



YANTAI XINHAO SWINE FARM MANURE MANAGEMENT SYSTEM GHG MITIGATION PROJECT



Document Prepared by Shenzhen CTI International Certification Co., Ltd

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Summary:

- *A description of the project*

The project activity developed in Yadi village, Muping District, Yantai City, Shandong Province, P. R. China, is to install a new animal waste management system (AWMS) by replace the current open anaerobic lagoon with a new closed anaerobic digester to a swine farm in project area, which will treat the manure and wastewater from the swine farm to avoid methane emissions generated in the baseline uncovered anaerobic lagoon. The project activity involves implemented one set of AWMS in an existing swine farm involving 144,000 heads of market swine, 13,650 heads of breeding swine, it is estimated to produce 58,765 tons of manure and $1,450 \times 10^4 \text{m}^3$ of biogas annually. The biogas produced is recovered and combusted for heat generation and used by swine farm, total heat production is estimated to be 342,200GJ. The project is expected to achieve 92,011 tCO_{2e} of emission reduction annually. The project started operation on 05-March-2021 with the VCS Ref. No. 3164.

- *A description of the validation and verification*

The approved CDM methodology ACM0010 "GHG emission reductions from manure management systems" (version 08.0) is applied to quantify the GHG removals achieved in this project. The calculation of the GHG emission reductions is carried out in a transparent and conservative manner. This project is being developed in conjunction with the validation and 1st periodic of verification.

- *The purpose and scope of validation and verification*

The validation objective is an independent assessment by a Third Party of a proposed project activity against all defined criteria set for the registration under the VCS. In order to confirm that the project activity, as documented, is sound reasonable and meets the identified criteria, the validation involves the assessment of: project conformance to VCS standards/programs, project conformance to the applied methodology, including the procedure for the demonstration of additionality specified in the methodology; and likelihood that methods and procedures set out in the project description will generate verifiable GHG data and information when implemented. Validation is a requirement and is seen as necessary to provide assurance to stakeholders of the quality of project and its intended generation of VCUs. Validation is part of the VCS project cycle and will finally result in a conclusion by the executing VVB whether a project activity is valid to be submitted for registration to VCS registry.

The objective of the verification is to have an independent review ex post determination by a VVB (Validation and Verification Body) of the monitored GHG emission reductions that have occurred as a result of the implementation of the project activity during a defined monitoring period.

- *The method and criteria used for validation and verification*

Validation and Verification is conducted using Shenzhen CTI International Certification Co., Ltd (CTI) procedures in line with the requirements specified in the latest version of the VCS Validation and Verification Manual and applying auditing techniques. The validation/verification team assessed the project activity's compliance against the VCS Standard Version 4.4, the selected CDM methodology and the joint project description and monitoring report. The project is eligible under Project Scope 1, 13 and 15. The validation/verification criteria followed the guidance documents provided by VCS included the following:

VCS Standard Version 4.4, VCS Program Guide Version 4.3 and the applied CDM methodology ACM0010 "GHG emission reductions from manure management systems" (version 08.0).

- *The number of findings raised during validation and verification*

In the course of the validation and verification, 15 Corrective Action Requests (CARs), 5 Clarification Requests (CLs) were raised and successfully closed. The assessment is included in the report.

- *Any uncertainties associated with the validation and verification*

There are no restrictions of uncertainty for both validation and verification.

- *Summary of the validation and verification conclusions*

Search CO2(Shanghai) Environmental Science & Technology Co., Ltd. has commissioned the Shenzhen CTI International Certification Co., Ltd to carry out the Verified Carbon Standard (VCS) validation joint with 1st periodical verification of the project, “Yantai Xinhao Swine Farm Manure Management System GHG Mitigation Project” (VCS ID 3164) with regard to the relevant requirements of VCS Standard Version 4.4. CTI confirms all validation and verification activities including objectives, scope and criteria, level of assurance, project description, monitoring and monitoring report adhere to VCS Standard Version 4.4 and all associated updated as documented in this report, are complete.

CTI concludes that the project activity “Yantai Xinhao Swine Farm Manure Management System GHG Mitigation Project” in China, as described in the final version of Joint-Project-Description-Monitoring-Report, meets all relevant requirements for VCS validation and verification activity and correctly applied the methodology ACM0010 Version 08.0. Hence CTI is able to certify that the GHG emission reductions from the project during the monitoring period from 05-March-2021 to 30-June-2022 were generated as 110,282 tCO₂e which can be claimed as VCUs.

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1 INTRODUCTION

1.1 Objective

Search CO2 (Shanghai) Environmental Science & Technology Co., Ltd. has commissioned the Shenzhen CTI International Certification Co., Ltd to carry out the Verified Carbon Standard (VCS) validation joint with 1st periodical verification of the project for the monitoring period from 05-March-2021 to 30-June-2022 (both days included).

The objective of validation is an independent assessment by a Third Party of a proposed project activity against all defined criteria set for the registration under the VCS. In order to confirm that the project activity, as documented, is sound reasonable and meets the identified criteria, the validation involves the assessment of: project conformance to VCS standards/programs, project conformance to the applied methodology, including the procedure for the demonstration of additionality specified in the methodology; and likelihood that methods and procedures set out in the project description will generate verifiable GHG data and information when implemented. Validation is a requirement and is seen as necessary to provide assurance to stakeholders of the quality of project and its intended generation of VCU. Validation is part of the VCS project cycle and will finally result in a conclusion by the executing VVB whether a project activity is valid to be submitted for registration to VCS registry.

The objective of verification is to have an independent review ex-post determination by a VVB of the monitored GHG emission reductions that have occurred as a result of the project activity implemented during a defined monitoring period. The evaluation is done against the requirements of the VCS Standard Version 4.4 based on the monitoring report. In order to confirm that the GHG emission reductions sound reasonable and meet the identified criteria, the verification involves the assessment of monitoring plan conformance to VCS rules and applied methodology. Verification is a requirement and is seen as necessary to provide assurance on the generation of VCUs.

1.2 Scope and Criteria

The validation scope is defined as an independent and objective review of the project description (PD) to validate that (a) the project design is actual, (b) the baseline scenario is correctly defined as per the applied methodology and related tools, (c) the project is additional, (d) the monitoring plan can be implemented and is transparent and adequate and (e) all data and information used for ex-ante calculation of emission reductions is of projected and/or hypothetical nature. The Joint-PD-MR is reviewed against the criteria stated in VCS Standard Version 4.4/57/ and the approved baseline and monitoring methodology ACM0010 Version 08.0/45/. The validation was based on the requirements VCS Validation and Verification Manual and VCS Standard Version 4.4 applying auditing techniques. The validation is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the project design.

The scope of the verification is to verify that: (a) the actual monitoring system and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan; (b) the GHG emission reductions data and express a conclusion with a reasonable level of assurance about whether the reported GHG emission reductions data are free from material misstatement; (c) the reported GHG emissions data is sufficiently supported by evidence. Verification shall ensure that the reported GHG emission reductions are complete and accurate in accordance with the applicable VCS criteria in order to be certified. Verification is conducted using CTI procedures in line with the requirements specified in the VCS Program and ISO14064-3 requirements and applying auditing techniques. The VVB assessed and determined that the implementation and operation of the project activity, and steps to report GHG emission reductions comply with the VCS rules. The verification involved a document review of relevant documentation and interview with the project participants. Verification is not meant to provide any consultancy towards the project participants; however, stated request for clarifications and/or corrective actions may have provided input for improvement of the monitoring.

1.3 Reasonableness of Assumptions and Level of Assurance

Based on the validated assumptions, limitations, and methods used during the validation (see section 3.4.6 for ex ante ER calculation result), the project is expected to generate average GHG emission removal of 92,011 tCO₂e per year, and it is confirmed that outcome of future activities will be achieved as the assumptions and limitations are reasonable.

All GHG sinks, sources and GHG emissions equal to or greater than 5% of the total GHG assertions are considered. The project is expected to generate average GHG emission removal of 92,011 tCO₂e per year, and therefore can be considered as a project per the VCS rules, in regards to its scale, subject to a 5% materiality threshold.

The assessment was conducted to provide a reasonable level of assurance of compliance against the defined audit criteria and materiality threshold within the audit scope. Based on the audit findings the validation and verification statement reasonably assure that the GHG assertion is materially correct and is a fair representation of the GHG data and information.

1.4 Summary Description of the Project

The project is implemented by Yantai Xinhao agriculture and animal husbandry Co., Ltd which aims to install new Animal Manure Management System by replace the current open anaerobic lagoon with a new closed anaerobic digester to an existing swine farm in Yadi village, Muping District, Yantai City, Shandong Province, which will treat the manure and wastewater from the swine farm to avoid methane emissions generated in the baseline uncovered anaerobic lagoon. An Animal Manure Management System (AWMS) has been installed in the swine farm which treat the manure and wastewater from the existing swine farm. The raw materials such as pig manure and wastewater are collected into waste collecting tank and then be separated first by Solid-liquid separators. The solid are treated in aerobic composting system, and the organic fertilizers are produced. The liquid is treated through anaerobic digestion and the biogas generated during the treatment process is captured for electricity generation. Anaerobic tank adopt Upflow Anaerobic Sludge Bed Reactor (UASB) as its anaerobic digester technology, and the biogas generated from the anaerobic digester is entered the biogas boiler set after

desulfurization and purification system. The generated heat is used for daily operation of AWMS for increasing the temperature of the anaerobic reactor and the heating in swine farm. The project implemented one set of AWMS in an existing swine farm involving 144,000 heads of market swine, 13,650 heads of breeding swine. Live swine are kept for 180 days in the farms before shipment and are estimated to produce 58,765 tons of manure and $1,450 \times 10^4 \text{ m}^3$ of biogas annually. The biogas produced is recovered and combusted for heat generation and used for daily operation of AWMS and the swine farm and the residual biogas (if any) will be flared, the total heat production is estimated to be annual 342,200GJ by considering the output of biogas boilers. For conservativeness, baseline emissions from heat generation are neglected. The sludge produced from anaerobic digestion are treated through aerobic composting together with the solid and produce organic fertilizers and sold to fertilizer companies finally for land application, the effluent is used for agriculture irrigation which has been confirmed by site inspection and checking the Project Evaluation Report (PER) of the project/5/.

The project activity enables an existing swine farm to use new AWMS instead of the open anaerobic lagoon in baseline scenario to achieve the harmlessness and ecological utilization of the swine manure, finally generate the heat to AWMS and swine farm, which has been verified by on-site inspection, and checking the related documentations, interview with the project implementer.

The project is expected to avoid GHG emission of methane from anaerobic treatment of swine manure and wastewater through recovery and destruction of biogas. The estimated emission reduction from the project is 92,011 tCO_{2e} per year during the first 7-year crediting period from 05-March-2021 to 04-March-2028.

The project activity generates GHG emission reductions by avoid GHG emission of methane from anaerobic treatment of swine manure and wastewater. Thus the project generates GHG emission reductions and produces financial, social and environmental benefits. The project has resulted in the local sustainable development as described in Section 1 of the Joint-PD-MR/1/. The project applied to be registered as a VCS project activity and the 110,282 tCO_{2e} of emission reductions have been certified as verified carbon units (VCUs) for 1st monitoring period from 05-March-2021 to 30-June-2022.

2 VALIDATION AND VERIFICATION PROCESS

2.1 Method and Criteria

A project specific validation and verification plan was developed to guide the validation and verification auditing process to ensure efficiency and effectiveness.

The purpose of the validation and verification is to present a risk assessment for determining the nature and extent of validation and verification procedures necessary to ensure the risk of auditing error is reduces to a reasonable level. According to the ISO14064-3, the criteria are the policy, procedure or requirement used as reference against which evidence is compared. Therefore, validation of the project description and verification of the monitoring plan and the reported project results were measured for compliance against the following criteria:

- VCS Standard, v4.4/57/
- VCS Program Guide, v4.3/56/
- VCS Program Definitions, v4.3/55/
- VCS-Joint-Project-Description-Monitoring-Report-Template-v4.2/53/

The validation and verification process derived from all items in the validation and verification criteria stated above. Field inspection and techniques based on the project parameters, scope and best professional judgement of the validation and verification team in order to meet a reasonable level of assurance. The validation and verification consisted of the following three phase:

- Document review
- On-site assessment
- The resolution of outstanding issues and the issuance of the final joint validation and verification report and certification.

The validation and verification process derived from all items in the validation and verification criteria stated above. Field inspection and techniques based on the project parameters, scope and best professional judgement of the validation and verification team in order to meet a reasonable level of assurance.

There is no sampling approach utilized by PP and VVB during validation and verification.

2.2 Document Review

The VCS Joint-PD-MR/1/ of the project and supporting background documents related to the project implementation were reviewed. Documents review was conducted to ensure consistency with and identify any deviation from VCS program requirements. Desk review included an examination of the project design details, baseline scenario, additionality, ex ante and monitoring data and parameters, and quantification of GHG emission reductions.

Furthermore, the validation and verification team used additional documentation by third parties like host party legislation, technical reports referring to the project design details, baseline scenario, additionality, monitoring or to the basic conditions and technical data.

The references used in the course of this validation and verification are summarized in Appendix 3.

The validation and verification were performed basing on the documents check and site inspection/measurements, refer to the section 3 and 4 of this report for the validation and verification process detail and corresponding documents review.

2.3 Interviews

Describe the interview process and identify personnel, including their roles, who were interviewed and/or provided information additional to that provided in the Joint-PD-MR/1/ and any supporting documents.

The objective of the interview process was to solicit important information from personnel related to project and relevant to the validation and verification process. Onsite interviews and information discussions were conducted with representatives from project implementer/I1/, Operation Staffs of the AWMS/I2/, local officers/I3/, local residents/I4/, representatives from the swine farm/I5/ and VCS consultant/I6/. The interviews were performed by the validation and verification team on-site (within the project area, in Yadi village, Muping District, Yantai City, Shandong Province, P.R. China) and the following is a list of the main interviewees and subject.

No.	Interviewee			Date	Subject, Reference Number/ID	Team member
	Last name	First name	Affiliation			
1.	Sun /I1/	Qishou	Yantai Xinhao agriculture and animal husbandry Co., Ltd / General Manager	27-July-2022~29-July-2022	Discussion on project financials, project design and implementation, Main equipment, Technical parameters, Baseline, Additionality, Project boundary, Monitoring plan, Monitoring devices, SDG impacts, ER calculation, Local legislation to biogas	Li Ziqi Dai Qinghua
2.	Liu /I2/	Yong	AWMS operation Director and staff	27-July-2022	Project implementation Treatment method Main equipment Biogas production Slurry General info of interviewee, name, gender, Age, Education, Location How to obtain this job?	Li Ziqi
3.	Leng	Yanbo				Dai Qinghua

					What is the main work? Training provided, Salary level, if satisfied	
4.	Liu/I5 /	Ping	Swine Farm/staff	27-July-2022	Scenario before the project started, Swine genetic source on-farm record keeping Feed supplier Swine weight Sale of Swine Living dates of Swine Daily stock of animals in the farm, discounting dead and discarded animals	Li Ziqi Dai Qinghua
5.	Wang	Keli				
6.	Ran	Wei				
7.	Luo /I4/	Huan	Local Stakeholders/ Residents	27-July-2022	Local Stakeholder Consultation issues, Local environment impact	Li Ziqi Dai Qinghua
8.	Wu	Guifang		27-July-2022		
9.	Zhang /I3/	Wei	Officer/ Muping District Ecological Environment Bureau	27-July-2022	Baseline Scenario Local Stakeholder Consultation issues, SDG impacts, Inputs, Grievances mechanism, Local legislation to swine and biogas	Li Ziqi Dai Qinghua
10.	Zhou	Hui	Officer/Local Bureau of Animal Husbandry			
11.	Zhang /I6/	Li	Search CO2(Shanghai) Environmental Science & Technology Co., Ltd. / Project Manager	27-July-2022~29-July-2022	Ex-ante and monitoring parameters, JPM and ER, IRR, NPV editable issues	Li Ziqi Dai Qinghua

2.4 Site Visit

The joint validation and verification site inspection was conducted on 27-July-2022~29-July-2022. A ground inspection of the project was conducted during the site visit and the joint validation and VVB interviewed representatives as listed in section 2.3.

During the site inspection, the project site was inspected and documents evidence were checked, details as following table,

Duration of on-site inspection: 27-July-2022~29-July-2022				
No.	Activity performed on-site	Site location	Date	Team member
1.	Opening meeting Interview with PP, local officers, consultant	Office in Yantai Xinhao agriculture and animal husbandry Co., Ltd in Yantai City,	27-July-2022	Li Ziqi Dai

	representatives	Shandong Province, P.R. China		Qinghua
2	On-site inspection Interview with Operation Staffs of the AWMS and representatives from the swine farm, local residents	Project Area in Yadi village, Muping District, Yantai City, Shandong Province, P.R.China	28-July-2022	Li Ziqi Dai Qinghua
3	Documents check	Office in Yantai Xinhao agriculture and animal husbandry Co., Ltd in Yantai City, Shandong Province, P.R. China	29-July-2022	Li Ziqi Dai Qinghua
4	Finding Summary	Office in Yantai Xinhao agriculture and animal husbandry Co., Ltd in Yantai City, Shandong Province, P.R. China	29-July-2022	Li Ziqi Dai Qinghua
5	Close Meeting	Office in Yantai Xinhao agriculture and animal husbandry Co., Ltd in Yantai City, Shandong Province, P.R. China	29-July-2022	Li Ziqi Dai Qinghua

2.5 Resolution of Findings

Material discrepancies identified in the course of the validation and verification are addressed either as CARs, CLs or FARs.

A Corrective Action Request (CAR) is established where:

- The project participants have made mistakes that will influence the ability of the project activity to achieve real, measurable additional emission reductions;
- The VCS Standard Version 4.4 requirements have not been met;
- There is a risk that the emission reductions cannot be monitored or calculated.

A Clarification Request (CL) will be issued where information is insufficient, unclear or not transparent enough to establish whether a requirement is met.

A Forward Action Request (FAR) will be issued when certain issues related to project implementation should be reviewed during the next verification.

A detailed list of the CARs CLs and FAR raised and discussed in the course of this validation and verification is included in Appendix 4 of this report.

In the course of the validation 15 Corrective Action Requests (CARs), 5 Clarification Requests (CLs) were raised and successfully closed. The assessment is included in the report.

2.5.1 Forward Action Requests

This is the joint validation and 1st VCS verification, thus there is no FAR raised previously.

3 VALIDATION FINDINGS

3.1 Project Details

- Project type, technologies and measures implemented, and eligibility of the project

Type:

Through the onsite visit, interviewing the project developer and reviewing the project description/1/, it was confirmed that the project is to introduce new Animal Manure Management System by replace the current open anaerobic lagoon with a new closed anaerobic digester to an existing swine farm in Yadi village, Muping District, Yantai City, Shandong Province, which will treat the manure and wastewater from the swine farm to avoid methane emissions generated in the baseline uncovered anaerobic lagoon and the biogas produced is recovered and combusted for heat generation and used by swine farm and AWMS in the project area in Yadi village, Muping District, Yantai City, Shandong Province, P.R. China.

Therefore, it was confirmed that the sectoral scope is Scope 01: Energy industries (renewable - / non-renewable sources) and Scope 13 Waste handling and disposal as per the UNFCCC Standard “Applicability of sectoral scopes version 01.0”/58/ and Scope 15 as per the applied methodology and VCS standard (V4.4)/57/.

It was confirmed that the project is not a grouped project.

- Technologies and measures implemented:

The information and descriptions reported in section 1.1 of the VCS Joint-PD-MR/1/ have been checked.

The project is implemented by Yantai Xinhao agriculture and animal husbandry Co., Ltd which aims to introduce a new Animal Manure Management System by replace the current open anaerobic lagoon with a new closed anaerobic digester to an existing swine farm in Shandong Province, which will treat the manure and wastewater from the swine farm to avoid methane emissions generated in the baseline uncovered anaerobic lagoon. An Animal Manure Management System (AWMS) has been installed in the swine farm respectively which treat the manure and wastewater from the existing swine farm. The raw materials such as pig manure and wastewater are collected into waste collecting tank and then be separated first by Solid-liquid separators. the solid is treated in aerobic composting system, and the organic fertilizers are produced. The liquid is treated through anaerobic digestion and the biogas generated during the treatment process is captured for electricity generation. Anaerobic tank adopt Upflow Anaerobic Sludge Bed Reactor (UASB) as its anaerobic digester technology, and the biogas generated from the anaerobic digester is entered the biogas boiler set after desulfurization and purification system. The generated heat is used for daily operation of AWMS and the swine farm, and the waste heat of the boiler is recycled for increasing the temperature of the anaerobic reactor. The project implemented one set of AWMS in an existing swine farm involving 144,000 heads of market swine, 13,650 heads of breeding swine. Live swine are kept for 180 days in the farms before shipment and are estimated to produce 58,765 tons of manure and $1,450 \times 10^4 \text{m}^3$ of biogas annually. The biogas produced is recovered and combusted for heat generation and used for daily operation of AWMS and the swine farm and the residual biogas (if any) will be flared, the total heat production is estimated to be annual

342,200GJ by considering the output of biogas boilers. For conservativeness, baseline emissions from heat generation are neglected. The sludge produced from anaerobic digestion are treated through aerobic composting together with the solid, the effluent is used for agriculture irrigation which has been confirmed by site inspection and checking the Project Evaluation Report (PER) of the project/5/.

The technology is confirmed by site inspection and checking the PER/5/, General design and construction contract/10/, Equipment purchase contracts/9/, Technical agreement of main equipment/11/ and Technical flow chart/27/.

The project activity enables an existing swine farm to use new animal waste management systems instead of the open anaerobic lagoon in baseline scenario to achieve the harmlessness and ecological utilization of the swine manure, finally generate the heat to swine farm, which has been verified by on-site inspection, and checking the related documentations, interview with the project implementer. The technology employed is environmentally safe and sound as well as state of the art. Via checking the Business License/4/of PP, General design and construction contract/10/ and Equipment purchase contracts/9/, it is verified that project owner invested in purchasing the AWMS for the farm and owned the farm. By implementing the project, it has provided an opportunity for local community to generate steady and continual income for their livelihood.

The project is applicable to the applied CDM Methodology ACM0010 “GHG emission reductions from manure management systems” (Version 08.0)/45/.

The expected total emission reduction of the Project in the first crediting periods of 7 years (from 05-March-2021 to 04-March-2028) is 644,077 tCO_{2e}, and the annual emission reduction is estimated to be 92,011 tCO_{2e}.

In conclusion, it is verified that the summary description of the project in section 1.1 is in line with the Joint-PD-MR template requirements and all the information has been provided and verified as correct.

- Eligibility of the project:

The PP has described and justified how the project is eligible under the scope of the VCS Program in Joint-PD-MR as per the section 2.1.1 of VCS Standard Version 4.4. The assessment is provided as below,

1. The project activity generates GHG emission reductions including CH₄ which belong to the six Kyoto Protocol greenhouse gases.
2. “The scope of the VCS Program excludes projects that can reasonably be assumed to have generated GHG emissions primarily for the purpose of their subsequent reduction, removal or destruction.” Via checking the Joint-PD-MR/1/ of the project, it is verified that the project is implemented to introduce new Animal Manure Management System by replace the current open anaerobic lagoon with a new closed anaerobic digester to an existing swine farm in Shandong Province, which will treat the manure and wastewater from the swine farm to avoid methane emissions generated in the baseline uncovered anaerobic lagoon, and the additionality is verified as actual, thus there is no assumption of having generated GHG emissions primarily for the purpose of their subsequent reduction, removal or destruction for this project.

3. The VCS Program also excludes the following project activities under the circumstances indicated in Table 1 of section 2.1.3 of VCS Standard Version 4.4, via checking all the excluded project activities in the table, it is verified that this project type is not excluded by the scope of VCS program.

PP has also described and justified how the project is eligible under the scope of the VCS Program in Joint-PD-MR as per the section 3.1 of VCS Standard Version 4.4. The assessment is provided as below,

1. Via checking the Joint-PD-MR and on-site inspection of the project, CTI confirmed that the project meets all applicable rules and requirements as set out under the VCS Program which has been demonstrated in the whole report, thus the project activities adhere to section 3.1.1 of the VCS Standard.
2. The project applies the CDM approved methodology ACM0010 (version 08.0) which is an eligible VCS methodology along with tool or modules, hence the project activities adhere to section 3.1.2 of the VCS Standard.
3. The project complies with all relevant local, regional and national laws, statutes and regulatory frameworks in China which has been assessed in detail as below, hence the project activities adhere to section 3.1.3 of the VCS Standard.
4. Section 3.1.4 of the VCS Standard is not applicable as no model needs to be chosen by the project proponent as per the applied methodology ACM0010 (version 08.0)/34/.
5. Section 3.1.5 of the VCS Standard is not applicable as no own model have been chosen by the project proponent as all calculation formulas used by PP are derived from the applied methodology ACM0010 (version 08.0)/34/.
6. The project proponent applies the CDM approved methodology ACM0010 (version 08.0) and Tool 02: “Combined tool to identify the baseline scenario and demonstrate additionality(version07.0)/46/ for baseline scenario analysis and additionality demonstration which has been assessed in section 3.4.4 and 3.4.5 of this report, hence the project activities adhere to section 3.1.6 of the VCS Standard.
7. Section 3.1.7 of the VCS Standard is not applicable.
8. There is no capacity limit from the Large-scale Consolidated methodology ACM0010 which has been applied by the project.
9. The project will refer to new VCS Program rules when VERRA issue, and following the effective dates of these requirements which in line with the Section 3.1.9 of the VCS Standard.

In conclusion, the project is eligible to the scope of the VCS Program.

- Project design, including eligibility criteria for grouped projects

The project activity involves the construction and operation an AWMS in a swine farm in Yadi village, Muping District, Yantai City, Shandong Province owned by Yantai Xinhao agriculture and animal husbandry Co., Ltd. It has been designed to install one animal manure management system in the swine farm, and a swine farm with one set of AWMS. Then the AWMS belongs to single project activity instance.

This project is not a grouped project.

- Project proponent and other entities involved in the project

The project proponent (Yantai Xinhao agriculture and animal husbandry Co., Ltd), and the contact information reported in section 1.5 of the VCS Joint-PD-MR/1/ have been confirmed to be correct through checking the business license of the company/4/, General design and construction contract/10/, Equipment purchase contracts/9/, Approval of EIA/7/ and interviewing with the PP representative through the on-site visit/I1/.

The other entities involved in the Project (Search CO2(Shanghai) Environmental Science & Technology Co., Ltd.) and the contact information reported in section 1.6 of the VCS Joint-PD-MR have been confirmed to be correct through checking the business license of the Search CO2(Shanghai) Environmental Science & Technology Co., Ltd. /4/and interviewing the representative of this company during the on-site visit/I6/.

- Ownership

The section 1.7 of the Joint-PD-MR has been checked, it is confirmed that the Project Proponent demonstrates that they have the legal right to control and operate project activity.

Via checking the National legal approval to the Environmental Impact Assessment (EIA)/7/, Equipment purchase contracts/9/ and the business license of the Yantai Xinhao agriculture and animal husbandry Co., Ltd/4/, it is verified that the PP has the legal right to control and operate the project activity. Thus, it is confirmed that the project owner has the ownership of the project.

- Project start date

The project start date is 05-March-2021 which is verified as the date on which the project began generating GHG emission reductions or removals as per the concept in VCS Standard Version 4.4.

Via checking the operation log/13/, it is verified that 05-March-2021 is the date when the AWMS had been put into operation, hence the start date is correct and in line with the VCS standard.

- Project crediting period

For the VCS crediting period, PP has chosen 21 years renewable crediting period and the 1st 7-year crediting period started from 05-March-2021 to 04-March-2028 which is in line with the concept for crediting period in section 3.9.2 of the VCS Standard Version 4.4.

- Project scale and estimated GHG emission reductions or removals

The average annual ERs of the project are 92,011 tCO₂e, which is lower than the threshold of large-projects (300,000 tCO₂e per year). Therefore the project falls in the category of “Project” as per definition in VCS standard. And the estimated total Estimated GHG Emission Reductions or Removals during the 10 years of VCS fixed crediting period (05-March-2021 to 04-March-2028) is 644,077 tCO₂e.

- Project description

Through the onsite visit, interviewing the project developer and reviewing the project description in Joint-PD-MR/1/, it was confirmed that the project installed a new Animal Manure Management System by replace the current an open anaerobic lagoon with a new closed anaerobic digester to an existing swine farm in Yadi village, Muping District, Yantai City, Shandong Province, which will treat the manure and wastewater from the swine farm to avoid methane emissions generated in the baseline uncovered anaerobic lagoon.

By means of an in-depth review of the Joint-PD-MR and the checks carried out during the on-site visit, an assessment has been carried out whether the project has been implemented and operated in line with the Joint-PD-MR and whether all physical features of the project are in place. The following has been checked: implemented technology, project equipment as well as monitoring equipment.

The verifier has performed a site visit to check the project equipment and interview with staffs from AWMSs and swine farms, in addition by all the provided evidence, it is found that the project implemented one set of AWMS in an existing swine farm involving 144,000 heads of market swine, 13,650 heads of breeding swine. Live swine are kept for 180 days in the farms before shipment and are estimated to produce 58,765 tons of manure and $1,450 \times 10^4 \text{m}^3$ of biogas annually. The existing swine farm were put into operation before the implementation of this project since 10-April-2020 which is verified by checking the License for production and operation of the breeding livestock and poultry/8/ for the swine farm issued by Muping District Administrative Approval Service Bureau dated on 14-February-2020.

The project started construction on 02-January-2021 which has been confirmed by checking the General design and construction contract/10/, and started first commissioning on 20-February-2021 and the farm was put into operation on 05-March-2021 which has been confirmed by checking the operation log of the project/13/ and statement of the AWMS started operation/12/. The factors and parameters used during this monitoring period to arrive at the emission reduction calculations are transparently described in the Joint-PD-MR/1/.

The actual operations during the 1st monitoring period are found in accordance with the descriptions provided in the Joint-PD-MR. There is no deviation / change evidenced during this monitoring period and there were no delays compared to information in approved project.

- Project location

The project site is located at Yadi village, Muping District, Yantai City, Shandong Province, P. R. China. There is an existing swine farm involved in the project. Details of the farm's location are given in table 3-1 below:

Table 3-1: Project Location

Item	Project Location
Host Country	China
Region:	Yadi village, Muping District, Yantai City, Shandong Province
Geographical Coordinates	
East longitude	North latitude
121° 12' 3.12" E	37° 11' 12.76" N

The project location has been clearly provided in section 1.12 of the JPM and the detailed coordinates of the swine farm have been provided respectively which have also been verified by site inspection with GPS device and checking the map and the information is verified as correct.

- Conditions prior to project initiation

Via checking the Joint-PD-MR/1/, it is confirmed that the scenario existing prior to the implementation of the project is the animal manure waste was left to decay in anaerobic manure management system (uncovered open lagoon) at the swine farm and methane is emitted to the atmosphere directly without any methane recovery and destruction facility. The baseline scenario is the same as the scenario existing prior to the implementation of the project activity, which has been confirmed during the site interview with PP and on-site checking the photo of baseline lagoon/14/. Thus it is verified that the baseline scenario is reasonable and correct.

And via site inspection and checking the related equipment purchase contracts/9/ and General design and construction contract/10/, it is verified that all the equipment involved in Animal Manure Management System covered by the project were newly built and there was no existing manure management system prior to the project activity hence no existing equipment in baseline scenario.

Therefore, the project is confirmed not to be implemented to generate GHG emissions for the purpose of their subsequent reduction, removal or destruction.

- Project compliance with applicable laws, statutes and other regulatory frameworks

The Joint-PD-MR has stated that the project is in the field of waste handling, this industry is confirmed as in line with the laws and regulations/75/ as listed in the Joint-PD-MR.

Also the project is legally approved by Local government by checking the EIA approval/7/, which means that the project is in line with the national and local laws and regulations based on the local expertise of the VVB. And as stated in the Joint-PD-MR/1/ and confirmed by interview with local officer/12/, CTI verified that the project will be subject to regular inspection by local government during the implementation period to ensure continuous compliance.

In conclusion, the project complies with all relevant local, regional and national laws, statutes and regulatory frameworks in China.

- Participation under other GHG programs:

-Projects registered (or seeking registration) under other GHG program(s)

The project has neither been registered nor seeking registration under any other GHG programs which has been confirmed via checking the UNFCCC/60/, GS/62/, VCS/61/ and other GHG schemes' website. It is verified that the project is seeking registration only in VCS program/61/.

-Rejection by other GHG programs

The project has neither been rejected by any other GHG programs which has been confirmed via checking the UNFCCC/60/, GS/62/, VCS/61/ and other GHG schemes' website.

- Other forms of credit:

-Emissions trading programs and other binding limits

The project proponent is not part of any emission trading program which has been confirmed via checking the UNFCCC/60/, GS/62/, VCS/61/ and other GHG schemes' website. The net GHG emission reductions during this monitoring period from the project was not used for compliance with emission trading programs or to meet binding limits on GHG emissions. The project activity has not participated under any other GHG programs which has been confirmed via checking the UNFCCC/60/, GS/62/, VCS/61/ and other GHG schemes' website, it is verified that the implementation of the project is consistent with the description in the Joint-PD-MR and the monitoring system is fully functional to generate Verified Carbon Units (VCUs) without any double counting for this monitoring period from 05-March-2021 to 30-June-2022 which has been confirmed by checking the Declaration of no double counting and not involved in other GHG scheme/30/.

Besides, based on VVB's local expertise, China has a national emissions trading scheme only cover the high-emission industries, such as eight emission-intensive industries including heat generation, petrochemicals, chemicals, building materials, non-ferrous metals, papermaking, steel and aviation that emitted at least 26,000 tons of CO₂e/year which has been verified in the public website/64/, and it is confirmed that the project activity belongs to agriculture sector is not included the mandatory emission control scheme and there is no emission cap enforced for the project owner by checking the enforced company list in public information/65/. On contrary, the project activity can reduce of GHG in the atmosphere through avoiding methane emissions from anaerobic treatment of swine manure and wastewater. Therefore, it can be concluded that the PP will not be included in the national ETS. Hence, it is confirmed that the emission reductions will not be double counted.

-Other forms of environmental credit sought or received and eligible to be sought or received

Via interview with the project developer/I1/ and based on above assessment, it is confirmed that the project has not created any other form of environmental credit.

-Issuance of public statement(s) to help prevent Scope 3 emissions double claiming

N/A

-Email notification of the potential risk of Scope 3 emissions double claiming

N/A

- Sustainable development contributions

Via on-site inspection, checking the evidence provided as below and interview with the project implementer, CTI verified that the project contributes the sustainable development through the following aspects:

1. The project generated biogas during the treatment process are captured for heat generation and the heat generated are all used by the AWMS and the swine farm replace the coal-fired boiler (Goal 7 of UN SDG) – verified by checking the Daily/22/ and Monthly operation record/21/ and Emission Reduction Calculation sheet/2/, it is confirmed that 367,461 GJ of heat was generated by the project during this monitoring period, which avoid the methane emitted to the atmosphere and provide clean heat energy by utilizing biogas, hence the contribution to this SDG has been confirmed and the provisions for monitoring and reporting this goal is verified as reasonable;
2. The project activity creates temporary and permanent job opportunities (Goal 8 of UN SDG) – verified by interview with staffs and checking the Labor Contracts/31/ and monthly payroll/32/, it is confirmed that 20 job opportunities (11 females and 9 males) have been provided during this monitoring period, hence the contribution to this SDG has been confirmed and the provisions for monitoring and reporting this goal is verified as reasonable;
3. Sequester greenhouse gas and mitigate climate changes (Goal 13 of UN SDG) – 110,282 tCO_{2e} GHG emission reductions have been achieved, which is verified by checking the Emission Reduction Calculation sheet/2/, hence the contribution to this SDG has been confirmed and the provisions for monitoring and reporting this goal is verified as reasonable.

- Additional information relevant to the project, including:

- Leakage management for AFOLU projects

According to the methodology, the leakage involved in this project includes the leakage of anaerobic digestion in a digester the leakage of organic fertilizer into the soil. The project participants have no authority, intervention, or control over the leakage of organic fertilizer into the soil. Via checking the ER calculation sheet/2/, CTI confirmed that the leakage has been included in the emission reductions calculation which is verified in line with the applied methodology/45/ and related tools. Refer to section 3.4.6 for detail assessment of the leakage.

- Commercially sensitive information

No commercially sensitive information has been excluded from the public version of the project description.

Based on above assessment and demonstration, it is concluded that the description in the project description is accurate, complete, and the nature of the project is actual and understandable, and it is confirmed that the project has been implemented as described in the project description via site inspection.

CL 01, CAR 01, CAR 02, CAR 03 and CAR 04 were raised and successfully closed. Refer to Appendix 4 for detail assessment.

3.2 Participation under Other GHG Programs

The project has neither been registered nor seeking registration under any other GHG programs which has been confirmed via checking the UNFCCC/60/, GS/62/, VCS/61/ and other GHG schemes' website. It is verified that the project is seeking registration only in VCS program/61/.

3.3 Safeguards

3.3.1 No Net Harm

In China, an Environmental Impacts Assessment is required according to Chinese legislation. The EIA was designed by Qingdao Jierui Environmental Protection Technology Service Co., LTD/6/ and approved by Yantai Ecological Environment Bureau on 29-September-2020/7/. The analysis of the environmental impacts of the project activity is sufficiently described according to EIA report/6/. The assessment is as below,

It is considered that the environmental impacts and the relevant mitigation methods have been comprehensively described in Section 2.3 of Joint-PD-MR including the air pollution and wastewater, noise, and solid waste impact on the ecosystem and environment of local area in project site for both construction and operation period according to the EIA report/6/.

Associated with the review of EIA report/6/, there was no adverse effect on the air, water and solid waste, for the project subject to the implementation of pollution mitigation measures according to the EIA report/6/. There was also no any endangered species found in the project location.

As per the approval of EIA/7/, it stated that the inspectors from the local Environmental Protection Bureau have to carry out monitoring work for the environmental impact arisen from the project activity during project commissioning periodically. Via interview with the local officers from local Environmental Protection Bureau/I3/, CTI confirmed that they are satisfactory with the environmental protection and recovery work carried out by the project owner. The local Environmental Protection Bureau also did not receive any public comment on the project activity during this monitoring period.

During the on-site interview, the local residents/I3/ were interviewed if there was critical impact to their living environment. It is verified that the project activity does not cause adverse effect to their daily life.

Furthermore, via interview with local officer and stakeholders, it is confirmed that the implementation of the project will improve local socio-economic development through creating career opportunities.

In conclusion, there were some impacts on environment during the construction and operation periods which has been demonstrated in the Joint-PD-MR/1/ and EIA/6/, also the proper measurements have been carried out by project implementer to mitigate such impacts.

3.3.2 Local Stakeholder Consultation

Local stakeholder consultation prior the project started construction

A stakeholder survey was carried out by the project developer in October 2020 which was prior to the start date of the construction.

A stakeholder consultation meeting was held at a meeting room of project owner on 20-October-2020. During the meeting, 30 relevant personnel of local villagers and government officials participated. The stakeholders' background information, meeting process, and final comments and response from PP were summarized and recorded in the Joint-PD-MR, Section 2.2.

Via checking the meeting records/28/, it is verified that all respondents knew or heard about the Project. Most of them are supportive of the project construction, and think the Project will bring more benefit than loss. And the survey shows that many local stakeholders think the Project will help improve the life of local people and promote local economic development without any adverse environmental impact.

Finally, it is verified that, some local stakeholders concern about the project technology, project mechanism operation and the environmental impact. It is verified that after the explanation by PP to the local stakeholder's concerns, they are supportive of the project construction by checking the minutes of stakeholder meeting/28/, and thus no need to change the project design based on the stakeholder inputs.

Mechanism for on-going communication and consultation during this monitoring period:

During the implementation stage of this monitoring period, via checking the local communication survey records/29/ and interview with the local officer/12/ and local residents/13/ during site visit, it is confirmed that the PP has conducted follow-up interviews and ongoing communication with local stakeholders to collect any comments or inputs to the project implementation. Based on the VVB's local expertise, CTI confirmed that the local government agencies and competent authorities will conduct spot checks on the implementation of the project from time to time as per the request from the local government's regulations.

Moreover, the project owner carried out a questionnaire survey for the local stakeholder to collect the relevant comments and suggestions from 10-December-2021 to 15-December-2021 during this 1st monitoring period. Via checking the 80 filled questionnaires/29/, interview with the local officer and local stakeholders during site visit, it is verified that nearly all the respondents believe that the Project will not have any negative environmental impact. It is verified that all local stakeholders who participated the survey were satisfied with the implementation of the project which has been confirmed by site interview with local stakeholders.

The local officers from Environment Protection Bureau/13/ has confirmed that the project was under supervised and the implementation of the project is in line with the local environment protection regulations and EIA/6/. And via checking the 80 filled questionnaires/29/, it is confirmed that no other negative impacts considered by local stakeholder to their local life.

Via interview with the local officer/13/ and local residents/14/ during site visit, it is verified that there were no comments and issues from the local stakeholders during the implementation period and the project passed all the periodic spot checks by local government. Hence there is no need to change the project design based on the stakeholder inputs.

Furthermore, via site inspection, CTI confirmed that a grievance book was put at the entrance of the swine farm so that to collect the grievances or comments from local stakeholders anytime, and via checking all the books, CTI verified that there was no any grievances or comments received during this monitoring period.

3.3.3 Environmental Impact

In China, an Environmental Impacts Assessment is required according to Chinese legislation. The EIA was designed by Qingdao Jierui Environmental Protection Technology Service Co., LTD/6/ and approved by Yantai Ecological Environment Bureau on 29-September-2020/7/. The analysis of the environmental impacts of the project activity is sufficiently described according to EIA report/6/. The assessment is as below,

It is considered that the environmental impacts and the relevant mitigation methods have been comprehensively described in Section 2.3 of Joint-PD-MR including the air pollution and wastewater, noise, solid waste and impact on the ecosystem in local area of project site according to the EIA report/6/.

The environmental impacts of the project were sufficiently assessed by means of an Environmental Impact Assessment (EIA) study report according to the Chinese laws & regulations such as “Environmental Protection Law of P.R. China”/75/ and “Law of the People's Republic of China on the Environmental Impact Assessment”/75/. Every aspect of environmental impact has been considered in the EIA report with corresponding measures during project construction and operation.

During the construction period, via interview with the local officer from environmental protection bureau, it is confirmed that the potential environmental impacts have been sufficiently identified for the construction period, such as air pollution, wastewater, noise and solid waste etc. The conclusion of the analysis has been described in the Joint-PD-MR as per the EIA report/6/ and the related mitigation measures have been listed as per the approval of EIA report/7/. Due to the project has been implemented during the site inspection, it is confirmed that the impact during the construction period has been solved and no significant environmental impacts are expected from the project activity.

Due to the project conducted joint validation and verification, for this 1st monitoring period, VVB has conducted the site visit and checking the project implementation and implementation of pollution mitigation measures conducted by PP to mitigate any potential negative environmental and socio-economic impact of the project activity, it is verified that related measures as stated in the Joint-PD-MR has been carried out by PP which confirmed in line with the “Technical Guidelines for the Construction of Faecal Waste Treatment Facilities in Livestock and Poultry Farms (Households)”/79/ and "Limit Requirements of Toxic and Hazardous Substances in Fertilizers"/80/.

Furthermore, associated with the review of EIA report/6/ and its approval/7/, VVB confirmed that there was no adverse effect on the ecology, air, water and solid waste, for the project subject to the implementation of pollution mitigation measures as stated above which are verified in line with the requirements in EIA report/6/ and its approval/7/. There was also no any endangered species found in the project location by site visit.

Via interview with the local officers from local Environmental Protection Bureau/13/, it is confirmed that they are satisfactory with the environmental protection and recovery work carried out by the project owner. The Environmental Protection Bureau also did not receive any public comment on the project activity after the implementation of the project.

3.3.4 Public Comments

The project sought the registration with the VCS Program, according to VCS requirements the Project Description was submitted for public comment period. The project was allocated with VCS ID 3164. The public comment period started on 15-July-2022 and ended on 14-August-2022 (<https://registry.verra.org/app/projectDetail/VCS/3164>).

No comments were received during this period which has been verified by checking the dedicated website as above.

CAR 05 was raised and successfully closed. Refer to Appendix 4 for detail assessment.

3.3.5 AFOLU-Specific Safeguards

N/A

3.4 Application of Methodology

3.4.1 Title and Reference

The approved consolidated methodology applied in the project activity is ACM0010 – “GHG emission reductions from manure management systems” (version 08.0)/45/.

This methodology also refers to the latest approved version of the following tools and guidelines:

Tool 02: Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0)/46/

Tool 05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)/47/

Tool 06: Project emissions from flaring (Version 04.0)/48/

Tool 08: Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)/49/

Tool 14: Project and leakage emissions from anaerobic digester (Version 02.0)/50/

Tool 24: Common practice (Version 03.1)/51/

Tool 27: Investment analysis (Version 10.0/12.0)/42/,/52/

3.4.2 Applicability

Demonstration regarding the applicability of the methodology, and any tools selected by the project proponent as provided in below table.

Table 3-1 Assessment of Applicability conditions of ACM0010 (version 08.0).

No.	Applicability conditions	Validation Assessment	Conclusion
1	This methodology applies to project activities that include destruction of methane emissions and displacement of a more GHG-intensive service in manure management of livestock farms by introducing a new animal waste management system or a combination of animal waste management systems that result in less GHG emissions.	Via site inspection and checking the PER/5/, related equipment purchase contracts/9/ and General design and construction contract/10/, CTI verified that this project activity is installing one set of new animal waste management systems to treat the manure and wastewater from the existing swine farm to avoid methane emissions generated in the baseline uncovered anaerobic lagoon. Hence this criteria is applicable for this project activity.	Applicable
2	This methodology is applicable to manure management on livestock farms where the existing anaerobic manure treatment system, within the project boundary, is replaced by one or a combination of more than one animal waste management systems (AWMS) that result in less GHG emissions compared to the existing system. The methodology is also applicable to Greenfield facilities.	Via site inspection and checking the PER/5/, related equipment purchase contracts/9/ and General design and construction contract/10/, CTI verified that this project activity is installing one set of new animal waste management systems to treat the manure and wastewater from the existing swine farm to avoid methane emissions generated in the baseline uncovered anaerobic lagoon in a swine farm respectively that result in less GHG emissions compared to the existing system. A swine farm was existed in the baseline with an old open lagoon and the animal waste management system (AWMS) is newly built in the project. Hence this criteria is applicable for this project activity.	Applicable
3	This methodology is applicable to manure management projects under the following conditions: (a) Farms where livestock populations, comprising of cattle, buffalo, swine, sheep, goats, and/or poultry, is managed under confined conditions; (b) Farms where manure is not discharged into natural water resources (e.g. rivers or estuaries); (c) In case of anaerobic lagoon treatments systems, the depth of the lagoon used for manure management under the	(a) Via site inspection and checking the Licenses for production and operation of the breeding livestock and poultry/8/ for the swine farm, and furthermore via checking the public information of the project owner/67/ and based on the local expertise of validation team, CTI confirmed that the project owner is one of the subsidiaries of New Hope Liuhe Biotechnology Industry Group, which is a national key leading enterprise of agricultural industrialization mainly in animal husbandry, CTI confirmed that all	Applicable

No.	Applicability conditions	Validation Assessment	Conclusion
	baseline scenario should be at least 1 m; (d) The annual average ambient temperature at the site where the anaerobic manure treatment facility in the baseline existed is higher than 5 °C; (e) In the baseline case, the minimum retention time of manure waste in the anaerobic treatment system is greater than one month; (f) The AWMS(s) in the project case results in no leakage of manure waste into ground water, for example the lagoon should have a non-permeable layer at the lagoon bottom.	the livestock population in the swine farm within the project boundary is managed under confined conditions. (b) All the swine manure is dumped into open anaerobic lagoon and are not discharged into natural water resources. This is verified by checking the Licenses for production and operation of the breeding livestock and poultry/8/ and related “Regulations on Prevention and Control of Pollution from Livestock and Poultry Farming”/77/. (c) In the baseline scenario the depth of the open lagoon used for manure management under the baseline scenario is 4 meters higher than 1m. This is verified by checking the photo of baseline lagoon/14/ and verified by checking the national standard “Design code for wastewater stabilization ponds (GJJ/T54-93)”/34/. (d) The annual average temperature of baseline site where anaerobic manure treatment facility is located is 13.2 °C which is higher than 5 °C. This is verified by checking the public information of local temperature/68/. (e) In the baseline scenario the retention time of manure waste in the anaerobic lagoon is at least 60 days. This is verified by interview with chiefs and staffs of the swine farm. This is verified by checking the latest Notice on the Issuance of Technical Guidelines for the Construction of Manure Treatment Facilities for Livestock and Poultry Farms (Households) (Nongbanmu [2022] No. 19) issued by General Office of the Ministry of Agriculture and Rural Affairs and General Office of the Ministry of Ecology and	

No.	Applicability conditions	Validation Assessment	Conclusion
		Environment on 24-June-2022/63/, VVB confirmed that the minimum retention time of manure waste in the open anaerobic lagoons should be up to 90 days in China. Therefore, it is confirmed that in the baseline scenario, the minimum retention time of manure waste in the anaerobic treatment system must greater than one month. (f) The manure from project will be utilized to produce fertilizer after methane capture, hence there is no leakage of manure waste into ground water occurred which is confirmed by site inspection and checking the produced fertilizer. Furthermore, via site inspection of the anaerobic tank, CTI confirmed that the material for the tank adopts anti leakage and anti-permeability materials. Via checking the Technical agreement of anaerobic tank/11/, it is verified that the tank are totally enclosed without any leak can be found, thus will not cause leakage of manure waste into ground water. Hence this criteria is applicable for this project activity.	
4	In addition, the applicability conditions included in the tools referred to below apply.	Refer to below assessments.	Applicable
Conclusion: Methodology ACM0010 (Version 08.0) is applicable to the project activity.			

In addition, the project meets the applicability conditions of the applied tools as follow table,

Table 3-2 Assessment of Applicability conditions of methodological tool

Tool	Criteria	Validation Assessment	Conclusion
(a) Tool 02 Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0)	The tool is applicable to all types of proposed project activities. However, in some cases, methodologies referring to this tool may require adjustments or additional explanations as per the guidance in the respective methodologies. This could include, inter alia, a listing of	The tool is applicable to all types of proposed project activities, and in section 15 of the applied methodology, it requires project proponents determine the most plausible baseline scenario through the use of the “Combined tool to	Applicable

Tool	Criteria	Validation Assessment	Conclusion
	relevant alternative scenarios that should be considered in Step 1, any relevant types of barriers other than those presented in this tool and guidance on how common practice should be established.	determine the baseline scenario and demonstrate additionality". Thus this tool is applicable to the project.	
Tool 05 Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)	If emissions are calculated for electricity consumption, the tool is only applicable if one out of the following three scenarios applies to the sources of electricity consumption: (a) Scenario A: Electricity consumption from the grid. The electricity is purchased from the grid only, and either no captive power plant(s) is/are installed at the site of electricity consumption or, if any captive power plant exists on site, it is either not operating or it is not physically able to provide electricity to the electricity consumer; (b) Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants are installed at the site of the electricity consumer and supply the consumer with electricity. The captive power plant(s) is/are not connected to the electricity grid; or (c) Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s). One or more fossil fuel fired captive power plants operate at the site of the electricity consumer. The captive power plant(s) can provide electricity to the electricity consumer. The captive power plant(s) is/are also connected to the electricity grid. Hence, the electricity consumer can be provided with	Via site inspection, it is confirmed that the electricity consumption of the project will be supplied by the NCPG (North China Power Grid), which falls under scenario A. Therefore, emissions related to electricity consumption need to be calculated based on Tool 05.	Applicable

Tool	Criteria	Validation Assessment	Conclusion
	electricity from the captive power plant(s) and the grid.		
	This tool can be referred to in methodologies to provide procedures to monitor amount of electricity generated in the project scenario, only if one out of the following three project scenarios applies to the recipient of the electricity generated: (a) Scenario I: Electricity is supplied to the grid; (b) Scenario II: Electricity is supplied to consumers/electricity consuming facilities; or (c) Scenario III: Electricity is supplied to the grid and consumers/electricity consuming facilities.	N/A	Applicable
	This tool is not applicable in cases where captive renewable heat generation technologies are installed to provide electricity in the project activity, in the baseline scenario or to sources of leakage. The tool only accounts for CO₂ emissions.	Via checking the ER calculation process, it is confirmed that Tool 05 is only used to calculate project emissions of electricity consumption supplied by NCPG. For conservativeness, baseline emissions of captive biogas heat generation system are ignored. Only CO₂ emissions will be accounted.	Applicable
Tool 06 Project emissions from flaring (Version 04.0)	This tool provides procedures to calculate project emissions from flaring of a residual gas. The tool is applicable to enclosed or open flares and project participants should document in the CDM-PDD the type of flare used in the project activity.	The project uses open flare system which has been confirmed by site inspection of the open flare in the swine farm. Hence this criteria is applicable for this project activity.	Applicable
	This tool is applicable to the flaring of flammable greenhouse gases where: (a) Methane is the component with the highest concentration in the flammable residual gas; and	Methane is the component with the highest concentration in the biogas (methane accounts for 70% of the biogas) flared in the project which has been	Applicable

Tool	Criteria	Validation Assessment	Conclusion
	(b) The source of the residual gas is coal mine methane or a gas from a biogenic source (e.g. biogas, landfill gas or wastewater treatment gas).	confirmed by site inspection and checking the PER/5/. Hence this criteria is applicable for this project activity.	
	The tool is not applicable to the use of auxiliary fuels and therefore the residual gas must have sufficient flammable gas present to sustain combustion. For the case of an open flare, there shall be operating specifications provided by the manufacturer of the flare.	The project does not use auxiliary fuels which has been confirmed by site inspection of the project implementation and checking the PER/5/. Hence this criteria is applicable for this project activity.	Applicable
Tool 08 Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)	Typical applications of this tool are methodologies where the flow and composition of residual or flared gases or exhaust gases are measured for the determination of baseline or project emissions.	Via site inspection, CTI confirmed the amount of biogas collected at the digester will be collected and monitored. Hence this criteria is applicable for this project activity.	Applicable
	Methodologies where CO ₂ is the particular and only gas of interest should continue to adopt material balances as the means of flow determination and may not adopt this tool as material balances are the cost-effective way of monitoring flow of CO ₂	It is confirmed that the biogas generated during the treatment process contains CH ₄ , H ₂ S, O ₂ , etc., hence the tool is used for determining the mass flow of a greenhouse gas. Hence this criteria is applicable for this project activity.	Applicable
	The underlying methodology should specify: (a) The gaseous stream the tool should be applied to; (b) For which greenhouse gases the mass flow should be determined; (c) In which time intervals the flow of the gaseous stream should be measured; and (d) Situations where the simplification offered for calculating the molecular mass of the gaseous stream (equations (3) or (17) is not valid (such as the gaseous stream is predominantly composed of a gas other than N ₂).	(a) The tool is confirmed applied in the JPM. (b) The mass flow has been determined in the monitoring plan of the JPM. (c) The flow of the gaseous stream will be measured continuously as determined in the monitoring plan of the JPM. (d) The gaseous stream is dry and related equations have been used to calculate the mass flow of greenhouse gas. Hence this criteria is applicable for this project activity.	Applicable

Tool	Criteria	Validation Assessment	Conclusion
Tool 14 Project and leakage emissions from anaerobic digester (Version 02.0)	The following sources of project emissions are accounted for in this tool: (a) CO ₂ emissions from consumption of electricity associated with the operation of the anaerobic digester; (b) CO ₂ emissions from consumption of fossil fuels associated with the operation of the anaerobic digester; (c) CH ₄ emissions from the digester (emissions during maintenance of the digester, physical leaks through the roof and side walls, and release through safety valves due to excess pressure in the digester); and (d) CH ₄ emissions from flaring of biogas.	Sources of project emissions including (a) and (c) which involved in the project implementation have been accounted by checking the ER calculation sheet/2/. Hence this criteria is applicable for this project activity.	Applicable
	The following sources of leakage emissions are accounted for in this tool: (a) CH ₄ and N ₂ O emission from composting of digestate; (b) CH ₄ emissions from the anaerobic decay of digestate disposed in a SWDS or subjected to anaerobic storage, such as in a stabilization pond.	The biogas generated during the treatment process will be captured for heat generation. After anaerobic digestion reactor, the fermented sludge will be treated in aerobic composting system, which will be used as fertilizer which has been confirmed by site inspection of the project implementation and checking the PER/5/. By site inspection, CTI confirmed that there was no additional storage yard to store the sludge produced from anaerobic digestion reactor. Therefore The leakage emissions associated with the anaerobic digester should not be taken into account for this project Hence this criteria is applicable for this project activity.	Applicable
	Emission sources associated with N ₂ O emissions from physical leakages from the digester, transportation of feed	N ₂ O emissions are neglected because these are minor emission sources via	Applicable

Tool	Criteria	Validation Assessment	Conclusion
	material and digestate or any other on-site transportation, piped distribution of the biogas, aerobic treatment of liquid digestate and land application of the digestate are neglected because these are minor emission sources or because they are accounted in the methodologies referring to this tool.	checking the applied methodology.	
Tool 24 Common practice (Version 03.1)	This methodological tool is applicable to project activities that apply the methodological tool “Tool for the demonstration and assessment of additionality”, the methodological tool “Combined tool to identify the baseline scenario and demonstrate additionality”, or baseline and monitoring methodologies that use the common practice test for the demonstration of additionality.	As assessed above, the project applies the methodological tool “Combined tool to identify the baseline scenario and demonstrate additionality” for the demonstration of additionality, the project can use the common practice test for the demonstration of additionality. Hence this criteria is applicable for this project activity.	Applicable
	In case the applied approved baseline and monitoring methodology defines approaches for the conduction of the common practice test that are different from those described in this methodological tool, the requirements contained in the methodology shall prevail.	Via checking the applied methodology, CTI confirmed that the methodology defines approaches for the conduction of the common practice test that are same to those described in this methodological tool. Hence this criteria is applicable for this project activity.	Applicable
Conclusion: All the relevant methodological tools are applicable to the project activity.			

CL 02 was raised and successfully closed. Refer to Appendix 4 for detail assessment.

3.4.3 Project Boundary

The project boundary basically defines the physical and geographical boundary of the project facility and it is well defined in the Joint-PD-MR/1/ (section 3.3) according to ACM0010 GHG emission reductions from manure management systems (Version 08.0)/45/. The project boundary includes following,

Project boundary has been defined in the JPM according to the applied methodology ACM0010/45/ as the geographical extent of the project boundary includes the site of the AWMS, including the flare and

heat generation equipment and the power source and considers the GHG emissions that come from AWMS, including the GHGs emissions from the anaerobic digestion, GHG emissions from sludge treatment by aerobic composting and GHG emissions from flaring system in a swine farm which is verified by checking the PER of the project/5/and on-site inspection.

Via site inspection and checking the PER/5/and the technical flow chart in the project site/27/, it is verified that project boundary is clearly defined in the JPM as per the methodology.

Emissions sources included in the project boundary have been appropriately included in the JPM. CH₄ and N₂O emissions due to emissions from the waste treatment processes is covered for baseline scenario and the project scenario has emissions due to on-site electricity use and CH₄ and N₂O emissions from the waste treatment processes.

It is concluded that the project boundary and selected sources are correctly justified for the project.

3.4.4 Baseline Scenario

The PP has applied an approved baseline and methodology ACM0010, version 08.0 which is approved under CDM scheme.

The JPM applies the stepwise approach as given by section 5.2 of the ACM0010/45/ and "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 07.0)/46/.

Step 1: Identification of alternative to the project activity consistent with current laws and regulations

Step 1a: Define alternative scenarios to the project activity

Due to the swine farm were existed before the project implemented, hence according to the applied methodology, for existing facilities, for the baseline alternatives for managing the manure, PP has listed the complete set of existing/possible manure management systems listed in the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Volume 4, Chapter 10, Table 10.17) which is confirmed consistent with the IPCC/39/, and possible combinations of Animal Manure Management System have been taken into account.

No further scenario is considered reasonable under the given context.

The alternatives are assessed by validation team as below

Alternatives	VVB Assessment
The manure is collected from the pasture/Range/Paddock	Via site inspection, CTI confirmed that swine in this project are bred in confined barns rather than pasture/range/paddock. This alternative is ruled out.
Daily spread: Manure removed from confinement and applied to pasture within 24 hours of excretion	Via site interview with chief and staffs in swine farm, CTI confirmed that it is not possible to remove the manure and apply on a daily basis for such large-scale swine farm, hence this alternative is not economically attractive. This alternative is ruled out.

Solid Storage: The manure is disposed by solid storage.	Via site interview with chief and staffs in swine farm, CTI confirmed that solid storage is a storage method of manure, not a disposal method, and not suitable for such large-scale swine farm for using of a scraping and flushing approach to remove manure which has large volumes of water, hence this alternative is not economically attractive. This alternative is ruled out.
Dry lot	Via site interview with chief and staffs in swine farm, CTI confirmed that dry lot is a storage method of manure, not a disposal method, hence this alternative is not economically attractive. This alternative is ruled out.
The manure is disposed as liquid/slurry.	Via site interview with chief and staffs in swine farm, CTI confirmed that this method is a storage method of manure, not a disposal method, and not suitable for such large-scale swine farm, hence this alternative is not economically attractive. This alternative is ruled out.
Uncovered anaerobic lagoon	Via site interview with chief and staffs in swine farm and by checking the photo of baseline lagoon/14/, CTI confirmed that this is the scenario prior to the project implementation and it is a kind of harmless treatment of manure as per the “Technical specification for sanitation treatment of livestock and poultry manure”/76/ which means the animal waste that has been treated by uncovered anaerobic lagoon can satisfy the above regulations. So, the uncovered anaerobic lagoon is an alternative baseline scenario.
Pit storage below animal confinements, <1month	Via site interview with chief and staffs in swine farm, CTI confirmed that this method is a storage method of manure, not a disposal method, and not suitable for such large-scale swine farm which need a lot of labour work, hence this alternative is not economically attractive. This alternative is ruled out.
Pit storage below animal confinements, >1month	Via site interview with chief and staffs in swine farm, CTI confirmed that this method is a storage method of manure, not a disposal method, and not suitable for such large-scale swine farm and long time storage will generate the toxic fumes which may kill the pigs, hence this alternative is not realistic. This alternative is ruled out.
Anaerobic digester (Anaerobic digester-Aerobic Treatment system)	This is part of the project scenario, due to a single anaerobic process is not yet able to meet the requirements for the use of the waste and must be followed up with disposal, which requires the use of a combination of aerobic and anaerobic processes together, this method is confirmed as one of the most advanced manure management systems, but need high investment. This alternative is realistic for this step.
Burned for fuel	Via site interview with chief and staffs in swine farm, CTI confirmed that this method is not suitable for such large-scale

	swine farm that generate too much dung and urine daily, which hard to dry and burned for fuel. This alternative is ruled out.
Cattle and Swine deep Bedding, <1month, Cattle and Swine deep Bedding, >1month	Via site interview with chief and staffs in swine farm, CTI confirmed that this method is a storage method of manure, not a disposal method, and not suitable for such large-scale swine farm as deep bedding is counter to achieving economies of scale associated with large animal counts, hence this alternative is not realistic. This alternative is ruled out.
Composting - In-vessel	Via site inspection, CTI confirmed that the manure in this project is in liquid with large volume of water, hence this alternative is not realistic. This alternative is ruled out.
Composting - Static pile	Via site inspection, CTI confirmed that the manure in this project is in liquid with large volume of water will consume a great deal of electricity for forced aeration as the large quantity of swine manure, hence this alternative is not economically attractive. This alternative is ruled out.
Composting - Intensive windrow	Via site inspection, CTI confirmed that the manure in this project is in liquid with large volume of water will consume a great deal of electricity for forced aeration as the large quantity of swine manure, hence this alternative is not economically attractive. This alternative is ruled out.
Composting – Passive windrow	Via site inspection, CTI confirmed that this method would take a long time and occupies a large area of land, even emits strong odors and GHGs during turning, hence this alternative is not economically attractive. This alternative is ruled out.
Poultry manure with litter	Via site inspection, CTI confirmed that only large-scale swine farm involved in the project, no Poultry farm.
Poultry manure without litter	Via site inspection, CTI confirmed that only large-scale swine farm involved in the project, no Poultry farm.
Aerobic treatment (Anaerobic Digester-Aerobic Treatment system)	Via site inspection, CTI confirmed that single aerobic treatment technique is not suitable for treating low concentration organic wastewater in wastewater. At present a combine Anaerobic Digester-Aerobic Treatment system is considered as one of the most advanced manure management systems, but to implement such technology need high invest and the proposed project will not be invested and constructed without being registered as a VCS project which has been demonstrated in the below step 3. Hence this alternative is not economically attractive. This alternative is ruled out.

Hence, based on above assessment, CTI confirmed that the remaining realistic and credible alternative scenarios for the new animal waste management system are

Scenario 6: “The manure is disposed in an uncovered anaerobic lagoon”

Scenario 8&17: “Anaerobic Digester-Aerobic Treatment i.e. the proposed project activity not being registered as a VCS project activity”

Step 1b: Consistency with mandatory applicable laws and regulations

Via searching the public website with laws and regulations in Shandong Province and China by CTI, it is confirmed that there is no legal law and regulation to mandate the livestock farm owners to implement anaerobic digestion, aerobic or other biological treatment techniques to treat the animal manure in China. And via checking the “Regulations on Prevention and Control of Pollution from Livestock and Poultry Farming”/77/ and “Technical specification for sanitation treatment of livestock and poultry manure”/76/, CTI confirmed that the manure is prohibited to discharge directly into environment without any treatment and the uncovered anaerobic lagoon is a kind of manure treatment method recognized by the state.

Besides, the “Specifications for the construction of manure resource utilization facilities for large-scale livestock and poultry farms (for trial implementation)”/78/ has been checked and CTI confirmed that anaerobic digester, aerobic treatment or other biological treatment techniques methods to dispose manure waste are encouraged by the state and not mandatory.

As assessed above, CTI confirmed that the above options of Scenario 6 and Scenario 8&17 are considered to follow all mandatory applicable legal and regulatory requirements which are verified based in validation team’s local expertise. The outcome of Step 1b is same to Step 1a.

Step 2: Barrier analysis

Based on above assessments, it is concluded that both the two alternatives have no technology barriers, acceptability barriers and financial barriers.

Therefore, both alternatives come to Step 3.

Step 3: Investment analysis

The purpose of this step is to determine which one is economic attractive.

For each alternative, all cost and economic benefits attributable to the waste management scenario should be illustrated in a transparent and complete manner according to the Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0)/46/.

Via checking the calculation formula and calculation process of the value of NPV and IRR in the calculation sheet/3/, CTI confirmed that the formula and inputs values are correct and actual by checking the PER/5/ and Economic Evaluation Method and Parameter of Construction Projects version 03/41/, thus CTI verified that the calculation results of the NPV for scenario 6 and scenario 8&17 are correct.

By comparing with the results, CTI confirmed that the NPV of the project activity is far more negative than that of the uncovered anaerobic lagoon.

Hence the uncovered anaerobic lagoon is the most attractive course of action and is considered to be the baseline scenario.

Furthermore, for the project scenario, PP has analyzed the IRR value to prove that only get revenues from VCUs, the IRR/3/ of the project activity is higher than the benchmark.

Via checking the calculation formula and calculation process of the value of IRR in the calculation sheet/3/, CTI confirmed that the formula and inputs values are correct and actual by checking the PER/5/ and Economic Evaluation Method and Parameter of Construction Projects version 03/41/, thus CTI verified that the calculation results of the IRR for scenario 8&17 is correct and the final value of IRR of the project scenario without carbon revenue is 5.03% which is lower than the benchmark of 8.58%.

Benchmark of 8.58% is confirmed as reasonable by checking the Tool 27 Investment Analysis (version 10.0)/42/,. The project construction started on 02-January-2021/10/ which is the earliest larger expenditure and can be considered as the date for investment decision. So based on checking the issued date of the Tool 27, it is confirmed that the default value for cost of equity (expected return on equity) defined in Tool 27 version 10.0/42/ (issued on 28-November-2019) is applicable to the project due to it is the latest version when the PP decided the investment of the project.

All the input values used in investment analysis are confirmed by VVB as sourced from Project Evaluation Report (PER)/5/, which was completed by an authorized entity in September 2020, while the project construction started on 02-January-2021/10/ which is the earliest larger expenditure and can be considered as the date for investment decision. Therefore, VVB confirmed that the time interval between the issuance date of the Project Evaluation Report and date when the investment decision was made is less than half year, therefore input values are valid and applicable at the time of the investment decision.

And by checking the calculation process of the value of IRR in the calculation sheet/3/, CTI confirmed that the value of IRR of the project scenario with carbon revenue is increased to 11.11% which is higher than the benchmark of 8.58% and thus the proposed project is financially acceptable with carbon revenue.

A sensitivity analysis has been provided in the JPM and the calculation sheet/3/. The analysis is assessed as follow,

The sensitivity analysis was demonstrated through two manners:

- a) Varying $\pm 10\%$ of three critical parameters (total static investment, O&M cost and Annual Organic fertilizers sales). The selection is checked as in line with the requirements in Tool of Investment analysis (version 11.0)/52/ of "Only variables, including the total static investment, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation", the Total static investment and Organic fertilizers sales are checked as constitutes more than 20% of total project costs. The total O&M throughout the project lifetime is checked as accounts for more than 20% of the project cost.

Via checking the sensitivity analysis for these three critical parameters as provided in JPM and the calculation sheet/3/, CTI verified that the IRR values are still lower than the benchmark by varying $\pm 10\%$ of three critical parameters.

- b) Threshold analysis by varying the above three parameters to make the IRR reach the benchmark. The threshold analysis of each parameter is assessed individually by the validation team as below,
- i. If the Total static investment decreases by 19.50%, the IRR reach the benchmark, however, via checking the price index of investment in fixed asset for China/71/, CTI confirmed that the price index was rising in the past years. Therefore, it is not likely to implement the project activity with the Total static investment reducing by 19.50% to make the project becomes economical attractive.
- ii. If the Annual organic fertilizers sales increases by 14.55%, the IRR reach the benchmark, however, via checking the PER/5/, CTI confirmed that the organic fertilizers are determined by the manure of the swine farm and fertilizer's price. And the population of livestock and scale of the swine farm will stay stable in the future as confirmed by site inspection and interview with chiefs of farms, besides, sales of organic fertilizers are only a small part of the total organic fertilizers' generation and the price of organic fertilizers is determined by the raw material, production technology, the quality of organic fertilizer and so on. the organic fertilizers produced by the project belong to semi-finished Products (or called compost), which is harmless but not reaching the Chinese organic fertilizer standard. It can be directly applied to farmland or sold to commercial organic fertilizer plants for further processing. Via checking the sale agreement of organic fertilizer/25/, CTI confirmed that the organic fertilizer is sold to local fertilizer companies with the fixed price i.e., 330 RMB/ton for 25 years which is same to the estimated price in PER/5/. Hence it is not likely to increase of annual organic fertilizers generation by 14.55% to make the IRR reach the benchmark.
- iii. If the O&M Costs decrease by 24.93%, the IRR reach the benchmark, however, via checking the PER/5/, CTI confirmed that O&M costs mainly consist of maintenance cost, salary & welfare, insurance expense of fixed assets, and other cost.

The maintenance cost is calculated as 5% of the Fixed assets. This rate of the maintenance cost is assessed as reasonable by checking the 'Economic Evaluation Method and Parameter of Construction Projects'/41/, which defined the maintenance & repair fee is 3%~5%. Hence maintenance fee is 5% is verified as reasonable.

The Salary is 60,000 CNY/ person per year which is confirmed as reasonable by checking the labor contracts with employees/31/ and monthly payroll/32/.

The welfare, labor insurance fee and housing fund is calculated as 14%, 17% and 10% of the annual salary which is confirmed as reasonable by checking the labor contracts with employees/31/ and monthly payroll/32/ and based on the public information searching by VVB/81/. Furthermore, Via checking the average monthly wage level in Shandong Province/71/, CTI confirmed that the average monthly wage keeps increasing in past years, it is confirmed that the salary, welfare, labor insurance fee and housing fund is reasonable. By considering the

increase of Average Wage of Staff and Workers and Related Indices in China/71/ for recent years, it is unlikely that this fee reduced in the whole project lifetime.

Insurance fee is calculated as 2.5% of the Fixed assets and Other costs are calculated as 50RMB/t of the Amount of organic fertilizers sales. These fees are considered as not main parts of the O&M cost and the values are confirmed as reasonable by checking the 'Economic Evaluation Method and Parameter of Construction Projects'/41/.

Besides, via checking the indices of purchasing price of raw material, power and fuel/71/, CTI confirmed that the price index was rising in the past years. Therefore, it is not likely to implement the project activity with the O&M cost reducing by 24.93% to make the IRR reach the benchmark.

In conclusion, the investment analysis concludes that the project IRR (after tax) will not reach the benchmark of 8.58% and the project activity is unlikely to be financially attractive. Threshold analysis is further proved this. The sensitivity analysis and threshold analysis was reproduced by the validation team and evaluated to be correct. Based above, it can confirm that the financial unattractiveness of the project is robust and thus the scenario 6 is the most economically attractive option and plausible baseline scenario.

Hence the scenario 6 is considered as baseline scenario which is "The manure is disposed in an uncovered anaerobic lagoon".

Based on the checking the data provided in Joint-PD-MR and above related assessment, it proves that the baseline scenario determined in the Joint-PD-MR is correct and reasonable. Therefore, baseline scenario is identified transparently for the project activity.

The assessment team has reviewed the Joint-PD-MR in line with the applied methodology and methodological tool and CTI confirmed that PP has correctly identified the baseline scenario.

CL 03 and CL 04 was raised and successfully closed. Refer to Appendix 4 for detail assessment.

3.4.5 Additionality

By means of comparison of the Joint-PD-MR with "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 07.0)/46/, the validation team has assessed the additionality demonstration in accordance with applicable methodology and tool.

Step 1-3 of the tool were already done in section B.4 of this Joint-PD-MR for selection of alternative 6 and 8&17 as assessed in above section 3.3.4.

Then for the demonstration of additionality, the below step is assessed,

Step 4 Common practice analysis

The common practice analysis was checked strictly followed Methodological tool "Common practice" (Version 03.1)/44/.

Step 1: calculate applicable capacity or output range as +/-50% of the design capacity or output of the proposed project activity

The project activity is to treat the manure from the swine farm, and a swine farm involving 144,000 heads of Market swine, 13,650 heads of breeding swine in stock are included, and are estimated to produce 58,765 tons of manure every year. So the range is the projects handle manure from 29,383 tons to 88,148 tons are considered as similar projects.

Step 2: identify similar projects (both CDM and non-CDM) which fulfill all of the following conditions:

- a) *The projects are located in the applicable geographical area,*
- b) *The projects apply the same measure as the proposed project activity,*
- c) *The projects use the same energy source/fuel and feedstock as the proposed project activity, if a technology switch measure is implemented by the proposed project activity,*
- d) *The plants in which the projects are implemented produce goods or services with comparable quality, properties and applications areas (e.g. clinker) as the proposed project plant,*
- e) *The capacity or output of the projects is within the applicable capacity or output range calculated in Step 1,*
- f) *The projects started commercial operation before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of proposed project activity, whichever is earlier for the proposed project activity.*

Demonstration as follow,

- a) *The region selected for common practice of Shandong Province is assessed as appropriate and reasonable. A province is the second administrative level of China after central Government and it is authorized to execute administrative examination and approval for construction projects considering local regulations based on local expertise of the validation team; also by considering differences of economic development level, population size, industrial structure, fundamental infrastructure, strategic planning etc, the investment environment of each province, and unique geological conditions in Shandong Province results in the different resource, thus region selected for common practice is Shandong Province.*
- b) *Same measures is defined as: Methane formation avoidance*
- c) *Same energy source/fuel and feedstock: biogas captured for heat generation and used in Swine Farm,*
- d) *Treat manure waste and produce heat technology,*
- e) *Output range: handle manure from 29,383 tons to 88,148 tons annually*
- f) *Commercial operation started before 05-March-2021.*

Thus, the Swine Farm Animal Manure Management System GHG Mitigation projects operated before 05-March-2021, handle manure from 29,383 tons to 88,148 tons annually and generate heat in Shandong province are determined similar projects.

The information source from local DRC of Shandong province website/72/ and other public information from Department of Agriculture and Rural affairs of Shandong Province/73/ for the common practice analysis is available and checked by the audit team. The information used is evaluated to be credible.

Via the source, CTI confirmed that there are no similar projects identified in Shandong Province based on the above criteria.

Step 3: within the projects identified in Step 2, identify those that are neither registered CDM project activities, project activities submitted for registration, nor project activities undergoing validation. Note their number N_{all} .

There are no similar projects identified in Shandong Province.

Hence $N_{all}=0$.

Step 4: within similar projects identified in Step 3, identify those that are different to the technology applied in the proposed project activity. Note their number N_{diff} .

Due to $N_{all}=0$, $N_{all}=N_{diff}=0$.

Step 5: calculate factor $F=1-N_{diff}/N_{all}$ representing the share of similar projects (penetration rate of the measure/technology) using a measure/technology similar to the measure/technology used in the proposed project activity that deliver the same output or capacity as the proposed project activity.

For this project, $F=1-N_{diff}/N_{all}=1-1=0$ and $N_{all}-N_{diff}=0$.

It can be concluded that the project is not a common practice.

In conclusion, the project meets the criteria and tool “Combined tool to identify the baseline scenario and demonstrate additionality (Version 07.0)”, thus deemed as additional.

Besides, as per the Section 3.14.1 of VCS Standard (Version 4.4), PP has demonstrated regulatory surplus in JPM which has been checked by VVB as below,

Via searching the public website with laws and regulations in Shandong Province and China by CTI, it is confirmed that there is no legal law and regulation to mandate the livestock farm owners to implement anaerobic digestion, aerobic or other biological treatment techniques to treat the animal manure in China. And via checking the “Regulations on Prevention and Control of Pollution from Livestock and Poultry Farming”/77/ and “Technical specification for sanitation treatment of livestock and poultry manure”/76/, CTI confirmed that the manure is prohibited to discharge directly into environment without any treatment and the uncovered anaerobic lagoon is a kind of manure treatment method recognized by the state.

Furthermore, via checking the Specifications for the construction of manure resource utilization facilities for large-scale livestock and poultry farms (for trial implementation)/78/, it is confirmed that anaerobic digester, aerobic treatment or other biological treatment techniques methods to dispose manure waste are encouraged by the state and not mandatory. Therefore, the project activity is not mandated by any law, statute, or other regulatory framework, it is deemed as regulatory surplus.

CL 05 was raised and successfully closed. Refer to Appendix 4 for detail assessment.

3.4.6 Quantification of GHG Emission Reductions and Removals

For validation of the estimated GHG emission reductions in the Joint-PD-MR/1/ and ER calculation sheet/2/,

Further, the VVB has downloaded from the UNFCCC website the applicable version of the CDM methodology,

Via verify the Joint-PD-MR/1/, it is confirmed the calculation of ERs is done as per the applied methodology (ACM0010 ver. 08.0) with follow steps listed below.

Baseline emissions

Via checking the paragraph 26 of the applied methodology, the baseline emissions BE_y in a year y are calculated as:

$$BE_y = BE_{CH_4,y} + BE_{N_2O,y} + BE_{elec/heat,y} \quad (1)$$

Where:

- BE_y = Baseline emissions in year y (t CO₂/yr)
- $BE_{CH_4,y}$ = Baseline CH₄ emissions in year y (t CO₂/yr)
- $BE_{N_2O,y}$ = Baseline N₂O emissions in year y (t CO₂/yr)
- $BE_{elec/heat,y}$ = Baseline CO₂ emissions from electricity and/or heat used in the baseline (t CO₂/yr)

1. Baseline CH₄ emissions ($BE_{CH_4,y}$)

$$BE_{CH_4,y} = GWP_{CH_4} * D_{CH_4} * \sum_{j,LT} (MCF_j * B_{0,LT} * N_{LT} * VS_{LT,y} * MS\%_{Bl,j}) \quad (2)$$

Where:

- $BE_{CH_4,y}$ = Baseline CH₄ emissions in year y (t CO₂/yr)
- GWP_{CH_4} = Global Warming Potential (GWP) of CH₄ (t CO₂e/t CH₄)
- D_{CH_4} = Density of CH₄ (t/m³). 0.00067t/m³ at room temperature (20°C) and 1am pressure.
- MCF_j = Annual methane conversion factor (MCF) for the baseline $AWMS_j$. 2019 Refinement to the 2006 IPCC Guidance, table 10.17, chapter 10, volume 4.
- $B_{0,LT}$ = Maximum methane producing potential of the volatile solid generated by animal type LT (m³CH₄/kg -dm)
- N_{LT} = Annual average number of animals of type LT for the year y (number)
- $VS_{LT,y}$ = Annual volatile solid excretions for livestock LT entering all $AWMS$ on a dry matter weight basis (kg -dm/animal/yr)
- $MS\%_{Bl,j}$ = Fraction of manure handled in system j in the baseline. In this project, the baseline manure management system is uncovered anaerobic lagoon only. The amount of manure handled by the anaerobic lagoon is 100%. $MS\%_{Bl,j} = 100\%$
- LT = Type of livestock
- j = Type of treatment system

Estimation of various variables and parameters for above equation:

(A) $VS_{LT,y}$

As per the methodology, there are four options to determine this value, via checking the options provided, CTI confirmed there is no published country specific data available based on the local expertise of audit team. The energy intake of the swine is not available, Option 2 can't be used. Option 3 utilizes the average weight of the swine, this data is available and therefore Option 3 is adopted by PP to calculate $VS_{LT,y}$.

Scaling default IPCC values $VS_{default}$ to adjust for a site-specific average animal weight as shown in equation below:

$$VS_{LT,y} = \left(\frac{W_{site}}{W_{default}} \right) * VS_{default} * nd_y \quad (3)$$

Where:

- $VS_{LT,y}$ = Annual volatile solid excretions for livestock LT entering all AWMS on a dry matter weight basis (kg -dm/animal/yr)
- W_{site} = Average animal weight of a defined livestock population at the project site (kg)
- $W_{default}$ = Default average animal weight of a defined population (kg)
- $VS_{default}$ = Default value for the volatile solid excretion per day on a dry-matter basis for a defined livestock population (kg-dm/animal/day)
- nd_y = Number of days treatment plant was operational in year y

(B) N_{LT}

As per the methodology, there are four options to determine this value, via checking the options provided, via site inspection, CTI confirmed that there are two types of swine in this project, i.e., Market swine and Breeding swine. For both Market swine and Breeding swine, PP can monitor the daily stock of market and breeding swine in a reliable way, discounting new imported animals are included and dead and discharge animals are excluded from the productive process from the daily stock. So, the Option 2 is adopted to calculate N_{LT} for both Market swine and Breeding swine.

Option 1:

$$N_{LT} = N_{da,LT} * \left(\frac{N_{p,LT}}{365} \right) \quad (4)$$

Where:

- N_{LT} = Annual average number of animals of type LT for the year y (number)
- $N_{da,LT}$ = Number of days animal of type LT is alive in the farm in the year y (number)
- $N_{p,LT}$ = Number of animals of type LT produced annually for the year y (number)

Option 2:

If the project developer can monitor in a reliable and traceable way the daily stock of animals in the farm, discounting dead animals and animals discarded from the productive process from the daily stock, then the annual average number of animals (N_{LT}) may be calculated as follows:

$$N_{LT} = \frac{\sum_{i=1}^{365} N_{AA,LT}}{365} \quad (5)$$

Where:

- N_{LT} = Annual average number of animals of type LT for the year y (number)
- $N_{AA,LT}$ = Daily stock of animals of type LT in the farm, discounting dead and discarded animals (number)

(C) $B_{0,LT}$

As per the applied methodology, this value varies by species and diet. Default values are used and they are taken from tables 10.16 (2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4, chapter10)/39/.

CTI verified that the maximum methane producing potential ($B_{0,LT}$) for high productivity system in Asia region is 0.45 m³ CH₄/kg VS is applicable to the project which is verified by checking the Table 10.16 of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4, chapter 10/39/.

(D) MCF_j

As per the applied methodology, the MCF_j values given in table 10.17, chapter 10, volume 4, 2019 Refinement to the 2006 IPCC Guidelines/39/ should be used. MCF_j values depend on the annual average temperature where the anaerobic manure treatment facility in the baseline existed.

i. For this project, the annual average temperature is confirmed as 13.2 °C > 10 °C/68/, the ratio of potential evapotranspiration to precipitation is 1,876.5 mm/1,105.1 mm=1.70>1/, Therefore, as per Annex 10A.2, 2019 Refinement to the 2006 IPCC Guidelines/39/, the climate zone of the project site can be determined to "Warm temperature moist" and the value of 73% applied is verified as consistent with IPCC/39/.

ii. A conservativeness factor should be applied by multiplying MCF_j values (estimated as per above bullet) with a value of 0.94, to account for the 20% uncertainty in the MCF_j values as reported by 2019 Refinement to the 2006 IPCC/39/.

2. Baseline NO₂ emissions ($BE_{N2O,y}$)

$$BE_{N2O,y} = GWP_{N2O} * CF_{N2O-N,N} * \frac{1}{1000} * (E_{N2O,D,y} + E_{N2O,ID,y}) \quad (6)$$

Where:

- $BE_{N2O,y}$ = Annual baseline N₂O emissions in (t CO₂e/yr)
- GWP_{N2O} = Global Warming Potential (GWP) for N₂O (t CO₂e/tN₂O)
- $CF_{N2O-N,N}$ = Conversion factor N₂O-N to N₂O (44/28)
- $E_{N2O,D,y}$ = Direct N₂O emission in year y (kg N₂O-N/year)
- $E_{N2O,ID,y}$ = Indirect N₂O emission in year y (kg N₂O-N/year)

$$E_{N2O,D,y} = \sum_{j,LT} EF_{N2O,D,j} * NEX_{LT,y} * N_{LT} * MS\%_{BL,j} \quad (7)$$

Where:

- $E_{N2O,D,y}$ = Direct N₂O emission in year y (kg N₂O-N/yr)
- $EF_{N2O,D,j}$ = Direct N₂O emission factor for the treatment system j of the manure management system (kg N₂O-N/kg N). (Estimated with site-specific, regional or national data if such data is available, otherwise use default EF₃ from table 10.21, chapter 10, volume 4, in the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories). The site-specific, regional or national data are not available, so this project activity adopts default EF₃.
- $NEX_{LT,y}$ = Annual average nitrogen excretion per head of a defined livestock population (kg N/animal/yr) estimated as described in appendix 2
- $MS\%_{BI,j}$ = Fraction of manure handled in system j (fraction)
- N_{LT} = Annual Average number of animals of type LT for the year y estimated as per equation 4 and 5 (number)
- N_{LT} = Annual Average number of animals of type LT for the year y estimated as per equation 4 and 5 (number)

$$E_{N2O,ID,y} = \sum_{j,LT} EF_{N2O,ID} * F_{gasMS,j,LT} * NEX_{LT,y} * N_{LT} * MS\%_{BI,j} \quad (8)$$

Where:

- $E_{N2O,ID,y}$ = Indirect N₂O emission in year y (kg N₂O-N/year)
- $EF_{N2O,ID}$ = Indirect N₂O emission factor for N₂O emissions from atmospheric deposition of nitrogen on soils and water surfaces (kgN₂O-N/kg NH₃-N and NO_x-N). (Estimated with site-specific, regional or national data if such data is available. Otherwise, default values for EF₄ from table 11.3, chapter 11, volume 4 of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories can be used). The site-specific, regional or national data are not available, so this project activity adopts default EF₄.
- $NEX_{LT,y}$ = Annual average nitrogen excretion per head of a defined livestock population (kg N/animal/yr) estimated as described in Appendix 2
- $MS\%_{BI,j}$ = Fraction of manure handled in system j (fraction)
- $F_{gasMS,j,LT}$ = Default values for nitrogen loss due to volatilisation of NH₃ and NO_x from manure management (fraction)
- N_{LT} = Annual Average number of animals of type LT for the year y estimated as per equation (4) or (5) (number)

Estimation of various variables and parameters for above equations:

(A) Procedure for estimating $NEX_{LT,y}$

As per the Appendix 2 of the applied methodology, two options provided, for this project, neither specific information on Portion of that N intake nor site-specific national or regional data is available. So, the Option 2 is adopted to calculate $NEX_{LT,y}$.

Option 2:

In the absence of availability of project specific information on protein intake, which should be justified in the Joint-PD-MR, national or regional data should be used for the nitrogen excretion $NEX_{LT,y}$, if available. In the absence of such data, default values from table 10.19 of the 2019 Refinement to the 2006 IPCC, volume 4, chapter 10) may be used and should be corrected for the animal weight at the project site in the following way:

$$NEX_{LT,y} = \frac{W_{site}}{W_{default}} * NEX_{IPCC\ default} \quad (9)$$

Where:

- $NEX_{LT,y}$ = Annual average nitrogen excretion per head of a defined livestock population (kg N/animal/yr)
- W_{site} = Average animal weight of a defined livestock population at the project site (kg)
- $W_{default}$ = Default average animal weight of a defined population (kg)
- $NEX_{IPCC\ default}$ = Default value for the nitrogen excretion per head of a defined livestock population (kg N/animal/year)

Via checking the IPCC, it is confirmed that below equation is used for calculate $NEX_{IPCC\ default}$

$$NEX_{IPCC\ default} = N_{rate(T)} * \frac{TAM}{1000} * 365 \quad (10)$$

Where:

- $N_{rate(T)}$ = the default N excretion rate, kg N/ (1,000 kg animal mass)/ day, table 10.19, chapter 10, volume 4 of 2019 Refinement to the 2006 IPCC Guidelines
- TAM = Typical animal mass for livestock in kg/animal

3. Baseline CO₂ emission from electricity and/or heat used in the baseline

$$BE_{elec/heat,y} = BE_{EC,y} + BE_{HG,y} \quad (11)$$

Where:

- $BE_{elec/heat,y}$ = Baseline CO₂ emissions from electricity and/or heat used in the baseline (t CO₂/yr)
- $BE_{EC,y}$ = Baseline emissions associated with electricity generation in year y (t CO₂/yr)
- $BE_{HG,y}$ = Baseline emissions associated with heat generation in year y (t CO₂/yr)

Via site inspection and checking the baseline scenario evidence/14/, CTI confirmed that baseline scenario of this project is uncovered anaerobic lagoon, and no electricity and heat used in the baseline, so the emission can be excluded for simplification. So, the baseline CO₂ emission from electricity and/or heat used in the baseline is 0, which is conservative.

Project Emissions

Based on the applied methodology, and via site inspection checking the project implementation, CTI confirmed that there are two stages involved in the manure treatment for the project activity: (1) anaerobic digester; (2) aerobic composting.

The Project emissions are estimated as follows:

$$PE_y = PE_{AD,y} + PE_{Aer,y} + PE_{N_2O,y} + PE_{EC/FC,y} \quad (12)$$

Where:

- PE_y = Project emissions in year y
- $PE_{AD,y}$ = Project emissions associated with the anaerobic digester in year y (t CO₂e/yr)
- $PE_{Aer,y}$ = Project CH₄ emissions from aerobic AWMS treatment (t CO₂e/yr)
- $PE_{N_2O,y}$ = Project N₂O emissions in year y (t CO₂/yr)
- $PE_{EC/FC,y}$ = Project emissions from electricity consumption and fossil fuel combustion (t CO₂e/yr)

i) $PE_{AD,y}$

$PE_{AD,y}$ is determined using the methodological tool “Project and leakage emissions from anaerobic digester” (Version 02.0) as defined in the applied methodology, as per the tool

$$PE_{AD,y} = PE_{EC,y} + PE_{FC,y} + PE_{CH_4,y} + PE_{flare,y} \quad (13)$$

Where:

- $PE_{AD,y}$ = Project emissions associated with the anaerobic digester in year y (t CO₂e)
- $PE_{EC,y}$ = Project emissions from electricity consumption associated with the anaerobic digester in year y (t CO₂e)
- $PE_{FC,y}$ = Project emissions from fossil fuel consumption associated with the anaerobic digester in year y (t CO₂e)
- $PE_{CH_4,y}$ = Project emissions of methane from the anaerobic digester in year y (t CO₂e)
- $PE_{flare,y}$ = Project emissions from flaring of biogas in year y (t CO₂e)

a. $PE_{EC,y}$

The project emissions from electricity consumption is calculated according to the “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0).

$$PE_{EC,y} = \sum_{j,LT} EC_{PJ,j,y} * EF_{EF,j,y} * (1 + TDL_{j,y}) \quad (14)$$

Where:

- $PE_{EC,y}$ = Project emissions from electricity consumption in year y (t CO₂e)

$EC_{PJ,j,y}$	=	Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr)
$EF_{EF,j,y}$	=	Emission factor for electricity generation for source j in year y (t CO ₂ /MWh)
$TDL_{j,y}$	=	Average technical transmission and distribution losses for providing electricity to source j in year y

As the electricity generated by this project will be used firstly for the operation of AWMS, and then surplus electricity will be supplied to the swine farm, if the boiler set is in a shutdown state or the electricity is insufficient for the operation of AWMS, the electricity consumed by the project will be provided from the regional power grid NCPG. So for ex ante calculation of $PE_{EC,y}$, it is assumed that all the electricity consumed of the project activities comes from the electricity generated by the biogas, therefore $PE_{EC,y} = 0$.

During the monitoring period, the project emissions from electricity consumption will be calculated as above formular 14 in the case of the electricity consumed from the regional power grid NCPG. And the electricity consumption sourced from the grid company will be determined through the electricity meter measurement and cross-check with the grid statement.

b. $PE_{FC,y}$

Via site inspection, CTI confirmed that there are no fossil fuels involved in the project for anaerobic digestion process, hence $PE_{FC,y} = 0$.

c. $PE_{flare,y}$

Via site inspection, it is confirmed that the residual gas stream will be flared by flaring, so the project emissions from flaring of biogas ($PE_{flare,y}$) shall be estimated using the tool 06 “Project emissions from flaring” (version 04.0)/48/

The calculation procedure in this tool determines the project emissions from flaring the residual gas ($PE_{flare,y}$) based on the flare efficiency ($\eta_{flare,m}$) and the mass flow of methane to the flare ($F_{CH4,RG,m}$). The flare efficiency is determined for each minute m of year y based either on monitored data or default values.

The calculation procedure of project emissions from flaring is given in the following steps:

STEP 1: Determination of the methane mass flow of the residual gas;

STEP 2: Determination of the flare efficiency;

STEP 3: Calculation of project emissions from flaring.

Step 1: Determination of the methane mass flow in the residual gas

The tool 08 “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” shall be used to determine the following parameter $F_{CH4,m}$:

The following requirements apply:

- (a) The gaseous stream to which the tool is applied is the residual biogas for flaring;
- (b) The flow of the gaseous stream shall be measured continuously;
- (c) CH₄ is the greenhouse gas i for which the mass flow should be determined;

(d) The simplification offered for calculating the molecular mass of the gaseous stream is valid (equations 3 and 17 in the tool); and

(e) The time interval t for which mass flow should be calculated is every minute m .

$F_{CH_4,m}$, which is measured as the mass flow during minute m , shall then be used to determine the mass of methane in kilograms fed to the flare in minute m ($F_{CH_4,RG,m}$). $F_{CH_4,m}$ shall be determined on a dry basis.

Therefore, option A is adopted to calculate the mass flow of the residual biogas for flaring as per Too 08 “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 03.0)/49/.

As per paragraph 23 of Tool 8: “Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)/49/, the way to prove that the gaseous stream is dry needs to demonstrate that the temperature of the gaseous stream (T_t) is less than 60°C (333.15 K) at the flow measurement point. For this project, the flowmeters installed in the outlet of the anaerobic tank and the temperature of the anaerobic treatment unit of this project is designed as medium temperature i.e. 35~38 °C. Therefore, the gas temperature measured by the flowmeter does not exceed 60 °C, it can be demonstrated that the gaseous stream is dry.

The mass flow of greenhouse gas i ($F_{i,t}$) is determined as follows:

$$F_{i,t} = V_{t,db} * v_{i,t,db} * \rho_{i,t} \quad (15)$$

$$\rho_{i,t} = \frac{P_t * MM_i}{R_u * T_t} \quad (16)$$

Where:

$F_{i,t}$	=	Mass flow of greenhouse gas i in the gaseous stream in time interval t (kg gas/h)
$V_{t,db}$	=	Volumetric flow of the gaseous stream in time interval t on a dry basis (m ³ dry gas/h)
$v_{i,t,db}$	=	Volumetric fraction of greenhouse gas i in the gaseous stream in a time interval t on a dry basis (m ³ gas i /m ³ dry gas)
$\rho_{i,t}$	=	Density of greenhouse gas i in the gaseous stream in time interval t (kg gas i /m ³ gas i)
P_t		Absolute pressure of the gaseous stream in time interval t (Pa)
MM_i		Molecular mass of greenhouse gas i (kg/kmol)
R_u		Universal ideal gases constant (Pa.m ³ /kmol.K)
T_t		Temperature of the gaseous stream in time interval t (K)

Therefore, option A is adopted to calculate the mass flow of the residual biogas for flaring as per Too 08 “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 03.0)/49/. The formulars are same to above (15) and (16).

Step 2: Determination of flare efficiency

Via site inspection, CTI confirmed that the open flares are applied

According to tool 06 paragraph 18: in the case of open flares, the flare efficiency in the minute m ($\eta_{flare,m}$) is 50% when the flame is detected in the minute m ($Flame_m$), otherwise $\eta_{flare,m}$ is 0%.

Since the flame is not detected in the minute, therefore, fixed value of 0% for the flare efficiency will be

applied for this project, and this is for conservative.

Step 3: Calculation of project emissions from flaring

Project emissions from flaring are calculated as the sum of emissions for each minute m in year y , based on the methane mass flow in the residual gas ($F_{CH_4, RG, m}$) and the flare efficiency ($\eta_{flare, m}$), as follows:

$$PE_{flare, y} = GWP_{CH_4, y} * \sum_{m=1}^{525600} F_{CH_4, RG, m} * (1 - \eta_{flare, m}) * 10^{-3} \quad (17)$$

Where:

- $PE_{flare, y}$ = Project emissions from flaring of the residual gas in year y (tCO₂e)
- GWP_{CH_4} = Global warming potential of methane valid for the commitment period (tCO₂e/tCH₄)
- $F_{CH_4, RG, m}$ = Mass flow of methane in the residual gas in the minute m (kg)
- $\eta_{flare, m}$ = Flare efficiency in minute m

$F_{CH_4, RG, m}$ will be determined as above assessment. So the Project emissions from flaring can be calculated by:

$$PE_{flare, y} = GWP_{CH_4, y} * V_{t, db} * v_{i, t, db} * \rho_{i, t} * (1 - \eta_{flare, m}) * 10^{-3} \quad (18)$$

Where:

- $V_{t, db}$ = Volumetric flow of the residual gas for flaring in time interval t on a dry basis (m³ dry gas/h)
- $v_{i, t, db}$ = Volumetric fraction of greenhouse gas i in the gaseous stream for flaring in a time interval t on a dry basis (m³ gas i /m³ dry gas)
- $\rho_{i, t}$ = Density of greenhouse gas i in the gaseous stream in time interval t (kg gas i /m³ gas i)

Via checking the Project design report/5/, it is confirmed that all the biogas generated in the AWMS is collected for heat generation, so no biogas is flared in pre-calculation. In the monitoring period, the project emissions from flaring of biogas should be calculated according to the actual situation.

d. $PE_{CH_4, y}$

The project emissions from methane from the anaerobic digester is calculated according to the tool “Project and leakage emissions from anaerobic digester (Version 02.0)”. According to the tool, Project emissions of methane from the anaerobic digester include emissions during maintenance of the digester, physical leaks through the roof and side walls, and release through safety valves due to excess pressure in the digester.

These emissions are calculated using a default emission factor ($EF_{CH_4, default}$), as follows:

$$PE_{CH_4, y} = Q_{CH_4, y} * EF_{CH_4, default} * GWP_{CH_4} \quad (19)$$

Where:

- $PE_{CH_4, y}$ = Project emissions of methane from the anaerobic digester in year y (t CO₂e)

- $Q_{CH_4,y}$ = Quantity of methane produced in the anaerobic digester in year y (t CH_4)
- $EF_{CH_4, default}$ = Default emission factor for the fraction of CH_4 produced that leaks from the anaerobic digester (fraction)
- GWP_{CH_4} = Global warming potential of CH_4 (t CO_2 / t CH_4)

$Q_{CH_4,y}$

Due to the project is a large scale, $Q_{CH_4,y}$ was determined following step 1 and Option 1 of the applied tool. Below is the formula used for the calculation of $Q_{CH_4,y}$.

Option1: Procedure using monitored data

$Q_{CH_4,y}$ shall be measured using the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 03.0)/49/. When applying the tool, the following applies:

- (a) The gaseous stream to which the tool is applied is the biogas collected from the digester;
- (b) CH_4 is the greenhouse gas i for which the mass flow should be determined; and
- (c) The flow of the gaseous stream should be measured on an hourly basis or a smaller time interval; and then accumulated for the year y . Please note that units need to be converted to tons, when applying the results in this tool.

The biogas is produced and collected from anaerobic digestion process. The flowmeters are installed at the outlet of the biogas digester and the measured on an hourly basis time interval. So the quantity of methane produced in the digester in year y ($Q_{CH_4,y}$) is the accumulation of the mass flow of methane in the gaseous stream in an hourly basis time interval. i.e., $Q_{CH_4,y} = \sum_{i=1}^{8760} F_{i,t}$.

As per the tool, the mass flow of greenhouse gas i ($F_{i,t}$) is determined as follows:

$$F_{i,t} = V_{t,db} * v_{i,t,db} * \rho_{i,t} \quad (20)$$

$$\rho_{i,t} = \frac{P_t * MM_i}{R_u * T_t} \quad (21)$$

Where:

- $F_{i,t}$ = Mass flow of greenhouse gas i in the gaseous stream in time interval t (kg gas/h)
- $V_{t,db}$ = Volumetric flow of the gaseous stream in time interval t on a dry basis (m³ dry gas/h)
- $v_{i,t,db}$ = Volumetric fraction of greenhouse gas i in the gaseous stream in a time interval t on a dry basis (m³ gas i /m³ dry gas)
- $\rho_{i,t}$ = Density of greenhouse gas i in the gaseous stream in time interval t (kg gas i /m³ gas i)
- P_t = Absolute pressure of the gaseous stream in time interval t (Pa)
- MM_i = Molecular mass of greenhouse gas i (kg/kmol)
- R_u = Universal ideal gases constant (Pa.m³/kmol.K)
- T_t = Temperature of the gaseous stream in time interval t (K)

In summary, the final determined Project emission associated with the anaerobic digester for the project activity is $PE_{AD,y} = PE_{EC,y} + PE_{CH_4,y} + PE_{flare,y}$

ii). $PE_{Aer,y}$

IPCC guidelines specify emissions from aerobic lagoon as 0.1 per cent of total methane generating potential of the waste processed, which can be used as a default for all types of aerobic AWMS treatment.

$$PE_{Aer,y} = GWP_{CH_4} * D_{CH_4} * 0.001 * F_{Aer} * \left[\prod_{n=1}^N (1 - R_{VS,n}) \right] * \sum_{j,LT} (B_{0,LT} * N_{LT} * VS_{LT,y} * MS\%_j) + PE_{sl,y} \quad (22)$$

All sludge produced from the aerobic composting will be used for land application which is calculated as leakage emission. So the $PE_{sl,y}=0$.

So,

$$PE_{Aer,y} = GWP_{CH_4} * D_{CH_4} * 0.001 * F_{Aer} * \left[\prod_{n=1}^N (1 - R_{VS,n}) \right] * \sum_{j,LT} (B_{0,LT} * N_{LT} * VS_{LT,y} * MS\%_j) \quad (23)$$

Where:

- GWP_{CH_4} = Global Warming Potential (GWP) of CH_4 (t CO_2e /t CH_4)
- $R_{VS,n}$ = Fraction of volatile solid degraded in AWMS treatment method n of the N treatment steps prior to waste being treated (fraction)
- D_{CH_4} = Density of CH_4 (t/m³)
- F_{Aer} = Fraction of volatile solid directed to aerobic system (fraction)
- LT = Type of livestock
- $B_{0,LT}$ = Maximum methane producing potential of the volatile solid generated by animal type LT (m³ CH_4 /kg dm)
- $VS_{LT,y}$ = Annual volatile solid excretion livestock type LT entering all AWMS on a dry matter weight basis in (kg -dm/animal/yr)
- N_{LT} = Annual average number of animals of type LT for the year y (number) as estimated in equation above
- $PE_{sl,y}$ = Project CH_4 emissions from sludge disposed of in storage pit prior to disposal during the year y (t CO_2e /yr)
- $MS\%_j$ = Fraction of manure handled in system j in the project activity (fraction)

iii). $PE_{N_2O,y}$

$$PE_{N_2O,y} = GWP_{N_2O} * CF_{N_2O-N,N} * \frac{1}{1000} * (E_{N_2O,D,y} + E_{N_2O,ID,y}) \quad (24)$$

Where:

- $PE_{N2O,y}$ = Project N₂O emissions in year y (t CO₂/yr)
 GWP_{N2O} = Global Warming Potential (GWP) for N₂O (t CO₂e/tN₂O)
 $CF_{N2O-N,N}$ = Conversion factor N₂O-N to N₂O (44/28)
 $E_{N2O,D,y}$ = Direct N₂O emission in year y (kg N₂O-N/year)
 $E_{N2O,ID,y}$ = Indirect N₂O emission in year y (kg N₂O-N/year)

The same method used to estimate the emissions in the baseline should be used to estimate the project emissions of nitrous oxide, so the Option 1 is used to calculate the Project N₂O emissions $PE_{N2O,y}$.

Option 1:

$$E_{N2O,D,y} = \sum_{j,LT} EF_{N2O,D,j} * NEX_{LT,y} * N_{LT} * MS\%_j \quad (25)$$

Where:

- $E_{N2O,D,y}$ = Direct N₂O emission in year y (kg N₂O-N/yr)
 $EF_{N2O,D,j}$ = Direct N₂O emission factor for the treatment system *j* of the manure management system (kg N₂O-N/kg N)
 $NEX_{LT,y}$ = Annual average nitrogen excretion per head of a defined livestock population (kg N/animal/yr) estimated as described in appendix 2
 $MS\%_j$ = Fraction of manure handled in system *j* (fraction)
 N_{LT} = Annual Average number of animals of type LT for the year y estimated as per equation 4 and 5 (number)

$$E_{N2O,ID,y} = \sum_{j,LT} EF_{N2O,ID} * F_{gasMS,j,LT} * NEX_{LT,y} * N_{LT} * MS\%_j \quad (26)$$

Where:

- $E_{N2O,ID,y}$ = Indirect N₂O emission in year y (kg N₂O-N/year)
 $EF_{N2O,ID}$ = Indirect N₂O emission factor for N₂O emissions from atmospheric deposition of nitrogen on soils and water surfaces (kgN₂O-N/kg NH₃-N and NO_x-N)
 $NEX_{LT,y}$ = Annual average nitrogen excretion per head of a defined livestock population (kg N/animal/yr) estimated as described in appendix 2
 $MS\%_j$ = Fraction of manure handled in system *j* (fraction)
 $F_{gasMS,j,LT}$ = Default values for nitrogen loss due to volatilisation of NH₃ and NO_x from manure management (fraction)
 N_{LT} = Annual Average number of animals of type LT for the year y estimated as per equation 4 and 5 (number)

iv) $PE_{elec/heat}$

$$PE_{EC/FC,y} = PE_{EC,y} + \sum_j PE_{FC,j,y} \quad (27)$$

Where:

- $PE_{EC,y}$ = Project emissions from electricity consumption in year y. The project emissions from electricity consumption will be calculated following the latest version of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”. In case, the electricity consumption is not measured then the electricity consumption shall be estimated as follows $EC_{PJ,y} = \sum_i CP_{i,y} * 8760$, where $CP_{i,y}$ is the rated capacity (in MW) of electrical equipment i used for the project activity.
- $PE_{FC,y}$ = Project emissions from fossil fuel combustion in process j during the year y. The project emissions from fossil fuel combustion will be calculated following the latest version of the “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion”. For this purpose, the processes j in the tool corresponds to all fossil fuel combustion in the AWMS (not including fossil fuels consumed for transportation of feed material and sludge or any other on-site transportation).

Via site inspection, CTI confirmed there is no consumption of heat related to the anaerobic digester. Hence, these emissions should not be considered.

Besides, as described in above, since the electricity consumption that is not related to the anaerobic digester cannot be separated from the total electricity consumption, therefore the emission for consumption of electricity is calculated in $PE_{EC,y}$.

The same for the $PE_{FC,y}$, please refer to $PE_{FC,y}$ calculation in above.

Therefore, $PE_{elec/heat}=0$.

Leakage

As per the applied methodology, Leakage covers the emissions from land application of treated manure as well as the emissions related to anaerobic digestion in a digester, occurring outside the project boundary. These emissions are estimated as net of those released under project activity and those released in the baseline scenario. Net leakage is only considered if they are positive.

$$LE_y = (LE_{PJ,N_2O,y} - LE_{BL,N_2O,y}) + (LE_{PJ,CH_4,y} - LE_{BL,CH_4,y}) + LE_{AD,y} \quad (28)$$

Where:

- $LE_{PJ, N_2O, y}$ = Leakage N₂O emissions released during project activity from land application of the treated manure in year y (t CO₂e/yr)
- $LE_{BL, N_2O, y}$ = Leakage N₂O emissions released during baseline scenario from land application of the treated manure in year y (t CO₂e/yr)
- $LE_{PJ, CH_4, y}$ = Leakage CH₄ emissions released during project activity from land application of the treated manure in year y (t CO₂e/yr)
- $LE_{BL, CH_4, y}$ = Leakage CH₄ emissions released during baseline scenario from land application of

the treated manure in year y (t CO₂e/yr)

LE_{AD, y} = Leakage emissions associated with the anaerobic digester in year y (t CO₂e)

i) Estimation of leakage N₂O emissions released during baseline scenario from land application of the treated manure in year y, LE_{BL, N₂O, y}

$$LE_{BL, N_2O, y} = GWP_{N_2O} * CF_{N_2O-N, N} * \frac{1}{1000} * (LE_{N_2O, land, y} + LE_{N_2O, runoff, y} + LE_{N_2O, vol, y}) \quad (29)$$

$$LE_{N_2O, land, y} = EF_1 * \prod_{n=1}^N (1 - R_{N, n}) * \sum_{LT} NEX_{LT, y} * N_{LT} \quad (30)$$

$$LE_{N_2O, runoff, y} = EF_5 * F_{leach} * \prod_{n=1}^N (1 - R_{N, n}) * \sum_{LT} NEX_{LT, y} * N_{LT} \quad (31)$$

$$LE_{N_2O, vol, y} = EF_4 * \prod_{n=1}^N (1 - R_{N, n}) * F_{gasm} * \sum_{LT} NEX_{LT, y} * N_{LT} \quad (32)$$

Where:

GWP_{N₂O} = Global Warming Potential (GWP) for N₂O (t CO₂e/tN₂O)

CF_{N₂O-N, N} = Conversion factor N₂O-N to N₂O (44/28)

LE_{N₂O, land, y} = Leakage N₂O emissions from application of manure waste in year y (kg N₂O-N/year)

LE_{N₂O, runoff, y} = Leakage N₂O emissions due to leaching and run-off in year y (kg N₂O-N/year)

LE_{N₂O, vol, y} = Leakage N₂O emissions due to volatilisation in year y (kg N₂O-N/year)

F_{gasm} = Fraction of N lost due to volatilization (fraction)

N_{LT} = Annual average number of animals of type LT estimated as per equation 4 and 5 (number)

NEX_{LT, y} = Annual average nitrogen excretion per head of a defined livestock population (kg N/animal/year) estimated as described in appendix 2

EF₁ = Emission factor for N₂O emissions from N inputs (kg N₂O-N/kg N input)

EF₅ = Emission factor for N₂O emissions from N leaching and runoff in (kg N₂O-N/kg N leached and runoff)

EF₄ = Emission factor for N₂O emissions from atmospheric deposition of N on soils and water surfaces, [kg N- N₂O/ (kg NH₃-N + NO_x-N volatilized)]

F_{leach} = Fraction of all N added to/mineralised in managed soils in regions where leaching/runoff occurs that is lost through leaching and runoff (fraction)

R_{N, n} = Nitrogen reduction factor (fraction)

ii) Estimation of leakage N₂O emissions released during project activity from land application of the treated manure in year y, LE_{PJ, N₂O}

$$LE_{PJ,N_2O} = GWP_{N_2O} * CF_{N_2O-N,N} * \frac{1}{1000} * (LE_{N_2O,land,y} + LE_{N_2O,runoff,y} + LE_{N_2O,vol,y}) \quad (33)$$

$$LE_{N_2O,land,y} = EF_1 * \prod_{n=1}^N (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (34)$$

$$LE_{N_2O,runoff,y} = EF_5 * F_{leach} * \prod_{n=1}^N (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (35)$$

$$LE_{N_2O,vol,y} = EF_4 * \prod_{n=1}^N (1 - R_{N,n}) * F_{gas} * \sum_{LT} NEX_{LT,y} * N_{LT} \quad (36)$$

Where:

- GWP_{N₂O} = Global Warming Potential (GWP) for N₂O (t CO₂e/tN₂O)
- CF_{N₂O-N,N} = Conversion factor N₂O-N to N₂O (44/28)
- LE_{N₂O,land,y} = Leakage N₂O emissions from application of manure waste in year y (kg N₂O-N/year)
- LE_{N₂O,runoff,y} = Leakage N₂O emissions due to leaching and run-off in year y (kg N₂O-N/year)
- LE_{N₂O,vol,y} = Leakage N₂O emissions due to volatilisation in year y (kg N₂O-N/year)
- F_{gas} = Fraction of N lost due to volatilization (fraction)
- N_{LT} = Annual average number of animals of type LT estimated as per equation 4 and 5 (number)
- NEX_{LT,y} = Annual average nitrogen excretion per head of a defined livestock population (kg N/animal/year) estimated as described in appendix 2
- EF₁ = Emission factor for N₂O emissions from N inputs (kg N₂O-N/kg N input)
- EF₅ = Emission factor for N₂O emissions from N leaching and runoff in (kg N₂O-N/kg N leached and runoff)
- EF₄ = Emission factor for N₂O emissions from atmospheric deposition of N on soils and water surfaces, [kg N- N₂O/ (kg NH₃-N + NO_x-N volatilized)]
- F_{leach} = Fraction of all N added to/mineralised in managed soils in regions where leaching/runoff occurs that is lost through leaching and runoff (fraction)
- R_{N,n} = Nitrogen reduction factor (fraction)

It is not possible to measure the quantity of manure applied to land in kg manure/yr (Q_{DM}) and the nitrogen concentration in kg N/kg manure (N_{DM}) in the manure to estimate the total quantity of nitrogen applied to land. In this case, $\prod_{n=1}^N (1 - R_{N,n}) * \sum_{LT} NEX_{LT,y} * N_{LT}$ does not need to be replaced by $Q_{DM} * N_{DM}$.

iii) Estimation of leakage CH₄ emissions from land application of the treated manure

The calculation of methane emissions from land application of manure in the baseline and project cases are estimated as below:

$$LE_{BL,CH_4,y} = GWP_{CH_4} * D_{CH_4} * MCF_d * \left[\prod_{n=1}^N (1 - R_{VS,n}) \right] * \sum_{j,LT} (B_{0,LT} * N_{LT} * VS_{LT,y} * MS\%_j) \quad (37)$$

$$LE_{PJ,CH_4,y} = GWP_{CH_4} * D_{CH_4} * MCF_d * \left[\prod_{n=1}^N (1 - R_{VS,n}) \right] * \sum_{j,LT} (B_{0,LT} * N_{LT} * VS_{LT,y} * MS\%_j) \quad (38)$$

Where:

- $LE_{BL,CH_4,y}$ = Leakage CH₄ emissions released during baseline scenario from land application of the treated manure in year y (t CO₂e/yr)
- $LE_{PJ,CH_4,y}$ = Leakage CH₄ emissions released during project activity from land application of the treated manure in year y (t CO₂e/yr)
- $R_{VS,n}$ = Fraction of volatile solid degraded in AWMS treatment method n of the N treatment steps prior to sludge being treated
- GWP_{CH_4} = Global Warming Potential (GWP) of CH₄ (t CO₂e/tCH₄)
- D_{CH_4} = Density of CH₄ (t/m³)
- $B_{0,LT}$ = Maximum methane producing potential of the volatile solid generated by animal type LT (m³CH₄/kg dm)
- N_{LT} = Annual average number of animals of type LT estimated as per equation 4 and 5, expressed (number)
- $VS_{LT,y}$ = Annual volatile solid excretions for livestock LT entering all AWMS on a dry matter weight basis (kg -dm/animal/yr)
- $MS\%_j$ = Fraction of manure handled in system j in the project activity (fraction)
- MCF_d = Methane conversion factor (MCF_d) assumed to be equal to 1

iv) Estimation of leakage emissions associated with the anaerobic digester

$LE_{AD,y}$ is determined using the methodological tool “Project and leakage emissions from anaerobic digester(Version 02.0)/43/.

The leakage emissions associated with the anaerobic digester ($LE_{AD,y}$) depend on how the digestate is managed. They include emissions associated with storage and composting of the digestate and are determined as follows:

$$LE_{AD,y} = LE_{storage,y} + LE_{comp,y} \quad (39)$$

Where:

- $LE_{AD,y}$ = Leakage emissions associated with the anaerobic digester in year y (t CO₂e)

$LE_{storage,y}$ = Leakage emissions associated with storage of digestate in year y (t CO₂e)

$LE_{comp,y}$ = Leakage emissions associated with composting digestate in year y (t CO₂e)

The anaerobic digestion process of this project is carried out in a fully enclosed system. The biogas generated during the treatment process is captured for heat generation or flared (if any). The Emissions from combustion is calculated in project emissions (if any). After anaerobic digestion, the fermented sludge is treated in aerobic composting system and organic fertilizer can be produced. Wastewater from the new animal waste management systems will be treated aerobically and then used for agriculture irrigation. So, the Estimation of leakage emissions associated with the anaerobic digester is 0. i.e., $LE_{AD,y}$ =0.

Emission reductions:

$$ER_y = BE_y - PE_y - LE_y \quad (40)$$

Where:

ER_y Emission reductions in year y (t CO₂e/yr).

BE_y Baseline emissions in year y (t CO₂e/yr).

PE_y Project emissions in year y (t CO₂/yr).

LE_y Leakage emissions in year y (t CO₂/yr)

Ex ante calculation of emission reductions

For Baseline Emission calculation, as per the equation as below

$$BE_y = BE_{CH_4,y} + BE_{N_2O,y}$$

Based on above assessment, the ex ante baseline emissions can be calculated as follows:

Baseline Emissions: $BE_y = BE_{CH_4,y} + BE_{N_2O,y} = 139,106 \text{ tCO}_2\text{e} + 6,957 \text{ tCO}_2\text{e} = 146,063 \text{ tCO}_2\text{e}$

All the ex ante determined values for each basic parameter for BE calculation is checked by CTI for both ex ante value for fixed parameters assessment as above and confirmed the ex ante value for monitored parameters as below. The values used for the ex ante baseline emissions calculation in both Joint-PD-MR/1/ and ER sheet/2/ is verified as correct.

Project Emissions

Based on above assessment, final PE_y calculation for the project activity is listed as below

$$PE_y = PE_{AD,y} + PE_{Aer,y} + PE_{N_2O,y}$$

Based on above assessment, the ex ante project emissions can be calculated as follows:

$PE_{AD,y} = PE_{EC,y} + PE_{CH_4,y} + PE_{flare,y} = 4,101 \text{ tCO}_2\text{e} + 9,520 \text{ tCO}_2\text{e} + 4,200 \text{ tCO}_2\text{e} = 17,821 \text{ tCO}_2\text{e}$

$PE_{Aer,y} = 33 \text{ tCO}_2\text{e}$

$$PE_{N20,y} = 27,332 \text{ tCO}_2\text{e}$$

Project emission:

$$\begin{aligned} PE_y &= PE_{AD,y} + PE_{Aer,y} + PE_{N20,y} \\ &= 17,821 \text{ tCO}_2\text{e} + 33 \text{ tCO}_2\text{e} + 27,332 \text{ tCO}_2\text{e} \\ &= 45,186 \text{ tCO}_2\text{e} \end{aligned}$$

All the ex ante determined values for each basic parameter for PE calculation is checked by CTI for both ex ante value for fixed parameters assessment as above and confirmed the ex ante value for monitored parameters as below. The values used for the ex ante project emissions calculation in both Joint-PD-MR/1/ and ER sheet/2/ is verified as correct.

Leakage

Based on above assessment, final LE_y calculation for the project activity is listed as below

$$LE_y = (LE_{PJ,N20,y} - LE_{BL,N20,y}) + (LE_{PJ,CH4,y} - LE_{BL,CH4,y})$$

Based on above assessment, the ex ante leakage emissions can be calculated as follows:

$$LE_{PJ,N20,y} = 9,507 \text{ tCO}_2\text{e}$$

$$LE_{BL,N20,y} = 2,669 \text{ tCO}_2\text{e}$$

$$LE_{PJ,CH4,y} = 32,435 \text{ tCO}_2\text{e}$$

$$LE_{BL,CH4,y} = 30,408 \text{ tCO}_2\text{e}$$

Leakage emission:

$$\begin{aligned} LE_y &= (LE_{PJ,N20,y} - LE_{BL,N20,y}) + (LE_{PJ,CH4,y} - LE_{BL,CH4,y}) \\ &= (9,507 \text{ tCO}_2\text{e} - 2,669 \text{ tCO}_2\text{e}) + (32,435 \text{ tCO}_2\text{e} - 30,408 \text{ tCO}_2\text{e}) \\ &= 8,866 \text{ tCO}_2\text{e} \end{aligned}$$

All the ex ante determined values for each basic parameter for LE calculation is checked by CTI for both ex ante value for fixed parameters assessment as above and confirmed the ex ante value for monitored parameters as below. The values used for the ex ante Leakage emissions calculation in both Joint-PD-MR/1/ and ER sheet/2/ is verified as correct.

Emission reductions

$$ER_y = BE_y - PE_y - LE_y$$

Based on the above assessment of the ex ante determined values, it is verified that the annual ex ante determined ERs calculated result is 92,011 tCO₂/yr.

The detail of emission reduction calculation is transparently discussed in the Joint-PD-MR/1/. The assessment team has checked the Joint-PD-MR/1/ and ER sheet/2/ for the detail calculation of all the particulars and found it to be correct.

In conclusion, based on above values for each parameter for determine the ex-ante of emission reduction calculation, the CTI verified that results in Joint-PD-MR are correct for the ex-ante ER values during the fixed 10 years crediting period.

The ER calculation sheet/2/ has been duly checked. Further it has been checked whether the results have been correctly calculated in Joint-PD-MR/1/ for determination of ex-ante ER. The VVB has further checked the Joint-PD-MR/1/ against the latest version of the applicable methodology for consistency.

CAR 07 was raised and successfully closed. Refer to Appendix 4 for detail assessment.

3.4.7 Methodology Deviations

There are no any methodology deviations applied to the project.

3.4.8 Monitoring Plan

1. Data and parameters available at validation

Please refer to the following tables for assessment of each parameter determined ex-ante only used to calculate the ex-ante emission reduction:

GWP_{CH4}	Global Warming Potential of CH₄
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	IPCC Fifth Assessment Report (AR5)
Correct value provided?	Yes –28 tCO ₂ e/tCH ₄ Derived from IPCC Fifth Assessment Report (AR5)/40/
Has this value been verified?	Confirmed as correct for ex ante determination. Via checking the 100-year values are adopted from Box 3.2, table 1, IPCC Fifth Assessment Report (AR5)/40/ and VCS Standard Version 4.4/57/, it is verified that the value is correct.
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

GWP_{N2O}	Global Warming Potential of N₂O
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	IPCC Fifth Assessment Report (AR5)
Correct value provided?	Yes –265 tCO ₂ e/tN ₂ O Derived from IPCC Fifth Assessment Report (AR5)/40/
Has this value been verified?	Confirmed as correct for ex ante determination. Via checking the 100-year values are adopted from Box 3.2, table 1, IPCC Fifth Assessment Report (AR5)/40/ and VCS Standard Version 4.4/57/, it is verified that the value is correct.
Choice of data correctly justified?	Yes

Measurement method correctly described?	N/A
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<i>D_{CH4}</i>	<i>Density of CH₄</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	The value is given in the applied methodology ACM0010 (Version 08.0)/45/.
Correct value provided?	Yes -0.00067 t/m ³ at room temperature 20 °C and 1 atm pressure
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the applied methodology/45/
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

<i>MCF_j</i>	<i>Methane conversion factor for the baseline AWMS_j</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	2019 Refinement to the 2006 IPCC table 10.17, chapter 10, volume 4
Correct value provided?	Yes – 68.62%
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the IPCC/39/. A conservativeness factor has been applied by multiplying MCF_j value with a value of 0.94, to account for the 20 per cent uncertainty in the MCF_j values. For this project, the annual average temperature is confirmed as 13.2°C>10°C/68/, the ratio of potential evapotranspiration to precipitation is 1,876.5 mm/1,105.1 mm=1.70>1/, Therefore, as per Annex 10A.2, 2019 Refinement to the 2006 IPCC Guidelines/39/, the climate zone of the project site can be determined to "Warm temperature moist" and the value of 73% applied is verified as consistent with IPCC/39/. Therefore, MCF_j value of 68.62% is applied.
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

<i>MS%_{BI,j}</i>	<i>Fraction of manure handled in system j in the baseline</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	In this project, the baseline manure management system is uncovered anaerobic lagoon only. The amount of manure handled by the anaerobic lagoon is 100%.

Correct value provided?	Yes – 100%
Has this value been verified?	Yes. Confirmed as correct for ex ante determination. The PER/5/and baseline evidence/14/ is checked and confirmed.
Choice of data correctly justified?	Yes.
Measurement method correctly described?	N/A

W_{default}	<i>Default average animal weight of a defined population</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	2019 Refinement to the 2006 IPCC table 10.16, chapter 10, volume 4/39/
Correct value provided?	Yes – W _{default} (Market swine)=56 kg W _{default} (Breeding swine)=160 kg
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the IPCC/39/ and the values in 2019 Refinement to the 2006 IPCC and US-EPA are compared and the lower value from 2019 Refinement to the 2006 IPCC is applied.
Choice of data correctly justified?	Yes.
Measurement method correctly described?	N/A

VS_{default}	<i>Default value for the volatile solid excretion per day on a dry-matter basis for a defined livestock population</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Calculated according to the default value in table 10.13A and 10A.5, chapter 10, volume 4 of 2019 Refinement to the 2006 IPCC/39/
Correct value provided?	Yes – VS _{default} (Market swine) =0.2856 kg-dm/animal/day VS _{default} (Breeding swine) =0.3680 kg-dm/animal/day
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the IPCC/39/ and the values in 2019 Refinement to the 2006 IPCC and US-EPA are compared and the lower value from 2019 Refinement to the 2006 IPCC is applied.
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

NEX_{IPCC default}	<i>Default value for the nitrogen excretion per head of a defined livestock population</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Calculated by the equation: NEX _{IPCC default} =N _{rate(T)} * TAM/1000*365
Correct value provided?	Yes –

	NEX _{IPCC default} (Market swine) =12.88 kg N/ animal/year NEX _{IPCC default} (Breeding swine) =18.69 kg N/ animal/year
Has this value been verified?	Yes. Confirmed as correct for ex ante determination according to the calculation equation, while NEX _{IPCC default} is calculated as equation 10.30 in 2019 Refinement to the 2006 IPCC and $N_{rate(T)}$ and TAM are default value from 2019 Refinement to the 2006 IPCC.
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

$N_{rate(T)}$	Default N excretion rate
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	2019 Refinement to the 2006 IPCC table 10.19, chapter 10, volume 4 used for NEX _{IPCC default} calculations as above equation
Correct value provided?	Yes – $N_{rate(T)}$ (Market swine) =0.63 kg N (1000 kg animal mass) ⁻¹ day ⁻¹ $N_{rate(T)}$ (Breeding swine) =0.32 kg N (1000 kg animal mass) ⁻¹ day ⁻¹
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the IPCC/39/
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

TAM	Typical animal mass for livestock category
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	2019 Refinement to the 2006 IPCC table 10A.5, chapter 10, volume 4 used for NEX _{IPCC default} calculations as above equation
Correct value provided?	Yes – TAM (Market swine) =56 kg animal ⁻¹ TAM (Breeding swine) =160 kg animal ⁻¹
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the IPCC/39/.
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

$F_{gas MS,J,LT}$	Default values for nitrogen loss due to volatilisation of NH₃ and NO_x from manure management
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	2019 Refinement to the 2006 IPCC table 10.22, chapter 10, volume 4 due to site specific data is unavailable
Correct value provided?	Yes – $F_{gas MS,J,LT}$, (Uncovered anaerobic lagoon) : 40%

	$F_{gasMS,j,LT}$ (Anaerobic digester) : 50% $F_{gasMS,j,LT}$ (Composting - In Vessel) : 60%
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the IPCC/39/.
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

$EF_{N2O,D,j}$	<i>Direct N_2O emission factor for the treatment system j of the manure management system</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	2019 Refinement to the 2006 IPCC table 10.21, chapter 10, volume 4 due to site specific data is unavailable
Correct value provided?	Yes – $EF_{N2O,D}=0$ for Uncovered anaerobic lagoon, $EF_{N2O,D}=0.0006$ for Anaerobic Digester $EF_{N2O,D,j}=0.006$ for Composting – In Vessel
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the IPCC/39/.
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

$EF_{N2O,ID,j}$	<i>Indirect N_2O emission factor for the treatment system j of the manure management system</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	2019 Refinement to the 2006 IPCC table 11.3, chapter 11, volume 4 due to site specific data is unavailable
Correct value provided?	Yes – 0.014 kg N_2O -N/kg NH_3 -N and NO_x -N
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the IPCC/39/.
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

$EF_{CH4,default}$	<i>Default emission factor for the fraction of CH_4 produced that leaks from the anaerobic digester (fraction)</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Tool 14: “Project and leakage emissions from anaerobic digester (version 02.0)”/50/ for UASB (Upflow Anaerobic Sludge Blanket) type digester
Correct value provided?	Yes – 0.05 t CH_4 leaked / t CH_4 produced

Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the tool/50/. Via checking the anaerobic digester purchase contract/9/, CTI confirmed that the Digester type belongs to UASB type digester, the information in the JPM is correct and actual which is identified by manufacturer information.
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

$R_{vs,n}$	Default emission factor for the fraction of CH_4 produced that leaks from the anaerobic digester (fraction)
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Appendix 1 of methodology ACM0010/45/
Correct value provided?	Yes – $R_{vs,n}$, aerobic treatment anaerobic digester: 20%, 80% for leakage N_2O emission released during project activity $R_{vs,n}$, one cell lagoon: 85% for leakage N_2O emission released during baseline scenario
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the Appendix 1 of methodology ACM0010/45/. Via checking Appendix 1 of methodology ACM0010/45/, CTI confirmed that before the treated manure is applied to the land, it undergoes two stages of pre-treatment and an anaerobic-aerobic combined treatment technology, the pre-treatment belong to underfloor pit storage in the Appendix 1 of applied methodology ACM0010 (version 08.0), so, the $R_{vs,n}$ is 20% which is the most conservative value. The anaerobic-aerobic combined treatment technology belongs to covered first cell of two cell lagoon in the Appendix 1 of applied methodology ACM0010 (version 08.0), so the R_{vs} 80% which is the most conservative value. Via checking Appendix 1 of methodology ACM0010/45/, CTI confirmed that the baseline is uncovered anaerobic lagoon which belongs to the anaerobic treatment of One-cell lagoon in the Appendix 1 of applied methodology ACM0010 (version 08.0), so, the $R_{vs,n}$ is 85% which is the most conservative value.
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

$R_{N,n}$	Nitrogen reduction factor
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Appendix 1 of methodology ACM0010/45/
Correct value provided?	Yes – $R_{N,n}$, anaerobic digester(project scenario): 5%, 25%

	$R_{N,n}$, uncovered anaerobic lagoon (baseline scenario): 80%
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the Appendix 1 of methodology ACM0010/45/. Via checking Appendix 1 of methodology ACM0010/45/, CTI confirmed that before the treated manure is applied to the land, it undergoes two stages of pre-treatment and the an anaerobic-aerobic combined treatment technology, the pre-treatment belong to underfloor pit storage in the Appendix 1 of applied methodology ACM0010 (version 08.0), so, the $R_{N,n}$ is 5% which is the most conservative value. The anaerobic-aerobic combined treatment technology belongs to covered first cell of two cell lagoon in the Appendix 1 of applied methodology ACM0010 (version 08.0), so the $R_{N,n}$ is 25% which is the most conservative value. Via checking Appendix 1 of methodology ACM0010/45/, CTI confirmed that the baseline is uncovered anaerobic lagoon which similar to the anaerobic treatment of One-cell lagoon in the Appendix 1 of applied methodology ACM0010 (version 08.0), so, the $R_{N,n}$ is 80% which is the most conservative value
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

EF₁, EF₄, EF₅	<i>Emission factor for N₂O emissions from N inputs; from N leaching and runoff; from atmospheric deposition of N on soils and water surfaces</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	2019 Refinement to the 2006 IPCC Guidelines default values are be used, since country specific or region specific data are not available. EF ₁ from table 11.1, chapter 11, volume 4. EF ₄ and EF ₅ from table 11.3, chapter 11, volume 4 due to site specific data is unavailable
Correct value provided?	Yes – EF₁ = 0.006 kg N₂O-N/kg N EF₄ = 0.01 kg N₂O-N/(kg NH₃-N and NO_x-N EF₅ = 0.011 kg N₂O-N/kg N
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the IPCC/39/
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

F_{gasm}	Fraction of N lost due to volatilization
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Default values from table 11.3, chapter 11, volume 4 of 2019 Refinement to the 2006 IPCC guidelines due to site specific data is unavailable
Correct value provided?	Yes – 0.21

Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the IPCC/39/
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

<i>F_{leach}</i>	<i>Fraction of all N added to/mineralised in managed soils in regions where leaching/runoff occurs that is lost through leaching and runoff</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Default values from table 11.3, chapter 11, volume 4 of 2019 Refinement to the 2006 IPCC guidelines due to site specific data is unavailable
Correct value provided?	Yes – 0.24
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the IPCC/39/
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

<i>MCF_d</i>	<i>Methane conversion factor for leakage calculation</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Methodology ACM0010 (version 08.0)/45/
Correct value provided?	Yes – 1
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the applied methodology/45/. Methane conversion factor for leakage calculation assumed to be equal 1.
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

<i>EF_{EF,j,y}</i>	<i>Emission factor for electricity generation</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Issued EF data of NCPG from China DNA/66/ as per the tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of heat generation”/47/
Correct value provided?	Yes – 0.7119 tCO ₂ /MWh
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the DNA data/66/
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

R_u	Universal ideal gases constant
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)/49/
Correct value provided?	Yes –8,314 Pa.m ³ /kmol.K
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the applied Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)/49/
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

MM_i	Molecular mass of greenhouse gas i
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)/49/
Correct value provided?	Yes –16.04 kg/kmol for methane
Has this value been verified?	Yes. Confirmed as correct for ex ante determination as per the applied Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)/49/
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

$\eta_{flare,m}$	Flare efficiency in minute m
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	“Project emissions from flaring (version 04.0)"/48/
Correct value provided?	Yes – 0% is the conservative value
Has this value been verified?	Yes. Confirmed as correct open flare as per the applied Project emissions from flaring (version 04.0)"/48/
Choice of data correctly justified?	Yes
Measurement method correctly described?	N/A

CAR 08 and CAR 09 were raised and successfully closed. Refer to Appendix 4 for detail assessment.

2. Data and Parameters Monitored

The monitoring parameters required by the methodology and applicable tools for the project are summarized in the below table.

$N_{AA,LT}$	Daily stock of animals in the farm, discounting dead and discarded animals
Title in line with Methodology?	Yes
Ex-ante Value	144,000 heads of market swine

	13,650 heads of Breeding swine
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- $N_{AA,LT}$ will be monitored by PP daily. Each pig involved in this project has a unique electronic ear tag when was born, which is an electronic device dedicated to the identification and electronic management of animals. This electronic ear tag will be connected to the Data Collection System (DCS), which can store and read information. The technicians in farm monitor and record the number of breeding swine through the auto tracking devices of electronic ear tag daily, of which new imported animals are included and dead and discharge animals are excluded. The annual average number of animals ($N_{AA,LT}$) is calculated as an average of the daily stock of market swine and breeding swine in the farms without considering dead animals and discarded animals. The ex-ante value 144,000 heads of market swine and 13,650 heads of Breeding swine is derived from PER/5/.
Correct value provided?	Yes
Has this value been verified?	Yes - The ex-ante value 144,000 heads of market swine and 13,650 heads of Breeding swine is derived from PER/5/
Choice of data correctly justified?	Yes
Measurement method correctly described?	Yes -Via site inspection of the Data Collection System (DCS), CTI confirmed that each swine has a unique electronic ear tag and has been connected to the Data Collection System (DCS) and the monitoring will be conducted as per the request in the Joint-PD-MR which in compliance with the applied methodology.
Monitoring frequency correctly described?	Monitored monthly - verified as per the applied methodology
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	Yes - The PP monitor the population of market swine and breeding swine through the auto tracking device, which is connected to the Data Collection System (DCS). Therefore, the data of $N_{AA,LT}$ can be obtained through DCS.
Purpose of data?	BE, PE and LE calculation

W_{site}	<i>Average animal weight of a defined livestock population at the project site</i>
Title in line with Methodology?	Yes
Ex-ante Value	85.5kg for market swine and 95.5kg for breeding swine
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- W_{site} will be monitored by PP monthly. Sampling procedures will be used to estimate this variable following guidance as provided in the methodology. The ex-ante value 85.5kg for market swine and 95.5kg for breeding swine are derived from PER/5/.
Correct value provided?	Yes
Has this value been verified?	Yes - The ex-ante value 85.5kg for market swine and 95.5kg for breeding swine are derived from PER/5/.
Choice of data correctly justified?	Yes

Measurement method correctly described?	Yes –The Joint-PD-MR has described the system of random sampling taking into account stratification of each livestock population into a minimum of three weight categories as per the request in the applied methodology/45/.
Monitoring frequency correctly described?	Monitored monthly - verified as per the applied methodology
Monitoring equipment correctly described?	Yes - weight measurer
QA/QC procedure correctly described?	Yes - This parameter is used in equation 4 for estimating $VS_{LT,y}$ using option 3, and in equation 2 (appendix 2) for estimating $NEX_{LT,y}$ when using 2019 Refinement to the 2006 IPCC default values. The weight measurer will be calibrated according to the national regulation.
Purpose of data?	Used for estimating $VS_{LT,y}$

n_{dy}	<i>Number of days treatment plant was operational in year y</i>
Title in line with Methodology?	Yes
Ex-ante Value	365 days
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- n_{dy} will be monitored by PP daily. The ex-ante value 365 days is total days for a year
Correct value provided?	Yes
Has this value been verified?	Yes - The ex-ante value 365 days is confirmed as reasonable due to it is expected that the treatment plant operated everyday.
Choice of data correctly justified?	Yes
Measurement method correctly described?	Yes –The number of of days treatment plant was operational will be recorded manually by the responsible staff.
Monitoring frequency correctly described?	Daily - verified as per the applied methodology
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	Yes - Production record sheet from the DCS system can be crosscheck that the treatment plant is operational.
Purpose of data?	BE calculation

F_{Aer}	<i>Fraction of volatile solids directed to aerobic treatment</i>
Title in line with Methodology?	Yes
Ex-ante Value	100%
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- As this parameter is not monitored in the actual operation. so in the monitoring period, the value of this parameter in the emission reduction calculation is 100% which is confirmed as conservative. The ex-ante value 100% is derived from PER/5/.
Correct value provided?	Yes
Has this value been verified?	Yes - The ex-ante value 100% is derived from PER/5/.
Choice of data correctly justified?	Yes
Measurement method correctly described?	Yes – As this parameter is not monitored in the actual operation. so in the monitoring period, the value of this parameter in the

	emission reduction calculation is 100% which is confirmed as conservative.
Monitoring frequency correctly described?	Annually - verified as per the applied methodology
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	Yes - The value of this parameter in the emission reduction calculation is 100%, which is conservative.
Purpose of data?	PE calculation

<i>v_r</i>	<i>Biogas flow</i>
Title in line with Methodology?	Yes
Ex-ante Value	1,450*10 ⁴ m ³
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- <i>v_r</i> will be monitored by flow meters continuously and reported cumulatively on weekly basis by PP. The ex-ante value 1,450*10 ⁴ m ³ of biogas are expected to be generated by the project annually is derived from PER/5/
Correct value provided?	Yes
Has this value been verified?	Yes - The ex-ante value 1,450*10 ⁴ m ³ of biogas are expected to be generated by the project annually is derived from PER/5/
Choice of data correctly justified?	Yes
Measurement method correctly described?	Yes - The biogas flow will be measured at four points. For the proposed project, based on the site inspection, it is confirmed that all the biogas generated are used for heat generation and the residual gas is sent to flare system, therefore the biogas generated from the anaerobic digestion, the amount of biogas used for heat generation and the amount of biogas burned will be monitored through the flow meters.
Monitoring frequency correctly described?	Continuously by flow meter and reported cumulatively on weekly basis - verified as per the applied methodology
Monitoring equipment correctly described?	Yes - flow meters
QA/QC procedure correctly described?	Yes - The calibration of flow meters, including the frequency of calibration, should be done in accordance with national standards or requirements.
Purpose of data?	PE and LE calculation

<i>EC_{PJ,j,y}</i>	<i>Quantity of electricity consumed by the proposed project in year y</i>
Title in line with Methodology?	Yes
Ex-ante Value	18,000 MWh
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- <i>EC_{PJ,j,y}</i> will be monitored by electricity meter continuously and at least monthly recording by PP. The ex-ante value is 18,000 MWh is derived from PER/5/.
Correct value provided?	Yes
Has this value been verified?	Yes - The ex-ante value is 0 MWh is derived from PER/5/ which is confirmed as reasonable.
Choice of data correctly justified?	Yes

Measurement method correctly described?	Yes - The electricity consumption will be measured by electricity meter. The electricity consumption supplied by the grid company, then the value will be determined by the electricity meter monitoring and cross-check with the grid statement.
Monitoring frequency correctly described?	Continuous measurement and at least monthly recording - verified as per the applied methodology
Monitoring equipment correctly described?	Yes - electricity meter
QA/QC procedure correctly described?	Yes - The calibration of electricity meter, including the frequency of calibration, should be done in accordance with national standards or requirements
Purpose of data?	PE calculation

$TDL_{j,y}$	<i>Average technical transmission and distribution losses for providing electricity to source j in year y</i>
Title in line with Methodology?	Yes
Ex-ante Value	20%
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- value is derived from "Baseline, project and/or leakage emissions from electricity consumption and monitoring of heat generation" (version 03.0)/47/
Correct value provided?	Yes
Has this value been verified?	Yes – default value of 20% is used, which is conservative
Choice of data correctly justified?	Yes
Measurement method correctly described?	Yes – value is derived from "Baseline, project and/or leakage emissions from electricity consumption and monitoring of heat generation" (version 03.0)/47/
Monitoring frequency correctly described?	Value will change once the tool is updated - verified as per the tool
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	N/A
Purpose of data?	PE calculation

$V_{t,db}$	<i>Volumetric flow of the gaseous stream in time interval t on a dry basis</i>
Title in line with Methodology?	Yes
Ex-ante Value	See ER sheet
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- $V_{t,db}$ will be monitored by flowmeters continuously. The ex-ante value was estimated according to the amount of manure.
Correct value provided?	Yes
Has this value been verified?	Yes - The ex-ante value was estimated according to the amount of manure.
Choice of data correctly justified?	Yes

Measurement method correctly described?	Yes –monitored by flowmeters continuously. Volumetric flow measurement should always refer to the actual pressure and temperature.
Monitoring frequency correctly described?	Continuous measurement - verified as per the applied methodology
Monitoring equipment correctly described?	Yes - flow meters
QA/QC procedure correctly described?	Yes - The periodic calibration against a primary device provided by an independent accredited laboratory is mandatory, the calibration and frequency of calibration should be in accordance with manufacturer's specifications.
Purpose of data?	PE calculation

$V_{i,t,db}$	<i>Volumetric fraction of greenhouse gas i in a time interval t on a dry basis</i>
Title in line with Methodology?	Yes
Ex-ante Value	See ER sheet
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- $V_{i,t,db}$ will be monitored by gas analyzers continuously. The ex-ante value was derived from Project design report/5/.
Correct value provided?	Yes
Has this value been verified?	Yes - The ex-ante value was derived from Project design report/5/.
Choice of data correctly justified?	Yes
Measurement method correctly described?	Yes –monitored by gas analyzers continuously. Continuous gas analyser operating in dry-basis. Volumetric flow measurement should always refer to the actual pressure and temperature.
Monitoring frequency correctly described?	Continuous measurement - verified as per the applied methodology
Monitoring equipment correctly described?	Yes - gas analyzers
QA/QC procedure correctly described?	Yes - Calibration should include zero verification with an inert gas (e.g. N_2) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases must have a certificate provided by the manufacturer and must be under their validity period.
Purpose of data?	PE calculation

T_t	<i>Temperature of the gaseous stream in time interval t</i>
Title in line with Methodology?	Yes
Ex-ante Value	293.15 K
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- T_t will be monitored by recordable electronic signal continuously. The temperature $T_t(K)$ is calculated as the equation $T(K)=t(^{\circ}C)+273.15$ The ex-ante value was estimated according to the applied methodology/45/.
Correct value provided?	Yes
Has this value been verified?	Yes - The ex-ante value was estimated according to the applied methodology/45/.

Choice of data correctly justified?	Yes
Measurement method correctly described?	Yes – monitored by recordable electronic signal continuously. Instruments with recordable electronic signal (analogical or digital) are required. Examples include thermocouples, thermo resistance, etc Provided all parameters are converted to normal conditions during the monitoring process, this parameter may not be needed except for moisture content determination and therefore it should be metered only when performing such measurements (with same frequency)
Monitoring frequency correctly described?	Continuous unless differently specified in the underlying methodology - verified as per the applied methodology
Monitoring equipment correctly described?	Yes - Instruments with recordable electronic signal (analogical or digital)
QA/QC procedure correctly described?	Yes - Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications.
Purpose of data?	PE calculation

P_t	<i>Pressure of the gaseous stream in time interval t</i>
Title in line with Methodology?	Yes
Ex-ante Value	101.325 kPa
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- P_t will be monitored by recordable electronic signal continuously. The ex-ante value was estimated according to the applied methodology/45/.
Correct value provided?	Yes
Has this value been verified?	Yes - The ex-ante value was estimated according to the applied methodology/45/.
Choice of data correctly justified?	Yes
Measurement method correctly described?	Yes – monitored by recordable electronic signal continuously. Instruments with recordable electronic signal (analogical or digital) are required. Examples include pressure transducers, etc. Provided all parameters are converted to normal conditions during the monitoring process, this parameter may not be needed except for moisture content determination and therefore it should be metered only when performing such measurements (with same frequency)
Monitoring frequency correctly described?	Continuous unless differently specified in the underlying methodology - verified as per the applied methodology
Monitoring equipment correctly described?	Yes - Instruments with recordable electronic signal (analogical or digital)
QA/QC procedure correctly described?	Yes - Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications.
Purpose of data?	PE calculation

$P_{i,t}$	Density of greenhouse gas i in the gaseous stream in time interval t
Title in line with Methodology?	Yes
Ex-ante Value	0.67 kg/m ³
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- The actual value will be calculated based on temperature of the gaseous stream in time interval t and pressure of the gaseous stream in time interval t . The ex-ante value is derived from applied methodology.
Correct value provided?	Yes
Has this value been verified?	Yes - The ex-ante value was estimated according to the applied methodology/45/.
Choice of data correctly justified?	Yes
Measurement method correctly described?	Yes - The actual value will be calculated based on temperature of the gaseous stream in time interval t and pressure of the gaseous stream in time interval t .
Monitoring frequency correctly described?	Pressure and temperature are measured continuously - verified as per the applied methodology
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	Yes - Calculated value according to the pressure and temperature
Purpose of data?	PE calculation

$MS\%_j$	Fraction of manure handled in system j in project activity
Title in line with Methodology?	Yes
Ex-ante Value	100%
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- All the manure flew into AWMS to be treated; no any manure will be discharged outside. Therefore, the value of this parameter is 100%. The value used is 100% for ex-ante determination for conservative.
Correct value provided?	Yes
Has this value been verified?	Yes - The value used is 100% for ex-ante determination for conservative.
Choice of data correctly justified?	Yes
Measurement method correctly described?	Yes - Since the treatment process of this project is an anaerobic-aerobic combined treatment technology and as this parameter is not monitored in the actual operation. so, in the monitoring period, to be conservative, the value of this parameter applied in the emission reduction calculation in the two phases are both 100%.
Monitoring frequency correctly described?	Annually - verified as per the applied methodology
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	Yes - 100% is the maximum value and conservative.
Purpose of data?	PE calculation

<i>B_{0,LT}</i>	<i>Maximum methane producing potential of the volatile solid generated by animal type LT</i>
Title in line with Methodology?	Yes
Ex-ante Value	B _{0,LT} =0.45
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- B _{0,LT} can be measured as per ISO 11734:1995. As this parameter is not monitored in the actual operation. So, in the monitoring period, ex-ante determined values are still applied which is verified as conservative. The value used is derived from Table 10.16 of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4, chapter 10, the maximum methane producing potential (B _{0,LT}) for high productivity system in Asia region in IPCC/39/.
Correct value provided?	Yes
Has this value been verified?	Yes - While the actual methane producing potential of the volatile solid generated by swine manure is 479.4ml/g VS via checking the public literature/69/, which is higher. Therefore 0.45 m ³ CH ₄ /kg -dm applied is conservative.
Choice of data correctly justified?	Yes
Measurement method correctly described?	Yes –As this parameter is not monitored in the actual operation. So, in the monitoring period, ex-ante determined values are still applied which is verified as conservative
Monitoring frequency correctly described?	Annually - verified as per the applied methodology
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	Yes – The values will be updated based on latest available data from IPCC
Purpose of data?	BE, PE calculation

<i>NEX_{LT,y}</i>	<i>Annual average nitrogen excretion per head of a defined livestock population estimated as described in Appendix 2</i>
Title in line with Methodology?	Yes
Ex-ante Value	NEX _{LT,y} (Market swine) =19.66 NEX _{LT,y} (Breeding swine) =11.15
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes - the value is calculated as the equation of option 2 in Appendix 2: $NEX_{LT,y} = \frac{W_{site}}{W_{default}} * NEX_{IPCC\ default}$ While, NEX _{IPCC default} calculated as equation 30 of the 2019 Refinement to the 2006 IPCC, volume 4, chapter 10 NEX _{IPCC default} =N _{rate(T)} * TAM/1000*365
Correct value provided?	Yes
Has this value been verified?	Yes - the value is calculated as the equation of option 2 in Appendix 2 of methodology ACM0010 Version 08
Choice of data correctly justified?	Yes
Measurement method correctly described?	Yes –W _{default} , N _{rate(T)} and TAM are default value from 2019 Refinement to the 2006 IPCC.

	The measurement methods and procedures for W_{site} , please refer to the monitoring parameter W_{site}
Monitoring frequency correctly described?	Annually - verified as per the applied methodology
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	Yes – The parameter is calculated as the equation of option 2 in Appendix 2 of methodology ACM0010 Version 08 and the value of other parameter applied in the equation is taken from published sources (2006 IPCC). The value should be updated on latest available public data source. QA/QC procedure for W_{site} , please refer to the monitoring parameter W_{site}
Purpose of data?	BE, PE calculation

Type	Type of barn and AWMS
Title in line with Methodology?	Yes
Ex-ante Value	N/A
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- Type will be monitored by PP. The swine barn and AWMS layout and configuration are collected for check if the type changed.
Correct value provided?	Yes
Has this value been verified?	Yes - Due to the project has been approved by government, it will not be changed during the implementation periods, hence the Type of barn and AWMS will not be changed.
Choice of data correctly justified?	Yes
Measurement method correctly described?	Yes – The swine barn and AWMS layout and configuration are collected for check if the type changed.
Monitoring frequency correctly described?	Once for each monitoring period - verified as per the applied methodology
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	Yes – After the first verification, only changes in the type of barn and AWMS will be reported.
Purpose of data?	Confirm whether the implementation of project as design

T	Annual average ambient temperature at project site
Title in line with Methodology?	Yes
Ex-ante Value	13.2 °C
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Source clearly referenced? (appropriate?)	Yes- This parameter will be monitored monthly by checking the annual average ambient temperature at project site from public website monthly. The value used is 13.2 °C for ex-ante determination which is derived from public website/68/.
Correct value provided?	Yes
Has this value been verified?	Yes - This parameter will be monitored monthly by checking the annual average ambient temperature at project site from public website monthly.

Choice of data correctly justified?	Yes
Measurement method correctly described?	Yes –Data sourced from Official public information
Monitoring frequency correctly described?	Monthly- verified as per the applied methodology
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	Yes –The actual temperature during the monitoring period will be compared with the value of ex-ante estimated, i.e., 13.2 °C, and to be conservative, corresponding MCF _j with lower annual average ambient temperature as per Appendix 3 of ACM0010 (Version 08.0) will be used for calculation after comparing the actual value and the value of ex-ante estimated.
Purpose of data?	Used to select the annual MCF _j from 2019 Refinement to the 2006 IPCC Guidelines

3. Monitoring plan

The VVB has checked the monitoring plan of the Joint-PD-MR against the applied methodology.

The monitoring plan in the Joint-PD-MR has been designed to comply with the latest applicable version of the methodology (ACM0010 version 08.0).

The validation team evaluated the feasibility and sufficiency of the monitoring plan. The key components of the monitoring plan are as follows.

Monitoring framework:

The Joint-PD-MR contains a diagram illustrating the Organization Structure of the Monitoring Team to be implemented by the project owner in order to implement the project activity. The VCS monitoring team will be responsible for the monitoring of all the parameters to be monitored. And all the data will be reviewed by the project developer and VVB. The organizational structure is considered sufficient to fulfil the monitoring requirements of the methodology and to ensure that emission reductions can be verified.

Monitoring equipment and installation:

Measurement instruments are described in the monitoring plan as subject to appropriate national standards with respect to installation, accuracy and calibration interval. Main instruments flow meters, electricity meter, weight measurers, gas analyzers are used to monitor related parameters as assessed in the above tables of monitored parameters.

This equipment setup is considered sufficient to carry out the monitoring requirements of the methodology, and the appropriate national standards will be followed.

Principle of Monitoring:

Listed as above table for each monitored value and assessed by VVB.

Parameters to be monitored:

Listed as above tables and assessed by VVB accordingly.

Quality assurance and quality control procedures:

The Joint-PD-MR contains sufficient description on how quality will be controlled and assured in the monitoring of emission reductions.

Training:

Training will be provided to relevant personnel.

Data management:

All data collected as part of monitoring plan will be archived electronically on hard disks and be kept at least 2 years after the end of the last crediting period.

Corrective actions:

In case of nonconformities would be observed, a corrective action plan will be established and the whole VCS monitoring team will follow recognized standard data evaluation methods to guarantee that the data is reliable and accurate.

Sample Plan:

Sample plan is designed by PP for monitoring the parameter W_{site} which is confirmed in line with the requirement for this parameter monitoring in the applied methodology. The sample plan is designed according to the Standard of "Sampling and surveys for CDM project activities and programmes of activities (Version 09.0)"/43/.

The sample plan including the below designs,

- a. To ensure representativeness, each defined livestock population should be classified into a minimum of three age categories - *verified as in line with the applied methodology*
- b. For each defined livestock population, a minimum of one monthly sample per age category should be taken - *verified as in line with the applied methodology*
- c. PP will use 95/10 confidence/precision as the criteria for the reliability of sampling efforts - *verified as in line with the standard of "Sampling and surveys for CDM project activities and programmes of activities (Version 09.0)" and applied methodology*

Via site inspection and interview with chiefs of farms and PP, CTI confirmed that the monitoring activities of the W_{site} will be conducted in the three age groups of Nursery phase, Growing phase and Mature phase (Nursery phase with 30-60 days, Growing phase with 60-130 days and Mature phase with 130-180 days. The three age categories of breeding swine are classified according to the age in days, i.e. Nursery phase with 30-70 days, Growing phase with 70-220 days and Mature phase with 220-310 days) in the swine farm at least one monthly which is verified as in line with the above requirements.

Via checking the request of applied methodology, it stated "The PDD should describe the system of random sampling taking into account stratification of each livestock population into a minimum of three weight categories as described above". Via site inspection, it is confirmed that the swine farm including

both market swine and breeding swine in stock. Due to a swine farm have two types of swine, and as per applied methodology, each defined livestock population should be classified into a minimum of three age categories, so the sampling method is chosen as Stratified random sampling which is confirmed as applicable to the project situation.

Hence, based on this, PP designed the sampling method as Stratified random sampling in a swine farm and divide the swine from each into at least 3 age groups, which is verified by CTI as correct and reasonable and in line with the request of applied methodology/45/.

The method of calculation of sample size is checked by CTI, it is confirmed that the calculation process is in compliance with the Appendix 6 of the Guideline of the “Sampling and surveys for CDM project activities and programmes of activities (Version 04.0)”/44/ and PP will use 95/10 confidence/precision as the criteria for the reliability of sampling efforts which is confirmed in line with Standard of “Sampling and surveys for CDM project activities and programmes of activities (Version 09.0)”/43/.

The implementation of sample plan including monitoring, data recording and collection, QA/QC procedure, emergency procedure is stated by PP which is confirmed as actual and reasonable by site inspection and interview with the chief of farms and monitoring team. The one monthly monitoring activity of the samples will be completed in the swine farm during each monitoring periods. The monitoring forms will be filled out daily by the Breeders in the swine farm to record the animal weight of the samples. All the samples will be changed at the beginning of next monitoring periods which is confirmed as conservative and more representative.

CAR 10, CAR 11 and CAR 12 were raised and successfully closed. Refer to Appendix 4 for detail assessment.

3.5 Non-Permanence Risk Analysis

N/A

4 VERIFICATION FINDINGS

4.1 Accuracy of GHG Emission Reduction and Removal Calculations

1. Assessment of Data and parameters available at validation

Via checking the Joint-PD-MR/1/, it is confirmed that all the ex-ante data and parameters are same to the Joint-PD-MR which is verified as correct. Refer to section 3.4.8 for the detail assessment of ex-ante parameters.

2. Assessment of Data and parameters monitored

During the verification all relevant monitoring parameters (as listed in chapter 3.4.8 of this report) have been verified with regard to the

- (i) appropriateness of the applied measurement / determination method,
- (ii) the correctness of the values applied for ER calculation,
- (iii) the accuracy, and applied QA/QC measures.

The monitoring results as well as the verification procedure are described parameter-wise in the below tables,

<i>N_{AA,LT}</i>	<i>Daily stock of animals in the farm, discounting dead and discarded animals</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes –Number
Appropriate description?	Yes
Monitored Value?	Refer to ER sheet/2/
Correct value provided?	Yes
Source clearly referenced? (appropriate?)	Yes–Values of Monitoring parameter of <i>N_{AA,LT}</i> were derived from Daily Swine stock record issued by PP/17/ for this monitoring period.
Choice of data correctly justified?	Yes – The measuring and reporting frequency are in line with the monitoring plan and applied methodology/45/.
Measurement method and procedures correctly described?	Yes –This parameter is monitored daily through the auto tracking devices of electronic ear tag. Data were recorded by technicians in farm each day and sourced from the data logged in the swine farm which has been confirmed by site inspection and checking the Daily Swine stock record issued by PP/17/ of the farm. Via site inspection, it is confirmed that each pig involved in this project has a unique electronic ear tag when was born, which is an electronic device dedicated to the identification and electronic management of animals, can track automatically. This electronic ear tag can be connected to the Data Collection System (DCS), which can store and read information. Through this method, the daily stock number of animals from the first day of monitoring period can be recorded, and this record data including the new imported animal and discounting dead and discharge animals which can be traced and recorded by the technical staffs using DCS in the farm, so it is confirmed that the recorded dates are reasonable and reliable.

	The annual average number of animals ($N_{AA,LT}$) was calculated as an average of the daily stock of market and breeding swine in the farm without considering dead animals and discarded animals. Above mentioned evidences were provided to the verification team during site verification. Via comparing the data in Joint-PD-MR with the evidence, CTI verified that the data in Joint-PD-MR is correct.
Calculation method?	N/A
Monitoring frequency correctly described?	Monitored daily
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	N/A as the data from DCS
Purpose of data?	BE, PE and LE calculation
Comments?	-

W_{site}	<i>Average animal weight of a defined livestock population at the project site</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes – kg
Appropriate description?	Yes
Monitored Value?	Refer to values provided in ER sheet/2/
Correct value provided?	Yes
Source clearly referenced? (appropriate?)	Yes–Values of Monitoring parameter of W_{site} were derived from Weight records issued by PP/18/ for this monitoring period.
Choice of data correctly justified?	Yes – The measuring and reporting frequency are in line with the monitoring plan and applied methodology/45/.
Measurement method and procedures correctly described?	Yes – For monitoring this parameter, a sampling method has been used by PP following the applied methodology and JPM. Sample plan is designed for monitoring the parameter W_{site} which is confirmed in line with the requirement for this parameter monitoring in the applied methodology. The sample plan is designed according to the Standard of “Sampling and surveys for CDM project activities and programmes of activities (Version 09.0)”/43/. For this monitoring period, as per the sample plan in the JPM, below methods have been taken by PP to carry out the sampling, - To determine the total population - Calculate the overall sample size based on the actual population of pigs in stock firstly– the Swine daily stock record/17/ have been checked and the total population of pigs determined are verified as correct and actual; - To determine the sample size for farm - The project involved a swine farm (including market swine and breeding swine), then the sample size in the swine farm is adjusted based on the proportion of the number of the farm in the total number of a swine farm– the calculation sheet of sample size/19/ is checked as correct and actual; - To determine the sample size of each age group - The sample size of each age group of Market swine and Breeding swine in a farm is also calculated based on the proportion of the number of each age group of Market swine and Breeding swine to the total number of swine– the calculation sheet of sample size/19/ is checked as correct and actual; - To ensure representativeness, each defined livestock

	population has been classified into a minimum of three age categories including Nursery phase, Growing phase and Mature phase – the monthly records of animal weight of a defined livestock population of three age categories/18/ have been checked and the three age categories determined are verified as in line with the JPM and applied methodology e. After the sample size in each age group of Market swine and Breeding swine of the swine farm determined, the sample is conducted in the swine farm. Since swine in different age are kept in the different pig houses, samples can be randomly selected from pig houses of this age group – the samples choosing method is checked as correct and actual; f. For each defined livestock population, a minimum of one monthly sample per age category has been taken - the monthly records of animal weight of a defined livestock population of three age categories/18/ have been checked and one monthly sample per age category determined for each defined livestock population are verified as in line with the JPM and applied methodology g. If the same samples are taken the following month, then new samples will be taken, this will be done every month until the end of the monitoring period - the monthly records of animal weight of a defined livestock population of three age categories/18/ have been checked and confirmed that the samples are not same for each month. PP uses 95/10 confidence/precision as the criteria for the reliability of sampling efforts - verified as in line with the standard of “Sampling and surveys for CDM project activities and programmes of activities (Version 09.0)” and applied methodology Via site inspection and interview with chiefs of farm, CTI confirmed that the monitoring activities of the W_{site} have been conducted in the three age groups of Nursery phase, Growing phase and Mature phase in the swine farm at least one monthly which is verified as in line with the above requirements and the 95/10 confidence/precision is confirmed as used by PP as the criteria for the reliability of sampling efforts. The one monthly monitoring activity of the samples have been completed in the swine farm during this monitoring period. The monitoring forms have been filled out by the Breeders in the swine farm to record the animal weight of the samples/18/. The implementation of sampling method and process including monitoring, data recording and collection, QA/QC procedure, emergency procedure is stated by PP which is confirmed as actual and reasonable by site inspection and interview with the chief of farms and monitoring team. Via checking the sampling method by reviewing the Weight records issued by PP/18/ and interview with technicians as stated in the MR, CTI verified that the sampling and recording method is in line with the monitoring plan and applied methodology/45/. Above mentioned evidences were provided to the verification team during site verification. Via comparing the data in MR with the evidence, CTI verified that the data in MR is correct.
Calculation method?	N/A

Monitoring frequency correctly described?	Monitored monthly		
Monitoring equipment correctly described?	Two weight measurers installed at swine farm Type: SCS-2t Accuracy: III level The calibration information and validity is listed as below table		
	Serial No.	Calibrated Date	Validity
	202004035	28-January-2021	27-January-2022
	202004037	25-January-2022	24-January-2023
QA/QC procedure correctly described?	Yes - The above calibration information has been confirmed by checking the calibration reports/15/ which has been conducted by qualified parties/16/ in compliance with JJG539-2016 “Verification Regulation of Digital Indicating Weighting Instruments” in China/38/.		
Purpose of data?	Used for estimating VS _{LT,y}		
Comments?	-		

F_{Aer}	<i>Fraction of volatile solids directed to aerobic treatment</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes – Fraction
Appropriate description?	Yes
Monitored Value?	100%
Correct value provided?	Yes
Source clearly referenced? (appropriate?)	Yes– the value of F_{Aer} is applied as 100%, which is conservative.
Choice of data correctly justified?	Yes – the measuring and reporting frequency are in line with the monitoring plan and applied methodology/45/.
Measurement method and procedures correctly described?	Yes –During this monitoring period, there is no equip install in the project activity to monitor the influent into anaerobic digestion and aerobic system, therefore the value of F_{Aer} is applied as 100%, which is conservative.
Calculation method?	N/A
Monitoring frequency correctly described?	Annually
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	N/A
Purpose of data?	PE calculation
Comments?	N/A

n_{dy}	<i>Number of days treatment plant was operational in year y</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes – number
Appropriate description?	Yes
Monitored Value?	483 days
Correct value provided?	Yes
Source clearly referenced? (appropriate?)	Yes–Monitoring parameter of n_{dy} was derived from Daily operation record of the treatment plant/22/.
Choice of data correctly justified?	Yes – the measuring and reporting frequency are in line with the monitoring plan and applied methodology/45/.

Measurement method and procedures correctly described?	Yes –PP record the actual number of days of the treatment plant that was operational daily. Finally, the Daily operation record of the treatment plant during this monitoring period were summarized by all the daily record. Via checking the Daily operation record of the treatment plant/22/ and interview with monitoring staff and PP, CTI verified that the method is in line with the monitoring plan and applied methodology/45/.
Calculation method?	N/A
Monitoring frequency correctly described?	Measured Daily
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	Yes - Daily operation record of the treatment plant/22/ is cross-checked with the production record from DCS system/17/, CTI verified that the treatment plant was operational in 483 days during this monitoring period.
Purpose of data?	BE calculation
Comments?	-

v_f	Biogas flow
Title in line with Methodology?	Yes
Data unit correctly expressed?	m ³
Appropriate description?	Yes
Monitored Value?	Refer to Joint-PD-MR
Correct value provided?	Yes
Source clearly referenced? (appropriate?)	Yes–Monitoring parameter of v_f was derived from Daily operation record/22/ saved automatically in the Data Collection System (DCS).
Choice of data correctly justified?	Yes
Measurement method and procedures correctly described?	Yes –The biogas flow data were measured by the flow meters installed at the treatment plant (total 3 flow meter 1,2,3), flow meter 1 are installed at outlet of the anaerobic digestion, flow meter 2 are installed at the inlet of biogas power boiler and flow meter 3 are installed at the inlet of flare system which have been verified as correct and actual by site inspection. The flowmeters monitored data continuously, record hourly and saved automatically in the Data Collection System (DCS). The data can be obtained from Data Collection System (DCS) and the monthly data was exported by the staff at the beginning of next month and then recorded in daily operation record, then summarized as the monthly biogas production, biogas flow to the power boiler and biogas flow to flare system is the sum of the daily output. Via checking the measuring method by reviewing the Daily operation record/19/ and interview with monitoring staff, CTI verified that the method is in line with the applied methodology.
Calculation method?	N/A
Monitoring frequency correctly described?	Continuously by flow meters and reported cumulatively on weekly basis
Monitoring equipment correctly described?	1 flow meter 1,2,3 installed Total 3 flow meters Type: FCTMF-DN80 Accuracy: 1.5 level

	For each flow meter, the calibration information and validity is listed as below table			
	Flow meter	Serial No.	Calibrated Date	Validity
	1	202006006	26-January-2021	25-January-2023
	2	202006008		
	3	202006012		
QA/QC procedure correctly described?	Yes - The above calibration information has been confirmed by checking the calibration reports/15/ which has been conducted by qualified parties/16/. Via checking the calibration reports/15/, CTI confirmed that all the flow meters are calibrated based on JJG1029-2007-Verification Regulation of Vortex-shedding Flowmeter/36/. And based on the validity as above table, CTI confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period.			
Purpose of data?	PE and LE calculation			
Comments?	For this monitoring period, all the biogas produced is used for heat generation. no surplus biogas for the flaring system.			

EC _{PJJ,y}	Quantity of electricity consumed by the proposed project in year y								
Title in line with Methodology?	Yes								
Data unit correctly expressed?	MWh								
Appropriate description?	Yes								
Monitored Value?	5,079.3								
Correct value provided?	Yes								
Source clearly referenced? (appropriate?)	Yes– Value derived from Monthly report of electricity/23/								
Choice of data correctly justified?	Yes - the measuring and reporting frequency are in line with the monitoring plan and applied methodology/45/.								
Measurement method and procedures correctly described?	Yes –The electricity consumptions were measured by the electricity meter 1 installed at the treatment plant. Monitoring staff read the readings of electricity daily and recorded meter reading data into Monthly report of electricity/23/ which includes the electricity consumption of the treatment plant daily, and then the electricity consumption is calculated for each month. Via checking the measuring method by reviewing the Monthly report of electricity/23/ and interview with monitoring staff, CTI verified that the method is in line with the monitoring plan and applied tool/47/.								
Calculation method?	N/A								
Monitoring frequency correctly described?	Continuous measurement and daily recording								
Monitoring equipment correctly described?	An electricity meter installed at treatment plant Type: YPD760E-9SY Accuracy: 0.5 For electricity meter, the calibration information and validity is listed as below table <table><tr><th>Serial No.</th><th>Calibrated Date</th><th>Validity</th></tr><tr><td>20201019002</td><td>13-January-2021</td><td>12-January-2026</td></tr></table>			Serial No.	Calibrated Date	Validity	20201019002	13-January-2021	12-January-2026
Serial No.	Calibrated Date	Validity							
20201019002	13-January-2021	12-January-2026							
QA/QC procedure correctly described?	Yes – The above calibration information has been confirmed by checking the calibration reports/15/ which has been conducted by qualified parties/16/.								

	Via checking the calibration reports/15/, CTI confirmed that all the electricity meter are calibrated based on JJG 596-2012 Electrical Meters for Measuring Alternating-current Electrical Energy/35/. And based on this regulation, if the electricity meter can be used normally, recalibration is not required. The validity is five years. And based on the validity as above table, CTI confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period. The electricity data is cross-checked with Grid Company Electricity Statement/24/ and the data are verified as consistent.
Purpose of data?	PE calculation
Comments?	During this monitoring period, the electricity consumed by the project came from the electricity sourced from the grid company.

$TDL_{j,y}$	<i>Average technical transmission and distribution losses for providing electricity to source j in year y</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	%
Appropriate description?	Yes
Monitored Value?	20
Correct value provided?	Yes
Source clearly referenced? (appropriate?)	Yes- Value is derived from Tool 05 "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0)/47/
Choice of data correctly justified?	Yes - the measuring and reporting frequency are in line with the monitoring plan and applied tool/47/
Measurement method and procedures correctly described?	Yes -As per the tool of Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)/47/, CTI confirmed that different values applied to different scenarios. For the project, the electricity consumption was derived from the power grid. Hence, scenario A: Electricity consumption from the grid is applied to this situation. For this situation, a default value of 20% is used for $TDL_{j,y}$ in line with the tool/47/ and it is confirmed that this value is the maximum value as per Methodology tool 05 Version 03.0 and conservative. Via checking the Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 03.0)/47/, CTI confirmed that the data in MR is correct.
Calculation method?	N/A
Monitoring frequency correctly described?	Changed once the tool is updated.
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	N/A, as the value is derived from tool.
Purpose of data?	PE calculation
Comments?	-

$V_{t,db}$	<i>Volumetric flow of the gaseous stream in time interval t on a dry basis</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	m ³ dry gas/h
Appropriate description?	Yes

Monitored Value?	Refer to values in ER sheet/2/
Correct value provided?	Yes
Source clearly referenced? (appropriate?)	Yes– Value is derived from Daily operation record/22/ saved automatically in the Data Collection System (DCS)
Choice of data correctly justified?	Yes - the measuring and reporting frequency are in line with the monitoring plan and applied methodology/45/.
Measurement method and procedures correctly described?	Yes – The volumetric flow of the gaseous stream data was measured by the flow meters installed at the treatment plant (flow meter 1,3), flow meter 1 are installed at outlet of the anaerobic digestion and flow meter 3 are installed at the inlet of flare system which have been verified as correct and actual by site inspection. The flowmeters monitored data continuously, record hourly and saved automatically in the Data Collection System (DCS). CTI confirmed that the measurement method is actual and the gaseous stream is defined as dry according to the Tool 8:” Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0)”/49/. Hence the monitoring parameter $V_{t,db}$ does not need to be calculated based on the wet basis flow plus water concentration. The data can be obtained from Data Collection System (DCS) and the monthly data was exported by the staff at the beginning of next month and then recorded in daily operation record. Daily biogas flow is equal to the cumulative value of 24 hours, and monthly biogas flow can be accumulated on daily basis. Via checking the measuring method by reviewing the Daily operation record/22/ and interview with monitoring staff, CTI verified that the method is in line with the tool and applied methodology.
Calculation method?	N/A
Monitoring frequency correctly described?	Continuously measurement
Monitoring equipment correctly described?	Refer to information for 18 flow meters (1,3) above
QA/QC procedure correctly described?	Yes - The above calibration information has been confirmed by checking the calibration reports/15/ which has been conducted by qualified parties/16/. Via checking the calibration reports/15/, CTI confirmed that all the flow meters are calibrated based on JJG1029-2007-Verification Regulation of Vortex-shedding Flowmeter/36/. And based on the validity as above table, CTI confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period.
Purpose of data?	PE calculation
Comments?	-

$V_{i,t,db}$	<i>Volumetric fraction of greenhouse gas i in a time interval t on a dry basis</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	m^3 gas i / m^3 dry gas
Appropriate description?	Yes
Monitored Value?	Refer to values in ER sheet/2/
Correct value provided?	Yes
Source clearly referenced? (appropriate?)	Yes– Value is derived from Daily operation record/22/.

Choice of data correctly justified?	Yes - the measuring and reporting frequency are in line with the monitoring plan and applied methodology/45/.								
Measurement method and procedures correctly described?	Yes –The data are measured continuously and record hourly by online gas analyser installed at the outlet of the anaerobic digester and saved automatically in the DCS. The data can be obtained from DCS and the monthly data was exported by the staff at the beginning of next month. Daily and Monthly CH4 concentration was calculated based on the 24-hour average and daily average CH4 concentration and recorded finally in the Daily operation record/22/. Via checking the measuring method by reviewing the Daily operation record/22/ as stated in the MR and interview with monitoring staff, CTI verified that the method is in line with the applied methodology.								
Calculation method?	N/A								
Monitoring frequency correctly described?	Continuous measurement								
Monitoring equipment correctly described?	Gas analyzer installed at treatment plant Type: Gasboard-9060 Accuracy: ±1% The calibration information and validity is listed as below table <table><tr><th>Serial No.</th><th>Calibrated Date</th><th>Validity</th></tr><tr><td>2020175</td><td>19-January-2021 15-January-2022</td><td>18-January-2022 14-January-2023</td></tr></table>			Serial No.	Calibrated Date	Validity	2020175	19-January-2021 15-January-2022	18-January-2022 14-January-2023
Serial No.	Calibrated Date	Validity							
2020175	19-January-2021 15-January-2022	18-January-2022 14-January-2023							
QA/QC procedure correctly described?	Yes - The above calibration information has been confirmed by checking the calibration reports/15/ which has been conducted by qualified parties/16/. Via checking the calibration reports/15/, CTI confirmed that all the gas analyzers are calibrated based on JJG693-2011 (Verification Regulation of Alarmer Detectors of Combustible Gas)/37/. And based on this regulation, the validity is one year. Calibration should include zero verification with an inert gas (e.g. N2) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). And the zero verification with an inert gas (N2) and one reading verification with a standard gas (single calibration gas) are implemented in the process of calibration, which is confirmed as in accordance with JJG693-2011/37/. All calibration gases are confirmed as from Nanjing Changyuan Industrial Gas Co. Ltd, which is a qualified reference materials manufacturer issued by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China on 06-September-2017/16/. And based on the validity as above table, CTI confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period.								
Purpose of data?	PE calculation								
Comments?	-								

T_t	<i>Temperature of the gaseous stream in time interval t</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	K
Appropriate description?	Yes
Monitored Value?	Refer to values in ER sheet/2/
Correct value provided?	Yes

Source clearly referenced? (appropriate?)	Yes- Value is derived from Daily operation record/22/.
Choice of data correctly justified?	Yes - the measuring and reporting frequency are in line with the monitoring plan and applied methodology/45/.
Measurement method and procedures correctly described?	Yes - The temperature of the gaseous stream data was measured by the flow meters installed at the treatment plant (flow meter 1,2,3), flow meter 1 are installed at outlet of the anaerobic digestion, flow meter 2 are installed at the inlet of biogas boiler and flow meter 3 are installed at the inlet of flare system, and record hourly and saved automatically in the DCS system. which have been verified as correct and actual by site inspection. Via site inspection and checking the manufacture specification of the flow meter/26/, it is confirmed that the flow meter has the function to measure the temperature with recordable electronic signal (digital). The data are monitored continuously, record hourly and saved automatically in the DCS. The data for this monitoring period have been obtained from DCS and the monthly data was exported by the staff at the beginning of next month. Daily and Monthly temperature was calculated based on the 24-hour average and daily average temperature. The readout of flowmeter was indicated degrees Celsius(°C). Therefore, the temperature $T_t(K)$ is calculated as the equation $T(K)=t(^{\circ}C)+273.15$ Via checking the measuring method by reviewing the Daily operation record/22/ as stated in the MR and interview with monitoring staff, CTI verified that the method is in line with the applied methodology.
Calculation method?	N/A
Monitoring frequency correctly described?	Continuously measurement
Monitoring equipment correctly described?	Refer to information for 3 flow meters above
QA/QC procedure correctly described?	Yes - The above calibration information has been confirmed by checking the calibration reports/15/ which has been conducted by qualified parties/16/. Via checking the calibration reports/15/, CTI confirmed that all the flow meters are calibrated based on JJG1029-2007-Verification Regulation of Vortex-shedding Flowmeter/36/. And based on the validity as above table, CTI confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period.
Purpose of data?	PE calculation
Comments?	-

P_t	<i>Pressure of the gaseous stream in time interval t</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Pa
Appropriate description?	Yes
Monitored Value?	Refer to values in ER sheet/2/
Correct value provided?	Yes
Source clearly referenced? (appropriate?)	Yes- Value is derived from Daily operation record/22/.

Choice of data correctly justified?	Yes - the measuring and reporting frequency are in line with the monitoring plan and applied methodology/45/.
Measurement method and procedures correctly described?	Yes – The pressure of the gaseous stream data was measured by the flow meters installed at the treatment plant (total 3 flow meter 1,2,3), flow meter 1 are installed at outlet of the anaerobic digestion, flow meter 2 are installed at the inlet of biogas boiler and flow meter 3 are installed at the inlet of flare system, and record hourly and saved automatically in the DCS system which have been verified as correct and actual by site inspection. Via site inspection and checking the manufacture specification of the flow meter/26/, it is confirmed that the flow meter has the function to measure the pressure with recordable electronic signal (digital). The data are monitored continuously, record hourly and saved automatically in the DCS. The data for this monitoring period have been obtained from DCS and the monthly data was exported by the staff at the beginning of next month. Daily and Monthly pressure was calculated based on the 24-hour average and daily average pressure. Via checking the measuring method by reviewing the Daily operation record/22/ as stated in the MR and interview with monitoring staff, CTI verified that the method is in line with the applied methodology.
Calculation method?	N/A
Monitoring frequency correctly described?	Continuously measurement
Monitoring equipment correctly described?	Refer to information for 3 flow meters above
QA/QC procedure correctly described?	Yes - The above calibration information has been confirmed by checking the calibration reports/15/ which has been conducted by qualified parties/16/. Via checking the calibration reports/15/, CTI confirmed that all the flow meters are calibrated based on JJG1029-2007-Verification Regulation of Vortex-shedding Flowmeter/36/. And based on the validity as above table, CTI confirmed that the installed monitoring equipment has been duly calibrated for this entire monitoring period.
Purpose of data?	PE calculation
Comments?	-

p_{it}	Density of greenhouse gas i in the gaseous stream in time interval t
Title in line with Methodology?	Yes
Data unit correctly expressed?	kg gas i /m ³ gas i
Appropriate description?	Yes
Monitored Value?	Refer to values in ER sheet/2/
Correct value provided?	Yes
Source clearly referenced? (appropriate?)	Yes– Calculated based on temperature of the gaseous stream in time interval t and pressure of the gaseous stream in time interval t .
Choice of data correctly justified?	Yes - the calculation methods are in line with the monitoring plan and applied methodology/45/.
Measurement method and procedures correctly described?	Yes –Calculated based on temperature of the gaseous stream in time interval t and pressure of the gaseous stream in time interval t. The monitoring result of Pressure and temperature are listed in the above two tables.
Calculation method?	Calculated based on temperature of the gaseous stream in time interval t and pressure of the gaseous stream in time interval t .

Monitoring frequency correctly described?	N/A
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	N/A
Purpose of data?	PE calculation
Comments?	-

MS_j	Fraction of manure handled in system j in project activity
Title in line with Methodology?	Yes
Data unit correctly expressed?	Fraction
Appropriate description?	Yes
Monitored Value?	100%
Correct value provided?	Yes
Source clearly referenced? (appropriate?)	Yes–As no monitoring was conducted in the project activity to monitor the fraction of manure handled, hence using 100% as conservative.
Choice of data correctly justified?	Yes
Measurement method and procedures correctly described?	Yes –As this parameter is not monitored during this monitoring period. so, to be conservative, the value of this parameter in the emission reduction calculation is 100%. All the manure flew into AWMS to be treated; no any manure will be discharged outside. Therefore, the value of this parameter is 100%
Calculation method?	N/A
Monitoring frequency correctly described?	Annually
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	N/A
Purpose of data?	PE calculation
Comments?	-

B_{0,LT}	Maximum methane producing potential of the volatile solid generated by animal type LT
Title in line with Methodology?	Yes
Data unit correctly expressed?	m ³ CH ₄ /kg -dm
Appropriate description?	Yes
Monitored Value?	B _{0, LT} =0.45
Correct value provided?	Yes
Source clearly referenced? (appropriate?)	Yes– Value is derived from Table 10.16 of 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories volume 4, chapter10/39/
Choice of data correctly justified?	Yes - the measuring and reporting frequency are in line with the monitoring plan and applied methodology/45/.
Measurement method and procedures correctly described?	Yes –As no monitoring was conducted in the project activity to monitor the value, so, 0.45 m ³ CH ₄ /kg -dm is still applied. The actual methane producing potential of the volatile solid generated by swine manure is 479.4ml/g VS via checking the public literature/69/, which is higher than JPM value, therefore 0.45 m ³ CH ₄ /kg -dm applied in monitoring period is conservative.
Calculation method?	N/A

Monitoring frequency correctly described?	Annually
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	Yes – The values will be updated based on latest available data from IPCC
Purpose of data?	BE, PE calculation
Comments?	-

$NEX_{LT,y}$	<i>Annual average nitrogen excretion per head of a defined livestock population estimated as described in Appendix 2</i>
Title in line with Methodology?	Yes
Data unit correctly expressed?	Yes
Appropriate description?	Yes
Monitored Value?	Refer to values in ER sheet/2/
Correct value provided?	Yes
Source clearly referenced? (appropriate?)	Yes–the value is calculated as the equation of option 2 in Appendix 2: $NEX_{LT,y} = \frac{W_{site}}{W_{default}} * NEX_{IPCC\ default}$ While, $NEX_{IPCC\ default}$ calculated as equation 30 of the 2019 Refinement to the 2006 IPCC, volume 4, chapter 10 $NEX_{IPCC\ default} = N_{rate(T)} * TAM / 1000 * 365$
Choice of data correctly justified?	Yes - the calculation is in line with the monitoring plan and applied methodology/45/.
Measurement method and procedures correctly described?	Yes – $W_{default}$, $N_{rate(T)}$ and TAM are default value from 2019 Refinement to the 2006 IPCC. The measurement methods and procedures for W_{site} , please refer to the monitoring parameter W_{site}
Calculation method?	$NEX_{LT,y} = \frac{W_{site}}{W_{default}} * NEX_{IPCC\ default}$
Monitoring frequency correctly described?	Annually - verified as per the applied methodology
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	Yes - The parameter is calculated as the equation of option 2 in Appendix 2 of methodology ACM0010 Version 08 and the value of other parameter applied in the equation is taken from published sources (2019 Refinement to the 2006 IPCC). The value should be updated on latest available public data source. QA/QC procedure for W_{site} , please refer to the monitoring parameter W_{site}
Purpose of data?	BE, PE calculation
Comments?	-

Type	Type of barn and AWMS
Title in line with Methodology?	Yes
Data unit correctly expressed?	-
Appropriate description?	Yes
Monitored Value?	-
Correct value provided?	Yes
Source clearly referenced? (appropriate?)	Yes– Value is derived from layout and configuration are collected to confirm whether the implementation of project as design

Choice of data correctly justified?	Yes - the measuring and reporting frequency are in line with the monitoring plan and applied methodology/45/.
Measurement method and procedures correctly described?	Yes -This monitoring is the first monitoring period and in this monitoring period, the swine barn and AWMS layout and configuration/27/ are consistent with the design which is approved by the official government/7/.
Calculation method?	N/A
Monitoring frequency correctly described?	After the first verification, only changes in the type of barn and AWMS will be reported.
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	Yes - Due to the project has been approved by government, it will not be changed during the implementation periods, hence the Type of barn and AWMS will not be changed, hence type will not be monitored due to all the other parameters monitored can determine if the project type has been changed or not.
Purpose of data?	BE calculation
Comments?	-

T	Annual average ambient temperature at project site
Title in line with Methodology?	Yes
Data unit correctly expressed?	°C
Appropriate description?	Yes
Monitored Value?	2021: 13.6 2022: 13.2
Correct value provided?	Yes
Source clearly referenced? (appropriate?)	Yes- Value is derived from Shandong provincial weather public website/70/.
Choice of data correctly justified?	Yes - the measuring and reporting frequency are in line with the monitoring plan and applied methodology/45/.
Measurement method and procedures correctly described?	Yes -This parameter monitored monthly by checking the annual average ambient temperature at project site from public website monthly. The parameter value should be updated upon the changes occur in the monitoring period.
Calculation method?	N/A
Monitoring frequency correctly described?	Annually
Monitoring equipment correctly described?	N/A
QA/QC procedure correctly described?	Yes - Cross-Check with the value of ex-ante estimated, i.e., 13.2°C. After compared the actual temperature in 2021, 2022 and the temperature of ex-ante estimated, it can be determined that the project site has >10°C mean annual temperature during the 1 st monitoring period Via comparing with the ex-ante value, CTI confirmed that MCF _j of 68.62% is applied in this monitoring period consistent with the value for ex-ante calculation.
Purpose of data?	Used to determine the climate zones of the project site and then select the annual MCF _j from 2019 Refinement to the 2006 IPCC Guidelines
Comments?	-

CAR 13 and CAR 14 were raised and successfully closed. Refer to Appendix 4 for detail assessment.

3. Assessment of GHG emission reductions Quantity

Calculation of baseline GHG emissions or removals

According to the methodology and above all the formulars listed in section 3.4.6, baseline emissions are calculated using the following formula:

$$BE_y = BE_{CH_4,y} + BE_{N_2O,y}$$

The values monitored during monitoring survey are transparently shown in the Section 6.1 of Joint-PD-MR. During onsite, CTI cross-checked these values in detail using various supporting records and documents. Refer to the above section 3.4.8 of this report for ex-ante and above section 4.1 for ex-post parameters' assessment.

The Baseline Emissions during this monitoring period is summarized as below,

Date	$BE_{CH_4,y}$ (tCO _{2e} /yr)	$BE_{N_2O,y}$ (tCO _{2e} /yr)	BE_y (tCO _{2e} /yr)
05-March-2021~31-December-2021	96,628	4,836	101,464
01-January-2022~30-June-2022	57,914	2,899	60,813
05-March-2021~30-June-2022	154,542	7,735	162,277

In conclusion, the calculations of baseline GHG emissions have been carried out in accordance with the formulae and methods described in the registered monitoring plan, the applied methodology and, where applicable, the applied standardized baseline. Any assumptions used in emission calculations have been justified. Appropriate emission factors, GWP and other reference values have been correctly applied. No errors, miscalculations, omissions, misstatements or incomplete information has been identified. It can be confirmed that the baseline calculation is overall correct.

Calculation of project GHG emissions or actual net GHG removals by sinks

According to the methodology, the project emissions are calculated using the following formula:

$$PE_y = PE_{AD,y} + PE_{Aer,y} + PE_{N_2O,y}$$

$$PE_{AD,y} = PE_{EC,y} + PE_{CH_4,y}$$

The values monitored during monitoring survey are transparently shown in the Section 6.1 of Joint-PD-MR. During onsite, CTI cross-checked these values in detail using various supporting records and documents. Refer to the above section 3.4.8 of this report for ex-ante and above section 4.1 for ex-post parameters' assessment.

So $PE_{AD,y}$ during this monitoring period is calculated as below table

Date	$PE_{EC,y}$ (tCO _{2e})	$PE_{CH_4,y}$ (tCO _{2e})	$PE_{flare,y}$ (tCO _{2e})	$PE_{AD,y}$ (tCO _{2e})
05-March-2021~31-December-2021	2,705	5,931	0	8,636
01-January-2022~30-June-2022	1,634	3,620	0	5,254
05-March-2021~30-June-2022	4,339	9,551	0	13,890

So Project Emissions during this monitoring period is calculated as below table

Date	PE _{AD,y} (tCO _{2e})	PE _{Aer,y} (tCO _{2e})	PE _{N20,y} (tCO _{2e})	PE _y (tCO _{2e})
05-March-2021~31-December-2021	8,636	23	18,999	27,658
01-January-2022~30-June-2022	5,254	14	11,387	16,655
05-March-2021~30-June-2022	13,890	37	30,386	44,313

In conclusion, the calculations of project GHG emissions have been carried out in accordance with the formulae and methods described in the registered monitoring plan, the applied methodology and, where applicable, the applied standardized project. Any assumptions used in emission calculations have been justified. Appropriate emission factors, GWP and other reference values have been correctly applied. No errors, miscalculations, omissions, misstatements or incomplete information has been identified. It can be confirmed that the project calculation is overall correct.

Calculation of leakage GHG emissions

According to the methodology, the leakage emissions are calculated using the following formula:

$$LE_y = (LE_{PJ,N20,y} - LE_{BL,N20,y}) + (LE_{PJ,CH4,y} - LE_{BL,CH4,y})$$

The values monitored during monitoring survey are transparently shown in the Section 6.1 of Joint-PD-MR. During onsite, CTI cross-checked these values in detail using various supporting records and documents. Refer to the above section 3.4.8 of this report for ex-ante and above section 4.1 for ex-post parameters' assessment.

So Leakage Emissions during this monitoring period is calculated as below table

Date	LE _{PJ,CH4,y} (tCO _{2e})	LE _{BL,CH4,y} (tCO _{2e})	LE _{BL,N20,y} (tCO _{2e})	LE _{PJ,N20,y} (tCO _{2e})	LE _y (tCO _{2e} /yr)
05-March-2021~31-December-2021	22,531	23,298	1,855	6,609	3,987
01-January-2022~30-June-2022	13,504	12,659	1,111	3,961	3,695
05-March-2021~30-June-2022	36,035	35,957	2,966	10,570	7,682

In conclusion, the calculations of leakage GHG emissions have been carried out in accordance with the formulae and methods described in the registered monitoring plan, the applied methodology and, where applicable, the applied standardized project. Any assumptions used in emission calculations have been justified. Appropriate emission factors, GWP and other reference values have been correctly applied. No errors, miscalculations, omissions, misstatements or incomplete information has been identified. It can be confirmed that the project calculation is overall correct.

Summary of calculation of GHG emission reductions or net anthropogenic GHG removals by sinks

The VVB has checked the Joint-PD-MR includes a summary table of the emission reductions calculation.

Summary of emission reductions during the monitoring period,

$$ER_y = BE_y - PE_y - LE_y$$

Furthermore, as per the applied methodology, if the actual methane captured from anaerobic digester in project activity is lower than $(BE_{CH_4,y} - PE_{AD,y})$, then $(BE_{CH_4,y} - PE_{AD,y})$ is replaced by actual methane captured $Q_{CH_4,y}$.

Biogas captured during monitoring period is 15,570,408.40 m³, which equals to 110,282 tCO_{2e}. Baseline methane emission ($BE_{CH_4,y}$) is 154,542 tCO_{2e}. The project emissions associated with anaerobic digester is ($PE_{AD,y}$) is 13,890 tCO_{2e}. Actual methane captured from anaerobic digester is higher than the difference of $BE_{CH_4,y}$ and $PE_{AD,y}$ (140,652 tCO_{2e} = 154,542 tCO_{2e} - 13,890 tCO_{2e}). Therefore, the equation $(BE_{CH_4,y} - PE_{AD,y})$ can be used to calculate emission reduction.

Hence, the emission reductions during this monitoring period from 2021 to 2022 are summarized in the table below

Parameters Period	Baseline Emissions BE_y	Project Emissions PE_y	Leakage Emissions LE_y	Net GHG emission reductions or removals ER
	(tCO _{2e})	(tCO _{2e})	(tCO _{2e})	(tCO _{2e})
05-March-2021~31-December-2021	101,464	27,658	3,987	69,819
01-January-2022~30-June-2022	60,813	16,655	3,695	40,463
05-March-2021~30-June-2022	162,277	44,313	7,682	110,282

All the figures as per the monitoring report were cross-checked by the VVB against basic monitored data. Refer to section 4.4.1 and 4.4.2 of this report for assessment details.

CAR 15 was raised and successfully closed. Refer to Appendix 4 for detail assessment.

4.2 Quality of Evidence to Determine GHG Emission Reductions and Removals

Refer to section 4.1 above for the detail assessment of each monitoring parameters and Appendix 3 for the supporting evidence used to determine the GHG emission reductions.

For each reported data, the evidence is provided and verified as sufficient and quality is appropriate. Also, the cross-checks have been performed on the reported data with different source of evidence. The information flow from data generation and aggregation, to recording, calculation and final transposition into the monitoring report has been assessed by VVB in section 4.1 for each parameter and also the calibration have been conducted as per the frequency of monitoring equipment defined in the JPM

Therefore, it is concluded that the evidence provided are verified as sufficient and quality is appropriate and thus the evidence can be used to determine the GHG emission reductions and removals for this monitoring period.

5 VALIDATION AND VERIFICATION CONCLUSION

Search CO2(Shanghai) Environmental Science & Technology Co., Ltd. has commissioned the CTI to carry out the Verified Carbon Standard (VCS) joint validation and 1st periodic verification of the project activity Yantai Xinhao Swine Farm Manure Management System GHG Mitigation Project (VCS ID 3164), for the monitoring period from 05-March-2021 to 30-June-2022, with regard to the relevant requirements for VCS Standard Version 4.4.

Based on the reviewing the documented evidence and by an on-site assessment, CTI can confirm that:

- the baseline scenario is correctly defined as per the applied methodology and relate tools;
- the project is additional;
- all data and information used for ex-ante calculation of emission reductions is of projected and/or hypothetical nature;
- the monitoring plan in the validated Joint-PD-MR is as per the applied baseline and monitoring methodology.
- the project has been implemented and operated as per the VCS Joint-PD-MR;
- the project complies with the validation and verification criteria for projects set out in VCS Standard Version 4.4;
- the monitoring report and other supporting documents provided are complete and verifiable and in accordance with the applicable VCS requirement and ACM0010 (version 08.0);
- the monitoring is in place as per the applied baseline and monitoring methodology ACM0010 (version 08.0);
- the monitoring complies with the monitoring plan in the validated PD;

It is certified that the GHG emission reductions from the project during the monitoring period amount as follows:

Verification period: From 05-March-2021 to 30-June-2022

Verified GHG emission reductions and removals in the above verification period by vintage is

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
05-March-2021~31-December-2021	101,464	27,658	3,987	69,819
01-January-2022~30-June-2022	60,813	16,655	3,695	40,463
05-March-2021~30-June-2022	162,277	44,313	7,682	110,282

The comparison between the ex-ante emissions reductions/removals and achieved emissions reductions/removals during this monitoring period is provided as below,

Year	Ex-ante emissions reductions/removals	Achieved emissions reductions/removals	Percent difference	Justification for the difference
05-March-2021~31-December-2021	83,944	69,819	-16.8%	The mainly difference between the ex-ante estimated value and actual value is due to the changes of the number of animals in the swine farm (N _{LT}), the average animal weight (W _{site}) and the amount of biogas generation and utilized during the anaerobic treatment.
01-January-2022~30-June-2022	45,627	40,463	-11.3%	
Total	129,571	110,282	-14.9%	

Li Ziqi

Li Ziqi

CTI

Verification Team Leader

26-July-2023

Wu Lin

Lin Wu

CTI

Technical Reviewer

26-July-2023

APPENDIX 1: ABBREVIATIONS

Abbreviations	Full texts
AWMS	Animal Waste Management System
BE	Baseline Emission
CAR	Corrective Action Request
CCER	China Certified Emission Reduction
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CL	Clarification Request
CO ₂	Carbon dioxide
CP	Crediting Period
DNA	Designated National Authority
EB	Executive Board
EIA	Environmental Impact Assessment
ER	Emission Reduction
ETS	Emission Trading Scheme
FAR	Forward Action Request
PER	Project Evaluation Report
GHG	Green House Gas
GS	Gold Standard
GSC/GSP	Global Stakeholder Consultation Process
IPCC	Intergovernmental Panel on Climate Change
JPM	Joint-PD-MR
KP	Kyoto Protocol
LSC	Local Stakeholder Consultation
MoV	Means of Validation
MP	Monitoring Plan
ODA	Official Development Assistance
PA	Project Activity
PE	Project Emission
PP	Project Participant
PS	Project Standard
QC/QA	Quality control/Quality assurance
NCPG	North China Power Grid
SD	Sustainable Development
SDG	Sustainable Development Goals
tCO ₂ e	Tonnes of Carbon di oxide equivalent
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Validation and Verification Standard
VCS	Verified Carbon Standard
VCSA	Verified Carbon Standard Association
VCU	Verified Carbon Unit
VVB	Validation/Verification Body

APPENDIX 2: COMPETENCE OF TEAM MEMBERS AND TECHNICAL REVIEWERS

Mr. Ziqi LI

Satisfies the requirements of competence management system of CTI Certification, and is hereby appointed as:

Qualification						
Status	GHG Auditor	Validator	Verifier	Team Leader	Technical Reviewer	Technical Expert
Date	√	√	√	√	√	√

Scope	Technical Area
SS 1: Energy industries (renewable/non-renewable sources)	TA 1.2: Energy generation from renewable energy sources
SS 4: Manufacturing industries	TA 4.1: Cement and lime production
SS 5: Chemical industry	TA 5.1: Chemical industry
	TA 5.2: Caprolactam, nitric and adipic acid
SS 11: Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride	TA 11.1: Emissions of fluorinated gases
	TA 11.2: Refrigerant gas production
SS 12: Solvents use	TA 12.1: Chemical industry
SS 13: Waste handling and disposal	TA 13.1: Solid waste and wastewater
	TA 13.2: Manure

This appointment is valid for 3 years from its date of approval below and is bound by internal requirements of management system of the Certification Body of CTI.

Approved by:

Wu LIN

Wu Lin

Technical Competent Manager

Shenzhen, 01/08/2020

Mr. Qinghua DAI

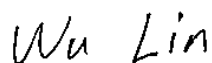
Satisfies the requirements of competence management system of CTI Certification, and is hereby appointed as:

Qualification						
Status	GHG Auditor	Validator	Verifier	Team Leader	Technical Reviewer	Technical Expert
Date	-	-	-	-	-	✓

Scope	Technical Area
SS 13: Waste handling and disposal	TA 13.2: Manure
SS 15: Agriculture	TA 15.1: Agriculture

This appointment is valid for 3 years from its date of approval below and is bound by internal requirements of management system of the Certification Body of CTI.

Approved by:



Wu LIN

Technical Competent Manager

Shenzhen, 01/01/2021

Mr. Wu LIN

Satisfies the requirements of competence management system of CTI Certification, and is hereby appointed as:

Qualification						
Status	GHG Auditor	Validator	Verifier	Team Leader	Technical Reviewer	Technical Expert
Date	✓	✓	✓	✓	✓	✓

Scope	Technical Area
SS 1: Energy industries (renewable/non-renewable sources)	TA 1.1: Thermal energy generation
	TA 1.2: Energy generation from renewable energy sources
SS 2: Energy distribution	TA 2.1: Electricity distribution
SS 3: Energy demand	TA 3.1: Energy demand
SS 4: Manufacturing industries	TA 4.1: Cement and lime production
SS 5: Chemical industry	TA 5.1: Chemical industry
	TA 5.2: Caprolactam, nitric and adipic acid
SS 10: Fugitive emissions from fuels (solid, oil and gas)	TA 10.1: Fugitive emissions from oil and gas
SS 11: Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride	TA 11.1: Emissions of fluorinated gases
	TA 11.2: Refrigerant gas production
SS 12: Solvents use	TA 12.1: Chemical industry
SS 13: Waste handling and disposal	TA 13.1: Solid waste and wastewater
	TA 13.2: Manure

This appointment is valid for 3 years from its date of approval below and is bound by internal requirements of management system of the Certification Body of CTI.

Approved by:

A handwritten signature in black ink, appearing to read 'Zhou', written in a cursive style.

Lu ZHOU

General Manager

Shenzhen, 01/01/2021

Ms. Shunrong LIN

Satisfies the requirements of competence management system of CTI Certification, and is hereby appointed as:

Qualification						
Status	GHG Auditor	Validator	Verifier	Team Leader	Technical Reviewer	Technical Expert
Date	√	√	√	√	√	√

Scope	Technical Area
SS 1: Energy industries (renewable/non-renewable sources)	TA 1.2: Energy generation from renewable energy sources
SS 14: Afforestation and reforestation	TA 14.1: Afforestation and reforestation
SS 15: Agriculture	TA 15.1: Agriculture

This appointment is valid for 3 years from its date of approval below and is bound by internal requirements of management system of the Certification Body of CTI.

Approved by:

Wu Lin

Wu LIN

Technical Competent Manager

Shenzhen, 01/01/2021

APPENDIX 3: DOCUMENTS REVIEWED OR REFERENCED

No.	Author	Title	References to the document	Provider
1.	PP	Joint-PD-MR of “Yantai Xinhao Swine Farm Manure Management System GHG Mitigation Project”	- Draft Version No. 1.0, dated 20-July-2022 - Version No. 2.0, dated 21-February-2023 - Final Version No. 3.0, dated 21-July-2023 after VERRA Review	PP
2.	PP	Emission Reduction Calculation spreadsheet of “Yantai Xinhao Swine Farm Manure Management System GHG Mitigation Project” – Ex-ante calculation	- Draft Version No. 1.0, dated 20-June-2022 - Final Version No. 2.0, dated 20-February-2023	PP
		Emission Reduction Calculation spreadsheet of “Yantai Xinhao Swine Farm Manure Management System GHG Mitigation Project” – related to 1 st monitoring period	- Draft Version No. 1.0, dated 20-July-2022 - Final Version No. 2.0, dated 21-February-2023	PP
3.	PP	NPV and IRR calculation sheet	- Draft Version No. 01, dated 20-June-2022 - Version No. 02, dated 21-February-2023 - Final Version No. 3.0, dated 21-July-2023 after VERRA Review	PP
4.	Local Administrative Examination and Approval Bureau	Business License of PP	Business License of Yantai Xinhao agriculture and animal husbandry Co., Ltd and Search CO2(Shanghai) Environmental Science & Technology Co., Ltd.	PP
5.	Tibet Xinhao Technology Co., Ltd.	Project Evaluation Report	Issued in September 2020	PP
6.	Qingdao Jierui Environmental Protection Technology Service Co., LTD	Environment Impact Assessment (EIA)	Issued in August 2020	PP
7.	Yantai Ecological	EIA approval	Issued on 29-September-2020	PP

	Environment Bureau Muping Branch			
8.	Local County Agriculture and Rural Affairs	Licenses for production and operation	Licenses for production and operation of the breeding livestock and poultry of a swine farm	PP
9.	PP and manufacturers	Equipment purchase contracts	Equipment purchase contracts of all the involved main equipment	PP
10.	PP and Hubei Shanding Environmental Technology Co., Ltd	General design and construction contract	Signed on 10-September-2020	PP
11.	Manufacturers	Technical agreement	Technical agreement of main equipment	PP
12.	PP	Statement	Statement of time for the AWMS started construction and operation	PP
13.	PP	Operation log of the project	Operation log of the AWMS plants	PP
14.	PP	Photo of baseline lagoon	Photo of baseline lagoon of the swine farm	PP
15.	Shandong Institute of Metrology	Calibration Reports	- Calibration Reports to all the electricity meter with validity covering this monitoring period - Calibration Reports to all the weight measurers with validity covering this monitoring period - Calibration Reports to all the gas analyser with validity covering this monitoring period - Calibration Reports to all the flow meters with validity covering this monitoring period	PP
16.	State Administration for Market Regulation	Certificate of Metrological Authorization	Certificate of Metrological Authorization of Shandong Institute of Metrology issued on 06-March-2018 valid to 05-March-2023	PP
	General Administration of Quality Supervision,		Certificate of Metrological Authorization of Nanjing Changyuan Industrial Gas Co.,	

	Inspection and Quarantine of the People's Republic of China		Ltd issued on 06-September-2017	
17.	PP	Swine daily stock record	Swine daily stock record including both market swine and breeding swine Daily Swine stock record of the farm covering this monitoring period	PP
18.	PP	Records of animal weight	Monthly records of animal weight of a defined livestock population of three age categories	PP
19.	PP	Calculation sheet of sample size	Calculation sheet of sample size for monitoring W_{site}	PP
20.	PP	Sale Records of Market swine	Monthly Sale Records of Market swine of the farm covering this monitoring period	PP
21.	PP	Monthly operation record	Monthly operation record of the treatment plant covering this monitoring period	PP
22.	PP	Daily operation record	Daily operation record of the treatment plant covering this monitoring period	PP
23.	PP	Monthly report of electricity	Monthly report of electricity issued by PP for this monitoring period	PP
24.	State Grid Shandong Company Yantai Power Supply Branch	Grid Company Electricity Statement	Grid Company Electricity Statement for this monitoring period	PP
25.	Project Owner and Yantai Lvyuan Organic Fertilizer Co., Ltd.	Sale agreement of organic fertilizer	Sale agreement of organic fertilizer dated 15-February-2021	PP
26.	Hangzhou Fengkong	Manufacture specification	Manufacture specification of the flow meter	PP
27.	PP	Technical flow chart	Technical flow chart in the project site of an AWMS	PP
28.	PP	Local Stakeholder Consultation Records prior to the construction start date	Local stakeholder consultation process evidences: - The Meeting Notice Letter for invitation; - LSC Meeting attendance's list with signature; - Minutes of meeting	PP
29.	PP	Local Stakeholder Consultation Records	Local stakeholder consultation process evidences:	PP

		during 1 st monitoring period	80 filled questionnaires by attendance in the Meeting	
30.	PP	Declaration of no double counting and not involved in other GHG scheme	Issued on 12-December-2022	PP
31.	PP and employees	Labor contracts	Labor contracts signed with employees for implementation of this project	PP
32.	PP	Payrolls	Monthly salary slips for employees	PP
33.	PP	Technical Training Records	Technical Training Records of project 1. Training Records in this monitoring period 2. Training register list	PP
34.	National Standard	GJJ/T54-93	Design code for wastewater stabilization ponds	Public Website
35.	National Standard	JJG 596-2012	Electrical Meters for Measuring Alternating-current Electrical Energy	Public website
36.	National Standard	JJG1029-2007	Verification Regulation of Vortex-shedding Flowmeter	Public website
37.	National Standard	JJG693-2011	Verification Regulation of Alarmer Detectors of Combustible Gas	Public Website
38.	National Standard	JJG539-2016	Digital Indicator Scale Verification Regulations	Public Website
39.	IPCC	IPCC	2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories	Public Website
40.	IPCC	IPCC Fifth Assessment Report	IPCC Fifth Assessment Report	Public Website
41.	National Development and Reform Commission and Ministry of Construction	Economic Evaluation Method and Parameter of Construction Projects	Version 03	Public Website
42.	UNFCCC	Methodological tool	Investment analysis (version 10.0)	UNFCCC website
43.	UNFCCC	Standard of Sampling and surveys	Standard of "Sampling and surveys for CDM project activities and programmes of activities (Version 09.0)"	UNFCCC website
44.	UNFCCC	Guideline of Sampling and surveys	Guideline of the "Sampling and surveys for CDM project activities and programmes of activities (Version 04.0)"	UNFCCC website
45.	UNFCCC	CDM Approved Methodology ACM0010	"GHG emission reductions from manure management systems" (Version 08.0)	UNFCCC website
46.	UNFCCC	Methodological tool	Combined tool to identify the baseline scenario and	UNFCCC website

			demonstrate additionality (Version 07.0)	
47.	UNFCCC	Methodological tool	Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (Version 3.0)	UNFCCC website
48.	UNFCCC	Methodological tool	Project emissions from flaring (Version 04.0)	UNFCCC website
49.	UNFCCC	Methodological tool	Tool to determine the mass flow of a greenhouse gas in a gaseous stream (Version 07.0)	UNFCCC website
50.	UNFCCC	Methodological tool	Project and leakage emissions from anaerobic digester (Version 02.0)	UNFCCC website
51.	UNFCCC	Methodological tool	Common practice (Version 03.1)	UNFCCC website
52.	UNFCCC	Methodological tool	Investment analysis (version 12.0)	UNFCCC website
53.	VERRA	Template	VCS-Joint-Project-Description-Monitoring-Report-Template-v4.2	VCS website
54.	VERRA	Registration and Issuance Process	Registration and Issuance Process version 4.1	VCS website
55.	VERRA	VCS Program Definitions	VCS Program Definitions, v4.3	VCS website
56.	VERRA	VCS Program Guide	VCS Program Guide, v4.3	VCS website
57.	VERRA	VCS Standard	VCS Standard Version 4.4	VCS website
58.	UNFCCC	CDM Standard	Applicability of sectoral scopes version 01.0	Public Website
59.	China CER platform	CCER	http://cdm.ccchina.org.cn/ccer.aspx	Public Website
60.	UNFCCC	UNFCCC website	https://cdm.unfccc.int	UNFCCC website
61.	VERRA	VCS	https://verra.org/project/vcs-program/	VCS website
62.	GS	GS	http://globalgoals.goldstandard.org/	GS website
63.	General Office of the Ministry of Agriculture and Rural Affairs and General Office of the Ministry of Ecology and Environment	Technical Guidelines	Technical Guidelines for the Construction of Manure Treatment Facilities for Livestock and Poultry Farms (Households) (Nongbanmu [2022] No. 19) issued on 24-June-2022	PP
64.	Ministry of Ecology and Environment of China	China cap & trade scheme	http://www.mee.gov.cn/xxgk2018/xxgk02/202101/t20210105_816131.html	Public Website
65.	Ministry of Ecology and Environment of China	Enforced company list	http://mee.gov.cn/xxgk2018/xxgk03/202012/W020201230736907682380.pdf	Public Website

66.	Ministry of Ecology and Environment of the People's Republic of China	Baseline emission factor of China	2019 China regional power grid carbon dioxide baseline emission factor OM calculation instructions http://www.mee.gov.cn/ywgz/ycqhbh/wsqtz/202012/t20201229_815386.shtml	Public Website
67.	Public Website	Public information of the project owner	http://www.newhopegroup.com/	Public Website
68.	Shandong Government	Public information of local temperature	https://baijiahao.baidu.com/s?id=1756797821554245444&wfr=spider&for=pc	Public Website
69.	Public Website	Public literature of methane producing potential of the volatile solid generated by swine manure	http://www.doc88.com/p-9902182440715.html	Public Website
70.	Shandong Provincial Climate statistics	Public information of local temperature for this monitoring period	https://baijiahao.baidu.com/s?id=1727982990945009906&wfr=spider&for=pc https://baijiahao.baidu.com/s?id=1756797821554245444&wfr=spider&for=pc	Public info
71.	Public Website	Price index of investment in fixed asset	http://www.stats.gov.cn/	Public Website
72.	Public Website	Local DRC of Shandong province website	http://fgw.shandong.gov.cn	Public Website
73.	Public Website	Other public information from Department of Agriculture and rural affairs of Shandong Province	http://nync.shandong.gov.cn	Public Website
74.	VVB	Site Visit Photo	Photo taken by VVB during site visit including main equipment, swine farm, monitoring devices, etc.	N/A
75.	National Government	Law&Regulation	1. Farmland Irrigation Water Quality Standard (GB5084-2005); 2. Odor Pollutant Discharge Standard (GB14554-93); 3. Comprehensive Emission Standards for Air Polluted Areas (GB16297-1996); 4. Boiler Air Pollutant Emission Standard (GB13271-2014); 5. Environmental Noise Emission Standard for Industrial Enterprise Boundary (GB12348-2008) 6. Environmental Protection Law of P.R. China 7. Law of the People's Republic of China on the Environmental Impact Assessment	Public Website

76.	National Standard	GB-T 36195	Technical specification for sanitation treatment of livestock and poultry manure https://oss.baigongbao.com/2020/12/27/MRyhTKQcWC.pdf	Public Website
77.	China State Council	Regulations on Prevention and Control of Pollution from Livestock and Poultry Farming	http://politics.people.com.cn/n/2013/1126/c1001-23662445.html	Public Website
78.	Ministry of Agriculture and Rural Affairs of China	Specifications for the construction of manure resource utilization facilities for large-scale livestock and poultry farms (for trial implementation)	http://www.moa.gov.cn/gk/tzgg_1/tfw/201801/t20180111_6134801.htm	Public Website
79.	Ministry of Agriculture and Rural Affairs of China	Technical Guidelines for the Construction of Faecal Waste Treatment Facilities in Livestock and Poultry Farms (Households)	http://www.moa.gov.cn/nybggb/2022/202209/202210/t20221010_6412911.htm	Public Website
80.	National Standard	Limit Requirements of Toxic and Hazardous Substances in Fertilizers	https://std.samr.gov.cn/gb/search/gbDetailed?id=9A0A4FA998C8D4A5E05397BE0A0AD02D	Public Website
81.	National Regulations	Public information of staff welfare, labor insurance fee and housing fund rate	https://www.gov.cn/zwggk/2007-12/11/content_830645.htm https://www.gov.cn/zhengce/content/2008-03/28/content_7376.htm http://www.mohrss.gov.cn/xxgk/2020/fdzdgknr/zcfg/gfxwj/shbx/201507/t20150729_216271.html http://www.mohrss.gov.cn/xxgk/2020/fdzdgknr/zcfg/fg/202011/t20201103_394936.html https://www.gov.cn/gongbao/content/2019/content_5468861.htm	Public Website

APPENDIX 4: CLARIFICATION REQUESTS, CORRECTIVE ACTION REQUESTS AND FORWARD ACTION REQUESTS

Table 1.Remaining FAR from validation and/or previous verification

FAR ID	N/A	Section no.	Date:
Description of FAR			
Project participant response			Date:
Documentation provided by project participant			
VVB assessment			Date:

Table 2.CL from this verification

CL ID	01	Section no.	1.3	Date : 12/08/2022
Description of CL				
In section 1.3, PP does not clarify how the project is in line with the requests from section 3.1 of the VCS standard version 4.4.				
Project participant response				Date : 20/02/2023
In section 1.3, PP has clarified line by line how the project is compliant in accordance with section 3.1 of the VCS standard version 4.4.				
Documentation provided by project participant				
/1/- version 2.0				
VVB assessment				Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that the clarification has been added. Refer to section 3.1 of this report for the detail assessment. CL 01 is closed.				

CL ID	02	Section no.	3.2	Date : 12/08/2022
Description of CL				
In section 3.2, for demonstrate the applicability of ACM0010, 1. PP is not to clarify that why all swine are managed in confined conditions. 2. PP is not to clarify how to prove that the depth of the lagoons used for manure management under the baseline scenario is higher than 1m.				
Project participant response				Date : 20/02/2023
1. Yantai Xinhao agriculture and animal husbandry Co., Ltd is one of the subsidiaries of New Hope Liuhe Biotechnology Industry Group, which is a national key leading enterprise of agricultural industrialization mainly in animal husbandry, and is a recyclable modern agricultural industrial base integrating breeding swine, market swine, feed, <i>environmental protection</i> and planting. The swine farm of this project has obtained the license of breeding livestock and poultry production and operation issued by the local government, and the layout of the swine farm's livestock and poultry house should be reasonable according to the requirements of this license. Therefore, all swine are managed in confined conditions and can be identified during the on-site investigation period. 2. The open anaerobic lagoon considered in the baseline scenario is designed for deep storage. In the context of this project, it is designed with a depth of 4 meters based on the national standard "Design				

code for wastewater stabilization ponds (GJJ/T54-93)", which is necessarily greater than 1 meter.	
Documentation provided by project participant	
/1/- version 2.0 /8/ /67/ /14/ /34/	
VVB assessment	Date: 27/02/2023
1. The revised Joint-PD-MR is checked, CTI confirmed that the clarification has been added. Via site inspection and checking the Licenses for production and operation of the breeding livestock and poultry/8/ for the swine farm, and furthermore via checking the public information of the project owner/67/ and based on the local expertise of validation team, CTI confirmed that the project owner is one of the subsidiaries of New Hope Liuhe Biotechnology Industry Group, which is a national key leading enterprise of agricultural industrialization mainly in animal husbandry, CTI confirmed that all the livestock population in the swine farm within the project boundary is managed under confined conditions. 2. The revised Joint-PD-MR is checked, CTI confirmed that the clarification has been added. In the baseline scenario the depth of the open lagoon used for manure management under the baseline scenario is 4 meters higher than 1m. This is verified by checking the photo of baseline lagoon/14/ and verified by checking the national standard "Design code for wastewater stabilization ponds (GJJ/T54-93)"/34/. CL 02 is closed.	

CL ID	03	Section no.	3.4	Date : 12/08/2022
Description of CL				
In section 3.4, the time of "Financial benchmark rate of return of construction projects" issued by NDRC is missing how to prove this is applicable to the project is not clarified.				
Project participant response				Date : 20/02/2023
In Section 3.4, the timing of the "Financial Baseline Rate of Return for Construction Projects" issued by the National Development and Reform Commission has been added. A proposed project activity is not economically or financially viable if there is no revenue from the sale of VCS-certified emission reductions. For the "simple cost analysis (the option I)", the proposed project activity will generate revenue from the sale of organic fertilizer in addition to VCUs, and therefore is not applicable to option I. For the "investment comparison analysis (option II)", the alternative baseline scenario for the proposed project is not part of the investment project and therefore is not applicable to option II. By elaboration of the financial and economic indicators identified as most applicable to the project, such as NPV, and based on the consideration of standard parameters in the market, the project's IRR is available and therefore the proposed project is applicable to "the benchmark analysis (Option III)".				
Documentation provided by project participant				
/1/- version 2.0				
VVB assessment				Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that related clarification has been added. Refer to section 3.3.2 of this report for detail assessment. CL 03 is closed.				

CL ID	04	Section no.	3.4	Date : 12/08/2022
Description of CL				
In section 3.4, 1. The demonstration of prior consideration of carbon revenue is not clarified. 2. Why the input values of financial parameters derived from PER is reasonable is not clarified.				
Project participant response				Date : 20/02/2023

1. The pp considered applying for carbon emission reduction projects to supplement the project revenue before the project started. PP explained that the NPV of the project activity and the uncovered anaerobic drainage lake are negative and the NPV of the project activity is much higher than the uncovered anaerobic drainage lake because the anaerobic digestion treatment technology used in the project activity requires higher investment costs compared to other technologies and the technology for biogas heat generation requires high investment costs, indicating that the project activity without vcs income has higher costs than the uncovered anaerobic drainage lake and the internal revenue of the project activity is lower than average, making it difficult for project proponents to obtain loans from banks. Only if the PP can demonstrate that the project can be VCS certified and generate revenue, it will be able to attract bank investment. Without VCS revenue, PP prefers to use a low-cost uncovered anaerobic drainage lake as a baseline, which will result in more GHG emissions. 2. PP has included a footnote stating that all inputs used in the investment analysis are from the Project Evaluation Report (PER), which was completed by an authorized entity on September-2020, and that the project's construction start date is 02-January-2021. The time interval between the completion date of the project evaluation report and the construction start date is less than one year, therefore, the input values are valid and applicable at the time of investment decision.	
Documentation provided by project participant	
/1/- version 2.0 /5/ /10/	
VVB assessment	Date: 27/02/2023
1. The revised Joint-PD-MR is checked, CTI confirmed that related information has been added. Via checking the PER/5/, CTI confirmed that the PER which confirmed as including prior consideration of carbon revenue was completed in September 2020. 2. The revised Joint-PD-MR is checked, CTI confirmed that related information has been added. All the input values used in investment analysis are confirmed by VVB as sourced from Project Evaluation Report (PER)/5/, which was completed by an authorized entity in September 2020, while the project construction started on 02-January-2021/10/ which is the earliest larger expenditure and can be considered as the date for investment decision. Therefore, VVB confirmed that the time interval between the issuance date of the Project Evaluation Report and date when the investment decision was made is less than half year, therefore input values are valid and applicable at the time of the investment decision. CL 04 is closed.	

CL ID	05	Section no.	3.5	Date : 12/08/2022
Description of CL				
For the additionality demonstration, the project shall demonstrate regulatory surplus at validation as per 3.14.1 of VCS standard. Clarification is requested.				
Project participant response				Date : 20/02/2023
For the additionality demonstration, in section 3.5 PP has demonstrated regulatory surplus at the time of validation in accordance with VCS standard 3.14.1.				
Documentation provided by project participant				
/1/- version 2.0 /76/ /77/ /78/				
VVB assessment				Date: 27/02/2023
The revised Joint-PD-MR is checked, the clarification has been added. As per the Section 3.14.1 of VCS Standard (Version 4.4), PP has demonstrated regulatory surplus in JPM which has been checked by VVB as below, Via searching the public website with laws and regulations in Shandong Province and China by CTI, it is confirmed that there is no legal law and regulation to mandate the livestock farm owners to implement anaerobic digestion, aerobic or other biological treatment techniques to treat the animal				

manure in China. And via checking the “Regulations on Prevention and Control of Pollution from Livestock and Poultry Farming”/77/ and “Technical specification for sanitation treatment of livestock and poultry manure”/76/, CTI confirmed that the manure is prohibited to discharge directly into environment without any treatment and the uncovered anaerobic lagoon is a kind of manure treatment method recognized by the state.

Furthermore, via checking the Specifications for the construction of manure resource utilization facilities for large-scale livestock and poultry farms (for trial implementation)/78/, it is confirmed that anaerobic digester, aerobic treatment or other biological treatment techniques methods to dispose manure waste are encouraged by the state and not mandatory. Therefore, the project activity is not mandated by any law, statute, or other regulatory framework, it is deemed as regulatory surplus.

CL 05 is closed.

Table 3.CAR from this verification

CAR ID	01	Section no.	Whole	Date : 12/08/2022
Description of CAR				
The JPM templated used by this project is not latest valid version.				
Project participant response				Date : 20/02/2023
PP has updated the JPM template used in this project to the latest valid version.				
Documentation provided by project participant				
/1/- version 2.0				
VVB assessment				Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that the JPM templated used by this project is updated to the latest valid version.				
CAR 01 is closed				

CAR ID	02	Section no.	1.1	Date : 12/08/2022
Description of CAR				
1. It is confirmed that there is one existing swine farm involved in the project, so all the description of “farms” need to be updated accordingly.				
2. The technology flow of the solid and sludge described in section 1.1 is not consistent with 1.11.				
Project participant response				Date : 20/02/2023
1. PP confirmed that the project involves only one swine farm and an AWMS was built, which contains both market and breeding swine. The description of “farm” in JPM has been corrected.				
2. PP has corrected the technical process for solids and sludges described in section 1.1 to be consistent with 1.11.				
Documentation provided by project participant				
/1/- version 2.0				
VVB assessment				Date: 27/02/2023
1. The revised Joint-PD-MR is checked, CTI confirmed that the inaccurate descriptions have been updated in the whole JPM which are verified as correct.				
2. The revised Joint-PD-MR is checked, CTI confirmed that the descriptions are updated to be consistent and in line with actual situation now.				
CAR 02 is closed.				

CAR ID	03	Section no.	1.3	Date : 12/08/2022
Description of CAR				
The VCS standard version used by PP is not the latest valid version.				
Project participant response				Date : 20/02/2023
PP has updated the VCS standard version in the full JPM to the latest valid version.				
Documentation provided by project participant				

/1/- version 2.0 /57/	
VVB assessment	Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that VCS standard version used by PP is updated to the latest valid version 4.4/57/. CAR 03 is closed.	

CAR ID	04	Section no.	1.17	Date : 12/08/2022
Description of CAR				
The evidence of the project's SD contributions is not provided in Appendix of JPM.				
Project participant response				Date : 20/02/2023
PP has supplied the evidence of the project's SD contribution in the appendix of JPM.				
Documentation provided by project participant				
/1/- version 2.0				
VVB assessment				Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that evidence of the project's SD contributions is provided in Appendix of JPM. Refer to section 3.1 of this report for detail assessment of the SD contributions. CAR 04 is closed.				

CAR ID	05	Section no.	2.4	Date : 12/08/2022
Description of CAR				
The actual information of public comments from VCS GSC is not specified.				
Project participant response				Date : 20/02/2023
The actual information for the VCS public comments is described in the JPM. No comments were received during the public notice period.				
Documentation provided by project participant				
/1/- version 2.0				
VVB assessment				Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that the information has been added. The project sought the registration with the VCS Program, according to VCS requirements the Project Description was submitted for public comment period. The project was allocated with VCS ID 3164. The public comment period started on 15-July-2022 and ended on 14-August-2022 (https://registry.terra.org/app/projectDetail/VCS/3164). No comments were received during this period which has been verified by checking the dedicated website as above. CAR 05 is closed.				

CAR ID	06	Section no.	3.4	Date : 12/08/2022
Description of CAR				
The IPCC version referred in section 3.4 is not the latest version. Revision is requested.				
Project participant response				Date : 20/02/2023
PP has updated the IPCC version mentioned in the section 3.4 to the latest version.				
Documentation provided by project participant				
/1/- version 2.0 /39/				
VVB assessment				Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that the latest version of IPCC has been referred in the whole MR. CAR 06 is closed.				

CAR ID	07	Section no.	4.1	Date : 12/08/2022
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Description of CAR	
The IPCC version which has been used for determine the related parameters that refer to IPCC default values is not the latest version. Revision is requested.	
Project participant response	Date : 20/02/2023
PP has updated the parameters related to the IPCC defaults referenced in JPM to the latest version.	
Documentation provided by project participant	
/1/- version 2.0 /39/	
VVB assessment	Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that the latest version of IPCC has been referred in the whole MR for determine related data for parameters. And the re-calculation of ER has been confirmed as correct. CAR 07 is closed.	

CAR ID	08	Section no.	5.1	Date : 12/08/2022
Description of CAR				
For the parameter $B_{0,LT}$, it listed in both Parameters Available at Validation and monitoring parameters section, revision is requested.				
Project participant response				Date : 20/02/2023
Modified the position of the parameters $B_{0,LT}$ listed in JPM.				
Documentation provided by project participant				
/1/- version 2.0				
VVB assessment				Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that the $B_{0,LT}$ is kept in monitoring parameters section which is verified in line with the applied methodology. CAR 08 is closed.				

CAR ID	09	Section no.	3.3	Date : 12/08/2022
Description of CAR				
In section 5.1, the parameter of $\eta_{flare,m}$ is missing.				
Project participant response				Date : 20/02/2023
In Section 6.1, the parameter of $\eta_{flare,m}$ was added.				
Documentation provided by project participant				
/1/- version 2.0				
VVB assessment				Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that the parameter has been added. Refer to section 3.4.8 of this report for detail assessment. CAR 09 is closed.				

CAR ID	10	Section no.	5.2	Date : 12/08/2022
Description of CAR				
For all the Parameters Monitored, the monitoring process and QA/QC procedure are not stated in detail. Revision is requested.				
Project participant response				Date : 20/02/2023
For all monitored parameters, the monitoring process and QA/QC procedures are supplemented with detailed descriptions.				
Documentation provided by project participant				
/1/- version 2.0				
VVB assessment				Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that monitoring process and QA/QC procedure of all the parameters have been further specified. Refer to section 3.4.8 of this report for detail assessment.				

CAR 10 is closed.

CAR ID	11	Section no.	5.3	Date : 12/08/2022
Description of CAR				
The monitoring system flow chart in section 5.3 is not corresponding to the actual situation of the project.				
Project participant response				Date : 20/02/2023
PP modified the flow chart in Section 6.3 to suit the actual project situation.				
Documentation provided by project participant				
/1/- version 2.0				
VVB assessment				Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that the monitoring system flow chart has been updated in section 5.3 and verified as reflect the actual situation of the project by site inspection. CAR 11 is closed.				

CAR ID	12	Section no.	5.3	Date : 12/08/2022
Description of CAR				
In section 5.3, the monitoring parameters listed in this section are not same to the section 5.2. Revision is requested.				
Project participant response				Date : 20/02/2023
The swine in this project are monitored in real time through ear tags, and the monitored values can be used directly in the er calculation process, so there is no need to monitor $N_{p,LT}$ and $N_{da,LT}$ to calculate the stock.				
Documentation provided by project participant				
/1/- version 2.0 /5/				
VVB assessment				Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that the all the missing parameters have been added which are verified consistent with section 5.2. CAR 12 is closed.				

CAR ID	13	Section no.	6.1	Date : 12/08/2022
Description of CAR				
For all the monitored parameters, PP does not provide the monitoring method, supporting evidence and data collection conducted during this monitoring period. Revision is requested.				
Project participant response				Date : 20/02/2023
For all the monitored parameters, PP has supplemented the JPM with a detailed description of the monitoring method, supporting evidence and data collection conducted during the monitoring period. All monitored parameters during the monitoring period will be recorded and uploaded to the DCS.				
Documentation provided by project participant				
/1/- version 2.0				
VVB assessment				Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that the r all the monitored parameters have been updated to include the requested information. Refer to section 4.1 of this report for detail assessment. CAR 13 is closed.				

CAR ID	14	Section no.	6.1	Date : 12/08/2022
Description of CAR				
For parameter T, the temperature values are not listed for vintage year respectively.				
Project participant response				Date : 20/02/2023

For the parameter T has been modified, the temperature values of the years are listed separately with the source.	
Documentation provided by project participant	
/1/- version 2.0	
VVB assessment	Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that the temperature values are listed for vintage year respectively. Refer to section 4.1 of this report for detail assessment. CAR 14 is closed.	

CAR ID	15	Section no.	6	Date : 12/08/2022
Description of CAR				
The calculation results for BE, PE and LE for this monitoring period need to be re-calculated after using the latest version of IPCC.				
Project participant response				Date : 20/02/2023
PP recalculates ER using the latest parameters and has been updated in JPM.				
Documentation provided by project participant				
/1/- version 2.0				
/2/- version 2.0				
VVB assessment				Date: 27/02/2023
The revised Joint-PD-MR is checked, CTI confirmed that the latest version of IPCC has been referred in the whole MR for determine related data for parameters. And the re-calculation of ER has been confirmed as correct. CAR 15 is closed.				

Table 4.FAR from this verification

FAR ID	N/A	Section No.	-	Date: -
Description of FAR				
Project participant response				Date: -
Documentation provided by project participant				
VVB assessment				Date: