Adoption of controlled-release fertilizers to transition to low-carbon agriculture

- Feedback & response -

July 28, 2025

Overview

This document outlines the feedback received from FoodChainID on version 0.95 of the GHG methodology for controlled-release fertilizers, detailing how the feedback was addressed and its impact on the methodology, culminating in version 1.

Feedback contributors

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Detailed feedback and responses

	Section	Feedback/comment	Response
1	List of definitions	**Comment**: The definitions section is comprehensive, encompassing major agronomic and GHG concepts. However, the term "enhanced efficiency fertilizers (EEF)" is defined, although its omission from the eligibility criteria (Section 1.3) may be further justified. Clarifying why EEFs (particularly slow-release or bio-stimulants) are excluded, while CRF + stabilizers are allowed will improve uniformity and reduce uncertainty. **Suggestion**: In Section 1.3, include a rationale note for the omission of standalone EEFs, as well as a potential scope for their inclusion.	We agree with the suggestion. We decided to limit the scope to products which we have confidence about their in-field emission reduction potential. Text has been added on the eligibility section to reflect that. "*There is currently no consistent, peer-reviewed evidence base or emission factors that support their inclusion across diverse conditions.* *Once robust methods and supporting data are available, these products may be incorporated through future methodology updates.*"
2	List of definitions	*Controlled release fertilizers* **Comment**: The phrase "at a specified temperature" is slightly ambiguous. Usually, release rate control is temperature dependent but not limited to a single temperature. **Suggestion**: It may be clearer to specify "at a specified release rate under certain temperature conditions."	Agreed. We used the definition of Trenkel (2010) for slow- and control- release fertilizers: "*A fertilizer containing a plant nutrient in a form which delays its availability for plant uptake and use after application, or which extends its availability to the plant significantly longer than a reference 'rapidly available nutrient fertilizer' such as ammonium nitrate or urea, ammonium phosphate or potassium chloride. Such delay of initial availability or extended time of continued availability may occur by a variety of mechanisms. These include controlled water solubility of the material by semi-permeable coatings, occlusion, protein materials, or other chemical forms, by slow hydrolysis of water-soluble low molecular weight compounds, or by other unknown means." based on Trenkel (2010)*" https://www.fertilizer.org/wp-content/uploads/2023/01/2010_Trenkel_slow-release-book.pdf
3	List of definitions	*Cumulative N2O emissions* **Comment**: The current definition of estimating includes both direct and indirect approaches, which is vague. Also, there was also no discussion about the type of emissions included. **Suggestion**: It should be clarified that estimation might use measurements or models. And to improve clarity, explicitly convey	Agree with the suggestion on being more specific on the definition, to prepare the reader. We changed the text. "*Total N2O emissions calculated over a specific period, leveraging direct or indirect methods. This means these can be calculated with either direct flux measurements using specialized equipment (e.g., gas chambers, spectrometers) or estimated using emission factors or models. Both direct N2O emissions and indirect emissions*

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		that both direct emissions (from sources like soil fluxes) and indirect emissions (from nitrification and leaching) are included.	*(from nitrate leaching and ammonia volatilization) are included."* However, clarification about direct and indirect emissions is already in section *2.2 GHG sources.*
4	1.2 Applicability of the methodology	**Comment**: The methodology is forward-thinking in allowing combination with different activities (cover cropping, zero tillage), provided that scientific non-interference is verified. **Suggestion**: Create a compatibility matrix for combining CRF technique with other third party standards to promote integrated carbon farming systems.	We agree that promoting integration across interventions is important for the development of holistic, climate-smart farming systems. However, creating a compatibility matrix involving other third-party standards or methodologies falls outside the scope of this document. Each registry or standard-setting body has its own policies regarding the stacking or combination of methodologies, and it would not be appropriate for Proba to make assumptions or recommendations about the eligibility rules of other systems.
5	1.2 Applicability of the methodology	**Comment 1**: "The baseline fertilizer (i.e. the product that would be used in the absence of the CRF) may contain multiple nutrients (e.g., nitrogen, phosphorus, and potassium) and come in various formulations (e.g., DAP, MAP, NPK blends, ammonium sulfate nitrate, etc.). All these fertilizer types are within the scope of this methodology. However, the impact of the CRF is attributed only to the nitrogen (N) component of the product." **Question**: How does the CRF work with respect to the complex fertilisers? As the N release pattern of complex fertilisers will not be similar with the N straight fertilisers. (Example: If a farmer applies N in the form of urea and DAP (60% + 40%)). Does the methodology work for both compositions or only for straight fertilisers? Also does CRFs works equally effective at all temperatures (particularly for tropical conditions, where crop growing seasons has high temperatures (35oC)	Clarifications were added in Section 1.2 Applicability and Appendix A.2.1 (i) "The baseline fertilizer (i.e. the product that would be used in the absence of the CRF may contain multiple nutrients (e.g., nitrogen, phosphorus, and potassium) and come in various formulations (e.g., DAP, MAP, NPK blends, ammonium sulfate nitrate, etc.). All these fertilizer types are within the scope of this methodology. However, the impact of the CRF is attributed only to the nitrogen (N) component of the product and *emission reductions are calculated proportionally based on the nitrogen fraction replaced by CRF, regardless of the baseline product's composition*." (ii) Environmental factors: The study must be conducted in a location with environmental conditions similar to the project area...... *For example, since CRF nutrient release can vary with temperature, project developers must select emission factors that reflect the temperature regime of the project region to ensure credible estimates.* ~ which means that for different temperatures (climates) we might have different EFs. See the updated section A.2 Emission factor selection criteria based on scientific studies.
6	1.2 Applicability of the methodology	**Comment 2**: The methodology allows the applicability of different tiered approaches but does not explicitly prioritize tiers. **Suggestion**: Guidance on preference of Tier 1 vs Tier 2 would enhance the transparency and align with the carbon market expectations.	While prioritization of Tier 3 > Tier 2 > Tier 1 is already detailed in Appendix A.1.1, we have added a clarifying sentence in Section 4.1 to make this hierarchy more visible in the main body of the methodology. What is already included: Section A.1.1 Prioritization of EF sources and Tiers says: "Priority should be given to Tier 3 ... Tier 2 should be used when Tier 3 data is

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			unavailable … Tier 1 can be used when neither Tier 2 nor Tier 3 data is available Text added in section 4.1: *Higher-tier emission factors (Tier 3 > Tier 2 > Tier 1) must be prioritized. If lower-tier EF are used, the project developer must justify why higher-tier options were not feasible (see Appendix A.1.1 Prioritization of EF sources and Tiers)*
7	1.2 Applicability of the methodology	**Comment 3:** The methodology does not clarify the applicability to flooded anaerobic conditions, such as those typically in paddy rice cultivation. In such systems both CH4 and N2O emissions are significant, but this methodology includes only N2O within its GHG accounting scope. **Suggestion**: Explicitly state whether flooded rice cultivation is within the scope of this methodology. Additionally provide a non-exhaustive list of eligible crop types or categories to clarify applicability.	Providing an exhaustive list of eligible crops is not practical, as the methodology is designed to be flexible and applicable across diverse cropping systems. Regarding paddy rice cultivation, we do not see the need to explicitly include or exclude it, since all GHG emission quantification is based on emission factors (EFs) derived from scientific studies relevant to the specific crop and conditions in scope. Therefore, the applicability to any given crop, including flooded systems like rice, depends on the availability and suitability of supporting EF data that reflects the crop's environmental context. We added a note under Table 1: GHG sources in scope : "*While it is acknowledged that there are other GHG sources on agricultural fields, such as CO_2 emissions from soil respiration or methane (CH_4) emissions from organic matter decomposition, these sources are not expected to be affected by the CRF products. Therefore, these emissions are considered out of scope for the purposes of this methodology, as they do not directly contribute to the emission reductions associated with the use of CRF products. However, CH_4 and CO_2 emissions are in scope for crop systems involving anaerobic conditions, such as flooded rice paddies. Project developers must assess and report CH_4 and CO_2 emissions in rice projects using relevant emission factors or direct measurements as described in section 4 Calculation of GHG emissions and Appendix A.2. For all other crop systems, CH_4 and CO_2 are excluded due to negligile impact..*"
8	Applicability	**Comment 4**: The methodology demonstrates a clear pathway from nitrogen overuse to N_2O emissions. The spatial flexibility (LMU vs. sourcing region) is excellent, but the project developers should be guided by a clearer decision tree or flowchart that specifies which technique to adopt and under what conditions. **Suggestion**: Include a decision matrix that compares the LMU, and	Agree with the suggestion. For now we added some prioritization direction in the 2.3 Spatial boundaries section. See feedback/response 24. In the next version we will translate it into a clearer flowchart.

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		source region approaches depending on farm size, data availability, monitoring capability, and project goals.	
9	1.2 Applicability of the methodology	**Comment 5:** The option to use peer-reviewed study data for blend-level EF is beneficial, but there is no direction on how to assure compatibility with the project's site-specific context. **Suggestion**: Require that the study meet at least three important criteria, soil type, crop type, and climate zone to be considered for EF adoption. Otherwise, consider discounting the EF or making conservative adjustments.	We agree that ensuring compatibility of emission factors is critical. This point is addressed in Section 4.1 "EF-data reference approaches," where the methodology emphasizes that emission factors must reflect the environmental and management conditions of the project. Project developers are expected to justify the alignment of selected EF studies with their project context in the Project Overview Document. The applicability section focuses on broader preconditions for using this methodology. On top of this, we give further conservativeness direction related to EFs in the section 4.3 Uncertainty.
10	1.4 Additionality	**Comment 1**: The multi-layered additionality criteria (regulatory, financial, and prevalence based) are rigorous and consistent with ICVCM standards. The introduction of separate criteria for offsetting and insetting is appreciated. **Suggestion**: Provide sample templates or evidence checklists (e.g., how to establish "no regulation" or "<20% adoption") to help verification.	We recognize the value of providing practical support for demonstrating compliance with additionality criteria, such as examples or checklists for evidence. To this end, we included a Proba specific supplementary guidance to help project developers, the *Proba Additionality Assessment Template.* See section 1.4 Additionality. https://proba.earth/hubfs/Project_Design/Proba_Additionality_Assessment_Template.pdf We also added the following: "*Alternatively, established tools and approaches can support project developers in assessing additionality, particularly for financial and common practice assessments. These include the UNFCCC's CDM Tool for the Demonstration and Assessment of Additionality (Version 07.0) and the CDM Tool for Common Practice (Version 03.1). These tools offer structured guidance for conducting barrier analyses, determining financial attractiveness, and assessing market penetration levels of a given practice. While originally developed for offsetting contexts, they can be adapted for insetting projects when transparently applied and justified in the POD.*"
11	1.4 Additionality	**Comment 2**: The requirement to demonstrate the absence of regulatory mandates, subsidies, and financial impediments remains	Additional guidance is given on the Proba Additionality Assessment Template. Regarding the partial subsidy issue, we require that project developers are fully

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		valid. However, it is unclear what forms of proof are acceptable. And how to handle "partial subsidy" coverage. **Suggestion**: Specify the evidence types along with possible examples. And also clarify what counts as "partial subsidy", for instance if subsidy covers <30% of costs, is sufficient to establish financial need.	transparent on the finance that has been received and how that affects the economics of the project. It is in the discretion of the offtaker to decide whether it makes sense to cover the rest of the financial gap or not.
12	1.4 Additionality	**Comment 3**: The prevalence and financial additionality are treated descriptively but lack performance thresholds or benchmarks, resulting in subjectivity in their assessment especially for insetting. **Suggestion**: Introduce quantitative indicators for insetting. For example: • Prevalence: CRF usage in the sourcing region is <20%. • Financial: At least a 10-20% increase in CRF uptake due to internal business funds or incentives related to carbon finance.	Same comment as above. The key with prevalence would be that the intervention leads to an increase of adoption. Which means that if before 5% was using the product, and the same 5% is targeted through the sourcing region approach, then there is still no additionality. As such, as you mentioned, the key is the Moreover, the intervention must lead to an increase in the uptake of the CRF product, in the spatial boundaries of the project.. We adjusted the text to reflect that. "*Moreover, the intervention must lead to an increase in the uptake of the CRF product, in the spatial boundaries of the project.*"
13	1.6 Co-benefits & no harm principle	**Comment 1**: Encouraging alignment with SDGs (particularly SDGs 2, 6, 13, and 15) is commendable. However, the existing design is primarily qualitative. **Suggestion**: To support improved effect tracking, provide a menu of KPIs for SDG co-benefits (for example, percentage nitrate reduction in groundwater, yield per unit N, and so on).	Section 1.6 already encourages the use of KPIs to support SDG-related co-benefits, particularly when claims are made in the POD. To enhance consistency and effect tracking, we have added several example KPIs to illustrate how co-benefits may be monitored and reported. These examples are now included in section 1.6 to guide project developers. "*In this case, relevant KPIs must be selected by the project developer and monitored throughout the years. Examples of relevant co-benefit indicators (KPIs) include:* *Percentage reduction in nitrate concentration in surface or groundwater (mg/L)* *Soil organic carbon (SOC) improvement (t/ha/year)* *Water use efficiency (kg yield/m³ water)*"
14	1.6 Co-benefits & no harm principle	**Comment 2**: Monitoring no-harm principle is a strong criterion in theory, but it is too vague in its implementation. There are no guidelines on frequency, indicators, or corrective action processes.	Agreed with the suggestion and added in the text. "*As such, in the POD, at least the following must be established:* • *monitoring frequency*

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		Suggestion: Add a requirement to establish monitoring frequency (annual, seasonal) and risk indicators (e.g., groundwater quality, community grievances). Also corrective pathways if harm is detected.	• *risk indicators (e.g., groundwater quality, community grievances)* • *corrective pathways if harm is detected.* *Proba's Environmental and Social do no harm principle Template can be used for this purpose."*
15	1.6 Co-benefits & no harm principle	**Comment 3**: Microplastic residues from polymer-coated CRFs is a significant and forward- looking environmental issue, especially given the growing concern about soil microplastic pollution. However, the existing mitigating technique is too generic. **Suggestion**: disclosure of coating material and biodegradability data, through support from third-party studies. Preference Hierarchy: 1) biodegradable, 2) biobased, and 3) inert. If polymer-coated CRFs are utilized, need a soil microplastic monitoring plan at sample plots during the crediting period.	Agreed on adding the requirement for clear disclosure on biodegradability as well as the preference hierarchy. Requiring periodic soil samples for microplastics seems unrealistic and too costly. However, to address this issue we also added a segment to ask project developers to present their plan on moving to higher hierarchy level options during the project period (e.g. having non-biodegradable CRFs as an intermediate solution). New text: "*Project developers must assess and document the type of coating used and any measures taken to mitigate microplastic accumulation. Preference should be given to CRFs with a coating that is (1) biodegradable > (2) non-biodegradable but bio-based > (3) non-reactive. Project developers must include a plan to monitor or address potential environmental risks associated with persistent plastic residues. Project developers must also present their plan on moving to higher hierarchy level options during the project period (e.g. having non-biodegradable CRFs as an intermediate solution).*" To add to this, from October 2028 onwards, new EU legislation requires that all coated fertilizers being sold in EU countries must be biodegradable within 48 months. In other words, there won't be any polymer-coated fertilizers of the current kind. Researchers and companies are actively working on new, biodegradable coatings and the first products that meet that new requirement have already entered the market. That'll become the de-facto standard, probably also in other world regions.
16	1.7 Risks	**Comment**: The addition of microplastic danger from polymer-coated CRFs is progressive and in line with emerging EU rules. **Suggestion**: Recommend biodegradable CRF coatings and establish a reporting requirement for polymers' environmental fate over project cycles.	See above comment. To strengthen this added this footnote: "I*n recognition of emerging regulatory concerns regarding polymer-coated fertilizers and microplastic pollution, project developers are encouraged to prioritize CRF products with biodegradable coatings. From 2028 onward, the EU will require only biodegradable polymers for*

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			polymer-coated fertilizers under its revised Fertilizing Products Regulation (EU 2019/1009). Future versions of this methodology will align accordingly.”
17	1.8 Leakage & permanence	**Comment 1**: The tiered deduction for fertilizer displacement risk is novel and well-organized. NUE thresholds are used to control leakage caused by yield displacement. The 10% NUE reduction criterion (used to assess ineligibility) is strict and may penalize climate-sensitive seasons. **Suggestion**: Allow for weighted multi-year average or yield-adjusted NUE (e.g., NUE per ton of biomass) to help mitigate year-to-year fluctuation.	Thank you! The methodology already allows for the exclusion of years with extreme weather events when assessing NUE performance. To further mitigate year-to-year fluctuations, we have clarified that project developers may apply a weighted multi-year average NUE and may use yield-adjusted NUE metrics (e.g., per tonne of biomass), provided they are transparently justified in the Project Overview Document. This has been added in section 1.8: “To reduce the impact of inter-annual variability, project developers may apply a weighted multi-year average NUE, excluding years with documented extreme weather. Additionally, yield-normalized NUE metrics (e.g., NUE per tonne of crop biomass) may be used where appropriate, provided they are transparently justified in the POD”
18	1.8 Leakage & permanence	**Comment 2**: The leakage deduction table is practical and provides transparency. However, the criteria for designating a project as low, medium, or high risk are not well established. Suggestion: Provide a short checklist in guidance document or an annex to assist developers in justifying their risk tier categorization.	To support transparent and consistent risk tier categorization, we have incorporated a stratified and structured explanation and evidentiary requirements within the methodology text. We provide clear guidance on how project developers must assess and justify leakage risk using traceability evidence such as supplier confirmations, farm-level data, or market analyses. Where evidence is lacking, more substantial deductions are applied based on project scale, with a tiered deduction table. This structure is now embedded in the methodology and serves the purpose of a practical checklist. Additionally, we specify an NUE-based safeguard to ensure that yield reductions do not trigger leakage through production displacement.
19	1.8 Leakage & permanence	**Comment 3**: The concept reversal of leakage deduction is a good incentive for thorough leakage monitoring. However, there is no clarity on what qualifies as “sufficient evidence”. **Suggestion**: Include examples of acceptable evidence to support the reversal request (e.g., market studies or agronomic surveys).	Good point. The sufficient evidence must now be aligned with the requirements mentioned in the previous comment/response. “*The project developer must provide reasonable evidence of how these volumes were managed. Evidence can include:* • *written confirmation from fertilizer supplier or distributor that production or delivery volumes were reduced;*

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			• *project-level fertilizer application data showing reduction in conventional fertilizer use without corresponding increase elsewhere;* • *national or regional sales/trade data showing stable or decreasing conventional fertilizer volumes;* • *market analysis or reports indicating no increase in non-project sales."*
20	1.8 Leakage & permanence	**Comment 4**: Leakage due to decreased yield is a valid concern. However, it presumes that the developer has access to regional production displacement data, which may be difficult. **Suggestion**: Instead of trying to prove the lack of leakage, it could be easy to demonstrate the yield and NUE stability.	Good point. However, this is still technically the case. The methodology does not require project developers to provide regional production displacement data to address leakage from potential yield reduction. Instead, the methodology provides an approach to demonstrating yield and NUE stability, as outlined in Section 1.8.1. Developers must show that NUE has not declined by more than 10%, using either project-level logs or regional NUE benchmarks, and may apply multi-year averaging or yield-normalized metrics where appropriate.
21	2.1 Scope of activities	**Comment**: Including the reducing machinery use is a valuable GHG reduction opportunity. However, it lacks reference to how these emissions are quantified. **Suggestion**: Recommend adding that avoided CO2 emissions from machinery should be calculated using standardised emission factors and should be verified using logs or machinery records.	We have revised the section on fertilizer spreading to clarify that CO_2 emissions resulting from machinery use should be calculated using standardized emission factors, and must be supported by verifiable evidence such as machinery logs, fuel receipts, etc. We also added a new row in Table "*Project design parameters for Land Management Unit level intervention*", which is related to "field operations"
22	2.2 GHG sources	**Comment 1**: The language about materiality and optional inclusion could result in inconsistent applicability across projects. **Suggestion**: Define a materiality criterion (for e.g., more than 5% of total project emissions) or need justification in the Project Overview Document (POD) if excluded. This ensures consistent treatment and reduces ambiguity.	Good point. We adjusted the text to reflect that.
23	2.2 GHG sources	**Comment 2**: The methodology assumes that CH4 and CO2 emissions from soil processes are unaffected by CRF use, which may not be true in all agroecological scenarios. Nitrogen supply, timing, and application rate can impact microbial activity, organic matter breakdown, and redox conditions, especially in flooded	Agreed. We made an adjustment for this. CO2 and CH4 emissions are now conditionally in scope. "*Project developers must justify the exclusion of these GHG emission sources due to their cropping system specifics."* See comment/response no 7 as well.

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		systems like rice paddies or organic-rich soils, thereby impacting CH4 and soil CO2 emissions. **Suggestion**: Include a clause, requiring project developers to justify the exclusion of CH4 and CO2 emissions due to site-specific constraints. To ensure thorough accounting and environmental integrity, consider declaring flooded or organic soils conditionally in-scope (e.g., for rice systems).	
24	2.3 Spatial boundaries	**Comment**: The section lacks standardised guidance on use of LMU type and sourcing region type projects. **Suggestion**: Define geospatial boundary more explicitly to delineate the LMU type and sourcing region type projects (e.g., by using spatial boundaries) and provide criteria.	Agree. Guidance added. "*Practical guidance for project developers on selecting between spatial level approaches:* *Use LMU Level if:* • *You have access to field-level data, including crop type, fertilizer use, and yields for each participating farm or field.* • *You aim for higher accuracy and lower uncertainty in emission estimates, potentially enabling greater GHG reduction claims.* • *You want to monitor site-specific changes, such as reductions in nitrogen application rate or improved efficiency at the farm level.* *Use Sourcing Region Level if:* • *Field-level data is not available, and you need to rely on aggregated regional information (e.g., from cooperatives, national/regional data, or supplier records).* • *Your project operates at a large scale involving many farmers with similar practices, but without granular farm-level visibility.* • *You are willing to accept higher uncertainty and more conservative emission reductions in exchange for streamlined data collection.*" Project developers are already asked to define the geospatial boundary more specifically in the MRV section, in the Table titled "*Project Scoping*". See comment/response 8 as well.
25	2.4 Temporal boundaries	**Comment 1**: The defined "1-year" duration for sourcing region projects lacks justification. It overlooks crop-specific changes in growing periods and does not specify what should be done in	In the sourcing region, it does not make sense to get into the detail of the crop year, as there could be many crops being cultivated in the supply shed. For that the emission factor approach is used where we assume that X amount of

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		multi-crop rotations or overlapping reporting cycles. **Suggestion**: Clarify whether the 1-year reporting cycle refers to the calendar year or the crop year. Allow crop-specific exceptions if data reveals that the cultivation cycle varies significantly from year to year (for example perennial systems).	CRF will be applied to the crop mix in the region, which will result in Y amount of emission reduction. It doesn't matter when the application or cropping will take place. What matters is that the CRF is applied instead of the typical fertilizer. For transparency, we added this explanation as text: "*This temporal boundary is used because, at the sourcing region scale, CRF products sales may span multiple cropping systems and planting seasons. Within one calendar year, it is possible to capture several crop cycles for short-duration or row crops (e.g., maize, wheat, etc.), reflecting an accurate representation of nitrogen use and related emissions across a variety of cropping systems and management practices..*"
26	2.4 Temporal boundaries	**Comment 2**: There is no guidance on nitrogen effects that can last beyond a crop season, such as residual N2O emissions from slow-release formulations. **Suggestion**: Include post-harvest emission impacts, especially for CRFs with extended- release characteristics, and give a window (30-45 days post-harvest) to capture lagged emissions in the reporting period.	Good point. This is addressed in the footnote of temporal boundaries "*It is acknowledged that the nitrogen can remain in significant portions in the soil till after the harvesting period, thus being at risk for later conversion and N losses as N2O emissions. However, this methodology relies on scientifically validated EFs for both the baseline and project intervention, which cover the same measurement timeframe...*" Essentially the emission factor (reduction) already covers the residual effects. If someone were to do in-field measurements, then it would make sense to extend this period. We added this guidance. "E*missions should be measured over a period that captures all significant nitrogen loss events, including heavy rainfall, drought, or temperature fluctuations, if they occurred. For fertilizers with extended nutrient release characteristics, it is recommended to extend the measurement period post-harvest to capture potential lagged* N_2O *emissions.*"
27	3 Baseline scenario	**Comment**: The system emphasizes dynamic baseline evaluation every three years, which is a strength. However, developers may find it complex to operationalize the NUE-based baseline, particularly in LMU-based applications. **Suggestion**: Include worked examples of NUE performance testing as well as instructions for gathering and validating multi-year NUE data (particularly in developing countries).	Added explanation on how the dynamic baseline is defined. "*Specifically, in such cases, project developers must reapply the baseline determination approach used at validation, updating inputs with the most recent regional or project-specific data to recalculate the baseline.*" Will consider adding actual examples on a next version of the methodology.

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28	4 Calculation of GHG emissions	**Comment 1**: Equations 2a and 2b lack clarity regarding variables such as a, x, and v, as well as their interrelationships. There are no structured classifications for activity types, intervention categories, or hierarchical dependencies. **Suggestion**: Provide a clear activity-intervention mapping table, clearly define all variables formally, and provide a decision tree to guide developers on how to apply Eqs. 2a vs. 2b.	Agree. Added further explanation of all the variables, to improve readability. "*One intervention refers to a group of project activities that share similar characteristics, such as the same type of controlled-release fertilizer (CRF), crop, and management conditions, applied across a set of farms. It is the responsibility of the project developer to define and group interventions in a logical and consistent way to ensure that subsets of the project are comparable, thereby simplifying MRV and emissions quantification.* " The activity-intervention table is Table 3.
29	4 Calculation of GHG emissions	**Comment 2**: The equations 3a (EF-based) and 3b (flux-based) are offered as alternatives, but there is no clear decision rule or preference hierarchy for when each should be applied. **Suggestion**: Mention the applicability conditions for choosing between 3a and 3b.	Added text to clearly explain when to use flux-based emissions: "*If direct N_2O measurements are in scope as part of the project, that follow Approach 2: Direct Measurements and the guidelines outlined in Appendix A.2.3 Quality Criteria of Experimental Design (of studies/trials), then those measured cumulative emissions can be used to replace emission factor-based calculations and the equation can then be adjusted accordingly (see equation 7b).*" Regarding the hierarchy, the idea is presented earlier in the section: "*The three approaches for quantifying baseline and project emission are listed in Table 3. In cases where more than one EF-data reference approach is allowed for a given activity, then the same approach must be used to calculate both the project and baseline scenarios. Regarding the prioritization of the EF sources, the project developers must prioritize granular data compared to aggregated data whenever possible (Tier 3 > Tier 2 > Tier 1). Specifically for the EF selection, Approach 2 (see Table 2) is the preferred approach, followed by 1, depending on the availability of data and the practicality in the implementation (also see A.1.1. Prioritization of EF sources and Tiers).*"
30	4 Calculation of GHG emissions	**Comment 3**: Overlapping of n pathways that may lead to double counting. Direct N2O emissions are calculated from total N applied, without subtracting the amount that has already volatilised or leached. **Suggestion**: Similarly, as fractions in equations 4 and 5 are correctly applied, equation 3a may be corrected to avoid potential overlapping.	The emission factors that can be used in this methodology are sourced from peer-reviewed literature and are defined on the basis of nitrogen applied (e.g., kg N_2O–N per kg N applied). Therefore, Equation 3a expresses direct N_2O emissions consistently with the definition of the EF itself, without adjusting for N losses via volatilization or leaching. Indirect emissions from those loss pathways are calculated separately using distinct fractions and EFs, as shown in Equations 4 and 5. As such, correcting for leached or volatilized N in the direct N_2O equation would not be compatible with how the emission factors were originally derived.

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31	4 Calculation of GHG emissions	**Comment 4**: Equation-6 simplifies machinery emissions ignoring the fuel type, machinery capacity and working time or speed. **Suggestion**: Include the emission factor tables for different fuel types, engine capacities and machinery types.	Good point. Adjusted text to reflect the field type related to the EF as well: "*The emissions are calculated based on the vehicle type or the field spreading machinery (mf) which apply the fertilizer on the field (cf), the distance traveled within the field (D cf, mf), the fuel type and the number of times the fertilizer is spread per year (Nf).*" As with all EF selection, the project developer is responsible for selecting an EF that properly represents the machinery and operations of their farming system. The focus of this methodology is not to provide EFs. There are existing specialized sources (such as IPCC) which are much better for that.
32	4.1 EF-data reference approaches	**Comment**: The use of meta-analyses and study-specific EFs provides flexibility. The three-tier EF source rationale (meta-analysis, direct trials, and IPCC) is consistent with the IPCC GHG Inventory Guidelines. The lack of a clear criterion for assessing emission factor quality may result in developer bias in picking positive studies. **Suggestion**: Use a peer-reviewed EF selection matrix (e.g., sample size, agroecological relevance, confidence intervals) as a screening tool.	The methodology already addresses this in Chapter A.2.3, which outlines the minimum *quality criteria* required for experimental studies used to derive emission factors, including replication, controls, measurement period, uncertainty reporting, and field-based conditions. Furthermore, the project developer is required to formally justify the selected emission factors and associated studies in the Project Overview Document (POD), in alignment with both the requirements of this GHG methodology and the Proba Standard. This ensures that emission factor selection is transparent, traceable, and subject to third-party validation
33	4.3 Uncertainty	**Comment 1**: The conservative end of available range is ambiguous. Without specifying what percentile, quantile, or method constitutes "conservative", as different developers may select values arbitrarily, undermining consistency. The statement "not necessarily the lowest value" creates confusion. Also, no threshold was specified for what level of relative uncertainty is acceptable for emission reduction claims. **Suggestion**: Specify the method for determining the conservative end (e.g., lower bound of 95% CI). Define a clear threshold for acceptable relative uncertainty in emission reduction claims.	Agree that the guidance must be more concrete. For this reason, we've revised the text to clarify that rather than selecting the absolute minimum of the 95% confidence interval (CI), the chosen value should correspond to a point located 25% of the distance from the mean toward the lower (more conservative) bound of the interval. With this, project developers are incentivized to select disaggregated EF ranges, for management practices and environmental factors that are specific to their circumstances.
34	4.3 Uncertainty	**Comment 2**: In the case of the EF from meta-analysis, there were no thresholds for heterogeneity (I2). A high I2 means a large variability among studies, and the average EF may not be reliable.	Great point. Added the following text: *"Meta-analyses must report or assess heterogeneity among studies. If I^2 is not provided, developers must provide evidence of variability (e.g., range, SD, forest*

	Section	Feedback/comment	Response
		Suggestion: Require reporting of heterogeneity and confidence intervals. Set threshold, for instance like if I2 exceeds 75%, the project developer must apply an uncertainty penalty of at least 10% or exclude the average EF.	*plot) and justify reliability. If high heterogeneity is evident (e.g., I^2 > 75% or clear visual spread), an uncertainty buffer of 10% must be applied unless justified via subgroup analysis."*
35	4.3 Uncertainty	**Comment 3**: What if multiple meta-studies exist for the same practices under the same agroecology and if derived EFs differ significantly due to varying studies? **Suggestion**: if multiple meta-studies exist with divergent EFs, either the lower EF must be used or an average of all qualified sources with weighted uncertainty must be reported for better transparency.	The project developer is required to find at least one proper meta-analysis. If multiple eligible and relevant meta-analyses exist and the project developer wants to use them, then an average EF (reduction) must be calculated across all qualified sources. If applicable, the average must be accompanied by a weighted uncertainty estimate to ensure transparency and reflect variability across sources. Added the text to reflect this.
36	6 Monitoring, reporting, and verification (MRV)	**Comment 1**: MRV components are logical, however the distinction between required and optional data streams (for cradle-to-gate emissions and fuel consumption reduction) should be more obvious. **Suggestion**: Create a consolidated MRV table with "mandatory" and "optional" monitoring settings for each LMU and sourcing area type.	We have added two additional parameters to the MRV tables: (i) the cradle-to-gate Product Carbon Footprint (PCF) of fertilizer products, and (ii) emissions related to field-level fertilizer spreading. Regarding the distinction between mandatory and optional data, we believe this is already sufficiently clear within the existing MRV framework. The differentiation between LMU and sourcing region approaches can be seen in the two distinct tables in the methodology. Finally, optional data points are marked with brackets and the word "(Optional)" in the tables.
37	6 Monitoring, reporting, and verification (MRV)	**Comment 2**: Most of the critical variables like crop type, fertiliser rate and yield, relies heavily on farmers logs and market-based information. **Suggestion**: Introduce a minimum threshold of variables (say 10% or 20%) that must be validated through independent sources like satellite data, remote sensed crop biomass proxies (especially for sourcing regions), harvest records with sale receipts, and yield estimation using NDVI and LAI data.	Good point. Rather than applying a fixed threshold, we've opted for a flexible, project-specific verification plan developed with the VVB to ensure robust validation of key variables. Added text to clarify this point: "*Project developers must transparently define a verification plan in collaboration with the VVB to ensure that key variables, particularly fertilizer rate and crop yield, are accurately represented. This plan must outline how critical claims will be substantiated using independent or verifiable data sources where applicable. The verification approach must be documented in the POD and implemented during the verification period."*