EXPERT ASSESSMENT REPORT: IMPROVED MANAGEMENT IN PADDY RICE PRODUCTION SYSTEMS

Methodology Title	Improved Management in Paddy Rice Production Systems
Version	1.0
Sectoral Scope(s)	Sectoral scope(s) applicable to this methodology
Document Reviewed	VM00xx Improved Management in Paddy Rice Production Systems_OC_06Jun2024
Date of Issue	11-December-2025
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1 INTRODUCTION

Verra is funding and managing the development of a new VCS Methodology for Improved Management in Paddy Rice Production Systems (ID#M0253). Per section 2.1.2 of the *Methodology Development and Review Process, v4.4*, this methodology is being developed through an alternative process that has been deemed more efficient and equally robust. The alternative process included:

- Replacement of Section 3.5 Step 5: Validation/verification body assessment of methodology with review by a group of independent experts.
- Conducting the review by a group of independent experts in parallel to the public consultation

Based on their experience in the measurement and monitoring of GHG emissions in rice systems and project development for the carbon market, Verra hired Dr. Tao Li (expert assessor) to provide an expert assessment of the proposed methodology. The expert assessor's assessment focused on:

1) Scientific rigor: Assessment of whether the methodology reflects the most recent scientific knowledge of GHG emissions measurement in rice production systems.
2) GHG quantification: Assessment of whether the approach for identifying GHG emissions sources, measuring and/or estimating emissions, and calculating emissions reductions is appropriate, adequate, and conservative.
3) MRV approaches: Assessment of whether the allowable MRV approaches reflect the most recent scientific understanding of best practices for monitoring, reporting and verifying GHG outcomes from improved paddy rice management practices.
4) Gap analysis: Assessment of potential gaps (e.g. lack of scientific consensus or technology readiness) that could jeopardize the methodology integrity and quality of the carbon credits.

2 ASSESSMENT APPROACH & FINDINGS

The expert assessor reviewed the draft methodology[1] that was published for the public consultation and provided feedback to Verra. Verra worked with the consultant hired to draft the methodology, ATOA Carbon, to prepare responses to the expert assessor findings and update the methodology accordingly. The expert assessor reviewed the responses and provided confirmation that the planned updates would address the findings. See Appendix 1 for the detailed list of expert assessment feedback received, Verra's responses and proposed updates.

[1] Draft methodology from June 11, 2024, available here: https://verra.org/wp-content/uploads/2024/06/VM00XX-Improved-Management-in-Paddy-Rice-Production-Systems_PC_06Jun2024.pdf

3 ASSESSMENT CONCLUSION

The expert assessor has completed the expert assessment of the draft *VMooxx Improved Management in Paddy Rice Production Systems*[2] and confirms the draft methodology, and proposed updates adhere to the criteria established.

4 EXPERT QUALIFICATIONS

Dr. Tao Li is a Senior Scientist – Environment/Crop Modeler at the International Rice Research Institute. He has authored 47 peer-reviewed scientific publications to date. A detailed list of Dr. Li's employment, education and qualifications, and research publications is available on the ORCID registry here: https://orcid.org/0000-0002-1360-1396.

5 SIGNATURE

Signed for and on behalf of:

Name of entity: _____Tao Li___________________________

Signature: ___ ______________________________

Name of signatory: __Tao Li_______________________________

Date: __14 Dec 2024_________________________

[2] Draft methodology from June 11, 2024, available here: https://verra.org/wp-content/uploads/2024/06/VM00XX-Improved-Management-in-Paddy-Rice-Production-Systems_PC_06Jun2024.pdf

APPENDIX 1 – EXPERT FEEDBACK

Section 2 – Summary Description of the Methodology			
#	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
1	This agricultural land management (ALM) methodology provides procedures to estimate the greenhouse gas (GHG) emission reductions (CH_4, N_2O, and CO_2) resulting from the adoption of improved management practices in paddy rice production systems.	Management practices - Is it addressing to all management practices such as irrigation, fertilizer application, residue management, tillage, crop establishment, cultivar, inhibitor application, and so on. If not, it is needed to be specified	Thank you for your comment. Yes, the methodology takes into consideration all of those elements.
2		Paddy - Restrict, paddy is only the land preparation method. For rice production ecosystems, we may need additional words, such as irrigated, rainfed, or irrigated and rainfed, to specify the definition of ecosystems that will be addressed in this methodology	Thank you for your comment. Only irrigated rice cultivation is eligible, so this description will be updated accordingly.
3	The crediting baseline and additionality are determined via a project method. The baseline scenario assumes continuously flooded rice paddies and the continuation of historical rice cultivation practices. The management practices in the baseline scenario are determined by applying a historical look-back period to produce an annual schedule of activities (i.e., irrigation, planting, fertilization, and harvest events) for each quantification unit within the project area (e.g., for each field). Each project must include	Continuation of historical rice cultivation practices - Rice monoculture or rice-based rotation? How many season or years? Hopefully, the information will come later on	Thank you for your comment. Guidance in Section 6 stipulates the historical lookback period must be at least 3 years in duration. The guidance in Section 6 has been updated to make it clear that at least 3 years of data pertaining to rice cultivation under flooded conditions is needed for the historical baseline (ie at least one season of flooded rice cultivation, for each of three years). Where rotations of non-rice crops are present within the period containing at least 3 years of flooded rice, the project proponent must ensure sufficient data is captured during the non-rice cultivation periods to satisfy all requirements of the stratification requirements (if using QA2) and the chosen emission factors. In particular the stratification criteria for water regime pre-season and the scaling factor SFbsl,p (as used in Equation (18))

Section 2 – Summary Description of the Methodology			
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	activities that materially reduce soil methanogenesis (reducing CH_4 emissions) and may optionally include further practices including avoided biomass burning (reducing CH_4 and N_2O emissions), more efficient nitrogen fertilizer usage (reducing N_2O emissions), and more efficient fossil fuel usage (reducing CO_2 emissions). Any quantitative adjustment in optional further practices (e.g., decrease in fertilizer application rate and/or fossil fuel use) must exceed 5% of the pre-existing value to qualify as a practice change.		representing the water regime pre-season must be captured.
4		Soil methanogenesis (reducing CH_4 emissions) - There are two different meanings (check the definition at https://en.wikipedia.org/wiki/Methanogenesis). I suggest it is focused on the reduction of CH_4 emissions. Simply, reduced CH_4 emissions may not imply the reduction of methanogenesis, possibly because of the increase of oxidation of methane which opposite to the methanogenesis.	Thank you for your comment. The guidance in this section has been updated to refer more generally to 'reduction in methane emissions'.
5		More efficient nitrogen fertilizer usage (reducing N_2O emissions) - More efficient use does not always mean the N_2O reduction.	Thank you for your comment. The guidance has been updated to refer to changes in nitrogen fertilizer management that reduce N_2O (i.e. reductions in total nitrogen usage, and/or the use of interventions such as nitrification inhibitors).
6		Fossil fuel usage - Do you mean this in the production chain or just directly used in rice paddy fields such as used to pumping irrigation water?	Thank you for your comment. Only on-field reductions in fossil fuel usage, primarily fossil fuels associated with running irrigation pumps, or for machinery used to remove rice straw, are calculated using this section.
7	Additionality is demonstrated by a barrier analysis and a common practice test to determine that the practice change implemented under the project activity is not common practice.	Common practice - Is it defined in CMD tool24?	Thank you for your comment. Please note we will be moving to instead reference the new VCS tool for additionality and ensuring alignment with that tool instead of the CDM tool referenced here.

Section 3 - Definitions			
#	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
8	A system of cultivating irrigated lowland rice using controlled and intermittent irrigation cycles (i.e., single or multiple drainage events during the cultivation period). This water management technique uses much less water than the usual system of maintaining continuous standing water in the crop field (i.e., continuous flooding). A periodic drainage and re-flooding irrigation schedule is followed, and the water level must reach -15 cm below the soil surface during the entire drainage period.	Much less - I supposed it is ok if water saving is >5%, according to the statement in previous section. If so, why do we not numeric it? The consistence of the document should be maintained	Thank you for your comment. We have updated the text to give indication that a greater than 5% reduction in water usage is to be expected.
9		~15 cm - Is it an essential condition for AWD? Personally, I do not agree because it is often but not always. Our recent study based on meta-analysis show that this constrain may result in significant yield loss in some biophysical conditions The meta_analysis article with https://doi.org/10.1016/j.agrformet.2024.110075 confirmed the reduction efficiency of AWD on CH_4) and the general increase of N_2O, but it does not have colusion about yield. The article https://doi.org/10.1016/j.jclepro.2022.131487 has some information AWD and yield, but did not have enough information about the relationship between AWD water level and yield. Our article, leading by Yan Bo with title "Global increase in water productivity through improved alternate wetting and drying irrigation" has be prepared and submitted for publication in the process. It has more insights about the relationship of AWD water level and yield (Figure1). If the groundwater level threshold is about 15 to 20, yield changed between -20 to +40%. Hopefully, this article could be published very soon. For this question	Thank you for your comment. Please note we received extensive expert feedback on this issue and crafted the following additional guidance to address your concerns and those of others. Please confirm if you consider this new guidance sufficient: "Each project must use persons with suitable qualifications and/or agronomic experience to develop criteria specific to each stratum and/or rice variety, with respect to the recommended depth and duration for AWD drainage events. In developing guidance for the project farmers, the given expert must take into account the critical goal of ensuring yield does not decline by more than 5% as a result of implementing the AWD activities. Where it is recommended by the given expert that a region of the project should employ AWD to a depth of less than 10cm below the soil level, the project must use Quantification Approach 2 for any such areas of the project. Note, where Quantification Approach 2 is applied, it is still necessary to ensure all project farmers are following the agronomic guidance provided by the project proponent with respect to the appropriate depth and duration of drainage specific to their stratum. With respect to timing of when AWD events are to occur, it is recommended, but not required, that farmers undertake their first AWD drainage event at least 21 days after the initial flood, to ensure the pre-flood N application has time to be absorbed and is not washed

Section 3 - Definitions			
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		need to be addressed more wisely.	away. Demonstrating that farmers have been provided training and agronomic guidance in the appropriate depth and duration for AWD for their given area is required. Training alone is not sufficient to demonstrate AWD was actually employed in a given project. It will be the responsibility of each project proponent to determine what data is sufficient to meet the Monitoring, Reporting and Verification requirements of the methodology, following the guidance throughout the methodology, including Box 1. It will then be the role of the VVB to determine if such MRV efforts are reasonable and sufficient to meet methodology requirements, in the given circumstances."
10	Rice paddies cultivated in water-logged soils where the land is flooded before puddling, then continuously flooded with surface standing water until crop maturity (i.e., a few days before harvesting).	The land is flooded before puddling - Do you mean it should be OK if the land is drought as upland during the fallow period, and then if it flooded just before the puddling?	Thank you for your comment. The guidance in the methodology will be updated to provide the following specific new guidance: "Lands that are kept dry for a significant period prior to cultivating rice in a given season are eligible. However, the dry period prior to cultivation of rice in the project must not be longer than any dry period in the baseline. The number of days of pre-season dry period need not be the same as the project scenario, but the project must not introduce an extra fallow rotation/dry period that was not present in their typical baseline rotation. If the project did introduce an additional dry period/rotation that was not present in their baseline crop rotation scenario, the project would have to ensure the management practices employed offseason did not materially impact SOC stock, leading to losses and leakage."
11	The period of time that begins with pre-planting field preparation on rice	Pre-planting field preparation - Can I assume the seedling bed period is excluded from	Thank you for your comment. The guidance in the methodology will be updated to provide the following specific

Section 3 - Definitions			
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	paddies and ends at the harvest event.	cultivation period for transplanting system.	new guidance: "Lands that are kept dry for a significant period prior to cultivating rice in a given season are eligible. However, the dry period prior to cultivation of rice in the project must not be longer than any dry period in the baseline. The number of days of pre-season dry period need not be the same as the project scenario, but the project must not introduce an extra fallow rotation/dry period that was not present in their typical baseline rotation. If the project did introduce an additional dry period/rotation that was not present in their baseline crop rotation scenario, the project would have to ensure the management practices employed offseason did not materially impact SOC stock, leading to losses and leakage."
11	A variety of rice growing under rain-fed or dry cultivation systems with minimal standing water, maintaining soil aerobic conditions.	Dry - Do you mean upland, aerobic, or upland aerobic? I cannot find "dry cultivation system" from Wikipedia. It may not be clearly enough. Do you mean rainfed without field bund for water reservation	Thank you for your comment. Please note that D-WDR has been removed from the methodology. Please also note that the definition was adapted from the defintion used in the CDM methodology: CDM MP93-A03 Draft Small-scale Methodology: Emission Reduction by Application of Dry-cultivated Water-saving and Drought-resistance Rice (D-WDR) in Rice Cultivation.
12		Rain-fed or dry cultivation systems with minimal standing water, maintaining soil aerobic conditions -	
13	The time period prior to the project start date covering at minimum three years and three complete crop rotation. The historical look-back period is used to produce the schedule of activities.	Crop rotation - Does it include rice monoculture system, rice-fallow, rice-based rotation?	Thank you for your comment. Yes.
14	Defined area within the project for which GHG emission reductions are estimated using the selected	Similar management activities - How much similar? Similarity is >90%, 70%, 50%, or 20%,	Thank you for your comment. The approach taken here mirrors the VM0042 methodology, in that it provides flexibility to allow the project proponent to themselves

Section 3 - Definitions			
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	quantification approach. The entire project area is divided into multiple quantification units that must be demonstrated to be homogenous for the purposes of estimating reductions (i.e., similar management activities, soil type, and climate). Estimates of reductions for each quantification unit within the project area are then aggregated to produce an estimate for the entire project area. Quantification units must be clearly defined in the description of the sampling design provided in the project description.	which one?	determine the most suitable stratification and sampling design for their project based on the available data/information. It is then the role of the third-party Validation and Verification Body to assess whether their stratification techniques are valid for the given project.
15	Rainfed and deep-water	They are two contrast things	Thank you for your comment. Please note that D-WDR has been removed from the methodology.
16	A type of water regime in which fields are flooded for a significant period of time and irrigation depends solely on precipitation, there is no controlled irrigation systems.	Irrigation depends solely on precipitation - Do you mean the irrigation water was harvest from rainfall? Maybe, you mean "reserve rainfall in field to maintain the flood period as long as possible?	Thank you for your comment. The key detail here is that there is no controlled irrigation. Any system without controlled irrigation equipment is not eligible.
17	Sample location of undefined area.	What is it? It should be more additional words to clarify it. Is it the area outside project area or the area do not have measurement activities? From "Quantification unit", I can guess it the area outside the project area, am I right or is it your meaning?	Thank you for your comment. That definition has been updated as follows: "Location where sample will be taken." The sample might relate to a control plot (i.e. chosen as representative of historical baseline activities for the given stratum) or sample of the activities implemented by the project. Control plots will by definition be outside of the project, as no eligible activities are being implemented in that field. We will also update the guidance to require that control same plots be no further than 250km from the relevant

Section 3 - Definitions			
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			quantification units/stratum they are linked to. Sample locations chosen to represent project activities must be within the project area.
18	Annual schedule of historical management/activity practices applied in the baseline scenario over the historical look-back period (e.g., irrigation, fertilizer usage, and biomass amendments). These practices are determined following the data requirements given in Box 1.	Annual - Can I assume it is the calendar year? How do you had the cropping period over cross calendar year?	Thank you for your comment. Project proponents need to capture data for an entire cropping season, including crossing into a new calendar year (as will be common). The guidance has been updated to make it clear that all data for the given season(s) needs to be captured, including where they span across multiple calendar years.
19	Microbial production of CH_4 gas in soils by several groups of soil bacteria (i.e. archaea) breaking down organic matter in anoxic conditions, like waterlogged or submergence soils.	"Process that produce methane (CH_4)".	Thank you for your comment. The suggested edit has been made.
20	A system of planting rice where seeds are raised in a nursery bed for 20 to 30 days. The young seedlings are then directly transplanted into flooded rice production fields.	Why? Is it "transplant rice" if the nursery bed duration is less than 20 days?	Thank you for your comment. We have removed reference to the 20 to 30 days. Given nursery time is variable, and has no impact at all on GHG flux, the guidance with respect to days has been removed from this definition.

Section 4 – Applicability Conditions			
#	**Paragraph from Draft Methodology**	**Comment**	**Developer's Response and/or Update**

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21	Use of methanotrophs	It implies the manipulation of microbe for reducing CH_4 emission such as cable bacteria, but exclude any kind of inhibitors such as biochar, EBS, ect. Please ensure it is your meaning.	Thank you for your comment. The guidance in the methodology has been updated to make it clear that the application of biochar to soils on project fields is eligible under this methodology, and that QA2 is necessary for all fields to which biochar is applied. The stratification guidance in Table 3 has also been updated to include biochar as a mandatory requirement, where biochar is applied. Please also note that under VCS rules it is possible for a project to use multiple methodologies, and thus a project may also use VM0044 to be credited for emission reductions associated with the production of biochar. Projects must ensure they meet the requirements in Applicability Condition (8) with respect to not materially reducing the volume of biomass input to soils relative to baseline conditions.
22	Improvements in nitrogen management (i.e., reduction in N-application rate and/or the use of nitrification inhibitors or slow-release N-fertilizers)	Nitrification inhibitors - Please ensure, the denitrification inhibitors are also excluded in this methodology	"Thank you for your comment. Please note, this guidance gives examples of potentially eligible activities, but ultimately whether an activity is eligible or not will be determined based on whether sufficient data, in particular emission factors, can be determined. With respect to underlying requirements for emission factors, please see the guidance in Section 8.3. With respect to de-nitrification inhibitors, can you please clarify why you are recommending these be excluded?"

Section 5 – Project Boundary

#	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
23	Use of nitrogen fertilizers and nitrogen derived from crop residue (i.e., rice straw) incorporated into soils	Can I assume the CH_4 changes have been quantified in soil menthanogenesis	Thank you for your comment. Yes.
24	Table 3: Schedule of activities and stratification guidance	There are several categories for each parameters. The table structure shows that parameter linked mandatory. It show be clarified for whether the mandatory applied all categories or just anyone of them, or something else?	Thank you for your comment. If a row aligned with the column indicating mandatory, then everything in the given row(s) is mandatory. Please note this is the same format used by the IPCC, and used in many offset methodologies, and we have not received any similar clarifying requests, so we believe it's best to leave the structure of the table as-is.

Section 6 – Baseline Scenario

#	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
25	Values/Categories	Are the categories used to define similarity of crop management for determining the quantification unit? If so, please make it clearly here and also in the definition of "quantification unit".	Thank you for your comment. Yes. The guidance in this section has been updated to require random stratified sampling, using the criteria set out in Table 3. The position taken in VM0042 is not to define the quantification unit, thus leaving it open for the project to adopt a two-stage stratification. We are allowing the same flexibility here, for the project proponent to themselves determine how best to define quantification units, and stratify.
26	Single	Single of what? Single irrigation, or single drainage	Thank you for your comment. We have updated that guidance to read 'single drainage'.
27	Flooded	What is the different of "flood" and "continuously flooded", or are they the same?	Thank you for your comment. They are the same. This matches the language used in Tables 5.12 and 5.13 in the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Section 6 – Baseline Scenario

#	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
28	Short drainage (<180 days)	Does it mean the method won't applied to double and triple rice system. If so, the "crop rotation" in page 7 should be clarified accordingly.	Thank you for your comment. The method does apply to single, double or triple systems. The idea is that the project area must be stratified to separate such systems.
29	Long drainage (>180 days)	Same comment as above	Thank you for your comment. Please see our response to your comment 214.
30	Straw on-season	Normally it is not practicable unless the straw was used for residue mulch. Therefore, the effects will be very much different between surface mulching and straw incorporation in soil. Clarify it in the document. Again, since residue mulching and incorporation may results in SOC sequestration and GHG emission increase. How to deal with such management? Future specific methodology?	Thank you for your comment. This category can be taken to mean mulching, as in-season soil incorporation will be impractical.

Section 7 - Additionality

#	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
31	The project proponent must assess whether the main project activity(ies) reducing soil methanogenesis is common practice with a penetration rate greater than 20%. To be eligible, the penetration rate of each single proposed main project activity must be	Each single proposed main project activity must be below 20% - To be considered as an additionality?	Thank you for your comment. Please note the methodology will be updated to instead refer to and align with the new VCS additionality tool.

Section 7 - Additionality			
#	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
	below 20%.		
32	The project proponent must also assess whether a single or suite of optional project activity(s) is common practice. For this assessment, the project proponent must show that the weighted mean adoption rate of the two (or more) optional project activities within the project spatial boundary is below 20% (see Equation (1)). Therefore, an individual activity with an existing adoption rate in the relevant region less than or equal to 20% is always considered additional. Where the adoption rate of one activity (e.g., furrow irrigation) is greater than 20%, the project must include a proportionally higher ratio of other activities with lower adoption rates (e.g., avoided burning of residues or fossil fuel use) to bring the weighted average of proposed project activities below 20%. An individual activity with an existing adoption rate greater than 20% may only be considered additional through the assessment of the weighted mean adoption rate for all project lands within that region.	Adoption rate - are the penetration rate and adaptation rate different? If not, for the consistency, it is better to use adoption rate only	Thank you for your comment. Adoption rate is the only term applied in the methodology. Please note the methodology will be updated to instead refer to and align with the new VCS additionality tool.

Section 8 – Quantification of Estimated GHG Emission Reductions			
#	**Paragraph from Draft Methodology**	**Comment**	**Developer's Response and/or Update**
33	This methodology provides a flexible approach to quantifying GHG emission reductions and carbon dioxide removals from the adoption of improved management practices in paddy rice production in the project compared to the baseline scenario. Baseline and project emissions are defined in terms of flux of CH_4, N_2O, and CO_2 in tonnes of CO_2e per unit area per monitoring period. Within each quantification unit, stock changes in each included pool and source are treated on a per unit basis. Where a monitoring period spans multiple calendar years, the equations quantify reductions by year to appropriately define vintage periods.	The equations quantify reductions by year to appropriately define vintage periods - It is unclear. Do you mean as: if a cropping period is from 2022 to 2023, with 30 days in 2022, and 80 days in 2023, the emission from 2022 to 2023 will be accounted into 2023; otherwise, with 80 days in 2022 and 30 days 2023, it will be accounted into 2022. If so, why do we just simply count the emissions based on calendar year. Anyhow, clarify it.	Thank you for your comment. Yes, you are correct. Further guidance on vintage allocation is given outside of the methodology and is therefore beyond the scope of the methodology. Please also note that we have brought this to Verra's attention, for future VCS Program updates.
34	For each pool/source, subdivisions of the project area that use different quantification approaches must be accounted separately.	To clarify, for single pool/source the approach cannot be mixed, but different approaches can be mixed for given quantification units.	Thank you for your comment. To improve clarity, the quoted guidance has been removed, and the subsequent paragraph has been updated to read as follows: "A project may employ multiple quantification approaches provided that the same approach is used for both the project and baseline scenarios for the GHG calculations of a given pool/source, in the given monitoring period."
35	A project proponent may switch between allowable quantification approaches for a given GHG source during the project crediting period, provided that the same approach is	Some repeat to content in the previous two paragraph	Thank you for your comment. To improve clarity, the quoted guidance has been removed, and the subsequent paragraph has been updated to read as follows: "A project may employ multiple quantification approaches provided that the same approach is used for both the project and baseline scenarios

Section 8 – Quantification of Estimated GHG Emission Reductions			
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	used for both the project and baseline scenarios. The quantification approaches are as follows.		for the GHG calculations of a given pool/source, in the given monitoring period."
36	An acceptable model is used to estimate GHG flux based on soil characteristics, implemented rice production practices, initial SOC stocks, and climatic conditions in homogenous quantification units. All modeling must be undertaken in accordance with the requirements and procedures in VM0042 (refer to Table 8, Section 8.3) and VMD0053. Where the project involves the introduction of a new cultivar with a materially different root biomass to the cultivar(s) used in the baseline, it must be demonstrated that the model domain sufficiently covers such changes. It must also be demonstrated that the model domain sufficiently covers any potential changes in N2O flux associated with the implementation of project activities including changes in irrigation, fertilization events, and changes in biomass to soils. Projects using QA1 must take initial measures of SOC at the project start for use within the model.	N2O flux - How is the CH4 flux, is it the default for model can cover the any potential changes in CH4. For example, the application of Lime or limestone will change the soil methanogenesis.	Thank you for your comment. We are confident that any impacts to CH4 emissions resulting from liming would be sufficiently covered under both QA1 or QA2. Under QA1, the calibration/validation requirements require that the project demonstrate their model domain would sufficiently cover such liming impacts. Under QA2, the project would capture any impacts on CH4. This leaves QA3, where the project would be using default emission factors for CH4 that do not include any accounting for changes in liming. It would be very helpful if you could elaborate a little further, and in particular confirm how significant any CH4 impacts of liming could be. If there are decreases in CH4 associated with changes in liming, we can ignore those, as doing so would be conservative (ie less credits issued relative to actual emission reductions). We need to be sure we are not ignoring any material increases in CH4 that may result from liming. We have reviewed literature that suggests that using lime can reduce CH4. This perhaps implies that if a project decreases liming, that could result in increases in CH4. It would be useful to know if we can any potential increases in CH4 resulting from changes in liming as de minimis, i.e. likely to represent an increase in CH4 that is greater than 5% relative to the total emission reductions expected from the project. Your further consideration and guidance on this would be greatly appreciated.

Section 8 – Quantification of Estimated GHG Emission Reductions			
#	**Paragraph from Draft Methodology**	**Comment**	**Developer's Response and/or Update**
			Thank you.
37		What is the t=o, it is the project starting time or model simulation starting time?	Thank you for your comment. T=o is the date the given activity was first implemented. The guidance in the methodology has been updated to make it clear that T=o, accords with the time the given activity was first implemented.
38	Direct measurement is used to quantify flux in CH_4 emissions for both baseline and project conditions. This approach is relevant where models are unavailable or have not yet been statistically validated or parameterized, or where project proponents prefer to use a direct measurement approach. The baseline scenario is measured and remeasured directly at a baseline control site linked to one or more quantification units. Requirements for directly measuring CH_4 are outlined in Section 9.1.	If the measurements are not implemented in all quantification units, how do you have the evidence to prove the quantifications in none measured units are right. Section 9.1 still does not clarified the doubts. Because the differences among quantification units, if direct measurement is applied, the measurements should be undertaken for all units that use this approach.	Thank you for your comment. The use of a stratified sampling based approach has been adopted, which was adapted from similar usage in VM0042.
39	Flux in CH_4, N_2O, and CO_2 (from energy usage) is calculated following the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories using equations and guidance contained in this methodology. Emission factors for nitrification inhibitors, enhanced efficiency fertilizers, and	This methodology is more interested in CH_4 emission, why does it include the application of methanogenesis inhibitors which even has more information and studies than methanotrophs that has not been implemented in field but more in lab incubation studies.	Thank you for your comment. Please note Verra has determined to retain methanotrophs as an eligible activity. The data we reviewed in considering methanotrophs indicate expected benefits of their use include significant reductions in CH_4, significant improvements to yield and grain quality, and significant improvements to Nitrogen Use Efficiency. Please also note that the guidance in the methodology has been updated to require that QA2 chamber measurements be used to determine CH_4 flux from the introduction of

Section 8 – Quantification of Estimated GHG Emission Reductions			
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	methanotrophs may be derived from literature (see Section 8.3 for further guidance). Where default emission factors are not available for a practice that has been implemented on a given quantification unit (e.g., for practices such as nitrification inhibitors or methanotrophs), one of the other quantification approaches must be used.		methanotrophs. We believe the requirements of QA2 are robust and conservative, ensuring projects are only credited if they result in actual emission reductions from the introduction of methanotrophs. With respect to other methanogenesis inhibitors, we felt it was a little late to be introducing such a significant change in the methodology post-public comment period, and to date we have not reviewed any literature or data on efficacy of the same. Verra may consider other methanogenesis inhibitors for future inclusion in the methodology.
40	Simplified global and national emission factors for CH_4 from soils may only be used by small-scale projects. Sub-national emission factors for CH_4 from soils, N_2O, and CO_2 from energy usage may be used by projects of any size.	Is the reason for the high variation of CH_4 emissions from soil?	Thank you for your comment. The reason of allowing the use of the IPCC Tier 1 EF only for small-scale project is too facilitate the implementation of project in such farmers which often has limited resources for field data collection. Nonetheless, as best practice, QA2 is preferable and as well allowed for small-scale projects.
41	Where the project involves the introduction of a new cultivar with a materially different root biomass to the cultivar(s) used in the baseline, the project must account for the changes in biomass to soil (via changes to the ROA parameter in Equation ().	Is it meaning the methodology is limited only for root biomass of new cultivar, but ignore other possible changes for example, aerenchyma density, the root morphology, root oxidation, etc. If so, it should be clarified in the section of definition	Thank you for your comment. The intent is to require projects to identify any changes that are likely to give rise to a material decline in Soil Organic Carbon (SOC) stock. Declines in SOC stock may be deemed de minimis and need not be accounted for (i.e., value set to zero) where the declines in SOC stock amount to less than 5% of the total GHG benefit generated by the project.
42	This section must be used to quantify any flux in CO_2 emissions from fossil fuel usage, regardless of which quantification approach is used. Where CO_2 emissions from fossil fuel are included in the project boundary per	It should be clarified in Table 4 also.	Thank you for your comment. The guidance has been updated to make it clear that "Flux in CO_2 emissions from fossil fuel usage, must be quantified using the guidance in this section under Quantification Approach 3".

Section 8 – Quantification of Estimated GHG Emission Reductions			
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	Table 2, they are quantified in the baseline scenario under all quantification approaches using Equations (2) and (3) below.		
43	Quantification Approach 3	Is it also for Approach 2	Thank you for your comment. No, Quantification Approach 2 can only be used for CH_4, so the project proponent must always also choose one of the other 2 quantification approaches to account for N2O.
44	Equation 22	It is a wrong equation. The equation for slope of linear regression should be used here.	Thank you for your comment. This equation is standard guidance used for most protocols, including: including eq 2 of the CDM AMS-III methodology. It is possible to also calculate the flux using this formula, where delta C/dleta t is equal to equation 22. If possible, please provide further guidance or suggestions regarding replacement equations or alternative methods, so that we may adjust the methodology accordingly. Linear regression is the most commonly used regression method (including in the above referenced methodologies), however it may not be the best method for calculating CH_4 flux in flooded soil. In such cases we can use a concentration difference method. If possible, please provide further guidance or suggestions regarding replacement equations or alternative methods, so that we may adjust the method accordingly.
45	Equation 24	This is wrong equation again. The 'sl' should be presented here.	Thank you for your comment. Sl will be removed, as it's a typo.
46	Emissions resulting from monitoring period rice cultivation activities are	8.2?	Thank you for your comment. All such cross-referencing errors

Section 8 – Quantification of Estimated GHG Emission Reductions			
#	**Paragraph from Draft Methodology**	**Comment**	**Developer's Response and/or Update**
	calculated or modeled based on monitored inputs. Emissions of CO_2, CH_4, and N_2O during the monitoring period must be quantified following the approaches found in Table 4 and using the equations provided in Section Error! Reference source not found.. For all equations, the subscript bsl must be substituted with mp to indicate that the relevant values are being calculated for the monitoring period.8.2?		have been corrected.
47	Model inputs must be collected following the guidance in VM0042 Table 8 (Section 8.3). As set out in Table 4 of this methodology, Quantification Approach 1 is applicable only to the changes of SOC and the fluxes of CH_4 and N_2O.	Is it CO_2? There is not a flux for SOC.	Thank you for your comment. The reference to SOC is correct. The intent is to require projects to identify any changes that are likely to give rise to a material decline in Soil Organic Carbon (SOC) stock. Declines in SOC stock may be deemed de minimis and need not be accounted for (i.e., value set to zero) where the declines in SOC stock amount to less than 5% of the total GHG benefit generated by the project. Model inputs must be collected following the guidance in VM0042 Table 8 (Section 8.3). As set out in Table 4 of this methodology, Quantification Approach 1 is applicable only to the changes of SOC stock and the fluxes of CH_4 and N_2O.
48	Project Emissions from Reductions in Embedded Fertilizer Emissions	Check this carefully. It seems not agree with the project boundary defined in Section 8	Thank you for your comment. Please note that the option to account for reductions in embedded emissions in upstream production of fertilizers (as set out in Section 8.3.3) has been removed from the methodology. The methodology has been updated throughout to remove reference to guidance related to this option.

Section 8 – Quantification of Estimated GHG Emission Reductions			
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49	Project proponents may estimate the emission reductions associated with upstream imbedded emissions using evidence including peer reviewed literature, government records, production facility records, survey data, publicly available LCA databases, or reports compiled by industry associations.	Life Cycle Assessment	Thank you for your comment. Please note that the option to account for reductions in embedded emissions in upstream production of fertilizers (as set out in Section 8.3.3) has been removed from the methodology. The methodology has been updated throughout to remove reference to guidance related to this option.
50	Model prediction error resulting from uncertainty in model parameters or model structural errors (i.e., inaccurate representation of actual biogeochemical processes). Model prediction error is calculated using independent statistical validation datasets per the processes outlined in VMD0053. Alternatively, project proponents may account for model prediction error by calibrating models to include parameter uncertainty (e.g., a Bayesian implementation of the model) and using the Monte Carlo simulation or error propagation approach detailed below.	Is the section 8.5.4	Thank you for your comment. The guidance in this section has been updated.
51	Sampling error resulting from measuring/modeling only a portion of the project area. Estimates of sampling error are contingent on the sampling design employed by the	Is it include the errors for model inputs and outputs. I think it the variations among sampling locations	Thank you for your comment. If some of the inputs to modeling are sample derived, then yes. Please note that this guidance was adapted from VM0042. We welcome your feedback relating to such guidance, and we will then use such feedback to inform potential updates to the guidance in this

Section 8 – Quantification of Estimated GHG Emission Reductions			
#	**Paragraph from Draft Methodology**	**Comment**	**Developer's Response and/or Update**
	project proponent.		rice methodology, and Verra will consider the same with respect to potential updates to the guidance in VM0042.
52	Measurement error of model inputs. In many cases, the impact of these measurement errors on the error of reduction and removal estimates is assumed to be captured in model prediction error and/or sampling error.	This paragraph is questionable. Practically, the Measurement error cannot be avoided and can be captured in model prediction but not in the sampling error that are for the outputs. I think it should derived from the variations among measuring replications.	Thank you for your comment. Please note we have updated the guidance in Section 8.5.1 on estimating uncertainty for QA1, to better align with updated guidance in the newly released VM0042, v2.1 (released 11 Sep 2024). We believe this addresses your concern without including parameter M_error. The updated guidance reads as follows: "Section 8.5.1 Quantification Approach 1 Quantification Approach 1 is a modeling approach in which a biogeochemical model is used to simulate changes in GHG fluxes over a given time period in both the monitoring period and baseline scenarios. Project proponents must use the guidance in VM0042 and VMD0053 with respect to modeling under Quantification Approach 1. Key sources of error accounted for under Quantification Approach 1 include: • Model prediction error resulting from uncertainty in model parameters or model structural errors (i.e., inaccurate representation of actual biogeochemical processes). Model prediction error is calculated using independent statistical validation datasets per the processes outlined in VMD0053. Alternatively, project proponents may account for model prediction error by calibrating models to include parameter uncertainty (e.g., a Bayesian implementation of the model) and using a Monte Carlo simulation or error propagation approach.
53	For each GHG flux, these sources of error are estimated separately and then combined to estimate a single uncertainty deduction for that GHG flux across the entire project.	I assumed the uncertainty is quantified from the measurements of model predicted variables. If so, please check your statement about sampling and measurement errors.	
54	Sampling error derived from only measuring subset of the entire project area, resulting in a potentially inaccurate estimate of the true variance of a GHG flux. Sampling error is determined by calculating the approximate standard error of GHG fluxes as directly measured following the guidance in Section 9.1.	I assumed this approach is not relating to modeling	

Section 8 – Quantification of Estimated GHG Emission Reductions			
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			• Sampling error resulting from measuring/modeling only a portion of the project area. Estimates of sampling error are contingent on the sampling design employed by the project proponent. • Measurement error of model inputs. In many cases, the impact of these measurement errors on the error of reduction and removal estimates is assumed to be captured in model prediction error and/or sampling error. Where alternative approaches for measuring CH_4 content, such as soil spectroscopy techniques, are used, procedures for estimating measurement error of these techniques as outlined in Appendix 6 must be followed. In this case, MC simulation is required unless it is demonstrated that such errors have a de minimis effect on model estimates of reductions and removals. These sources of error are estimated separately and then combined to estimate a single uncertainty deduction across the entire project." Please note that should you recommend further changes to this approach, Verra will take such guidance into consideration for future updates to VM0042, and this methodology, as the intent is to have the two methodologies align with respect to such guidance.
55	Measurement error of methods used to determine GHG trace measurements at sample points. Where samples are collected in accordance with the guidance in Section 9.1, these errors are assumed to be unbiased and negligible.	But it is important for identifying the sources of uncertainty	Thank you for your comment. Please note that this guidance pertaining to measurement error of model inputs is sourced from VM0042, which contains significant additional guidance related to assessing uncertainty for modeling requirements. We welcome your feedback relating to such guidance, and we will then use such feedback to inform potential updates to the guidance in this rice methodology, and Verra will consider the

Section 8 – Quantification of Estimated GHG Emission Reductions			
#	**Paragraph from Draft Methodology**	**Comment**	**Developer's Response and/or Update**
			same with respect to potential updates to the guidance in VM0042.
56	For projects using Quantification Approach 2, UNC_{t,CH_4_soil} and UNC_{t,N_2O_soil} must be calculated in accordance with the guidance in Section 8.5.2.	Does this methodology consider the uncertainty of approach 1. What is the uncertainty deduction for approach 1.	Thank you for your comment. We have added a statement that For projects using Quantification Approach 1, UNC_{t,CH_4_soil} and UNC_{t,N_2O_soil} must be calculated in accordance with the guidance in Section 8.5.1, requirements in the VCS Methodology Requirements guidance and also the error range data provided by the IPCC.

Section 9 - Monitoring			
#	**Paragraph from Draft Methodology**	**Comment**	**Developer's Response and/or Update**
57	Project proponents must develop a detailed direct measurement plan for measuring CH_4. The detailed project plan must include details regarding the stratification methodology, sampling methodology, and gas analysis methodology. The stratification methodology must follow the guidance in Section 6 and Table 3.	Do you mean three samples per chamber, or three chambers per sample location. From next sentence, you have total 12 samples for 4 location, which means you only have 3 samples in each location, so can we assume one chamber at one location. Please make the statement more clear and logical.	Thank you for your comment. We have updated the guidance in this section to try and improve clarity and logic, as follows: "Each project must have a minimum of three sample points per stratum for project fields and at least three baseline control site per stratum (i.e. a minimum of 6 sample points per stratum). For each sample point, either a separate chamber must be used, or chambers may be moved around between sample points for each measuring event. For each sample point 3 samples must be taken per measuring event (i.e. 3 samples, from each chamber, at each sample point). Therefore a project employing a single stratum, with a single consistent deployment of practices (i.e. AWD and methanotrophs are used across the entire project), would have a minimum of 18 samples taken per measuring event, 9 for sample points representing project activities and 9 for sample points representing baseline practices, per measuring
58	Each project must have a minimum of three sample locations per stratum for project fields and at least one baseline control site per stratum, and a minimum of three measurements per deployment (i.e., at least three chambers must be used per sample	Must the sampling time be the same for all four locations or somehow manage the measurement order. Here, the deployment, measurements, locations, samples are confusion. To make them more clear and easy following, do not	

Section 9 - Monitoring			
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	location or chambers may be moved around), per sample location. Chambers may be moved between sample locations. A project with a single stratum would thus need at least 12 samples for each sampling event: 9 for project fields and 3 for baseline fields, per deployment.	jump among word for the same thing. For example, based the complex statement, the measurements and samples are the same, deployment = measuring event	event."
59	All sampling must take place between 09:00 and 11:00 in the morning. Sampling must commence within one week after initial flooding at the commencement of each cultivation season. Gas samples must be taken at least weekly and measurements should continue until any significant fallow period commences (i.e., after harvest). Records must be kept demonstrating the timing of each sample, and the relevant management practices being deployed in each sample location.	consistent	Thank you for your comment. Please note, that following guidance received by other experts we have revised the guidance to allow for a larger 5 hour window (i.e. 07:00 to 12:00) within which a 3 hour sampling window must be chosen for each stratum. We have also stipulated that all chamber measurements within a stratum and control site must be done simultaneously.
60	Baseline emissions: at least three	not corresponding with the statement in above paragraphs.	Thank you for your comment. We have updated the guidance in this section to try and improve clarity and logic, as follows: "Each project must have a minimum of three sample points per stratum for project fields and at least three baseline control site per stratum (i.e. a minimum of 6 sample points per stratum). For each sample point, either a separate chamber must be used, or chambers may be moved around between sample points for each measuring event. For each sample point 3 samples must be taken per measuring event (i.e. 3 samples, from each chamber, at each sample point).
61	At least three (i.e., at least three chambers must be used or chambers are moved around for three separate samples)	Samples and chamber are not corresponding. Simply, how many samples for each chamber. Because the static close chamber was used, at least 3 samples should be collected for each chamber. Do you mean three chambers move around the four sample locations, or three chambers for one location. The sentence just	

Section 9 - Monitoring			
#	**Paragraph from Draft Methodology**	**Comment**	**Developer's Response and/or Update**
		confuse me. I assume the "deployment" is the same meaning of per field measurement event. If so, watch the sample numbers. Remember, to determine the flux by static close chamber, at least 3 samples should be collected at certain time intervals within the 30 minute.	Therefore a project employing a single stratum, with a single consistent deployment of practices (i.e. AWD and methanotrophs are used across the entire project), would have a minimum of 18 samples taken per measuring event, 9 for sample points representing project activities and 9 for sample points representing baseline practices, per measuring event."
62	Once direct measurements for CH_4 are undertaken for one full season, they may be used for that same season for the duration of a 7-year crediting period, or for the first 5 years of a single 10-year crediting period. Undertaking direct measurements over multiple seasons is likely to decrease uncertainty. Whilst direct measurement data may be aggregated across an entire year to create an annual average emission factor, a seasonal emission factor from one season must not be used as the seasonal emission factor for any other season (i.e., in a double cropping system, direct measurements must be taken for both seasons).	Should be with condition "under the same the practice". The emission will be very much different if the practice has been changed or did not follow the guidance.	Thank you for your comment. Please note, the ability to use results from a single season/year of chamber measurements across multiple years has been removed. Chamber measurements are now required for every season where Quantification Approach 2 is used.

Appendix 1 – Guidance for Digital Monitoring, Reporting and Verification

#	Paragraph from Draft Methodology	Comment	Developer’s Response and/or Update
63	Under this methodology, project proponents are encouraged to employ digital monitoring, reporting, and verification (dMRV) tools, in particular remote sensing, to efficiently enable third-party validation of project data. This appendix provides guidance with respect to best practices for utilizing dMRV for projects developed under this methodology.	It is more like the data sources for estimating GHG, but not the direct information of GHG emission at this moment. Therefore, I change “remote sensing” to “remote sensing as one of the data source”	Thank you for your comment. Please note that the methodology makes it clear that remote sensing is not to be used for quantifying emissions. Remote sensing is encouraged in order to cross-validate (using additional data sources) that the given management practices have been employed.
64	A project proponent uses RS to detect irrigation events. The project proponent ensures satellite image frequency is high enough to capture the typical and/or expected dry period duration for project farmers. The project proponent employs the use of satellite imagery with 2–4-day frequency around expected irrigation events, as they know that the farmers typically dry their fields for 4–5 days.	It is not maturity approach yet for detecting irrigation events, particularly it is more difficulty after the land was fully covered by crop. Also, the cost is the big constraint.	Thank you for your comment. Please note that the methodology makes it clear that remote sensing is not to be used for quantifying emissions. Remote sensing is encouraged in order to cross-validate (using additional data sources) that the given management practices have been employed.
65		Is it feasible, even considering the potential cost for high temporal and spatial resolution information.	Thank you for your comment. Please note, it is not our intent to study feasibilty of the given monitoring options, but to delineate what sources of data are allowed, and provide some guidance with respect to how one may reasonably employ such options. Having said that, there are proponents currently using remote sensing to detect practice changes, including once the soil is no longer visible due to plant growth has been established (with varying degrees of success).
66	Project proponents should only use RS to create data that can be independently verified.	Does it mean the ground truth verification. If so, why do not clarify it?	Thank you for your comment. In Table A2.1, the first row in the first column "Remove Sensing" in 4th issue in the second column "verifiability", contained the following statement: "Project proponents should only use RS to create data that can be independently verified." Please note we will look to update the guidance further, to include clear statements that "RS should only be used where ground truth verification can be employed".

Appendix 1 – Guidance for Digital Monitoring, Reporting and Verification			
#	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
67		It is important to have high reliability to the outcomes	Thank you for your comment. Please note we will update the guidance in Table A2.1 to include the following additional guidance: "Remote Sensing should not be used to quantify emission reductions, but it's use to monitor practice changes is encouraged."
68	Project proponents should validate ML/AI model results against independent ground truth data, using either cross-validation (preferably spatial rather than random) and/or independent holdout datasets.	Should be recommended for independent data verification, and the cross-validation should be limited because it is forced with shortage of quality data.	Thank you for your comments. We will take your input under consideration while revising the guidance.

Appendix 3 – Additional Guidance for Surrogate Process Models			
#	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
69	Recent research has demonstrated that Surrogate Process Models (also called model emulators) can leverage the power of well-calibrated process models while reducing the data burdens of full process modeling. This methodology allows Surrogate Process Models for Quantification Approach 1 provided the modeling is done in accordance with VM0042 (Table 8, section 8.3) and VMD0053, and with the requirements set out in Section 8.1 of	Be careful with this statement.	Thank you for your comment. Please note, the guidance on the ability to use Surrogate Process Based Models has been removed from the methodology.

Appendix 3 – Additional Guidance for Surrogate Process Models			
#	Paragraph from Draft Methodology	Comment	Developer's Response and/or Update
	this methodology.		
70	Step 1: Model selection. The process model used to develop the Surrogate Process Model must be publicly available, shown through peer-reviewed publications to be able to simulate changes in both CH_4 and N_2O emissions from rice production systems under the management systems for which the surrogate model is being developed, and the steps to create the surrogate model are described in detail.	Generally, whether the model is suitable or better for application purposes is highly link whether the model is applied in correctly within the development and capability scopes of developed models. So far, no model is always the better or best in the world yet."	Thank you for your comment. Please note, the guidance on the ability to use Surrogate Process Based Models has been removed from the methodology.
71	Step 2: Model Calibration. There are two options for the model calibration step of Surrogate Process Model. The first option is to calibrate the process model prior to creating the Surrogate Process Model. The second option is to first develop the Surrogate Process Model and then calibrate the Surrogate Process Model. Both options are applicable to this methodology. However, the model calibration procedure must clearly state:	Watch this sentence. Do you mean the surrogate is developed from the process model?	Thank you for your comment. Please note, the guidance on the ability to use Surrogate Process Based Models has been removed from the methodology.
72		I do not think it is necessary to calibrate the process model. It is more simple and straight forward by only and direct calibrate the surrogate process model unless the estimation is not produced 100% from the surrogate process model.	