



**Verified Carbon
Standard**

CARBON CAPTURE AND STORAGE
MODULE VMD0059 CO₂ CAPTURE FROM
BIOENERGY ASSESSMENT REPORT



Document Prepared by Aster Global Environmental Solutions Inc.

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Summary

Aster Global Environmental Solutions, Inc., (Aster Global) was commissioned by the Perspectives Climate Group to perform the methodology assessment of the new methodology *VM0049 Carbon Capture and Storage (CCS)* and associated modules and tools in accordance with the VCS Methodology Development and Review Process, VCS Program Guide, VCS Standard, VCS Methodology Requirements, and VCS Program Definitions. A specific carbon offset project will be able to use the methodology combined with applicable capture, transport, and storage modules for a project using this modular approach. This report documents the assessment of *VMD0059 CO₂ Capture from Bioenergy*, which is the fourth module to be incorporated with VM0049 Carbon Capture and Storage.

The purpose and scope of this methodology module assessment was to evaluate whether the methodology module document was prepared in conformance with the VCS program requirements. Aster Global's module assessment included a detailed review of adherence to the VCS requirements and adherence to the principles of the VCS rules and requirements (relevance, completeness, consistency, accuracy, transparency, and conservativeness). Aster Global's assessment also included a detailed analysis of the methodology module, supporting calculations, Verra technical reviews, and responses to all non-conformance reports (NCRs), clarifications (CLs), and opportunities for improvement (OFIs) based on the VCS rules and requirements.

The methodology storage module was listed for public stakeholder consultation from 1 March to 15 April 2024. The module assessment team identified 26 (NCRs, CLs and OFIs), related to responses to public comments and 26 Findings related to the module's adherence to the VCS program requirements. All were addressed satisfactorily in line with the VCS program requirements. These

NCRs, CLs, and OFIs provided necessary clarity to ensure the methodology complied with the VCS rules and requirements.

As detailed in v4.4 of The Methodology Development and Review Process document a methodology assessment must, at a minimum, cover the following fifteen categories: Relationship to approved or pending methodologies, Stakeholder consultation, Structure and clarity of methodology, Definitions, Applicability conditions, Project boundary, Baseline scenario, Additionality, Baseline emissions, Project emissions, Leakage emissions, Estimated GHG emission reductions and removals, Monitoring, data and parameters, Uncertainty, and Verifiability. The initial scope of this module assessment covered all of these categories (as applicable); however, during the assessment process Verra limited the assessment scope by removing the following categories: Uncertainty, Definitions, Structure and clarity of methodology.

Aster Global confirms all module assessment activities, including objectives, scope and criteria, level of assurance and the module's adherence to the VCS Program, as documented in this report, are complete. Aster Global concludes without any qualifications or limiting conditions that *VMD0059 CO₂ Capture from Bioenergy* meets the requirements of the VCS Program. Aster Global recommends that Verra approve the methodology module.

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1 INTRODUCTION

1.1 Objective

This methodology module assessment, hereinafter referred to as “module assessment”, was performed to evaluate the likelihood that implementation of the module would result in accurate calculations and appropriate eligibility criteria for GHG emission reductions/removals (ISO 14064-3:2019). This assessment evaluates the fourth storage module in the framework that will include Verra’s methodology - Carbon Capture and Storage (VM0049), this module, 13 other modules and one other methodology. The VM0049 methodology provides the framework for carbon capture and storage projects. This report documents the assessment of *VMD0059 CO₂ Capture from Bioenergy*.

This report summarizes the Findings of the module assessment of the Verified Carbon Standard (VCS) methodology development and review process. The Perspectives Climate Group, referred to as the “methodology developer”, commissioned Aster Global Environmental Solutions, Inc. (Aster Global), referred to as the “assessment team,” to perform the module assessment of *VMD0059 CO₂ Capture from Bioenergy* hereafter referred to simply as the “BECCs Module”.

This report presents the Findings of a qualified methodology/module assessment team of auditors and experts in methodologies for GHG emissions, who have assessed the module under the applicable rules of the VCS Program. Section 2 below presents the module assessment approach, Section 3 below summarizes the module assessment process and conclusions, Appendix A lists the documents reviewed during the assessment, Appendix B provides details and resolutions of all individual Findings from the module assessment process.

1.2 Summary Description of the Methodology Module

The VM0049 methodology establishes framework, criteria, and procedures to quantify the greenhouse gas (GHG) emission reductions and carbon dioxide (CO₂) removals from Carbon Capture and Storage (CCS) projects.

This module provides procedures and requirements to calculate CO₂ emissions from project activities that capture CO₂ from bioenergy within the VCS Methodology *VM0049 Carbon Capture and Storage*.

The emissions calculated in this module, together with those calculated in the transport and storage modules, are used in VM0049 to calculate the net CO₂ reductions/removals from a CCS project.

This module provides the overall project requirements for project activities that capture CO₂ from bioenergy. It is a technology module to be used with other modules and the methodology. This module establishes criteria and procedures for quantifying emissions from project activities that capture CO₂ from bioenergy. A carbon offset project will be able to use this module combined with applicable storage and transport modules for a project using VM0049.

2 ASSESSMENT APPROACH

2.1 Method and Criteria

This module assessment is based on standard auditing techniques in line with Verra requirements to assess the correctness of the information provided. In accordance with the VCS rules, the assessment encompasses applicability conditions, module boundary, procedure for determining baseline scenario, baseline quantification, project emissions, leakage emissions, quantification of net GHG emission reduction and/or removals, monitoring, and data and parameters.

The Verra documents used to assess the methodology module were:

- Program Guide (v4.4, 29 August 2023)
- Program Definitions (v4.5, 16 April 2024)
- Methodology Requirements (v4.4, 4 October 2023)
- Methodology Development and Review Process (v4.4, 16 April 2024)
- Methodology Template (v4.3, 29 August 2023)
- Module Template (v4.1 20 January 2022)
- Methodology Assessment Report Template (v4.2, 29 August 2023)
- Standard (v4.5, 4 October 2023, v4.6, 21 March 2024, v4.7, 16 April 2024)

2.2 Document Review

Documents provided and reviewed are listed in Appendix A.

2.3 Interviews

Interviews were conducted online using Microsoft Teams for the opening meeting, methodology walkthroughs, meetings to discuss reviews and Findings, and the closing

meeting, in addition to email exchanges, and phone calls.,. Details and attendees of each meeting are included below:

Opening Meeting		13 December 2024
Methodology Assessment Team	Methodology Development Team	
Barbara Toole O'Neil	Paulien Veen	
Drake Fisher	Jordan Kummerfield	
	Ian Kuwahara	
Meetings – Reviews and Issues		19 December 2024
		23 January 2025
		3,7,14 February 2025
		10,11 March 2025
Methodology Assessment Team	Verra Methodology Development Team	
Barbara Toole O'Neil	Jordan Kummerfield	
Drake Fisher		
Meetings – Reviews and Issues		17 March 2025
Methodology Assessment Team	Verra Methodology Development Team	
Barbara Toole O'Neil	Ian Kuwahara	
Drake Fisher		

2.4 Assessment Team

The names, roles, and summary of qualifications/expertise/experience relevant to the methodology assessment team follow:

Name	Role	Summary of qualifications, expertise, relevant methodology experience
Barbara Toole O'Neil, MS ChemE, QEP	Lead Assessor/Approved Standards Methods Expert	<p>Since 2010 Barbara Toole O'Neil has completed assessments of 14 new methodologies. Her work responsibilities have addressed a wide range of environmental issues, from preparing inventories or offset project documents to assessing methodologies submitted to the Verified Carbon Standard (VCS) (forestry to energy efficiency), validating/ verifying inventories and carbon offset projects, corporate social responsibility auditing, developing governance for sustainability non-profits, to writing a social standard to assess the impact of environmental projects (carbon, water, forestry, agriculture) on the quality of life for women in emerging third world countries.</p> <p>Ms. Toole O'Neil has the following accreditations: ICAO Certified CORSIA Verifier, Accredited Lead Verifier for California Air Resources Board under the mandatory reporting rule (H-21-133), Accredited Lead Verifier for California Air Resources Board under the Compliance Offset program, Ozone</p>

		<p>Depleting Substances (ODS) offset project specialist and livestock project specialist (H2- 19-198), Verra (VCS) Approved Standardized Methods Expert, ANAB Assessor for ISO-14064.</p> <p>Prior to her focus on climate services, Ms. Toole O'Neil was an experienced engineer and research manager focused on energy, air quality and environmental issues. She has worked as a process engineer, research manager, regulatory inspector, and consultant. The work includes pre and post combustion research for fossil-powered generation focusing on fuel, fuel quality and fuel upgrades while with EPRI. At EPA she was an accredited enforcement inspector in Air Division of EPA Region 9 focusing on power generation, and the cement industry. She is a published fuels and combustion expert and has over 120 publications including a book on combustion research to control emissions of criteria and air toxic pollutants. In addition to Aster Global work, she is currently a member of the Hearing Board of the Bay Area Air Quality Management District.</p>
<p>Drake Fisher, BS Mech Eng.</p>	<p>Assessment Team Member</p>	<p>Drake Fisher has worked on verifications and validations across multiple sectoral scopes for VCS, ACR, CAR, GHG Protocol, and the Canadian GHG Reporting Program (Sask & BC). He has consulted on the development of two VCS methodologies and is now part of the methodology assessment team for this VCS methodology. Prior to working at Aster Global, he worked for six years as a new product development engineer for Stanley Black & Decker, and Pentair Inc. This work included overseeing a small design team, conducting Finite Element Analysis for part stress/airflow optimization, and reviewing manufacturing processes to ensure that parts and assemblies met all design criteria. Relevant course work from The Johns Hopkins University Mechanical Engineering degree includes Fluid Mechanics, Heat Transfer, Design and Analysis of Dynamic Systems, Mechanics Based Design, and Electronics & Instrumentation.</p>
<p>Janice McMahon, MS Env Science</p>	<p>QA/QC / President</p>	<p>Janice McMahon has been conducting third-party validations and verification since 2007 and has been responsible for and oversees the accredited VVB activity under ANAB for her previous employer and Aster Global for the past 14 years.</p> <p>Ms. McMahon has been the Lead Verifier on over 85 organizational level GHG inventory verifications focusing on the energy sector in Canada (BC and TCR) and has provided technical review or QA/QC on 100+ AFOLU offset projects and methodology assessments for VCS, CCB, CAR, ACR, ARB and NFS.</p>

		<p>She holds multiple accreditations including ICAO Certified CORSIA Verifier, ISO 14064 Series Class Certifications, and Certified Wildlife Biologist. As President, Ms. McMahon is responsible for leading Aster Global teams on Validation/Verification and auditing projects all around the world.</p>
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2.5 Resolution of Findings

The process of the module assessment involved formal rounds of evaluation, called Findings, by the assessment team, followed by additional clarifications and resulted in a methodology version in conformance with VCS rules. Findings related to Non-conformance reports (NCRs) and clarifications (CLs) were resolved during communication between the assessment team and the methodology/module development team. More specifically, where noted by the assessment team, the methodology development team implemented corrective actions by amending methodology text and requirements and providing written clarification responses. Types of Findings were characterized in the following manner:

NCRs were issued as a response to material discrepancies in a part of the methodology and generally fell into one of the following categories:

- Non-conformance to a VCS guiding document listed in Section 2.1 above
- Lack of clarity in definitions, calculations, and boundary conditions
- Additional information was required to confirm reasonable assurance for compliance

CL were issued when language within the methodology needed extra clarification to avoid ambiguity/confusion for the reader.

Opportunities for Improvement (OFIs) were issued to the methodology developer when an opportunity for improvement was identified but was not required to be addressed to confirm to VCS rules.

During the course of the module assessment, 26 Findings (NCRs, CLs) related to the module's adherence to the VCS program requirements were identified. Of those, Aster Global ensured *reasonable* assurance was achieved to close all Findings. Throughout the module assessment, all NCRs/CLs were satisfactorily addressed to the standards and requirements of Aster Global and/or VCS. The NCRs/CLs provided necessary clarity to ensure the module complied with the requirements of VCS. Detailed summaries of each finding, including the issue raised, responses and final conclusions are provided in Appendix B.

3 ASSESSMENT FINDINGS

The module was found to be in conformance with the principles set out in the VCS Methodology Development and Review Process, the VCS Standard and other VCS rules and requirements. The module provides the quantification methods for a capture activity in a carbon capture project, while adhering to the principles of VCS (relevance, completeness, consistency, accuracy, transparency, and conservativeness). A specific carbon offset project will be able to use the methodology combined with this module and applicable transport and storage modules for a project using this modular approach. The module assessment addressed specific issues, which are pertinent to the above-mentioned principles set forth by the VCS Standard.

3.1 Relationship to Approved or Pending Methodologies

This is a methodology module and not a separate methodology. This section was completed in the assessment report for the assessment of VM0049 and is not repeated here.

3.2 Stakeholder Comments

The module was listed for public stakeholder consultation from 1 March 2024 to 15 April 2024. The public comments received were reviewed and addressed by Verra. They were not part of the scope of this assessment. □

3.3 Structure and Clarity of Methodology

Through the module development and review process, the assessment team ensured the module was written in a clear, logical, concise, and precise manner in accordance with the Methodology Development and Review Process using the current version of the Verra template.

The developer has followed the instructions in the methodology template and ensured that the module's various criteria and procedures are documented in the appropriate sections of the template. This was confirmed through a detailed review of the template requirements within the assessment team's Findings process. Several Findings were issued related to the module's structure and clarity that would enable projects to be developed in a consistent manner, and all Findings were resolved to ensure VCS requirements were achieved.

The terminology used in the methodology module is consistent with that used in the VCS Program, and GHG accounting generally. The assessment team issued Findings related to VCS definitions, and all Findings were resolved to ensure the terminology was consistent.

The key words must, shall, should, and may have been used appropriately and consistently to denote firm requirements, (non-mandatory) recommendations, and permissible or allowable options, respectively. This was confirmed through the assessments team's overall read, interpretation, and review process.

The criteria and procedures are written in a manner that can be understood and applied readily and consistently by project proponents. Applicable Findings were resolved to ensure this was achieved.

The criteria and procedures are written in a manner that allows projects to be audited. Several Findings were issued to ensure the module can be consistently and robustly applied with the VM0049 methodology and other proposed modules.

Overall, it is the Assessment Team's opinion that the structure of the module document meets the methodological requirements of the VCS Program.

3.4 Definitions

In addition to the definitions set out in the VCS Program Definitions v4.5 and VM0049, eleven additional terms were defined in the module. For ease of use, the key terms defined in the module were clearly and appropriately presented by the methodology developers in the definition's sections at the beginning of the documents. The assessment process ensured definitions of key terms are presented concisely and can assist the reader in comprehension for effective implementation of the methodology and modules. The definitions section only includes key terms used in the module, and not those key terms relevant to the methodology, nor does it include any terms defined in the Program Definitions v4.5.

3.5 Applicability Conditions

During the module assessment process, the assessment team ensured the applicability conditions were appropriate for the activities targeted by the module, the quantification procedures required by the methodology and module adequately target the relevant applicability conditions, and the applicability conditions appropriately specify relevant requirements to individual projects. The assessment team determined the applicability conditions contained within the module are appropriate, adequate and in compliance with the VCS Program.

Further, the assessment team determined the applicability conditions provide sufficient clarity to projects determining if their activities are or are not eligible under the

methodology and module. The applicability conditions address environmental integrity and practical considerations, where relevant.

In general, this module combined with the VM0049 methodology is applicable to project activities that capture CO₂ from bioenergy. Other modules ensure that the CO₂ is captured and transported safely to be stored permanently in geological storage complexes using the appropriate modules. An assessment of the specific applicability conditions is below:

Applicability Condition	Assessment
<p>1. Project activities include at least one of the following:</p> <ul style="list-style-type: none"> a. Installation and operation of a new capture facility at a new or existing bioenergy source facility b. Refurbishment of an existing capture facility, that would otherwise be decommissioned prior to the project start date, at an existing bioenergy source facility c. Expansion of existing capture capacity at an existing bioenergy source facility 	<p>This applicability provides clarity for the types of facilities that are applicable. The applicability condition is written in a clear and concise manner, ensuring a project adheres to the condition and that conformance can be demonstrated at the time of project validation.</p>
<p>2. Capture occurs using one or a combination of the following processes:</p> <ul style="list-style-type: none"> a. Chemical or physical absorption or adsorption, with liquid solvents or solid sorbents (e.g., amines) b. Membrane processes c. Electrochemical processes d. Cryogenic processes 	<p>This applicability provides clarity for the types of processes that are applicable. The applicability condition is written in a clear and concise manner, ensuring a project adheres to the condition and that conformance can be demonstrated at the time of project validation.</p>
<p>3. Project activities are designed to regenerate the primary capture fluid or media, such that it is not a one-time use, and a concentrated CO₂ stream is recovered from regeneration and available for subsequent transport (where applicable) and storage.</p>	<p>This applicability condition further clarifies the processes that are applicable. The applicability condition is written in a clear and concise manner, ensuring a project adheres to the condition and that conformance can be demonstrated at the time of project validation.</p>

The methodology is not applicable for the following project activities:

Project Activity	Assessment
1. Project activities that use oxy-fuel combustion capture for power generation	It is appropriate that this activity be considered not applicable for this methodology. Oxy-fuel combustion uses multiple fuels, not just biofuel.
2. Project activities that comprise upgrades to existing BECCS facilities or changes in operational practices leading to improved capture efficiency	It is appropriate that this activity be considered not applicable for this methodology. These upgrades or operational changes would not be additional.

3.6 Project Boundary

The VCS Standard requires that the methodology or module establish criteria and procedures for describing the project boundary and identifying the sources, sinks, and reservoirs relevant to the baseline and project scenarios. In addition to the requirements in Section 5 of the most recent version of VM0049, the module boundary includes at least the BECCS facility. It does not include the bioenergy facility generating the emissions captured by the project. Commonly used equipment or processes include:

- Equipment used to generate airflow for the capture process (e.g., fans);
- Capture of CO₂ in contactors, beds, or vessels by absorption, adsorption, or other processes;
- Regeneration processes to generate a CO₂ stream and recover capture fluid or media;
- Conditioning of CO₂ to allow further processing of CO₂ along the CCS segments (namely transport and storage); and
- Co-located utilities for the CO₂ capture process (e.g., air separation units, water treatment systems, steam systems).

Section 5 of the most recent version of VM0049 provides further details on determining the module boundary. The BECCS facility, ancillary sites, equipment, and relevant project emissions included in the module boundary and quantified using this module must be clearly identified and documented. The project proponent must ensure that equipment is not omitted or double counted.

The BECCS module provides clear diagrams (Figure 1 and 2) defining the BECCS facility. Table 1 provides a detailed description of the emissions sources for the BECCS module. The assessment team’s comments are included below:

For the project:

Project	Gas	Included?	Justification/Explanation	Assessment Comments
Electricity Consumption	CO ₂	Yes	Major source. Details are provided in the BECCS module.	It is appropriate to include this source and this gas to be conservative.
	CH ₄	Yes	Details are provided in the BECCS module.	It is appropriate to include this source and this gas to be conservative.
	N ₂ O	Yes	Details are provided in the BECCS module.	It is appropriate to include this source and this gas to be conservative.
	Other	No	Negligible	This is an appropriate assumption. The above gases are the main gases of interest.
Fuel Consumption	CO ₂	Yes	Major source. Details are provided in the BECCS module.	It is appropriate to include this source and this gas to be conservative.
	CH ₄	Yes	Details are provided in the BECCS module.	It is appropriate to include this source and this gas to be conservative.
	N ₂ O	Yes	Details are provided in the BECCS module.	It is appropriate to include this source and this gas to be conservative.
	Other	No	Negligible	This is an appropriate assumption. The above gases are the main gases of interest.
	CO ₂	No	Any loss of CO ₂ due to fugitive emissions or venting during capture is inherently deducted from the	This justification is inline with the VM0049 baseline equations.

Project	Gas	Included?	Justification/Explanation	Assessment Comments
Fugitive and Venting Emissions from CO ₂ Stream Processing			overall calculation of GHG emission reductions since only injected CO ₂ volumes are quantified as the baseline emissions..	
	CH ₄	No	Negligible.	It is an appropriate assumption. CO ₂ is the main gas of interest.
	N ₂ O	No	Negligible	It is an appropriate assumption. CO ₂ is the main gas of interest.
	Other	No	Negligible	It is an appropriate assumption. CO ₂ is the main gas of interest.
Fugitive and Venting Emissions from on-site Fuel Use	CO ₂	No	Negligible.	This is an appropriate assumption. CH ₄ is the main gas of interest.
	CH ₄	Yes	Details are provided in the BECCS module.	It is appropriate to include this source and this gas to be conservative
	N ₂ O	No	Negligible.	This is an appropriate assumption. CH ₄ is the main gas of interest.
	Other	No	Negligible	This is an appropriate assumption. CH ₄ is the main gas of interest.

3.7 Baseline Scenario

The VM0049 methodology uses a project method to determine the crediting baseline. The BECCS module follows the methodology requirements for the baseline scenarios. The baseline scenario identified in the module is used to inform the assessment of project additionality in Section 7 of VM0049. There are three options that the project proponent must evaluate:

- Baseline B1: No CO₂ is captured from the bioenergy source facility.

- Baseline B2: CO₂ is captured from the bioenergy source facility at historical levels with a capture facility that was operational before the project start, without any expansion of its capture capacity.
- Baseline B3: The proposed project activity without being registered under a GHG program

No additional assessment of the methodology baseline scenario was completed for this module assessment. The assessor reviewed this approach to the baseline requirements and confirmed the two proposed scenarios are appropriate for the relevant capture activity.

3.8 Additionality

Additionality is determined using VM0049 and appropriate Verra or CDM Tools. Additionality is not part of the methodology module assessment.

3.9 Quantification of GHG Emission Reductions and Carbon Dioxide Removals

3.9.1 Baseline Emissions

Baseline emissions are calculated using the procedures in VM0049. The procedures for calculating baseline emissions cover all GHG sources, sinks and reservoirs included in the project boundary.

Through detailed review during the assessment process, the assessment team confirmed with reasonable assurance that all procedures for estimating the baseline scenarios emissions are appropriate and without error.

3.9.2 Project Emissions

The equations for calculating project emissions are provided in Section 5.3. The project emissions include:

- Project emissions from fuel combustion to operate on-site and/or third-party (for off-site heat/steam supply) equipment for capture and conditioning processes;
- Fugitive emissions and venting from on-site fuel use (e.g., natural gas) inside the module boundary;
- Project emissions from electricity consumption to operate equipment in the BECCS facility calculated using VT0010;
- Project emissions from processes and equipment related to non-VCS sources determined using the most recent version of VT0012; equal to zero for projects with no non-VCS CO₂.

Projects using natural gas on-site must quantify fugitive and venting emissions during facility operations. Quantification is based on component counts and respective emission factors, fugitive emissions are quantified following the approach in the US Environmental Protection Agency's Electronic Code of Federal Regulations, Title 40, Part 98, Subpart W, § 98.233(r).

Examples of emission sources for fugitive emissions include components such as valves, pipe fittings/connectors, open-ended pipes, pressure relief valves, flanges, meters, and instruments.

Through detailed review during the assessment process, the assessment team confirmed with reasonable assurance that all procedures for estimating the project emissions are appropriate and without error.

3.9.3 Leakage Emissions

The equations for calculating leakage emissions are provided in Section 5.4 equation 5 and include:

- Leakage emissions from upstream sources related to the fuel consumed in the module boundary in year y determined using Equation (6);
- Leakage emissions from electricity consumption to operate equipment in the capture facility in year y calculated using VT0010;
- Leakage emissions from capture materials used in the capture process in year y determined using Equation (7);
- Leakage emissions from the supply of biomass feedstock for energy production in year y determined using Equation (8);
- Leakage emissions from processes and equipment related to non-VCS sources in year y determined using the most recent version of VT0012; equal to zero for projects with no non-VCS CO₂.

Through detailed review during the assessment process, the assessment team confirmed with reasonable assurance that all procedures for estimating the leakage emissions are appropriate and without error.

3.9.4 GHG Emission Reductions and Carbon Dioxide Removals

The standard equation for GHG emissions reductions or CO₂ removals is provided in VM0049, Section 8.4. The calculation methods supporting the GHG emissions reductions and carbon dioxide removals for the BECCS activities and processes are described in Section 5.3 and 5.4 of the BECCs module and assessed in the sections above. The

assessment team confirmed with reasonable assurance that all procedures are appropriate and without error.

3.9.5 Uncertainty

Uncertainty is assessed as part of the BECCs module. The assessment of uncertainty associated with the project quantification is necessary to provide a conservative approach to quantification.

The assessment of uncertainty was completed by Verra and is not part of this assessment.

3.10 Monitoring, Data and Parameters

The following are the data and parameters available at validation. Additional data and parameters are defined in VM0049 and related tools (VCS and CDM). Through review of all data/parameters at validation, the assessment team confirms with reasonable assurance that they are appropriate for the project activities covered by the methodology.

Data/Parameter	Assessment Team Findings
GWP_{CH_4}	This is the Global Warming Potential (GWP) used from the most recent VCS Standard
GWP_{N_2O}	This is the GWP used from the most recent VCS Standard
$msb_{,base,b}$	Mass of sustainable biomass type b used in the absence of the project
$mnt_{,base,b}$	Mass of non-traceable biomass type b used in the absence of the project

The following are data, parameters and procedures that will be monitored during the monitoring period.

Data/Parameter	Assessment Team Findings
$Q_{Fuel,d,y}$	Quantity of fuel type d used to operate on site and/or by a third-party (for off-site heat/steam supply). Data sourced from invoices or on-site meters.
$EF_{Fuel,CO_2,d}$	This is the CO_2 emission factor for combustion of fuel d in year y . The emission factor can be sourced from the IPCC, EPA, or other national reputable source.
$EF_{Fuel,CH_4,d}$	This is the CH_4 emission factor for combustion of fuel d . The emission factor can be sourced from the IPCC, EPA, or other national reputable source.
$EF_{Fuel,N_2O,d}$	This is the N_2O emission factor for combustion of fuel d . The emission factor can be sourced from the IPCC, EPA, or other national reputable source.

$Q_{Cogen,d,y}$	Total quantity of fuel type d used by the cogeneration unit to generate electricity and/or heat in year y . It is monitored through invoices or calibrated meters.
$Heat_{BECCS,y}$	Quantity of useful thermal energy supplied to the capture facility by the cogeneration unit in year y . It is monitored through utility receipts.
$Electricity_{BECCS,y}$	Quantity of electricity supplied to the capture facility by the cogeneration unit in year y . It is monitored through utility receipts.
$Heat_{Cogen,y}$	Total quantity of useful thermal energy produced by the cogeneration unit in year y . It is measured through direct measurements at the facility.
$Electricity_{Cogen,y}$	Total quantity of electricity produced by the cogeneration unit in year y . It is measured through direct measurements at the facility.
$Count_{n,y}$	Total number of components n at the facility during year y . It is counted every year.
T_y	Time for which component n is pressurized in year y . This is monitored through a data acquisition system.
V_m	Vented CH_4 emissions for venting event m . This is monitored through a data acquisition system.
EF_n	Emission factor of fugitive emissions for component n . Emission factor derived from Subpart W of the U.S. EPA Mandatory Greenhouse Gas Reporting Program (GHGRP) or equivalent nationally appropriate regulations.
$EF_{Upstream_Fuel,d}$	Emission factor for upstream sources related to fuel type d used in the module boundary. Calculated value.
$Q_{Mat,jy}$	Quantity of make-up capture material j consumed by the capture facility in year y . This is monitored through a data acquisition system.
EF_j	GHG emissions from the production of capture material j . This is a calculated value.
$m_{sb,project,b,y}$	Mass of sustainable biomass type b used after the project start date in year y . This is monitored through a data acquisition system.
$m_{nt,project,b,y}$	Mass of non-traceable biomass type b used after the project start date in year y . Monitored through data acquisition system.
EF_b	Embodied emissions factor for biomass type b . Calculated value
$Yield_{b,y}$	Yield data for individual feedstock provided by feedstock producer. This is a measured value.
$m_{b,y}$	Mass of biomass type b transported in year y . This is monitored through a receipts and weigh systems.
$D_{mode,y}$	Total distance traveled to transport biomass type b by different modes (ship, truck, or rail) in year y . This is a measured value.

Through review of all data/parameters to be monitored for this module and VM0049, the assessment team confirms with reasonable assurance the data/parameters are appropriate for the project activities covered by the methodology. The assessment team concludes the monitoring plan ensures that these elements of GHG emission reductions

and removals are monitored and reported appropriately and the data/parameters and procedures for monitoring are in line with VCS rules.

3.11 Verifiable

After completion of the full methodology module assessment, the assessment team confirms with reasonable assurance that the methodology module is sufficiently clear and specific to require project developers to transparently report project results in combination with the methodology and appropriate modules that can pass validation and verification audits with high confidence.

4 ASSESSMENT CONCLUSION

Aster Global Environmental Solutions, Inc., has completed the methodology module assessment of *VMD0059 CO₂ Capture from Bioenergy*. The assessment team confirms the methodology module adheres to the criteria established for this methodology module assessment, which are documented and complete. Aster Global concludes without any qualifications or limiting conditions that the methodology documentation meets the requirements of the *VCS Methodology Development and Review Process, VCS Program Guide, VCS Standard, VCS Methodology Requirements, and VCS Program Definitions*. Therefore, Aster Global recommends that Verra approve the methodology *VMD0059 CO₂ Capture from Bioenergy* as prepared by Perspective Climate Group and Verra.

5 EVIDENCE OF FULFILMENT OF VVB ELIGIBILITY REQUIREMENTS

This is the first methodology and fourth module in Sectoral Scope 16 Carbon Capture and Storage. There are no registered Carbon Capture and Storage projects in the Verra pipeline. Aster Global has requested accreditation for scope expansion with ANAB for Sector Scope 16, Carbon Capture and Storage (ANAB 4).

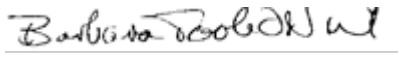
Aster Global fulfills the eligibility requirements for validation/verification bodies as the assessor for this methodology in the following ways:

- Aster Global and/or the Lead Assessor has assessed at least 28 methodologies,
- Aster Global has two standard methods experts on staff, and
- Aster Global staff are experienced assessors including a power and energy generation expert.

6 SIGNATURE

Signed for and on behalf of:

Name of entity: Aster Global Environmental Solutions, Inc.

Signature: 

Name of Lead Assessor: Barbara Toole O'Neil

Signature: 

Name of signatory: Janice McMahon

Date: 3 October 2025

7 APPENDIX A: LIST OF DOCUMENTS RECEIVED FROM CLIENT

Document Name	Date Received
VMD0059-CO2-Capture-from-Bioenergy-final-publication	4/22/2025
11_CCS-Tool01_Removals-Reductions_final.docx	9/9/2024
12_CCS-Tool02_non_VCS_final.docx	9/9/2024
20231122-Batch 1_Documentation summary.pptx	11/22/2023
22025.00 - BECCS Module - Round 1 Findings - Verra Respones.xlsx	2/24/2025
22025.00 - Carbon Capture Storage+ Findings Document 20Dec2023_GK.docx	1/11/2024
22025.00 - Carbon Capture Storage+ Findings Document 20Dec2023_GK.docx	2/2/2024
22025.00 - Carbon Capture Storage+ Findings Document 2February2024.docx	3/5/2024
22025.00 - CCS Meth - Checklist - Round 2 Findings - 2024-04-18.xlsx	5/13/2024
22025.00 - CCS Meth - Public Comments - Round 2 Findings - 2024-04-18.xlsx	5/13/2024
22025.00 - DAC - Checklist - Round 2 Findings - 2024-04-18.xlsx	5/15/2024
22025.00 - DAC - Checklist - Round 3 Findings - 2024-09-10_Verra responses.xlsx	9/13/2024
22025.00 - DAC - Public Comments - Round 2 Findings - 2024-05-03.xlsx	5/15/2024
22025.00 - DAC - Public Comments - Round 3 Findings - 2024-09-10 - Verra responses.xlsx	9/18/2024
22025.00 - Non-VCS Tool - Round 1 Findings - Verra Response.xlsx	2/24/2025
22025.00 - Red-Rem Tool - Round 1 Findings - Verra Responses.xlsx	2/24/2025
22025.00 - Storage (Saline DOGR)- Checklist - Round 1 Findings - 2024-10-09 - Verra Responses.xlsx	10/17/2024
22025.00 - Storage (Saline DOGR)- Checklist - Round 1 Findings - 2024-10-09 - Verra Responses.xlsx	10/18/2024
22025.00 - Storage (Saline DOGR)- Public Comments - Round 1 Findings - 2024-10-09 - Verra Responses.xlsx	10/17/2024
22025.00 - Storage (Saline DOGR)- Public Comments - Round 1 Findings - 2024-10-09 - Verra Responses.xlsx	10/18/2024
22025.00 - Transport - Checklist - Round 3 Findings - 2024-10-09 - Verra Responses.xlsx	10/17/2024
22025.00 - Transport - Checklist - Round 3 Findings - 2024-10-09 - Verra Responses.xlsx	10/18/2024
22025.00 - Transport - Public Comments - Round 3 Findings - 2024-10-09 - Verra Responses.xlsx	10/18/2024
22025.00 - Transport - Public Comments - Round 3 Findings - 2024-10-09.xlsx	10/17/2024
22025.00 Docs List Index.xlsx	6/27/2024
22025.00_VCS methodologyassessment_propV5-03242022_PCG.pdf	4/2/2022
220250_1.DOC	1/25/2024
Aquifer and DOGR module_final.docx	9/18/2024
Aquifer and DOGR module_final.docx	10/17/2024
Aquifer and DOGR module_final.docx	10/18/2024
Aquifer and DOGR module_final_publication.docx	10/22/2024
Aquifer and DOGR module_final_publicationv2.docx	10/22/2024
Aquifer and DOGR module_working_2.docx	9/16/2024

Aquifers Storage Module - Public Consultation_clean.docx	11/22/2023
Aquifers Storage Module - Public Consultation_clean.docx	4/19/2024
Aquifers Storage Module - Public Consultation_TC.docx	11/17/2023
Aquifers-Storage-Module-Public-Consultation-Draft.pdf	6/5/2024
BECCS module_final_v1.docx	12/2/2024
BECCS module_final_v2.docx	2/24/2025
BECCS module_final_v3.docx	3/11/2025
BECCS module_final_v3.docx	3/19/2025
CCS Methodology - Public Consultation_clean.docx	11/22/2023
CCS Methodology - Public Consultation_TC.docx	12/12/2023
CCS Methodology.docx	1/11/2024
CCS Methodology.docx	1/25/2024
CCS Methodology.docx	2/2/2024
CCS Methodology.docx	3/11/2024
CCS Methodology_04042024.docx	4/9/2024
CCS Methodology_05052024.docx	5/13/2024
CCS Methodology_18032024.docx	3/21/2024
CCS Methodology_22052024 - Clean.docx	5/23/2024
CCS Methodology_22052024 - TC.docx	5/23/2024
CCS Methodology_24052024 - clean.docx	5/24/2024
CCS Methodology_24052024 - TC.docx	5/24/2024
CCS Methodology_27032024.docx	3/28/2024
CCS Methodology_27052024 - Clean.docx	5/27/2024
CCS Methodology_27052024 - TC.docx	6/20/2024
CCS Methodology-Road Map.xlsx	1/19/2024
CCS Methodology-Road Map.xlsx	2/2/2024
CCS+ Figures.pptx	3/5/2024
CCS+ Initiative .pptx	11/14/2023
CCS+ VVB (1).pdf	6/24/2024
CCS+-Batch 2 internal PC - Responses.xlsx	10/2/2024
CCS+-internal Public Consultation Template.xlsx	11/17/2023
CCS+-internal Public Consultation Template_20240405.xlsx	4/8/2024
CCS-Methodology-Public-Consultation-Draft.pdf	7/13/2023
Compare result - CCS Methodlogy_Verra Reveiw and CCS+052724 - Clean.docx	6/19/2024
Compare result - CCS Methodlogy_Verra Reveiw and CCS+052724 - Copy.docx	6/19/2024
Compare result - CCS Methodlogy_Verra Reveiw and CCS+052724.docx	6/19/2024
DAC Module - Public Consultation_clean.docx	11/22/2023
DAC Module - Public Consultation_TC.docx	11/17/2023
DAC Module.docx	1/11/2024
DAC Module.docx	1/25/2024
DAC Module.docx	2/2/2024
DAC Module.docx	3/5/2024
DAC Module_04042024.docx	4/9/2024

DAC Module_04042024.docx	4/19/2024
DAC Module_05052024.docx	5/15/2024
DAC Module_18032024.docx	3/21/2024
DAC Module_27032024.docx	3/28/2024
DAC module_Final_draft.docx	8/28/2024
DAC module_Final_draftv2.docx	9/13/2024
DAC module_Final_draftv2.docx	9/16/2024
DAC module_Final_draftv3.docx	9/17/2024
DAC module_Final_draftv3.docx	9/20/2024
DAC module_Final_draftv3.docx	10/17/2024
DAC module_Final_draftv3.docx	10/18/2024
DAC module_Final_publication.docx	12/24/2024
DAC-Module-Public-Consultation-Draft.pdf	7/13/2023
Draft-PC-document-CCS-Methodology.pdf	7/13/2023
Example calculation - Batch 1.xlsx	11/27/2023
FAR Responses.pdf	12/11/2023
Fw_22025.00 Update.zip	11/17/2023
GCS-Non-Permanence-Risk-Tool-v4.0-FINAL.pdf	7/13/2023
GCS-Requirements-v4.0-FINAL.pdf	7/13/2023
Graphic schedule from CCS+ Feb2023.docx	4/13/2023
Methodology for Carbon Capture and Storage.docx	2/28/2024
Module for CO2 Capture from Air (Direct Air Capture).docx	12/11/2023
Module for CO2 Storage in Saline Aquifers.docx	12/11/2023
Module for CO2 Transport.docx	12/11/2023
MRR_CCS Methodology and Modules_Batch1.pdf	11/22/2023
MRR_CCS Methodology and Modules_Batch1_Responses June 26.pdf	11/13/2023
Non-VCS Tool_final_v1.docx	1/29/2025
Non-VCS Tool_final_v2.docx	2/24/2025
Non-VCS Tool_final_v3.1.docx	3/11/2025
Non-VCS Tool_final_v3.docx	3/11/2025
Re_22025.00 CCS+ update and questions (1).zip	1/11/2024
Reductions and Removals_final_v1 - Copyw comments.docx	1/29/2025
Reductions and Removals_final_v1.docx	12/2/2024
Reductions and Removals_final_v2.docx	2/24/2025
Reductions and Removals_final_v3.1.docx	3/11/2025
Reductions and Removals_final_v3.docx	3/11/2025
Specific Questions_VVB.docx	3/21/2024
Storage Module.docx	1/11/2024
Storage Module.docx	2/2/2024
Summary of comments Aug2023.pdf	8/27/2023
Transport Module - Public Consultation_clean.docx	11/22/2023
Transport Module - Public Consultation_TC.docx	11/17/2023
Transport Module.docx	1/11/2024

Transport Module.docx	1/25/2024
Transport Module.docx	2/2/2024
Transport Module.docx	3/6/2024
Transport Module.docx	4/19/2024
Transport Module_final.docx	9/18/2024
Transport Module_final.docx	10/17/2024
Transport Module_final.docx	10/18/2024
Transport Module_final_publication.docx	10/22/2024
Transport Module_final_publicationv2.docx	10/22/2024
Transport Module_working.docx	9/16/2024
Transport-Module-Public-Consultation-Draft.pdf	7/13/2023
Uncertainty assessment - Batch 1_v2.xlsx	4/10/2024
Uncertainty assessment - Batch 1_v3.xlsx	5/13/2024

8 APPENDIX B: FINDINGS

Item	1
VCS Methodology Requirements v4.4 4 October 2023 (Section)	2.2.1
VCS Methodology Requirements v4.4 4 October 2023 (Description)	Methodologies may employ a modular approach in which a framework document provides the structure of the methodology and separate modules and/or tools are used to perform specific methodological tasks. Such methodologies shall use the VCS Methodology Template for the framework document and the VCS Module Template for the modules and tools. The framework document shall clearly state how the modules and/or tools are to be used within the context of the methodology
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	BECCS Module
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team why the latest VCS module template is not being used.
Round 1 NCR/CL/OFI	NCR: The latest VCS module template is not being used.
Round 1 Response from Methodology Development Team	Our technical editor has organized the module to meet the requirements of the most recent template. We understand that Aster is reviewing against the version that was in place at the outset of the review process for Batch 1, which is no longer active. We are ok with leaving this non-conformance in your review report as an unresolved finding or having you discuss with Christian (Director of Methodologies) to find a solution that works for all.
Round 2 Findings	Verra has decided to use a new unpublished version of the methodology template. The majority of the sections are the same as the previous template that the assessment team used during the assessment. This will be noted in the assessment report.

Item	2
VCS Methodology Requirements v4.4 4 October 2023 (Section)	a)
VCS Methodology Requirements v4.4 4 October 2023 (Description)	The literature shall be in a journal indexed in the Web of Science: Science Citation Index (SCI; available at https://mjl.clarivate.com).
Applicability to Project (Y or N/A)	Y

Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	EF,j - GHG emissions from the production of capture material j - Source of data row in section 6.2
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team how the third option for determining emissions from the production of capture materials meets the requirements for peer-reviewed literature (Section 2.5.2 (1) a-c).
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Updated text to align with vetted approach from DAC module which includes relevant references for the data source options.
Round 2 Findings	Text has been updated with an appropriate reference the methodology requirements specific to peer-reviewed literature. Finding is closed.

Item	3
VCS Methodology Requirements v4.4 4 October 2023 (Section)	3.2.1
VCS Methodology Requirements v4.4 4 October 2023 (Description)	Methodologies shall use applicability conditions to specify the project activities to which it applies and shall establish criteria that describe the conditions under which the methodology can (and cannot, if appropriate) be applied. Any applicability conditions set out in tools or modules used by the methodology shall also apply.
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	BECCS - Applicability Condition #2
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team how the applicability condition requiring capture fluids/media to not be a one-time use or disposable material is in line with the leakage emissions from consumption of the capture material. If the capture material is consumed then wouldn't that make it a disposable material?
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Updated text to align with that used in DAC which removes the term "disposable".
Round 2 Findings	Text has been updated. Finding is closed.

Item	4
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VCS Methodology Requirements v4.4 4 October 2023 (Section)	3.2.2
VCS Methodology Requirements v4.4 4 October 2023 (Description)	Applicability conditions shall be specified clearly, and in a manner that allows easy determination of whether an activity being undertaken by a potential project proponent is eligible.
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	BECCS - Section 4 - Applicability Condition #1
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team how applicability condition #1, which specifies CO2 capture from flue gas aligns with the first paragraph of Section 5.1 of the reductions and removals tool. Section 5.1 states that removals activities include "capture of CO2 from bioenergy pathways that use sustainable biomass as a fuel source directly or that convert sustainable biomass into a gaseous or liquid fuel through alcoholic fermentation, digestion, pyrolysis, or gasification (BECCS). " Specifically, it is unclear how the bold section above aligns with capture from flue gas, which typically implies some sort of combustion must take place in order to capture CO2. The introduction paragraph also specifically mentions generating or co-generating heat and power, which does not appear to cover conversion of biomass into a gas or liquid fuel.
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	The issue identified is with the R&R tool. Responding to this comment does not require a change to the module.
Round 2 Findings	The project development team explained that the conversion of biomass into liquid or gaseous fuels mentioned in the R&R tool is in reference to a different module, and removed the "BECCS" mention to avoid confusion. No changes to the BECCS module were required with this explanation and update. Finding is closed.

Item	5
VCS Methodology Requirements v4.4 4 October 2023 (Section)	

VCS Methodology Requirements v4.4 4 October 2023 (Description)	The project boundary includes the GHG sources, sinks and reservoirs that are controlled by the project proponent, are related to the project or are affected by project activities. Methodologies must describe the project boundary and the GHG sources, sinks and reservoirs included in or excluded from the project boundary
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Section 5.1 - Module Boundary
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team why the DAC facility is referenced in section 5.1 of the BECCS module. DAC is also used three other times throughout the document. Please update accordingly, or provide an explanation for the references.
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Cut and paste error. Five instances updated.
Round 2 Findings	Text has been updated. Finding is closed.

Item	6
VCS Methodology Requirements v4.4 4 October 2023 (Section)	3.3.2
VCS Methodology Requirements v4.4 4 October 2023 (Description)	In identifying GHG sources, sinks and reservoirs relevant to the project, methodologies shall set out criteria and procedures for identifying and assessing GHG sources, sinks and reservoirs that are controlled by the project proponent, related to the project or affected by the project (i.e., leakage).
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Section 5.1 - Module Boundary - Table 1 - Fugitive and venting emissions from on-site fuel use
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team why CO2 and N2O are included as project emissions in table 1 for the 'Fugitive and venting emissions from on-site fuel use' section. CO2 and N2O were not included for this project emission source in previous modules. If CO2 and N2O should be included section 5.3.2 may need to be updated to provide quantification guidance.

Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Text updated to align with gases included in DAC
Round 2 Findings	Table has been updated to exclude CO2 and N2O, which is consistent with other capture module calculations. Finding is closed.

Item	7
VCS Methodology Requirements v4.4 4 October 2023 (Section)	
VCS Methodology Requirements v4.4 4 October 2023 (Description)	Leakage is the net change of anthropogenic GHG emissions that occurs outside the project boundary and is attributable to project activities. Methodologies must establish procedures to quantify leakage, where the potential for leakage is identified, as projects may otherwise overestimate their net emission reductions and/or removals.
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Parameter descriptions under Eqn 10 and 11
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team if there are missing parameters and parameter descriptions under equations 10 and 11 or if the blank sections are simply formatting errors.
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Formatting error. Empty rows removed.
Round 2 Findings	Text has been updated with formatting errors removed. Finding is closed.

Item	8
VCS Methodology Requirements v4.4 4 October 2023 (Section)	3.7.1
VCS Methodology Requirements v4.4 4 October 2023 (Description)	The methodology shall establish criteria and procedures for quantifying leakage.
Applicability to Project (Y or N/A)	Y

Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	5.4.3.3 - Leakage emissions from transportation to an emissions source facility
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team how emissions from other forms of transportation (boat, rail) will be accounted for in section 5.4.3.3. The assessment team reviewed CDM Tool 12 and this tool appears to be only applicable for freight transportation by road. The latest version appears to be 01.1.0.
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	The approach to calculate leakage emissions from transport has been changed to align with the approach used in the Transport module under VM0049 to allow for the use of ships, truck and rail. As such, it no longer uses Tool 12.
Round 2 Findings	The reference to Tool 12 has been removed, and the calculation method has been aligned with VM0057. Finding is closed.

Item	9
VCS Methodology Requirements v4.4 4 October 2023 (Section)	3.7.1
VCS Methodology Requirements v4.4 4 October 2023 (Description)	The methodology shall establish criteria and procedures for quantifying leakage.
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Equation 14
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team if PE,BP,y and PE,BRP,y are supposed to be added together in equation 14.
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Equation 14 adjusted.
Round 2 Findings	Equation 14 has been updated. Finding is closed.

Item	10
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VCS Methodology Requirements v4.4 4 October 2023 (Section)	3.7.1
VCS Methodology Requirements v4.4 4 October 2023 (Description)	The methodology shall establish criteria and procedures for quantifying leakage.
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Equation 10 - Delta Q,Bio,y
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team if delta Q,Bio,y should be totaled for each biomass type b in equation 9 prior to calculating Leakage emissions in equations 10. If EFb is specific for each biomass type, then it seems Delta Q,Bio,y would also need to be specific to the biomass type. The same comment applies for equation 11.
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Yes, delta Q should be calculated for each type of biomass individually. Index 'b' added in Equations 9, 10, 11.
Round 2 Findings	Equations and subscripts have been updated. Finding is closed.

Item	11
VCS Methodology Requirements v4.4 4 October 2023 (Section)	3.7.1
VCS Methodology Requirements v4.4 4 October 2023 (Description)	The methodology shall establish criteria and procedures for quantifying leakage.
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	5.4.3.2 - Calculating Leakage from Biomass Cultivation in a dedicated plantation

Aster Global Initial Findings (2025 Feb 03)	It is unclear why the leakage calculation from biomass cultivation only applies to a dedicated plantation. If the biomass is not sourced from a dedicated plantation, will the leakage emissions from 5.4.3.2 be = 0? Is dedicated plantation defined somewhere to ensure the biomass is from a dedicated plantation?
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Reference to "dedicated plantations" removed.
Round 2 Findings	Text has been updated and references to dedicated plantations removed. Finding is closed.

Item	12
VCS Methodology Requirements v4.4 4 October 2023 (Section)	3.7.1
VCS Methodology Requirements v4.4 4 October 2023 (Description)	The methodology shall establish criteria and procedures for quantifying leakage.
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Eqn (8) - LE,BM,y
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team if Appendix 1 is the correct reference for the LE,BM,y parameter description. Appendix 1 does not mention market leakage.
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Reference should refer to Appendix 3; corrected in-text.
Round 2 Findings	The text has been updated to reference the correct appendix. Finding is closed.

Item	13
VCS Methodology Requirements v4.4 4 October 2023 (Section)	3.7.1

VCS Methodology Requirements v4.4 4 October 2023 (Description)	The methodology shall establish criteria and procedures for quantifying leakage.
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	5.4.3.4 - Calc leakage from processing of biomass
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team if any leakage calculations from CDM Tool 16 need to be accounted for or if only section 5.3 of CDM Tool 16 is required to be calculated. Section 5.4.3.2 has a note that clarifies that only section 5.1 should be used from the tool for calculation in eqn 12. Section 5.4.3.4 simply refers to the CDM tool 16 in general and does not reference any specific sections
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	EQ 14 lists the variables which to be calculated using Tool 16. IN that tool they are project emissions but because the biomass processing stage happens outside of the control of the BECCS project, they are treated as leakage emissions in the module. Text revised to clarify.
Round 2 Findings	Text has been updated. Finding is closed.

Item	14
VCS Methodology Requirements v4.4 4 October 2023 (Section)	
VCS Methodology Requirements v4.4 4 October 2023 (Description)	Methodologies must describe the data and parameters available at validation (i.e., those that are fixed for the duration of the project crediting period) and data and parameters monitored (i.e., those that must be monitored during the project crediting period for each verification). Additionally, methodologies must describe the criteria and procedures for obtaining, recording, compiling, and analyzing monitored data and parameters.
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Description row of parameter table - msb,project,b,y and other biomass variables

Aster Global Initial Findings (2025 Feb 03)	he reduction and removals tool requires measurement of sustainable biomass on a dry basis. It is unclear to the assessment team if the biomass variables in the BECCS module will require an equivalent requirement in order to align the measurements between modules and tools.
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Text updated in parameter table to align with R&R tool (i.e. - biomass weight is measured on a dry basis"
Round 2 Findings	Parameter tables have been updated. Finding is closed.

Item	15
VCS Methodology Requirements v4.4 4 October 2023 (Section)	
VCS Methodology Requirements v4.4 4 October 2023 (Description)	Methodologies must describe the data and parameters available at validation (i.e., those that are fixed for the duration of the project crediting period) and data and parameters monitored (i.e., those that must be monitored during the project crediting period for each verification). Additionally, methodologies must describe the criteria and procedures for obtaining, recording, compiling, and analyzing monitored data and parameters.
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Equation row of parameter table - GWP,CH4
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team why equation (4) is not listed in the equations row of the table for GWP,CH4
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Equation #4 added to CH4 GWP parameter table.
Round 2 Findings	Parameter table has been updated. Finding is closed.

Item	16
Methodology Development and Review Process v4.4 16 April 2024 (Section)	3)

Methodology Development and Review Process v4.4 16 April 2024 (Description)	Structure and clarity of methodology: Assessment of whether the methodology is written in a clear, logical, concise, and precise manner that will enable project developers to consistently implement projects and transparently report project results;
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Appendix 2 - Note on 5th version of Verra Standard
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team what purpose the note mentioning harmonization with the coming 5th version of the verra standard serves in the module. Will the upcoming standard changes supersede the requirements presented in the module, or will the module be updated once the standard comes out? The concern being that methodology/module updates do not always happen as quickly as desired so a new version of the standard could contradict the existing module requirements presented in the appendices.
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	This text is no longer relevant and has been removed.
Round 2 Findings	The updated document no longer mentions alignment with the 5th version of the VCS standard. Finding is closed.

Item	17
Methodology Development and Review Process v4.4 16 April 2024 (Section)	3)
Methodology Development and Review Process v4.4 16 April 2024 (Description)	Structure and clarity of methodology: Assessment of whether the methodology is written in a clear, logical, concise, and precise manner that will enable project developers to consistently implement projects and transparently report project results;
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Appendix 2.1 - First sentence and Table 2

Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team if the first sentence under A2.1 contradicts the requirements in Table 2. Specifically, table 2 shows that biomass from waste is required to meet the 6th sustainability principle, but the first sentence says "except those from waste" implying that biomass feedstocks from waste do not need to conform to any of the suitability principles.
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Discrepancy corrected. The waste category has been removed from Table 2.
Round 2 Findings	Table 2 has been removed from the module, and requirements for biomass from waste have been updated to be more clear. Finding is closed.

Item	18
Methodology Development and Review Process v4.4 16 April 2024 (Section)	3)
Methodology Development and Review Process v4.4 16 April 2024 (Description)	Structure and clarity of methodology: Assessment of whether the methodology is written in a clear, logical, concise, and precise manner that will enable project developers to consistently implement projects and transparently report project results;
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Appendix 2.1 - Sustainability principle 7, LULUCF
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team if the country from which the biomass is sourced must be a party to the Paris Agreement. The first sentence in sustainability principle 7 states that they must, but the last sentence seems to contradict this requirement by providing other options.
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Wording changed to remove discrepancy. Requirements are now provided for countries party to and not party to the Paris Agreement.
Round 2 Findings	Text has been updated. Finding is closed.

Item	19
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Methodology Development and Review Process v4.4 16 April 2024 (Section)	3)
Methodology Development and Review Process v4.4 16 April 2024 (Description)	Structure and clarity of methodology: Assessment of whether the methodology is written in a clear, logical, concise, and precise manner that will enable project developers to consistently implement projects and transparently report project results;
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Appendix 2.1 - Table 2
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team what type of regulatory compliance or sustainability certification could be received for biomass from waste or from non-forest, non agricultural biomass. Regulatory/sustainability certifications are typical in the agricultural and forestry sectors, but the assessment team is not aware of such regulations or certification for the 'Other' category in table 2. Are there any other options for project developers to meet the biomass sustainability criteria outside of regulatory or certifications? If a WtE plant meets the sustainability principles in A2.2, are they still required to meet sustainability principle 6 from table 2 via regulatory compliance or certification?
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	The biomass categories have been revised to include non-forest/non-agricultural biomass as biomass from waste and thus not subject to demonstrating compliance with the sustainability requirements
Round 2 Findings	The biomass categories have been updated, and table 2 removed. Text has been updated to clearly state that biomass was waste is not subject to the sustainability requirements. Finding is closed.

Item	20
Methodology Development and Review Process v4.4 16 April 2024 (Section)	3)
Methodology Development and Review Process v4.4 16 April 2024 (Description)	Structure and clarity of methodology: Assessment of whether the methodology is written in a clear, logical, concise, and precise manner that will enable project developers to consistently implement projects and transparently report project results;

Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Appendix 2.1 - B-Sustainability certification i)
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team how regulatory compliance and sustainability certifications will be tied back specifically to the sustainability principles. For example the FSC 100% label appears to meet the biodiversity, sustainable forest management, and social sustainability principles, but does not appear to specifically mention the other principles. Would the project developer then need to meet the other requirements through a combination of other certifications or regulatory compliance methods? Are there any examples of regulations/certifications of biomass (forestry or Ag) that would in combination or by themselves meet the requirements presented in Table 2?
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Sustainability Principles have been revised to be requirements. It is expected that the use of regulatory compliance and sustainability certification in combination will be sufficient to address the requirements listed. The specific combinations needed will be a product of the type of biomass used and the jurisdiction of sourcing.
Round 2 Findings	The Appendices have been substantially revised, and provide clear criteria for how a project can demonstrate that biomass is considered sustainable. Finding is closed.

Item	21
Methodology Development and Review Process v4.4 16 April 2024 (Section)	3)
Methodology Development and Review Process v4.4 16 April 2024 (Description)	Structure and clarity of methodology: Assessment of whether the methodology is written in a clear, logical, concise, and precise manner that will enable project developers to consistently implement projects and transparently report project results;
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Appendix 2.1 - A - Regulatory compliance

Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team who could be considered qualified as a third party to confirm that regulatory schemes meet the sustainability principles. It is also unclear why a qualified 3rd party is required to confirm that regulatory schemes meet the sustainability principles, but certifications automatically meet the sustainability principles with no 3rd party review.
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Language for Sustainability certification updated to require a demonstration that the certification program sufficiently addresses the sustainability requirements of the module: " Certification under an approved scheme from a legislative or international body such as the European Union, CORSIA, or national/state governments may meet the requirements of this module where it can be demonstrated that the requirements are sufficiently addressed in the certification process. Proponents must provide evidence of such certification"
Round 2 Findings	The Appendices have been substantially revised, and provide clear criteria for how a project can demonstrate that biomass is considered sustainable. Finding is closed.

Item	22
Methodology Development and Review Process v4.4 16 April 2024 (Section)	3)
Methodology Development and Review Process v4.4 16 April 2024 (Description)	Structure and clarity of methodology: Assessment of whether the methodology is written in a clear, logical, concise, and precise manner that will enable project developers to consistently implement projects and transparently report project results;
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	Appendix 3
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team which category secondary forestry and agricultural biomass fall into for Appendix 3. The first category is "Forest and Agricultural Primary" so it appears that secondary forest and agricultural biomass would fall into the second category and LE,BM,y would be set to 0?
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Appendix 3 adjusted to indicate that Secondary products from Forestry and Agriculture must follow the same process from determining market leakage as primary products.
Round 2 Findings	Appendix 3 has been updated (now appendix 2). Finding is closed.

Item	23
Methodology Development and Review Process v4.4 16 April 2024 (Section)	16)
Methodology Development and Review Process v4.4 16 April 2024 (Description)	Verifiable: Whether the methodology is sufficiently clear and specific to require project developers to transparently report project results that can pass validation and verification with high confidence.
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	BECCS - Definition - Existing bioenergy source facility
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team what a mixed feedstock is, in reference to the definition of 'existing bioenergy source facility.' Is a mixed feedstock specific to waste to energy plants?
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Definition of mixed feedstock added
Round 2 Findings	Mixed feedstock definition has been added. Finding is closed.

Item	24
Methodology Development and Review Process v4.4 16 April 2024 (Section)	16)
Methodology Development and Review Process v4.4 16 April 2024 (Description)	Verifiable: Whether the methodology is sufficiently clear and specific to require project developers to transparently report project results that can pass validation and verification with high confidence.
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y

Evidence Used to Assess (Location in PD/MR or Supporting Documents)	BECCS - Definition - High ILUC risk biomass
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team how biomass not included in the Annex of Article 3 of the delegated regulation on indirect land-use will be classified by the project. If the biomass type used by the project is not listed in the Annex will it automatically be classified as low ILUC risk biomass? Is article 3 applicable to other locations outside of the EU?
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Reference to Annex 3 replaced with guidance on using a newer (2024) and more straight-forward reference document and look-up table contained within, to determine whether a feedstock is considered to be a high ILUC risk.
Round 2 Findings	Reference has been updated and replaced with a globally applicable standard that provides clear guidance on location and criteria for biomass that will be considered high ILUC risk. Finding is closed.

Item	25
Methodology Development and Review Process v4.4 16 April 2024 (Section)	16)
Methodology Development and Review Process v4.4 16 April 2024 (Description)	Verifiable: Whether the methodology is sufficiently clear and specific to require project developers to transparently report project results that can pass validation and verification with high confidence.
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	BECCS - Definition - Ineligible biomass
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team what requirements 'cascading use and LULUCF criteria' is referring to in the Ineligible biomass definition. Appendix 2 shows that LULUCF is a sustainable biomass principle, but table 2 only requires that the LULUCF principle to be met for primary forest biomass.
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Definition revised, "Cascading use" defined and added as sustainability requirement for forestry products. Reference in definition of Ineligible biomass no longer mentions LULUCF, as it is covered in the sustainability requirements section.

Round 2 Findings	Definition has been updated with cascading use and LULUCF requirements removed. Sustainability principles have also been updated per the methodology developers response. Finding is closed.
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Item	26
Methodology Development and Review Process v4.4 16 April 2024 (Section)	16)
Methodology Development and Review Process v4.4 16 April 2024 (Description)	Verifiable: Whether the methodology is sufficiently clear and specific to require project developers to transparently report project results that can pass validation and verification with high confidence.
Applicability to Project (Y or N/A)	Y
Requirement Met (Y, N or Pending)	Y
Evidence Used to Assess (Location in PD/MR or Supporting Documents)	BECCS - Definition - Capture materials
Aster Global Initial Findings (2025 Feb 03)	It is unclear to the assessment team if the definition of Capture Materials is written correctly. The first sentence says "The chemicals and media used by a to capture CO2". It appears that a word or words may be missing to complete the sentence.
Round 1 NCR/CL/OFI	CL: Please clarify in line with the finding.
Round 1 Response from Methodology Development Team	Typo, corrected to read "...used to capture CO2"
Round 2 Findings	Definition has been updated. Finding is closed.

9 APPENDIX C: RESPONSES TO PUBLIC COMMENT