. If internal garage then **phone office** during the visit to confirm the following items:*
a) Sloping Floor	*Check if the developer has sloping garages, if so these are critical to membrane positioning and requires particular attention to membrane positions.*
b) Internal Walls	*If sloping floor then check the membrane transitions at a low level through the internal wall to the plot to ensure it will not be exposed above the frontage of the sloping garage.*
c) External Walls	*If sloping floor then check the membrane steps up within the external wall cavity of the internal garage to ensure it is not exposed above the fall of the garage.*
d) Pillars	*Check the pillar/garage entrance section for the use of detailed strip to ensure not exposed around the entrance and closure of the cavity – refer to construction guide for details.*
15. External Wall Venting	*Check positioning of vents are on 3 sides of dwelling at approximately 2m centres. Take photographs of vents on external walls for each plot. (May be possible to photograph other plots on site which are at stage of installing vents. Will be useful for these plots later on).*
16. Subfloor Venting Type Checked	*If stone venting then check the stone is single sized, 20-40mm. May need to do this on adjacent plots, stockpile or ask for delivery tickets. Some designs need drains laid in the stone so check the construction details, if dims given then measure with tape and photograph*
17. Subfloor Venting Thickness	*The venting medium (void/stone) is of a designated thickness as shown on the gas design details. Photograph thickness of adjacent plots showing how large the void dimension will be with a staff. If not visible on adjacent plots request this item be provided for future inspection.*
18. Internal/Partition Wall Venting	*Check the spacing and dimensions of any interconnecting pipes between the subfloor venting medium. This can vary by size of building and design approaches so be careful to check against the gas details*

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Plot Specific Gas Inspection

Coopers' inspection of the installed gas mitigation measures took place on the dates shown on the attached Coopers "Gas Mitigation Inspection Record Sheets". Taylor Wimpey North-West and their contractor MJ Evans Ltd subcontracted the gas membrane installation to UK Membranes Ltd for heat welded installation. Whilst specialists in gas membrane installation they provided no information to indicate they were NVQ2 qualified and therefore designated the same as a general contractor under CIRIA C735. The contractors opted to use Visqueen Gas Barrier membrane which comprises a multi-layer, reinforced polyethylene gas barrier with a central shield layer of 20-micron thick aluminium foil protected by a separate coating.

The inspections occurred prior to the placement of the or insulation; this was in order to inspect the membranes prior to their obscuration during the construction of the plots. Coopers noted that the membranes were adequately sealed to service entrance points and were present over the entire internal floor space of the plots. The inspections identified that the membranes were installed to a good standard. The attached Coopers "Gas Mitigation Inspection Record Sheets" detail the protective measures that were witnessed on these plots. All measures were determined to have been installed in accordance with Coopers approved design.

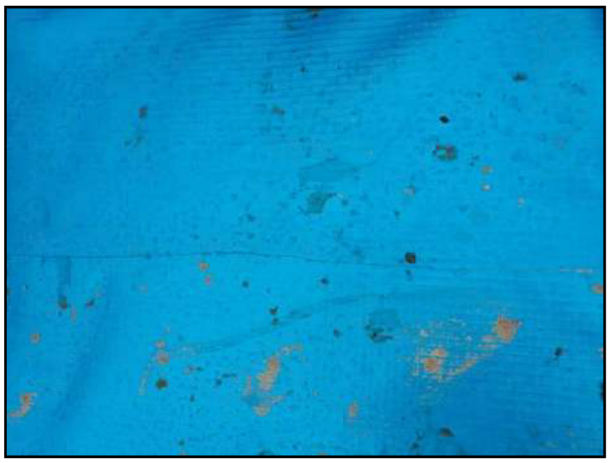
PHOTOGRAPHIC RECORDS OF TYPICAL INSTALLATION



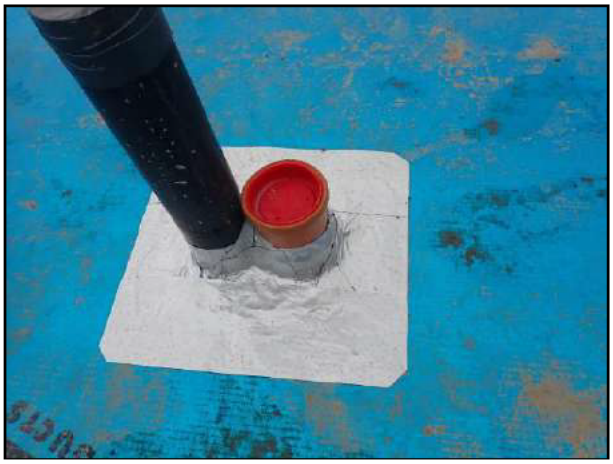
Photograph 1: Showing the general condition of the gas membrane installation on Plot 1 as witnessed by Coopers on 10th March 2022.



Photograph 2: Showing the gas membrane spanning the external walls on Plot 1, as witnessed by Coopers on 10th March 2022.



Photograph 3: Showing the heat sealed jointing of the membrane on Plot 1, as witnessed by Coopers on 10th March 2022.



Photograph 4: Showing the gas membrane sealed to a dual service entry point as per Coopers detail on Plot 1, as witnessed by Coopers on 10th March 2022.

DEVELOPMENT NAME:	"Coed Issa" Parc Brymbo, Wrexham	Validation Certificate Approved By	BH



Photograph 5: Showing the gas membrane sealed to a service entry point as per Coopers detail on Plot 1, as witnessed by Coopers on 10th March 2022.



Photograph 6: Showing the general condition of the gas membrane installation on Plot 2-3 as witnessed by Coopers on 10th March 2022.



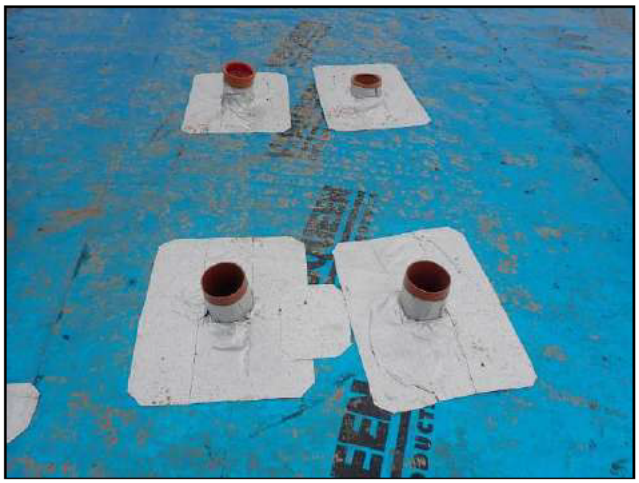
Photograph 7: Showing the gas membrane spanning the external walls on Plots 2-3, as witnessed by Coopers on 10th March 2022.



Photograph 8: Showing the heat sealed jointing of the membrane on Plots 2-3, as witnessed by Coopers on 10th March 2022.



Photograph 9: Showing the gas membrane sealed to a dual service entry point as per Coopers detail on Plots 2-3, as witnessed by Coopers on 10th March 2022.



Photograph 10: Showing the gas membrane sealed to a service entry point as per Coopers detail on Plots 2-3, as witnessed by Coopers on 10th March 2022.

Coopers confirm the gas mitigation measures were installed in accordance with the approved construction details for these plots. More photographs are available upon request.

Documents appended:

1. Coopers Gas Mitigation Inspection Record Sheet Plot 1 dated 10th March 2022.
2. Coopers Gas Mitigation Inspection Record Sheet Plots 2-3 dated 10th March 2022.

Footnote: -

It is advisable that this document is forwarded to the local authority environmental health department and the relevant warranty provider's engineering department for their approval. This Report is a record of Coopers' inspection on the dates given within the aforementioned text. Coopers undertake inspections when requested by the developer. Compliance or non-compliance of the criteria is ascertained on those dates only. Coopers cannot be held responsible for any subsequent actions by third parties not under Coopers direct supervision, which may compromise the integrity of the gas precaution measures after the date of validation.

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GAS MITIGATION INSPECTION RECORD SHEET

PROJECT NAME:	: Plot Baymbo		
DATE OF INSPECTION:	: 10/3/22	**PROJECT No.:**	7565
INSPECTED BY:	: MW	**PLOT No. INSPECTED:**	1

	INSPECTED ITEM	✓/X/n/a	REMARKS
	GAS MEMBRANE		
1	Product Identification *(membrane & tapes)*	✓	Visqueen gas barrier + associated tape products
2	General Condition	✓	Good
3	Membrane Subgrade	✓	Raft
4	Jointing/Welds	✓	Heat sealed
5	Creases/Folds	✓	None
6	Service Entry Points	✓	Constructed using pre-detailing tape.
7	Corner Sections	✓	See #6.
8	Reinforcement Spacers	N/A	
9	Membrane Dirt/Debris	✓	Clean
10	Puncture Repairs	✓	1 No. puncture Repair observed
11	Party Walls	N/A	
12	Door Thresholds	N/A	
13	Cavity Inspection	✓	Sports fully + external walls
14	Internal Garage	N/A	
a)	Sloping Floor		
b)	Internal Walls		
c)	External Walls		
d)	Pillars		
	PASSIVE VENTING		
15	External Wall Venting	N/A	
16	Subfloor Venting Type Checked	N/A	
17	Subfloor Venting Thickness	"	
18	Internal/Partition Wall Venting	"	

***Final Remarks/Additional Notes:**

INSPECTION APPROVAL	COMPLETE ONE BOX:
The inspection has PASSED in accordance to all items of the inspection	✓
The inspection has PASSED, Attention is drawn to item Numbers:	
The inspection has FAILED due to issues with items Numbers: (an additional visit is required)	

SIGNED:

Site Manager: (Print Name) [redacted]

Verification Engineer: (Print [redacted]

Park House, Sandpiper Court,
Chester Business Park,
Chester, CH4 9QU

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Company registered in England & Wales.
Company number 09730429.

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web: www.coopers.co.uk
email: admin@coopers.co.uk

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GAS MITIGATION INSPECTION RECORD SHEET

PROJECT NAME:	: Pear Brymbo		
DATE OF INSPECTION:	: 10/3/22	**PROJECT No.:**	7565
INSPECTED BY:	: MW	**PLOT No. INSPECTED:**	2-3

	INSPECTED ITEM	✓/X/n/a	REMARKS
	GAS MEMBRANE		
1	Product Identification *(membrane & tapes)*	✓	Visqueen gas barrier + associated tapes
2	General Condition	✓	Good
3	Membrane Subgrade	✓	Raft
4	Jointing/Welds	✓	heat sealed
5	Creases/Folds	✓	None
6	Service Entry Points	✓	Constructed using pro-detailing tape.
7	Corner Sections	✓	See #6.
8	Reinforcement Spacers	N/A	
9	Membrane Dirt/Debris	✓	Clean
10	Puncture Repairs	✓	None
11	Party Walls	✓	Flat as per coopers detail under party wall
12	Door Thresholds	N/A	
13	Cavity Inspection	✓	Spens only + external walls.
14	Internal Garage	N/A	
a)	Sloping Floor	↓	
b)	Internal Walls	↓	
c)	External Walls	↓	
d)	Pillars	↓	
	PASSIVE VENTING		
15	External Wall Venting	N/A	
16	Subfloor Venting Type Checked	↓	
17	Subfloor Venting Thickness	↓	
18	Internal/Partition Wall Venting	↓	

***Final Remarks/Additional Notes:**

INSPECTION APPROVAL	COMPLETE ONE BOX:
The inspection has PASSED in accordance to all items of the inspection	✓
The inspection has PASSED, Attention is drawn to item Numbers:	
The inspection has FAILED due to issues with items Numbers: (an additional visit is required)	

SIGNED:

Site Manager: (Print Nam[redacted]....

Verification Engineer: (P[redacted]....

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Document Verification

Project Title	"*Coed Issa*" Parc Brymbo, Wrexham
Project Number	7565
Document Title	Gas Membrane Validation Report for Plots 4-5 & 63
Document Number	7565gval_Plots 4-5 & 63
This document is not to be used for contractual or engineering purposes unless the document verification sheet is signed where indicated by the approver of the document.	

Prepared by

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BSc (Hons), MSc

Checked and Approved

[redacted]

M Wall
BSc (Hons), FGS

Document Revision

Report Reference	Date	Description	Prepared	Checked and Approved
7565gval Plots 4-5 & 63	08/07/2022	Gas Membrane Validation Report for Plots 4-5 & 63	S Thomas	M Wall

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GAS MEMBRANE VALIDATION REPORT FOR PLOTS 4-5 & 63

Developer	Taylor Wimpey North-West
Site Name	"*Coed Issa*" Parc Brymbo, Wrexham
NHBC Site Reference	ENGPROJ/274367
Date of Report:	8th July 2022

Gas Mitigation Requirements

The assessments of the ground gas risk were initially drawn up for this site by Smith Grant (SG) LLP in 2007, with the completion report SG produced reviewed and enclosed within a report by Wardell Armstrong, dated November 2018. The previous assessments by SG identified that prior to remediation this parcel of the site was unaffected by hazardous ground gases. However, due to the absence of post remediation gas monitoring and the potential risks of gas emissions from previous coal mining beneath the site, all properties should be constructed with Characteristic Situation 2 (CS2) mitigation measures, as highlighted within Coopers report reference 7565bprs. The CS2 mitigation measures (following BS8485:2015+A1:2019) will therefore be installed on all of the proposed integral floor slabs to semi-stiff raft constructions.

The gas mitigation designs were shown on Coopers Drawing No. 7565/LRH/GS2A/RF/02. The gas mitigation measures were proposed to include a proprietary aluminium foil LDPE gas membrane, compliant with BS8485:2015+A1:2019. Underlying the gas membrane is the designated raft foundation. The insulation was proposed to overlay the gas membrane separating the membrane from the concrete screed to act as protection boards and limit risks of concrete corrosive attack to the membrane. The approved gas membrane types and associated tapes are listed in Table 1 (below).

For all the plots designated as CS2, the following proprietary gas membrane will have been heat sealed and used with associated products as appropriate.

Table 1: Approved Gas Membrane and Ancillary Products.

PRODUCT	MANAFACTURER	PRODUCT NAME
Gas Membrane	Visqueen	Gas Barrier
Detailing Strip	Visqueen	Detailing Strip (or Pro Detailing Strip)

Gas Mitigation Design Details

Coopers provided typical gas mitigation details for the proposed gas mitigation measures:

- Typical Gas Precaution Detail to Semi-Stiff Raft Foundation for Characteristic Situation 2 - *Drawing 7565/LRH/GS2A/RFSS/02.*

Additionally, Coopers have provided construction details for complex aspects of membrane installation:

- Gas Membrane Corner Detail - *2019-SD-GM-CU*
- Dual Service Entry Detail – *2019-SD-GM-DSE*
- Door Threshold Detail – *2019-SD-GM-DT_RevA*
- Service Entry Detail - *2019-SD-GM-SE*
- Party Wall Detail – *2019-PW-GM-SS*

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Plot Specific Verification Requirements

All plots are to be inspected and verified by Coopers, in accordance with CIRIA C735. The inspection criteria for each plot are as follows:

Inspection Criteria	Detailed Inspection Notes
1. Product Verification	*Confirmation that suitable products have been installed to consist of photographs of product types (manufacturer/name), labels on packaging and delivery tickets. Gas Membrane **AND** tapes*
2. General Condition	*The membrane is to be inspected to ensure there are no tears, punctures or rips. Take photographs of full plot status for each plot being inspected.*
3. Membrane Subgrade	*Commonly either insulation or sand blinding, check no gravel or other items with the potential to puncture when weight is applied.*
4. Jointing/Welds	*Checking the overlaps between membranes are correctly sealed, with correct tapes with sufficient overlaps or a good quality heat sealed weld if this method being utilised. Take photographs of at least one jointing section per plot being inspected to show sufficient overlap and use of tapes.*
5. Creases/folds	*Care must be taken to ensure that creases & folds within the membrane do not span over the jointing sections (bridging) as this provides an unacceptable gas pathway.*
6. Service Entry Points	*Verification of the presence of preformed tophats sealed to the pipe and membrane. If service entries are constructed using detailing strip or equivalent product then ensure adequate seal is achieved. Ensure installation is carried out in accordance with manufacturers guidance. Take photographs of all tophat installations.*
7. Corner Sections	*Not cut and folded where punctures are present but concealed with tapes. Either formed with Detailing Strip or preformed corner units.*
8. Reinforcement Spacers	*Use of metal spacers/ties with potential to puncture the membrane would only be permitted with protection board.*
9. Membrane Dirt/Debris	*Whilst we appreciate the membranes are constructed on a real-world construction site, the membrane must be free of debris such as stones or mortar that would be liable to damage the membrane when weight is applied through subsequent construction. Whilst mud is inevitable on the membrane it must be kept to a minimal level to allow the membrane to be inspected and defects disclosed. If the membrane is not visible due to the amount of mud then it will be failed and need to be cleaned for reinspection.*
10. Puncture Repairs	*Punctures are relatively common and occasional damage with proper repair is not considered to be indicative of defective workmanship. All punctures require a patch that spans the damaged section by at least 150mm on each side.*
11. Party Walls	*The use of temporary blockwork for shuttering commonly involves placing the gas membrane above the blocks for the initial concrete pour. When this is removed we advocate placing the membrane back to run flat through the party wall to allow this to be sealed and inspected on the subsequent plot. Alternative approaches are available but the membrane must not be cut and patched after the second plot is cast (due to additional damage, difficult repairs, and lack of inspection at this stage). Also if robust details adopted the membrane will need to drop through the cavity.*
12. Door Thresholds	*Care is required in relation to gas membrane positions through the wall cavity to the external wall around the door thresholds, closing the cavity, and protection beneath any sills. The use of preformed cloaking units and/or detailing strip protection would be recommended.*
13. Wall Cavity Inspection	*Confirming that proprietary gas membrane or gas DPC spans the external walls. Check for rips across cavity. Check for jointing detail of gas resistant DPC or membrane across cavity to main membrane. Take photographs for all plots inspected.*
14. Internal Garage	*One of the most common problems/defects in construction occur for internal garages where the membrane positions need to account for variations in proposed slab level. If internal garage then **phone office** during the visit to confirm the following items:*
a) Sloping Floor	*Check if the developer has sloping garages, if so these are critical to membrane positioning and requires particular attention to membrane positions.*
b) Internal Walls	*If sloping floor then check the membrane transitions at a low level through the internal wall to the plot to ensure it will not be exposed above the frontage of the sloping garage.*
c) External Walls	*If sloping floor then check the membrane steps up within the external wall cavity of the internal garage to ensure it is not exposed above the fall of the garage.*
d) Pillars	*Check the pillar/garage entrance section for the use of detailed strip to ensure not exposed around the entrance and closure of the cavity – refer to construction guide for details.*
15. External Wall Venting	*Check positioning of vents are on 3 sides of dwelling at approximately 2m centres. Take photographs of vents on external walls for each plot. (May be possible to photograph other plots on site which are at stage of installing vents. Will be useful for these plots later on).*
16. Subfloor Venting Type Checked	*If stone venting then check the stone is single sized, 20-40mm. May need to do this on adjacent plots, stockpile or ask for delivery tickets. Some designs need drains laid in the stone so check the construction details, if dims given then measure with tape and photograph*
17. Subfloor Venting Thickness	*The venting medium (void/stone) is of a designated thickness as shown on the gas design details. Photograph thickness of adjacent plots showing how large the void dimension will be with a staff. If not visible on adjacent plots request this item be provided for future inspection.*
18. Internal/Partition Wall Venting	*Check the spacing and dimensions of any interconnecting pipes between the subfloor venting medium. This can vary by size of building and design approaches so be careful to check against the gas details*

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Plot Specific Gas Inspection

Coopers' inspection of the installed gas mitigation measures took place on the dates shown on the attached Coopers "Gas Mitigation Inspection Record Sheets". Taylor Wimpey North-West and their contractor MJ Evans Ltd subcontracted the gas membrane installation to UK Membranes Ltd for heat welded installation. Whilst specialists in gas membrane installation they provided no information to indicate they were NVQ2 qualified and therefore designated the same as a general contractor under CIRIA C735. The contractors opted to use Visqueen Gas Barrier membrane which comprises a multi-layer, reinforced polyethylene gas barrier with a central shield layer of 20-micron thick aluminium foil protected by a separate coating.

The inspections occurred prior to the placement of the insulation; this was in order to inspect the membranes prior to their obscuration during the construction of the plots. Coopers noted that the membranes were adequately sealed to service entrance points and were present over the entire internal floor space of the plots. The inspections identified that the membranes were installed to a good standard. The attached Coopers "Gas Mitigation Inspection Record Sheets" detail the protective measures that were witnessed on these plots. All measures were determined to have been installed in accordance with Coopers approved design.

PHOTOGRAPHIC RECORDS OF TYPICAL INSTALLATION



Photograph 1: Showing the general condition of the gas membrane installation on Plot 4 as witnessed by Coopers on 10th March 2022.



Photograph 2: Showing the gas membrane spanning the external walls on Plot 4, as witnessed by Coopers on 10th March 2022.



Photograph 3: Showing the heat sealed jointing of the membrane on Plot 4, as witnessed by Coopers on 10th March 2022.



Photograph 4: Showing the gas membrane sealed to a dual service entry point as per Coopers detail on Plot 4, as witnessed by Coopers on 10th March 2022.

DEVELOPMENT NAME:	"Coed Issa" Parc Brymbo, Wrexham	Validation Certificate Approved By	MW



Photograph 5: Showing the gas membrane sealed to a service entry point as per Coopers detail on Plot 4, as witnessed by Coopers on 10th March 2022.



Photograph 6: An example of the correct Visqueen product labelling, as witnessed by Coopers on 10th March 2022.



Photograph 7: Showing the general condition of the gas membrane installation on Plot 5 as witnessed by Coopers on 28th April 2022.



Photograph 8: Showing the gas membrane spanning the external walls on Plot 5, as witnessed by Coopers on 28th April 2022.



Photograph 9: Showing the heat sealed jointing of the membrane on Plot 5, as witnessed by Coopers on 28th April 2022.



Photograph 10: Showing the gas membrane sealed to a dual service entry point as per Coopers detail on Plot 5, as witnessed by Coopers on 28th April 2022.



Photograph 11: Showing the gas membrane sealed to a service entry point as per Coopers detail on Plot 5, as witnessed by Coopers on 28th April 2022.



Photograph 12: Showing the general condition of the gas membrane installation on Plot 63 as witnessed by Coopers on 28th April 2022.



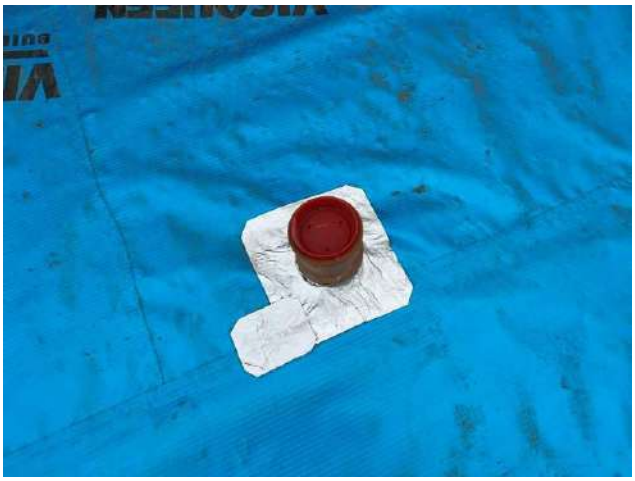
Photograph 13: Showing the gas membrane spanning the external walls on Plot 63, as witnessed by Coopers on 28th April 2022.



Photograph 14: Showing the heat sealed jointing of the membrane on Plot 63, as witnessed by Coopers on 28th April 2022.



Photograph 15: Showing the gas membrane sealed to a dual service entry point as per Coopers detail on Plot 63, as witnessed by Coopers on 28th April 2022.



Photograph 16: Showing the gas membrane sealed to a service entry point as per Coopers detail on Plot 63, as witnessed by Coopers on 28th April 2022.

Coopers confirm the gas mitigation measures were installed in accordance with the approved construction details for these plots. More photographs are available upon request.

Documents appended:

1. Coopers Gas Mitigation Inspection Record Sheet Plot 4, dated 10th March 2022.
2. Coopers Gas Mitigation Inspection Record Sheet Plot 5, dated 28th April 2022.
3. Coopers Gas Mitigation Inspection Record Sheet Plot 63, dated 28th April 2022.

Footnote: -

It is advisable that this document is forwarded to the local authority environmental health department and the relevant warranty provider's engineering department for their approval. This Report is a record of Coopers' inspection on the dates given within the aforementioned text. Coopers undertake inspections when requested by the developer. Compliance or non-compliance of the criteria is ascertained on those dates only. Coopers cannot be held responsible for any subsequent actions by third parties not under Coopers direct supervision, which may compromise the integrity of the gas precaution measures after the date of validation.

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GAS MITIGATION INSPECTION RECORD SHEET

PROJECT NAME:	: Parc Bymbo		
DATE OF INSPECTION:	: 10/3/22	**PROJECT No.:**	7565
INSPECTED BY:	: MW	**PLOT No. INSPECTED:**	4

	INSPECTED ITEM	✓/X/n/a	REMARKS
	GAS MEMBRANE		
1	Product Identification *(membrane & tapes)*	✓	Visqueen gas barrier + associated tape products
2	General Condition	✓	Good
3	Membrane Subgrade	✓	Raft
4	Jointing/Welds	✓	heat sealed
5	Creases/Folds	✓	none
6	Service Entry Points	✓	Constructed using visqueen pro-defailing tape
7	Corner Sections	✓	See #6
8	Reinforcement Spacers	N/A	
9	Membrane Dirt/Debris	✓	Clean
10	Puncture Repairs	✓	None
11	Party Walls	N/A	
12	Door Thresholds	N/A	
13	Cavity Inspection	✓	Spare cavity fully + external walls
14	Internal Garage	NC	
a)	Sloping Floor	↓	
b)	Internal Walls	↓	
c)	External Walls	↓	
d)	Pillars	↓	
	PASSIVE VENTING		
15	External Wall Venting	N/A	
16	Subfloor Venting Type Checked	"	
17	Subfloor Venting Thickness	"	
18	Internal/Partition Wall Venting	"	

***Final Remarks/Additional Notes:**

INSPECTION APPROVAL	COMPLETE ONE BOX:
The inspection has PASSED in accordance to all items of the inspection	✓
The inspection has PASSED, Attention is drawn to item Numbers:	
The inspection has FAILED due to issues with items Numbers: (an additional visit is required)	

SIGNED:
Site Manager: (Print Name) [redacted]

Verification Engineer: (Print

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GAS MITIGATION INSPECTION RECORD SHEET

PROJECT NAME:	: Heritage Way, Bromley		
DATE OF INSPECTION:	: 29/4/22	**PROJECT No.:**	7565
INSPECTED BY:	: SJ	**PLOT No. INSPECTED:**	05

	INSPECTED ITEM	✓/X/n/a	REMARKS
	GAS MEMBRANE		
1	Product Identification *(membrane & tapes)*	✓	Blue Visqueen gas barrier & associated Visqueen tapes.
2	General Condition	✓	Good – Only one minor repair needed.
3	Membrane Subgrade	✓	Semi-stiff soft
4	Jointing/Welds	✓	Heat sealed.
5	Creases/Folds	✓	None encountered.
6	Service Entry Points	✓	Formed out of V.S queen detail strip.
7	Corner Sections	✓	See #6
8	Reinforcement Spacers	N/A	N/A
9	Membrane Dirt/Debris	✓	Clean, some minor dust, dirt.
10	Puncture Repairs	✓	One small puncture repaired with 300mm x 300mm piece of detail strip.
11	Party Walls	N/A	N/A
12	Door Thresholds	✓	See #6 & #7
13	Cavity Inspection	✓	Spans outer cavity on all four sides.
14	Internal Garage		
a)	Sloping Floor		
b)	Internal Walls	N/A	N/A
c)	External Walls		
d)	Pillars		
	PASSIVE VENTING		
15	External Wall Venting	N/A	N/A
16	Subfloor Venting Type Checked	N/A	N/A
17	Subfloor Venting Thickness	N/A	N/A
18	Internal/Partition Wall Venting	N/A	N/A

***Final Remarks/Additional Notes:**

INSPECTION APPROVAL	COMPLETE ONE BOX:
The inspection has PASSED in accordance to all items of the inspection	✓
The inspection has PASSED. Attention is drawn to item Numbers:	
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SIGNED:

Site Manager: (Print Name) [redacted] .....

Verification Engineer: (Print [redacted] .....

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GAS MITIGATION INSPECTION RECORD SHEET

PROJECT NAME:	: Heritage Way, Bryn bo		
DATE OF INSPECTION:	: 28/4/22	**PROJECT No.:**	7565
INSPECTED BY:	: SI	**PLOT No. INSPECTED:**	b3

	INSPECTED ITEM	✓/X/n/a	REMARKS
	GAS MEMBRANE		
1	Product Identification *(membrane & tapes)*	✓	Blue Visqueen Gas barrier & Visqueen detail Strip.
2	General Condition	✓	Good - no defects encountered
3	Membrane Subgrade	✓	Semi-Stiff Chalk
4	Jointing/Welds	✓	Heat Sealed, > 100mm overlaps
5	Creases/Folds	✓	None encountered - heat sealed
6	Service Entry Points	✓	Cored out of Visqueen detail Strip.
7	Corner Sections	✓	See #6
8	Reinforcement Spacers	N/A	N/A
9	Membrane Dirt/Debris	✓	Dusty on surface, but all aspects visible
10	Puncture Repairs	✓	None required
11	Party Walls	N/A	N/A
12	Door Thresholds	✓	See #6
13	Cavity Inspection	✓	Spray outer wall cavity on all four sides.
14	Internal Garage		
a)	Sloping Floor		
b)	Internal Walls	N/A	N/A
c)	External Walls		
d)	Pillars		
	PASSIVE VENTING		
15	External Wall Venting	N/A	N/A
16	Subfloor Venting Type Checked	N/A	N/A
17	Subfloor Venting Thickness	N/A	N/A
18	Internal/Partition Wall Venting	N/A	N/A

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