Department for Energy Security & Net Zero

Implementing Upstream Greenhouse Gas Removals

CO2 Venting guidance

January 2025

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Introduction

The Greenhouse Gas Emissions Trading Scheme (Amendment) (No. 2) Order 2024 ("the Order")[1] was laid across all four parliaments in October 2024. This expands the scope of the scheme to include process emissions from Carbon Dioxide (CO2) venting from the upstream oil and gas sector, which comes into force on 1st April 2025 as the relevant date under sub-paragraph 6A of the amended Schedule 2. The amendment does not include methane.

The Order brings all process emissions from the removal of carbon dioxide which is extracted from oil and gas into the United Kingdom Emissions Trading Scheme (UK ETS). It applies to all installations in the upstream oil and gas sector that carry out upstream GHG removal of any quantity of CO2 from petroleum (whether by a chemical or physical process)that is then vented and already in the UK ETS by virtue of the existing combustion threshold. This ensures that CO2 process emissions from the sector are in scope of the UK ETS irrespective of whether they are emitted during flaring (combustion already being reported) or are otherwise vented without a combustion process (which will now require reporting in the annual emissions report going forward).

Operators should note amendments to Schedule 2 of the Order and modifications to the Monitoring and Reporting Regulation 2018 (The MRR)[2] and the Verification Regulation 2018 (The AVR)[3].

The venting of CO2 is a new regulated Schedule 2 activity and requires a UK ETS Greenhouse Gas (GHG) permit if the installation already qualifies under the combustion threshold. So this must be permitted by 1st April 2025 irrespective of how much CO2 is vented.

The reader is encouraged to read the Order in conjunction with this guidance.

While every effort has been made to ensure the accuracy and completeness of this Guidance, information may become out of date or may on occasion include errors. For example, links to Department and Third-Party websites, which are provided for ease of reference, can break as a result of website changes.

Please contact the Department (OPRED@energysecurity.gov.uk) for clarification on any aspects of the guidance. The Department will update / correct any information identified as outdated or erroneous at the time of the next revision of this Guidance. Revisions will be made as the Department sees fit.

[1] The Greenhouse Gas Emissions Trading Scheme (Amendment) (No. 2) Order 2024
[2] Monitoring and Reporting Regulation 2018
[3] Verification Regulation 2018

Document control		
Revision	Issue Date	Description of changes
0.1	10/01/2025	Draft shared with industry for comment.
0.2	11/03/2025	update for industry and internal comments and legal review
1.0	22/04/2025	Final version for publishing

Abbreviations	
AD	Activity Data
AVR	Accreditation and Verification regulations
CBA	Cost Benefit Analysis
CO2	Carbon Dioxide
EF	Emission Factor
GHG	Greenhouse Gas
LNG	Liquified Natural Gas
MRR	Monitoring and reporting regulations
MW	Mega Watt
MWth	Mega Watt thermal
METS	Manage your Emissions Trading System
MMP	Monitoring methodology plan
MRV	Monitoring, reporting, verification
NM3	Normal cubic meter
NSTA	North Sea Transition Authority
SI	Statutory Instrument
t	Tonne

UK ETS	United Kingdom Emissions Trading Scheme

Statutory Instrument (SI)

The Order aim is to expand the scope of the scheme to include process emissions from CO2 venting from the upstream oil and gas sector. The initial phases of oil and gas production may require on site localised processing to remove excess CO2 from hydrocarbon oil and gas prior to being exported. The removed CO2 can be emitted by two routes, it is emitted via the flare stream combusting gas, or it is released through venting of unignited gas. CO2 emitted through the flare stream is already reported and subject to the carbon price. Venting has not been required to be reported prior to the Order. The Order incorporates CO2 venting from upstream GHG removal into UK ETS for installations already in the scheme because they exceed the combustion threshold, de-incentivising CO2 venting, widening verification accreditation to include verification of CO2 vented emissions.

Consultation

Consultation was carried out on CO2 venting as part of a wider 2022 “Developing the UK Emissions Trading Scheme” consultation and the government response was published in 2023[4].

The government response clarified that process emissions from CO2 venting from the upstream oil and gas sector are to be included in the UK ETS.

- ‘Process emissions’ are any process, via any means of technology, that **removes** carbon dioxide from the oil or gas, and then releases it to the atmosphere via a vent (a vent includes an unlit flare). *This will not include any carbon dioxide that is emitted via an unlit flare that has not come through the carbon dioxide-stripping processes.*
- These emissions count as any form of carbon dioxide-stripping process (also known as ‘gas sweetening’ for example) in the upstream oil and gas sector.

Note: There are no free allowances allocated for CO2 venting.

[4] https://www.gov.uk/government/consultations/developing-the-uk-emissions-trading-scheme-uk-ets

Overview of changes to the Order

New Schedule 2 Activity – Upstream Greenhouse Gas (GHG) Removal

Schedule 2 of the Order has been amended to include Upstream GHG removal carried out on an upstream site:

- "Upstream GHG removal" is defined as the removal of constituent greenhouse gases from petroleum (whether by a chemical or physical process).

  Note:

  - Only where the process is designed to remove CO2 from hydrocarbons, this must be included and permitted.
  - For example, where the process may include amine units, stripping, absorption, degassing that is designed to remove CO2 prior to export etc that results in vented emissions that is in scope.
  - An example of an out-of-scope process is a glycol regeneration system used to remove water and re-use the glycol. This would also remove some CO2 by its inherent nature of operation. However, the purpose is to remove water not CO2 and therefore this is not in scope of the new venting regulated activity.

- 'Upstream site' means the site of –

  (a) a project carried out by virtue of a licence granted under section 2 of the Petroleum (Production) Act 1934(a), section 3 of the Petroleum Act 1998(b) or section 2 of the Petroleum (Production) Act (Northern Ireland) 1964(c);

  (b) a facility (other than a liquefied natural gas import or export facility or a facility operated by a gas transporter) where constituent greenhouse gases are removed from petroleum for the purpose of enabling it to be introduced into a pipeline system operated by a gas transporter or to be conveyed to an electricity generating station, a gas storage facility, a liquefied natural gas import or export facility or any place outside the United Kingdom.

The new activity is only applicable where an installation already qualifies under the UK ETS by having a 'combustion' activity. Where an installation does not come under scope of the UK ETS because it does not meet the schedule 2 activity 'combustion of fuels on a site where combustion units with a total rated thermal input exceeding 20 MW are operated' it will not fall in scope of the new activity 'upstream greenhouse gas removal'. This association is shown in the following table.

Activities	Greenhouse gases
‘Combustion of fuels on a site where combustion units with a total rated thermal input exceeding 20 MW are operated’	Carbon dioxide
‘Upstream greenhouse gas removal’ applies by virtue of the above Schedule 2 activity at an upstream site on or after the relevant date in any stationary technical unit on a site that results in emissions.	Carbon dioxide

Table 1 - Schedule 2 activities which are applicable.

Operators must consider their own installations and processes to determine if they are undertaking CO2 removal from oil and gas which is then vented and therefore qualifies.

Scope

The operator shall monitor and report all CO2 emissions from upstream GHG removal (as defined in paragraph 3(6A) of Schedule 2 to the 2020 Order) that are released in a combustion process or as vented emissions without a combustion process.

Where emissions are released in a combustion process, the scope is as set out in section 1 of Annex IV of the MRR. Where emissions are released as vented emissions without a combustion process, the operator shall include at least vents (which include venting at unlit flares) as a permitted activity

Sources

All vented emissions of CO2 that is removed from oil and gas (upstream GHG removal) must be measured, verified, reported and allowances surrendered which is the same as per existing emissions for other regulated activities. These include: -

- Vents
- Unlit flaring (cold flaring)
- Any other sources of emissions, aside those arising from combustion.

It should be noted that unlit flares which are specifically referred to in the Order are to be accounted for as a vent, the only difference being that this vent is from a flare tip (the emission point). This emissions source may also be referred to as cold flaring.

Threshold

There is no threshold for the quantity of vented carbon dioxide emissions from the new regulated activity. All venting of CO2, from upstream GHG removal, irrespective of quantity must be reported.

Monitoring methodologies that can be applied

- Calculation
- Fall back
- Measurement

Calculation methodology

> Where emissions are released as vented emissions without a combustion process, an operator may choose to apply a calculation-based methodology, as stipulated in Articles 24-37 of the MRR (and as amended via the UK ETS Order), whereby:(a) vented emissions released at a vent (including unlit flare) are to be treated as a “source stream” for the purposes of MRR and monitored accordingly;
>
> (b) venting is to be treated as the process that causes vented emissions;
>
> (c) emissions are to be determined by multiplying the activity data related to vented emissions, expressed as tonnes or normal cubic metres, by the corresponding emission factor, expressed as t CO2/t or t CO2/Nm3.

i.e. Vented CO2 emissions = activity data (AD, in t or Nm3) x emissions factor (EF, in t CO2/t or t CO2/Nm3).

Note: only activity data and the emission factor are required. All other parameters (e.g. net calorific value, oxidation factor etc) are not relevant.

Activity data:

> Means the amount of fuels or materials consumed or produced by a process relevant for the calculation-based monitoring methodology, mass in tonnes or volume in normal cubic metres, as appropriate;

Activity data shall be determined via metering at the process that causes the emissions according to the respective tier (Figure 1) i.e. Metering the flow of the source stream that gives rise to emissions of CO2.

Activity/source stream type	*Parameter to which the uncertainty is applied*	*Tier 1*	*Tier 2*	*Tier3*
"Vented emissions from upstream GHG removal (as defined in paragraph 3(6A) of Schedule 2 to the 2020 Order)	Amount of vented emissions [t] or [Nm^3]	± 17.5%	± 12.5 %	± 7.5%";

Figure 1. Applicable Tiers for the activity/source stream (Annex II).

Emission factor:

Is the average emission rate of a greenhouse gas relative to the activity data of a source stream, i.e., the amount of CO2 within the source stream.

Operators shall monitor vented CO2 emissions from upstream GHG removal using tiers for emission factors.

The applicable tiers are:

Tier 1:

- The operator shall derive emission factors for vented emissions based on a proxy agreed with the regulator, in combination with an empirical correlation as determined at least once per year in accordance with Articles 32 to 35 (MRR) i.e. validating the proxy being proposed to be used where information from the sources that result in the emissions cannot be analysed directly from the source stream, and alternative means upstream of that source may be used to support a proxy.
- The operator shall ensure that the correlation satisfies the requirements of good engineering practice and that it is applied only to values of the proxy which fall into the range for which it was established.

Tier 2 – The operator shall apply one of the following:

(a) determination of the emission factor in accordance with the relevant provisions of Articles 32 to 35 (MRR);

(b) the empirical correlation as specified for Tier 1, subject to demonstration to the regulator that the uncertainty of the empirical correlation does not exceed 1/3 of the uncertainty value to which the operator has to adhere with regard to the activity data determination of the vented emissions.

Analysis - Tier 2 (a)

Where the emission factor is determined based on analysis i.e. sampling of the source stream or via gas chromatograph. The operator must ensure the sampling plan reflects the planned approach and the frequency of analysis is at least weekly (Figure 2).

Fuel/material	*Minimum frequency of analyses*
"Vented emissions from upstream GHG removal (as defined in paragraph 3(6A) of Schedule 2 to the 2020 Order)	At least weekly""".

Figure 2. Frequency of analysis.

Frequency of analysis - The regulator may allow the operator to use a frequency that differs from weekly, where minimum frequencies are not available or where the operator demonstrates one of the following:

- based on historical data, including analytical values for the vented emissions in the reporting period immediately preceding the current reporting period, any variation in the analytical values for the respective vented emissions does not exceed 1/3 of the uncertainty value to which the operator has to adhere with regard to the activity data determination of the vented emissions (i.e. using the sampling frequency tool); or
- using the required frequency would incur unreasonable costs i.e. a Cost Benefit Analysis (CBA).

Where an installation operates for part of the year or batch processing is carried out over more than one year and vented emissions are not continuously released.

Minimum tiers

For Vented CO2 emissions, the minimum tiers (Figure 3) to be applied for calculation-based methodologies for the activity/source stream (Annex V of the MRR) are:

Activity/Source stream type	*Activity data* *Amount of fuel or material*	*Net calorific value*	Emission factor	Composition data (carbon content)	Oxidation factor	*Conversion factor*
"Upstream GHG removal						
Vented emissions from upstream GHG removal (as defined in paragraph 3(6A) of Schedule 2 to the 2020 Order)	1	n.a.	1	n.a.	n.a.	n.a.";

Figure 3. Minimum tiers for calculation-based emission factor methodology.

Fallback methodology

A methodology that is not based on tiers for selected source streams or emissions sources requires application for derogation from Article 21(1) of the MRR provided all of the following conditions are met:

- Applying at least tier 1 under the calculation-based methodology for one or more major source streams or minor source streams and a measurement-based methodology for at least one emission source related to the same source streams is technically not feasible or would incur unreasonable cost (CBA).
- Operator assesses and quantifies each year the uncertainties of all parameters used for the determination of the annual emissions in accordance with the ISO guide to the expression of uncertainty in measurement (JCGM 100:2008) or another equivalent internationally accepted standard, and includes the results in the annual emissions report;
- Demonstrates to the satisfaction of the regulator that by applying such a methodology, the overall uncertainty thresholds for the annual level of greenhouse gas emissions for the whole installation do not exceed 7.5 % for category A installations, 5.0 % for category B installations and 2.5 % for category C installations.

Measurement based methodology

Where CO2 emissions are vented from upstream GHG removal, without a combustion process, the normal rules are to be followed as stipulated in Articles 40-46 and Annex VIII of the MRR (as amended via the UK ETS Order). The tiers for activity data (Figure 4) and concentration of CO2 may be continuously measured in the vented gas.

	Tier 1	Tier 2	Tier 3	Tier 4
"CO_2 emission sources	± 17.5%	± 12.5%	± 7.5 %	N.A.".

Figure 4. Activity data Tiers for measurement-based methodology

Permit Changes

Operators must:

- Review the installations current hydrocarbon processes and determine if there are any vented CO2 emissions from upstream GHG removal to account for the new regulated activity.

If this is applicable:

- Update the Monitoring Plan on the Manage your UK Emissions Trading Scheme (METS) system, see screen shots below.
- Consider the vented CO2 emissions from upstream GHG removal and what methodology or methodologies (if more than one vent and chemical or physical extraction process) are applicable to this source stream.
- Consider how it will be measured, with evidence of the uncertainty to achieve the tier provided, or justification provided for not metering (technically infeasible / cost benefit analysis).
- Determine the source stream size (major, minor, de-minimis, marginal) and thus category as a proportion of the total installation emissions.
- Determine if this changes the installations category.
- Prepare / update sampling plans to determine the composition (emissions factor) and justify / demonstrate frequency of analysis / provide a CBA if differing from weekly.
- Update management procedures etc to include the new regulated activity.
- Provide anything else in the monitoring plan that maybe of relevance to account for the new activity.
- Update the MMP.

Adding vented emissions from GHG removal to a GHG permit on METS

A permit variation workflow needs to be raised in the relevant installation’s account. This is a significant modification to the monitoring plan and the relevant modifications must be selected in the ‘About the Variation section’ (Figure 5). The changes to the MMP should also be listed.

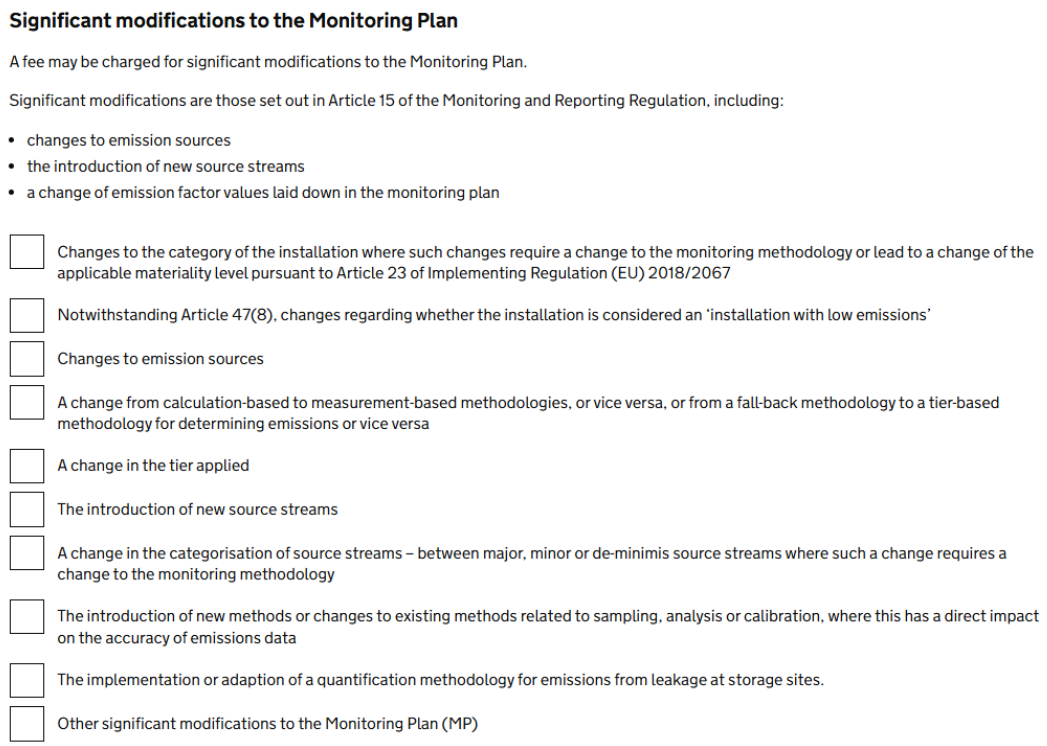

Figure 5 – Significant modifications to the Monitoring Plan.

Installation details

Description of the installation

The 'Activities at the installation' section - must be updated to include the removal method of constituent GHG from petroleum by chemical or physical means resulting in venting of CO2. There is no capacity information required.

Regulated activities carried out at the installation

The relevant regulated activity is Combustion, so there is no need to amend this. In the Installation details select 'Upstream GHG Removal (Carbon dioxide)' (Figure 6).

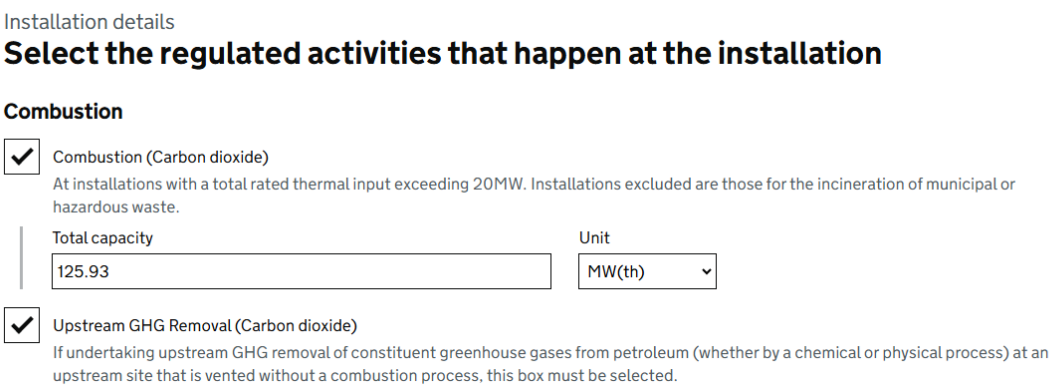

Figure 6 – Regulated activities

Estimated annual CO2e

The estimated emissions arising from upstream GHG removal CO2 venting must be added to the existing installations estimated annual emissions. Noting that this may lead to a change in the installations category as well.

Fuels and equipment inventory permit

Source streams (fuels and materials).

Add a separate source stream by clicking the ‘Add another source stream’ button. From the drop-down menu’s choose ‘Vented Gas’ as the description and ‘Upstream GHG removal: Venting CO2’ as the Type (Figure 7).

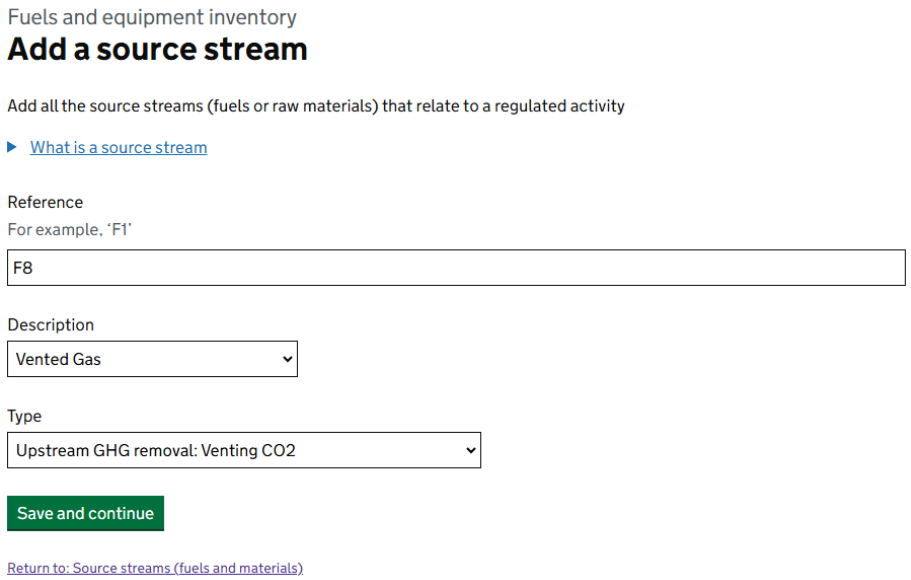

Figure 7 - Including CO2 venting in METS.

Emissions sources and Emissions points

Add the emission source of where the CO2 is removed and the emission point at the installation where the CO2 is vented.

Emissions summaries and regulated activities

See Figure 8 below for an example table.

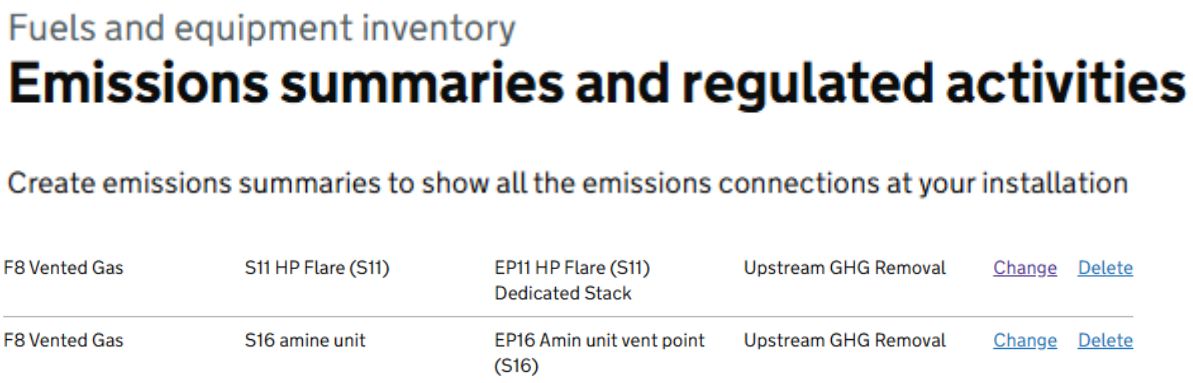

Figure 8 - Emissions summaries and regulated activities

Note - for unlit flaring, the existing flare emission sources and points can be used. The process flow for each flare should be reviewed to determine whether any CO2 venting can occur at each flare source/emission points.

Measurement devices or methods

Depending on how the amount to be vented is calculated, the measurement devices or method along with the associated uncertainty must be added to the measurement devices table.

Site diagram

This must be updated to show the new CO2 venting regulated activity. This must include the source streams, emission sources and points and the metering equipment.

Monitoring approaches

The monitoring approach used must be added to the ‘Define monitoring approaches’ section. i.e. Calculation of CO2, Measurement of CO2 or Fallback approach.

The new source stream(s) must be added to this section, with the relevant sections populated as normal, including the estimated emissions and category of the source stream. The approach description should be updated and the sampling plan updated to include how the stream is sampled, if applicable, as well as uploading any uncertainty documents.

Approach description.

This section must be updated to include details of the new source stream(s) and how the CO2 vented emissions are calculated. For unlit flaring (cold flaring) this must include a description of when the flare(s) have ceased combustion and becomes a cold flare and when it is re-ignited, along with how this is recorded and where, to support the annual verification and compliance. This detail should already be known to inform the vent consent through the North Sea Transition Authority (NSTA).

Note: For offshore installations, the oxidation factor for flares is assumed to be 98% (i.e. a factor of 0.98) of the gas that is combusted to account for incomplete combustion. However, for any CO2 that is removed, because of the new regulated activity, and routed to the flare it must be assumed that the 2% is vented when the flare is lit.

Management procedures

All sections / supporting documents must be reviewed and updated to include any CO2 venting where applicable.

Monitoring Methodology Plan (MMP)

CO2 venting is not eligible for a free allocation. However, the MMP must be updated with regard to emissions from this new source. A brief description of the CO2 venting should be included and shown how this is not a qualifying activity for free allocations. The flow diagram must also be updated to include this. When reporting activity levels, the total CO2 emissions must still be reported, which will include the CO2 vent.

The rest of the sections within the permit should be filled in as normal including review of any supporting documents.

Verification Regulations

Schedule 5 of the Verification regulation 2018 is amended to account for the new scope of accreditation for verifiers (Figure 9).

Activity Group No	*Scopes of accreditation*
"13	Upstream GHG removal (as defined in paragraph 3(6A) of Schedule 2 to the 2020 Order)"".

Figure 9 – Scope of accreditation for Verifiers.

There is no change to other provisions as the approach to Monitoring Reporting and Verification (MRV) is the same as per existing pollutants and methodologies.

General points to note

Where an installation has ceased petroleum production and is undergoing decommissioning, but is yet to submit a surrender application, the permit changes may still be required should any of the new regulated activity be undertaken in that period.

Historic emissions related to the new activity do not need to be accounted for in the next baseline data collection in 2025.

Activity level change reports submitted by the end of March 2025 do not need to account for the new activity.

Activity level change reports submitted by the end of March 2026 will need to account for the new activity.

Timings

17th December 2024	The new regulated activity is accessible.
31st January 2025	Operators must submit a permit variation to account for the new regulated activity, if applicable.
31st March 2025	Regulators will review the variations, and all relevant permits will be approved with the new regulated activity. Applications should be submitted in good time and contain all the relevant information needed to carry out the determination. The permit changes are requested to be focussed on this new change where these are submitted by the above timing. Where other changes are also being made, these must still follow the corresponding legislation timings, i.e. year end for minor changes and as soon as possible for significant modifications, and an update made to account for the new regulated activity.

This publication is available from: https://www.gov.uk/guidance/oil-and-gas-offshore-environmental-legislation#greenhouse-gases-emissions-trading-scheme-ets

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