Atmospheric nitrous oxide (N_2O) destruction using photocatalysts

Methodology Validation Report

Summary

This methodology applies to project targeting N_2O destruction from the atmoshphere using photocatalysts deployed on eligible surface such as crop leaves. Landowners incorporate the photocatalyst during routine crop spraying. N_2O reduction is quantified through flux measurements and monitoring of influencing parameters.Photocatalytic efficiency, validated via lab and field trails, is adjusted for real world conditions to estimate N_2O destruction.

Validation body: Enviance Services Private Limited

Template version 3.0

Project Details

Methodology name	Atmospheric nitrous oxide (N_2O) destruction using Photocatalysts
Methodology ID	M-ICR011
Methodology developer	Crop Intellect Ltd.
Date of methodology description	10/06/2025
Version of methodology	1.3

Title of report	Atmoshpheric nitrous oxide (N_2O) destruction using Photocatalysts Validation Report
ID of report	ICR_ve_Uk_109_24
Criteria for validation	☒ ICR methodology requirements v.3 ☒ ISO 14064-2 ☒ ISO 14064-3 ☐ Other, please specify.
Date of validation	02/04/2025
Version number of this validation report	1.2
Date of version	18/06/2025
Validation body	Enviance Services Private Limited
Contact	Address: Smartworks Brilliant Centre 17, Race Course Rd, Janjeerwala Square, opp. Basket Ball Complex, New Palasia, Indore, Madhya Pradesh 452001. Contact no: +91 9576430298 Email: admin@enviance.in Website: https://enviance.in/
Independent review	Mr. Nikunj Agarwal
Validation team leader	Mr. Pankaj Kumar
Validation statement	Enviance Services Private Limited has performed a validation assessment of the methodology M-ICR011 ''Atmospheric nitrous oxide (N_2O) destruction using Photocatalysts''. The assessment was performed in conformance to ICR methodology requirements version 3.0, ICR requirements version 6.0, ISO 14064-2 and ISO 14064-3. Enviance Services Private Limited certifies that the proposed methodology meets the specified criteria. As no existing or proposed methodology under any other GHG program adequately addresses

	the required quantification approach, this new methodology is being submitted to ICR for approval and registration
Signature	Vidhya Muralikrishna Quality Manager Date: 18/06/2025

Statement by Enviance Services Private Limited

The Enviance Services Private Limited states that Enviance Services Private Limited is responsible for the preparation and fair presentation of this validation report. The Enviance Services Private Limited further validates that the Atmospheric nitrous oxide (N_2O) destruction using Photocatalysts methodology ensures conservativeness, accuracy, entails scientific integrity, technical advancements, is scientifically proven and supported with peer-reviewed literature and research. The Atmospheric nitrous oxide (N_2O) destruction using Photocatalysts methodology encourages ambition over time; encourages broad participation; is real, transparent, conservative, credible, and below 'business as usual'; avoids leakage; recognizes suppressed demand. The Atmospheric nitrous oxide (N_2O) destruction using Photocatalysts includes relevant assumptions, parameters, data sources, and key factors. The Atmospheric nitrous oxide (N_2O) destruction using Photocatalysts methodology has also considered uncertainty, leakage, policies and measures, and relevant circumstances, including social, economic, environmental, and technological circumstances, and address reversals where applicable.

Contents

1. Summary

Crop Intellect Ltd., has contracted Enviance Services Private Limited, to conduct the validation assessment for the proposed methodology titled ' Atmospheric nitrous oxide (N_2O) destruction using Photocatalysts', M-ICR011. The proposed methodology targets the destruction of atmospheric nitrous oxide (N_2O) using a photocatalyst based innovation called R-Leaf which is developed by Crop Intellect Ltd. R-Leaf uses double -doped titanium dioxide (TiO_2) to enable photocatalysis under visible light, allowing it to be sprayed directly onto crops without altering farming practices. It breaks down N_2O into harmless nitrogen and oxygen gases with no environmental impact, while also converting No_X into nitrate and promoting plant growth. The photocatalyst works independently of the type of crop it is applied to. The size of TiO2 in R-Leaf is in micrometre range, which is well over the size of concern (nanometre size) and has no effect on soil ecology. The TiO2 particles aggregate with other soil particles and become part of the soil structure. The recommended usage of R-Leaf is 2 litres per hectare per season, thus only 1 kg of TiO2 is added per hectare (10,000 m2) per season, or 10 kg in 10 years. On average, soils contain 0.33% Ti equating to some 2 t/ha considering the top few centimeters, and so the addition of 10kg of Ti in 10 years is negligible compared to the benefit it offers. The technology is cost-effective, IP-protected, and validated through lab and field trials, with a 12-week active period. It supports accurate GHG emission reductions through measurable N_2O flux data collection and aligns with CDM-UNFCCC baseline and additionality requirements.

The scope of validation is to conduct an independent assessment of the methodology against the ICR requirements, ICR methodology requirements, and to determine that the application conforms to the ISO 14065 requirements at the methodology level.

The validation is performed in accordance with the requirements of ISO 14064-3 using standard audit techniques including but not limited to document review, interviews and independent cross-checks by the assessment team. CL 05, CAR 00 were raised as findings during the validation process. All findings were addressed and there were no uncertainties identified during the assessment of methodology.

Enviance Services Private Limited confirms that all methodology assessment activities, including objectives, scope and criteria, level of assurance and the methodology adherence to the ICR requirements, as documented in this report are complete. Enviance concludes that the methodology ''Atmospheric nitrous oxide (N_2O) destruction using Photocatalysts'', M-ICR011 meets the requirements of ICR.

Validation summary	
Validation start and end date	13/02/2025 – 12/05/2025
Sectoral scope of project activities	Sectoral Scope – 15 Agriculture
Project type	☐ CDR ☒ RAD ☐ Hybrid

2. General

2.1. Objective

Crop Intellect Ltd., has contracted Enviance Services Private Limited, to conduct the validation assessment for the proposed methodology titled '' Atmospheric nitrous oxide (N_2O) destruction using Photocatalysts' to determine its compliance with the requirements of the ICR , ISO 14064-3 and ISO 14065. The assessment of the proposed methodology was performed to evaluate the likelihood that the application of the methodology would result in accurate calculations and appropriate eligibility criteria of the GHG eission reduction/avoidance.

2.2. Criteria

☒ ICR methodology requirements v.3.0
☒ ISO 14064-2:2020
☒ ISO 14064-3:2019
☐ Other, please specify.

2.3. Scope

The scope of the validation assignment is defined as an independent and objective review of the ICR Methodology Description Document and supporting annexures. Furthermore, publicly available information is considered as far as available and required.

The scope of the assignment is to:

- Conduct a validation assessment in accordance with own QMS that is based on the ISO 14065 and ISO 14066 along with the guidance provided by ICR Board to determine if the project meets all applicable ICR Requirements, including those specified in the ISO 14060 family of standards, relevant methodologies, and tools and processing the same with ICR Process Requirements.
- Assess the accuracy, conservativeness, relevance, completeness, consistency and transparency of the information provided by the methodology developer.
- Determine whether information provided by the methodology developer is reliable and credible.
- Present information in the form of validation report in a factual, neutral, coherent manner and referencing the sources and assumptions, other forms of validation mean employed.
- Report the findings and conclusions in an objective manner and conduct the validation in accordance with ICR Principles, requirements, and guidance.
- Apply consistent validation criteria in providing expert judgments to the requirements of applicable approved methodologies, tools, and also cross check the same.
- Safeguard the confidentiality of all information obtained during validation and verification; and Adhere to the principles of independence, ethical conduct, fair presentation, and due professional care in assessment process.

2.4. Materiality thresholds

Materiality has qualitative and quantitative components. Quantitative materiality refers to error in value in the GHG statement, while qualitative materiality refers to intangible issues that affect the GHG statement.

With respect to the 5.1.7 of ISO 14064-3:2019, GHG programme can establish a threshold for materiality, hence ICR validation and verification specification v2.0 has been referred and stated below:

- 2 per cent of the GHG emission mitigations for project activities achieving a total GHG emission mitigations equal to or more than 250,000 t CO2-e/yr.
- 5 per cent of the GHG emission mitigations for project activities achieving a total GHG emission mitigations equal to or less than 250,000 t CO2-e/yr.
- For projects activities achieving a total GHG emission mitigations equal to or less than 10,000 t CO2-e/yr, 10 per cent is allowed.

2.5. Validation team

Full Name	Role or Responsibility	Type of activity performed
Lead Auditor **Technical Expert in Trainee**	Mr. Pankaj Kumar	Conducting Assessment, Identifying Resolution of findings, Remote audit.
Validator-Verifier **Technical expert in Trainee**	Mr. Vipul Jain	Assessment, Resolution of findings, Remote audit, Report Writing, Communication with Project Proponent
Team Member **Technical Expert**	Dr. Manthan Tailor	Assessment, Resolution of findings, Remote audit, Report Writing, Communication with Project Proponent
Technical Expert	Mr. Virendra Kumar Jain	Conducting technical assessment of Validation Report
Independent Technical Reviewer	Mr. Nikunj Agarwal	Conducting Independent technical assessment of Validation report

2.6. Validation activities and techniques

Provide information on evidence-gathering activities and techniques in the validation

Observation	☒	Recalculation	☐	Control testing	☐	Reconciliation	☐
Inquiry	☒	Examination	☒	Sampling	☐		
Analytical testing	☐	Retracing	☒	Estimate testing	☐		
Confirmation	☒	Tracing	☒	Cross-checking	☒		

2.7. Documented information

Confirm what documented information/records are maintained by the VVB considering 5.4.4 in ISO 14064-3, justify if some are missing

Engagement terms	☒
Validation plan	☒
Evidence-gathering plan	☒
Who performed the evidence-gathering activities and when they were performed	☒
Collected evidence	☒
Requests for clarification, material misstatements, and nonconformities arising from the validation and the conclusions reached	☒
Communication with the responsible party on material misstatements	☒
The conclusions reached and opinions by the validator	☒
The name of the independent reviewer, the date of review and comments of the reviewer	☒

3. Project

3.1. Description of the methodology

This proposed methodology is designed for the project activities aimed at destroying atmospheric nitrous oxide (N_2O) using photocatalysts, specifically through the application of R-Leaf technology which is developed by Crop Intellect Ltd. It facilitates the breakdown of N_2O into harmless nitrogen and oxygen gases when applied to crop leaves under visible light. This approach mainly targets the agricultural lands which are a major sources of N_2O emissions.

The proposed methodology is applicable to land-based projects where crops or vegetation are sprayed with photocatalysts to destroy N_2O from the air. It can be used in regions with suitable environmental conditions that support effective photocatalytic activity and where crop canopies are maintained for at least four weeks. While, this methodology is not applicable for permenantly shaded areas, non-vegetative surface or projects lacking sufficient environmental or monitoring infrastructure.

The emission mitigation is quantified by calculating the amount of N_2O destroyed using flux measurements and parameters affecting N_2O emissions, primarily through flux and atmospheric sampling. This approach ensures that the reduction in N_2O emissions is accurately measured and verified based on verified destruction rates.

4. Validation activities

4.1. Validation planning

Provide information on the establishment of the planning of the validation.

Task	**Performed (Y/N)**
Strategic analysis	☒
Materiality thresholds	☐
Test estimates	☐
Assessment of GHG-related activity characteristics	☒
Validation plan	☒
Evidence-gathering plan	☒

4.2. Validation plan

The VVB established the validation assessment plan following a risk-based approach in compliance with ISO 14064-3. The steps undertaken to establish the validation assessment plan included:

1. Scope definition by Methodology developer and agreement with VVB on the assessment criteria.
2. Conflict of interest review and selection of audit team.
3. Kickoff interaction with the methodology and project developers.

4. Developing a documented Validation/Verification plan in compliance with ISO 14065:2020 and ISO 14064-3:2019 which includes:

    a. Identification of verification requirements e.g., project documentation, and supporting documents.
    b. Desk review of the methodology description documents and the supporting evidence.
    c. Incorporation of any revisions as necessary to the validation plan and communication of the same to the Methodology developer at conclusion.
    d. Reporting and resolution of audit findings.
    e. Preparing a draft validation report.
    f. Technical review of the draft validation report prepared by the assessment team along with other documents as appropriate by an independent competent technical review team for finalization of the validation opinion (this report).
    g. Final report is accepted by the Technical Reviewer is then approved by Enviance Services Private Limited which is processed further according to the ICR process requirements.

4.3. Evidence gathering plan

For the VVB to ascertain compliance and provide a reasonable level of assurance, the evidence gathering plan must be sufficient and appropriate. Having signed a non-disclosure contract with Methodology developer that there were no impediments to the evidence gathering process. Enviance therefore developed evidence gathering or audit plan based on the results of the risk assessment and in compliance with ISO 14065 and ISO 14064-3. The audit plan included a plan for checking the sources of errors to assess the degree to which they are free of material errors, mistakes, and misstatements.

The following are the evidence gathering activities applied by VVB:

1. Inspection of records and documents: The VVB examined documents and data provided by PP and other external sources relevant to the project activity. The Methodology developer was requested to provide both electronic and paper form data where applicable. The documentary evidence provided alongside the ICR methodology description document is listed under Appendix I of this document.
2. Inquiry: Throughout the assessment process VVB sought information and clarifications from the representatives of Methodology developer through formal written requests. Please refer Appendix II for the finding overview.
3. Analytical procedures: VVB analyzed the sufficiency of the data monitoring procedures established by the proposed methodology.

4.4. Activities and techniques

The process of validation and verification as undertaken by Enviance involves the following steps:

a) Contract with the Methodology developer and appointment of validation team and technical review team.
b) Desk review of the methodology description document.
c) Interviews with the methodology developer.
d) Reporting and closure of findings (CARs/CLs/FARs) and preparation of draft validation report.

e) Independent technical review of the draft validation report and final/revised documentation.
f) Reporting and closure of TR comments/findings (CARs/CLs/FARs) and final approval for the decision made.
g) Issuance of final validation report to contracted Methodology developer (or authorized representatives) and submission of request for issuance, as appropriate.

4.5. Review of documented information

The validation assessment of the project entails a desk review of the ICR methodology description document and supporting documents submitted at various stages of the process, and reference documents as stated in detail in appendix I of this document. The assessment is performed by a validation team using protocol. The assessment team cross-checks all information provided in the ICR Methodology description document and other relevant external sources. Additionally, and, if necessary, independent background investigation is conducted.

Inconsistencies between the Methodology description document and the stated criteria as per methodology requirements were considered findings and identified for corrective action. Appropriate justification for any noncompliance with the requirement criteria was also sought. All the Non-conformities (findings) have been raised and resolved under Appendix II of this report.

4.6. Interviews

As part of the validation assessment of the methodology and its related project activity, Enviance conducted interviews with various personnel involved in the development of the methodology titled 'Atmospheric Nitrous Oxide (N_2O) Destruction Using Photocatalysts', M-ICR011, as well as the implementation of the associated project activity. A remote audit of the actual project activity took place on 02/04/2025, followed by additional interviews with representatives of the methodology developer to provide further clarification requested by the assessment team.

ID	Last name	First name	Role	Date	Subject	Team member
1	Rogozinska	Aleksandra	Project Proponent	02/04/2025	Methodology description and its implementation	Dr. Manthan Tailor, Mr. Pankaj Kumar & Mr. Vipul Jain
2	Bockos	Alvaro Montero	Project Proponent	02/04/2025	Methodology description and	Dr. Manthan Tailor,

					its implementation	Mr. Pankaj Kumar & Mr. Vipul Jain
3	Khambhati	Yusuf	Project Proponent	02/04/2025	Methodology description and its implementation	Dr. Manthan Tailor, Mr. Pankaj Kumar & Mr. Vipul Jain
4	Alej	Carlos Bueno	Project Proponent	02/04/2025	Methodology description and its implementation	Dr. Manthan Tailor, Mr. Pankaj Kumar & Mr. Vipul Jain
5	Papadopoulos	Dr Apostolos	Project Proponent	02/04/2025	Methodology description and its implementation	Dr. Manthan Tailor, Mr. Pankaj Kumar & Mr. Vipul Jain

4.7. Inspection

The remote audit was conducted on 02/04/2025. The audit team reviewed project documentation, conducted virtual site assessments, and engaged in stakeholder interviews. In this audit the key areas covered included data management systems, monitoring processes, and compliance with relevant ICR program standards and ISO 14064-3: 2019.

4.8. Conformity

Provide information on assessments conducted during the validation and non-conformities (if any) and their status.

Criteria	Assessed	No. non-conformities	Resolved
1. Methodology			
1.1 Other methodologies	☐ Y ☐ N	-	☐ Y ☐ N ☐ N/A
1.2 Sources	☐ Y ☐ N	-	☐ Y ☐ N ☐ N/A
2. Summary	☒ Y ☐ N	CL 01	☒ Y ☐ N ☐ N/A
3. Definitions	☐ Y ☐ N	-	☐ Y ☐ N ☐ N/A
4. Applicability conditions	☐ Y ☐ N	-	☐ Y ☐ N ☐ N/A
5. Baseline Scenario	☐ Y ☐ N	-	☐ Y ☐ N ☐ N/A
6. Additionality	☐ Y ☐ N	-	☐ Y ☐ N ☐ N/A
7. Project Boundary	☐ Y ☐ N	-	☐ Y ☐ N ☐ N/A
8. Quantification of GHG emission mitigations			
8.1 Criteria and procedures for quantification	☒ Y ☐ N	CL 02, CL 03, CL 04	☒ Y ☐ N ☐ N/A
8.1 Baseline emissions	☐ Y ☐ N	-	☐ Y ☐ N ☐ N/A
8.2 Project emissions	☐ Y ☐ N	-	☐ Y ☐ N ☐ N/A
8.3 Leakage	☐ Y ☐ N	-	☐ Y ☐ N ☐ N/A
8.4 Quantification of Net-GHG emissions and/or removals	☐ Y ☐ N	-	☐ Y ☐ N ☐ N/A
8.5 Risk assessment for permanence	☐ Y ☐ N ☐ N/A	-	☐ Y ☐ N ☐ N/A
9. Monitoring			
9.1 Monitoring plan	☒ Y ☐ N	CL 05	☒ Y ☐ N ☐ N/A
9.2 Data and parameters remaining constant	☐ Y ☐ N	-	☐ Y ☐ N ☐ N/A
9.3 Data and parameters monitored	☐ Y ☐ N	-	☐ Y ☐ N ☐ N/A
10. References	☐ Y ☐ N	-	☐ Y ☐ N ☐ N/A
Appendix I – [OTHER]	☐ Y ☐ N ☐ N/A	-	☐ Y ☐ N ☐ N/A

5. Validation Findings

As an outcome of the validation process, the assessment team raised different types of findings.

Clarification request (CL) is raised if information is insufficient or not clear enough to determine whether the applicable ICR/ISO 14064-2 have been met.

Where a non-conformance arises, the verifier raises a Corrective Action Request (CAR). A CAR is issued, where:

- The project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions.
- The ICR/ISO 14064-2 requirements have not been met.
- There is a risk that emission reductions cannot be monitored or calculated.

Irrespective of the nature of findings, all of these were given to the Methodology developer in a separate finding document. In this document, the project proponent(s) were given the opportunity to respond to the findings. Based on the responses received from the Methodology developer along with relevant supporting documents/evidence, the validation team determined whether the findings are resolved or not. The findings were also raised at a later stage e.g., during internal technical review process and these are also communicated/dealt in the same manner as described above. The validation assessment report reflects the status of the findings, if any, as appropriate under Appendix II.

In summary, the type and total number of findings that were raised are indicated below.

Type of Finding	CAR	CL
Total Findings	00	05

V1.Methodologies

V1.1 Other methodologies

Means of Project Validation	Desk Review, Remote Audit and Interview
Sections ISO 14064-2/ICR requirements	In compliance with the Para. 6.1 of the ICR methodology requirements - Methodology developers shall list all methodologies reviewed during the methodology development, both those of similar nature and those utilized in constructing the proposed methodology, along with modules/tools/regulations.
Findings	No findings were raised.
Conclusion	The approach of the proposed methodology '' Atmospheric nitrous oxide (N_2O) destruction using Photocatalysts'' is to destroy N_2O from the air using photocatalytic processes applied to crop canopies. This involves integrating photocatalytic technology into agricultural practices, typically through standard spraying, to break down N_2O emissions resulting from farming activities. Unlike existing approaches that focus on reducing or capturing emissions, this method directly destroys N_2O present in the ambient air over agricultural fields. The methodology developer has provided a detailed comparison with existing methodologies under the applicable sectoral scope in the section 1.1 of the ICR methodology description document. The assessment of comparison with other methodologies is as follows: Methodology | VVB Assessment

	VM0042 'Methodology for Improved Agriculture Land Management' (Verra)	The assessed methodology focuses on reducing N_2O emissions by improving agricultural practices, such as fertilizer management, and does not cover the direct destruction of N_2O present in ambient air. In contrast, Crop Intellect's proposed methodology is fundamentally different, as it aims to destroy N_2O already present in the atmosphere over agricultural fields using photocatalytic processes. While the general approach of the assessed methodology is similar to the proposed methodology, the VVB conducted a comparison and determined that the existing methodology could not be sufficiently modified to meet the specific requirements of the proposed approach. Therefore, the VVB concluded that the development and submission of a new methodology was justified and acceptable.
	AM0028 'N_2O destruction in tail gas of Caprolactam Production Plants' (CDM)	The assessed methodology focuses on the catalytic or thermal destruction of concentrated N_2O emissions from industrial caprolactam production, requiring complex equipment in industrial settings and continuous emissions monitoring. In contrast, Crop Intellect's proposed methodology applies photocatalytic technology sprayed over the crop canopy,

		integrates into routine agricultural operations, and relies on ambient air sampling, making it specifically suited for addressing agricultural N_2O emissions. However, the assessed methodology does not allow the project participant (PP) to select the most appropriate baseline product, which led to the correct conclusion that the registered methodology is insufficient to meet the quantification requirements. As a result, the proposal for a new methodology was considered justified and acceptable.
	Methodology developer has provided a detailed comparison along with the justification of non-applicability as per the methodology requirements under section 6.1 of the methodology description and it was verified that no similar methodology under the ICR or another GHG programme was identified.	

V1.2 Sources

Means of Project Validation	Desk Review, Remote Audit and Interview
Sections ISO 14064-2/ICR requirements	In compliance with the Para. 6.1 of the ICR methodology requirements - Methodology developers shall list all methodologies reviewed during the methodology development, both those of similar nature and those utilized in constructing the proposed methodology, along with modules/tools/regulations.
Findings	No findings were raised.
Conclusion	The proposed methodology is not directly based on any existing methodology but draws reference from established tools within the CDM framework. Specifically, it refers to TOOL02 (Combined Tool to Identify the Baseline Scenario and Demonstrate Additionality, v7.0, CDM-UNFCCC) to guide baseline setting and additionality assessment. All the sources (tools/modules/regulation/standards) referred are mentioned under section 1.2 of the ICR methodology description

	document in line with para 6.1 of the ICR methodology requirements v3.0.

V2.Summary

Means of Project Validation	Desk Review, Remote Audit and Interview
Sections ISO 14064-2/ICR requirements	In compliance with the Para 6.2 of the ICR methodology requirement- The methodology developer shall provide a summary of the proposed methodology where essential components and associated project activities are described generally.
Findings	CL 01 was raised and resolved.
Conclusion	The target of the proposed methodology is destruction of atmospheric nitrous oxide (N_2O) using advanced photocatalysts, specifically Crop Intellect Ltd's R-Leaf technology. R-Leaf uses a double-doped titanium dioxide (TiO_2) photocatalyst that operates under visible light and is applied by spraying it on crop leaves. This innovation enables large-scale economical N_2O reduction in agriculture. The photocatalyst breaks down N_2O into nitrogen (N_2) and oxygen (O_2) without sequestering it in soil or crops, and the reaction is irreversible under atmospheric conditions. R-Leaf is a liquid suspension applied at standard crop stages without altering farming practices, using 1000 g of catalyst per hectare and remains active for about 12 weeks. In addition to reducing greenhouse gases, R-Leaf also converts nitrogen oxides (NO_x) into nitrate (NO_3^-), enhancing crop yields and potentially reducing fertilizer needs. Emission reductions are determined by comparing project outcomes to a baseline scenario representing standard farming practices, as outlined in the UNFCCC's combined tool for baseline determination and additionality assessment. Air samples from treated fields are collected using specialized sampling bags and analyzed with instruments such as the LI-COR LI-7820 N_2O/H_2O trace gas analyzer or commonly used techniques like Gas Chromatography (GC). To calculate N_2O flux and total greenhouse gas reduction in CO_2-equivalent terms, the analysis incorporates key parameters including wind speed, crop canopy height, and measured N_2O concentrations. A detailed summary of the proposed methodology is provided under section 2 of the ICR methodology description document which is found to be in line with para 6.2 of ICR methodology requirements v3.0. Hence, acceptable,

V3.Definitions

Means of Project Validation	Desk Review, Remote Audit and Interview
Sections ISO 14064-2/ICR requirements	In compliance with the Para 6.3 of the ICR methodology requirement – Methodologies may set out defined terms in addition to those already included in the ICR program to help users understand the context of methodology and improve its readability.
Findings	No findings were raised.
Conclusion	The ICR methodology description document provides a comprehensive list of definitions of terms/acronyms applicable to the proposed methodology under section 3. The list is ordered alphabetically, and defintions were found to be provided in addition to those in the ICR definitions version V3.1. The terminology used in the methodology is consistent with the ICR programme requirements and GHG accounting, and the language chosen is precise. Specific key terms were used appropriately; must, should, and may to indicate a firm requirement and permissible or allowable options, respectively. The definitions were consistently incorporated throughout the methodology text, with appropriate references provided. They are clear and concise, helping to establish context for the methodology and improving overall clarity and readability.

V4.Applicability conditions

Means of Project Validation	Desk Review, Remote Audit and Interview
Sections ISO 14064-2/ICR requirements	In compliance with the Para 6.4 of the ICR methodology requirement – Applicability conditions define conditions where the project activities can be applied.
Findings	No findings were raised.
Conclusion	The proposed methodology is applicable to projects focused on destroying atmospheric N_2O using advanced photocatalysts applied to crop leaves. It specifically supports the use of technologies like R-Leaf, which operates under visible light to break down N_2O into nitrogen and oxygen. This approach enables large-scale, cost-effective reduction of greenhouse gases across agricultural lands. Section 4 of the ICR methodology description document defines the applicability conditions in line with para. 6.4 of the ICR methodology requirements.

The validation assessment determined that the applicability condition contained within the methodology is appropriate, adequate and in compliance with the ICR methodology requirements.

The results of the assessment are given below:

Applicability Condition	VVB Assessment
Geographical Scope: The methodology can be applied globally to any land-based projects where plants/crops/vegetation are typically sprayed, or where such spraying operations can be performed. This encompasses the project boundary. The methodology applies to any region where local environmental conditions support effective spray application and photocatalytic activity.	The validation team confirms that the methodology has a global geographical scope and can be applied to any land-based project where crops, plants, or vegetation are typically sprayed. It is also confirmed that the methodology can be used in any region where local environmental conditions support effective spray application and photocatalytic activity. This condition is clearly described and is considered reasonable and appropriate. Thus, the applicability condition is found to be appropriate and acceptable.
Project Boundary and Aggregation of Project Areas: The aggregation of several project boundaries into one larger project is encouraged for efficiency in measuring, reporting, and verification (MRV) processes, provided that either the geographic proximity ensures uniformity in regional parameters, or if different, these are measured (using project-relevant weather stations). The spatial extent of the project boundary includes all areas where the photocatalyst is applied. This boundary is defined by the land or farmland directly subject to the intervention. For	The validation team confirms that the methodology allows combining multiple project areas into one larger project to improve MRV efficiency, as long as the sites have similar environmental conditions or these conditions are properly measured. The project boundary includes all land where the photocatalyst is applied. The approach for aggregation is clearly described and considered appropriate to ensure consistency and reliable results. Thus, this applicability condition is found appropriate and acceptable.

	aggregate projects, multiple project sites within the same geographical region can be grouped together under one umbrella project, provided they are subjected to similar environmental conditions (e.g., temperature, rainfall, sunlight) that influence the photocatalytic efficiency of the intervention. Aggregate projects may be formed where multiple project locations share comparable climatic, soil, and operational parameters. These aggregated areas must be located within a reasonably defined region to ensure consistency in environmental conditions and the uniform application of the photocatalyst.	
	Technology and Equipment Requirements: This methodology is applicable only to projects that have access to photocatalytic technology with demonstrated evidence of its ability to destroy N2O under visible light. Projects must also have the necessary equipment to deploy the photocatalytic material, such as appropriate spraying systems or other relevant application methods. In addition, projects must be equipped with appropriate monitoring tools to track regional environmental conditions (e.g., light, humidity, temperature) that impact the efficiency of the photocatalytic	The validation team confirms that the methodology applies only to the projects using photocatalytic technology that works under visible light. Projects also requires suitable equipment for applying the material and for monitoring environmental conditions and N_2O destruction. These requirements are clearly defined and appropriate for reliable reporting and verification. Thus, it is acceptable.

	process. Furthermore, equipment for accurately measuring the destruction of N2O emissions, as outlined in this methodology, is required to ensure that the outcomes can be reliably reported and verified.	
	Type of surface for photocatalyst application: This methodology applies to any project where photocatalysts for N2O destruction can be sprayed or spread on an appropriate surface. If the surface is permanently shaded (e.g., indoors or lacking light in general), a suitable light source of sufficient intensity relevant to the surface area must be provided to enable photocatalysis. The most suitable surface for the photocatalyst application is the canopy of plant leaves either on a crop farm or any other crop area. In this case, the type of crop selected is required to maintain a canopy for at least 4 weeks to ensure adequate impact from the photocatalytic activity. Application of agrochemical input onto a plant canopy by spraying is a standard practice in crop production; the photocatalyst for N2O destruction can be mixed with the agricultural inputs (e.g., fungicides) and therefore no further activity than the farm standard is required.	The validation team confirms that the methodology can be used on any project where the photocatalyst for N_2O destruction can be sprayed or spread, with an added light source if needed in shaded areas. The most suitable surface is the crop canopy, which should last a t least 4 weeks for effective results. Mixing the photocatalyst with standard farm inputs is a common and practical approach. Therefore, this applicable condition is found appropriate and acceptable.

	Project Duration: Different types of plants/crops/vegetation have different sowing and harvesting time periods which also depend on the part of the world they are grown in. Due to this, the deployment times and rate of the photocatalyst can be different, resulting in varying project durations for different types of plants/crops/vegetation. The residual time of the photocatalyst on the leaves should be at least 4 weeks, and hence it can only be deployed on crops that maintain full leaves for a minimum of 4 weeks. The photocatalyst for N2O destruction resides on leaves for a duration of 4-12 weeks. It is recommended to deploy further layers as deemed required to maintain a sufficient level of efficiency. This typically relates to the crop growth and development. Therefore, a minimum of two sprays of the photocatalyst (1 kilogram/hectare in total) during the growth period will be typically required. In cases where two different crops are grown one after another on the same land over one year/season, each crop shall be considered separately regarding its impact, but can be included under the same project, and each shall receive photocatalyst applications. These applications will still align	The validation team confirms that the methodology accounts for different project durations based on crop type, growth stage, and regional conditions. Crops must maintain a full leaf canopy for at least 4 weeks, with typically two photocatalyst applications during the growth period. For non-harvested vegetation like grasslands or evergreen trees, the accounting period is one year, with reapplication every 4–12 weeks. Thus, this condition is found acceptable.

with agricultural inputs which is the standard farm practice. In case that the project includes vegetation that does not require harvesting, for example, grasslands or evergreen trees, then the maximum duration for accounting should be one year, and a new accounting period should commence each year. As such, projects will have vegetation that maintains canopy or leaves year-round, the photocatalyst application shall be carried out every 4-12 weeks throughout the year.	

The methodology is not applicable to the projects where necessary environmental conditions for effective photocatalytic activity are not met. The conditions are given below:

Permanently Shaded Areas: Projects where the target surface is continuously shaded and lacks sufficient exposure to natural or artificial light necessary for photocatalysis	This condition clearly states that the methodology does not apply to areas that are permanently shaded and lack the light needed for photocatalysis.
Non-Vegetative Surfaces: Projects that propose applying the photocatalyst to non-vegetative surfaces (e.g., soil, bare ground, or artificial structures) without a demonstrated ability to maintain effectiveness in N_2O destruction.	The condition provides requied clarity that the methodology does not apply to non-vegetative surfaces like soil, bare ground, or artificial structures unless there is proof that the photocatalyst can effectively destroy N_2O on those surfaces.
Short-Lived Crops: Agricultural systems where crops do not maintain a canopy for at least four weeks, as this would not allow sufficient time for the photocatalyst to achieve its intended effect.	This condition clarifies that the methodology is not applicable to agricultural systems with crops that do not maintain a canopy for at least four weeks, as this would not provide enough time for the photocatalyst to be effective.

	<table><tr><td>**Lack of Monitoring Capability:** Projects that do not have access to appropriate monitoring tools to track environmental conditions affecting photocatalytic efficiency or the means to verify N_2O destruction in accordance with the methodology.</td><td>This applicability condition ensures the methodology used in projects that have the necessary monitoring tools to track the environmental conditions and verify N_2O destruction.</td></tr><tr><td>**Regulatory Restrictions:** Areas where the use of photocatalytic substances is restricted or prohibited by local environmental or agricultural regulations.</td><td>This applicability condition clearly states that the methodology cannot be used in areas where local regulations restrict or ban the use of photocatalytic substances.</td></tr></table> All the applicability condition of the proposed methodology are met with the proposed methodology description

V5.Baseline scenario

Means of Project Validation	Desk Review, Remote Audit and Interview
Sections ISO 14064-2/ICR requirements	In compliance with Para 6.6 of the ICR methodology requirement- the baseline scenario represents activities in the absence of the project activity and associated GHG emissions; accompanied by a justification for the appropriateness of the choices. Methodology developer shall include a detailed comparison with other alternatives as a plausible baseline scenario and appropriateness of the chosen. And In compliance with the para 6.5 of the ISO 14064-2
Findings	No findings were raised.
Conclusion	The baseline scenario described in the proposed method includes N2O emissions from regular farming practices without using photocatalytic technologies or any other methods to eliminate N2O. The project aims to reduce atmospheric N2O released from agricultural activities and other sources. The use of synthetic nitrogen fertilizers is the standard farming practice .Standard farming practices involve using synthetic nitrogen fertilizers, which convert to N2O through nitrification and denitrification. The carbon footprint of the fields or farms in the project forms the baseline. The greenhouse gas emissions from standard farming without photocatalyst use will be compared to the N2O reduction achieved with the photocatalyst. The application of the photocatalyst does not change standard farming practices, as it is mixed with other agricultural inputs

	already in use. Additionally, the background N2O levels will be measured in the project area before starting the activities. Since the area is open and allows air movement, the N2O levels are expected to be consistent throughout the project site. Another method for establishing a baseline is through control fields. In the 2024 field trials, the control field was similar to the treated field in crop type, soil type, and inputs used, except for the photocatalyst application. The same sampling methods were used in both fields to ensure comparable data. The control field served as the baseline, but this method may not work for larger projects due to the diversity of crops and extensive land involved, making control fields impractical. Hence, the methodology developer has considered the appropriate options for baseline scenario section and quantification. The project baseline activity can be demonstrated using the latest version of the “Combined tool to identify the baseline scenario and demonstrate additionality” Adequate justification has been provided by the methodology developer on the appropriateness of the baseline scenario and quantification approach. The proposed methodology clearly outlines the use of standard farming practices, including synthetic fertilizer. Thus, the description of the baseline scenario under section 5 of the proposed methodology was found to be in line with Para 6.6 of the ICR methodology requirements.

V6.Additionality

Means of Project Validation	Desk Review, Remote Audit and Interview.
Sections ISO 14064-2/ICR requirements	In compliance with the para. 6.7 of the ICR methodology requirements v3.0- Methodologies shall establish a procedure for demonstrating additionality, where they demonstrate alignment with the requirements and additionality structure (levels) of section 6.4.1 of the ICR requirement document v.6.0.
Findings	No findings were raised.
Conclusion	The projects adopting this methodology to generate certified carbon credits shall demonstrate additionality. Crop Intellect proposes that demonstration of additionality is based on the latest version of the “Combined tool to identify the baseline scenario and demonstrate additionality” which is available on the CDM - UNFCCC website. Furthermore, the VVB found that project adopting this methodology has complied with the multi-level additionality approach described in the ‘ICR methodology requirements v.3.0 and as detailed in the ‘ICR requirement document v6.0 section 6.4.1 The methodology also

	considers that developer shall consider that it demonstrate that when applied the project meets at minimum, meet level 1, and either 2a or 2b. It shall also meet one additional level from 3, 4 or 5. Thus, the procedures for demonstrating additionality are appropriate, adequate and conform to ICR requirements.

V7.Project boundary

Means of Project Validation	Desk Review, Remote Audit and Interview
Sections ISO 14064-2/ICR requirements	In compliance with para 6.5 of the ICR methodology requirement - Methodologies shall establish criteria and procedures for describing and determining project boundaries, identifying GHG SSRs, and justifying any inclusion or exclusion of GHG SSRs.
Findings	No findings were raised.
Conclusion	The methodology can be applied globally to any land-based projects where plants/crops/vegetation are typically sprayed, or where such spraying operations can be performed. The project boundary as stated under section 5 of the ICR methodology description document includes the production system boundary based on cradle to grave assessment. The impacted GHG sources, sinks and reservoir are include and excluded from the project boundary along with the justifications are listed under section 5 in line with para 6.5 of the ICR methodology requirements. The amount of N2O and CO2 emission avoided due to measure under the project activity is the primary impact which is quantified as the emission reduction achieved by the project activity. Other impact are negligible in the project boundary and are therefore excluded. The methodology addresses the establishment of spatial, temporal, and gaseous boundaries to meet the requirements as per para 6.3 of the ICR requirements and methodology requirements.

V8.Quantification of GHG emission mitigations

V8.1 Criteria and procedures for quantification

Means of Project Validation	Desk Review, Remote Audit and Interview
Sections ISO 14064-2/ICR requirements	In compliance with Para 6.8 of the ICR methodology requirement V3.0-Methodologies shall establish separate criteria and procedures for quantifying net GHG emission mitigations for the selected GHG SSRs for both the project (including leakage) and the baseline scenarios. And In compliance with the para 6.7 and para 6.8 of the ISO 14064-2
Findings	CL 02, CL 03 and CL 04 were raised and resolved.

<table>
<tr>
<td>Conclusion</td>
<td>
The procedure for quantifying of GHG emission mitigations (criteria and procedures for quantification) are described in the methodology section 8.1. It is important to measure how much N_2O is destroyed by the photocatalyst to calculate GHG reduction in tCO_2-e. Since the end products (N_2 and O_2) are released into the air. Instead, N_2O quantification is done by calculating flux and considering related factors.

N_2O Breakdown Equation
The N_2O breakdown equation focuses on key factors and uses established knowledge and assumptions to ensure reliable and practical calculation of reaction rates.

Scientific Background
Specifically, the amount of N_2O converted by the photocatalyst (the vertical flux (F) of N_2O towards the plants, in units of mass per unit area per second) is given by:

$F = \overline{w'c'}$ [Eq. 1]

Where w’ is the vertical velocity fluctuation due to turbulence and c’ is the fluctuation in the N_2O concentration around the mean concentration C (mass per unit volume). The overbar represents the mean value of this quantity (the covariance), which can be measured directly using suitable instrumentation, and this is known as the eddy covariance method.

An approximate representation of Eq. 1 is to express the flux of N_2O in terms of mean quantities as follows:

$F = K.dC/dz$ [Eq. 2]

where K is the exchange coefficient which depends on the magnitude and length scales of the atmospheric turbulence and z is the height above the ground. The length scales of the turbulence increase with the height above the ground z, and so, for constant flux, dC/dz decreases with z and hence, the most easily measurable changes in C are likely to be relatively close to the plants (for example, within a few meters).

N_2O breakdown calculation from N_2O flux
To calculate the N_2O flux, it is important to determine the exchange coefficient. The exchange coefficient K depends on the atmospheric turbulence and height above the ground. Hence, it can be represented in terms of the wind friction velocity u^*, von Karman’s constant κ and representative height z. It is calculated using Eq. 3.
</td>
</tr>
</table>

	$K = \kappa . z . u^{*}$ [*Eq. 3*] The value of von Karman's constant κ is 0.4. The wind friction velocity u^* is calculated using the following equation: $u^{*} = z_u \, \kappa / \ln(U_{(10)} / z_0)$ [*Eq. 4*] Where, u* Wind friction velocity (m/s) zu Height of wind measurement (taken as 10m) κ Von Karman's constant (0.4) U(10) Average wind speed at 10m height (m/s) z0 Surface roughness (taken as 0.1m for most crops) The representative height for exchange coefficient is calculated using the following equation: $z = (z_1 + z_2)/2$ [*Eq. 5*] Where, z Representative height (m) z_1 Height of canopy measurement (m) z_2 Height at least 1m above canopy (m) Assuming that the concentrations over the untreated field at least 1m above the canopy represent the background concentration, the flux may be estimated using *Eq. 2* and *Eq. 3* as follows: $F = \kappa . z . u^{*} . dC/dz$ [*Eq. 6*] Where, F Flux of N_2O from the atmosphere to canopy (ppb.m/s) The gradient in N_2O concentration between the two measurement heights (in ppb/m) is represented by *dC/dz* and it can be calculated using the following equations: $dC = C_2 - C_1$ [*Eq. 7*] $dz = z_2 - z_1$ [*Eq. 8*] Where, C_1 N_2O concentration at canopy height (ppb) C_2 N_2O concentration at least 1m above canopy (ppb)

z_1 Height of canopy measurement (m)

z_2 Height at least 1m above canopy (m)

Flux of N_2O is converted into the unit $\mu g_{N2O}/m^2/s$ and multiplied with Light Intensity Factor by using the following equation:

$$F_{N2O} = (F \cdot \frac{MW_{N2O}}{V_g}) \cdot I \qquad [Eq.\ 9]$$

Where,

F_{N2O} Flux of N_2O from the atmosphere to canopy ($\mu g_{N2O}/m^2/s$)

F Flux of N_2O from the atmosphere to canopy (ppb.m/s)

MW_{N2O} Molecular weight of N_2O (44 g/mol)

V_g Volume (approx.) of 1 mole of gas (22.4 L)

I Light Intensity Factor (taken as 1)*

The Light Intensity Factor is taken as 1, and this will be updated once further experiments and modelling of light intensity are concluded.

The Equivalent CO_2 flux (F_{CO2}) is calculated using the Global Warming Potential of N_2O, which is 273 times greater than that of CO_2 [8]:

$$F_{CO2} = F_{N2O}.273 \qquad [Eq.\ 10]$$

Where,

F_{CO2} Equivalent CO_2 flux ($\mu g_{CO2}/m^2/s$)

The Equivalent CO_2 is converted to the unit g/ha/day using the following equation:

$$F'_{CO2} = F_{CO2}.\left(\frac{1}{1000000}\right).10000 \times 3600 \times 24 \qquad [Eq.\ 11]$$

The estimated loss of efficiency of the R-Leaf** photocatalyst over time is 0.08%/day (0.92 factor), hence, the equivalent CO_2 destruction per hectare for a 90-day active period (assuming 13 hours of daylight per day during the project period) in terms of tCO_2-e is:

$$F_{tCO2eq} = (F'_{CO2} \times (\frac{90 \times 13}{24}) \times 0.92)/1000000 \qquad [Eq.\ 12]$$

Where,

$F_{tCO2\text{-}e}$ Equivalent CO_2 destruction (tCO2-e/ha)

**If any other photocatalyst is used, efficiency of that photocatalyst shall be considered instead

	This value is multiplied by the total area of application of the photocatalyst for N_2O destruction (treated area) to obtain the total GHG destruction in terms of tCO2-e. $TF_{tCO2eq} = F_{tCO2eq} \times TreatA$ [*Eq. 13*] Where, TF_{tCO2-e} Total Equivalent CO_2 destruction (tCO2-e) TreatA Total treated area with application of the photocatalyst for N_2O destruction (ha) **If the control field is established as the baseline, these calculations must be performed for both the treated and the control fields.** This section provides the guideline for quantifying the net GHG emissions and removal. The methods for calculation of emission reduction and removals from the methodology section 8.1 is appropriate, adequate and in compliance with the ICR methodology requirement section 6.8.

V8.2 Baseline emissions

Means of Project Validation	Desk Review, Remote Audit and Interview
Sections ISO 14064-2/ICR requirements	In compliance with Para 6.8 of the ICR methodology requirement V3.0- Methodologies shall establish separate criteria and procedures for quantifying net GHG emission mitigations for the selected GHG SSRs. And In compliance with the para 6.7 and para 6.8 of the ISO 14064-2
Findings	No findings were raised.
Conclusion	The proposed methodology identified the most plausible baseline scenario is the continuation of pre-project N_2O emissions without any measures to destroy that N_2O. The project activities are designed to remove ambient N_2O from agricultural and other sources. The baseline scenario has been clearly described in Section 5 of this validation report. If the carbon footprint of the field or farms included in the project is considered as the baseline, the baseline emissions are calculated as follows: $BE = BE_1$ [*Eq. 14*] Where: BE Baseline emissions (tCO2-e) BE_1 Baseline emissions from the carbon footprint of the field or farms prior to/without the intervention that are included in the

	project (tCO2-e) If the control field is set up as the baseline, the baseline emissions are calculated as follows: $BE = BE_2$ [*Eq. 15*] Where: BE Baseline emissions (tCO2-e) BE_2 Baseline emissions obtained from calculations in section 8.1 performed for control field (tCO2-e) The baseline emissions model approach encompasses all GHG sources, sinks, and carbon pools as specified by the delineated project boundary. In conclusion, methods for calculation of baseline emissions are appropriate, adequate and in compliance with para 6.7 ICR requirements v6.0.

V8.3 Project emissions

Means of Project Validation	Desk Review, Remote Audit and Interview
Sections ISO 14064-2/ICR requirements	In compliance with Para 6.8 of the ICR methodology requirement V3.0- Methodologies shall establish separate criteria and procedures for quantifying net GHG emission mitigations for the selected GHG SSRs. And In compliance with the para 6.7 and para 6.8 of the ISO 14064-2
Findings	No findings were raised
Conclusion	The project activity emissions are the emission that arise from the operations required to implement, monitor and conclude the project. As these activities release the GHGs into the atmoshphere which would not have occurred in the absence of project. Emissions from raw material procurement, manufacturing, process, transport, and other project activities (like monitoring and measurement) related to the photocatalyst shall be calculated using standard methods, such as a Life Cycle Assessment (LCA), and deducted from the total GHG destruction claims. Project emissions are calculated as follows: $PE = PE_1 + PE_2$ [*Eq. 16*] Where: PE Project emissions (tCO2-e) PE_1 Project emission from procurement of raw materials, manufacturing processes packaging and transportation associated with the production and supply of the photocatalyst for N_2O

	destruction (tCO2-e) PE_2 Project emissions from other project activities like monitoring and measurements (tCO2-e) The project emissions will be calculated either from actual measurements or from data based on scientifically validated sources, based upon the quantification approach applied. Parameters and equations to calculate project emissions were checked and found appropriate. The assessment team found that the procedure for calculating project emissions cover all GHG sources, sinks and reservoirs and are adequate and in compliance with para. 6.8 of ICR requirements V6.0.

V8.4 Leakage

Means of Project Validation	Desk Review, Remote Audit and Interview
Sections ISO 14064-2/ICR requirements	In compliance with Para 6.8 of the ICR methodology requirement V3.0- Methodologies shall establish procedures to quantify leakage where the potential for leakage is identified. When quantifying GHG emissions and/or removals achieved by the project, the sum of GHG emissions resulting from project activities and leakage shall be withdrawn. And In compliance with the para 6.7 and para 6.8 of the ISO 14064-2.
Findings	No findings were raised.
Conclusion	The proposed methodology considers leakage as 0 because the photocatalyst breaks down N_2O into N_2 and O_2, which are released into the atmosphere without being stored in soil or crops. This reaction is stable and irreversible under normal atmospheric conditions, with no risk of recombining into N_2O, even after the project ends. Because recombining these gases back into N_2O requires very high-energy conditions, such as extreme heat, intense pressure, or specialized catalysts typically found only in controlled industrial settings. Such conditions do not exist naturally in open agricultural environments. Therefore, once the photocatalyst has converted N_2O into harmless gases, there is virtually no realistic scenario in nature for these gases to recombine into N_2O, ensuring that the emission destructions achieved by this reaction are permanent. Hence, there is no risk of reversal of the benefits, even after cessation of the use of the photocatalyst. Thus, the proposed methodology under section 8.4 provides a justification for considering default leakage emission as 0. The leakage emissions of the proposed methodology account for GHGs from SSRs displaced by the project activity. Therefore, the approach is

	found acceptable by the assessment team and in line with Para 6.8 of the ICR methodology V3.0 and Para 6.7 and 6.8 of ISO 14064-2.

V8.5 Quantification of Net-GHG emissions and/or removals

Means of Project Validation	Desk Review, Remote Audit and Interview
Sections ISO 14064-2/ICR requirements	In compliance with para 6.8 of the ICR methodology requirements v3.0 - Net GHG emission mitigations achieved by projects are the basis for the volume of ICCs that can be issued, where baseline GHG emissions and project GHG emissions and/or removals must be accurately quantified in order to determine net emission reductions and/or removals achieved by projects.
Findings	No findings were raised.
Conclusion	The proposed methodology gives the procedure for quatifying net GHG emission mitigation as a function of baseline emission, project emission and leakage. Net GHG Emission Mitigations are calculated as follows: $EM = TF_{tCO2eq} - BE - PE$ [*Eq. 17*] Where: EM Net GHG emissions mitigations (tCO2-e) $TF_{tCO2\text{-}e}$ Total Equivalent CO_2 destruction calculated from Equation 13 (tCO2-e) BE Baseline emissions calculated from Equation 14 or 15 (tCO2-e) PE Project emissions calculated from Equation 16 (tCO2-e) The quantification of net GHG emission mitigation has been clearly defined in section 8.5 of the proposed methodology description and In line with Para 6.8 of the ICR methodology V3.0.. This ensures that the total CO2 equivalent destruction is adjusted for baseline and project emissions. The approach is found to be appropriate and acceptable by the assessment team.

V8.6 Risk assessment for permanence

Means of Project Validation	Desk Review, Remote Audit and Interview
Sections ISO 14064-2/ICR requirements	In compliance with para. 5.11 of ICR requirement document v6.0- The project proponent shall conduct a risk assessment of the project's implementation and operation and implement actions to reduce any risks identified.
Findings	No findings were raised.

<table>
<tr><td>Conclusion</td><td>
The permenance of N_2O destruction achieved through the proposed methodology is influenced by valious risk factors. However, the breakdown the N_2O via the photocatalytic reaction is irreversible under atmospheric conditions. There is no risk of reversal once the emissions are mitigated.
Following measures have been taken to mitigate the risks –
<table>
<tr><td>Risk Identified</td><td>Mitigation Measures</td></tr>
<tr><td>Natural Risk : Extreme weather may reduce photocatalyst efficiency but does not reverse mitigated emissions.</td><td>The risk can be managed by optimizing the timing of photocatalyst application and establishing reapplication protocols to ensure continued effectiveness. Regular monitoring of weather conditions will help to maintain the desired emission reduction performance.</td></tr>
<tr><td>Political Risk: Policy changes may affect future deployment but not past reductions.</td><td>This risk can be managed by engagement with regulatory bodies is recommended to promote alignment with evolving regulations.</td></tr>
<tr><td>Abandonment Risk: Project discontinuation would halt future GHG mitigation but not undo past benefits.</td><td>This risk can be managed by Financial incentives for landowners, farmer training to to ensure competency, and regular monitoring of project budget and are planned to reduce the risk of project abandonment and ensure ongoing implementation.</td></tr>
<tr><td>Legal Risk: Regulatory restrictions could limit deployment but do not affect past reductions.</td><td>This risk can be managed by approval and collaboration with authorities.</td></tr>
<tr><td>Performance Risk: Variability in effectiveness impacts ongoing GHG mitigation, not permanence.</td><td>The risk can be managed through regular field assessments, optimization of application rates, and third-party verification to ensure consistent and reliable performance.</td></tr>
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<tr><td>Internal Risk: Governance or financial instability may disrupt operations but not affect past results.</td><td>The project has incorporated strong governance measures, diversified funding sources, and training programs to reduce the risk of operational disruptions.</td></tr>
</table>
the proposed methodology does not require a non-permanence buffer since N_2O destruction is permanent. However, the methodology incorporates measures to address risks affecting ongoing GHG mitigation, including:

Conservative credit issuance based on verified N_2O destruction.
Regular monitoring and reassessment to optimize performance of the photocatalyst and ensure its continued application.

Use of weather data and performance tracking to refine application protocols and maintain efficiency.

The assessment team confirm that the methodology developer has identified relevant risk and implemented appropriate mitigation strategies. The risk assessment for permenance has been clearly defined in section 8.6 of proposed methodology description. The approach is found to be appropriate and acceptable by the assessment team.
</td></tr>
</table>

V9.Monitoring

Means of Project Validation	Desk Review, Remote Audit and Interviews
Sections ISO 14064-2/ICR requirements	In compliance with para 6.9 of ICR methodology requirements V3.0 - methodologies shall describe the criteria and procedures for obtaining, recording, compiling, and analyzing monitored data and parameters.
Findings	No findings were raised.
Conclusion	The monitoring of the proposed methodology has been clearly defined in section 9 of the methodology decription document and in compliance with the para6.9 of the ICR methodology requirements v3.0. The monitoring plan comprehensively describes all implementation procedures for monitoring all parameters required which is given section below.

V9.1 Monitoring plan

Means of Project Validation	Desk Review, Remote Audit and Interviews
Sections ISO 14064-2/ICR requirements	In compliance with para 6.9 of ICR methodology requirements V3.0 - methodologies shall describe the criteria and procedures for obtaining, recording, compiling, and analyzing monitored data and parameters.

Findings	CL 05 was raised and resolved.
Conclusion	The monitoring plan in the methodology is designed to gather all necessary data for accurate N_2O emission quantification. It clearly outlines procedures to track key environmental parameters such as average wind speed at 10 m height, canopy height, and N_2O concentration gradients using air samples from both canopy level and above. The collected data has managed by the project developer is then used for flux calculations to estimate N_2O emission reductions. **Uncertainty Analysis** The uncertainty analysis follows IPCC protocols, combining quantitative assessment of parameters, model variables and results. When statistical data is unavailable, a pedigree matrix is assessment shall be performed. Uncertainties are combined using error propagation methods from the IPCC 2019 Guidelines. **Sampling and Analysis** The methodology provides a detailed procedure for N_2O air sampling and analysis to support flux calculations. Air samples are collected at two vertical heights (canopy height and at least 1 m above the canopy) in multilayer foil sampling bags or Tedlar bags using electric pumps. Measurement points are carefully selected based on wind direction, accessibility, and distance from external influences, and geo-locations are recorded to ensure consistency across sampling rounds. The procedure ensures collection of representative composite samples over 1–2 minutes to account for short-term fluctuations in N_2O levels, with 8–10 sample sets recommended per session. The analysis of collected air samples using sensitive equipment such as LI-COR LI-7820 analyzers or Gas Chromatography ensures reliable measurement of N_2O concentrations in parts per billion (ppb), which are then applied in the flux equations. The methodology was field-tested through trials with both treated and control fields, providing evidence that the sampling and analysis procedures are practical, reliable, and suitable for accurately capturing N_2O flux differences attributable to the photocatalyst application. Thus, the monitoring plan has been found appropriate and acceptable by the assessment team.

V9.2 Data and parameters remaining constant

Means of Project Validation	Desk Review, Remote Audit and Interview
Sections ISO 14064-2/ICR requirements	In compliance with para 6.9 of ICR methodology requirements V3.0 - methodologies shall describe the criteria and procedures for obtaining, recording, compiling, and analyzing monitored data and parameters.

<table>
<tr><td>Findings</td><td>No findings were raised.</td></tr>
<tr><td>Conclusion</td><td>The proposed methodology clearly identifies a set of parameters assumed to remain constant across all project activities. The paarameters are given below;
Data and Parameter available at validation:
<table>
<tr><th>Data Parameter</th><th>Assessment</th></tr>
<tr><td>Von Karman's constant (κ)</td><td>The parameter is essential for calculating the wind friction velocity in the flux calculations. This parameter is well-established in fluid dynamics and accurate quantification of GHG emission reduction.
The default value of the parameter chosen by the methodology is 0.4 which was found acceptable by the assessment team Hence, the parameter was found accurate and acceptable.</td></tr>
<tr><td>Height of Wind Measurement (z_u)</td><td>The selection of 10m as the height of wind measurement is appropriate. This parameter is necessary for calculating wind friction velocity in the flux calculations, directly supporting the accurate estimation of GHG emission destruction. Hence, the parameter was found accurate and acceptable.</td></tr>
<tr><td>Surface Roughness (z_0)</td><td>The value of surface roughness is 0.1m . As it reflects the surface roughness which is caused by presence of crop on lands. This parameter is essential for calculating wind friction velocity in the flux calculations. Hence, the parameter was found accurate and acceptable.</td></tr>
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<tr><td>Molecular weight of N₂O (MW_{N2O})</td><td>The molecular weight of N_2O is (44 g/mol). The parameter is found to be appropriately chosen because it is essential for accurate flux calculations, and its use to ensures the consistency in the quantification of GHG emission destruction. Hence, the parameter was found accurate and acceptable.</td></tr>
<tr><td>Volume (approx.) of 1 mole of gas (V_g)</td><td>This parameter clarifies that the the volume of 1 mole of gas (22.4L) is a standard value under ideal gas conditions at standard temperature. This parameter is essential for flux calculations as it allows for the conversion of gas quantities into volumes, ensuring accurate estimation of GHG emission destruction. Hence, the parameter was found accurate and acceptable.</td></tr>
<tr><td>Light Intensity Factor (I)</td><td>The Light Intensity Factor (I) is a critical parameter for flux calculations as it accounts for the effect of light intensity on the N_2O breakdown process. This factor is necessary to accurately quantify GHG emission destruction in the context of the proposed methodology. The applied value of this parameter is 1 which is found accurate and acceptable.</td></tr>
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The assessment team finds this approach acceptable, as these constant parameters are well-established and found acceptable to the assessment team.
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</table>

V9.3 Data and parameters monitored

Means of Project Validation	Desk Review, Remote Audit and Interview

<table>
<tr><td>Sections ISO 14064-2/ICR requirements</td><td>In compliance with para 6.9 of ICR methodology requirements V3.0 - methodologies shall describe the criteria and procedures for obtaining, recording, compiling, and analyzing monitored data and parameters.</td></tr>
<tr><td>Findings</td><td>No findings were raised.</td></tr>
<tr><td>Conclusion</td><td>The proposed methodology includes the monitoring parameters for flux calculations and GHG emission quantification. These parameters are given below;
<table>
<tr><th>Data Parameter</th><th>Assessment</th></tr>
<tr><td>Average wind speed at 10m height ($U_{(10)}$)</td><td>The parameter is essential for calculating wind friction velocity which is needed for accurate N_2O flux calculations. The data will be collected from meteorological stations or weather reports and the Project Developer will record daily wind speed measurements at 10 m throughout the project. Hence, the parameter is appropriate and acceptable.</td></tr>
<tr><td>Height of Canopy (z_1)</td><td>The parameter is essential for calculating the exchange coefficient and the N_2O concentration gradient for flux calculations. This data will be measured directly in the field during air sampling activities. The Project Developer is responsible for recording canopy height at each sampling event. Hence, the parameter is appropriate and acceptable.</td></tr>
<tr><td>Height at least 1m above the canopy (z_2)</td><td>The parameter is essential for calculating the exchange coefficient and the N_2O concentration gradient for flux calculations. This height will be measured directly in the field during air sampling. The Project Developer is responsible for recording this data at each sampling point.</td></tr>
</table>
</td></tr>
</table>

N_2O concentration at canopy height (C_1)	The parameter is essential for calculating the N_2O gradient needed in the flux calculations. This value is measured from air samples collected at the canopy level in the field. The Project Developer is responsible for collecting and recording this data, with at least one measurement required during the project, though three measurements are recommended for better accuracy.
N_2O concentration at least 1m above the canopy height (C_2)	The parameter is essential for calculating the N_2O gradient used in flux calculations. This value is measured from air samples collected about 1 m above the crop canopy. The Project Developer is responsible for collecting and recording this data, with at least one measurement required, though three measurements are recommended for better accuracy.

The assessment team finds this approach acceptable, as the data and parameters monitored are well-established and found acceptable to the assessment team.

V10. References

Means of Project Validation	Desk Review, Remote Audit and Interview
Sections ISO 14064-2/ICR requirements	NA
Findings	No findings were raised.
Conclusion	The proposed methodology and sources cited in the report have been carefully assessed for relevance and sufficiency to support the proposed approach.

	[1] Verra. "VM0042 Improved Agricultural Land Management, v2.1". *Verra*, October 22, 2024. https://verra.org/methodologies/vm0042-improved-agricultural-land-management-v2-1/ [2] Kočí, K., Reli, M., Troppová, I., Šihor, M., Kupková, J., Kustrowski, P. and Praus, P. "Photocatalytic decomposition of N2O over TiO2/g-C3N4 photocatalysts heterojunction." *Applied Surface Science*, 396 (2017): 1685-1695. [3] Bueno-Alejo, C. J., Khambhati, Y. K., Papadopoulos, A. "Photocatalytic removal of N_2O in cropped fields using R-Leaf." *Applied Catalysis O: Open*, 201 (2025), DOI: https://doi.org/10.1016/j.apcato.2025.207032 [4] DEFRA National statistics, 2022. "Chapter 11: Environment". *GOV.UK,* October 22, 2024. https://www.gov.uk/government/statistics/agriculture-in-the-united-kingdom-2021/chapter-11-environment#:~:text=Agriculture%20is%20the%20major%20source,dioxide%20emissions%20in%20the%20UK [5] CDM. "Tools". UNFCCC, October 22, 2024. https://cdm.unfccc.int/Reference/tools/index.html [6] International Carbon Registry (ICR). *ICR Methodology Requirements v3.0*. December 13, 2024. https://documentation.carbonregistry.com/documentation/icr-program/methodology-development/criteria/icr-methodology-requirements-v3.0 [7] International Carbon Registry (ICR). "ICR Requirement Document v6.0*"*. December 13, 2024. https://documentation.carbonregistry.com/documentation/icr-program/project-development/criteria/icr-requirement-document-v6.0 [8] IPCC Greenhouse Gas Protocol, 2024. "IPCC Global Warming Potential Values", Version 2.0. October 11, 2024 https://ghgprotocol.org/sites/default/files/2024-08/Global-Warming-Potential-Values%20%28August%202024%29.pdf [9] IPCC, 2019. "2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories". October 25, 2024. https://www.ipcc.ch/report/2019-refinement-to-the-2006-ipcc-guidelines-for-national-greenhouse-gas-inventories/ The sources referenced in the report are credible. They collectively provide sufficient scientific, technical, regulatory, and contextual support to justify the methodology's assumptions and calculation approaches. Hence, it is appropriate and acceptable.

6. Independent review

The project documentation is reviewed by internal technical reviewer in order to independently confirm whether the applicable GHG program requirements were objectively met or not, in addition to whether internal procedures were followed while arriving at the validation opinion. The technical reviewer may accept or reject the validation opinion prepared by the assessment team and gives the reason. The resolved findings may be opened at this stage or new findings may be identified that are required to be addressed by assessment team and/or project proponents, as appropriate. The technical reviewer is the decision maker on behalf of the Enviance Services Private Limited. A positive opinion is issued if all the findings have been satisfactorily resolved and in all other cases a negative opinion is issued unless the contract is terminated by either party before reaching the final opinion.

Enviance keeps all documents and records in a secure and retrievable manner for at least two years after the end of the project crediting period.

7. Validation opinion

Enviance Services Private Limited has performed a validation assessment of the proposed methodology ‘’Atmospheric nitrous oxide (N_2O) destructing using photocatalysts’’,M-ICR011. The assessment was performed in conformance to ICR methodology requirements version 3.0, ICR requirements version 6.0 and tools referenced therein. The review of the methodology description document, supporting evidence, and ultimately, the resolution of findings is a sufficient measure, in Enviance’s opinion to determine the compliance of the proposed methodology to the stated criteria.

In summary, it is Enviance’s opinion that the proposed methodology fulfills the aforementioned criteria no existing/proposed methodology in any other GHG programmed was found to fulfill the required quantification approach therefore the new methodology is being proposed to ICR for approval and registration in conjunction with the validation report for the ‘’Atmospheric nitrous oxide (N_2O) destructing using photocatalysts’’,M-ICR011 as recommended by the methodology approval process v3.0.

Appendix I

I. Documents reviewed or referenced in the report

Provide a list of documents reviewed or are referenced in the report.

No.	Title	Version	Provider
1.	ICR Methodology requirements	3.0	ICR
2.	ICR requirements documents	6.0	ICR
3.	ICR definitions	3.1	ICR
4.	ICR methodology approval process	3.0	ICR
5.	ICR methodology description	3.1	ICR
6.	ICR concept note	3.0	ICR
7.	ISO 14064-2	2019	Others
8.	ISO 14064-3	2019	Others
9.	https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-02-v7.0.pdf		Others
10.	https://verra.org/methodologies/vm0042-improved-agricultural-land-management-v2-1/		Others
11.	https://cdm.unfccc.int/UserManagement/FileStorage/IV326LBA5XCTF04RUQ7MWDKG8SPNZ1		Others
12.	**DEFRA National Statistics, Chapter 11: Environment (Updated July 27, 2022)** GOV.UK, October 22, 2024 https://www.gov.uk/government/statistics/agriculture-in-the-united-kingdom-2021/chapter-11-environment#:~:text=Agriculture%20is%20the%20major%20source,dioxide%20emissions%20in%20the%20UK		Others
13.	**IPCC Greenhouse Gas Protocol, Global Warming Potential Values (v2.0)** **October 11, 2024**		Others
14.	**IPCC, 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories** **October 25, 2024**		Others
15.	**ICR Project Design Description (Atmospheric nitrous oxide (N2O) destruction using R-Leaf® in Dyson Farming maize field)**	V1.0	PP

II. Site visits

Provide a list of locations visited during the validation activities and type of visit.

No.	Site ID	Location	Type	Team member(s)
1	NA	NA	NA	NA

III. Non-conformities

Provide a list of non-conformities and their status. Amend as required.

<table>
<tr><td>Non-conformity ID:</td><td>CL 01</td><td>Reference to criteria:</td><td>Para 6.2 of the ICR methodology requirement</td><td>Date:</td><td>11/04/2025</td></tr>
<tr><td>Requirement:</td><td colspan="5">The methodology developer shall provide a summary of the proposed methodology where essential components and associated project activities are described generally.</td></tr>
<tr><td>Observation:</td><td colspan="5">Project proponent proposes to use Titanium Dioxide (TiO_2) as an active compound in their formulation. It is evident from past studies that Titanium Dioxide nanoparticles may have negative impact on the biodiversity including pollinators and soil organisms at a certain level of threshold concentration in the environment. Validators would like to be informed if the prolonged application of proposed photo-catalyst is expected to cause surge in the Titanium Dioxide in the environment where it is applied. It is also worth to know that the surge (if it does) in the Titanium Dioxide concentration pose any threat to the local biodiversity.

Reference:

Özkan, Y., Irende, İ., Akdeniz, G., Kabakçi, D., & Sökmen, M. (2014). Evaluation of the comparative acute toxic effects of TiO2, Ag-TiO2 and ZnO-TiO2 composite nanoparticles on honey bee (Apis mellifera). Journal of International Environmental Application & Science, 10, 26-36.

Khare, P., Sonane, M., Pandey, R., Ali, S., Gupta, K. C., & Satish, A. (2011). Adverse effects of TiO2 and ZnO nanoparticles in soil nematode, Caenorhabditis elegans. Journal of Biomedical Nanotechnology, 7(1), 116-117.</td></tr>
<tr><td>Non-conformity:</td><td colspan="5">The project proponent has not provided sufficient assessment or evidence regarding the potential environmental accumulation of Titanium Dioxide resulting from prolonged application of the proposed photocatalyst. Specifically, the project documentation lacks:
• An evaluation of whether the continued use of TiO_2 under the proposed conditions is expected to lead to a significant increase in environmental TiO_2 concentrations at the application sites.
• An assessment of whether any potential increase in TiO_2 concentration could pose a risk to local biodiversity, particularly pollinators and soil organisms.</td></tr>
</table>

Response from project proponent:	We appreciate the comment. As mentioned during our remote audit held on 2/04/2025 via MS Teams and as stated in the references provided by the auditing team, the toxicity concerns regarding TiO_2 come from the nanometre size of typical photocatalysts. R-Leaf is in the micrometre range, thus well over the size of concern and have no effect on soil ecology. That said, FDA and other official agencies around the world consider TiO_2 safe as food additive if kept under 1%. The TiO_2 particles aggregate with other soil particles and become part of the soil structure (Thiagarajan and Ramasubbu, 2021). The recommended usage of R-Leaf is 2 litres per hectare per season, thus only 1 kg of TiO_2 is added per hectare (10,000 m^2) per season, or 10 kg in 10 years. On average, soils contain 0.33% Ti (Lyu et al., 2017) equating to some 2 tn/ha considering the top few centimetres and so making the addition of 10kg of Ti in 10 years is negligible compared to the benefit it offers. Furthermore, in one of references provided by the auditing team (Khare et al., 2011), it is stated that TiO_2 of particle size 100 nm is much less toxic than the one of 25 nm, providing evidence that size is a key element in its toxicity. References: Thiagarajan, V., & Ramasubbu, S. (2021). Fate and behaviour of TiO_2 nanoparticles in the soil: Their impact on staple food crops. Water, Air, and Soil Pollution, 232(264). Lyu, S., Wei, X., Chen, J., Wang, C., Wang, X., & Pan, D. (2017). Titanium as a beneficial element for crop production. Frontiers in Plant Science, 8, Article 597. Khare, P., Sonane, M., Pandey, R., Ali, S., Gupta, K. C., & Satish, A. (2011). Adverse effects of TiO2 and ZnO nanoparticles in soil nematode, Caenorhabditis elegans. Journal of Biomedical Nanotechnology, 7(1), 116-117
Referenced documentation:	NA
Validators assessment of corrective actions:	PP has clarified that the Titanium Dioxide (TiO_2) used in their formulation is in the micrometre range not the nanoparticle size, additionally the recommended usage of R-Leaf is 2 litres per hectare per season, thus only 1 kg of TiO_2 is added per hectare (10,000 m^2) per season, or 10 kg in 10 years. Based on this information, the use of TiO_2 in this context does not raise significant environmental impact on biodiversity including pollinators and soil organisms. Thus, this finding is closed.
Type:	Clarification Request
Status:	Closed

Non-conformity ID:	CL 02	**Reference to criteria:**	Para 6.8 of the ICR methodology requirement V3.0	**Date:**	11/04/2025

Requirement:	Methodologies shall establish separate criteria and procedures for quantifying net GHG emission mitigations for the selected GHG SSRs for both the project (including leakage) and the baseline scenarios. And In compliance with the para 6.7 and para 6.8 of the ISO 14064-2
Observation:	Under section 8.1: Criteria and procedures for quantification of the methodology proponent has proposed equation 1 which describes calculation of vertical flux (F) of N_2O. While vertical velocity fluctuation due to turbulence and the fluctuation in the N_2O concentration around the mean concentration are widely acceptable influential variables, further information is requested if the air density will have any significant effect on the flux F and should it be considered while calculating flux or not.
Non-conformity:	The methodology lacks sufficient justification or assessment regarding the potential influence of air density on the calculated N_2O flux. Specifically, the documentation does not address: • Whether air density variations at the project site could materially affect flux estimates. • Whether and how air density should be incorporated into the flux calculation to ensure accurate and conservative quantification.
Response from project proponent:	Thank you for the comment. As mentioned in the methodology, we contracted Cambridge Environmental Research Consultants (CERC) to confirm the most accurate way to estimate the removal of N_2O and one that is in line with scientific community and industry standards. CERC's advice is that due to the homogeneity of typical agricultural fields, the proximity of the two vertical measurements, and the fact that measurements are being taken simultaneously in a control field, only the variables included in the model would have an influence on the vertical flux estimation. It is true that in other micrometeorology methods, like Eddy Covariance, air density should be considered since the measurement are typically done at approximately 10 meters, so little changes in air density are expected, but in the case of Crop Intellect's methodology, that parameter is not relevant.
Referenced documentation:	NA
Validators assessment of corrective actions:	Based on the explanation provided by PP in accordance to Cambridge Environmental Research Consultants (CERC), the most accurate way to estimate the removal of N_2O has been referred in the methodology that is in line with scientific community and industry standards. Since, only variables included in the model would have an influence on the vertical flux estimation therefore, in the case of Crop Intellect's methodology, air density has not been considered as a parameter. Hence, this finding is closed.
Type:	Clarification Request
Status:	Closed.

Non-conformity ID:	CL 03	**Reference to criteria:**	Para 6.8 of the ICR methodology requirement V3.0	**Date:**	11/04/2025
Requirement:	Methodologies shall establish separate criteria and procedures for quantifying net GHG emission mitigations for the selected GHG SSRs for both the project (including leakage) and the baseline scenarios. And In compliance with the para 6.7 and para 6.8 of the ISO 14064-2				
Observation:	Under *section 8. 1, Equation 9 expresses the conversion of* Flux of N_2O into appropriate unit for further calculations. The light intensity factor is taken as 1. What is the rationale of using the light intensity factor as 1 in the proposed method?				
Non-conformity:	The methodology does not sufficiently explain the basis for setting the light intensity factor to 1 in Equation 9. Specifically, the documentation lacks: • A justification for why light intensity is assumed to have no influence on the conversion or calculation process. • A description of whether this assumption is universally valid across all expected project conditions or whether it requires site-specific validation.				
Response from project proponent:	Thank you for the comment. In the methodology, the following comment has been made: "The Light Intensity Factor is taken as 1, and this will be updated once further experiments and modelling of light intensity are concluded." Since further data is required to fully take that parameter into account, it was set to '1', so that it doesn't affect the rest of the calculation. As mentioned, once more data is obtained on the relationship between light and photocatalytic activity, the parameter will be changed accordingly.				
Referenced documentation:	NA				
Validators assessment of corrective actions:	PP has clarified that the light intensity factor was set to 1 because there is not enough data yet to adjust it accurately. They confirmed that the factor will be updated once more data from experiments and modelling becomes available. Once adequate data is available, the parameter will be revised accordingly. This explanation is acceptable, and the finding is closed.				
Type:	Clarification Request				
Status:	Closed				

Non-conformity ID:	CL 04	**Reference to criteria:**	Para 6.8 of the ICR methodology requirement V3.0	**Date:**	11/04/2025
Requirement:	Methodologies shall establish separate criteria and procedures for quantifying net GHG emission mitigations for the selected GHG SSRs for both the project (including leakage) and the baseline scenarios.				

	And In compliance with the para 6.7 and para 6.8 of the ISO 14064-2
Observation:	Under section 8. 1, Equation 12 for Equivalent CO_2 destruction uses the values of loss of efficiency factor as 0.92 and 13 hours of daylight period during the project duration. While the day light period is usually considered to be of 12 hours, what forms basis to use the value of 13 hours? Reference to validate these values are requested.
Non-conformity:	The methodology lacks sufficient justification and documentation for the parameter assumptions used in Equation 12. Specifically, the following gaps were identified: • No explanation or reference is provided to justify the use of 13 hours as the daylight period instead of the commonly used 12-hour estimate. • No supporting data or references are provided to validate the value of the loss of efficiency factor (0.92) applied in the calculation
Response from project proponent:	Thank you for the comment. The calculation was based on UK daylight in summer as that is the crop growing season. The average of total daylight in the UK is approximately 16 hours during this period (https://www.worlddata.info/europe/united-kingdom/sunset.php), but at the beginning and at the end of the day, the light angle from the sun is too shallow, therefore '13 hours' was considered as appropriate conservative value. We have added a comment in the methodology indicating that the 13 hours period is based on UK daylight hours, but it should be taken as the average daylight period during crop growing season of the region where the project is based. Regarding the loss efficiency factor, in photocatalytic reactions, in some cases, a deactivation of the catalyst is expected due to deposition of reaction products blocking active sites among other causes. In open field experiments, the wind (or ventilation if the experiment is indoors, such as Guarino et al., 2008) can help improve the stability of the photocatalysts significantly. As can be seen in our publication (Bueno-Alejo et al., 2025), after 3 days of intense continuous irradiation, the photocatalyst is still active and converts N2O at a similar rate. From bibliography, experiments performed with TiO2 inside animal barns (Guarino et al., 2008) showed no reduction in activity over 24h reaction periods. Taking all that into account, a significant drop in the activity of the photocatalyst is not expected over time. As far as we know, there is no published study investigating the activity of the photocatalyst over long periods (weeks), hence in order to be conservative, we introduced an estimated loss of activity due to other factors such as wash-off from plant surfaces. Reference: Guarino, M., Costa, A., & Porro, M. (2008). Photocatalytic TiO_2 coating—to reduce ammonia and greenhouse gases concentration and emission from animal husbandries. Bioresource Technology, 99(7), 2650–2658. Bueno-Alejo, C. J., Khambhati, Y. K., Papadopoulos, A., Reli, M., & Ricka, R. (2025). Using photocatalysis for sustainable agriculture: R-leaf's potential in large-scale N_2O mitigation. Environmental Advances, 13, 100469.

Referenced documentation:	NA
Validators assessment of corrective actions:	PP has clarified that the 13-hour daylight period used in the calculation is based on average summer daylight conditions in the UK, which aligns with the crop growing season. While the total daylight can be around 16 hours and they considered 13 hours to be a conservative estimate and accounting for the lower light intensity during early morning and late evening. Also, PP has now been updated the methodology to specify that this value should reflect the average daylight duration for the crop growing season in the specified project region. Hence, the explanation is acceptable and the finding is closed.
Type:	Clarification Request
Status:	Closed

Non-conformity ID:	CL 05	**Reference to criteria:**	para 6.9 of ICR methodology requirements V3.0	**Date:**	11/04/2025
Requirement:	Methodologies shall describe the criteria and procedures for obtaining, recording, compiling, and analyzing monitored data and parameters.				
Observation:	*Under section 9. 1, the proponent proposed two fixed sampling points, one for the project field and one for control field. While variation in the* N_2O concentrations is expected not only temporally but also spatially, and thus, spatially distinct sampling points may be consider to collect a composite sample which may pose higher representativeness. Validators would like to be aware about the rationale behind single sampling static point proposed in the monitoring plan.				
Non-conformity:	The monitoring plan lacks sufficient justification for the use of a single static sampling point in each field. Specifically, the following gaps were identified: • No explanation is provided for why spatial variability is not being accounted for through multiple or composite sampling points. • The proponent has not demonstrated that the proposed fixed-point approach provides a representative and robust estimate of N_2O concentrations across the full spatial extent of both the project and control fields.				
Response from project proponent:	We appreciate the comment. As mentioned above, our calculation is based on a micrometeorology method called the flux-gradient methodology. One of the key characteristics of this methodology is the higher footprint of the measurements taken, typically compliant with the 1:100 rule, meaning that measurement taken at 1 point represents air sampled from 100 meter upwind. This provides such micrometeorology methodologies with a significantly greater spatial representativeness compared to other methods, such as chambers, where the footprint of the measurements is much smaller (typically limited to the chamber size). Christensen et al., (1996) further demonstrates that a single point measurement is equivalent to the average reading of several chambers distributed across the same surface.				

	Reference: Christensen, S., Ambus, P., Arah, J., Clayton, H., Galle, B., Griffith, D., Hargreaves, K., Klenzedtsson, L., Lind, A., Maag, M., Scott, A., Skiba, U., Smith, K. A., Welling, M., & Wienhold, F. (1996). Nitrous oxide emission from an agricultural field: Comparison between measurements by flux chamber and micrometeorological techniques. Atmospheric Environment, 30, 4183–4190.
Referenced documentation:	NA
Validators assessment of corrective actions:	PP has clarified that, the calculation is based on micrometeorology method called the flux-gradient methodology, which allows measurements at a single point to represent a much larger area—up to 100 meters upwind. This gives it better spatial coverage compared to other methods like chambers. And also supported this with the given scientific study showing that one micrometeorological reading is similar to the average of many chamber measurements. Thus, this response is acceptable and finding is now closed.
Type:	Clarification Request
Status:	Closed