# METHODOLOGY ASSESSMENT REPORT

## REDUCTION OF ENTERIC METHANE EMISSIONS FROM RUMINANTS THROUGH THE USE OF 100% NATURAL FEED SUPPLEMENT

Document Prepared By: Ruby Canyon Engineering, Inc.

<table>
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<tr>
<th>Methodology Title</th>
<th>Reduction of Enteric Methane Emissions from Ruminants Through the Use of 100% Natural Feed Supplement</th>
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<tbody>
<tr>
<td>Version</td>
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<td>Methodology Category</td>
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<td>Module</td>
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<td>Tool</td>
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<td>Sectoral Scope(s)</td>
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<th>Report Title</th>
<th>Methodology Assessment Report for Reduction of Enteric Methane Emissions from Ruminants Through the Use of 100% Natural Feed Supplement</th>
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<td>Report Version</td>
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<tr>
<td>Client</td>
<td>MOOTRAL SA</td>
</tr>
<tr>
<td>Pages</td>
<td>37</td>
</tr>
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<td>Date of Issue</td>
<td>November 7, 2019</td>
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<tr>
<td>Prepared By</td>
<td>Ruby Canyon Engineering, Inc.</td>
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<td>743 Horizon Court, Suite 385, Grand Junction, CO, 81506</td>
</tr>
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</table>
Summary:

Ruby Canyon Engineering, Inc. (RCE) was retained by MOOTRAL SA (Mootral) to perform the methodology assessment of the *Reduction of Enteric Methane Emissions from Ruminants Through the Use of 100% Natural Feed Supplement* (Methodology). This was the second assessment for the Methodology.

The purpose and scope of the methodology assessment was to evaluate whether the Methodology was prepared in accordance to VCS program requirements. RCE’s assessment included a detailed review of the eligibility criteria, baseline scenarios and emissions, project boundaries and definitions, standardized methods applied, quantification calculations and data and parameters monitored.

The assessment was conducted in accordance with the VCS Methodology Approval Process, VCS Standard, VCS Program Guide and VCS Guidance for Standardized Methods.

RCE’s assessment included a total of 26 findings. Mootral provided satisfactory responses to all RCE’s corrective action requests, requests for additional documentation and clarification requests.

RCE confirms that any uncertainties associated with the methodology assessment were addressed by Mootral as part of the assessment process.

RCE confirms all methodology assessment activities, including objectives, scope and criteria, level of assurance, and the activity method and methodology revisions conform to the VCS Program Version 3.7 and VCS Standard Version 3.7. RCE concluded without any qualifications that the Methodology meets the requirements of the VCSA and recommends that VCSA approve the Methodology.
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1 INTRODUCTION

1.1 Objective
The purpose of the methodology assessment was to evaluate whether the Reduction of Enteric Methane Emissions from Ruminants Through the Use of 100% Natural Feed Supplement methodology was prepared in accordance to VCS program requirements. The findings of the assessment are described in this report.

1.2 Summary Description of the Methodology
This methodology provides procedures to estimate enteric methane (CH₄) emission reductions generated from the inhibition of methanogenesis due to the introduction of a natural feed supplement into ruminants’ diet. This methodology considers only emission reductions from enteric fermentation.

Feed supplements applicable under this methodology reduce CH₄ emissions by directly acting on the population of methanogenic archaea in the rumen. This methodology focuses on application of natural plant-based feed supplements, which along with inhibiting methanogenesis, may also have advantageous effects on rumen bacteria, thereby improving fermentation in the rumen.

2 ASSESSMENT APPROACH

2.1 Method and Criteria
RCE conducted the assessment methods in accordance with the VCS Methodology Approval Process and standard GHG accounting and auditing procedures. RCE’s assessment included a detailed review of the eligibility criteria, baseline scenarios and emissions, project boundaries and definitions, standardized methods applied, quantification calculations and data and parameters monitored. In addition, RCE assessed the documents’ structure and clarity, including the clear definition of key terms.

RCE followed the following VCS criteria:
- VCS Standard v3.7, June 21, 2017
- VCS Program Guide v3.7, June 21, 2017
- VCS Guidance for Standardized Methods v3.3, October 8, 2013
- VCS Methodology Approval Process v3.7, June 21, 2017

2.2 Document Review
RCE conducted a detailed review of the Methodology to ensure that all Methodology components were in alignment with VCS criteria and requirements. In addition, RCE reviewed supporting documentation that was used to support Methodology components. RCE focused on the following components of the Methodology: definitions, applicability conditions, project boundary, baseline emissions, quantification, monitoring and emissions factors utilized. RCE’s VCS Standardized Methods Expert reviewed the activity method and positive list for adherence to VCS Guidance for Standardized Methods and Methodology Approval Process. RCE also assisted with the review of the activity method and positive list. All team members reviewed the documents for conformance to VCS Program Guide, the VCS Standard, VCS Guidance for Standardized Methods, and other guidance documents.
The final list of documents received and reviewed by the RCE assessment team is provided in Appendix A.

2.3 Interviews

RCE assessment team conducted interviews with the methodology proponent and their technical consultant throughout the assessment process. The interviews were used to discuss methodology assumptions, conservativeness, demonstration of additionality, VCS requirements, as well as to resolve corrective action requests, clarification requests, and other methodology issues. Several rounds of teleconferences were needed to resolve all outstanding issues. The following table identifies the team members and stakeholders involved in the interviews.

<table>
<thead>
<tr>
<th>Dates</th>
<th>Attendees</th>
<th>Topics</th>
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<tr>
<td>9/30/2019</td>
<td>Zach Eyler, Elsa Zoupanidou</td>
<td>Further discussion of List of Findings 1.0, remaining open items and an updated methodology.</td>
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2.4 Assessment Team

Zach Eyler – Lead Assessor

Zach serves as a Vice President for Ruby Canyon, utilizing his broad experience with GHG programs and renewable energy to assist on a variety of work including GHG verifications, technical research and other client projects. In addition, he assists the company in understanding GHG regulations and policies across North America and internationally, using this knowledge to analyze potential new areas of growth. Specifically, Zach is helping lead Ruby Canyon’s expansion into California’s AB 32 cap-and-trade program as well as new Canadian province GHG programs in Quebec and Ontario. Zach also serves as Ruby Canyon’s representative on a variety of GHG registry stakeholder groups that assist in the development of high-level protocol and verification standards for new GHG programs. Zach has completed a wide range of verification work for projects across registries (PCT, CAR, TCR, ACR) including landfills, livestock, oil/gas, fuel switching, ODS, nitric acid production, and GHG entity inventories. Zach is currently an accredited Lead Verifier for the CAR, PCT and ACR programs. Zach is also an ARB accredited Lead Verifier and Project Specialist for livestock and ODS projects.

Prior to joining Ruby Canyon, Zach worked at Element Markets since 2008 where he managed over 15 carbon offset projects and conducted all GHG policy and regulatory analysis to support the company’s trading activities and client relationships in the U.S. and Canada. He also served as a company representative on carbon offset working groups including the Coalition for Emission Reduction Policy (CERP) and the Canadian Industry Provincial Offsets Group (IPOG). He holds a Bachelor’s degree in
Environmental Technology from NC State University and a Master’s of Environmental Management from Duke University’s Nicholas School of the Environment.

David LaGreca – Staff Environmental Scientist

David LaGreca began working at Ruby Canyon Engineering in June 2017. Since then, he has become increasingly engrossed in the political and scientific underpinnings of evolving greenhouse gas marketplaces. David became certified under the Climate Action Reserve Landfill and General Protocols in 2017, having completed mandatory trainings as well as working on numerous CAR Landfill projects as verification team member. He has worked as verification team member on projects in the Ontario and British Columbia mandatory greenhouse gas reporting mechanisms, along with inventory verifications under The Climate Reserve. Additionally, he has thoroughly researched and reported on emerging markets under Mexico's evolving EMA standards, recently assisting with translation and project work for RCE’s first four Oil and Gas Verifications under RENE. David provided support for greenhouse gas inventory consulting for domestic and international abandoned mine methane (AMM) and coal mine methane (CMM) projects through the US EPA. Along with GHG audits, he has developed corporate sustainability plans and conducted market analysis for environmentally preferred purchasing standards for retailers. David has conducted feasibility analyses for adopting and advancing corporate performance within LEED and Energy Star building rating systems.

David graduated in 2015 from the University of Denver with a Master of Science in Environmental Policy and Management, emphasizing Energy and Sustainability. He wrote extensively on life cycle analysis in commercial product and building sciences, culminating with a thesis on deep energy retrofits in residential homes. In 2009, David obtained a Bachelor of Science degree from the University of Colorado at Boulder in Environmental Studies, where he presented his research into a comprehensive paradigm on new urbanism. Since graduation, David has focused on understanding environmental systems and the interconnectedness of human activities with ecological impacts. He spent time as a research intern with an environmental consulting company, and as sustainability lead/project manager for a green building company in Grand Junction, CO.

Barbara Toole O’Neil – VCS Standardized Methods Expert

Since 2012, Ms. Toole O’Neil has focused on climate services, air quality, corporate responsibility and energy efficiency projects from the industrial manufacturing to ecosystems services sectors. Her work responsibilities have addressed a wide range of environmental issues from assessing methodologies, to preparing inventories or offset project documents to supporting the development of the ARB Mine Methane Capture Protocol as part of the working group, corporate social responsibility auditing, developing governance for sustainability non-profits, to writing the social standard (W+) to assess the impact of environmental projects (carbon, water, forestry, agriculture) on the quality of life for women in emerging third world countries. Ms. Toole O’Neil has been the lead assessor or part of the assessment team for multiple VCS methodologies.

Bonny Crews – Independent Technical Reviewer

Bonny Crews is a microbiologist with broad experience in soil, water, and environmental applications; she has a strong scientific and technical background with excellent communication skills. Bonny has a B.S. in Biology from St. Edward’s University and an M.S. in Microbiology from Colorado State University where
she studied the effects of oil shale retort on soil microorganism function. Bonny has a strong commitment to sustainable development. Specific interests in the greenhouse gas sector include landfill gas to energy projects, biogas production from agricultural wastes, composting and co-digestion of agro-industrial wastes, and alternative energy projects. Bonny is an accredited lead verifier for the livestock, organic waste digestion, and landfill sectors for the Climate Action Reserve (CAR). Additionally, Bonny is an accredited lead verifier for The Climate Registry (TCR), the American Carbon Registry (ACR) and the California Air Resources Board (ARB). Bonny is also an RCE-designated lead verifier and validator to the British Columbia (BC) Pacific Carbon Trust (PCT).

In various roles as Lead Verifier, Senior Reviewer, Team Member, and Project Lead at Ruby Canyon, Ms. Crews has participated in numerous projects that include GHG inventories, verifications, project and protocol validations, research, and consulting. Prior to joining Ruby Canyon, Bonny worked for seven years at Atlantic Richfield’s research laboratory in Plano, TX. There she was a technical expert with the environmental support group and served as the in-house expert on bioremediation and other biological environmental remediation methods. She has given presentations at national conferences and written technical reports and journal articles. Bonny enjoys environmental problem-solving and working with multi-disciplinary teams.

2.5 Resolution of Findings
The methodology assessment included multiple rounds of evaluation by the assessment team, with the final assessment closing out all outstanding issues. Findings related to corrective action requests, requests for additional documentation and clarification requests were resolved at the conclusion of the evaluation. The RCE assessment team submitted an updated List of Findings to Mootratal during each round of assessment and Mootratal responded with corrective actions, edited documents, additional documents, as well as written responses for clarifications. The RCE assessment team and Mootratal discussed the List of Findings via teleconferences throughout the assessment process as noted above in section 2.3.

During the methodology assessment process, the RCE assessment team identified 26 items requiring a response including corrective action requests, additional documentation requests and clarification requests.

Several of the findings of the assessment involved adding clarification language and definitions to ensure that project proponents and verification bodies could properly utilize the Methodology. Similarly, clarifications were made to some of the quantification questions to ensure proper use. A variety of edits were made to the applicability conditions to ensure that all eligibility criteria were clear, sufficient and logical.

The RCE assessment team requested additional support documentation to justify the proposed activity method applicability conditions and positive list. RCE requested additional information regarding the maximum adoption potential (MAP) and observed activity (OA) to demonstrate that the standardized method was appropriate. Mootratal provided sufficient documentation and evidence.

For a summary of all the findings and resolutions please see Appendix B.
3 ASSESSMENT FINDINGS

The RCE assessment team found the Methodology to be in full compliance with the VCS Standard and other VCS requirements. RCE followed a methodological approach to the assessment, using applicable sections of the VCS documents outlined in section 2.1 as well as the VCS Validation and Verification Manual. Key elements of the methodology assessment included the following areas:

- Definitions
- Applicability Conditions
- Project Boundary
- Baseline Scenario
- Additionality
- Quantification of GHG Emissions Reductions and Removals
- Data Monitoring
- Activity Method analysis
- Emission Factors and their source documentation

3.1 Relationship to Approved or Pending Methodologies

The RCE assessment team reviewed methodologies similar to the Methodology and agrees with Mootral that no existing methodologies could have been reasonably revised to meet the objectives of this new Methodology. A list of the similar methodologies considered are noted below:

- CDM AMS-III.BK Strategic feed supplementation in smallholder dairy sector to increase productivity
- CDM SSC-NM085 Strategic supplementation of a large ruminant dairy sector for the reduction of methane
- CDM SSC-NM094 Strategic supplementation of a small holder dairy sector to increase productivity and reduce methane emissions
- CDM NM0260 Uganda Cattle Feed Project (UCFP)
- VCS V02 Methodology to reduce enteric methane emissions in beef cattle using organic or natural feed supplements

3.2 Stakeholder Comments

Multiple stakeholder comments were received during the public comment period and Mootral has responded to each. RCE reviewed the responses and determined that all were sufficiently addressed through clarification or changes to the Methodology. Please see Appendix C for all comments.

3.3 Structure and Clarity of Methodology

The RCE assessment team concluded that the Methodology is clear, logical, concise and precise in manner. The RCE assessment team also concluded that:

- Mootral correctly followed the instructions in the methodology template.
- The Methodology is consistent with the terminology used in the VCS Program and GHG accounting generally.
- Key words such as must, should and may have been used appropriately and consistently in the Methodology.
• The criteria and procedures were written in a manner that can be understood and applied readily and consistently by project proponents.
• The criteria and procedures were written in a manner that allows projects to be unambiguously audited against them.

Overall, the RCE assessment team concluded that the Methodology structure and clarity meet the VCS requirements.

3.4 Definitions
The RCE assessment team concluded that the Methodology has included all key terms, that they have been defined clearly and appropriately, and that they are consistently used in the Methodology. The RCE assessment team also confirmed that the definitions were listed in alphabetical order and were not already defined in other VCS documents.

3.5 Applicability Conditions
The RCE assessment team concluded that the applicability conditions are appropriate for the project activities targeted by the Methodology and are sufficiently clear for determining which project activities are eligible under the Methodology and which are not.

The applicability conditions represent a carefully targeted positive list. The applicability conditions are written in a sufficiently clear and precise manner. The RCE assessment team believes conformance with the applicability conditions can be demonstrated at the time of project validation.

The applicability conditions in the Methodology and how they address environmental integrity and practical considerations are noted below:

1. Livestock producers must feed their animals a natural feed supplement which reduces enteric CH₄ emissions by direct inhibition of methanogens in the rumen.
   a. This condition ensures that only ruminant animals are eligible, only natural, plant—based supplements can be used and the mode of action to reduce methane emissions.

2. Livestock in the project boundaries must include only ruminant animals.
   a. The condition ensures that only ruminants are eligible.

3. The project feed supplement must meet the following conditions:
   a. The active ingredients of the feed supplement must be 100% natural plant-based or macroalgae-based and non-GMO. This includes extracted components of plants. The feed manufacturer needs to provide a non-GMO certificate based on lab analysis.
      i. This condition ensures that only natural, non-GMO supplements can be used for the project activity, ensuring environmental integrity.
   b. The feed supplement must have been demonstrated to comply with all feed and food regulations in each national or subnational (including local) jurisdiction in which it is consumed. Where conflict arises between regulations, the most stringent standard will apply.
i. This condition ensures that any supplement used for project activities follows all applicable laws and regulations.

c. The feed supplement must have no significant negative health or performance impacts on the animal to which it is fed. Where conflict arises between regulations, the most stringent standard will apply.

i. This ensures that animal health will not be impacted by project activities, as well as ensuring that there is no potential risk of leakage emissions for a decrease in animal productivity.

d. The feed supplement must be used as per feeding instructions provided by the manufacturer. The instructions provide critical defining conditions to secure the default level of reduction of the enteric methane emissions, such as the feeding routine and dose of supplement per kg of DMI to the animal.

i. This condition ensures that emission reductions from feed supplement use will actually occur since variation from manufacturer guidance could lead to different emissions reduction outcomes.

4. Emission reductions generated by the use of other feed supplements and/or activities (e.g. improving animal productivity or nutritional and management strategies), the objective of which does not lead to the inhibition of methanogenesis, cannot be claimed through this methodology. This is to prevent overestimation of emission reductions achieved.

a. This condition ensures that this methodology is limited to a specific type of activity and excludes other potential activities from claiming emission reductions.

5. The implementation of project activities must confirm that the herd of ruminants in a given operation is fed the project feed supplement. For this purpose, the project proponent must be able to trace the feed supplement from on-farm consumption.

a. This condition ensures that the feed supplement is actually fed to a livestock group and it can be confirmed with supporting evidence.

6. The feed manufacturer needs to provide proof of evidence for no increase in the manure emissions due to feed supplementation (e.g., evidence-based literature, peer-reviewed publications, study reports).

a. This condition ensures that emissions from manure from a livestock group are not increased due to supplement use. This allows emissions associated with manure to be excluded from the project boundary, simplifying the monitoring and quantification aspects of the Methodology.

7. Baseline emissions included in this methodology are CH4 production from enteric fermentation and is determined as the average activity over at least three continuous years prior to project implementation. Therefore, the project activities are required to meet the following conditions:

a. Where project areas involve livestock farms that were operating prior to the start of project activities, reliable data (e.g., gross energy intake and dry matter intake) per animal group must be available for a minimum of three years if using Option 2 and two years if using Option 1.
i. This condition ensures that if Option 2 is used to determine baseline emissions that enough historical data will be used to avoid a one-year bias and to provide an average of historical conditions.

b. Where project areas involve livestock farms that no farm records and farming data are available, the project proponent must be able to provide evidence to substantiate the animal group to which each new project area is allocated according to the average group as described in national or regional statistical accounts (i.e., the baseline emissions will be considered as the average activity of where the project is located).

i. This condition ensures that if no data is available then baseline emissions must be determined using regional or national data and that the current livestock groups that are part of the farm are reasonable.

### 3.6 Project Boundary

The project boundary includes:

- All geographic locations where the feed supplement is used in livestock production operations
- The facility or facilities that manufacturer the feed supplement; and
- Transportation of the feed supplement to all livestock production operations.

The GHG sources, sinks and reservoirs (SSRs) included in the Methodology are:

<table>
<thead>
<tr>
<th>Source</th>
<th>Gas</th>
<th>Included?</th>
<th>Justification/Explanation</th>
<th>RCE Assessment Team Conclusion</th>
</tr>
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<tbody>
<tr>
<td>Baseline Enteric Fermentation</td>
<td>CO₂</td>
<td>No</td>
<td>Not included in the project boundary(^1) since these emissions are biogenic and mostly produced by the respiration process.</td>
<td>The exclusion of CO₂ is appropriate.</td>
</tr>
<tr>
<td></td>
<td>CH₄</td>
<td>Yes</td>
<td>CH₄ emissions from enteric fermentation, prior to the project technology implementation, represent the major source of emissions in the baseline scenario.</td>
<td>The inclusion of CH₄ is appropriate as it is the main source of emissions.</td>
</tr>
<tr>
<td></td>
<td>N₂O</td>
<td>No</td>
<td>Not a by-product of the</td>
<td>The exclusion of N₂O is</td>
</tr>
</tbody>
</table>

\(^1\) Carbon dioxide and methane are produced during the fermentation of carbohydrates. They are either removed through the rumen wall or lost by eructation (belching). Some carbon dioxide is used by the intestinal microbes and by the animal to maintain bicarbonate levels in saliva. Methane cannot be used by the animal’s body systems as a source of energy.
<table>
<thead>
<tr>
<th>Source</th>
<th>Gas</th>
<th>Included?</th>
<th>Justification/Explanation</th>
<th>RCE Assessment Team Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enteric Fermentation</td>
<td>CO₂</td>
<td>No</td>
<td>Not included in the project boundary(^2) since these emissions are biogenic and mostly produced by the respiration process.</td>
<td>The exclusion of CO₂ is appropriate.</td>
</tr>
<tr>
<td></td>
<td>CH₄</td>
<td>Yes</td>
<td>CH₄ emissions from enteric fermentation are the major source of emissions in the project scenario.</td>
<td>The inclusion of CH₄ is appropriate as it is the main source of emissions.</td>
</tr>
<tr>
<td></td>
<td>N₂O</td>
<td>No</td>
<td>Not a by-product of the enteric fermentation process and is not expelled by the animal through burping.</td>
<td>The exclusion of N₂O is appropriate.</td>
</tr>
<tr>
<td>Supplement Production</td>
<td>CO₂</td>
<td>Yes</td>
<td>CO₂ emitted from supplement production, transportation and production.</td>
<td>The inclusion is appropriate for the use of electricity of combustion of fossil fuels.</td>
</tr>
<tr>
<td></td>
<td>CH₄</td>
<td>Yes</td>
<td>CH₄ may be emitted from combustion of fossil fuels during the processing.</td>
<td>The inclusion is appropriate for the combustion of fossil fuels.</td>
</tr>
<tr>
<td></td>
<td>N₂O</td>
<td>No</td>
<td>N₂O emissions are not expected during the production process.</td>
<td>The exclusion is appropriate.</td>
</tr>
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Overall, the RCE assessment team concluded that the project boundary is appropriate for the project activities in the Methodology.

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\(^2\) Carbon dioxide and methane are produced during the fermentation of carbohydrates. They are either removed through the rumen wall or lost by eructation (belching). Some carbon dioxide is used by the intestinal microbes and by the animal to maintain bicarbonate levels in saliva. Methane cannot be used by the animal’s body systems as a source of energy.
3.7 Baseline Scenario
The Methodology employs the project method for baseline crediting. The baseline scenario is the continuation of livestock operations following business as usual practices (i.e., typical feeding regime without using a natural feed supplement to reduce CH4 enteric fermentation).

The RCE assessment team determined that the baseline was appropriate for the project activities covered by the Methodology and agrees with the criteria and procedures for determining the baseline scenario.

3.8 Additionality
The Methodology uses an activity method to determine additionality. First, projects must demonstrate regulatory surplus as required by the VCS Standard. Second, the Methodology employs a positive list, which is represented by the applicability conditions found in the Methodology. The positive list was established using the activity penetration Option A and the analysis is found in Appendix I of the Methodology. Mootral provided sufficient evidence to demonstrate that natural feed supplements to reduce enteric methane emissions in ruminants is not employed currently in livestock operations at any scale. Mootral found some evidence of some supplements being used at certain times in the past decade and used this information to develop a conservative estimate of observed activity (OA). Mootral also provided evidence and an analysis for the determination of the maximum adoption potential (MAP) of the project activity. The RCE assessment team agrees with the determination of the current activity penetration of the project activity (AP) and concludes that the criteria and procedures to determine additionality are appropriate.

The applicability conditions are sufficient to ensure that projects meeting them are additional, while also ensuring that non-additional projects cannot use the methodology. This is primarily accomplished by the requirement to use natural feed supplements in livestock operations and other criteria noted in the applicability conditions.

3.9 Quantification of GHG Emission Reductions and Removals

3.9.1 Baseline Emissions
Baseline emissions in the Methodology can calculated using three different options.

Option 1 calculates the baseline emissions by performing direct enteric methane emission measurements to estimate the enteric emission factor for each animal group. The enteric emission factor is an estimate of the methane production per animal group per day (EF_{Production}). The direct measurements could be completed using a variety of technologies, some of which are noted in an Appendix II of the Methodology. The direct measurements of enteric methane emissions could be taken prior to project implementation with a sample for each animal group subsequently included in the project. Alternatively, a control group for each animal group can be used during project implementation, thus allowing baseline monitoring and project monitoring to occur simultaneously. The control group is used as a baseline measure and is identical to all other animals with the exception that it does not receive the feed supplement. The equations and formulas used in the calculation of this component are appropriate and without error.

Option 2 provides procedures to calculate the enteric emission factor for each animal group by applying an IPCC Tier 2 method. Data used in Option 2 must be available for three years prior to the project activity beginning. The Methodology provides appropriate default emission factors. The emission factors
are from reputable sources and were found to be reasonable and correctly applied for the project activities in the Methodology.

Option 3 is only suitable for animal species listed in Table 4 of the Methodology, which are less-common ruminants and can only be used if Option 2 is not possible. Option 3 utilizes emission factors from country or regional specific factors or the IPCC for Tier 1 methods. Due to the uncertainty associated with the IPCC default emission factors a discount factor must be applied to ensure baseline emissions are conservative.

The RCE assessment team concludes that the procedures for calculating baseline emissions are appropriate for the project activities covered by the Methodology and that all GHG sources, sinks and reservoirs in the project boundary are covered.

3.9.2 Project Emissions

Project emissions in the Methodology are comprised of three components.

The first component is the enteric methane emission factor as determined in the baseline emissions section of the Methodology.

The second component is enteric methane emissions reduction factor, which represents the supplement’s percentage reduction of the enteric methane per animal during the monitoring period. There are two options to determine the enteric methane emissions reduction factor. Option 1 uses a default enteric emission reduction factor estimated by the manufacturer of the feed supplement. This option may only be used where the enteric methane emission reduction factor provided by the manufacturer of the feed supplement is supported by peer reviewed literature or farm-specific emissions data. Additionally, there must be no significant differences between project parameters (e.g., feed regime, animal type, weight, production phase, geographic region, and management practices) and the manufacturer’s supporting documents. If there are significant differences between the project parameters and the manufacturer’s supporting documents, the project will need to use Option 2. Option 2 determines the enteric methane emissions reduction factor for each animal group by performing direct enteric methane measurements to estimate the methane production per animal group per day during the monitoring period, using a technology (or something similar) found in Appendix II of the Methodology. The feed supplement’s enteric emission reduction factor will be quantified by comparing actual project performance to enteric emission factors determined when quantifying baseline emissions.

The third component is the emissions from electricity consumption and fossil fuel combustion at the project production facility as well as emissions associated with the transport of the supplement to a livestock operation that is part of a project. These emissions are based on any electricity or fossil fuels used and applicable emission factors for each fuel type. The RCE assessment team found this quantification and the emission factors reasonable and appropriate.

The RCE assessment team concludes that the procedures for calculating project emissions are appropriate for the project activities covered by the Methodology and that all GHG sources, sinks and reservoirs in the project boundary are covered.

3.9.3 Leakage

The Methodology identifies one potential source of leakage if project activities negatively affect animal performance. The risk of activity shifting is very low as farmers tend to be risk averse and will not allow a
negative performance impact on animals. In addition, this leakage risk is dealt with by applicability condition 3c of the Methodology.

The RCE assessment team concludes that the procedures in the Methodology to address leakage are sufficient and appropriate.

3.9.4 Net GHG Emission Reductions and Removals
Net GHG emissions reductions and removals are calculated by subtracting project emissions from baseline emissions. The RCE assessment team concludes that this calculation is appropriate for project activities.

3.10 Monitoring
The Methodology appropriately includes all necessary data, parameters and procedures for monitoring. In addition, the Methodology will allow project proponents to develop a monitoring plan to ensure that that GHG emission reductions and removals are monitored and reported appropriately. A summary table of all parameters and the RCE assessment team’s conclusion is below.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>RCE Assessment Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE&lt;sub&gt;i&lt;/sub&gt;</td>
<td>All information for this parameter is appropriate. Values to be calculated based on three continuous years of historical data.</td>
</tr>
<tr>
<td>DMI&lt;sub&gt;i&lt;/sub&gt;</td>
<td>All information for this parameter is appropriate. Values to be calculated based on three continuous years of historical data.</td>
</tr>
<tr>
<td>Ym&lt;sub&gt;i&lt;/sub&gt;</td>
<td>All information for this parameter is appropriate. Country or regional and population specific values should be used when available or default values.</td>
</tr>
<tr>
<td>NDF&lt;sub&gt;i&lt;/sub&gt;</td>
<td>All information for this parameter is appropriate. Values to be calculated based on three continuous years of historical data.</td>
</tr>
<tr>
<td>ED</td>
<td>All information for this parameter is appropriate. Values to be calculated based on default values or farm specific data.</td>
</tr>
<tr>
<td>EC</td>
<td>All information for this parameter is appropriate. Value to be sourced from IPCC 2006 guidance.</td>
</tr>
<tr>
<td>EF&lt;sub&gt;Enteric&lt;/sub,i&lt;sub&gt;j&lt;/sub&gt;</td>
<td>All information for this parameter is appropriate. Values to be calculated using one of the three options noted for baseline emissions.</td>
</tr>
<tr>
<td>GWP of CH&lt;sub&gt;4&lt;/sub&gt;</td>
<td>All information for this parameter is appropriate. GWP is sourced from IPCC 4&lt;sup&gt;th&lt;/sup&gt; Assessment Report.</td>
</tr>
</tbody>
</table>
### Data and Parameters Monitored

<table>
<thead>
<tr>
<th>Parameter</th>
<th>RCE Assessment Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>( N_{ij} )</td>
<td>All information for this parameter is appropriate. Methodology provides adequate guidance on how to determine averages of livestock population. The measurement procedures and QA/QC procedures are sufficient to ensure accurate population values.</td>
</tr>
<tr>
<td>Days</td>
<td>All information for this parameter is appropriate. The measurement procedures and QA/QC procedures are sufficient to ensure accurate accounting of days when the supplement is used.</td>
</tr>
<tr>
<td>( j )</td>
<td>All information for this parameter is appropriate. The measurement procedures and QA/QC procedures are sufficient to ensure that all livestock groups are accounted for.</td>
</tr>
<tr>
<td>FM</td>
<td>All information for this parameter is appropriate. The measurement and documentation procedures and QA/QC procedures are sufficient to ensure that the amount of supplement purchased and used during the monitoring period is correct.</td>
</tr>
<tr>
<td>( EF_P )</td>
<td>All information for this parameter is appropriate. The measurement procedures and QA/QC procedures are sufficient.</td>
</tr>
<tr>
<td>( EF_{T1} )</td>
<td>All information for this parameter is appropriate. The measurement procedures and QA/QC procedures are sufficient.</td>
</tr>
</tbody>
</table>
4 ASSESSMENT CONCLUSION

The RCE assessment team concludes, without limitation, that the Methodology titled “Reduction of Enteric Methane Emissions from Ruminants Through the Use of 100% Natural Feed Supplement,” version 10, October 31, 2019, complies with all assessment criteria.

5 REPORT RECONCILIATION

Not applicable.

6 EVIDENCE OF FULFILMENT OF VVB ELIGIBILITY REQUIREMENTS

RCE met the eligibility requirements set out in the VCS Methodology Approval Process and VCS Standard based on its experience and accreditation in VCS Sectoral Scope 15 – Livestock and Manure Management and ANSI Sectoral Scope 5. In addition, RCE included a standardized methods expert as part of the assessment team, meeting VCS requirements.
7 SIGNATURE

Signed for and on behalf of:

Name of entity:  _Ruby Canyon Engineering, Inc._

Signature:  

Name of signatory:  _Zach Eyler_

Date:  _November 7, 2019_
APPENDIX A – DOCUMENTS REVIEWED


6. FAOSTAT. FAO Statistical Database. HTTP://WWW.FAO.ORG/FAOSTAT/EN/


APPENDIX B – SUMMARY OF FINDINGS
### CAR 1
A variety of edits and comments have been noted relating to clarity, grammar, references and using consistent language throughout the methodology.

**Reference**

**Project Proposal Response**

**RCS Response**

**Additional Project Proposal Response**

**Additional RCS Response**

**Open or Closed**

Closed

### CAR 2
Direct measurement approach (baseline and project) lacks specificity and structure. While three potential technologies are listed as options, we have the following questions concerns: 1) The minimum criteria or guidelines or sampling and measurement analysis (there are many, how many are used, independently used, etc). No clear procedures centre core project proponents and site visits possible to significant differences between projects? 2) As discussed, he VCS standard guidelines are several reason why a direct inhibition is very unlikely to cause a change in the composition of the manure which leads to more or less biogas production. Please see updated text section 5.3.4

**Reference**

**Project Proposal Response**

**RCS Response**

**Additional Project Proposal Response**

**Additional RCS Response**

**Open or Closed**

Closed

### CAR 3
Uncertainty is mentioned for many parameters (defaults or measured) throughout the methodology, and there is no sound approach or methodology with this in the methodology. Any uncertainty must be dealt with in a conservative manner (e.g. discount factor, confidence limits, etc.)

**Reference**

**Project Proposal Response**

**RCS Response**

**Additional Project Proposal Response**

**Additional RCS Response**

**Open or Closed**

Closed

### CAR 4
A direct inhibition is very unlikely to cause a change in the composition of the manure which leads to more or less biogas production. Please see updated text section 5.3.4

**Reference**

**Project Proposal Response**

**RCS Response**

**Additional Project Proposal Response**

**Additional RCS Response**

**Open or Closed**

Closed

### CAR 5
Uncertainty is mentioned for many parameters (defaults or measured) throughout the methodology, and there is no sound approach or methodology with this in the methodology. Any uncertainty must be dealt with in a conservative manner (e.g. discount factor, confidence limits, etc.)

**Reference**

**Project Proposal Response**

**RCS Response**

**Additional Project Proposal Response**

**Additional RCS Response**

**Open or Closed**

Closed

### CAR 6
Uncertainty is mentioned for many parameters (defaults or measured) throughout the methodology, and there is no sound approach or methodology with this in the methodology. Any uncertainty must be dealt with in a conservative manner (e.g. discount factor, confidence limits, etc.)

**Reference**

**Project Proposal Response**

**RCS Response**

**Additional Project Proposal Response**

**Additional RCS Response**

**Open or Closed**

Closed
**Q1:** Equation 7 for EFME needs to be expanded to include enacted. The source for EFp and EFt is stated as the manufacturer – will they provide a CO2e value?

**Q2:** Not applicable. Not expected in production process. Please see updated version.

**Q3:** Not applicable. Manufacturer needs to demonstrate that there will be no impact in the emissions from the manure. For project emissions from manure – how will this be calculated? This section 4.7.2.

**Q4:** Appropriability condition 6.

- **CAR 11**
  - The methodology states that there are no leakage emissions expected, however there is some leakage from milk production or other production parameters decreases as a result of supplement. The leakage risk is dealt with by applicability condition 6b. It would be more accurate to note this in the methodology baseline section. Please update.

**CL 1**

- **AS**
  - There is no clear statement on the methodology or the methodology that there are no leakage emissions expected, however there is some leakage from milk production or other production parameters decreases as a result of supplement. The leakage risk is dealt with by applicability condition 6b. It would be more accurate to note this in the methodology baseline section. Please update.

**CL 2**

- **AS**
  - The methodology provides an overview of different options allowed in the methodology. There are scientific articles discussing different options/solutions to reduce enteric methane emissions, but not all the options in our knowledge, only those two sources have information on commercially available solutions. We can also find some information in Table 5 of this publication. There are scientific articles discussing different options/solutions to reduce enteric methane emissions, but not all the options in our knowledge, only those two sources have information on commercially available solutions. We can also find some information in Table 5 of this publication.

**CL 3**

- **AS**
  - There are scientific articles discussing different options/solutions to reduce enteric methane emissions, but not all the options in our knowledge, only those two sources have information on commercially available solutions. We can also find some information in Table 5 of this publication. There are scientific articles discussing different options/solutions to reduce enteric methane emissions, but not all the options in our knowledge, only those two sources have information on commercially available solutions. We can also find some information in Table 5 of this publication.

**CL 4**

- **AS**
  - There are scientific articles discussing different options/solutions to reduce enteric methane emissions, but not all the options in our knowledge, only those two sources have information on commercially available solutions. We can also find some information in Table 5 of this publication. There are scientific articles discussing different options/solutions to reduce enteric methane emissions, but not all the options in our knowledge, only those two sources have information on commercially available solutions. We can also find some information in Table 5 of this publication.
The limitations of the supplement being 100% natural plant-based or macronutrient based and non-GMO was mentioned by multiple commenters. Can you please expand further on this limitation and the reason for it? Is there a barrier in the use of a synthetic supplement? The methods proposed to determine eligibility only applicable to natural supplements? I would think that “synthetic” would be the greatest possible project impacts of this methodology and corresponding emission reductions. It is possible modify the methodology in the future, but why not include it now?

Thanks for the additional information and I can see the benefits of natural supplements as compared to synthetic. There is no reason why the suggestions by other commenters asking about chemically extracted components or reduced identical substitutions were not included in the methodology? These edits seem reasonable.

As we discussed this methodology doesn’t present chemically extracted components, because identical substances can still fall under synthetic. In the context of current developments in scientific literature, regulation and in view of societal expectations, the use of chemical additives and antibiotics should be avoided.

Acceptable. Perhaps redundant, but I included include chemically extracted components in applicability conditions to make sure it is 100% clear.

The project boundary could include emissions associated with leakage as defined by VCS “Leakage [is] attributable to the project or program,” but are attributable to the project or program? 

VCS Standard

Applicability condition 3e states that there must be no negative health or performance impacts to the animal to which it is fed. This is a broad statement and could be open to interpretation, especially if this component is being used to maintain any emission leakage risk. Please clarify what it impact on health or performance is acceptable and consider including more specifically in the provision.

VCS Standard

Applicability condition 3d. You have addressed this question in the public comments, but we would like further justification for the 15% cutoff. I understand that you are seeking technologies with significant impact, but including one that reduces emission by 15% seems arbitrary. A 15% reduction in emissions would benefit. Also, what happens if this condition is not met throughout the entire period? Are credits are allowed during a monitoring period alone or >15% reduction?

VCS Standard

There are several existing enteric methane mitigation strategies reported in the literature (Knapp et al 2014; Boadi et al 2004). Mitigation strategies that reduce methane emissions are (1) Improving livestock productivity, (2) Nutritional and management strategies and (3) Manipulation of rumen fermentation.

VCS Standard

We have chosen this value to ensure that the methodology is used for technologies/solutions which have a significantly greater impact vs improvement of farming practices, therefore, reducing methane emissions is deemed “additional” to existing methane mitigation practices. Table 1 and 2, provide a summary of feeding management and mitigation approaches to alter feeding management and reducing CH4 emissions. The range of reduction varies depending on the strategy. The selection of 15% threshold derived from these tables and it reflects the savings of the lower values reported.

VCS Standard

There are changes made to the methodology activities associated with improved feeding practices, decreased (GHE) intensity of milk production or improved animal health practices are achieved some entered CH4 reduction without the need of a feed supplement (Knapp et al 2014), but such emission reductions cannot be quantified with this methodology. Also, there are existing methodologies “CDM SSC-NM094: Strategic supplementation of a smallholder dairy sector to increase productivity and reduce methane emissions” that allows to reduce methane emissions per unit of milk production via improved nutritional conditions of feeding animals in the project.

VCS Standard

The neutral detergent fiber (NDF) provides information to the quality of the feed. For table 6, when the quality of the feed is good the lower bounds should be used (above 50% would be considered poor). For grass forages, NDF < 50% would be considered high quality and > 60% as low quality. For table 6, when the quality of the feed is good the lower bounds should be used (above 50% would be considered poor). For grass forages, NDF < 50% would be considered high quality and > 60% as low quality.
APPENDIX C – STAKEHOLDER COMMENTS
The reduction of enteric methane emissions from ruminants through the use of 100% natural feed supplement

Not all of the animals in Table 5 are ruminants. This is confusing and in addition the fermentation process is different for each group of animals. Therefore, enteric emission reduction factor might be different and should be measured for each group of animals.

We agree with the comment. We included only the ruminants in Table 5 and not all animals that produce enteric CH4.

EFEntericij Option 1

Not all of the animals in... they are the chemical equivalent of natural ingredients, but chemically synthesized rather than being extracted from source materials) to the animal and that the results are published in a peer-reviewed paper.

The paragraph in the methodology refers to the enteric methane production especially in the rumen and not to methane production in any other part of the digestive tract. Therefore, we have changed the definition after taking all the public comments into consideration.

We have changed this value in order to ensure that the methodology is used for technologies/solutions which have a significantly greater impact on improvement of farming practices. CH4 mitigation activities associated with improved feeding practices, decreased CH4 intensity of milk production or improved animal health practices can achieve some enteric CH4 reduction without the need for a feed supplement (Knapp et al. 2014), but such emission reductions cannot be quantified with this methodology. Table 1 in Knapp et al. (2014) provides a summary of feeding management approaches to alter rumen fermentation and reducing CH4 emissions, the range of reduction varies from 0–2% and 20% in a single cow/cows/p遗传 vaiation from this table.

We have changed the definition after taking all the public comments into consideration.

There is no scientific reason to have such an arbitrary default value and a substantial impact can be achieved with a 17% reduction as well. It is more important that in addition to the VCS Standard guidelines (4.1.7 and 4.5.6), the effect of the reduction factor has been proven not only by in vitro but also by individual studies according to EFSA guidelines (or similar) for animal trials and that the results are published in a peer-reviewed paper.

The methodology provides procedures for a plant-based technology and we cannot foresee the applicability conditions for different technologies, such as a chemical product, that may have the same mode of action. Therefore a project developer could always request amendment of the methodology to avoid having two similar methodologies.

We have changed 17% to 20%.

There is some additional information in the Annex, but more specifications on the level of detail is needed. Such as: feed supplements could impact the portion of protein, carbohydrates and fats in the excreted faeces that are available as food and contribute 17% to global methane emissions whereas manure just contributes 2% (review Knapp et al. 2014).

According to VCS guidelines on factor, indicator, data etc provided must meet the requirements of VCS Standard guidelines (4.1.7 and 4.5.6) as supporting data are reviewed by an appropriately qualified, independent organization.

The emission reduction calculation follows this form: 1. Section 3.1.1 Baseline emissions 2. Have you performed a planned-off site farm measurements? If yes use option , which suggests an enteric emission factor for each animal group by performing direct enteric methane measurements to estimate the production per animal group per day (enteric emissions production factor for each animal group measured by the chosen technology must be available for each validation and verification).

We have responded to the appropriate comment.

The substrate, which has not been converted into methane during digestion, can theoretically lead to increased methane emissions during subsequent manure storage (especially when stored in liquid form) and not methane production in manure. "Enteric methane is mainly produced in the rumen and just to a smaller extent in the large intestine. Feed supplements cannot change anything on this ratio."

The comments/references (Kühl et al, 2002, Müller et al 2013) refer to the impact of feed supplements on the rumen. This is a different source of methane than enteric methane emissions and not the scope of this methodology.

According to the paragraph in the methodology refers to the enteric methane production especially in the rumen and not to methane production in manure. "Enteric methane is mainly produced in the rumen and just to a smaller extent in the large intestine. Feed supplements cannot change anything on this ratio."

We have updated based on RCE review and this provision has been removed.

We have responded to the appropriate comment.

There is some additional information in the Annex, but more specifications on the level of detail is needed. Such as: feed supplements could impact the portion of protein, carbohydrates and fats in the excreted faeces that are available as food and contribute 17% to global methane emissions whereas manure just contributes 2% (review Knapp et al. 2014).

We have responded to the appropriate comment.

There is some additional information in the Annex, but more specifications on the level of detail is needed. Such as: feed supplements could impact the portion of protein, carbohydrates and fats in the excreted faeces that are available as food and contribute 17% to global methane emissions whereas manure just contributes 2% (review Knapp et al. 2014).

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There is some additional information in the Annex, but more specifications on the level of detail is needed. Such as: feed supplements could impact the portion of protein, carbohydrates and fats in the excreted faeces that are available as food and contribute 17% to global methane emissions whereas manure just contributes 2% (review Knapp et al. 2014).

We have responded to the appropriate comment.

No new comments....
According to Equation 4, the data in Table 5 has to be converted into values per day. How is this conversion done? If divided by constant (365 days), then seasonal fluctuation is neglected. This is problematic if not a complete year is monitored.

The methodology encourages country or regional specific data to reflect the ruminants' characteristics as well as seasonal fluctuations. Please see section 9.1: "The project proponent must provide evidence to demonstrate the level of enteric CH4 production during the baseline scenario. Country or regional specific EF values should be used, when available, to reflect the ruminant's characteristics. If not available, use the default values provided in Table 5."

The IPCC Guidelines for National Greenhouse Gas Inventories is internationally recognized and the data provided in the guidelines is peer reviewed.

The reference is from IPCC. ENTERIC FERMENTATION EMISSIONS FACTORS for Livestock species in the table are Buffalo, Sheep, Goats, Camels, Horses, Mules and Asses, Swine, and Poultry. FAO: http://www.fao.org/gleam/results/en/

Table 5: Not all of the animals in Table 5 are ruminants. The idea of the Methodology is to reduce CH4 emissions from ruminants. Table 5 should be adapted.

Comment responded to appropriately and methodology updated.
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Text Passage</th>
<th>Comment</th>
<th>Answers</th>
<th>Corrections</th>
<th>RCE Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>2a. The active ingredients of the feed supplement must be 100% natural plant-based and non-GMO.</td>
<td>The eligibility requirement that the feed additive be 100% plant based and non-GMO seems to unnecessarily exclude other feed additive types from utilizing this methodology. If there are other eligibility requirements to demonstrate the effectiveness of the feed additive, and a threshold for performance, that should be sufficient, as long as the product is approved by any applicable regulatory body.</td>
<td>This methodology provides procedures for a plant based technology and we cannot foresee the applicability conditions for different technologies, such as a chemical product, that may have the same mode of action. Therefore a project developer could always request an amendment of the methodology to avoid having two similar methodologies. However in order not to exclude technologies based on plant-like organisms we modified the definition in the following “The active ingredients of the feed supplement must be 100% natural plant or macroalgae based and non-GMO.”</td>
<td>Section 4 point 2a. Pg7</td>
<td>The methodology has chosen to focus on natural and plant based supplements to ensure environmental integrity. Synthetic supplements could be included at a later time with a methodology revision. Comment responded to appropriately.</td>
</tr>
</tbody>
</table>
Feedback on VCS draft methodology: Methodology for the Reduction of Enteric Methane Emissions from Ruminants through the Use of 100% Natural Feed Supplements

by Dr. Jacqueline Gehrig-Fasel (TREES Consulting), March 28, 2019 (DSM’s consultant)

<table>
<thead>
<tr>
<th>Methodology Section</th>
<th>Paragraph</th>
<th>Page</th>
<th>Topic</th>
<th>Question / Comment</th>
<th>Answers</th>
<th>Correction</th>
<th>RCE Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary</td>
<td>5</td>
<td></td>
<td></td>
<td>&quot;...applying empirically-derived regional emission reduction factor provided by the supplement manufacturer...&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

What scientific evidence is required for accuracy/applicability of the regional emission factors provided by the manufacturer? Are other sources also applicable (e.g., scientific research results not provided by the supplement manufacturer)?

Please see section 8.2-"EF/Enteric Option 1: Apply the default enteric emission reduction factor estimated by the manufacturer of the feed supplement and calculate the emissions using equation 5.5 This option may only be used where the enteric emission reduction factor provided by the manufacturer of the feed supplement is supported by peer reviewed literature or farm-specific emissions data. This information must be provided for review at validation and verification. Additionally, there must be no significant differences in project parameters (e.g., feed regime, geographic region, and management practices) from the manufacturer’s supporting documents."

Please see footnote 5 "The default factor provided by the manufacturer must meet the requirements of VCS Standard guidelines (4.1.7 and 4.5.6) as supporting data are reviewed by an appropriately qualified, independent organisation."

4. Applicability Conditions 2a | 7 | 100% natural plant-based and non-GMO." | What is the reason for this requirement? There does not appear to be a content-based rationale behind this in the methodology. Consequently, more detailed specification and rationale is needed for "100% natural plant-based". E.g. does this include chemically extracted components of plants? What about nature identical substances?

This methodology provides procedures for a plant based technology and we cannot foresee the applicability conditions for different technologies, such as a chemical product, that may have the same mode of action. Therefore a project developer could always request an amendment of the methodology to avoid having two similar methodologies. However in order not to exclude technologies based on plant-like organisms we modified the definition in the following: "The active ingredients of the feed supplement must be 100% natural plant or macroalgae based and non-GMO."

4. Applicability Conditions 5a | 8 | "...there is no change in such activities due to the project." | How is this ensured (e.g. no change in feed composition and sources to increase impact of feed supplement)?

This sentence is referring to the farm's operations which would have occurred either way, with or without the project.

Comment addressed in the methodology and many of these specific requirements will be confirmed during validation/verification.

5. Project Boundary first paragraph | 8 | "...there is no change in such activities due to the project." | This sentence is referring to the farm's operations which would have occurred either way, with or without the project.

Comment addressed in the methodology.
What evidence is required to prove negligibility? In some cases growing and harvesting, processing and transport of the natural components for the supplement production could be considerable. Transparency on emissions from production and transport should be provided. Feed production, including the feed supplement, is excluded as upstream production or other agricultural inputs are not impacted by the implementation of the project and as such the baseline and project conditions will be functionally equivalent. The feed supplement is considered to be part of the feed production. Therefore it is the responsibility of the feed supplement manufacturer to be transparent on its own carbon footprint.

We agree that the current statement “There would be some small additional upstream emissions in feed supplement manufacture and transport, which are considered negligible in this methodology.” might not be the case for all feed supplement and will therefore change the wording in the following: “There would be some additional upstream emissions in feed supplement manufacture and transport, which are not considered in this methodology. It is, therefore, the responsibility of the feed supplement manufacturer to be transparent on the carbon footprint of the feed supplement production.”

Section 5 justifies why N2O are not part of the methodology. The paragraph in section 5 refers to the enteric methane production especially in the ruminants and not to methane production in manure. “Enteric methane is mainly produced in the rumen and just to a smaller extent in the large intestine. Feed supplements cannot change anything on this ratio.”

The comments/ references (Külling et al. 2002, Møller et al 2014) refer to the impact of feed supplements on the manure. This is a different source of methane than enteric methane emissions and not the scope of this methodology. Feed supplements could impact the portion of protein, carbohydrates and fats in the excreted faeces that are available as food and energy for growth of anaerobic bacteria in manure and therefore impact the microbiome indirectly in the manure. The scope of this methodology is enteric methane emissions and not methane emissions in manure so far as enteric fermentation contributes 17% to global methane emissions whereas manure just contributes 2% (review Knapp et al. 2014).

Methodology addressed comments by excluding manure emissions from the boundary (and having to prove that any supplement would not increase emissions).

Methodology is sufficient and decision tree shows options clearly. Methodology now includes discount factor if using default values and any direct measurements need to take into account uncertainty per VCS guidelines.

Methodology addressed comments by excluding manure emissions from the boundary (and having to prove that any supplement would not increase emissions).

Methodology now includes discount factor if using default values and any direct measurements need to take into account uncertainty per VCS guidelines.

Methodology addresses this comment.
6.1 Baseline Emissions

Eq.3 Option 2: Conversion factor (Ym)
Default IPCC conversion factors are applied per animal category. These factors have been shown to be imprecise and not suitable for project-level application due to dependencies on various factors (e.g. feed composition, climate,...) and errors up to 30% (IPCC 2006 Vol 4 Ch 10, Table 10.12 and 10.13).
Methodology indicates dependency on “quality of feed” (“high digestibility and energy value”) but does not further specify classification.

Country or regional and population specific Ym values should be used when available to better reflect the ruminants’ population characteristics. Default values provided in the IPCC guidelines (Section 10.3.1, p. 10.10) may be used as an alternative if regional values are not available.
Methodology now includes discount factor if using default values to ensure conservativeness.

Eq.4 Default emission factors
High-level default IPCC conversion factors are applied per animal category. These are per-head EJ% not suitable for conservative project-level application due to high errors (+30-50%, according to IPCC 2006 Vol 4 Ch 10, Table 10.10).
The methodology encourages country or regional specific data to reflect the ruminants’ characteristics as well as seasonal fluctuations. Please see section 9.1 “The project proponent must provide evidence to demonstrate the level of enteric CH4 production during the baseline scenario.

Country or regional specific EF values should be used, when available, to reflect the ruminant’s characteristics. If not available, use the default values provided in Table 5.”
The IPCC Guidelines for National Greenhouse Gas Inventories is internationally recognized and the data provided in the guidelines is peer reviewed. Please see table 5 “Note: All estimates are +/-20% Sources: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 10, Table 10.10. and background paper by Ulyatt, J. et al.”
Methodology now includes discount factor if using default values to ensure conservativeness.

Table 5 13 Horse, mule/ass, swine, poultry
Horse, mule/ass, swine, and poultry are not ruminants: remove from table as the methodology is limited to ruminants only.
We agree with the comment. We included only the ruminants in table 5 and not all animals that produce enteric CH4.
Methodology corrected for this comment.

Table 5 13 Number of animals
The proposed equation does not take into account differences in animal count between Baseline and Project (or at least does not explicitly state that “BEEnterici” would have to be calculated with project herd structure and animal count).
If unchanged number of animals is presumed, a respective applicability condition should be added. However, as such herd fluctuations are very common, an approach to account for change in animal numbers should be added.
Methodology corrected for this comment.

Eq.6 14 emission factors (defaults)
Defaults per group (EFEnterici,j) need to be calculated with correct number of animals (project scenario) in each group. This is not specified explicitly (just that the baseline equations should be used).
The number of animals in each group for baseline and project is the same.
Methodology is sufficient.

Eq.5 15 Supplement production and transport
Emissions from production and transportation of the supplement are missing. The project level assessment of transportation of feed supplement, where applicable, shall be included in project boundary. Also, depending on the ingredients used for the supplement, significant emissions might arise from growth and harvest. Instead of general exclusion of these emission sources, they should be generally included (unless otherwise shown).

Feed production, including the feed supplement, is excluded as upstream production or other agricultural inputs are not impacted by the implementation of the project and as such the baseline and project conditions will be functionally equivalent. The feed supplement is considered to be part of the feed production. Therefore it is the responsibility of the feed supplement manufacturer to be transparent on its own carbon footprint.
We agree that the current statement “There would be some small additional upstream emissions in feed supplement manufacture and transport, which are considered negligible in this methodology.” might not be the case for all feed supplement and will therefore change the wording in the following: “There would be some additional upstream emissions in feed supplement manufacture and transport, which are not considered in this methodology. It is, therefore, the responsibility of the feed manufacturer to be transparent on the carbon footprint associated with the manufacturing and transport of supplements are within the boundary and accounted for.

8.3 Leakage

Eq.2 26 Activity shift due to potential change in milk production
No consideration of decreasing emissions due to decreasing production (i.e. leakage), as supplements may have impacts on milk production, thus making it necessary to consider leakage from activity shift.
Applicability condition 2b: “...and must have no negative health or performance impacts on the animal to which it is fed.”
Section 4: point 2b, Pg7 Methodology has applicability condition that deals with this comment.

9.1 Data and Parameters Available at Validation

First Table 15 Parameter GEj
Equation error: Should Be GEj = DMj/Energy Density Correct: DM = GE/Energy density
https://www.journalofdairyscience.org/article/S0022-0302(17)30988-6/pdf
Parameter GEj; Section 9.1, pg 25
Methodology corrected for this comment.

General
Current loose approaches (e.g. no proof of effects of feed supplement trough in vivo trials) require very deep knowledge of VVB / auditor to assess applicability and conservativeness of parameters applied. This could become a liability for VCS as VVBs may not have specialists with animal nutrition and calculations and experience.

NA Comment addressed through requirements in methodology and VCS standards on default factors.
| General | GHG scope | **No emission accounting from manure is provided. Inclusion of manure in feed-related methodologies is common practice, e.g. in the Alberta protocol, or the Gold Standard feed additive methodology “Reducing Methane Emissions from Enteric Fermentation in Dairy Cows through Application of Feed Supplements”. Manure emissions are tracked in these methodologies to assess potential changes due to the project activity (increase or decrease), i.e. as a consequence of feeding a supplement or changing feed. How can the methodology developer be sure that any supplement feed by anyone does not have an effect?**

Please see paragraph in section 5. “Note that ruminants release methane by exhaling the gas mainly through their mouth and nostrils. Enteric CH4 is produced mainly in the rumen (90%) and, to a smaller extent (10%), in the large intestine (Muray et al., 1999; Dixi et al., 2012). Feed supplements that inhibit rumen methanogenesis cannot influence the ratio of enteric methane emissions in exhaled air compared to methane emissions in extracted feces due to the ruminants' physiology.”

Our methodology refers to the enteric methane production especially in the rumen and not to methane production in manure.

Feed supplements could impact the portion of protein, carbohydrates and fats in the excreted

Methodology addressed comments by excluding manure emissions from the boundary (and having to prove that any supplement would not increase emissions).

***Methodology now includes discount factor if using default values to ensure conservativeness.*** | NA |
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<th>Corrections</th>
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<td>Clause No 1 – the methodology cites an Alberta protocol: “Quantification Protocol” approved by the Alberta Offset System: Quantification protocol for reducing days on feed for beef cattle”. That is not the correct title and version of the current Alberta Protocol. It should read: “Quantification protocol for reducing greenhouse gas emissions from fed cattle” (version 3.0), February 2016.</td>
<td>Ok. “Quantification Protocol” approved by the Alberta Offset System: Quantification protocol for reducing days on feed for beef cattle” Replaced by: Quantification protocol for reducing greenhouse gas emissions from fed cattle (version 3.0)</td>
<td>pg 5 Methodology updated for this comment.</td>
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<td>Clause 4.2d – For a public review, it would be advisable to have some substantiation of why there is a cut-off at 17% emission reductions. Citing a manufacturer’s claims on enteric methane emissions reduction as acceptable seems questionable as to the validity of the claim. The validity of the additive needs to be based on peer reviewed science proving the performance of the additive with live animals over a sufficient time period (dosaging, predictability under certain conditions, proof of intake, species, durability of effect over time).</td>
<td>We have chosen this value in order to ensure that the methodology is used for technologies/solutions which have a significantly greater impact vs improvement of farming practices. CH4 Mitigation activities associated with improved feeding practices, decreased GHG intensity of milk production or improved animal health practices can achieve some enteric CH4 reduction without the need of a feed supplement (Knapp et al 2014), but such emission reductions cannot be quantified with this methodology. Table 1 in Knapp et al (2014), provides a Summary of feeding management approaches to altering rumen fermentation and reducing CH4 emissions, the range of reduction varies from 2-15% and 20% in a single case(rumen ph). The selection of 17% threshold derived from this table.</td>
<td>NA Threshold has been removed as part of RCE’s assessment.</td>
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<td>Clause 4.3 - This clause eliminates the use of feed supplements that have a similar mode of action and uses the general definition of ‘those that do not inhibit methanogenesis’. This statement needs to be more detailed in what exactly the mode of action of the supplement is. In other words, the scientific basis of the mode of action (enzyme destabilization; surface area activation [eg. Biochar addition to feed; protozoan immobilization] needs to be firmly described in order to be considered ‘complementary’ and allowed to be also used under this protocol. Otherwise, remove it and if there is a synergistic effect on enteric methane emissions, then why be concerned about it?</td>
<td>In the previous versions of the methodology we were describing in more detail the mode of action “...methane (CH4) enteric emissions by direct inhibition of methanogenesis in the rumen; in particular, it suppresses high-methane producing Methanobrevibacter species of the “Smitii-Gottschalki-Milleriae-Thaueri” clade (SGMT clade).” VCS asked to delete the detailed description</td>
<td>NA Methodology based on VCS guidance.</td>
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<td>General Comment - As far as I know, Verra bases their methodologies on project-based accounting (WRI GHG Project-Based Protocol or ISO 14064-2). This methodology does not give the reviewer the logic behind the emissions intensity of the feed additive product to ensure the production of this product does not constitute a ‘relevant’ source of emissions (ISO 14064-2 streamlined life cycle assessment approach) or has significant ‘out of project boundary’ emissions that need to be taken into account (WRI GHG Project-Based Protocol – so called secondary effects). Natural, plant-based feed additives will need to be grown/processed in significant quantities and it is uncertain what the GHG emissions associated with the growing/processing of these products are. This work needs to be demonstrated.</td>
<td>Feed production, including the feed supplement, is excluded as upstream production or other agricultural inputs are not impacted by the implementation of the project and as such the baseline and project conditions will be functionally equivalent. The feed supplement is considered to be part of the feed production. Therefore it is the responsibility of the feed supplement manufacturer to be transparent on its own carbon footprint. We agree that the current statement “There would be some small additional upstream emissions in feed supplement manufacture and transport, which are considered negligible in this methodology. “ might not be the case for all feed supplement and will therefore change the wording in the following “There would be some additional upstream emissions in feed supplement manufacture and transport, which are not considered in this methodology. It is, therefore, the responsibility of the feed manufacturer to be transparent on the carbon footprint of the feed supplement production. ”</td>
<td>NA Upstream emissions from the growing of crops for the supplement have been excluded as negligible. Natural ingredients for supplements are already being grown for other uses and any use for supplements for projects would be a small and negligible increase. Project emissions associated with the manufacturing and transport of supplements are within the boundary and accounted for.</td>
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Section 5 justifies why N2O are not part of the methodology. The paragraph in section 5 refers to the enteric methane production especially in the rumen and just to a smaller extent in the large intestine. Feed supplements cannot change anything on this ratio.”

The comments/ references (Külling et al. 2002, Moller et al 2014) refer to the impact of feed supplements on the manure. This is a different source of methane than enteric methane emissions and not the scope of this methodology. Feed supplements could impact the portion of protein, carbohydrates and fats in the excreted faeces that are available as food and energy for growth of anaerobic bacteria in manure and therefore impact the microbiome indirectly in the manure. The scope of this methodology is enteric methane emissions and not methane emissions in manure so far as enteric fermentation contributes 17% to global methane emissions whereas manure just contributes 2% (review Knapp et al. 2014).

Table 5 speaks of ruminants only. The listing of animals in Table 5 includes non-ruminants (horses for example). Since the protocol doesn’t speak to having a scientific basis for the testing of the feed additive across other species, I think this is an unjustified extension to say it can be applied to these species when it has not been through a peer-review publication stage.

Clause 9.1, Page 15 – re-check the GEI equation. I think GE is multiplied by DMI not divided by. Also, As per the Alberta Protocol, if added lipids are fed, the fat content of the diet is altered to suppress enteric methane, a higher energy density figure can be used (refer to the Alberta protocol for the value of a ‘safe’ lipid content of the diet (19.10 MJ kg-1).

Correct: DMI = GE/Energy density
GE content of diet, assumed to be constant at 18.45 MJ/ kg of DM
https://www.journalofdairyscience.org/article/S0022-0302(17)30988-8/pdf

Parameter GEj, Section 9.1, pg 15

Methodology updated for this comment.
Climate Focus and the Tropical Forages Program of the International Center for Tropical Agriculture (CIAT)

Submitted by: Simon König
Organization: Climate Focus and The Tropical Forages Program of the International Center for Tropical Agriculture (CIAT)
Country: United States

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<td>Footnote 1 is referring to point 2.7 and not point 1. This might have caused a misunderstanding.</td>
<td>NA</td>
<td>NA</td>
<td>Methodology only focuses on reduction in enteric methane.</td>
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<td>Page 7, 2.c.: Please correct spelling to: &quot;as per&quot; rather than &quot;as for&quot;</td>
<td>OK</td>
<td>pg 7</td>
<td>Methodology corrected for this comment.</td>
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<td>We have chosen this value in order to ensure that the methodology is used for technologies/solutions which have a significantly greater impact vs improvement of farming practices. CH4 Mitigation activities associated with improved feeding practices, decreased GHG intensity of milk production or improved animal health practices can achieve some enteric CH4 reduction without the need of a feed supplement (Knapp et al, 2014), but such emission reductions cannot be quantified with this methodology. Table 1 in Knapp et al (2014), provides a summary of feeding management approaches to altering rumen fermentation and reducing CH4 emissions, the range of reduction varies from 2-15% and 20% in a single case (average). The selection of 17% threshold derived from this table.</td>
<td>Methodology addresses comment.</td>
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<td>Methodology states that any direct measurements need to take into account uncertainty per VCS guidelines and the development of default factors.</td>
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<td>Methodology addresses comment.</td>
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Page 7, Footnote #1: Please provide an explanation as to why such emission reductions cannot be quantified with this methodology. If peer-reviewed, empirical studies confirm such emission reductions, have derived reliable emission factors, may not be included? | NA | Methodology only focuses on reduction in enteric methane. |

Page 7, 2.d.: What is the justification for the 17% threshold? | Methodology addresses comment. |

Page 8, 5.a.: Please explain the choice of the recommended baseline period of “at least one year prior to project implementation”. A longer period may be chosen to determine business-as-usual practices if the farm was engaged in livestock production for a longer period. It should be demonstrated that operations over the baseline period are representative of expected future operations in the absence of the project and that baseline operations have not been significantly altered for the purpose of influencing baseline emissions. | Methodology addresses comment. |

Page 8, 5.b.: The meaning of “stratum” and “situation” in this context should be clarified. It is unclear whether it is supposed to refer to typical livestock operations in the country or region in which the operation is to be established and if so, procedures should be outlined for the project to reliably demonstrate that the chosen “situation” serves as a conservative baseline. | Methodology addresses comment. |

Page 8, Table 4: Given possible revisions of the IPCC Guidelines, it may be preferable to reference the “latest version” of the IPCC Guidelines to reduce the need for making continuous updates to the methodology document. It might be 2006 or a future iteration. In section 9 we always specify for each parameter “To be updated each crediting period if new data exists.” | Methodology addresses comment. |

Page 11, Parameter GEF: Additional guidance should be provided regarding the data sources and the period over which an average should be derived. Examples of documentation may be given, including feed production or purchase records as well as record of feedstuff provision to animals. | Methodology addresses comment. |

Page 12, Monitoring Plan: The same standard should hold for the determination of the baseline scenario, i.e. “project proponents must provide detailed feeding records for each farm” | Methodology addresses comment. |
Uncertainty does not seem to be addressed in the methodology. Procedures for calculating (and making deductions from EIs for) uncertainties should be provided.

| We capture the uncertainty when the emission factors derived. Please see section 9.1. Data and Parameters available at Validation. "All CH4 measurement techniques are subject to experimental variation and random errors therefore it should be taken into account when reporting the final enteric CH4 emission value." |
| Methodology now includes discount factor if using default values and any direct measurements need to take into account uncertainty per VCS guidelines. |
"We are encouraged to see this methodology under development through VCS as a mechanism for advancing natural feed supplements to reduce emissions from enteric fermentation. We believe there are several adds to the methodology needed to: (a) provide clarity that allows for greater prevalence of these projects and (b) provide the rigor necessary to ensure that offset credits produced have environmental integrity."

| Text Passage | Comments | Responses | Table 1-2 Example 1: Add to the default enteric emission reduction factor estimated by the manufacturer of the feed supplement and calculate the emissions using equation 5.5. This option may only be used where the enteric emission reduction factor provided by the manufacturer of the feed supplement is supported by peer reviewed literature or form specific emissions data. This information must be provided for review at validation and verification. Additionally, there must be no significant differences in project parameters (e.g. feed, age, geographic region, and control practices) from the manufacturer’s supporting documents. |
| --- | --- | --- |  |
| **1.** The feed supplement must be used as pre product specification provided by the manufacturer. The Specifications provide critical defining conditions to secure the default level of reduction of the enteric methane emissions, such as the feeding routine and dose of supplement per kg of DMI to the animal.** |
| This should read “must be used as per” product specification. |
| Methodology addresses comment. |
| **Efferent Option 1:** Apply the default enteric emission reduction factor estimated by the manufacturer of the feed supplement and calculate the emissions using equation 5.5. This option may only be used where the enteric emission reduction factor provided by the manufacturer of the feed supplement is supported by peer reviewed literature or form specific emissions data. This information must be provided for review at validation and verification. Additionally, there must be no significant differences in project parameters (e.g. feed, age, geographic region, and control practices) from the manufacturer’s supporting documents.** |
| We believe that the standard used for Efferent Option 1 is relatively weak and should be specified to ensure environmental integrity in the project activities. Although there are examples provided, there are no criteria described for what constitutes “significant differences” between project parameters and the manufacturer’s supporting documents. This cedes the determination of significance to the project developer and verifies, which creates a risk of ignoring substantial differences. Given the huge variation in enteric fermentation, until we have factors for rumen mass based on breed, feed, climate, management, and other factors, it is necessary to set out the suite of criteria, the indicators to compare the manufacturer’s specifications with the project circumstances, and the acceptable range of variation (including adjustments if required). While the text quoted above requires that “Specifications provide critical defining conditions to secure the default level of reduction of the enteric methane emissions, such as feeding routine and dose of supplement per kg of DMI to the animal,” it does not specifically name other aspects of variability and management that will determine the baseline rumen emissions, potentially the efficacy of emissions reductions, and ultimately the reduction in emissions as a result of the project activity. In addition, the language in the following phrase is in the right direction, but insufficient: “the enteric emission reduction factor provided by the manufacturer of the feed supplement is supported by peer reviewed literature or form specific emissions data.” Here, “supported” is ambiguous and overly flexible. The criteria suggested above will help set a higher standard of proof. We suggest replacing “supported” with “established.” In particular, this text can be made much stronger by requiring compliance with relevant ISO/ANSI standards. |
| Methodology addresses comment. |
| These feed supplements are rare on the market now and used in relatively small quantities. This is, after all, the justification for using the activity penetration option of the positive list to justify additionally for the project methodology. Because of the few products available, there may be significant transportation miles between the point of feed supplement production and its site of use. The feed supplement per head may also be a significant part of the animal’s intake and therefore significant mass. As such, there may be significant associated transportation emissions from the feed supplement compared against baseline feed, which can be measured more locally. As such, we recommend that the transportation emissions associated with the feed supplement be estimated, or project developers credibly demonstrate that the transportation emissions are likely to be insignificant using a simplified estimation method. |
| Feed production, including the feed supplement, is excluded as upstream production or other agricultural inputs are not impacted by the implementation of the project and as such the baseline and project conditions will be functionally equivalent. The feed supplement is considered to be part of the feed production. Therefore it is the responsibility of the feed supplement manufacturer to be transparent on its own carbon footprint. We agree that the current statement “There would be some small additional upstream emissions in feed supplement manufacture and transport, which are considered negligible in this methodology” might not be the case for all feed supplement and will therefore change the wording in the following. There would be some additional upstream emissions in feed supplement manufacture and transport, which are not considered in this methodology. It is, therefore, the responsibility of the feed manufacturer to be transparent on the carbon footprint of the feed supplement production.” |
| Methodology addresses comment and it is understood that the burden of approving the sampling and measurements or manufacturer data will rest with the validator. |
| **Upstream emissions from the growing of crops for the supplement have been excluded as negligible. Natural ingredients for supplements are already being grown for other uses and any use for supplements for projects would be a small and negligible increase. Project emissions associated with the manufacturing and transportation of supplements are within the boundary and accounted for.** |
| There would be some small additional upstream emissions in feed supplement manufacture and transport, which are considered negligible in this methodology.” |
| Methodology addresses comment and has included additional language for specificity. |
| The active ingredients of the feed supplement must be 100% natural plant or macroalgae based and non-GMO.** |
| Methodology addresses comment. |