



Verified Carbon Standard

TOOL FOR ACCOUNTING NON-VCS CO₂ IN CCS PROJECTS



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1 SOURCES

This module is used in combination with the latest version of the following methodologies, modules and tools:

- *VM00XX Methodology for Carbon Capture and Storage*

Capture Modules

- *VMD00XX Module for CO₂ Capture from Air (Direct Air Capture)*
- *VMD00XX Module for CO₂ Capture from Bioenergy Combustion*
- *VMD00XX Module for CO₂ Capture from Bioproduction Processes*
- *VMD00XX Module for CO₂ Capture from Post combustion Flue Gases in Fossil Fuel Power and Heat Generation*
- *VMD00XX Module for CO₂ Capture from Industrial Processes*
- *VMD00XX Module for CO₂ Capture from Oil and Gas Production and Processing*
- *VMD00XX Module for CO₂ Capture from Precombustion Processes in Fossil Fuel Power and Heat Generation*
- *VMD00XX Module for CO₂ Capture from Oxyfuel Combustion in Fossil Fuel Power and Heat Generation*

Transport Module

- *VMD00XX Module for CO₂ Transport*

Storage Module

- *VMD00XX Module for CO₂ Storage in Saline Aquifers and Depleted Hydrocarbon Reservoirs*

Other Modules/Tools

- *VT00XX Tool for Differentiating Reductions and Removals in CCS Projects*
- *Geologic Carbon Storage (GCS) Non-Permanence Risk Tool*

VCS Program Requirements/Tool(s)

- *GCS Requirements*

2 SUMMARY DESCRIPTION OF THE TOOL

This tool establishes criteria and procedures for quantifying the allocation of project emissions ($PE_{non-VCS CO_2,y}$) and leakage emissions ($LE_{non-VCS CO_2,y}$) for projects where CO₂ that is not eligible for crediting in the VCS (non-VCS CO₂) flows through the project boundary. This tool is intended for use in conjunction with *VM00XX Methodology for Carbon Capture and Storage* and associated modules.

3 DEFINITIONS

In addition to the definitions set out in the *VCS Program Definitions*, the following definitions apply to this methodology:

Non-VCS CO₂

CO₂ that flows through a CCS project boundary that is not eligible for crediting in the VCS

Segment

A defined section within a project activity system where VCS and non-VCS CO₂ streams are jointly processed, transported, or stored that is equipped with metering devices that monitor the VCS and non-VCS CO₂ streams.

4 APPLICABILITY CONDITIONS

This tool is applicable to project activities that comply with *VM00XX Methodology for Carbon Capture and Storage*.

This tool is applicable under the following conditions:

- 1) Non-VCS CO₂ streams must enter or leave the project boundary.

5 PROCEDURES

5.1 Determining Quantity of Non-VCS CO₂ Injected

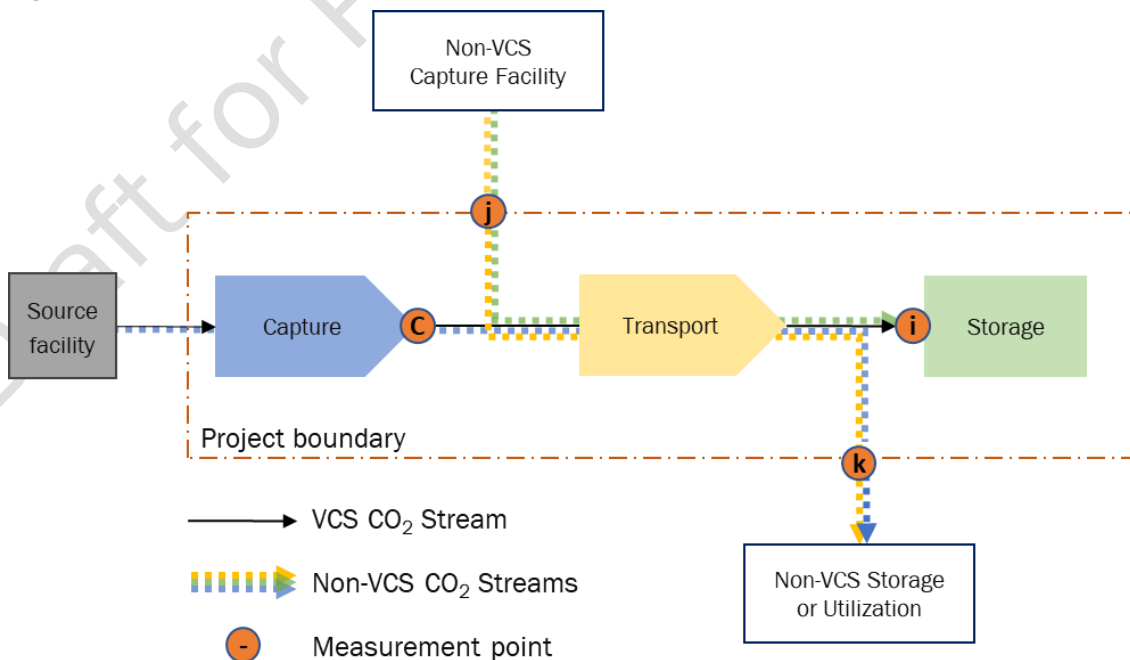
Three types of non-VCS CO₂ must be accounted for to determine the quantity of non-VCS CO₂ injected, as described below.

Non-VCS CO₂ Streams Received: Non-VCS CO₂ is received from capture facilities outside the project boundary and stored inside the project boundary. This is shown in Figure 1 with a green dashed line. The VCS CO₂ stream is shown as a black solid line. This type of non-VCS CO₂ flows through measurement point *j* and measurement point *i*. At each measurement point *i*, it is measured together as a part of total injected CO₂.

Non-VCS CO₂ Streams Transported: Non-VCS CO₂ is transported through the project boundary. It is captured outside the project boundary and delivered outside the project boundary. This is shown in Figure 1 where a non-VCS CO₂ stream (yellow dashed line) flows into and out of the project boundary. This type of non-VCS CO₂ flows through measurement point *j* and measurement point *k*. When applicable, both received and transported non-VCS CO₂ streams are measured together at each measurement point *j*.

Non-VCS CO₂ Streams Delivered: Non-VCS CO₂ is delivered for storage or utilization outside the project boundary and is captured in the project boundary. This is shown in Figure 1 where non-VCS CO₂ streams are shown with a blue dashed line. This type of non-VCS CO₂ stream flows through measurement points *c* and *k*. Non-VCS CO₂ delivered and VCS CO₂ are measured together at each measurement point *c*.

Figure 1: Non-VCS CO₂ Streams



Non-VCS CO₂ delivered outside the project boundary must be determined using Equation (1).

$$Q_{CO_2,nonVCS,c,y} = (Q_{Total\ CO_2,c,y}) \times (R_{nonVCS\ CO_2,c,y}) \quad (1)$$

Where:

$Q_{CO_2,nonVCS,c,y}$	=	Non-VCS CO ₂ captured in the project boundary at measurement points c in year y (t CO ₂)
$Q_{Total\ CO_2,c,y}$	=	Total carbon dioxide measured at each measurement point c in year y (t CO ₂)
$R_{nonVCS\ CO_2,c,y}$	=	Ratio of non-VCS CO ₂ to total carbon dioxide at each measurement point c in year y (-)

The ratio of non-VCS CO₂ captured in the project boundary to the total captured CO₂ at each measurement point c must be defined by the proponent ex-ante. It may be defined as a fixed value, as a project specific variable that is determined based on a fixed cap, algorithmically, or as a variable dependent on other quantities.

The quantity of non-VCS CO₂ injected in the project boundary in year y is quantified using Equation (2).

$$Q_{CO_2,nonVCS,injected,y} = \sum_j Q_{Total\ CO_2,j,y} + \sum_c Q_{CO_2,nonVCS,c,y} - \sum_k Q_{Total\ CO_2,k,y} \quad (2)$$

Where:

$Q_{CO_2,nonVCS,injected,y}$	=	Non-VCS CO ₂ injected in the project boundary in year y (t CO ₂)
$Q_{Total\ CO_2,j,y}$	=	Total carbon dioxide measured at each measurement point j in year y (t CO ₂)
$Q_{CO_2,nonVCS,c,y}$	=	Non-VCS CO ₂ captured in the project boundary at measurement points c in year y (t CO ₂)
$Q_{Total\ CO_2,k,y}$	=	Total carbon dioxide measured at each measurement point k in year y (t CO ₂)

5.2 Determining Non-VCS CO₂ Project and Leakage Emissions

Proponents must apply the following three steps to allocate project and leakage emissions between VCS and non-VCS CO₂ streams.

- **Step 1:** Identify segments.
- **Step 2:** Identify Emissions and CO₂ Flows in Segments.

- **Step 3:** Select an option to allocate project emissions.
- **Step 4:** Calculate total project and leakage emissions from VCS and non-VCS CO₂ streams.

5.2.1 Step 1: Identify Segments

Proponents must identify segments of the project in the project description. Segments allow allocation of project and leakage emissions between VCS and non-VCS CO₂ streams. The proponent should aim to maximize the accuracy and simplicity of both measurement and quantification activities when defining segments.

When identifying segments, the following requirements apply:

- 1) All activities within the project boundary must be included in one and only one segment;
- 2) Segments must not straddle module boundaries; and
- 3) Descriptions of each segment and its boundaries must be included in the project description.

5.2.2 Step 2: Identify Emissions and CO₂ Flows in Segments

For each segment *x*, the proponent must identify:

- 1) CO₂ flows entering and exiting the segment, and whether they are VCS, non-VCS or commingled flows, defining $Q_{\text{nonVCS CO}_2,x,y}$ and $Q_{\text{Total CO}_2,x,y}$
- 2) Project and leakage emission sources (as described in each of the applicable module boundaries for the project) arising from project activities in the segment, defining $PE_{\text{Total},x,y}$ and $LE_{\text{Total},x,y}$ or $PE_{\text{VCS CO}_2,x,y,D}$, $LE_{\text{VCS CO}_2,x,y,D}$, $PE_{\text{nonVCS CO}_2,x,D}$, and $LE_{\text{nonVCS CO}_2,x,y,D}$ (presented below in section 5.2.3),

5.2.3 Step 3: Select an Option to Allocate Project Emissions

Proponents must choose one or a combination of the following options to allocate corresponding project emissions and leakage for each segment.

5.2.3.1 Option 1: Assign All Project and Leakage Emissions to VCS CO₂ stream

This option is applicable to all projects. Equations (3) and (4) assign all project and leakage emissions from a given segment to the VCS CO₂ stream. This is the most conservative option.

$$PE_{\text{VCS CO}_2,x,y} = PE_{\text{Total},x,y} \tag{3}$$

$$LE_{\text{VCS CO}_2,x,y} = LE_{\text{Total},x,y} \tag{4}$$

Where:

- $PE_{VCS\ CO_2,x,y}$ = Project emissions from segment x in year y associated with VCS CO₂ streams (t CO₂)
- $PE_{Total,x,y}$ = Total project emissions generated from segment x in year y, calculated as per Equation (7) in the most recent version of *VM00XX Methodology for Carbon Capture and Storage* (t CO₂)
- $LE_{VCS\ CO_2,x,y}$ = Leakage emissions from segment x in year y associated with VCS CO₂ streams (t CO₂)
- $LE_{Total,x,y}$ = Total leakage emissions generated from segment x in year y, calculated as per Equation (8) in the most recent version of *VM00XX Methodology for Carbon Capture and Storage* (t CO₂)

As all project and leakage emissions are assigned to VCS CO₂ streams in this option, project and leakage emissions for non-VCS CO₂ streams are zero for the segment, as given in Equations (5) and (6).

$$PE_{nonVCS\ CO_2,x,y} = 0 \quad (5)$$

$$LE_{nonVCS\ CO_2,x,y} = 0 \quad (6)$$

Where:

$PE_{nonVCS\ CO_2,x,y}$ = Project emissions from segment x in year y associated with non-VCS CO₂ streams (t CO₂)

$LE_{nonVCS\ CO_2,x,y}$ = Leakage emissions from segment x in year y associated with non-VCS CO₂ streams (t CO₂)

5.2.3.2 Option 2: Differentiation Method

This option is applicable when CO₂ streams can be categorized entirely as VCS or non-VCS streams based on equipment or temporal differentiation. Equipment differentiation means that equipment involved in the processing of captured CO₂ has individual metering and the resulting emissions can be directly attributed to each CO₂ stream. Temporal differentiation means captured CO₂ streams flow at different times and equipment meters have a time resolution sufficient to resolve and attribute the emissions from each period accordingly.

Equations (7), (8), (9) and (10) assign the differentiated portion of project and leakage emissions to either VCS or non-VCS CO₂ streams.

$$PE_{VCS\ CO_2,x,y} = \sum_D PE_{VCS\ CO_2,x,y,D} \quad (7)$$

$$LE_{VCS\ CO_2,x,y} = \sum_D LE_{VCS\ CO_2,x,y,D} \quad (8)$$

$$PE_{nonVCS\ CO_2,x,y} = \sum_D PE_{nonVCS\ CO_2,x,y,D} \quad (9)$$

$$LE_{nonVCS\ CO_2,x,y} = \sum_D LE_{nonVCS\ CO_2,x,y,D} \quad (10)$$

Where:

$PE_{VCS\ CO_2,x,y}$	=	Project emissions from segment x in year y associated with VCS CO ₂ streams (t CO ₂)
$PE_{VCS\ CO_2,x,y,D}$	=	Project emissions from segment x in year y in differentiated equipment D or with temporal differentiation D, associated with VCS CO ₂ streams (t CO ₂)
$LE_{VCS\ CO_2,x,y}$	=	Leakage emissions from segment x in year y associated with VCS CO ₂ streams (t CO ₂)
$LE_{VCS\ CO_2,x,y,D}$	=	Leakage emissions from segment x in year y in differentiated equipment D or with temporal differentiation D, associated with VCS CO ₂ streams (t CO ₂)
$PE_{nonVCS\ CO_2,x,y}$	=	Project emissions from segment x in year y associated with non-VCS CO ₂ streams (t CO ₂)
$PE_{nonVCS\ CO_2,x,y,D}$	=	Project emissions from segment x in year y in differentiated equipment D or with temporal differentiation D, associated with non-VCS CO ₂ streams (t CO ₂)
$LE_{nonVCS\ CO_2,x,y}$	=	Leakage emissions from segment x in year y associated with non-VCS CO ₂ streams (t CO ₂)
$LE_{nonVCS\ CO_2,x,y,D}$	=	Leakage emissions from segment x in year y in differentiated equipment D or with temporal differentiation D, associated with non-VCS CO ₂ streams (t CO ₂)

5.2.3.3 Option 3: Mass Balance

This option is applicable under the following conditions:

- 1) Available measurements for CO₂ streams in a segment can resolve the quantity of VCS and non-VCS CO₂ streams; and
- 2) Measurement is available for both project and leakage emissions arising from activities or processes in a segment.

Equations (11) and (12) allocate project and leakage emissions, respectively, from a segment based on the fraction of the CO₂ stream that qualifies as VCS CO₂.

$$PE_{nonVCS\ CO_2,x,y} = PE_{total,x,y} \times R_{nonVCS\ CO_2,x,y} \quad (11)$$

$$LE_{nonVCS\ CO_2,x,y} = LE_{total,x,y} \times R_{nonVCS\ CO_2,x,y} \quad (12)$$

Where:

- $PE_{total,x,y}$ = Total project emissions generated from segment x in year y, calculated as per Equation (7) in the most recent version of *VM00XX Methodology for Carbon Capture and Storage* (t CO₂)
- $LE_{total,x,y}$ = Total leakage emissions generated from segment x in year y, calculated as per Equation (8) in the most recent version of *VM00XX Methodology for Carbon Capture and Storage* (t CO₂)
- $R_{nonVCS\ CO_2,x,y}$ = Ratio of VCS CO₂ to total CO₂ processed, transported or stored in the segment

Equation (13) calculates the ratio of non-VCS CO₂ to the total CO₂ that is processed, transported or stored in the segment.

$$R_{nonVCS\ CO_2,x,y} = \left(\frac{Q_{nonVCS\ CO_2,x,y}}{Q_{total\ CO_2,x,y}} \right) \quad (13)$$

Where:

- $R_{nonVCS\ CO_2,x,y}$ = Ratio of non-VCS CO₂ to total CO₂ captured, transported or stored in segment x in year y
- $Q_{nonVCS\ CO_2,x,y}$ = Non-VCS CO₂ processed, transported or stored in segment x in year y (t CO₂)
- $Q_{total\ CO_2,x,y}$ = Total CO₂ processed, transported or stored in segment x in year y, as per Section 8.1 of *VM00XX Methodology for Carbon Capture and Storage* (t CO₂)

5.2.4 Step 4: Calculate Total Project and Leakage Emissions from VCS and Non-VCS CO₂ Streams

Equation (14) calculates the total project emissions associated with VCS and non-VCS CO₂ flows as the sum the of emissions from all segments in a module boundary.

$$PE_{nonVCS\ CO_2,y} = \sum_x PE_{nonVCS\ CO_2,x,y} \quad (14)$$

Where:

- $PE_{nonVCS\ CO_2,y}$ = Total project emissions in a module boundary in year y associated with non-VCS CO₂ flows (t CO₂)

The total amount of leakage emissions associated with non-VCS and VCS CO₂ flows are calculated as the sum of emissions from all segments in a module boundary as per Equation (15).

$$LE_{nonVCS\ CO_2,y} = \sum_x LE_{nonVCS\ CO_2,x,y} \quad (15)$$

Where:

$LE_{nonVCS\ CO_2,y}$ = Total leakage emissions in a module boundary in year y associated with non-VCS CO₂ flows (t CO₂)

$Q_{CO_2,nonVCS,injected,y}$ as calculated in Equation (2), $PE_{nonVCS\ CO_2,y}$ and $LE_{nonVCS\ CO_2,y}$ as calculated in Equations (14) and (15) are used as described in *VM00XX Methodology for Carbon Capture and Storage* and in the capture, transport and storage modules relevant to the project.

6 DATA AND PARAMETERS

6.1 Data and Parameters Available at Validation

Data / Parameter	$R_{nonVCS\ CO_2, c,y}$
Data unit	Dimensionless
Description	Ratio of non-VCS CO ₂ to total captured CO ₂
Equations	Equation (1)
Source of data	Proponent defined based on project design, agreements, or other contracts
Value applied	0 for projects that only have non-VCS CO ₂ streams that are received or transported. For projects with non-VCS CO ₂ streams that are delivered, the proponent must specify value in PD.
Justification of choice of data or description of measurement methods and procedures applied	This value defines the ratio of non-VCS CO ₂ that is captured for projects where some CO ₂ is non-VCS
Purpose of Data	Calculation of baseline emissions
Comments	Definition of this parameter must also include how metering imbalance, system vents and fugitive emissions are accounted and must be done in consideration of system design and the nature of each non-VCS CO ₂ stream (i.e., received, transported or delivered)

6.2 Data and Parameters Monitored

Data/Parameter	$Q_{Total\ CO_2,k,y}$; $Q_{Total\ CO_2,c,y}$; and $Q_{Total\ CO_2,j,y}$
Data unit	t CO ₂
Description	Total carbon dioxide measured at each measurement point <i>k</i> , <i>c</i> or <i>j</i> in year <i>y</i>
Equations	Equation (1) and (2)
Source of data	Measured using either volumetric flow meters or mass flow meters
Description of measurement methods and procedures to be applied	Direct measurement of CO ₂ stream as per Section 8 of <i>VM00XX Methodology for Carbon Capture and Storage</i> Measurements must be taken at the corresponding measurement point <i>k</i> , <i>c</i> or <i>j</i> where CO ₂ enters or leaves the project boundary.
Frequency of monitoring/recording	Monitored continuously (i.e., one measurement at least every 15 minutes)
QA/QC procedures to be applied	Directly monitored parameters in Section 8 of <i>VM00XX Methodology for Carbon Capture and Storage</i> must use corresponding QA/QC requirements in Section 9 of the same methodology.
Purpose of data	Allocation of baseline and project emissions to VCS CO ₂ and non-VCS CO ₂
Calculation method	As described in Section 8 of <i>VM00XX Methodology for Carbon Capture and Storage</i>
Comments	

7 REFERENCES

This tool does not include any references.