METHODOLOGY ASSESSMENT REPORT

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

RUBY CANYON ENGINEERING

Document Prepared By: Ruby Canyon Engineering, Inc.

Methodology Title	Reduction of Enteric Methane Emissions from Ruminants Through the Use of 100% Natural Feed Supplement	
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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 (CH_4) 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 CH_4 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.

Dates	Attendees	Topics
9/5/2019	Zach Eyler, Barbara Toole O'Neil, Elsa Zoupanidou, Michael Mathres	Discussion of List of Findings 1.0.
9/30/2019	Zach Eyler, Elsa Zoupanidou	Further discussion of List of Findings 1.0, remaining open items and an updated methodology.
10/4/2019	Zach Eyler, Elsa Zoupanidou	Further discussion of List of Findings 1.0, remaining open items and an updated methodology.

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 Mootral during each round of assessment and Mootral responded with corrective actions, edited documents, additional documents, as well as written responses for clarifications. The RCE assessment team and Mootral 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. Mootral 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 CH_4 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 CH_4 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:

Source		Gas	Included?	Justification/Explanation	RCE Assessment Team Conclusion
Baseline	Enteric Fermentation	CO_2	No	Not included in the project boundary[1] since these emissions are biogenic and mostly produced by the respiration process.	The exclusion of CO_2 is appropriate.
		CH_4	Yes	CH_4 emissions from enteric fermentation, prior to the project technology implementation, represent the major source of emissions in the baseline scenario.	The inclusion of CH_4 is appropriate as it is the main source of emissions.
		N_2O	No	Not a by-product of the	The exclusion of N_2O is

[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.

Source		Gas	Included?	Justification/Explanation	RCE Assessment Team Conclusion
				enteric fermentation process and is not expelled by the animal through burping.	appropriate.
Project	Enteric Fermentation	CO_2	No	Not included in the project boundary[2] since these emissions are biogenic and mostly produced by the respiration process.	The exclusion of CO_2 is appropriate.
		CH_4	Yes	CH4 emissions from enteric fermentation are the major source of emissions in the project scenario.	The inclusion of CH_4 is appropriate as it is the main source of emissions.
		N_2O	No	Not a by-product of the enteric fermentation process and is not expelled by the animal through burping.	The exclusion of N_2O is appropriate.
	Supplement Production	CO_2	Yes	CO2 emitted from supplement production, transportation and production.	The inclusion is appropriate for the use of electricity of combustion of fossil fuels.
		CH_4	Yes	CH4 may be emitted from combustion of fossil fuels during the processing.	The inclusion is appropriate for the combustion of fossil fuels.
		N_2O	No	N2O emissions are not expected during the production process	The exclusion is appropriate.

Overall, the RCE assessment team concluded that the project boundary is appropriate for the project activities in the Methodology.

[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 CH_4 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.

Data and Parameters Available at Validation	
Parameter	**RCE Assessment Conclusion**
GE_j	All information for this parameter is appropriate. Values to be calculated based on three continuous years of historical data.
DMI_j	All information for this parameter is appropriate. Values to be calculated based on three continuous years of historical data.
Ym_j	All information for this parameter is appropriate. Country or regional and population specific values should be used when available or default values.
NDF_j	All information for this parameter is appropriate. Values to be calculated based on three continuous years of historical data.
ED	All information for this parameter is appropriate. Values to be calculated based on default values or farm specific data.
EC	All information for this parameter is appropriate. Value to be sourced from IPCC 2006 guidance.
$EF_{Enteric,j}$	All information for this parameter is appropriate. Values to be calculated using one of the three options noted for baseline emissions.
GWP of CH_4	All information for this parameter is appropriate. GWP is sourced from IPCC 4th Assessment Report.

PE_j	All information for this parameter is appropriate. Values to be determined by direct measurement using a chosen technology.
$ERF_{Enteric\ j}$	All information for this parameter is appropriate. Values to be provided by the feed manufacturer for each animal group or calculated using Equation 6 of the Methodology.
$EF_{Productioni,j}$	All information for this parameter is appropriate. Values to be determined by direct measurement using a chosen technology.
$EF_{i,j}$	All information for this parameter is appropriate. Values to be country or regional population specific factors or default values provided in Table 4 of the Methodology sourced from IPCC.
$DF_{Enteric_{i,j}}$	All information for this parameter is appropriate. Values to be determined by source of $EF_{i,j}$.

Data and Parameters Monitored	
Parameter	**RCE Assessment Conclusion**
N_{ij}	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.
Days	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.
j	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.
FM	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.
EF_P	All information for this parameter is appropriate. The measurement procedures and QA/QC procedures are sufficient.
EF_{Ti}	All information for this parameter is appropriate. The measurement procedures and QA/QC procedures are sufficient.

Q_{elec}	All information for this parameter is appropriate. The measurement procedures and QA/QC procedures are sufficient.
Q_{ff}	All information for this parameter is appropriate. The measurement procedures and QA/QC procedures are sufficient.
EF_{elec}	All information for this parameter is appropriate. The measurement procedures and QA/QC procedures are sufficient.
FCa	All information for this parameter is appropriate. The measurement procedures and QA/QC procedures are sufficient.
EF_{fuel}	All information for this parameter is appropriate. The measurement procedures and QA/QC procedures are sufficient.
TEF	All information for this parameter is appropriate. The measurement procedures and QA/QC procedures are sufficient.
Di	All information for this parameter is appropriate. The measurement procedures and QA/QC procedures are sufficient.

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

1. Aguerre, M. J., Wattiaux M. A., Powell J. M., Broderick, G. A. and Arndt, C., 2011. Effect of forage-to-concentrate ratio in dairy cow diets on emissionof methane, carbon dioxide, and ammonia, lactation performance, and manure excretion. J. Dairy Sci. 94 :3081–3093 doi: 10.3168/jds.2010-4011

2. Aguerre, M. J., Wattiaux M. A., and Powell J. M., 2012. Emissions of ammonia, nitrous oxide, methane, and carbon dioxide during storage of dairy cow manure as affected by dietary forage-to-concentrate ratio and crust formation. J. Dairy Sci. 95 :7409–7416 http://dx.doi.org/ 10.3168/jds.2012-5340

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

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10. IPCC Guidelines for National Greenhouse Gas Inventories Volume 4 Agriculture, Forestry and Other Land Use. Chapter 10. 2006 https://www.ipcc nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_10_Ch10_Livestock.pdf

11. Knapp, J.R., Laur, G.L., Vadas, P.A., Weiss, W.P., Tricarico, J.M., (2014). Enteric methane in dairy cattle production: quantifying the opportunities and impact of reducing emissions. J. Dairy Sci. 97, 3231–3261.

12. Kreuzer M., Hindrichsen I.K. (2006). Methane mitigation in ruminants by dietary means: The role of their methane emission from manure. International Congress Series 1293,199–208.

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APPENDIX B – SUMMARY OF FINDINGS

Corrective Action Request, Additional Documentation Request, or Clarification ID#	Finding	Reference	Project Proponent Response	RCE Response	Additional Project Proponent Response	Additional RCE Response	Open or Closed
CAR 1	In section 4.8.4 Monitoring of VCS Standard; " The methodology shall establish criteria and procedures for monitoring, which shall cover the following: 1) Purpose of monitoring. 2) Monitoring procedures, including estimation, modeling, measurement or calculation approaches. 3) Procedures for managing data quality. 4) Monitoring frequency and measurement procedures" The monitoring described in the proposed methodology does not meet these requirements. Specifically on p. 11, options for direct measurement of the enteric emissions factor are mentioned. In the appendix on p. 30 a list of methods are discussed. These methods although proposed to be used, are not listed or included in the Monitoring section.	VCS Standard , V 3.7, 2017	The monitoring process with regards to direct measurements will be decided by the project proponent in collaboration with a scientific partner if project proponent cannot demonstrate experience in direct measurements and animal studies. However, we have included a description of the process in section 8.1 for baseline emissions option 1	This response and added detail to the methodology is acceptable, closed.			Closed
CAR 2	A variety of edits and comments have been noted relating to clarity, grammar, references and using consistent language throughout the methodology.	VCS Standard section 4	We have updated the document taking into consideration all the comments and suggestions. Please see attached	All edits and comments were addressed, closed.			Closed
CAR 3	Direct measurement approach (baseline and project) lacks specificity and structure. While three potential technologies are listed as options, we have the following questions/concerns: -No minimum criteria or guidelines on sampling and measurement analysis (how often, how many samples, 3rd party required?, etc.). No clear procedures causes risk to project proponents and VBs and could lead to significant differences between projects. -How should sampling procedures be different for each technology? Specific requirements for certain ones? -Rigorous QA/QC procedures need to be included around sampling -How are the results of sampling to be used? Any additional statistical analysis needed? -What is the accuracy of the technologies? Do results need to take this into account? Different for each technology? Is this a preferred technology?	VCS Standard section 4.5.6	Appendix II attempts to provide relevant information on direct enteric methane measurements. These three technologies are used for demonstration purposes and are not restrictive, as improving technologies could allow more accurate measurements in the future. The proposed three methodologies are very well documented in the scientific literature and accepted by all the scientist in the field. Please see also updated text in Appendix II 1. In the description of parameters available at validation, we write that the project proponent or associated partner must demonstrate experience in methane measurement technologies. See also answer in CAR 1 2. In general, animal studies the most favoured and most scientific method is the calculation of sample size by power analysis.. See Charan J, Kantharia ND. How to calculate sample size in animal studies?. J Pharmacol Pharmacother. 2013;4(4):303–306. doi:10.4103/0976-500X.119726 3. A protocol needs to be established at the project level 4. A protocol includes rigorous QA/QC procedures 5. There are various studies demonstrating the reliably of these technologies to quantify the dynamics of CH4 concentrations exhaled by dairy cows. For more details see K.J. Hammond, L.A. Crompton, A. Bannink, J. Dijkstra, D.R. Yáñez-Ruiz, P. O'Kiely, E. Kebreab, M.A. Eugène, Z. Yu, K.J. Shingfield, A. Schwarm, A.N. Hristov, C.K. Reynolds, Review of current in vivo measurement techniques for quantifying enteric methane emission from ruminants, Animal Feed Science and Technology, Volume 219, 2016, Pages 13-30, ISSN 0377-8401, https://doi.org/10.1016/j.anifeedsci.2016.05.018. (http://www.sciencedirect.com/science/article/pii/S0377840116302048) Diana Sorg, Gareth F. Difford, Sarah Mühlbach, Björn Kuhla, Hermann H. Swalve, Jan Lassen, Tomasz Strabel, Marcin Pszczola, Comparison of a laser methane detector with the GreenFeed and two breath analysers for on-farm measurements of methane emissions from dairy cows, Computers and Electronics in Agriculture, Volume 153, 2018, Pages 285-294, ISSN 0168-1699, https://doi.org/10.1016/j.compag.2018.08.024. (http://www.sciencedirect.com/science/article/pii/S0168169918306124)	The clarifications and changes made to the methodology are sufficient, closed.			Closed
CAR 4	Baseline monitoring period - While it is stated in the applicability section, section 8.1 and 9 need to be updated to reflect that baseline emissions and baseline parameters need to be calculated over three years. -It is also unclear how this is to be calculated - straight year averages, weighted averages for all data? -Does the 3 years of data apply to all 3 options for the baseline?	VCS Standard section 4.5.6	1. Since option 1 includes direct measurements the data of 3 years will be used to demonstrate that the measured baseline does not represent a biased event. For option 2 data will be used to calculate the annual emissions and is determined as the straight year average activity. 2. The three years of data is to ensure that baseline does consider variations and mainly does not represent a biased event. Therefore it is required for all 3 options unless see applicability condition 8b.	I am unclear on this new requirement - does this mean that a control group would need to be monitored for 3 years?	The 3 years data are required prior to the project implementation. When direct measurements are required the control group will be used to calculate the methane production levels without the feed supplement. The baseline is just a reference point to control for best representation of the conditions in the farm. To show that nothing major has changed to the farm. As we discussed data of two years will be sufficient . See the updated methodology	Changes in methodology sufficient, closed.	Closed
CAR 5	Uncertainty is mentioned for many parameters (defaults or measured) throughout the methodology, but there is no standard approach or method to deal with this in the methodology. Any uncertainty must be dealt with in a conservative manner (e.g. discount factors, confidence limits, etc.). For example, IPCC default factors have the following noted in their parameter tables: "Parameters from any source (e.g., IPCC or national agencies) must include an uncertainty component itself". What is an uncertainty component? There should be a defined method to address uncertainty, otherwise projects will attempt to address it in different ways, leading to different ER outcomes. In addition, uncertainty will vary from parameter to parameter - uncertainty around IPCC default factors is different than the uncertainty associated with direct measurements. So, different means to deal with uncertainty will need to be considered.	VCS Standard section 4.1.4	As this methodology and the different options proposed to quantify the emissions reduction are using mostly parameters from other sources (e.g., IPCC or national agencies). Where sufficient country-specific information is unavailable, information may be derived from other published studies if those studies are reflective of conditions in the country. There are uncertainties associated with the original measurements, as well as with the use of the factors in circumstances other than those associated with the original measurements.. We also specify in the methodology document that parameters from any source (e.g., IPCC or national agencies) must include an uncertainty component itself- uncertainty estimates quantitatively describing the respective uncertainty source / An uncertainty component is the uncertainty for an individual aspect of an analysis. The first step in collecting data should be to investigate existing national statistics, industry sources, research, studies and FAO statistics. Often, national livestock population statistics already have associated uncertainty estimates in which case these should be used. In the case the project proponent performs direct measurement to quantify enteric methane emissions must respect the following "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." The project proponent or associated partner conducting the measurement and sample selection etc will normally be able to advise on study errors like calibrating or sampling error.	1) Uncertainty components - this is noted for parameters, but it is unclear what this actually means and how a project would apply it. For example, if I used a default value from Table 4 for EF, what uncertainty component should I use? IPCC notes +/- 30-50% for these default values, do I pick something in that range and apply it to the EF value? 2) Similar to above it is not clear what "taken into account" means for sampling or measurement errors (#3 in Appendix II). If the measurement error of the technology is 3%, should the results be adjusted in a conservative manner for this? My main concern is that if you have two identical projects that are managed by two different project proponents, they could use different methods to deal with uncertainty leading to different ER outcomes for the exact same project. To guard against this happening, more specificity needs to be included in the methodology.	1) default factor added for eq 4. 2) As discussed he VCS standard guidelines covers the range of confidence level that has to be taken into account.	Changes in methodology sufficient, closed.	Closed
CAR 6	As noted by a comment by Verra, if a change in manure management emissions in the project scenario is accounted for, then the baseline manure management emissions would need to be accounted for. This is not noted in Table 3 for SSRs, equations for baseline emissions from manure are not included and they are also not noted in the monitoring parameters tables.	VCS Standard section 3.12	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 "The specific and direct inhibition of the methanogenesis in the rumen is not supposed to cause a major change in the overall rumen fermentation as this process is downstream of these metabolic processes. Consequently, the digestibility of feed supplement will not be impaired in a way that would lead to a change in the CH4 or N2O emissions in the manure and during decomposition. Keuzer et al. (2006) concluded that feed additives taken to limit methane emission from the digestive tract of ruminants shown to be effective in reducing methane in the animal and in the manure as well. Another study by Nampoothiri et al. (2015) reports that in general dietary manipulations have very little effect on manure N2O production. A few more studies (Aguerre et al, 2011; Aguerre et al, 2012; Hristov et al, 2012) verified that methane reduction achieved by manipulating the rumen fermentation had no change in manure emissions. Avoidance of increase in the manure emissions due to feed supplementation is dealt with by the applicability condition 6 of this methodology."	I would like to have you walk me through these studies as it appears certain activities do increase manure emissions.	As discussed the are several reason why a feed supplement with direct inhibition will have no material impact on the emissions from the manure i.e, downstream process of this metabolic process, normally small doses are fed to the animals. In any case this is covered by the applicability condition 6	Sufficient, closed.	Closed

CAR 7	Project emissions due to supplement production/transport and project emissions due to a change in manure need further information and clarification. Specifically: -The source for EFp and EFt is stated as the manufacturer - will they provide a CO2e value? If the manufacturer will provide electricity and fossil fuel consumption, then specific equations for this should be added. -N2O is included for supplement production due to fertilizer use - how will this be calculated? This source has a high level of uncertainty and can be difficult to calculate. -For project emissions from manure - how will this be calculated? No equations included, just a single CO2e value from the manufacturer? Given the level of uncertainty around CH4 and N2O emissions from changes in project manure, additional equations or specificity in the parameter tables seems warranted. -Can it determined that manure emissions did not change or possibly decrease?	VCS Standard section 4.7.2.	Q1. The source for EFp and EFt is stated as the manufacturer - will they provide a CO2e value? Yes, If the manufacturer will provide electricity and fossil fuel consumption, then specific equations for this should be added. EFp represents emission factor for production of feed supplement. Doesn't this include electricity and fossil fuel consumption? Q2: Not applicable. Not expected in production process. Please se updated version Q3: Not applicable. Manufacturer needs to demonstrate that there will be no impact in the emissions from the manure Q4: Applicability condition 6	Q1: Equation 7 for EFME needs to expanded to include other equations as components - 1) for electricity used at manufacturing facility 2) any fossil fuels used at manufacturing facility 3) fuels used for transport of supplement to project site. See VM0040 section 8.2 as an example. New parameters added will need to be included in the parameters monitored tables. Q2-4: Closed.	equations added. See updated methodology.	Sufficient, closed.	Closed
CAR 8	Equations for baseline and project emissions: A variety of edits, clarifications and questions are noted as tracked changes in the methodology.	VCS Standard section 4.7.2.	Done. Please see updated document	Updates acceptable, closed.			Closed
CAR 9	A variety of parameters are incorrectly labeled as available at validation or monitored, please see the tracked changes version of the methodology.	VCS Standard section 4.7.2.	Done. Please see updated document	Updates acceptable, closed.			Closed
CAR 10	The GE parameter includes additional calculations steps noted in its parameter box. These calculations should be included in the emissions calculation section 8.1 of the methodology and not within the parameter table. For any new parameters included in the calculation section, please add parameter boxes as appropriate.	VCS Standard section 4.7.2.	Ok, please see updated document	The calculation of GE as a separate equation has not been added to section 8.1	ok	Equation added, closed	Closed
CAR 11	RCE believes that Mootral's response to some public comments need additional information or revising: -South Pole: Table 5 values are annual, where Equation 4 is per day. There needs to be a conversion in Equation 4. -Variety of commenters: Mootral answers questions stating 17% reduction and the use of 1 year of data for baseline emissions is sufficient, but these have changed in the latest version of the methodology. -TREES: Mootral's answer to the question on whether to include upstream GHGs for supplement production does not match current methodology which includes these emissions. -TREES: MAP question is not fully addressed, see CL 1 below.	VCS Meth Approval Process 4.3	1. South Pole: Please see updated document 2. Variety of commenters: Please see answer CL 11 3. TREES In our answer we suggested the to include the following in the methodology "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. " However after reviewing we found appropriate to include the equations to quantify these emissions. 4. TREES: See answer for CL1	South Pole: I do not see a conversion in equation 4 for EF being an annual value. 2-4: Closed.	As we discussed there is no need to add this, since there are different sources for these parameter that could be daily, monthly, or yearly	Sufficient, closed.	Closed
CAR 12	Leakage: The methodology states that there are no leakage emissions expected, however there is some risk of leakage if milk production or other production parameters decrease as a result of supplement. If this leakage risk is dealt with by applicability condition 3b, it would more accurate to note this in the methodology leakage section. Please update.	VCS Meth Approval Process 4.3	Exactly, this is covered by the applicability condition 3b. Section 8.3 has been updated	Methodology updated, closed.			Closed
ADR 1	Please provide the Zimmerman and Zimmerman document referenced in the methodology.	N/A	ok, Zimmerman 2009	Provided.			Closed
ADR 2	Please provide a sample calculation for baseline emissions, project emissions and net emission reductions using some of the different options allowed in the methodology.	VCS Standard section 4.5.6	ok	Provided.			Closed
CL 1	Under the discussion on activity method: It is also important to specify that activity penetration should be determined in relation to the maximum adoption potential. The proposed method uses the global population of ruminants as the potential market. It is possible that the market penetration in a particular country would be greater than 5%. In that case, the project would be deemed additional under the proposed methodology when it may be 'a business as usual' situation with market penetration higher than 5%. Other methodologies have provided a different approach to activity penetration including by region or country. Is a global approach reasonable? How can this possibility be addressed?	VCS Guidance for Standardized Methods, v. 3.3, 2013 p. 12	Some countries given the ruminant population and the readiness of the country and specific industry to take action it might contribute more into the global agenda of reducing GHGs. Therefore a global approach is more relevant for this methodology and these type of carbon projects.	There might be a misunderstanding of our original question, we would like to discuss this more.	We believe a global approach is more suitable given that the number of animals is not normally distributed. And also given the number of ruminants and the current situation there is no plausible scenario of passing this 5% in the next 5 years.	The determination of MAP was revised to exclude 1.6 billion ruminants that were part of sectors not potentially viable for project activities as well as remove meat animals that are grazing animals.	Closed
CL 2	Activity method: The methodology references an interview and a news article on supplement use for 2010 and 2018. Is that the only available documentation regarding their current use? No other literature on their current use (or lack thereof) exists?	VCS Guidance for Standardized Methods, v. 3.3, 2013 p. 12	There are scientific articles describing different activities/solutions to reduce enteric methane emissions, but to the best of our knowledge, only these two sources have information on commercially available solutions. You can also find some information in table 1 of this publication. https://ec.europa.eu/eip/agriculture/sites/agri-eip/files/fg18_mp_feeding_strategies_2017_en.pdf	This response is acceptable, closed.			Closed
CL 3	From the VCS Guidance: Baseline: This is permitted, recognizing that project performance (and potentially the crediting baseline, where a dynamic dataset is used) may fluctuate. In the proposed methodology under Section 8.1 Baseline: "This methodology provides options for determining the enteric emissions factor (EFEntericj). Depending on the availability of relevant project data and measurements, each project proponent must choose the most appropriate of the following options for each animal grouping" Options are provided to calculate the enteric emissions factor. A couple of clarifications: -It is not clear whether once an option is chosen if it need to be used for the entire crediting period? Why or why not? -Is their a hierarchy, i.e. if direct measurements exist, do you have to use those as opposed to picking another option?	VCS Guidance for Standardized Methods, v. 3.3, 2013 p. 15; Section 8.1 of proposed meth	Please see update document. -The duration of the measurement will be determined by the protocol. See appendix I - There is no restriction but on-site farm measurements could be more relevant.	1) Sorry, I think there might be a misunderstanding of our question. If a project chooses Option 1 to calculate baseline emissions in year 1 of the crediting period, do they need to use Option 1 for the remainder of years? I would worry about "gaming" the baseline emissions calculation. Ex: Option 1 gives me 2,000 credits, but Option 3 gives me 10,000 so I'm going to use that one. 2) Thanks. It does appears that Option 3 is already somewhat limited by the language in the methodology: "Option 3 is only suitable for animal species listed in Table 4 below, and where the project proponent does not have the required data for Option 2". This seems reasonable. Closed.	As we discussed this will be secured from the project design document	Sufficient, closed	Closed
CL 4	Options are also proposed for project emissions. It is not clear whether once an option is chosen if it need to be used for the entire crediting period? Why or why not?	VCS Guidance for Standardized Methods, p. 15; Section 8.3 of proposed meth	Once an option is chosen it should be used for the entire crediting period. The option 1 to calculate ERFenteric will only change if the conditions in the farm change and feed manufacturer cannot justify the applicability of the feed under these conditions	Thanks for this clarification. Please add language stating this in beginning of section 8.2.1.	As we discussed this will be secured from the project design document	Sufficient, closed	Closed
CL 5	Should the options for baseline and project emissions be paired, e.g. Option 1 in the baseline with Option 1 under project emissions?	VCS Guidance for Standardized Methods, p. 15; Section 8.1, 8.3 of proposed meth	Not necessarily. A feed manufacturer might have a study that is reflective of conditions in the project. Therefore if there are no available data to quantify the baseline you can perform direct measurements (option 1) and apply the emission reductions factors as determined by the feed manufacturer (option 1). Baseline option 2 and option 3 could also be paired with option 1 project emissions if the feed manufacturer has a study that is reflective of conditions in the project. Option 2 project emissions could also be paired with all 3 options for baseline emissions.	Thanks for this clarification, closed.			Closed

CL 6	Section 8.5 Leakage There are no known or expected sources of leakage caused by this project type. The project boundary could include emissions associated with leakage as defined by VCS "Leakage [is the Net changes of anthropogenic emissions by GHG sources that occur outside the project or program boundary, but are attributable to the project or program".	VCS Program Definitions, V 3.7, 2017	See updated version	Updates are sufficient, closed.			Closed
CL 7	The limitation of the supplement being 100% natural plant-based or macroalgae 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 harm in the use of a synthetic supplement? Are the methods proposed to determine ERs only applicable to natural supplements? I would think that Verra would like the greatest possible project adoption of this methodology and corresponding emission reductions. It is possible modify the methodology in the future, but why not include it now?	VCS Standard section 4.1.20	Q1: Can you please expand further on this limitation and the reason for it? Is there a harm in the use of a synthetic supplement? The reason we focus on natural is because 1. Chemical methane inhibitors are mostly not suitable for use in practice and effects are frequently transient, too. (M. Kreuzer, I.K. Hindrichsen / International Congress Series 1293 (2006) 199–208) 3. Synthetic products require much more regulatory approval which increases as the time and gets the product to the market. 4. Typically farmers are negative to add more synthetic products in their animal which creates another barrier to entry. 5. We can not foresee the applicability conditions of a synthetic supplement Q2: Are the methods proposed to determine ERs only applicable to natural supplements? No, methods proposed for supplements that directly inhibit methanogenic bacteria Q3: It is possible to modify the methodology in the future, but why not include it now? The reason we are not including it now is that there is more evidence of enteric methane reduction using natural products.	Thanks for the additional information and I can see the benefits of natural supplements as compared to synthetic. Is there a reason why the suggestions by other commenters asking about chemically extracted components or nature identical substances were not included in the methodology? These edits seem reasonable.	As we discussed this methodology doesn't prevent chemically extracted components. Nature identical substances can still fall under synthetic . In the context of current developments in scientific literature, legislation and in view of societal expectations, the use of chemical additives and antibiotics should be avoided.	Acceptable. Perhaps redundant, but I included a note on chemically extracted components in applicability conditions to make sure it is 100% clear.	Closed
CL 8	The methodology allows multiple farms to be part of one project - is the intent to allow grouped projects with farms locations potentially all over the world as part of one project?	VCS Standard section 3.10	Yes could it be possible if geographic areas can be clearly defined	Thanks for this clarification, closed.			Closed
CL 9	ERFenteric - the discussion in the monitoring section in the methodology regarding QA/QC or other support to justify the use of a value from the manufacturer and ensure its accuracy and applicability seems insufficient. With little guidance this could be an area of uncertainty and risk at validation and verification. -Are there other steps or assurance that can be included to ensure the accuracy of the manufacturer's claim? -How can it be assured that the manufacturer supplement value is applicable or usable by the specific farm operation? Could the manufacturer value change from operation to operation based on different variables?	VCS Standard section 4.7.2.	see updated version	Edits to methodology are sufficient, closed.			Closed
CL 10	Applicability condition 3b states that there must be no negative health or performance impacts on 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 % impact on health or performance is acceptable and consider including more specificity in this provision.	VCS Standard section 3.15	The definition of healthy ruminant could be variable because it may also depend on the person. Someone may think a small numerical decrease is also large effect on animal health and someone may not. Farmers always have a vet and a nutritionist to follow the health of the cows	Yes, and that is my point. If someone believes even a small health concern is a big issue then condition 3b would not be met. Maybe include "significant" in the language? For health and performance are talking disease/mortality and milk/weight production?	Understood. See updated methodology, condition 3b.	Added, closed.	Closed
CL 11	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 excluding one that reduces emission by 10% seems arbitrary. A 10% reduction in emissions is still beneficial. Also, what happens if this condition is not met throughout the crediting period? No credits are allowed during a monitoring period unless > 15% reduction?	VCS Standard section 3.15	There are several existing enteric methane mitigation strategies reported in the literature (Knapp et al 2014; Boadi et al 2004). Mitigation strategies that reduce ruminal methanogenesis are a) Improving Animal Productivity, b) Nutritional and Management Strategies and c) Manipulation of Rumen Fermentation 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 3, provide a summary of feeding management and mitigation approaches to altering rumen fermentation 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 average of the lower values reported. 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. Also, there are existing methodologies "CDM SSC-NM094: Strategic supplementation of a smallholder dairy sector to increase productivity and reduce methane emissions" that aims to reduce methane emission per unit of milk production via improved nutritional conditions of lactating animals in the project	Thanks for this additional information, but I would like to discuss this further and have you walk me through the Tables. I do not understand your comment related to "additional to existing methane mitigation practices." RCE believes this requirement should be deleted.	Methodology revised.	Condition was deleted, closed.	Closed
CL 12	It is unclear how Ym should be determined: -Should the default values from Table 4 or Table 7 be used? Is there a hierarchy? -If diet % is used from Table 7, is this also based on 3 years of historical data as other baseline parameters? -Is NDF only relevant if Table 7 is used?	VCS Standard section 4.7.2.	Table Ym in section 9 prioritizes the country or regional population specific l values. For example Swiss studies are showing a Ym 6.5% for dairy cows which is also accepted in the NIR. Table 4 and table 7 can be used in conjunction. Table 7 and NDF parameter helps you to define the +/- uncertainty range	Thanks for the clarification and edits to the methodology. Is NDF only relevant if using Table 7? If so, then I would consider adding this note to the parameter table for NDF.	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 (i.e., high digestibly and energy value). Higher bounds are more appropriate when poorer quality of feed is available. NDF within a given feed regime is a good measure of feed quality and plant maturity. For legume forages, NDF content below 40% would be considered good quality, while above 50% would be considered poor. For grass forages, NDF < 50% would be considered high quality and > 60% as low quality.	Thanks for this explanation, closed.	Closed

APPENDIX C – STAKEHOLDER COMMENTS

Feedback on Methodology for the reduction of enteric methane emissions from ruminants through the use of 100% natural feed supplement Version

Comments received on Methodology for the Reduction of Enteric Methane Emissions from Ruminants through the Use of 100% Natural Feed SupplementThis comment was received via email by the VCS. **Submitted by: Tanushree Bagh Organization: South Pole Country: Switzerland**

Chapter	Text Passage	Comment	Answers	Corrections	RCE Assessment
Title	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, the *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 Please see section8.1->"**EFEntericij Option 1** Option 1 **calculates the 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).**The enteric emissions production factor for each animal group measured by the chosen technology must be available at each validation and verification. "**	table 5	Comment taken into account and methodology updated.
2	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.	The chemical process of the methanogenesis requires energy. With a reduced methanogenesis, the animals have more energy at their disposal, which in many cases leads to an increase in milk yield or meat production. Therefore, not only the direct inhibition shall be accountable but also these side-effects if the change can be traced back (shall be part of an in-vivo study) to the application of the feed supplement.	There are existing methodologies that provide procedures to estimate the CO2eq reduction by milk yield produced or beef cattle performance like daily weight gain. This methodology aims to quantify emissions from directly reducing the enteric methane. This methodology focuses its calculation on methane emission reduction, not intensity (CO2 emission / litre of milk or kg of meat) **For Examples of these Methodologies please see Table 1 overview of similar methodologies**	NA	This methodology only focuses on direct GHG reductions from enteric fermentation, closed.
4	1. Livestock producers must feed their animals a natural feed supplement which reduces enteric CH4 emissions by direct inhibition of methanogens in the rumen.				
4	2a. The active ingredients of the feed supplement must be 100% natural plant-based and non-GMO.	The exclusion of non-GMO makes sense. But we suggest to add *nature-identical* ingredients (they are the chemical equivalent of natural ingredients, but chemically synthesized rather than being extracted from source materials) to the list. Otherwise, we will have two identical Methodologies for the same cause in the near future.	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 a 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 activ	We have changed the definition after taking all the public comments ino consideration	Comment taken into account and methodology updated. Further language added based on RCE review.
4	2d. The application of the feed supplement must demonstrate a minimum enteric CH4 reduction factor of 17% to ensure substantial impact.	There is no scientific reason to have such an arbitrary default value and a substantial impact can be achieved with a 5% reduction as well. It is more important that in addition to the VCS Standard guidelines (4.1.7 and 4.5.6), the effect or the reduction factor has been proven not only by an in-vitro but also by an **in-vivo** study according to *EFSA Guidelines* (or similar) for animal trials and that the results are published in a peer-reviewed paper.	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.	footnote 1 was placed wrongly. It's for point 2d.	Comment taken into account, but methodology further updated based on RCE review and this provision has been removed.
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; Dini 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.	Reference? 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) (e.g. Külling et al., 2002). Møller et al. (2014) were able to show that the addition of certain supplements reduces methane emissions from digestion, but at the same time increases the potential for methane emissions from manure management.	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." 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).	NA	Comment taken into acocunt and this methodology is focused on GHG reductions form enteric fermentations and the use of applicability condition to ensure that no increase in manure emissions.
8	Emission Reduction Calculation	A scientific measured (in-vivo, according to e.g. EFSA Guidelines and Peer-Reviewed) default *enteric emission reduction factor* needs to be available. Otherwise, the scientific evidence is not given. Based on that, we suggest to simplify the decision tree: Option 1: Performing direct enteric methane measurements to estimate the production per animal group per day. Option 2: Calculation of Baseline Emission according to the newest applicable National Greenhouse Gas Inventory (Tier 1 to 3) for all animal groups. If accurate on-site data for *GE (Gross Energy Intake)* and / or *Ym (Conversion factor)* is available, they can be used instead of the default values used in the *National Greenhouse Gas Inventory* (Option 1).	**According to VCS guidelines any 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 2 steps: 1) Section 8.1 Baseline emissions - Have you performed or planned on-site farm mesurements ? 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. the enteric emissions production factor for each animal group measured by the chosen technology must be available at each validation and verification. Section 9.1 describes the source of data , it is therefore reduntant to include this information in the decision tree	NA	Comment responded to appropriately.
8	Option 1 calculates the 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). The enteric emissions production factor for each animal group measured by the chosen technology must be available at each validation and verification.	There is some additional information in the Annex, but more specifications on the level of detail is needed. Such as: - time duration of the measurements (to avoid e.g. diurnal, postprandial or seasonal fluctuations) - sample size (how many animals of each group) - 3rd party verification or even a publication should be considered	According to VCS guidelines any 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. Please see Section 9.1. Source of data and level of detail is described for each patameter "The project proponent must provide evidence to demonstrate the level of enteric CH4 production during the baseline scenario To quantify the project enteric CH4 animal samples for each group are selected to perform the direct measurement. The project proponent needs to describe the required sampling protocols against objectives conditions. Sampling protocols should include sufficient numbers and sampling times to account for diurnal and postprandial variation in CH4 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...Because this requires direct measurements of methane emissions project proponent or associated partner must demonstrate experience in methane measurement technologies"	NA	Comment responded to appropriately and each project will need to ensure that VCS Standard requirements are met.
8	Option 3 is only suitable for animal species listed in Table 6	Wrong Reference. It is *Table 5* .	ok	page 12 correction. chapter 8	Comment responded to appropriately and methodology updated.
8	Enteric CH4 emissions factor for each animal in the group j during the monitoring period (country or regional specific factors or Table 6), (kg CH4 head-1 day-1)		ok	page 13 correction. chapter 8	Comment responded to appropriately and methodology updated.

8	Table 5	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 flactuations. 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.		Comment responded to appropriately.
	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.	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	Comment responded to appropriately and methodology updated.

Submitted by: Laura Wilkinson Organization: Native Energy Country: United States

Chapter	Text Passage	Comment	Answers	Corrections	RCE Assessment
4	2a. The active ingredients of the feed supplement must be 100% natural plant-based and non-GMO.	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.	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."**	Section 4 point 2a . Pg7	The methodology has chosen to focus on natural and plant based supplments to ensure environmental integrity. Synthetic supplements could be included at a later time with a methodology revision. Comment responded to appropriately.

Feedback on VCS draft methodology: Methodology for the Reduction of Enteric Methane Emissions from Ruminants through the Use of 100% Natural Feed Supplement

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

Methodology Section	Paragraph	Page	Topic	Question / Comment	Answers	Correction	RCE Assessment
Summary		5	"...applying empirically-derived regional emission reduction factor provided by the supplement manufacturer..."	What scientific evidence is required for accuracy / applicability of the the 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->"ERFEnteric 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 organization."	NA	Comment addressed through requirements in methodology and VCS standards on default factors.
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 planted-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."**	Section 4 point 2a . Pg7	To ensure environmental integrity, only natural supplements are allowed at this time. To clarify that chemically extracted components are allowed, additional language has been added.
4. Applicability Conditions	2b	7	.."must have no negative health impacts on the animal to which it is fed."	What proof is required that the supplement does not lead to any negative health impact to animals? What about to impact on humans when using the animal products (e.g. milk, meat)?	Please see section 4:" The feed supplement must have been demonstrated to meet all requirements and conditions for the assurance of feed safety in each national or subnational jurisdiction in which it is consumed" In order to be more clear we sligthly modified the sentence: "The feed supplement must have been demonstrated to comply with all feed and food regulations in each national or subnational jurisdiction in which it is consumed"	Secion 4 point 2b pg7	Proof no negative impacts to animals would need to be provided during validation/verification. Language in methodology also edited to include "significant" so that small changes do not impact projects.
4. Applicability Conditions	2c	7	"...pre product specification..."	typo? "per" instead of "pre"	ok	section 4 point 2c . Pg7	Corrected in methodology.
4. Applicability Conditions	2c	7	"...such as the feeding routine and dose of supplement per kg of DMI to the animal."	Are these just examples? Some substances will vary in effect depending on feed composition (e.g. NDF) and thus require tracking of more information on feed composition.	We agree, and these are examples, however, this applicability condition is to secure that the farmer is using the supplement according to the manufacturer's specifications. Details on feed composition/ quality can be found in sections 8&9	NA	Comment addressed through requirements in methodology.
4. Applicability Conditions	2d	7	"...factor of 17%..."	What is the rationale for this threshold? No background (scientific or other) is provided for this very specific number. Also, maintaining this requirement would prevent project activities with lower reduction factors - which for example could be low-cost options which could be applied when funds are limited.	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.	NA	Threshold has been removed as part of RCE's assessment.
4. Applicability Conditions	5a	8	"...for a minimum of one year."	Animal feeding practices are known to vary significantly between years (e.g. changes in feed availability due to weather events or market changes). What are the conditions / reasoning for limiting the baseline to one year? What safeguards are in place to ensure that baseline does consider variations, respectively does not represent a biased event?	The applicability condition is asking data for a minimum of one year. The situation before and after the project implementation needs to be described. Examples such as changes in feed availability due to weather events or market changes are extreme and highly unpredictable. If there are huge variations from the previous year should be addressed in the project design document and the monitoring report. Also, many scientific sources report average annual values, therefore, one year is representative to capture the variations in a farm.	NA	Comment addressed through changes in methodology including the requirement to provide 3 years of historical data for Option 2 baseline and 2 years of historical data for comparative purposes for Option 1 baseline.
4. Applicability Conditions	4	8	.."project proponent must be able to trace the feed supplement from on-farm consumption"	More specific information may be needed here. E.g. how would one ensure that each animal receives the necessary amount of supplement in less controlled (non-TMR/PMR) dairy systems such as are common in developing countries? Are there options for management systems where animals roam and graze over a large area and do not receive dietary supplements? Consumption of feed supplement per animal should be listed in the monitoring plan.	The consumption of the feed supplement is listed in Section 9.3: "..In order to do so, project proponents must provide detailed feeding records for each farm as well as proof of purchase of an appropriate quantity of the feed supplement." The monitoring process and feed traceability are something that the project proponent has the liberty to design and not the methodology developer. Therefore, this methodology makes sure the project developer demonstrates to the verification body the feed consumption.	NA	Comment is addressed in the methodology and many of these specifics will be confirmed during validation/verification.
5. Project Boudary	first paragraph	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.	NA	Comment is addressed in the methodogy.

5. Project Boudary	first paragraph	8	"...emissions in feed supplement manufacture and transport, which are considered negligible in this 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 manufacturer to be transparent on the carbon footprint of the feed supplement production.** "	Section 5, pg 8	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 neglible increase. Project emissions associated with the manufacturing and transport of suppplements are within the boundary and accounted for.
5. Project Boudary	Table 3	8 and 9	N2O emissions	Certain supplements may have an impact on manure composition and thus N2O emissions. Methodology developer needs to provide an approach to account for N2O emissions which could be omitted if it can be proven that there is no effetc for a specific supplement.	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 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, 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).	NA	Methodology addressed comments by excluding manure emissions from the boundary (and having to prove that any supplement would not increase emissions).
7. Additionality	Step 2	9	Positive list / activity penetration	1) According to VCS Standard, new products which have not yet been available on the commercial market in the project region cannot directly apply positive list approach A but must instead perform a barrier analysis. Also applying the positive list to the entire world without further restrictions seams unjustified. 2) MAP is likely less than 3.6bn ruminants as no product will be avaialble for all catlle owners worldwide. Some key factors likely reducing MAP are a) animal access for supplement provision (e.g. range fed animals will not be accessible to feed supplements in a controlled fashion), b) maximum production, storage and transport capacity, c) distribution to rural environments will likely be limited.	1)This is probably no true. Our first approach was barrier analysis demonstrating that projects would not have been implemented without the benefits of carbon certification but VCS proposed to change it. 2)We undersand the argument however the proposed factors are random and cannot be adrressed as the scope of this methodology is new and therefore this will be a discussion for the second round of the additionality assessment	NA	Comment one was addressed by VCS. Comment two was addressed by changes during RCE's assessment. The MAP value was decreased by ~1.6 billion to focus on meat and dairy ruminants.
8. Quantification...	Figure 1	10	Decision tree	Options should be described for easier comprehension of the decision tree.	We appreciate the comment, however, the decision tree is simply a set of cascading questions. The questions will guide you to choose the correc option which is furher described in the section 8 and under the decision tree	NA	Methodology is sufficient and decision tree shows options clearly.
8. Quantification...	Figure 1	10	Decision tree	If different options are used for baseline and project assessment, it must be ensured that emission reduction are calculated conservatively (due to the high uncertainty for Option 2/3 values). This is especially true if default values (Option 2/3) are applied in the project scenario while referencing a measured baseline. How is conservativeness ensured in the methodology?	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."	NA	Methodology now includes discount factor if using default values and any direct measurements need to take into account uncertainty per VCS guidelines.
8.1 Baseline Emissions	Eq. 2ff	11	Number of animals	Number of days for each animal in group j is unclear, as this would have to be either an average, if formula 2 is applied, or a total of days (sum over days per cow) in a formula without Ni,j number of animals.	During the monitoring period, the animals in each group are fed with the feed supplement. For example if the emissions factor for animals in group j is 100kg/day then the total will be 100 kg/day * AVG number of animals in the group * dyas on feed	 CR1.New eq 1 without the sum since we take the sum in eq 2 etc. CR2 of section 9.2 parameer Nij	Methodology addresses this comment.

8.1 Baseline Emissions	Eq.3	11f	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. 10.30) may be used as an alternative if regional values are not available.	NA	Methodology now includes discount factor if using default values to ensure conservativeness.
8.1 Baseline Emissions	Eq.4	12f	Default emission factors	High-level default IPCC conversion factors are applied per animal category. These are per-head EFs not 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 flactuations. 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. "	NA	Methodology now includes discount factor if using default values to ensure conservativeness.
8.2 Project Emissions	Eq. 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 explicity state that "BEEnterici" would have to be calculated with project herd structure and animal counts). 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.	please see answer row 17	please see correction row 17	Herd fluctuations are assumed to occur regardless of project activity, therefore no change is needed.
8.1 Baseline Emissions	Table 5	13	Horse, mule/ass, swine, poultry	Horse, donkey (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	table 5	Methodology corrected for this comment.
8.2 Project emissions	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.	$EFEnteric_{i,j} = \sum_{j=1}^{N} [EFProduction_{i,j} * N_{i,j} * Days_{i,j}]$	Methodology is sufficient.
8.2 Project emissions		15	Supplement prodution 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, siginificant emissions might arise from growth and harvest. Instead of general exclusion of these emission sources, they should be generally inclduded (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	$EFEnteric_{i,j} = \sum_{j=1}^{N} [EFProduction_{i,j} * N_{i,j} * Days_{i,j}]$	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 neglible increase. Project emissions associated with the manufacturing and transport of suppplements are within the boundary and accounted for.
8.3 Leakage		15	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 = DMIj*Energy Density	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 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.	ok. Please see also answer in row 3	NA	Comment addressed through requirements in methodology and VCS standards on default factors.

General			GHG scope	No emisson 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 paragraphin 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; Dini 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	NA	Methodology addressed comments by excluding manure emissions from the boundary (and having to prove that any supplement would not increase emissions).
General				Default IPCC values cited refer to IPCC 2006 specifically. It is known that many IPCC 2006 default values have high errors (see comments above) and should thus not be applied. New IPCC values are expected this spring. It should thus be recommended to apply the newest IPCC values available (but only if errors of default values are in an acceptable range as required by the VCS standard).	We agree therefore it is clear that our methodology encourages country or regional specific data to reflect the ruminants characteristics. Please see as an example 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." Also in our methodology we suggest to use updated data, please see section 9.1 as an example "..To be updated each crediting period if new data exists." The 2019 Refinement will not revise the 2006 IPCC Guidelines, but update, supplement and/or elaborate the 2006 IPCC Guidelines where gaps or out-of-date science have been identified. It will not replace the 2006 IPCC Guidelines. It should be used in conjunction with the 2006 IPCC Guidelines.	NA	Methodology now includes discount factor if using default values to ensure conservativeness.

Comments received on Methodology for the Reduction of Enteric Methane Emissions from Ruminants through the Use of 100% Natural Feed Supplement
This comment was received via email by the VCS.
Submitted by: Karen Haugen-Kozyra
Organization: Viresco Solutions Country: Canada

Comment	Answers	Corrections	RCE Assessment
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.**	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)	pg 5	Methodology updated for this comment.
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).	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.	NA	Threshold has been removed as part of RCE's assessment.
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 methanogensis'. 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 protocd. Otherwise, remove it and if there is a synergistic effect on enteric methane emissions, then why be concerned about it?	In the previous versions of the methodoogy we were describing in more detail the mode of action "..methane (CH4) enteric emissions by direct inhibition of methanogens in the rumen; in particular, it suppresses high-methane producing Methanobrevibacter species of the "Smithii-Gottschalkii-Millerae-Thaurei" clade (SGMT clade)." VCS aked to delet the detailed description	NA	Methodology based on VCS guidance.
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 intoaccount (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.	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. "	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 neglible increase. Project emissions associated with the manufacturing and transport of suppplements are within the boundary and accounted for.

General Comment – related to the above, focusing only on methane emissions from enteric fermentation, and not potential effects of other gases such as N2O or CO2 isn't sufficient. The protocol should at least demonstrate that they are not affected. To be credible, the process of reviewing controlled, related and affected sources and sinks (ISO 14064:2) for their 'relevance' to the accounting process, or demonstrating that secondary effects outside the project boundary (WRI GHG Project-based Protocol) are minimal or need to have a discount applied is important; even in the production of the feed additive. This needs to be demonstrated to the reviewer.	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 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, 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).	NA	Methodology addressed comments by excluding manure emissions from the boundary (and having to prove that any supplement would not increase emissions).
Table 5 – IPCC Tier 1 - The methodology 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.	table 5 updated	pg 13	Methodology updated for this comment.
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

Comment	Answers	Correction	RCE Assessment
Page 7, Footnote #1: Please provide full reference, this publication is not listed in Section 10 (References)	Knapp, J.R., Laur, G.L., Vadas, P.A., Weiss, W.P., Tricarico, J.M., 2014. bemNInvited review:b/emN Enteric methane in dairy cattle production: quantifying the opportunities and impact of reducing emissions. J. Dairy Sci. 97, 3231–3261.	page 24	Methdology corrected for this comment.
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, and a project can reliably demonstrate the use of corresponding feeding practices per this methodology, should such emission reductions not be included?	Footnote 1 is referring to point 2.d and not point 1. This might have caused a misunderstanding.	NA	Methodology only focuses on reduction in enteric methane.
Page 7, 2.c.: Please correct spelling to “as per” rather than “as pre”	OK	pg 7	Methdology corrected for this comment.
Page 7, 2.d.: What is the justification for the 17% threshold?	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.	NA	Threshold has been removed as part of RCE's assessment.
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.	please see updated document		Comment addressed through changes in methodology including the requirement to provide 3 years of historical data for Option 2 baseline and 2 years of historical data for comparative purposes for Option 1 baseline.
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 outline for the project to reliably demonstrate that the chose “situation” serves as a conservative baseline.	5b."Where project areas involve livestock farms that begin to engage in livestock production only after the start of project activities, the project proponent shall provide evidence to substantiate the farm stratum to which each new project area is allocated (i.e., the baseline emissions will be considered as the average situation of where the project is located). "		Methodology addresses comment.
○ If new livestock operations are to be established, it should be demonstrated by the farm that plans for establishing such operations have existed and would have been realized in the baseline scenario. Otherwise, it could be argued that new livestock operations may result in net emission increases relative to the prior land use activity.	please see updated document		Methodology addresses comment.
Page 12, Table 4: Given possible revisions of the IPCC Guidelines, it may be preferable to reference the “latest version” of the IPCC Guidance to reduce the need for making continuous updates to the methodology document. It might be 2006 or a future iteration.	In section 9 we alway specify For each parameter "To be updated each crediting period if new data exists."		Methodology addresses comment.
Page 14, $ERF_{Enteric}$ Option 2: We assume that emission reductions from any improved feeding practice (e.g. provision of supplemental legume feed) could be accounted for using this method as long as baseline and project EFs can be reliable quantified and feeding practices demonstrated.	Yes, this methoology is for any feed supplememnt that reduces enteric methane		Methodology addresses comment.
Page 15, Parameter GE_j:			
○ 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.	Please see section 9: Parameter GE : "Data must be provided by the livestock operator or associated partners for each animal group. Gross energy intake can be calculated by dividing dry matter intake by the energy density of the feedstuff: The right gross energy (GE) content of the diets is being calculated depending on the fat level of the diets therefore the livestock operator or associated partners need to demonstrate if the fat content of the diet is in the 4 to 6 % range...The right gross energy (GE) content of the diets is being calculated depending on the fat level of the diets therefore the livestock operator or associated partners need to demonstrate if the fat content of the diet is in the 4 to 6 % range. Parameteter DMI: "Data must be provided by the livestock operator or associated partners for each animal group. The farm records must document the average daily dry matter intake by animal grouping in the project DMI values are used to calculate the GEj "		Methodology addresses comment.
○ Conservativeness of default value 18.45 MJ kg should be demonstrated.	If a more accurate value of energy density cannot be determined: - 18.45 MJ kg’-1 may be used as a default for diets including edible oils in the range of 4 to 6% - 19.10 MJ kg’-1 may be used as a default for diets including edible oils below the range of 4 to 6%	parameter GEj , Section 9.1, pg 15	Methodology addresses comment.
Page 19, Parameter $EF_{Production i,j}$:			
○ Purpose of the data indicates calculation of the *baseline* scenario, however *project* emission procedures are described in “Justification of choice of data [...]” box. Please clarify.	The world project in this section is referring to the implementation of a carbon project. We will rewrite to avoid misunderstanding	pg19. "To quantify the production of enteric CH4 animal samples for each group are selected to perform the direct measurement. "	Methodology addresses comment.
○ “Justification of choice of data [...]” box further refers to a “sufficient number and sampling times” which requires further definition. Sufficient by which standard?	Sampling protocols should include sufficient numbers and sampling times to account for diurnal and postprandial variation in CH4 . We also specify that because this approach requires direct measurements of methane emissions project proponent or associated partner must demonstrate experience in methane measurement technologies	pg19. Sampling protocols should include sufficient numbers (statistically significant sample size) and sampling times to account for diurnal and postprandial variation in CH4	Methodology states that any direct measurements need to take into account uncertainty per VCS guidelines and the development of default factors.
Page 22, 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”	please see applicability condition 5. Section 4		Methodology addresses comment.

Uncertainty does not seem to be addressed in the methodology. Procedures for calculating (and making deductions from ERs 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.

Submitted by: Patrick Cage
Organization: Greenhouse Gas Management Institute
Country: United States

"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 edits 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	Answers	RCE Assessment
"a. The active ingredients of the feed supplement must be 100% natural plant-based and non-GMO."	In recent years, studies have shown that particular species of seaweed (macroalgae) have the ability to reduce emissions from enteric fermentation. To clarify that such macroalgae can be used under this methodology, we recommend the text changing the text to state "100% natural plant-based (terrestrial or aquatic) and non-GMO" or "100% natural plant-based (including macroalgae) and non-GMO."	The active ingredients of the feed supplement must be 100% natural plant or macroalgae based and non-GMO."	Methodology addresses comment and has included additional language for specificity.
"c. 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.	ok	Methodology addresses comment.
ERFEnteric 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."	We believe that the standard used for ERFEnteric 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 verifier, which creates a risk of ignoring substantial differences. Given the huge variation in enteric fermentation emission factors for ruminants 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 husbandry and management that will determine the baseline ruminant 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 farm-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.	According to VCS guidelines any 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. Please see Section 9.1. Source of data and level of detail is described for each patameter "The project proponent must provide evidence to demonstrate the level of enteric CH4 production during the baseline scenario To quantify the project enteric CH4 animal samples for each group are selected to perform the direct measurement. The project proponent needs to describe the required sampling protocols against objectives conditions. Sampling protocols should include sufficient numbers and sampling times to account for diurnal and postprandial variation in CH4 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...Because this requires direct measurements of methane emissions project proponent or associated partner must demonstrate experience in methane measurement technologies"	Methodology addresses comment and it is understood that the burden of approving the sampling and measurements or manufacutrer data will rest with the validator.
There would be some small additional upstream emissions in feed supplement manufacture and transport, which are considered negligible in this methodology."	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 additionality 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 sourced more locally. As such, we recommend that the transportation emissions associated with the feed supplement be estimated, or that 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. "	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 neglible increase. Project emissions associated with the manufacturing and transport of suppplements are within the boundary and accounted for.