UNC Workgroup Report	At what stage is this document in the process?

UNC 0900:

Amendment to the Gas Quality NTS Entry Specification at Biomethane System Entry Points

01 Modification

02 Workgroup Report

03 Draft Modification Report

04 Final Modification Report

Purpose of Modification:

This enabling Modification will facilitate a change to the contractual oxygen limit at the Murrow and Glentham System Entry Points, through modification of a network entry provision contained within the relevant Network Entry Agreements (NEAs).

Next Steps:

The Workgroup recommends that this Modification should not be subject to Self-Governance

The Workgroup asks Panel to agree that this Modification should proceed to consultation.

The Panel will consider this Workgroup Report on 20 February 2025. The Panel will consider the recommendations and determine the appropriate next steps.

Impacted Parties:

Low: Transporters, Shippers and Consumers

Impacted Codes:

UNC

Contents

Timetable

Modification timetable:

Pre-Modification Discussed	07 November 2024
Date Modification Raised	07 November 2024
New Modification to be considered by Panel	21 November 2024
First Workgroup Meeting	13 January 2025
Workgroup Report to be presented to Panel	20 February 2025
Draft Modification Report issued for consultation	21 February 2025
Consultation Close-out for representations	13 March 2025
Final Modification Report available for Panel *(at short notice)*	18 March 2025
Modification Panel decision	20 March 2025

Any questions?

Contact:
Joint Office of Gas Transporters

enquiries@gasgovernance.co.uk

0121 288 2107

Proposer:
Tim Davis
CNG Services

tim.davis@cngservices.co.uk

07768 456604

Transporter:
National Gas Transmission

Malcolm.Montgomery@nationalgas.com

07970 114460

Systems Provider:
Xoserve

UKLink@xoserve.com

1 Summary

What

This proposed Modification seeks to enable an increase to 1% in the Oxygen (O_2) limit within the Network Entry Agreement (NEA) at two biomethane entry points. This covers the only existing biomethane entry point on the NTS, Murrow, and one under construction, Glentham.

Why

Biomethane entering a GDN is permitted to contain up to 1% Oxygen. National Gas Transmission (NGT) has indicated that they are seeking an exemption from the Health and Safety Executive (HSE) that would allow them to consider accepting biomethane with the same specification, increasing the Oxygen limit to a maximum of 1%. This modification is proposed to allow the two identified entry points to see this change adopted if and when HSE agreement is obtained. This is preferable to waiting to raise this Modification Proposal after HSE agreement has been obtained, which would introduce a delay before the benefits of the change would be seen.

How

In accordance with the UNC Transportation Principal Document Section I 2.2.3 (a), the Proposer is seeking to permit amendment of the relevant NEAs described above via this enabling Modification.

2 Governance

Proposer's Justification for Self-Governance

The Modification is a change to two small entry points that:

(i) is unlikely to have a material effect on:

(aa) existing or future gas consumers; and

(bb) competition in the shipping, transportation or supply of gas conveyed through pipes or any commercial activities connected with the shipping, transportation or supply of gas conveyed through pipes; and

(cc) the operation of one or more pipe-line system(s); and

(dd) matters relating to sustainable development, safety or security of supply, or the management of market or network emergencies; and

(ee) the uniform network code governance procedures or the network code Modification procedures; and

(ii) is unlikely to discriminate between different classes of parties to the uniform network code/relevant gas transporters, gas shippers or DN operators.

Requested Next Steps

The UNC Panel determined that this Modification does not meet the Self-Governance criteria noting that it is likely to have a material effect on sustainable development, safety or security of supply, or the management of market/network emergencies. Therefore, this Modification will follow the Authority Direction process.

Workgroup's Assessment

It was noted during Workgroup discussions that a link to a HSE decision should not direct whether this Modification should be authority direction or not. National Gas Transmission (NGT) were not expecting there to be a material impact.

3 Why Change?

The natural Oxygen content when biomethane is produced is in excess of the current NTS specification. Reducing the Oxygen content incurs costs and uses resources. Higher Oxygen concentrations are accepted by the GDNs and National Gas has indicated that they are seeking an exemption to allow gas with up to 1% Oxygen to be accepted. Murrow is already operating with a tighter limit and would wish to be in a position to move to the higher specification as soon as HSE agreement is available. An under-construction plant at Glentham is expected to be operational before a higher limit is available and would similarly aim to move to the higher limit as soon as agreement is reached that this is acceptable.

4 Code Specific Matters

Knowledge/Skills

No additional skills or knowledge are required to assess this Modification.

5 Solution

This Modification seeks to amend a Network Entry Provision within NEAs. The amendment would increase the O_2 upper limit for gas delivered at Glentham and Murrow to 1%.

No change to the text of the UNC is required since this is an enabling Modification in accordance with UNC Transportation Principal Document Section I 2.2.3 (a).

6 Impacts & Other Considerations

Does this Modification impact a Significant Code Review (SCR) or other significant industry change projects, if so, how?

No.

Consumer Impacts

In principle, reducing injection costs could lead to a fall in gas prices to the benefit of consumers. In practice, the effect will be too small to be noticeable. The saving of resources is, however, of benefit to society as a whole.

Workgroup response??

Impact of the change on Consumer Benefit Areas:	
Area	Identified impact
Improved safety and reliability	None
Lower bills than would otherwise be the case	None
Reduced environmental damage Reduced resource use is positive	Positive
Improved quality of service	None
Benefits for society as a whole	None

Performance Assurance Considerations

None. This enabling Modification, in accordance with UNC Transportation Principal Document Section I 2.2.3 (a), is seeking to amend Network Entry Agreements. There will be no UNC changes as a result of implementation.

Cross-Code Impacts

None.

EU Code Impacts

None.

Central Systems Impacts

None.

Initial Representations

None Received.

Panel Questions

The Workgroup were asked by Panel to consider the consequential impacts on downstream users for example impact on DNs, bio injection sites, storage sites and also impacts on sensitive users (including consideration of heat map - network penetration analysis).

National Gas Transmission (NGT) believe there could be some adverse downstream impacts as a result of accepting gas at a higher Oxygen content onto the NTS, notably underground storage which includes corrosion risks. This would be examined on a case-by-case basis against required criteria to determine whether parties would be negatively impacted.

Workgroup Impact Assessment

Insert NGT analysis... simple explanation!

The Workgroup considered the Network Penetration Assessment for Glentham……

At the point at which Biomethane is delivered into the network, unless an Oxygen removal kit is added, there would be elevated Oxygen above 0.2% which is the current GS(M)R limit. The GDNs are allowed to transport gas on their network of up to 1% Oxygen content, provided pressures are under 38bar. Work to extend this to the NTS is not being extended without control.

NGT cannot legally contract for an entry specification for Oxygen above 0.2%, this would need the HSE to agree to an exemption. If this Modification is approved, it permits NGT to execute a change to the network entry agreements to increase the level from 0.2% to 1%. The Modification is conditional on other processes however this is not a reason not to progress this Modification. NGT clarified they will be submitting an evidence case to the HSE for a GS(M)R exemption to allow NGT to offer a 1% entry specification for Oxygen on the NTS for new entry connections to accommodate Biomethane entry points.

Please refer to National Gas Transmission's Impact Analysis, appended to this report.

Reference Documents

No changes required to Code Related Documents or Guidance Documents.

7 Relevant Objectives

Impact of the Modification on the Transporters' Relevant Objectives:

Relevant Objective	Identified impact
a) Efficient and economic operation of the pipe-line system.	None
b) Coordinated, efficient and economic operation of (i) the combined pipe-line system, and/ or (ii) the pipe-line system of one or more other relevant gas transporters.	None
c) Efficient discharge of the licensee's obligations.	None
d) Securing of effective competition: (i) between relevant shippers; (ii) between relevant suppliers; and/or (iii) between DN operators (who have entered into transportation arrangements with other relevant gas transporters) and relevant shippers.	Positive
e) Provision of reasonable economic incentives for relevant suppliers to secure that the domestic customer supply security standards… are satisfied as respects the availability of gas to their domestic customers.	None
f) Promotion of efficiency in the implementation and administration of the Code.	None
g) Compliance with the Regulation and any relevant legally binding decisions of the European Commission and/or the Agency for the Co-operation of Energy Regulators.	None

Increasing the Oxygen limit potentially supports competition between Shippers by ensuring that biomethane can be produced as economically as possible. Aligning the requirements for injection to GDNs and the NTS also facilitates competition between Transporters.

Workgroup Assessment of Relevant Objectives

The Workgroup agreed that this Modifcation would have a positive effect on Relevant Objective …

8 Implementation

This is an enabling Modification to facilitate a change to the contractual oxygen limit at the Murrow and Glentham System Entry Points, through the modification of a network entry provision contained within the relevant Network Entry Agreements (NEAs). As this does not require an amendment to the UNC implementation could be immediately after the Authority's Decision to allow the contractual changes to commence.

9 Legal Text

None. This is an enabling Modification to change the appropriate Network Entry Agreement.

10 Recommendations

At the November UNC Modification Meeting the UNC Panel determined that this Modification does not meet the Self-Governance criteria noting that it is likely to have a material effect on sustainable development, safety or security of supply, or the management of market/network emergencies. Therefore, this Modification will follow the Authority Direction process.

Workgroup's Recommendation to Panel

The Workgroup asks Panel to agree that this Modification should proceed to consultation.

11 Impact Assessment

The attached analysis provided by National Gas Transmission summarises the impact of up to 1mol% oxygen being delivered by Murrow and Glentham biomethane sites.

12 Appended Representations

Initial Representations – None

UNC 0900: Amendment to the Gas Quality NTS Entry Specification at Biomethane System Entry Points

10 February 2025

Introduction

Exemption

NGT are in the process of documenting an evidence case for the HSE to enable us, and the higher-pressure tiers of the GDNs, to offer up to 1mol% on our networks. This is to support the biomethane industry.

An NIA funded study had been undertaken by to determine the impacts of an elevated level of oxygen of up to 1mol% on the NTS: https://smarter.energynetworks.org/projects/nia_ngt0236/

Managing requests

- Requests for non-standard gas quality parameters, which include requests for elevated levels of oxygen, will be reviewed on a case by-case-basis
- We are developing a methodology to determine how these requests will be managed

Analysis

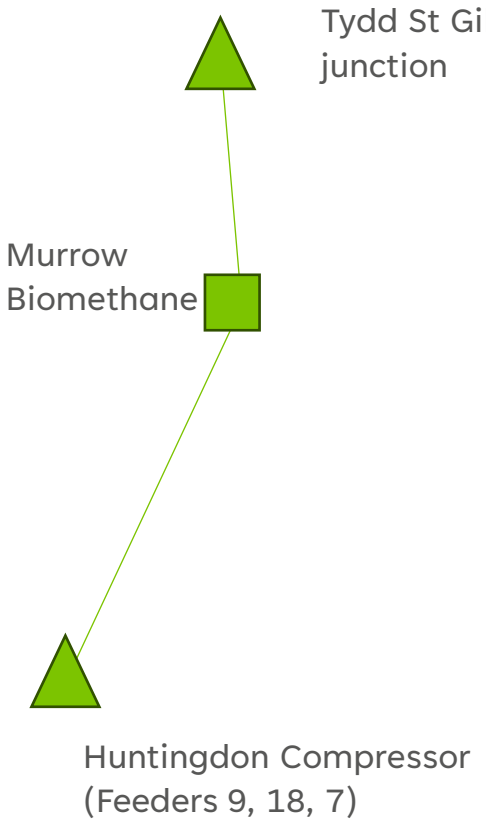
The following slides summarise the impacts of up to 1mol% oxygen being delivered by Murrow and Glentham biomethane sites

Note that any change to the allowable oxygen levels will be dependent on the exemption being granted by the HSE

Murrow Entry Point Analysis

Murrow: Site Overview

Simplified NTS Details (*not to scale)*



Murrow	Details
Site Location:	Feeder 9, circa 48km upstream of Huntington Compressor, 16km downstream of Tydd St Giles multijunction
Entry Connection:	Biomethane
Daily Maximum Flow rate:	48,000 standard cubic meters (scm) a day, 2,000scm/ hour (0.048 mcm/day) typical flows ~ 0.02 mcm/day
Gas Quality:	The site is operational and may deliver biomethane to the NTS with oxygen up to <0.2mol%, in line with current GS(M)R requirements. The site requests an increase to their allowable oxygen concentration of up to 1mol% oxygen. This will be dependent on an HSE exemption.
Connections:	There are no 3rd Party connections in the location of the site

Murrow: 3rd Party Connections and Flows (1 of 2)

The predominant flows in this area of the network are north to south. There are no off-takes between Murrow and Huntingdon compressor, where the gas will blend further with other NTS gas.

If the gas flows south to north, the gas will travel to Tydd St Giles multijunction. There have been some instances where the gas could potentially reach Hatton compressor (which will then blend further), and could therefore reach a power station, as well as GDN off-takes.

Given the low volumes of biomethane injection at the Murrow Biomethane site relative to the dilution flows in the feeder it is being injected into, the injection of the higher oxygen content biomethane from Murrow is highly unlikely to result in any significant change to the characteristics of gas in the NTS as under normal circumstances the higher oxygen content biomethane will be diluted to very low levels by blending with the pipeline gas flowing past the injection point.

Typical flows in this area of the network are 5mcm/day.

Analysis undertaken has been conducted on a worst-case scenario:

- 1mol% oxygen delivered by Murrow*:
- Flow at the maximum rate of 0.002 mcm per hour
- Assuming the average oxygen level in the NTS gas is 0.1mol%

a flow of 0.016 mcm per hour (0.384 mcm/day) or greater would be required past the connection point for the gas to remain at or below the GS(M)R limit of 0.2mol%.

Blending Calculation	
Oxygen from Murrow (mol%)	1
Max Hourly Flow	0.002
Assumed O2 level in NTS gas	0.1
Min hourly flow to ensure compliance	**0.016**
Required level of O2 (mol%)	0.2

***Assuming the exemption is granted, the site would operate at ~0.5mol% O2 under normal conditions. Assuming 0.1% O2 in NTS, a flow of 0.0075mcm/hour would be required for blending to the current GS(M)R limit.**

Murrow: 3rd Party Connections and Flows (2 of 2)

Four years of flow data have been considered:

Flow rates have been calculated based on the recorded hourly pressure data at Huntingdon and Tydd Multi-junction over a 4.5-year period

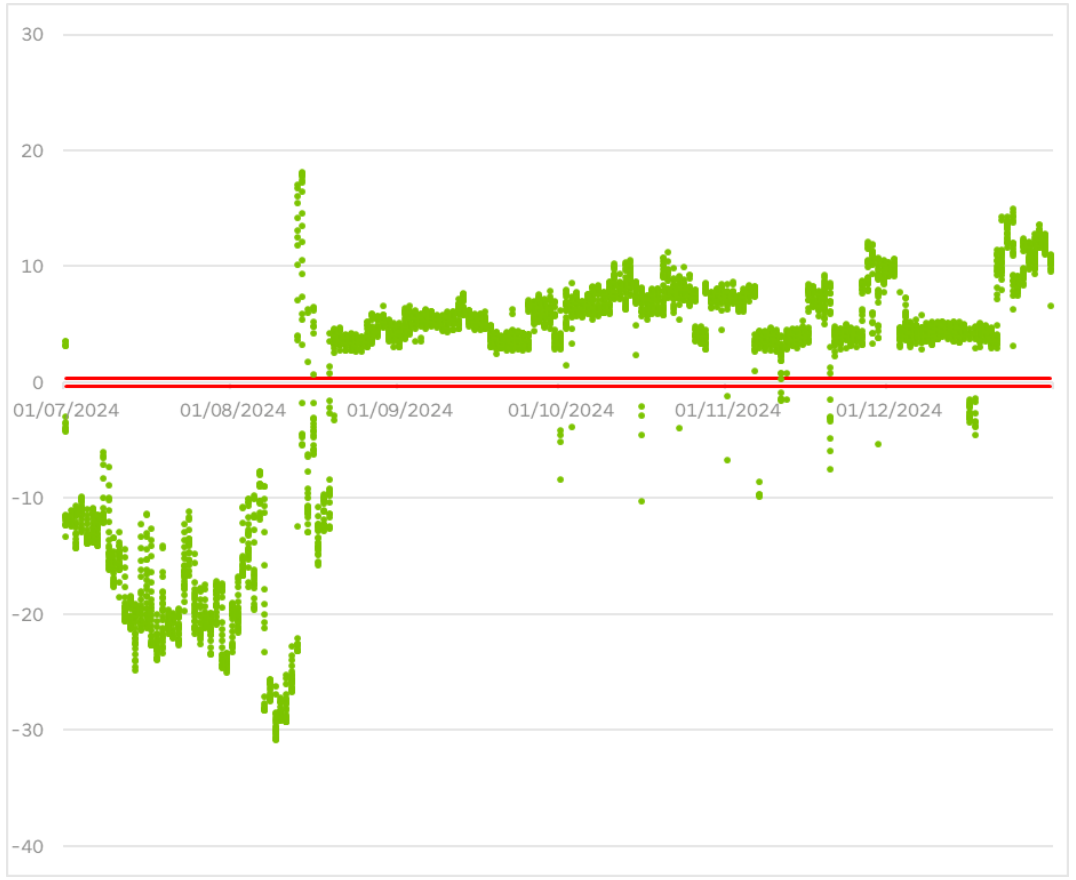
There have been 25 instances during the period (over 39k data points) where flows have been less than required (0.384mcm daily rate) for blending to 0.2mol%.

Flows past the site the vast majority (99.94%) of the time are sufficient for blending
Typical flows in this area of the network are 5mcm/day.

Assuming a flow past the site of 5mcm/day and max flows at 1% oxygen:

- If NTS oxygen past site is 0.1mol%, blended O2 is 0.1036mol%
- If NTS oxygen past site 0.01mol%, blended O2 is 0.014 mol%

Derived flows past Murrow



Snapshot: July 24 – December 24

Conclusions:

The analysis of hourly average feeder flowrates has shown that there were only 25 instances over 39,000 hourly data points considered where the flow in the feeder was insufficient to dilute the maximum flow of biomethane from the Murrow facility from 1% to 0.2% oxygen.

There are no 3rd party sites in the vicinity of Murrow. Flows in this area of the network are predominately (over 90%) from north to south, where the gas will blend further with other NTS gas at Huntingdon. However, if certain network conditions are seen, gas from Murrow could potentially reach a power station and GDN. The power station is located over 20km away. Any high oxygen content gas will further blend rapidly once flow rates increase and therefore long before the first of any offtakes is reached.

Glentham Entry Point Analysis

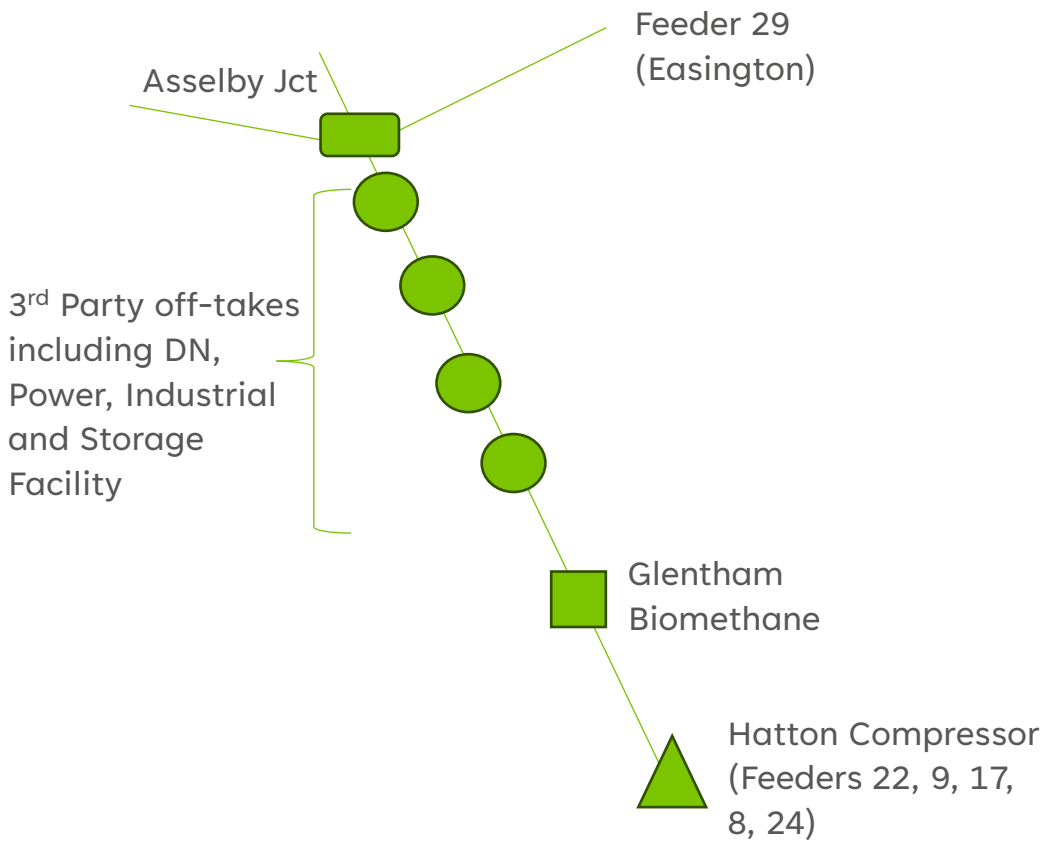
Glentham: Site Overview

Glentham Green Energy Limited have submitted an application to NGT for a new entry/exit connection to the NTS.

Glentham	Details
Site Location:	Feeder 7, circa 20km upstream of Hatton Compressor
Entry Connection:	Biomethane
Daily Maximum Flow rate:	24,000 standard cubic meters (scm) a day, 1,000scm/ hour (0.024mcm/day)
Flight Time:	The site will be located within approximately 200m of the NTS, with an approximate travel time of 4 minutes.
Gas Quality:	The maximum level of oxygen the site may deliver into the NTS is <0.2mol%, in line with current GS(M)R requirements. The site is proceeding with the construction on this basis and will only deliver oxygen with an elevated level of oxygen if the exemption is granted.
Connections:	There are a number of 3rd Party connections north of the site

Glentham: Third Party Connections

Simplified NTS Details (*not to scale)*



Analysis of flow and pressure data has shown that the gas in this section of feeder 7 travels both north to south and south to north depending on the prevailing supply and demand patterns.

If flows are travelling from north to south, there are no third-party connections between Glentham and Hatton Compressor Station and AGI, where the gas will mix with gas from Easington flowing via feeders 9 & 22 before being transported to other parts of the network.

If the gas is travelling from south to north, there is the potential for the gas from Glentham Biomethane Connection to travel as far as Asselby before it will blend further with gas feeding in via Feeder 29. There are a number of third-party connections north of Glentham on the section between there and Asselby. The salt cavity storage site, which is believed to be sensitive to increased oxygen levels, is circa 30km away from Glentham.

Given the extremely low volumes of biomethane injection at the Glentham Biomethane site relative to the dilution flows in the feeder it is being injected into, the injection of the higher oxygen content biomethane from Glentham is highly unlikely to result in any significant change to the characteristics of gas in the NTS as under normal circumstances the higher oxygen content biomethane will be diluted to very low levels by blending with the pipeline gas flowing past the injection point.

 Note that NGT have been in contact with all 3rd Party sites (apart from GDNs) between Glentham site and Asselby

Glentham: Oxygen and Flows (1 of 2)

Analysis undertaken has been conducted on a worst-case scenario:

- 1mol% oxygen delivered by Glentham*:
- Flow at the maximum rate of 0.001 mcm per hour
- Assuming the average oxygen level in the NTS gas is 0.1mol%

a flow of 0.008 mcm per hour (0.192 mcm/day) or greater would be required past the connection point for the gas to remain at or below the GS(M)R limit of 0.2mol%.

Blending Calculation	
Oxygen from Glentham (mol%)	1.000
Max Glentham hourly flow (mcm)	0.001
Assumed O2 level in NTS past site (mol%)	0.100
Min hourly flow to ensure compliance	**0.008**
Required O2 level (mol%)	0.200

The level of oxygen in the gas going past the connection is likely to contain a much lower level of oxygen due to entry connection agreements.

If we amend the assumed level of oxygen in the gas to 0.01mol%, **a flow of 0.004 mcm per hour** (0.096mcm/day) or greater would be required past the pipe for the gas to remain at or below the GS(M)R limit of 0.2mol%.

Blending Calculation	
Oxygen from Glentham (mol%)	1.000
Max Glentham hourly flow (mcm)	0.001
Assumed O2 level in NTS past site (mol%)	0.010
Min hourly flow to ensure compliance	**0.004**
Required O2 level (mol%)	0.200

Note that in practice, the gas in the NTS is unlikely to have an oxygen concentration this high because the 0.001% applies to most entry connections

***Note that the site would operate at 0.5mol% O2 under normal conditions, assuming 0.1% O2 in NTS, a flow of 0.003mcm/hour would be required for blending to the current GS(M)R limit.**

Glentham: Oxygen and Flows (2 of 2)

Two years of flow data have been considered:

Flow rates have been calculated based on the recorded hourly pressure data at Hatton Compressor Station and the closet off-take

There have been 7 instances during the 2-year period (18,610 data points) where flows have been less than required (0.192mcm daily rate) for blending to 0.2mol%.

Flows past the site the vast majority (99.96%) of the time are sufficient for blending

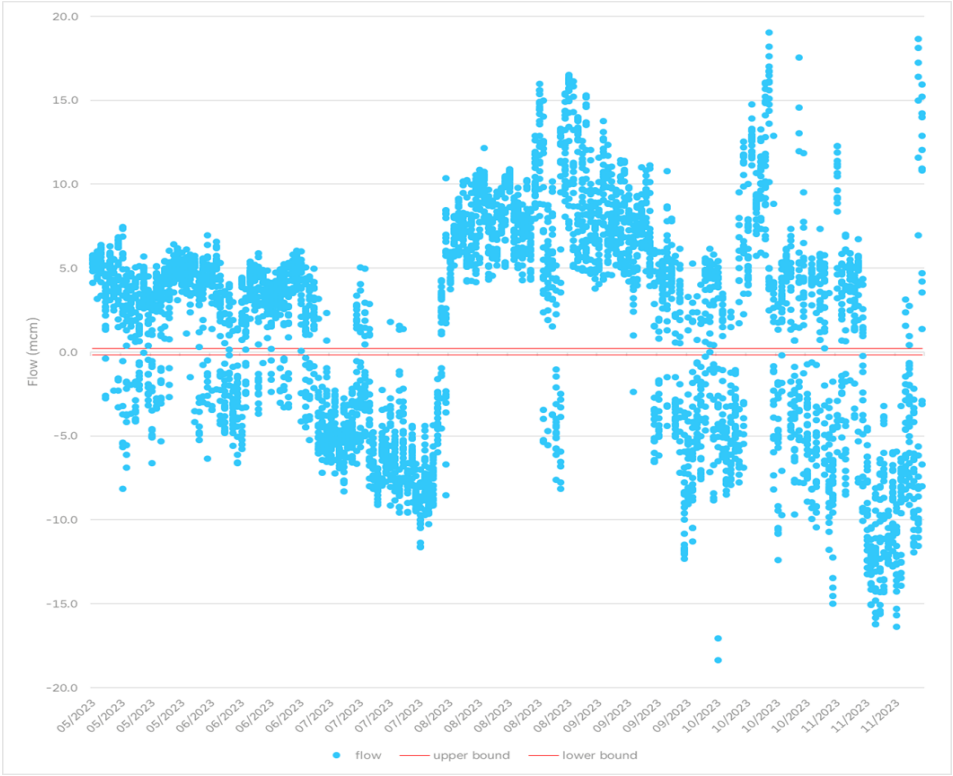
- Typical Winter Flow: 7.9 mcm
- Typical Summer Flow: 8.2 mcm

Assuming a flow past the site of 7.9mcm/day and max Glentham flows at 1% oxygen:

- If NTS oxygen past site is 0.1mol%, blended O2 is 0.103mol%
- If NTS oxygen past site 0.01mol%, blended O2 is 0.013 mol%

This, however, oversimplifies the situation. Every time there is a flow direction change, at some point flow will reduce to zero, before increasing in the reverse direction

Derived flows past Glentham



Snapshot: May 23 – November 23

Low/ Null Flow Scenario (1 of 2)

In the event there is no flow through feeder 7 past the Glentham injection point (during a flow reversal), and biomethane injection continues, a 'slug' of biomethane containing up to 1% oxygen might form in the vicinity of the injection point.

Flow data determines that null flows do not last long in duration (7 instances out of 18,610 hourly data points where average flows was less than required for blending)

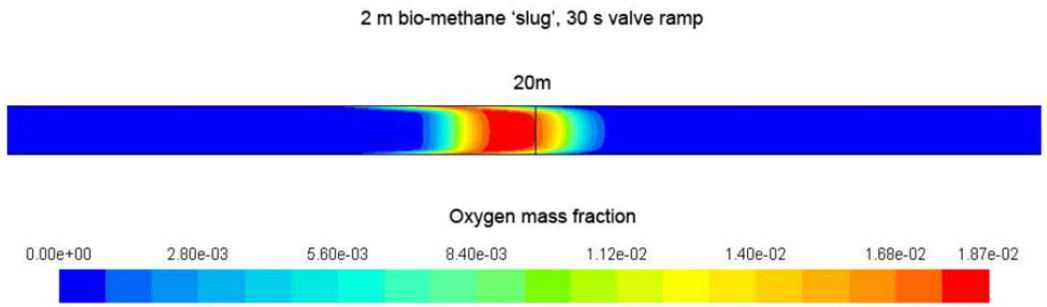
There is little concern if such a slug were to be transported south towards Hatton where it will be mixed with gas from Easington before being transported away from the locality.

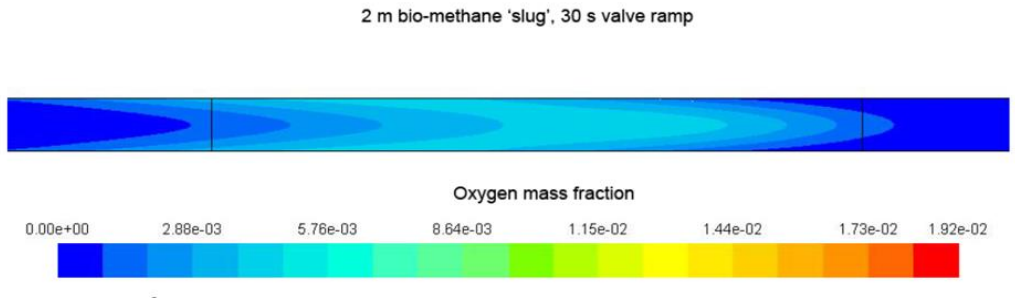
The greater potential concern is in the event of any such slug being propagated northwards towards the various offtakes and in particular the storage site.

NGT commissioned Computational Fluid Dynamic (CFD) Studies to better understand the behaviour of any slug of high oxygen content gas as the flow of gas in the feeder resumes. Output can be found in the NIA study: https://smarter.energynetworks.org/projects/nia_ngt0236/

Low/ Null Flow scenario (2 of 2)

Computation Fluid Dynamic Studies
The simulation of transient gas flows is quite complicated and requires considerable computing power and it has therefore been necessary to adopt a simplified model representing a worst-case scenario
The analysis has considered the behaviour of a pre-formed ‘slug’ of biomethane containing 1mol% oxygen with the flow in the feeder stationary as the flow in the main feeder restarts. For simplicity and as a worst-case, the flow geometry has been considered as a straight pipe with no branches or offtakes. Any branches or bends will increase the turbulence in the system which will lead to enhanced mixing.
It can be seen that the high oxygen content slug is blended out very rapidly and has been almost completely blended within a distance of around 100m.
It can therefore be concluded that any slug of biomethane which could accumulate in the event of a flow cessation or reversal will be effectively mixed out well before the slug of gas could reach any sensitive offtake.





Conclusions:

The analysis of hourly average feeder flowrates has shown that there were only 7 instances out of the 18,640 hourly data points considered where the flow in the feeder was insufficient to dilute the maximum flow of biomethane from the Glentham facility from 1% to 0.2% oxygen.

During the analysis, it has become apparent that the direction of flow in this section of the network changes. During any flow reversal, the flow must, of necessity, fall to zero before accelerating in the reverse direction.

During these flow reversals, a ‘slug’ of high oxygen gas could develop around the injection point. This will initially be diluted by the pipeline gas already present, however, the oxygen concentration will progressively increase until the flow restarts.

It has been shown by Computational Fluid Mechanics that any such slug of high oxygen content gas blends out rapidly once flow restarts even under the most adverse conditions (sharply defined plug of 1% oxygen gas, straight pipe with no branches or other flow disturbances). Blending is largely complete within a distance of around 100m. Mixing is found to be effective both longitudinally and axially. Any pockets of high oxygen content gas would be blended out within 1 – 200m and therefore long before the first of any offtakes is reached.

Thank you

national gas transmission