

UNC Modification	At what stage is this document in the process?
<h1>UNC 0780:</h1> <h2>Amendment to Gas Quality NTS Entry Specification at the St Fergus SAGE System Entry Point</h2>	<div style="display: flex; flex-direction: column; gap: 10px;"> <div style="border: 1px solid green; background-color: #00a651; color: white; padding: 5px; display: flex; align-items: center; justify-content: center;"> <span style="font-weight: bold; font-size: 1.2em; margin-right: 5px;">01</span> Modification         </div> <div style="border: 1px solid #00a651; padding: 5px; display: flex; align-items: center; justify-content: center;"> <span style="font-weight: bold; font-size: 1.2em; margin-right: 5px;">02</span> Workgroup Report         </div> <div style="border: 1px solid #00a651; padding: 5px; display: flex; align-items: center; justify-content: center;"> <span style="font-weight: bold; font-size: 1.2em; margin-right: 5px;">03</span> Draft Modification Report         </div> <div style="border: 1px solid #00a651; padding: 5px; display: flex; align-items: center; justify-content: center;"> <span style="font-weight: bold; font-size: 1.2em; margin-right: 5px;">04</span> Final Modification Report         </div> </div>
<p><b>Purpose of Modification:</b></p> <p>This enabling Modification will facilitate a change to the current contractual carbon dioxide limit at the St Fergus SAGE System Entry Point, through modification of a network entry provision contained within the Network Entry Agreement (NEA) between National Grid Gas plc and SAGE North Sea Limited (SNSL) in respect of the St Fergus SAGE Sub-Terminal.</p>	
<p><b>Next Steps:</b></p> <p>The Proposer recommends that this Modification should be:</p> <ul style="list-style-type: none"> <li>subject to Self-Governance</li> <li>assessed by a Workgroup</li> </ul> <p>This Modification was first presented by the Proposer to the Panel on 19 August 2021. This revised version will be presented to the panel on 4 November 2021. The Panel will consider the Proposer’s recommendation and determine the appropriate route.</p>	
<p><b>Impacted Parties:</b></p> <p>High:</p> <p>Low: Transporters, Shippers and Consumers</p> <p>None:</p>	
<p><b>Impacted Codes:</b></p> <p>None</p>	

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Timetable	
Pre-Modification discussion	05 November 2020
Date Modification raised	11 August 2021
New Modification to be considered by Panel	19 August 2021
First Workgroup meeting	07 September 2021
Workgroup Report to be presented to Panel	18 November 2021
Draft Modification Report issued for consultation	19 November 2021
Consultation Close-out for representations	10 December 2021
Final Modification Report available for Panel (at short notice)	14 December 2021
Modification Panel decision	16 December 2021


 Any questions?

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# 1 Summary

## What

This proposed Modification seeks to enable a temporary increase in the carbon dioxide (CO<sub>2</sub>) limit within the Network Entry Agreement (NEA) at the SAGE North Sea Limited (SNSL) sub-terminal at St. Fergus between National Grid Gas plc and SNSL.

It is proposed to increase the CO<sub>2</sub> limit from 4.0 mol% to 6.0 mol% subject to a cap on total inerts (CO<sub>2</sub> and N<sub>2</sub>) at 7.0 mol% until the end of Gas Year 2026/2027. To allow for future re-evaluation of the CO<sub>2</sub> blending at St Fergus, such as to extend a similar relaxation to another party should it be requested, it is proposed that this increase will be subject to a 2 year cancellation period that can be invoked at any time for any reason by the UNC modification process. This period will allow the SAGE facility to reinstate its CO<sub>2</sub> removal facilities if necessary.

In addition, the Modification will be subject to an annual confirmation of a continued requirement. This will take the form of a review, submitted by the SAGE terminal operator to National Grid NTS, showing the actual usage of the specification relaxation, and demonstrating a continued credible threat of high CO<sub>2</sub> pipeline upset situations.

## Why

The SAGE Terminal receives gas from some 40 different offshore Shippers. Of these Shippers, a number produce gas with a CO<sub>2</sub> content in excess of 4 mol% including the Beryl, Brae and T Block fields. Historically, when production rates from these fields were at their peak, gas arriving at the terminal required continual treatment to remove the CO<sub>2</sub> before entry into the National Grid. This was achieved through the use of two amine absorption-based treatment trains operating in parallel.

Today, gas flow rates through the SAGE Terminal are below the original nameplate capacity. Production rates from Beryl, Brae and Tiffany have reduced whilst sources of sweeter gas from fields including Britannia as well as developments in the Norwegian sector such as Alvheim, Edvard Greig and Ivar Aasen have increased. Typically, the CO<sub>2</sub> content arriving at the SAGE Terminal is on average circa 3 mol% and this is predicted to continue declining towards 2 mol% by the end of the 2026/2027 Gas Year. As a consequence, the SAGE Terminal no longer requires continual CO<sub>2</sub> removal for the remainder of the life of the facility. One treatment train has already been retired from service and the remaining treatment train remains on standby for intermittent use for unplanned platform shutdowns.

The SAGE Terminal operator now proposes to mothball the remaining treatment train as part of an overall terminal rationalisation project. In so doing, terminal unit costs and carbon emissions will be reduced in line with industry benchmark data for the forecast throughput and scale of the operation. This essential change is required to maximise the economic life of the terminal and promote the development of remaining undeveloped discoveries and prospects in both the UKCS and the Norwegian Sector.

## How

In accordance with the UNC Transportation Principal Document Section I 2.2.3 (a), the Proposer is seeking to amend the NEA described above via this enabling Modification. On satisfactory completion of the UNC process, the parties to the NEA will be able to amend the agreement.

It should be noted that a similar enabling Modification (UNC Modification 0607 - Amendment to Gas Quality NTS Entry Specification at the St Fergus NSMP System Entry Point) was approved by Ofgem in February 2018.

## 2 Governance

### Justification for Self-Governance

The Proposer considers that this proposed modification meets the self-governance criteria on the basis that the change is unlikely to have a material effect on:

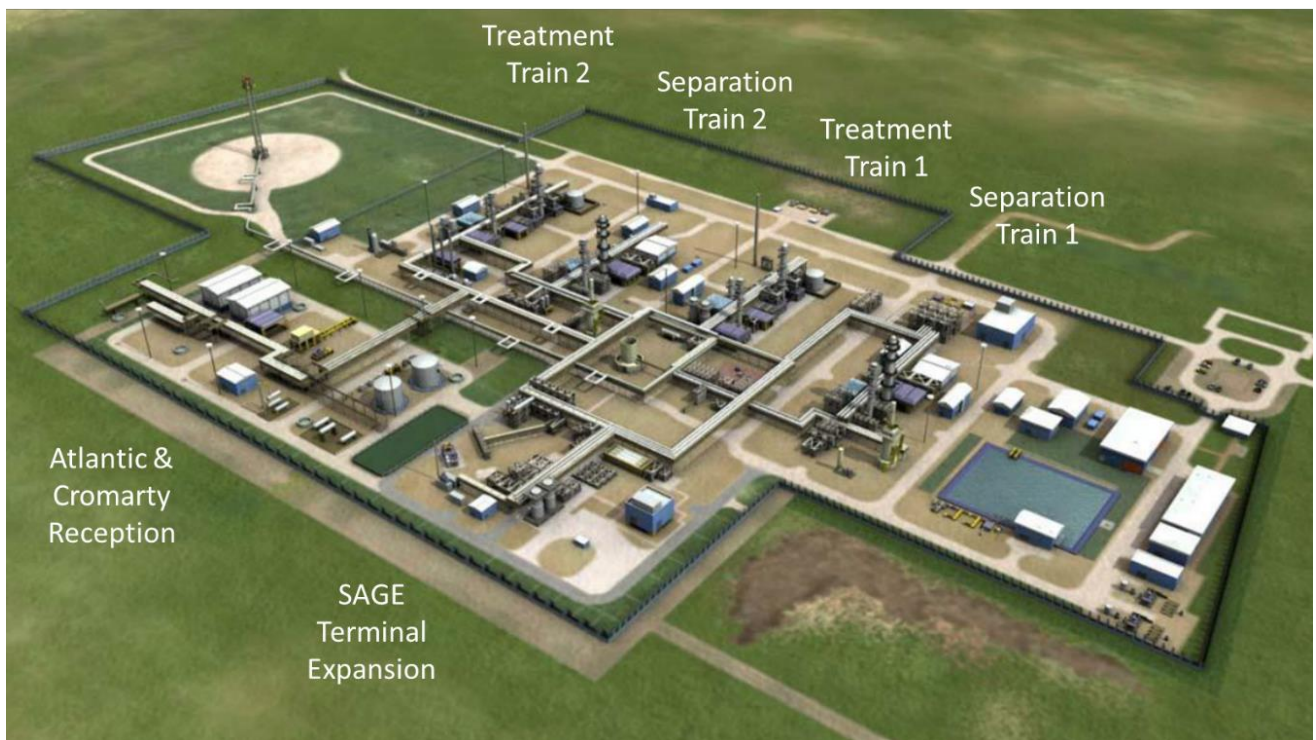
- (aa) **Existing or future gas consumers.** The dilution from low CO<sub>2</sub> gas from the SEGAL sub-terminal and Norway through the Vesterled pipeline will result in gas being exported into the NTS which remains within the UNC limit of 4 mol%. It is noted that there is the possibility of CO<sub>2</sub> of up to 5.5 mol% from the NSMP terminal as a result of unplanned shutdowns associated with offshore shippers. However, the likelihood of this occurring coincident with an unplanned shutdown due to SAGE Terminal offshore Shippers is considered very low (1 event every 5 to 10 years) and therefore manageable.
- (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.** The proposed modification does not disadvantage the competitive position of the other terminal operators at St Fergus. Furthermore, increasing the UNC limit from 4 mol% to 6 mol% for the SAGE Terminal will create a comparable entry specification with the NSMP Terminal in particular and therefore maintain the competitive environment amongst the St Fergus sub-terminals.
- (dd) **Matters relating to sustainable development, safety or security of supply, or the management of market or network emergencies.** The export of gas with a CO<sub>2</sub> content of between 5.5 and 6.0 mol% and for limited periods of time, (circa 48 hours) is unlikely to have a material impact on the management of the network nor safety and security of supply. The overall inert content will remain at or below 7 mol%. As previous, the likelihood of coincident excursions at both NSMP and SAGE is considered very low. Furthermore, given the notification period ahead of a high CO<sub>2</sub> event (also circa 48 hours), the St Fergus sub-terminal operators could take mitigating and co-ordinated steps, such as rate reduction in flow from high CO<sub>2</sub> fields.

### Requested Next Steps

This Modification should:

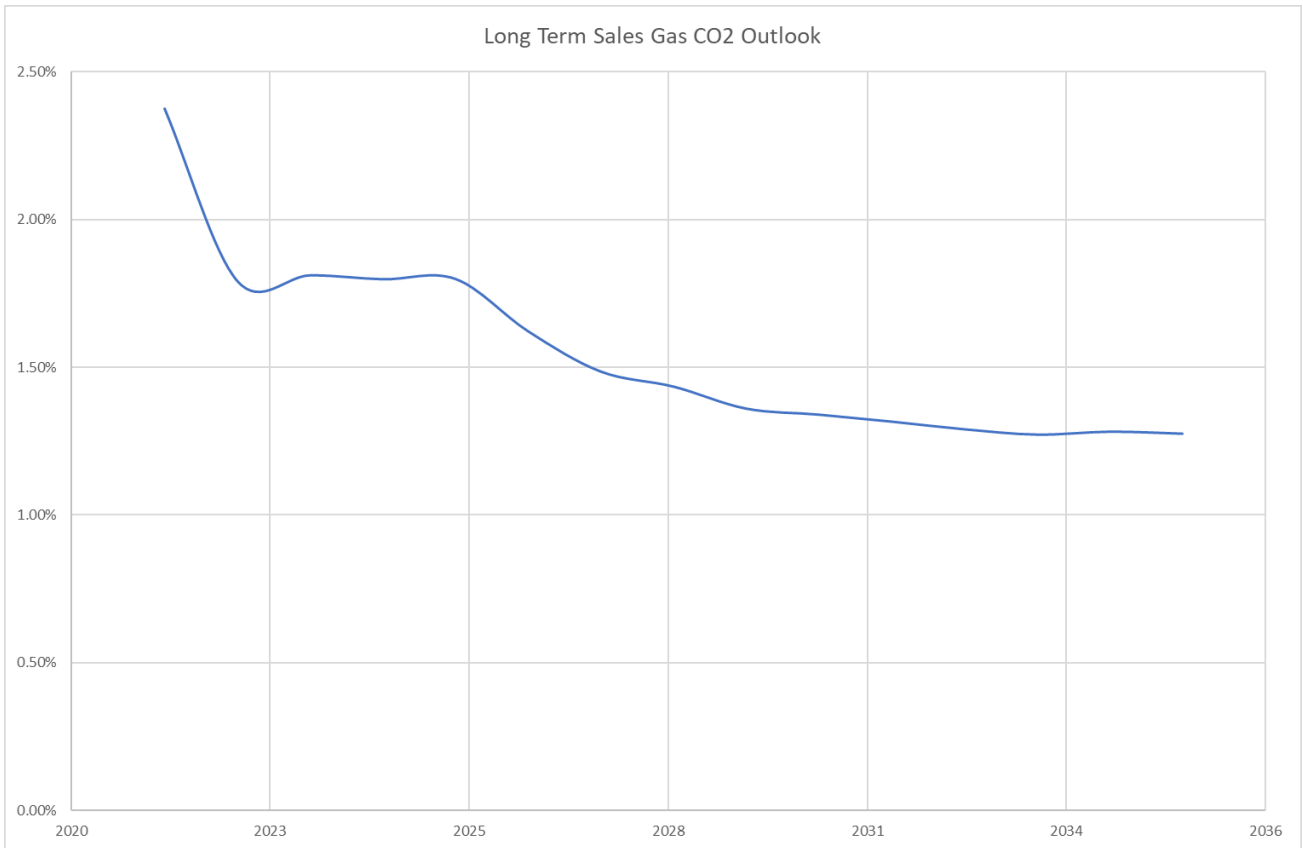
- be considered a non-material change and subject to Self-Governance.
- be assessed by a Workgroup.

### 3 Why Change?



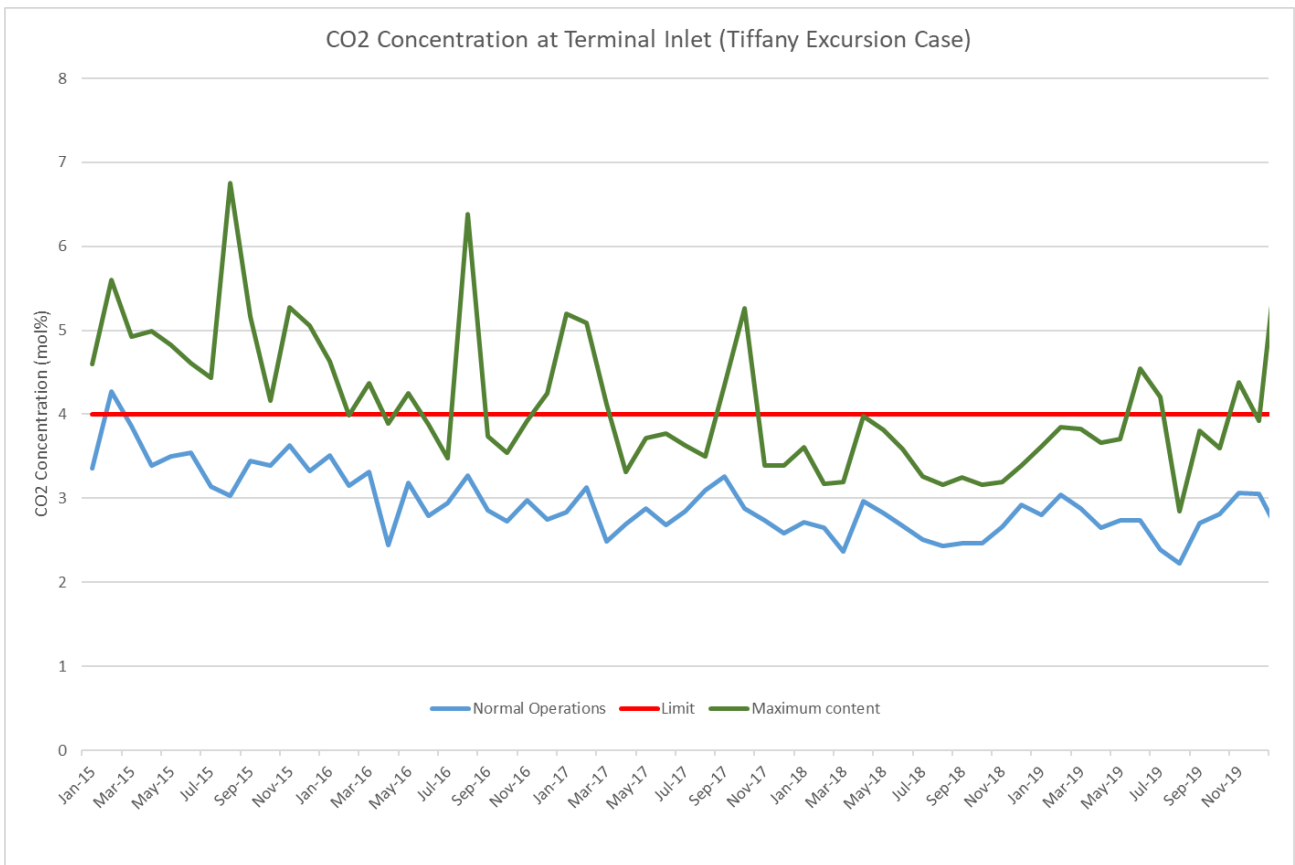
The original design of the SAGE facility included two identical amine absorption-based acid gas treatment trains each designed to remove around 1200 tonnes per day of CO<sub>2</sub>. The acid gas stream was incinerated to oxidise H<sub>2</sub>S and then vented to atmosphere. At design rates, each train consumes approximately 15 MW of fuel gas and 3 MW of electrical power.

At the present time, gas flow rates through the SAGE Terminal are below original nameplate capacity. Production from Beryl, Brae and Tiffany have reduced whilst rates from sweet gas fields including Britannia as well as developments in the Norwegian sector such as Alvheim, Edvard Greig and Ivar Aasen have increased. As a consequence, the blended gas arriving at the SAGE Terminal no longer requires continuous CO<sub>2</sub> removal using the two treatment trains. Today, the CO<sub>2</sub> content arriving at the SAGE Terminal is on average circa 3 mol% and this is predicted to continue declining towards 2 mol% by the end of the 2026/2027 Gas Year. One treatment train was retired from service 6 years ago.



However unplanned platform outages can result in flow disturbances and short duration composition spikes on the pipeline. Some of these events can require short term CO<sub>2</sub> removal to maintain the sales gas within the 4% CO<sub>2</sub> specification. Typically, these excursions occur around five times per year, last less than 48 hours and would otherwise result in a sales gas CO<sub>2</sub> concentration of 6 mol% or less if not treated. The remaining treatment train has therefore been maintained for intermittent use to treat these spikes.

The blue line on the following chart shows the decreasing CO<sub>2</sub> content that has been experienced over the last five years. The green line shows the potential CO<sub>2</sub> levels that could be created should one of the potential upset scenarios occur – here a Brae outage where Tiffany gas fills the Brae pipeline and then enters the SAGE pipeline at Brae rates. In such a scenario, the blue line would spike up to the green line for a short period of time.



The annual combined CO<sub>2</sub> removed is usually around 1000 tonnes per year or less. This represents less than 0.25% of the design 400,000 tonnes per year removal capacity of each treatment train and less than 0.5% of the normal 200,000 tonnes per year of CO<sub>2</sub> exported within the current specification.

In addition to the ongoing operation and maintenance costs, this mode of operation is extremely inefficient from an energy and emission perspective.

Firstly, there is the inefficiency that results operating such large capacity equipment at low rates with limited turndown. Secondly there are inefficiencies that result from the intermittent operation – a significant proportion of the time the unit is in warm standby or in warm-up where the power usage is at normal levels whereas the CO<sub>2</sub> removal is nil. Thirdly it is often the case that the train is brought online as a precaution and not usefully used. The net effect of all these inefficiencies is that the CO<sub>2</sub> emitted directly as a result of fuel gas consumption or indirectly as a result of electricity consumption is far greater than the CO<sub>2</sub> that is removed. This is illustrated in the following chart.





For example, in 2020 more than 12000 tonnes of CO<sub>2</sub> were emitted to remove (and emit) 400 tonnes of CO<sub>2</sub>. To date this year only 74 tonnes of CO<sub>2</sub> have been removed.

It is therefore proposed that SAGE be allowed to export this small quantity of CO<sub>2</sub> into the NTS by relaxing the specification to 6 mol%.

### Terminal Efficiency and Longevity

The SAGE Terminal operator proposes to use this UNC modification to retire from service and mothball the second treatment train as part of an ongoing terminal rationalisation effort. Mothballing allows for a future revocation of this Modification and allows future reuse opportunities to be explored before decommissioning.

In doing so, terminal emissions will be reduced by up to 28%. Furthermore, terminal unit costs will also be reduced in line with industry benchmark data for the forecast throughput and scale of the operation. This in turn means that terminal operating costs may be reduced, operational efficiency improved, and the economic life of the terminal extended. Offshore Shippers will benefit as the change delays the point in time when they cease paying a transportation and processing tariff and commence paying a share of the terminal operating costs. The effect is to extend the economic life of such offshore fields and furthermore promote the development of remaining undeveloped discoveries and prospects in both the UKCS and the Norwegian sector of the North Sea. In turn this continues to support the security of gas supplies into the UK.

To allow SAGE to transition the treatment train and its associated utilities into a properly preserved and zero energy & emission mothballed state, it is necessary to obtain a specification relaxation with a validity period greater than the time it would be necessary to recommission the train. To avoid sterilising CO<sub>2</sub> capacity, this period should also be less than the typical development time necessary for which another party may need such a relaxation. SAGE believes that a period of 2 years would achieve both these goals.

SAGE is therefore proposing that that this modification be subject to a 2 year cancellation period that can be invoked at any time for any reason via the UNC modification process. This means that National Grid NTS shall



be permitted to reduce the CO<sub>2</sub> limit at the St Fergus SAGE System Entry Point to a level between 4.0 mol% and 6.0 mol% with a 2 year notice period if another UNC Modification(s) is raised that seeks to increase the CO<sub>2</sub> limit at another NTS System Entry Point that National Grid NTS would be unable to accommodate without incurring material cost,

### **What the effects are, should the change not be made**

Without change, the SAGE Terminal will be required to continue operating and maintaining under-utilised facilities and equipment required to remove CO<sub>2</sub> from the SAGE pipeline gas stream on an infrequent basis. The SAGE Terminal carbon footprint will remain comparatively high for the volume of gas transported through the system, using both electricity from the grid and steam generated on site to continue operation of the remaining treatment train. The SAGE Terminal operating costs will remain comparatively high and will likely truncate the economic life of the terminal and the offshore Shippers who transport and process their gas through the SAGE Terminal.

## **4 Code Specific Matters**

### **Reference Documents**

Relevant Modification UNC 0607: Amendment to Gas Quality NTS Entry Specification at the St Fergus NSMP System Entry Point, Version 1, 19 October 2017. <https://www.gasgovernance.co.uk/0607>

### **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 the existing SAGE Terminal NEA. The amendment would increase the CO<sub>2</sub> upper limit for gas delivered from the SAGE Sub-Terminal System Entry Point into the National Transmission System to 6.0 mol% from the current limit of 4.0 mol%, subject to a cap on total inerts (CO<sub>2</sub> and N<sub>2</sub>) at 7.0 mol% and through to the end of the Gas Year 2026/2027.

It is proposed that National Grid NTS shall be permitted to reduce the CO<sub>2</sub> limit at the St Fergus SAGE System Entry Point to a level between 4.0 mol% and 6.0 mol% with a 2 year notice period if another UNC Modification(s) is raised that seeks to increase the CO<sub>2</sub> limit at another NTS System Entry Point that National Grid NTS would be unable to accommodate without incurring material cost,

In addition, the modification will be subject to an annual demonstration of a continued requirement. This will take the form of a review submitted to National Grid NTS by the St Fergus SAGE terminal operator for each year within the time period for which this Modification applies, showing the actual usage of the specification relaxation, and demonstrating the continued credible threat of high CO<sub>2</sub> pipeline upset situations. Further, the SAGE terminal operator shall use its reasonable endeavours to notify National Grid NTS if it expects an increase in CO<sub>2</sub> beyond 4 mol% to occur in the gas it delivers at St Fergus.

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?

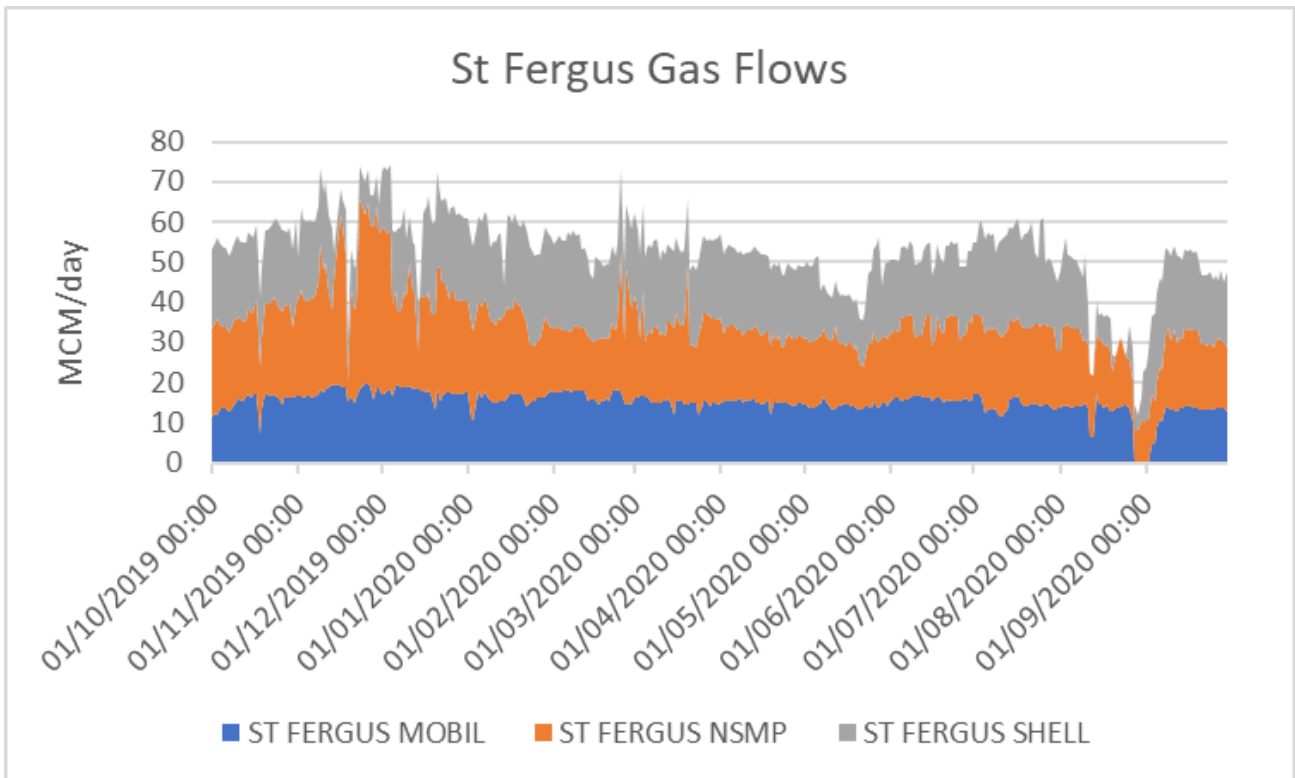
No

#### Impacts of Modification

Consumers currently receive gas with a CO<sub>2</sub> content of 4 mol% from the SAGE Terminal, 2% from the SEGAL Terminal and between 4% and 5.5% from the NSMP Terminal, (ref: UNC 0607). An assessment of the flowrates and CO<sub>2</sub> content of gas entering the NTS at St Fergus has been undertaken by SNSL based on flowrates over the last 18 months. This is illustrated in the following graph and summarised in the following pages.

To complement this assessment, a penetration analysis has also been undertaken by National Grid which illustrates the impact of the proposed modification. A copy of the analysis is provided alongside this modification proposal. This suggests a degree of CO<sub>2</sub> penetration into the NTS of between 4.0 and 4.8 mol%, assuming that the SAGE Terminal is flowing at 6 mol% coincident with the NSMP Terminal flowing at 5.5 mol%.

The basis and likelihood of this scenario is considered further below.



Entry Point Flowrates	SAGE (mcm/day)	NSMP (mcm/day)	Shell (mcm/day)
Max Flowrates	19.70	47.46	26.44
Average Flowrates	15.35	19.86	18.14

A detailed analysis of the CO<sub>2</sub> and total inert content exported into the NTS from the SAGE Terminal, assuming retiral of the remaining treatment train, has been undertaken. This includes a probabilistic (Monte Carlo) simulation of the likelihood of excursions in excess of 4 mol%. Such excursions are a consequence of shipper unplanned shutdowns which result in a lack of blend gas within the SAGE Terminal.

Of the various scenarios considered, there is one outlier involving both the East Brae field and the Tiffany field. The Tiffany field exports gas with a relatively high CO<sub>2</sub> content but a relatively low flow rate such that blending from other shippers within the SAGE pipeline quickly dilutes this content to circa 3 mol% during normal operations. The exception to this is when the East Brae platform trips and allows Tiffany gas to flow directly into the Brae pipeline, gradually building a high CO<sub>2</sub> slug of gas. When East Brae starts-up again, this high CO<sub>2</sub> slug is further compressed before dilution with gas from other shippers. The consequence is a circa 48-hour excursion with a maximum of between 5.5 and 6 mol% CO<sub>2</sub> and an estimated frequency of five times per annum (95% confidence). This estimate forms the basis and limiting case for this proposed UNC Modification.

The range of representative scenarios for the maximum CO<sub>2</sub> content from the three respective sub-terminals at St Fergus, assuming that this UNC modification is approved are summarised in the following table:

CO <sub>2</sub> mol% at Entry Point	SAGE	NSMP	Shell
CO <sub>2</sub> Base Case	4.0%	4.0%	2.0%
CO <sub>2</sub> Steady State @ FUKA and High SAGE	6.0%	2.7%	2.0%
CO <sub>2</sub> High SAGE	6.0%	4.0%	2.0%
CO <sub>2</sub> High NSMP	4.0%	5.5%	2.0%
CO <sub>2</sub> High NSMP and High SAGE	6.0%	5.5%	2.0%

The above scenarios have been combined with the representative flowrates from the three sub-terminals at St Fergus to provide a likely range for CO<sub>2</sub> content entering the grid, as summarised in the following table:

Export into NTS	CO <sub>2</sub> Base Case	CO <sub>2</sub> Steady state @ FUKA and High SAGE	CO <sub>2</sub> High SAGE	CO <sub>2</sub> High NSMP	CO <sub>2</sub> High NSMP and High SAGE
Max Flowrates	3.4%	3.2%	3.9%	4.2%	4.6%
Average Flowrates	3.3%	3.4%	3.9%	3.9%	4.5%

It is evident from the analysis that gas entering the NTS as a consequence of a high CO<sub>2</sub> excursion from the SAGE Terminal remains below 4 mol% due to blending with gas from the two neighbouring terminals.

There are two exceptions to this scenario:

(a) The first involves a coincident high CO<sub>2</sub> excursion from the NSMP terminal as well as a high CO<sub>2</sub> excursion from the SAGE Terminal. The overall CO<sub>2</sub> content entering the grid in this instance is predicted to reach between 4.5 and 4.6 mol%. The likelihood of such an event is considered very low and estimated at 1 event every 5 to 10 years. Due to the nature of the offshore events, both the SAGE Terminal and NSMP Terminal Operators will receive advance notice of a high CO<sub>2</sub> event, likely 48 hours ahead of the high CO<sub>2</sub> slug arriving at the terminal.

Offshore Shippers may be co-ordinated and / or gas rates reduced in order to mitigate the impact on the NTS and maintain the overall content below 4 mol%.

(b) The second scenario involves the arrival of high CO<sub>2</sub> gas at the SAGE Terminal coincident with the inadvertent shut-in of one or both of the neighbouring terminals at St Fergus; ie: NSMP and / or Shell. All three terminals at St Fergus operate with high availability, estimated in excess of 99%. The likelihood of such a coincident event is considered negligible and greater than 1 in 1000 years. Furthermore, in the event of such an occurrence, it is expected that National Grid might take action to restrict the flow of high CO<sub>2</sub> gas into the grid as appropriate.

### **Impact on Greenhouse Gas Emissions**

The remaining treatment train at the SAGE Terminal requires ongoing operation in order circulate and heat amine within the plant. Amine is the main chemical component within the treatment train which removes carbon dioxide from process gas. However, circulating and heating the amine is energy intensive in and of itself, using both electricity from the grid and steam generated at the terminal. Rationalisation of the treatment train has the potential to support a reduction in total emissions from the SAGE Terminal from circa 94,000 tonnes per annum to 67,000 tonnes per annum. Based on the Shipper unplanned shutdown scenarios described above, the treatment train is only required to remove an estimated 3,000 tonnes of CO<sub>2</sub> per annum from the SAGE pipeline gas.

### **Consumer Impacts**

Based on the analysis undertaken to date, including a penetration analysis undertaken by National Grid and complemented by an assessment of the likelihood of CO<sub>2</sub> penetration into the NTS of between 4.0 and 4.8 mol%, the proposed modification is considered no have no impact on consumers other than positive benefits as detailed below.

### **What is the current consumer experience and what would the new consumer experience be?**

Positive benefits on both current consumers as well as any new consumers are detailed in the following table:

<b>Impact of the change on Consumer Benefit Areas:</b>	
Area	Identified impact
<p><b>Improved safety and reliability</b></p> <p>The SAGE Terminal is a top tier COMAH site. The modification will facilitate the rationalisation of under-utilised hydrocarbon plant and equipment at the SAGE Terminal which in turn will reduce the process safety risk associated with the operation.</p>	Positive
<p><b>Lower bills than would otherwise be the case</b></p> <p>No impact</p>	None
<p><b>Reduced environmental damage</b></p> <p>The modification will facilitate a reduction in total CO2 emissions to atmosphere from the SAGE Terminal whilst continuing to process and transport gas into the UK grid as a transitional fuel and consistent with the UK's net zero agenda.</p>	Positive
<p><b>Improved quality of service</b></p> <p>The proposed modification will have no impact on the ability of the SAGE Terminal to continue processing and transporting as into the NTS.</p>	None
<p><b>Benefits for society as a whole</b></p> <p>The modification will support the continued economic life of the SAGE Terminal and as a consequence, continued security of supply of gas into the UK during a transitional period.</p>	Positive

**Cross Code Impacts**

None

**EU Code Impacts**

None

**Central Systems Impacts**

None

## 7 Relevant Objectives

### Impact of the Modification on the Transporters' Relevant Objectives:

Impact of the modification on the Relevant Objectives:

Relevant Objective	Identified impact
a) Efficient and economic operation of the pipe-line system.	Positive
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

Implementation of the proposed Modification has a positive impact on Relevant Objective (a) *Efficient and economic operation of the pipe-line system* and Relevant Objective (d) *securing of effective competition between relevant shippers*.

The Modification enables the SAGE Terminal Operator to commence a terminal rationalisation programme and retire equipment which has limited utilisation based on forecast throughout and gas composition. As a consequence, unit operating costs will be reduced, and the economic life of the SAGE Terminal extended. This in turn will continue to secure effective competition between shippers for access to SAGE as a cost-efficient sub-terminal at St Fergus and promote the development of remaining gas reserves and resources in both the UKCS and Norwegian sector of the North Sea.

## 8 Implementation

Implementation is required by 16 December 2021. As Self-Governance procedures are proposed, implementation could be sixteen business days after a Modification Panel decision to implement, subject to no Appeal being raised. This would enable the SAGE Terminal Operator to commence the process of isolating and retiring component parts of the treatment train in early 2022 and reduce the environmental impact of the train as the first priority.

No implementation costs for other industry parties are anticipated.

## 9 Legal Text

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).

## 10 Recommendations

### Proposer's Recommendation to Panel

Panel is asked to:

- Agree that self-governance procedures should apply
- Refer this proposal to a Workgroup for assessment.