



**Verified Carbon
Standard**

BRUSQUE LANDFILL GAS PROJECT



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Project title	Brusque landfill Gas Project
Project ID	4138
Verification period	11-July-2022 to 31-December-2023
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Client	Recicle Catarinense de Resíduos Ltda.
Prepared by	LGAI Technological Center, S.A. (Applus+ Certification)
Approved by	LGAI Technological Center S.A. (Applus+ Certification)

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Summary:

LGAI Technological Center, S.A. (hereafter referred to as “Applus+ Certification”) was commissioned by Recicle Catarinense de Resíduos Ltda. to perform the 1st periodic verification of achieved greenhouse gas (GHG) emission reductions for the project-based initiative registered under the Verified Carbon Standard (VCS) titled “Brusque landfill Gas Project” (VCS Ref. No. 4138) (hereafter referred to as “the VCS project activity”).

The Applus+ Certification verification assessment and its verification opinion are based on information and data reported in the latest version of the Monitoring Report ^{/4/} for the monitoring period from 11-July-2022 to 31-December-2023 of the VCS project activity (hereby termed as “the considered monitoring period”). Achieved GHG emission reductions for the considered monitoring period are claimed as Verified Carbon Units (VCU) under conformance with guidelines, rules and procedures of VCS Standard (version 4.7) ^{/5/}.

The VCS project activity was previously validated by the Validation and Verification Body (VVB) LGAI Technological Center, S.A. (hereafter referred to as “Applus+ Certification”). Details for the VCS project activity is available online at the VERRA/VCS registry (<https://registry.verra.org/app/projectDetail/VCS/4138>).

The design of the VCS project activity encompasses destruction of collected landfill gas (LFG) (in high temperature enclosed flare) and LFG utilization as gaseous fuel for electricity generation (in set of engine-generator sets which represent the major components of an electricity generation infrastructure with gradual/phased implementation schedule and with total final combined nameplate installed capacity of 3 engine-generator sets with about 4.5 MW when fully implemented). While during the considered monitoring period the VCS project activity promoted collection and destruction of LFG in the installed high temperature enclosed flare, the project’s electricity generation infrastructure is yet to be gradually installed (with its initial implementation phase currently being forecasted to occur by the end of year 2024). The VCS project activity is partially implemented (as per its gradual/phased implementation schedule) at the Brusque landfill, located at the in the municipality of Brusque in Santa Catarina State (Southern region of Brazil). LFG (which is rich in methane (CH₄)) has since the year 2009 been generated at the Brusque landfill as a result of anaerobic decomposition of municipal solid waste (MSW) disposed in this solid waste disposal site (SWDS). MSW generated and collected in the municipality of Brusque and other municipalities have been permanently disposed daily at the Brusque landfill. Combustion of collected LFG during the considered monitoring period has occurred exclusively in the installed high temperature enclosed flare.

As per the VCS Project Description document (VCS PD) for the VCS project activity, collected LFG is also be utilized as gaseous fuel for electricity generation in an electricity generation infrastructure comprising 3 engine-generator sets (of which 2 are expected to be installed by the end of year 2024 and the third engine-generator set in the year of 2029). Upon the implementation and start of operation of the project’s electricity generation infrastructure, net generated electricity will be exported through the electricity grid the VCS project activity is connected to (National Electricity Grid of Brazil).

While in the absence of the VCS project activity (baseline scenario), generated LFG (rich in methane) would be otherwise directly emitted into the atmosphere (not destroyed/utilized), the VCS project activity thus promotes real and permanent reduction of CH₄ emissions.

In addition, upon the implementation and start of operation of the project's electricity generation infrastructure, the VCS project activity will also promote displacement of equivalent amount of electricity that would be otherwise generated by existent grid-connected power generation facility (including fossil fuel fired power plants) and addition of new power generation sources within the National Electricity Grid of Brazil in the absence of the VCS project activity (baseline scenario). Therefore, the VCS project activity thus will also promote CO₂ emission reductions associated with generation of electricity using non-conventional renewable energy sources.

The purpose and scope of the VCS verification assessment is to ensure that reported emission reductions for a VCS project activity within a considered monitoring period are deemed/sufficiently complete, accurate and are determined based on appropriate monitoring and calculation approaches and under conformance with applicable VCS standard regulatory documents ^{/5/} and applied baseline and monitoring methodology in order to be certified.

Extensive document desk-review, on-site inspection, interviews with representatives of the project proponents and additional complementary auditing measures were conducted by the verification team appointed by Applus+ Certification in order to verify and confirm the correctness and appropriateness of information and data included in the Monitoring Report ^{/1/}.

Applus+ Certification confirms the following documentation has been reviewed:

- Registered VCS Project Description Document (VCS-PD) ^{/2/} (version 3.0, dated 14-April-2023);
- The Validation Report for the VCS project activity ^{/3/} (version 2.0, dated 20-April-2023);
- Monitoring Report ^{/1/} for the considered monitoring period (from 11-July-2022 to 31-December-2023) for the VCS project activity (version 1.0, dated 07-February-2024, version 2.0, dated 20-May-2024 and version 2.1 dated 10-October-2024");
- VCS standard (version 4.7) ^{/5/}
- VCS guidance Validation and Verification Manual (version 3.2) ^{/4/}, as well as relevant applicable UNFCCC CDM requirements
- The applied CDM baseline and monitoring methodology and applied CDM methodological tools:
 - ACM0001 "Flaring or use of Landfill Gas"; Version 19.0 ^{/14/}
 - "Emissions from solid waste disposal sites" (version 08.0) ^{/26/}
 - "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0) ^{/27/}
 - "Project emissions from flaring" (version 04.0) ^{/28/}
 - "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) ^{/29/}
 - "Tool to calculate the emission factor for an electricity system" (version 07.0) ^{/30/}

All information and references relevant to the VCS project activity resulting in emission reductions were also reviewed. As part of the performed VCS verification assessment, a set of six (6) Corrective Action Requests (CARs) were identified/raised by the appointed Applus+ Certification's verification team. All of such raised CARs were confirmed by the Applus+ Certification's verification team as being appropriately/sufficiently addressed by the project proponent Recicle Catarinense de Resíduos Ltda. through the completion of a correctly revised version of the Monitoring Report ^{/1/} for the considered monitoring period.

Applus+ Certification hereby confirms that in general the VCS project activity is implemented and has operated within the considered monitoring period under conformance with project design details established in its previously completed and registered VCS PD ^{/2/}. As also confirmed by the Applus+ Certification's verification team, the design of the monitoring plan for the VCS project activity is under conformance with applicable requirements of the applied CDM baseline and monitoring methodology ACM0001 (version 19.0) ^{/14/} + applied CDM methodological tool.

Furthermore, as also confirmed by the Applus+ Certification's verification team, monitoring related activities for the VCS project activity were performed during the considered monitoring period under full conformance with requirements and guidance of the monitoring plan as per the registered VCS PD ^{/2/}. The monitoring system for the VCS project activity is in place was also confirmed as being operated in a way that emission reductions achieved during the considered monitoring period are correctly determined based on available monitoring data without material misstatements, uncertainties and under a deemed reasonable level of assurance.

In the context of the verification risk assessment and planning stages, while aiming to minimize both the risk of having potential material discrepancies or uncertainties not being detected in the course of the VCS verification assessment (detection risk) and risks inherent in the verification assessment, Applus+ Certification performed an identification of potential risks that could lead to quantitative material errors, omissions, uncertainties and misstatements in its verification opinion as further seen in Sections 1.3 and 2.1.

Based on assessed and reviewed information, Applus+ Certification hereby confirms that the implementation of the VCS project activity and its operation during the monitoring period from 11-July-2022 to 31-December-2023 (including both days) resulted on achieved GHG emission reductions of 123,555 tCO₂e

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1 INTRODUCTION

1.1 Objective

LGAI Technological Center, S.A. (Applus+ Certification) was commissioned by the project proponent Recicle Catarinense de Resíduos Ltda. to perform the 1st periodic verification assessment of GHG emission reductions for the VCS project activity titled “Brusque landfill Gas Project” (VCS Ref. No. 4138) for the monitoring period from 11-July-2022 to 31-December-2023 as reported in the Monitoring Report ^{/1/}.

LGAI Technological Center, S.A. (Applus+ Certification) in the position of the selected Validation and Verification Body (VVB) responsible for performing the VCS verification assessment is accredited both as a VVB under VCS and as a Designated Operational Entity (DOE) under the CDM for the technical scope the VCS project activity falls into (Technical scope 1 and 13). Applus+ Certification also meets applicable competence requirements as established in Standard ISO 14065. These aspects and status qualify Applus+ Certification to act as a VVB responsible for performing the periodic verification assessment for the VCS project activity.

The objective of the verification assessment is to have an independent review and ex-post determination by an appointed VVB of determined reductions of GHG emissions that have occurred as a result of the registration of VCS project and its operation during a considered monitoring period. Certification is the written assurance by the VVB/DOE that, during a considered monitoring period, a VCS project activity achieved reductions in anthropogenic emissions by sources of GHGs under a reasonable level of assurance.

The objective of this verification/certification assessment is to verify and certify emission reductions, reported for the VCS project activity “Brusque landfill Gas Project”, for the monitoring period from 11-July-2022 to 31-December-2023.

1.2 Scope and Criteria

The VCS verification scope is defined as an independent and objective review of the content of the registered VCS PD ^{/2/} (incl. the project’s baseline study), Monitoring Report (MR) for the considered monitoring period and other relevant documents. The information in these documents is reviewed inter alia against requirements of VCS Standard (version 4.7).

The VCS verification assessment is not meant to provide any consulting towards the project proponent and/or any other Party. However, stated requests for forward actions and/or corrective actions may eventually provide input(s) for improvement of the project monitoring.

1.3 Level of Assurance

In line with applicable VCS requirements and under conformance with Standard ISO 14064-3:2019 ^{/8/}, a reasonable level of assurance was defined and was followed for the performance of the verification assessment for the VCS project activity.

By taking into account applicable guidance from the CDM Guideline - Application of materiality in verifications (version 02.0) ^{/18/}, VCS Standard Version 4.7 ^{/5/} and Validation and verification manual (version 3.2) ^{/4/} materiality was considered in conducting the verification.

As part of the performance of the verification assessment, the previously elaborated verification plan ^{/25/} was directly applied (without being revised) in order to have potentially detected errors, omissions or misstatements being addressed through additional (and not previously planned) audit/verification procedures during the sub-sequential phases of the performance of verification assessment (e.g. document desk review, interviews with representatives of the project proponent, identification and resolution of outstanding issues (CARs and CLs), etc.).

As per monitoring and QA/QC procedures applied as part of operation of the VCS project activity, as confirmed by the Applus+ Certification's verification team, emission reductions are accounted only for monitoring data that is deemed correct, authentic and reliable (based proof of measurements performed by calibrated and well-maintained monitoring equipment/instruments, checking of correctness and reasonability in recorded/reported monitoring data (e.g. data values within an acceptable/plausible range)).

In this context it is also crucial to note that, as also confirmed by the Applus+ Certification's verification team, in case of identification of uncertainties related to correctness/reasonability of reported monitoring data for a particular time period (e.g. continuous measurements related monitoring for a particular minute) as part of the monitoring of the VCS project activity, the monitoring procedure applied by the project proponent Recicle Catarinense de Resíduos Ltda. ensures that no emission reductions for such particular time period are claimed/accounted under such circumstances (thus minimizing risks of overestimations of claimed GHG emission reductions).

Furthermore, it is also crucial to note that as per the monitoring and GHG calculation approaches that are valid for the project activity (as established in the VCS PD ^{/2/} and the applied CDM baseline and monitoring methodology + applicable methodological tools) no sampling procedure and no sampling-based monitoring are valid/required for the determination of achieved emission reductions.

Finally, it is also relevant to note that, as a response to risks identified during the planning phase of the verification, for minimizing the risks of having incorrect monitoring data (measurement records) being considered in the context of the calculation and reporting of achieved emission reductions (in a way that calculated emission reductions are overestimated), the verification assessment encompassed the performance of a checking of authenticity of all electricity generation related monitoring data as follows:

Data authenticity check: As part of the performed verification assessment, the Applus+ Certification's verification team was able to confirm that the monthly emission reduction calculation spreadsheets ^{/20/} completed by the host country project proponent Recicle Catarinense de Resíduos Ltda. are basically MS-Excel spreadsheets that, in theory, could have recorded data being easily edited/modified (intentionally or unintentionally). Thus, these spreadsheets, if inappropriately edited, could potentially tamper reported monitoring records, thus resulting in unreal and incorrect calculation and reporting of emission reductions achieved by the project activity during the considered monitoring period. In order to ensure that all emission reductions calculations are entirely and correctly based on authentic and real monitoring records valid for the considered monitoring period, a data authentic checking was performed as part of the verification assessment. Such checking aimed to ensure that only authentic and unmodified monitoring data records were used by the project proponent for performing the emission reduction calculation for the considered monitoring period (thus ensuring that measurement records made available in the MS-Excel format "raw data" input files ^{/16/} and measurement records reported in the monthly emission reduction spreadsheets were not intentionally or unintentionally edited/modified during the generation or handling of these files).

In summary, Applus+ Certification has established an internal quality control process in order to ensure, as part of its technical assessment, that information and values provided in the Monitoring Report ^{/4/} are materially correct and fairly represent the implementation status and operation of the VCS project activity within the considered monitoring period, is completed under conformance with applicable VCS requirements + specific requirements of the applied CDM methodology being also sufficiently met for the calculation and reporting of GHG quantification and monitoring activities within the considered monitoring period.

1.4 Summary Description of the Project

Project title	Brusque landfill Gas Project
VCS reference number	4138
Project Participant	Recicle Catarinense de Resíduos Ltda.
Other entities involved in the project	UniCarbo – Energia e Biogás Ltda. ¹
Location of the project	The VCS project activity is located within the margins of the Ivo Silveira Highway, Bateas District - Brusque, SC - Brazil Geographical coordinates: Latitude: -27.011737 (27° 00' 42.3" S) Longitude: -48.870436 (48° 52' 13.6" W)
Project start date	Operation start date: 11-July-2022
Project Crediting Period	7-year renewable crediting period from 11-July-2022 to 10-July-2029.
Version of VCS PD	Version 3.0, dated 14-April-2023
Monitoring period	11-July-2022 to 31-December-2023
Initial version of the Monitoring Report	Version 1.0, dated 07-February-2024

¹ The following disclaimer about the organization “UniCarbo – Energia e Biogás Ltda” is confirmed by the Applus+ Certification’s verification team as being appropriately and correctly added in Section 1.5 of the Monitoring Report:

“The project owner and project proponent Recicle Catarinense de Resíduos Ltda. and company/enterprise UniCarbo Energia e Biogás Ltda. have signed a contractual agreement for provision of technical and strategical advisory + consultancy services which defines that UniCarbo Energia e Biogás Ltda. does not have and will not have any ownership, titularity or rights over VCUs or any other type of GHG emission reduction unit/credit or environmental unit/credit generated as a result of the implementation and operation of the VCS project activity and registered under an authorized VCS/VERRA registry”.

Final version of the Monitoring Report	Version 2.1, dated 10-October-2024
Applied Methodology/Version	CDM baseline and monitoring methodology ACM0001 “Flaring or use of Landfill Gas” (version 19.0) /6/
Scope/Technical Area	1 and 13

2 VERIFICATION PROCESS

2.1 Method and Criteria

The VCS verification assessment was performed by applying Applus+ Certification's rules and procedures in line with the requirements specified in the VCS Standard (version 4.7) ^{/5/}, the latest version of the CDM Validation and Verification Standard for project activities (version 03.0) ^{/21/} and relevant UNFCCC requirements (whenever applicable) as well as through the application of standard auditing techniques. As part of performed VCS verification assessment, Applus+ Certification performed a strategic review and risk assessment of the VCS project activity and processes in order to gain a full understanding of:

- Activities, aspects and circumstances associated with all the sources contributing to the project related GHG emissions (baseline and project emissions) and emission reductions.
- Protocols and methodological approaches used to measure and/or determine GHG emissions associated with these sources.
- Collection and handling of monitoring data.
- Controls on the gathering, processing, recording and reporting of monitoring data.
- Means of verifying reported monitoring data; and
- Compilation of the Monitoring Report ^{/1/}.

The appointed Applus+ Certification's verification team verified the implementation and operationalization of the monitoring plan for the VCS project activity during the considered monitoring period and performed a detailed assessment of monitoring data reported in the Monitoring Report ^{/1/} for the considered monitoring period. This assessment work was fully based on a desk review of the content of the Monitoring Report, interviews with representatives of the project proponents and additional auditing measures.

The information of the assessment team is included in below:

Verification team

According to the applicable sectoral scope / technical area and experience in the sectoral or national business environment, Applus+ Certification has composed an assessment team in compliance with the Contract Review and Assessment Team appointment rules in the internal Quality Management System of Applus+ Certification as well as in compliance with the applicable requirements in the Accreditation Standard.

The composition of the verification team has been approved by Applus+ Certification during the Contract Review process ensuring that the required skills and capabilities are covered.

The qualification levels for verification team members assigned by aforementioned appointment rules are as presented below:

- Lead Auditor (LA).
- Auditor (A).
- Technical Expert (TE).
- Technical Reviewer (TR).
- Any of the above-mentioned roles in training (iT, e.g. AiT for auditor in training).

The Sectoral Scope / Technical Area required knowledge linked to the applied methodology (ies) is covered by the Assessment Team as shown below:

Verification Team:

Name	Qualification	Coverage of scope	Coverage of technical Area	Host country experience	Attendance to the On-Site Assessment
Marco A. Ratton	LA/TE	Y	Y	Y	Y
Guilherme Horiuchi	AiT	N	N	Y	Y

Technical Review and Approval Team:

Name	Qualification
Denny Xue	Technical Reviewer / Technical Expert
Agustín Calle de Miguel	Report Approver

The curricula vitae of the Applus+ Certification's verification team members are provided below:

Mr. Marco A. Ratton:

Marco A. Ratton is based in Brazil and has acted as a GHG auditor since 2007. He holds vast experience with independent assessments of GHG project activities within the area of renewable energies, solid waste management and effluent treatment implemented in Latin America and other regions. He also has previous working experience with planning of municipal waste management as well as educational background in mechanical fabrication and manufacturing technologies, economics and environmental management & policy. He has undergone extensive training on GHG validation and verification and is a qualified Expert for Sectoral Scope 13 under Technical Area “Waste management” and Sectoral Scope 1, among others and in accordance with procedures of Applus+. He also has years-long previous experience of conducting ISO 9001/14001 assessments.

Mr. Guilherme Horiuchi:

Guilherme Horiuchi has bachelor's degree in environmental engineering. Mr. Horiuchi has worked as a GHG auditor since 2011 with CDM/GS4GG/GS project assessments in Latin America before he joined Applus+.

While counting with relevant previous experience/expertise as a trainee auditor with an U.N. accredited Certification Body and with proven experience and knowledge in both validation and verification assessments of GHG abatement/mitigation project-based initiatives under the U.N. Clean Development Mechanism (CDM) and Voluntary Carbon Standard (VCS), Mr. Horiuchi has supported the assessment/analysis of PDDs/PDs, Monitoring Reports, GHG emission reduction calculation spreadsheets, investment analysis spreadsheet for multiples project-based initiatives (under the CDM and VCS) promoting GHG abatement/mitigation through collection and destruction/utilization of landfill gas (LFG) located in Brazil, Chile and Colombia.

He is certified by SustainCERT Academy under the following scopes: “GS4GG”, “Energy and Waste” and also “Land use and Forest”. Moreover, he has also experience in conducting GHG Inventories for corporate and industry entities under ISO 14064.

Mr. Denny Xue:

Mr. Denny Xue (master's degree in environmental engineering, Bachelor's Degree in Thermal Engineering) is a GHG auditor appointed by Applus+ Certification for performing GHG project assessments, auditing and technical reviews. He has more than 6 years of work experience in CDM/GS4GG/VCS project assessment and technical review with Applus+ Certification. Before he joined Applus+ LGAI, he worked for Shanghai Chuanji Investment and Management which is a CDM consultancy company as a project manager for CDM project development. Mr. Denny Xue is based in Shanghai, China. Mr. Denny Xue participates in the project's technical review team.

2.2 Document Review

The Applus+ Certification's verification team conducted a comprehensive and detailed desk review of all documents initially provided by the project proponent + other publicly available documents that are relevant for the verification assessment. The main assessed documents are listed below:

- The registered VCS PD ^{/2/} for the 7-year renewable crediting period of the VCS project activity "Brusque landfill Gas Project", including the corresponding Validation Report ^{/3/}
- The initial version of the Monitoring Report for the 1st verification of the project activity ^{/1/}
- The applied CDM baseline and monitoring methodology ACM0001 "Flaring or use of landfill gas" (version 19.0) ^{/6/} + the following methodological tools:
 - "Emissions from solid waste disposal sites" (version 08.0) ^{/26/}
 - "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0) ^{/27/}
 - "Project emissions from flaring" (version 04.0) ^{/28/}
 - "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) ^{/29/}
 - "Tool to calculate the emission factor for an electricity system" (version 07.0) ^{/30/}
- Relevant decisions, clarifications and guidance from the CMP of the Kyoto Protocol and the CDM Executive Board;
- Any other information and references relevant to the project activity's resulting emission reductions (e.g. IPCC reports, data on electricity generation in the national grid or laboratory analysis and national regulations).

Besides the above-mentioned documents, the Applus+ Certification's verification team also assessed other additional documents that were required to assess the accuracy of the emission reduction calculations presented in the Monitoring Report ^{/1/}.

A detailed list of all assessed documents is included in Appendix 1 (Documents reviewed or referenced) of this Verification Report.

The desk review for the initial version of the Monitoring Report for the 1st verification of the project activity ^{/1/} and the registered VCS PD ^{/2/} included the following assessments:

- a review of data and information presented in the Monitoring Report to verify their completeness;
- a review of the monitoring plan from the registered VCS PD ^{/2/} and applied CDM baseline and monitoring methodology (ACM0001 (version 19.0) ^{/6/}), paying particular attention to the required frequency for measuring, recording and reporting of monitoring data. Requirements related to the quality of monitoring instruments/equipment (including calibration requirements, and the QA/QC procedures) were also observed;
- an evaluation of data management and the QA/QC system in the context of their influence on the generation and reporting of ERs.

2.3 Interviews

Applus+ Certification's verification team has performed an on-site inspection to the VCS project activity on 24-April-2024 and 25-April-2024, with the following interviews being performed on-site:

Interviewed personnel	Role / organization	Subject
Mr. Fernando Freitas	Veolia Environment ²	- General implementation and operational aspects of the VCS project activity. - Technical equipment and operational issues for installed equipment. - Specifications and operational details of monitoring and measurement equipment/instruments. - Calibration procedures for installed monitoring instruments/equipment. - Quality management system and related compliance with valid QA/QC procedures. - Implementation and operation of the project's monitoring plan.
Mr. Robson dos Santos	Veolia Environment	
Mr. Diego Borges	Veolia Environment	
Mr. Luiz Felipe Dall'Agnol	Unicarbo Biogás e Energia Ltda.	

² It is important to note that the company Recicle Catarinense de Resíduos Ltda. is part of the French multinational group Veolia Environment.

		- Monitoring data handling and management (incl. data gathering, recording and reporting). - Data uncertainty and residual risks. - Performance of emission reduction calculations. - Procedural aspects of the verification. - Performance of related maintenance and repair events. - Performance of the crosschecking procedures according to the monitoring plan.
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Moreover, the Applus+ Certification's verification team has performed three additional interviews on 14/10/2024 (via phone call) with the following representatives of local neighbourhoods (in order to obtain opinions regarding the implementation of the project activity and its operation during the considered monitoring period from local stakeholders):

- Mr. Jackson Beilfuss, operational manager of the local recycling company "Reciclagem Brusque" and resident of the neighbourhood Souza Cruz (located close to the Brusque landfill)
- Mr. Andresson Beilfuss, managing director of the local solid waste recycling company "Reciclagem Brusque" and resident of the neighbourhood Tomaz Coelho (located close to the Brusque landfill)
- Mr. Valter Floriani, operational director at company "Cacamba Cidade Limpa" (local company responsible for waste collection in Brusque)

The interviewees pointed out a set of benefits promoted by the VCS project activity in the region (including reduction of odor and generation of employment opportunities), with no negative impacts related to the implementation of the project activity and its operation during the considered monitoring period being indicated. In summary, the environmental, social and economic benefits of the VCS project activity were announced by all the interviewees, with no negative aspects being identified.

2.4 Site Visits

Applus+ Certification's verification team has performed an on-site inspection to the VCS project activity on 24-April-2024 and 25-April-2024, with the following assessment activities being performed on-site:

Activity performed on site	Site location	Date - team members
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Opening meeting for the on-site inspection. During such initial meeting, the Applus+ Certification's verification team was introduced. It was confirmed/outlined the objectives and scope of the on-site inspection and it was confirmed the previously planned agenda for the on-site inspection. The representatives of the project developer Recicle Catarinense de Resíduos Ltda. also introduced themselves and completed/signed the Applus+ Certification list of participants form for the on-site visit.	Operation control room of the VCS project activity	24-April-2024 Marco A. Ratton Guilherme Horiuchi
Visual inspection of the project's LFG collection system (installed LFG collecting wells and high-density polyethylene pipeline network) and confirmation of correctness of related information included in the Monitoring Report ^{/4/} and the registered VCS PD ^{/2/} regarding the implementation (project design) and operation of the assessed VCS project activity.	LFG flaring station	24-April-2024 Marco A. Ratton Guilherme Horiuchi
Visual inspection of the flaring station (set of equipment comprising high temperature enclosed flare, centrifugal blowers and all LFG / flaring monitoring instruments/equipment) and confirmation of correctness of related information included in the Monitoring Report ^{/4/} and the registered VCS PD ^{/2/} for the VCS project activity regarding the implementation (project design) and operation of the assessed VCS project activity.	LFG flaring station / project's data storage and control room	24-April-2024 Marco A. Ratton Guilherme Horiuchi
Visual inspection of related monitoring equipment (Programmable Logic Controller unit (PLC unit), data acquisition and storage infrastructure (database) and monitoring instruments); and checking/confirmation of correctness and appropriateness of data processing and data recording by the so far under operation project's monitoring infrastructure as well as correctness of related information included in the Monitoring Report ^{/4/} and the registered VCS PD ^{/2/} for the VCS project activity.	LFG flaring station / project's data storage and control room	25-April-2024 Marco A. Ratton Guilherme Horiuchi
Visual inspection and checking/confirmation of the correctness and appropriateness of the data	Conference room at the Brusque landfill	25-April-2024

acquisition process and procedures (including the process for retrieval of new set of raw data monthly files that are used as input data (raw data) for the calculation of emission reductions) as well as correctness of related information included in the Monitoring Report ^{/4/} and the registered VCS PD ^{/2/} for the VCS project activity. In the context of the performed checking, measurement figures of selected LFG and flaring monitoring parameter as visualized by the Applus+ Certification's verification team in the screen of the project's data supervisory system (in the control room of the VCS project activity) were compared with figures displayed in displays existent in selected monitoring equipment/instruments (for the same time instant) at the time of the performance of the on-site inspection. Such data checking/comparison aimed to confirm correct data processing and recording by the project's PLC unit and monitoring equipment respectively (at the time of the performed on-site inspection to the project site).		Marco A. Ratton Guilherme Horiuchi
Checking of the documented evidence provided by the project owner/operator (original documents that are kept stored in the project site + additional documentation used for cross-checking of calculation and information) and confirmation of correctness of related information presented in the Monitoring Report ^{/4/}. Such checking also encompassed assessment related to performance of calibration events in monitoring instruments/equipment and overall QA/QC practices as part of the operation of the VCS project activity (incl. assessment of authorities and responsibilities of project management and training related issues).	Conference room at the Brusque landfill	25-April-2024 Marco A. Ratton Guilherme Horiuchi

2.5 Resolution of Findings

As an outcome of a VCS verification process, the appointed verification team may raise different types of findings for identified issues.

Where a non-conformance arises the verification team shall raise a Corrective Action Request (CAR). A CAR is issued, where:

- Non-compliance with applicable requirement from the monitoring plan and/or applied baseline and monitoring methodology is identified in applied monitoring and/or reported in the Monitoring Report ^{1/} and/or reporting and has not been sufficiently documented by the VCS project proponent, or if the evidence provided to prove conformity is insufficient.
- Occurred modifications to the implementation, operation and monitoring of the VCS project activity occurred and were not sufficiently documented and/or reported in the Monitoring Report ^{1/}.
- Errors, inconsistencies and/or mistakes in applying assumptions, data and/or calculations of emission reductions (that impact the quantity of emission reductions) are identified.
- Issues previously identified in Forward Action Request (FAR) as part of validation or previously performed verification assessment for the VCS project activity (which would be required to be considered/addressed for the monitoring period encompassed by the verification assessment) are not addressed by the project proponent.

The Applus+ Certification's verification team shall raise a Clarification Request (CL) if information is insufficient or not sufficiently clear to determine whether the applicable CDM requirements have been met.

All CARs and CLs raised during verification shall be resolved prior to submitting a request for issuance.

As part of the performed verification assessment, six (6) CARs were raised by the Applus+ Certification's verification team. No CL and no FAR were raised as part of the performed verification assessment. The description of the raised findings, the responses of the project proponent and the assessment of such responses by the Applus+ Certification's verification team is presented in Appendix 2.

2.5.1 Forward Action Requests

No Forward Action Request (FAR) was raised as part of the performed VCS verification assessment. Furthermore, there are no FAR previously raised (as part of the previously performed validation assessment for the VCS project activity) which would be required to be considered/addressed for the considered monitoring period encompassed by the VCS verification assessment.

2.6 Eligibility for Validation Activities

This section is not applicable since Applus+ Certification holds the accreditation for Validation of projects under the Sectoral Scopes the VCS project activity falls into.

3 VALIDATION FINDINGS

3.1 Methodology Deviations

Not applicable. There are no methodology deviations identified during the current monitoring period.

3.2 Project Description Deviations

Not applicable. There are no project description deviations identified during the current monitoring period.

3.3 New Project Activity Instances in Grouped Projects

Not applicable.

3.4 Baseline Reassessment

Did the project undergo baseline reassessment during the monitoring period?

☐ Yes

☒ No

4 VERIFICATION FINDINGS

4.1 Project Details

Item	Evidence gathering activities, evidence checked, and assessment conclusion:
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Audit history	Applus+ Certification’s verification team has assessed the Validation Report ^{/3/}, the registered VCS PD ^{/2/}, Verra website project search page (https://registry.verra.org/app/projectDetail/VCS/4138) and thus confirmed the information stated in the Monitoring Report ^{/1/}: <table><tr><th>Audit type</th><th>Period</th><th>Program</th><th>Validation/v erification body name</th><th>Number of years</th></tr><tr><td>Validation</td><td>11-July-2022 to 10-July-2029</td><td>VCS</td><td>LGAI Technologic al Center, S.A. (Applus+ Certification)</td><td>7 years</td></tr><tr><td>1st Verification</td><td>(11-07-2022 to 31-12-2023)</td><td>VCS</td><td>LGAI Technological Center, S.A. (Applus+ Certification)</td><td>1 year and 174 days</td></tr></table>	Audit type	Period	Program	Validation/v erification body name	Number of years	Validation	11-July-2022 to 10-July-2029	VCS	LGAI Technologic al Center, S.A. (Applus+ Certification)	7 years	1 st Verification	(11-07-2022 to 31-12-2023)	VCS	LGAI Technological Center, S.A. (Applus+ Certification)	1 year and 174 days
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1 st Verification	(11-07-2022 to 31-12-2023)	VCS	LGAI Technological Center, S.A. (Applus+ Certification)	1 year and 174 days												
Double counting and participation under other GHG programs	The compliance of the VCS project activity with the applicable rules of “Participation under other GHG Programs” from VCS Standard (version 4.7) ^{/5/}: <i>“3.23.1 Project participants shall not seek credit for the same GHG emission reduction or removal under the VCS Program and another GHG program. Projects issuing GHG credits from different time periods under the VCS Program and another GHG program shall also conform with the rules and requirements in the Registration and Issuance Process”.</i> Applus+ Certification checked the registry/database for Program of Renewable Energy Certificates (RECs) in Brazil (I-REC Brazil) and confirmed that the VCS project activity is not accredited / registered under I-REC Brazil program (https://site.institutototum.com.br/). The Applus+ Certification’s verification team also checked publicly information and registration details valid for the registries/programs below and also confirmed that the VCS project activity has not previously sought registration in such															

	registries/programs (and therefore was not rejected by such registries/programs either): - The International REC Standard (https://www.irecstandard.org/) - - Global Carbon Council (GCC) (https://www.globalcarboncouncil.com/) - CERCARBONO (Certified Carbon Standard) (https://www.cercarbono.com/) - The Gold Standard for the Global Goals (GS4GG) (http://www.goldstandard.org/) Other forms of credit: The Applus+ Certification's verification team was also able to confirm that the GHG emission reductions generated and/or yet to be generated by the VCS project activity (including GHG emission reductions generated during the considered monitoring period) were not and will not be used for compliance with any emissions trading program or used to meet binding limits on GHG emissions in any compliance or voluntary GHG emission trading program or other binding limit mechanism. This was also confirmed by the Applus+ Certification's verification team through assessment of a declaration signed by the project developers, which is enclosed to the Monitoring Report ^{/1/}. Currently there is no compliance or voluntary GHG emission trading program or other binding limit mechanism in the host-country Brazil for which GHG emission reductions promoted by the VCS project activity would be eligible under. Moreover, the Applus+ Certification's verification team has confirmed that the applicability requirements 3.23.3 to 3.23.11 from the VCS Standard (version 4.7), which are also related to double counting and participation under other GHG Programs are not applicable since, as mentioned above, the VCS project activity is not registered under other GHG programs, nor has it previously sought registration in other registries/programs
No double claiming with emissions trading programs or binding emission limits	The Applus+ Certification's verification team has confirmed that the project activity is not registered/included in any other emissions trading program nor has any binding emission limit, as indicated above.

No double claiming with other forms of environmental credit	The Applus+ Certification's verification team has confirmed that the project activity has not sought, received nor is planning to receive credits from other GHG-related environment credit system.
Supply chain (scope 3) emissions double claiming	The Applus+ Certification's verification team has confirmed that neither the project proponent nor any authorized representative of the project activity are buyers/sellers of products whose emissions footprint are changed by the project activity.
Sustainable development contributions	Applus+ Certification's verification team has assessed the sustainable development contribution as described in the Monitoring Report ^{/1/}: SDG 13: 123,555 tCO₂e. The overall correctness of the presented figure was confirmed by Applus+ Certification's verification team by assessing the emission reductions calculation spreadsheets ^{/1/}. SDG 8: 3 job opportunities. The Applus+ Certification's verification team has confirmed, through assessment of a list of all the employees from the project proponent Recicle Catarinense de Resíduos Ltda. which are directly involved in the operation of the GS project activity ^{/48/}, that 3 (three) individuals associated with the operation of the VCS project activity were registered as employees/collaborators under conformance with procedures and requirements of the Brazilian labour legislation framework. SDG 7: No electricity generation occurred during the considered monitoring period as the project's electricity generation infrastructure is not yet implemented.
Additional information relevant to the project	There is no commercially sensitive information valid for the considered monitoring period.

4.2 Safeguards and Stakeholder Engagement

4.2.1 Stakeholder Identification

Item	Evidence gathering activities, evidence checked, and assessment conclusion
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Stakeholder identification	Not applicable. The stakeholder identification has not changed nor has been complemented since the validation of the VCS project activity, as confirmed by Applus+ Certification's verification team by assessing the Monitoring Report ^{/1/} , Validation Report ^{/3/} and the registered VCS PD ^{/2/} .
Legal or customary tenure/access rights	By taking into account the project type, design and location (including economic & social conditions and aspects in the region of influence of the landfill where the proposed VCS project activity is implemented), the Applus+ Certification's verification team is of the opinion that, as appropriately outlined in the Monitoring Report ^{/1/}, there are no legal or customary tenure/access rights to territories and resources, including collective and/or conflicting rights held by stakeholders which would need to be considered. While an Environmental Compliance Report (ECR) ^{/50/} was confirmed as being previously elaborated as part of the process to obtain the environmental license/permit for the Brusque landfill ^{/31/}, the content of the related ECR report sufficiently confirms the above-mentioned information.
Stakeholder diversity and changes over time	By taking into account the project type, design and location (including economic & social conditions and aspects in the region of influence of the landfill where the proposed VCS project activity is implemented), the Applus+ Certification's verification team is of the opinion that, as appropriately outlined in the Monitoring Report ^{/1/}, there are no changes expected to occur over time on the social, economic and cultural diversity within stakeholder groups to be considered. While an Environmental Compliance Report (ECR) ^{/50/} was confirmed as being previously elaborated as part of the process to obtain the environmental license/permit for the Brusque landfill ^{/31/}, the content of the related ECR report sufficiently confirms the above-mentioned information.
Expected changes in well-being	As confirmed by the Applus+ Certification's verification team through assessment of (i) the previously issued and approved Environmental Compliance Report (ECR) ^{/50/} for the construction and operation of the Brusque landfill (which addresses the influence of the construction and operation of this landfill over social-economical regional aspects) and (ii) the environmental license/permit ^{/31/} previously issued by the <i>Instituto do Meio Ambiente de Santa Catarina (IMA)</i> (environmental

	authority for the Santa Catarina State) for the Brusque landfill, there are no negative impacts or relevant risks for the general well-being of local stakeholders which could be caused or triggered by the occurred gradual/phased implementation of the VCS project activity (which does not adversely affect the operational conditions of the Brusque landfill and does not adversely affect the social-economical aspects of region of influence of this landfill under any circumstance).
Location of stakeholders	As confirmed by the Applus+ Certification's verification team through assessment of (i) the previously issued and approved Environmental Compliance Report (ECR) ^{/50/} for the construction and operation of the Brusque landfill, (ii) the environmental license/permit ^{/31/} previously issued by the <i>Instituto do Meio Ambiente de Santa Catarina</i> (IMA) (environmental authority for the Santa Catarina State) for the Brusque landfill and by also taking into account the nature of the project activity, it is reasonable to assume that the occurred partial/phased implementation of the project activity per se is not expected to cause any negative impacts over local stakeholders.
Location of resources	As confirmed by the Applus+ Certification's verification team through assessment of (i) the previously issued and approved Environmental Compliance Report (ECR) ^{/50/} for the construction and operation of the Brusque landfill, (ii) the environmental license/permit ^{/31/} previously issued by the <i>Instituto do Meio Ambiente de Santa Catarina</i> (IMA) (environmental authority for the Santa Catarina State) for the Brusque landfill and by also taking into account the nature of the project activity, it is reasonable to assume that there are no territories or resources owned by local stakeholders nor to which they have customary access.

4.2.2 Stakeholder Consultation and Ongoing Communication

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Ongoing consultation	Ongoing channels of communication were confirmed as being established by the project proponent Recicle Catarinense de Resíduos Ltda. and presented to the stakeholders during the conducted LSC meeting. As outlined in Section 2.1.2 of the Monitoring Report and confirmed by the Applus+ Certification's verification team through assessment of

	the slide presentation shown to stakeholders during the conducted meeting, the project proponent maintains open channels of communication with stakeholders through phone, WhatsApp application and email communication. Moreover, a grievance book is also confirmed as being made available at the central office of the Brusque landfill for any stakeholders to present their complaints and questions, as confirmed by Applus+ Certification's verification team during the conducted on-site visit. It is the opinion of the Applus+ Certification's verification team that the project proponent Recicle de Catarinense Resíduos Ltda. sufficiently demonstrated all actions taken in respect of both the stakeholder consultation and ongoing communications. Established mechanisms for ongoing communication with stakeholders allow stakeholders to raise concerns about potential impacts during project implementation and operation.
Date(s) of stakeholder consultation	13-July-2022
Communication of monitored results	As outlined in Section 2.1.2 of the Monitoring Report and confirmed by the Applus+ Certification's verification team through assessment of an email ^{/51/} sent by the project proponent on 28-February-2024 to all stakeholders invited to the previously conducted physical Stakeholder Consultation meeting, weblinks ^{/52/} containing the initial version of the Monitoring Report and an evaluation form were made available to all the stakeholders. General aspects about the operation of the project activity were also detailed in such email communication. It is the opinion of the Applus+ Certification's verification team that the project proponent Recicle de Catarinense Resíduos Ltda. sufficiently demonstrated all actions taken in respect of communication of monitored results and established mechanisms for communication of monitored results with stakeholders allow stakeholders to be informed and updated during project implementation and operation.
Consultation records	A grievance book is made available at the central office of the Brusque landfill for any stakeholders to present their complaints and questions, as confirmed by Applus+ Certification's verification team during the conducted on-site visit. It is the opinion of the Applus+ Certification's verification team that the project proponent Recicle de Catarinense Resíduos Ltda.

	sufficiently demonstrated all actions taken in respect of recording of consultation records and established mechanisms to recording of consultation records during project implementation and operation.
Stakeholder input	As confirmed by the Applus+ Certification's verification team, the project proponent Recicle de Catarinense Resíduos Ltda. has established a written procedure ^{/53/} (which was assessed by the Applus+ Certification's verification team) for addressing any potential concerns raised by local stakeholders, with responsible personnel and their contact information also being made available. It was also confirmed that there were so far no negative inputs from stakeholders regarding the implementation/operation of the VCS project activity. Furthermore, there are no changes in the project design that require updates to the local stakeholders.

4.2.3 Free, Prior, and Informed Consent

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Consent	As confirmed by the Applus+ Certification's verification team, Recicle de Catarinense Resíduos Ltda. is the only owner of the area where the infrastructure encompassed by the VCS project activity is located. Moreover, by taking into account the nature of the VCS project activity and its implementation location (a well-managed landfill site owned and operated by private party), Applus+ Certification's verification team has therefore confirmed that there are no risk of indigenous people or local communities sharing access rights to the area of where the VCS project activity is implemented and has operated, with no legal or customary tenure/access rights being applicable. In summary, there is no disrespect by the project proponent Recicle de Catarinense Resíduos Ltda. to stakeholders' rights to participate in and/or in terms of consenting to consultation as part of project design, implementation and operation. The project proponent Recicle de Catarinense Resíduos Ltda. has respected stakeholders' rights to participate in and consent to consultation as part of project design, its implementation and its so far occurred continuous operation. While an Environmental Compliance Report (ECR) ^{/50/} was confirmed as being previously elaborated as part of the process to obtain the environmental license/permit for the Brusque landfill ^{/31/}, the content

	of the related ECR report sufficiently confirms the above-mentioned information.
Outcome of FPIC discussion	Not applicable as explained above.

4.2.4 Grievance Redress Procedure

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Grievance received and steps taken to resolve the grievance including the outcomes of the resolution	The Applus+ Certification's verification team has confirmed, by assessing the written procedure and records for addressing stakeholder's grievances ^{/53/}, that no grievance was received during the considered monitoring period. It is the opinion of the Applus+ Certification's verification team that the project proponent Recicle de Catarinense Resíduos Ltda. developed a sufficient complete grievance redress procedure to address disputes with stakeholders that may arise during operation. Such procedure sufficiently included processes for receiving, hearing, responding and attempting to resolve grievances within a reasonable time period, taking into account culturally appropriate conflict resolution methods. The procedure and documentation of disputes resolved through the procedure was confirmed by the Applus+ Certification's verification team as being made publicly available.
Grievance redress procedure	The assessment for addressing stakeholder's grievances is described above.

4.2.5 Public Comments

Comments received	Actions taken by the project proponent	Evidence gathering activities, evidence checked, and assessment conclusion
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No comments were received so far since the opening of the “public comments period” as part of the Validation stage (period from 22/02/2023 to 24/03/2023).	No action was necessary as no comments have been received from stakeholders so far.	The Applus+ Certification’s verification team has confirmed, through assessment of the project’s webpage at the Verraa Registry, that no comments were received during the public comments period. Moreover, by assessing the grievance book (which is available at the central office of the Brusque landfill) and also by conducting interviews with project representatives during the performed on-site visit, Applus+ Certification also confirmed that no comments have been received so far.
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4.2.6 Risks to Local Stakeholders and the Environment

4.2.6.1 Management Experience

As confirmed by Applus+ Certification’s verification team and as correctly outlined in Section 2.2.1 of the Monitoring Report, the project proponent Recicle Catarinense de Resíduos Ltda. Is owned by the Brazilian division of a group that owns and operates different landfill sites in Brazil (Veolia Brasil), with management teams frequently sharing their experiences (in order to improve internal procedures related to best management practices). Moreover, the company always ensures that its employees undergo training in human resources integration, safety and the integrated management system. Related employees documentation ^{/48/} was assessed by the Applus+ Certification’s verification team.

Furthermore, for Recicle Catarinense de Resíduos Ltda. and Veolia Brasil, it is a corporate policy (with controls being implemented) not to have any kind of discrimination and sexual harassment being promote by employees, collaborators, and external parties as part of the operation of its companies.

4.2.6.2 Risk Assessment

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Natural and human induced risks to stakeholders’ wellbeing	By considering the type and design of the VCS project activity (project-based LFG recovery and destruction/utilization initiative) as well as the social and economic context of the location of the VCS project activity, the Applus+ Certification’s verification team is of the opinion (based on its expertise and experience with similar/comparable project-based

	initiatives also implemented in the country Brazil) that there are no risk to Natural and human induced risks to stakeholders' wellbeing.
Risks to stakeholder participation	By considering the type and design of the VCS project activity (project-based LFG recovery and destruction/utilization initiative) as well as the social and economic context of the location of the project activity, the Applus+ Certification's verification team is of the opinion (based on its expertise and experience with similar/comparable project-based initiatives also implemented in the country Brazil) that there are no risk to local stakeholder participation.
Working conditions	As appropriately outlined in the VCS PD, there are rigid procedures implemented at both the Brusque landfill and the project activity, as can be demonstrated at both company's guidelines "Programa de Controle Médico de Saúde Ocupacional" (translated as "Medical Control Program of Occupational Health") ^{/55/} and "Programa de Gerenciamento de Riscos" (translated as "Risk Management Program") ^{/54/}, which were assessed by the Applus+ Certification's verification team. These programs and procedures are in conformance with national Labor regulations. Furthermore, for Recicle Catarinense de Resíduos Ltda. it is a corporate policy (with controls being implemented) having good working conditions being ensured to employees, collaborator and external parties as part of the operation of its companies. The content of the related Environmental Compliance Report (ECR) ^{/31/} previously elaborated as part of the process to obtain the environmental license/permit for the Brusque landfill sufficiently confirms the above-mentioned information.
Safety of women and girls	By taking into account the type, design of the VCS project activity as well as the social and economic context of the location of the VCS project activity, the Applus+ Certification's verification team is of the opinion (based on its expertise and experience with similar/comparable project-based initiatives also implemented in the country Brazil) that it is deemed reasonable and acceptable to assume that there are no women and girls in the local community for which risks related to safety would need to be identified and/or for which related mitigation measures would need to be implemented due to the project design, its occurred implementation and so far occurred continuous operation.

Safety of minority and marginalized groups, including children	By taking into account the type, design and location of the VCS project activity (incl. the social and economic context of such location), the Applus+ Certification's verification team is of the opinion (based on its expertise and experience with similar/comparable project-based initiatives also implemented in the country Brazil) that it is deemed reasonable and acceptable to assume that there are no children, and minority and marginalized groups in the local community for which risks would need to be identified and/or for which related mitigation measures would need to be implemented due to the project design, its occurred implementation and so far occurred continuous operation.
Pollutants (air, noise, discharges to water, generation and release of hazardous materials and chemical pesticides and fertilizers)	By taking into account the type, design and location of the VCS project activity, the Applus+ Certification's verification team is of the opinion (based on its expertise and experience with similar/comparable project-based initiatives also implemented in the country Brazil) that it is deemed reasonable and acceptable to assume that there are no identified impacts (caused by pollutant emissions to air, discharges to water, noise and vibration, generation of waste, or the release of hazardous materials) to be mitigated due to the project design, its occurred implementation and so far occurred continuous operation.

4.2.7 Respect for Human Rights and Equity

4.2.7.1 Labor and Work

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Discrimination	As appropriately outlined in the Monitoring Report, it is reasonable to assume that the VCS project activity complies with principles of the National Council on Women's Rights, formed in 1975, which advocated successfully on behalf of including gender conscious legislation in the updated Brazilian Federal Constitution of 1988. The Applus+ Certification's verification team conducted an investigation in a Brazilian web portal which lists legal procedural consultation and initiated court cases (https://www.jusbrasil.com.br/) in order to check whether the project proponent Recicle Catarinense de Resíduos Ltda. is involved in any prosecuting cases or court cases involving discrimination and sexual harassment issues. No case was found involving Recicle Catarinense de Resíduos Ltda.

	Furthermore, for Recicle Catarinense de Resíduos Ltda. it is a corporate policy (with controls being implemented) not to have any kind of discrimination and sexual harassment being promote by employees, collaborator and external parties as part of the operation of its companies.
Sexual harassment	As appropriately outlined in the Monitoring Report, it is reasonable to assume that the VCS project activity complies with principles of the National Council on Women's Rights, formed in 1975, which advocated successfully on behalf of including gender conscious legislation in the updated Brazilian Federal Constitution of 1988. The Applus+ Certification's verification team conducted an investigation in a Brazilian web portal which lists legal procedural consultation and initiated court cases (https://www.jusbrasil.com.br/) in order to check whether the project proponent Recicle Catarinense de Resíduos Ltda. is involved in any prosecuting cases or court cases involving discrimination and sexual harassment issues. No case was found involving Recicle Catarinense de Resíduos Ltda. Furthermore, for Recicle Catarinense de Resíduos Ltda. it is a corporate policy (with controls being implemented) not to have any kind of discrimination and sexual harassment being promote by employees, collaborator and external parties as part of the operation of its companies.
Gender equity in labor and work	As appropriately outlined in the Monitoring Report, gender equality in Brazil is a right protected by the Brazilian Federal Constitution³. The Applus+ Certification's verification team conducted an investigation in a Brazilian web portal which lists legal procedural consultation and initiated court cases (https://www.jusbrasil.com.br/) in order to check whether the project proponent Recicle Catarinense de Resíduos Ltda. is involved in any prosecuting cases or court cases involving gender equality offenses. No case was found involving Recicle Catarinense de Resíduos Ltda. Furthermore, for Recicle Catarinense de Resíduos Ltda. it is a corporate policy (with controls being implemented) not to have any kind of discrimination and sexual harassment being promote by employees,

³ https://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm

	collaborator and external parties as part of the operation of its companies. In summary, it is sufficiently confirmed that the project design, its implementation and its so far occurred continuous operation provide equal opportunities (in the context of gender both in terms of employment and general project consultation) and also potentially provide equal pay for equal work in project design, implementation and operation.
Forced labor	As confirmed by Applus+ Certification's verification team and as correctly outlined in Section 2.3.1 of the Monitoring Report, the operation of the VCS project activity requires skilled and trained employees. Under conformance with applicable national regulations, Recicle Catarinense de Resíduos Ltda. does not employ and are not complicit in any form of child labour. The VCS project activity complies with applicable national legislation which prohibits the violation of the human rights principle and actively enforces the compliance of such principle. Furthermore, for Recicle Catarinense de Resíduos Ltda. it is a corporate policy (with controls being implemented) not to have any kind of human trafficking, forced labour, and child labour as part of the operation of its companies. In summary, it is sufficiently confirmed that the project proponent Recicle Catarinense de Resíduos Ltda. prohibits the use of forced labour, child labour and/or victims of human trafficking in project design and implementation.
Child labor	As confirmed by Applus+ Certification's verification team and as correctly outlined in Section 2.3.1 of the Monitoring Report, the operation of the VCS project activity requires skilled and trained employees. Under conformance with applicable national regulations, Recicle Catarinense de Resíduos Ltda. does not employ and are not complicit in any form of child labour. The VCS project activity complies with applicable national legislation which prohibits the violation of the human rights principle and actively enforces the compliance of such principle. Furthermore, for Recicle Catarinense de Resíduos Ltda. it is a corporate policy (with controls being implemented) not to have any kind of human trafficking, forced labour, and child labour as part of the operation of its companies.

	In summary, it is sufficiently confirmed that the project proponent Recicle Catarinense de Resíduos Ltda. prohibits the use of forced labour, child labour and/or victims of human trafficking in project design and implementation.
Human trafficking	As confirmed by Applus+ Certification's verification team and as correctly outlined in Section 2.3.1 of the Monitoring Report, the operation of the VCS project activity requires skilled and trained employees. Under conformance with applicable national regulations, Recicle Catarinense de Resíduos Ltda. does not employ and are not complicit in any form of child labour. The VCS project activity complies with applicable national legislation which prohibits the violation of the human rights principle and actively enforces the compliance of such principle. Furthermore, for Recicle Catarinense de Resíduos Ltda., it is a corporate policy (with controls being implemented) not to have any kind of human trafficking, forced labour, and child labour as part of the operation of its companies. In summary, it is sufficiently confirmed that the project proponent Recicle Catarinense de Resíduos Ltda. prohibits the use of forced labour, child labour and/or victims of human trafficking in project design and implementation.

4.2.7.2 Human Rights

Risks identified	Evidence gathering activities, evidence checked, and assessment conclusion
No risks identified.	As appropriately outlined in the Monitoring Report, human rights principles in Brazil are protected by the legislation (as per Brazilian Federal Law No. 12.986 of 2014⁴). This national legislation is under conformance with principles and rationale of the International Bill of Human Rights and universal instruments relating to human rights, The Applus+ Certification's verification team conducted an investigation in a Brazilian web portal which lists legal procedural consultation and initiated court cases (https://www.jusbrasil.com.br/) in order to check whether the project proponent Recicle Catarinense de Resíduos Ltda. is involved in any prosecuting cases or court cases

⁴ https://www.planalto.gov.br/ccivil_03/_ato2011-2014/2014/lei/l12986.htm

	involving human rights offenses. No case was found involving Recicle Catarinense de Resíduos Ltda. Furthermore, for Recicle Catarinense de Resíduos Ltda. it is a corporate policy (with controls being implemented) not to have any kind of discrimination and sexual harassment being promote by employees, collaborator and external parties as part of the operation of its companies. In summary, it is sufficiently confirmed that human rights have been respected as part of the project design, its implementation and its so far occurred continuous operation. It is also sufficiently confirmed that the project proponent Recicle Catarinense de Resíduos Ltda. has respected human rights as set out in the International Labour Organization's Declaration on Fundamental Principals and Rights at Work as part of project design, its implementation and so far occurred continuous operation.
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4.2.7.3 Indigenous Peoples and Cultural Heritage

Risks identified	Evidence gathering activities, evidence checked, and assessment conclusion
No risks identified.	As confirmed by Applus+ Certification's verification team through assessment of the previously performed Environmental Compliance Report (ECR) for the construction of the Brusque landfill, there are no sites of cultural heritage in the area of influence of this landfill site. As confirmed by the Applus+ Certification's verification team, there are no identified indigenous people for which respect would need to be recognized and for which protection of the rights would need to be ensured in line with applicable international human rights law, and the United Nations Declaration on the Rights of Indigenous People and ILO Convention 169 on Indigenous and Tribal Peoples as part of the project design, its implementation and its so far occurred continuous operation. Furthermore, as also confirmed by the Applus+ Certification's verification team, there are no cultural heritages to be preserved and/or protected consistent with indigenous people practices and/or UNESCO Cultural Heritage conventions as part of the project design, its implementation and its so far occurred continuous operation.

4.2.7.4 Property Rights

Risks identified	Evidence gathering activities, evidence checked, and assessment conclusion
No risks identified.	As confirmed by the Applus+ Certification's verification team through assessment of (i) the previously issued and approved Environmental Compliance Report (ECR) ^{/50/} for the construction and operation of the Brusque landfill (which addresses legal aspects such as rights to territories and/or resources) and (ii) the environmental license/permit previously issued for the Brusque landfill ^{/31/}, there are no issues related to rights to territories and/or resources which could be caused or triggered by the previously occurred construction of the Brusque landfill and/or later occurred gradual/phased implementation of the VCS project activity (which does not adversely affect the operational conditions of the Brusque landfill and does not adversely affect the social-economical and legal aspects of region of influence of this landfill under any circumstance). Therefore, it is the opinion of the Applus+ Certification's verification team that the issue of rights to territories and/or resources was appropriately addressed/justified in Section 2.3.4. of the Monitoring Report and under conformance with applicable VCS requirements. In summary, while an Environmental Compliance Report (ECR) was confirmed as being previously undertaken as part of the process to obtain the environmental license/permit for the Brusque landfill ^{/31/}, the content of the related Environmental Compliance Report (ECR) sufficiently confirms the above-mentioned information.

4.2.7.5 Benefit Sharing

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Summary of the benefit sharing plan	Not applicable. As appropriately outlined in Section 2.3.5 of the Monitoring Report, the project activity does not impact property rights. There are no people that were relocated and/or had to be compensated due to the design of the VCS project activity, its implementation and its so far occurred continuous operation. The content of the previously elaborated Environmental Compliance Report (ECR) ^{/50/} as part of the process to obtain the environmental

	license/permit for the Brusque landfill / ^{31/} sufficiently confirms the above-mentioned information.
Benefit sharing during the monitoring period	Not applicable. As appropriately outlined in Section 2.3.5 of the Monitoring Report, the project activity does not impact property rights. There are no people that were relocated and/or had to be compensated due to the design of the VCS project activity, its implementation and its so far occurred continuous operation. The content of the previously elaborated Environmental Compliance Report (ECR) /^{50/} as part of the process to obtain the environmental license/permit for the Brusque landfill /^{31/} sufficiently confirms the above-mentioned information.

4.2.8 Ecosystem Health

Item	Evidence gathering activities, evidence checked, and assessment conclusion
Impacts on biodiversity and ecosystems	By taking into account the type, design and location of the VCS project activity, the Applus+ Certification's verification team is of the opinion (based on its expertise and experience with similar/comparable project-based initiatives also implemented in the country Brazil) that it is deemed reasonable and acceptable to assume that there are no negative impacts on biodiversity and ecosystems (for which risks and/or mitigation measures would need to be implemented) due to the project design, its occurred implementation and so far occurred continuous operation. As also appropriately outlined in the Monitoring Report, in general, the identified environmental aspects for the VCS project activity are positive (with no relevant negative environmental impact being identified) While there is no relevant negative environmental aspect/impact for the VCS project activity, the currently valid environmental license/permit valid/applicable for the Brusque landfill /^{31/} does not define or require any regular monitoring of potentially relevant negative environmental aspect/impact.

	The Applus+ Certification's verification team confirmed, through assessment of related licensing documentation that, as appropriately outlined in Section 2.4 of the Monitoring Report, the Brusque landfill was granted with valid environmental licensing/permit issued by the local environmental authority. It is also relevant to note that all the possible environmental impacts caused by the construction of the landfill were previously identified (with mitigation measures being presented, where necessary) in the Environmental Compliance Report (ECR) for the construction of the landfill, as established by National and local requirements. While the implementation of the project activity per se does not have any impacts over the construction/operation of the landfill, such impacts should not be considered as impacts that may be caused by the project activity.
Soil degradation and soil erosion	By taking into account the type, design and location of the VCS project activity, the Applus+ Certification's verification team is of the opinion (based on its expertise and experience with similar/comparable project-based initiatives also implemented in the country Brazil) that it is deemed reasonable and acceptable to assume that the project design, its occurred implementation and so far occurred continuous operation do not contribute in any manner for soil degradation and soil erosion by converting natural non-degraded ecosystems, or drain or degrade the hydrological functions of a natural, non-degraded ecosystem.
Water consumption and stress	By taking into account the type, design and location of the VCS project activity, the Applus+ Certification's verification team is of the opinion (based on its expertise and experience with similar/comparable project-based initiatives also implemented in the country Brazil) that it is deemed reasonable and acceptable to assume that the project design, its occurred implementation and so far occurred continuous operation do not promote any water consumption and stress by converting natural non-degraded ecosystems, or drain or degrade the hydrological functions of a natural, non-degraded ecosystem.

4.2.8.1 Rare, Threatened, and Endangered species

Item	Evidence gathering activities, evidence checked, and assessment conclusion
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Species or habitat	By taking into account the type, design and location of the VCS project activity, the Applus+ Certification's verification team is of the opinion (based on its expertise and experience with similar/comparable project-based initiatives also implemented in the country Brazil) that it is deemed reasonable and acceptable to assume that there are no habitat adversely affected by the project design, its occurred implementation and so far occurred continuous operation. As confirmed by the Applus+ Certification's verification team, the VCS project activity and the Brusque landfill are not located in areas in or adjacent to, habitats for rare, threatened, or endangered species.
Areas needed for habitat connectivity	Not applicable. As appropriately outlined in Section 2.4.1 of the Monitoring Report, the project activity is not located in, or adjacent to areas needed for habitat connectivity. The content of the previously elaborated Environmental Compliance Report (ECR) ^{/50/} as part of the process to obtain the environmental license/permit for the Brusque landfill ^{/31/} sufficiently confirms the above-mentioned information.

Evidence gathering activities, evidence checked, and assessment conclusion	
Habitats for rare, threatened, and endangered species	Not applicable. As appropriately outlined in Section 2.4.1 of the Monitoring Report, the project activity is not located in, or adjacent to habitats for rare, threatened, or endangered species. The content of the previously elaborated Environmental Compliance Report (ECR) ^{/50/} as part of the process to obtain the environmental license/permit for the Brusque landfill ^{/31/} sufficiently confirms the above-mentioned information.
Areas for habitat connectivity	By taking into account the type, design and location of the VCS project activity, the Applus+ Certification's verification team is of the opinion (based on its expertise and experience with similar/comparable project-based initiatives also implemented in the country Brazil) that it is deemed reasonable and acceptable to assume that there are no habitat adversely affected by the project design, its occurred implementation and so far occurred continuous operation. As confirmed by the Applus+ Certification's verification team, the VCS project activity and the Brusque landfill are not located in areas for habitat connectivity.

4.2.8.2 Introduction of Species

Species introduced	Evidence gathering activities, evidence checked, and assessment conclusion
N/A	

Existing invasive species	Evidence gathering activities, evidence checked, and assessment conclusion
N/A	

Evidence gathering activities, evidence checked, and assessment conclusion	
Invasive species	N/A

4.2.8.3 Ecosystem conversion

Item	Evidence gathering activities and evidence checked
Ecosystem conversion	Not applicable. By taking into account the type, design and location of the VCS project activity, the Applus+ Certification's verification team is of the opinion (based on its expertise and experience with similar/comparable project-based initiatives also implemented in the country Brazil) that it is deemed reasonable and acceptable to assume that the project design, its implementation and its so far occurred continuous operation do not promote any ecosystem conversion or allow ecosystem conversion to occur.

4.3 Accuracy of Reduction and Removal Calculations

As per the applied monitoring procedure and in accordance with the requirements of the applied CDM baseline and monitoring methodology ACM0001 (version 19.0) ^{/6/} and related provisions of the registered VCS PD ^{/2/} for the VCS project activity, GHG emission reductions are calculated based on measurement records and selected values of the ex-post monitored parameters (of which monitoring details are presented in the tables below) and also correctly considering values for ex-ante determined parameters.

Assessment of ex-ante determined parameters:

Values for the following ex-ante determined parameters are correctly reported in the Monitoring Report /1/ and are correctly considered in the context of ex-post determination of GHG emission reductions achieved by the VCS project activity during the considered monitoring period:

Ex-ante determined parameter	Applied value		
Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline (OX_{top_layer})	0.1		
Global Warming Potential of CH_4 (GWP_{CH_4})	28 tCO_2e/tCH_4		
Universal ideal gases constant (R_u)	8,314 $Pa \cdot m^3/kmol \cdot K$		
Molecular mass of greenhouse gas i (MM_i)	16.04 $kg/kmol$		
Molecular mass of gas k (MM_k)	28.01 $kg/kmol$ for the gas Nitrogen (N_2)		
Molecular mass of water (MM_{H_2O})	18.0152 $kg/kmol$		
Total pressure at normal conditions (P_n)	101,325 Pa		
Temperature at normal conditions (T_n)	273.15 K		
Manufacturer's flare specifications for temperature, flow rate and maintenance schedule ($SPEC_{flare}$)	$SPEC_{flare}$	Min.	Max.
	Operational LFG flow (for continuous operation)	400 Nm^3/h	2,000 Nm^3/h
	Required temperature of the exhaust gas of the flare (to ensure LFG destruction (combustion) under high CH_4 destruction efficiency):	850 $^{\circ}C$	1,200 $^{\circ}C$
Manufacturer's flare specifications for temperature, flow rate and maintenance schedule ($SPEC_{flare}$)	Required minimum frequency for inspection and maintenance service (incl. inspection in the conditions of the flare isolation ceramics revetment material):	Min. every 6 months	

Weighting of build margin emissions factor (w_{BM})	0.50
Weighting of operating margin emissions factor (w_{OM})	0.50
Build margin CO ₂ emission factor in year y ($EF_{grid,BM,y}$)	0.0540 tCO ₂ /MWh

Ex-ante determined parameters not used in the context of ex-post calculation of emission reductions achieved by the VCS project activity during the considered monitoring period:

The Applus+ Certification's verification team has also confirmed that the following ex-ante determined parameters (which are also included/listed in the registered VCS PD ^{/2/}) were not considered/used for the purpose of ex-post determination of baseline emissions and/or project emissions achieved by the VCS project activity during the considered monitoring period:

- Efficiency of the LFG capture system that will be installed in the project activity (η_{PJ})
- Default value for the model correction factor to account for model uncertainties ($\phi_{default}$)
- Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil (or other material covering the waste)) (OX)
- Fraction of methane in the SWDS gas (volume fraction) (F)
- Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS ($DOC_{f,default}$)
- Methane correction factor ($MCF_{default}$)
- Fraction of degradable organic carbon in the waste type j (weight fraction) (DOC_j)
- Decay rate for the waste type j (k_j)
- Weight fraction of the waste type j (W_j)

The above-listed parameters are confirmed by the Applus+ Certification's verification team as being only used in the context of ex-ante estimation of emission reductions to be achieved by the VCS project activity as reported and further explained in its registered VCS PD ^{/2/}.

Moreover, as appropriately outlined in the Monitoring Report ^{/1/}, while the emission factor for the electricity grid was determined as the combined emission factor ($EF_{grid,CM,y}$) as per Option A.1 of the CDM methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0), the ex-ante determined parameter "CO₂ emission factor for grid-sourced electricity in year y " ($EF_{EL,grid,y}$) was thus not used for the determination of baseline emissions and project emissions achieved by the VCS project activity during the considered monitoring period.

Assessment of parameters monitored ex-post:

The Applus+ Certification's verification team has assessed whether the monitoring parameter of which monitoring ex-post is required as per the monitoring plan of the VCS PD ^{/2/} was correctly monitored during the considered monitoring period.

As confirmed by the Applus+ Certification's verification team, monitoring activities for the VCS project activity were performed for the considered monitoring period under full conformance with related requirements as established in the monitoring plan of the registered VCS PD ^{/2/} for the project activity ^{/2/}. Assessment details for monitoring the parameter monitored ex-post for the considered monitoring period are summarized below in the following table:

Data / Parameter:	Management of SWDS (Management of SWDS)
Measuring, recording and reporting frequencies:	The ex-post determination of the monitoring parameter "Management of the SWDS" is not based on measurements. As correctly outlined in the Monitoring Report ^{/1/}, management aspects of the Brusque landfill are compared against previously defined landfill management practices (as per the also previously conceived original construction and operational design of this particular landfill). This comparison aims to confirm that management and operation of the Brusque landfill (including relevant aspects related to landfilling practice) were not intentionally modified with the unique aim of increasing generation of methane on site and thus artificially increasing baseline emissions for the project activity. As per the monitoring plan from the registered VCS PD ^{/2/}, monitoring for the parameter "Management of the SWDS" is confirmed as being performed on the basis of a technical evaluation assessment ^{/18/} of the overall management and operation of the Brusque landfill with at least every year frequency. The evaluation assessment performed by the independent 3rd party engineering company "GSA Engenharia Ltda." as the applicable monitoring procedure for the parameter Management of the SWDS valid for valid from 11-July-2022 to 10-July-2023 ^{/32/}. are of deemed reasonable and acceptable frequency. That sufficiently confirms that the applied monitoring frequency is in accordance with both the monitoring plan from the registered VCS PD ^{/2/} and ACM0001 (version 19.0) ^{/6/}. While the Registered VCS PD ^{/2/} establishes monitoring frequency for the parameter "Management of the SWDS" of

	every one-year (12 months), evaluation assessment valid for considered monitoring period were performed under a higher frequency. By taking into account the required monitoring frequency as per the monitoring plan from the registered VCS PD /2/, the performed technical assessments which are referred to in the Monitoring Report /1/ are thus correctly assumed as being valid for the whole considered monitoring period.
Type of monitoring equipment/instrument:	Not applicable
Calibration frequency	Not applicable
How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	The Applus+ Certification's verification team was able to verify that related information included in the Monitoring Report /1/ is fully in accordance with the content of the evaluation/declaration report issued by GSA Engenharia Ltda. /32/. These technical reports were made available and were assessed by the Applus+ Certification verification team.
Does the applied monitoring data management process (from monitoring equipment/instrument to emission reduction calculation) ensure correct recording, transfer and reporting of data to be used for the emission reductions calculations? Are necessary/applicable QA/QC processes in place?	Yes. Details for data transfer and reporting of emission reductions (incl. relevant QA/QC process) are further assessed at the end of this Section. In the particular case of the monitoring parameter "Management of the SWDS", there are no monitoring records (figures) to be considered/accounted in the context of emission reduction calculations for the considered monitoring period. However, the annual comparison of applied management aspects of the Brusque landfill against the defined landfill management practices as per the previously conceived original construction and operational design of the landfill (in order to confirm that management and operation of the Brusque landfill were not intentionally modified with the unique aim of increasing generation of methane on site) is a monitoring requisite. As required by ACM0001 (version 19.0) /6/, any change in the management of the landfill after the implementation of the project activity is to be justified by referring to technical or regulatory specifications and related impacts of such eventual changes should be addressed in the determination of baseline emissions. In summary, monitoring information for the parameter "Management of the SWDS" is used for the

	determination/confirmation of baseline emissions and/or confirmation of the project's implementation as per project design descriptions included in the registered VCS PD ^{/2/} (in terms of operation and management conditions of the landfill from which LFG is combusted).										
Data / Parameter:	Volumetric flow of the LFG stream in time interval t on a wet basis (where j is the LFG delivery pipeline to the flare and/or to each engine-generator set). ($V_{t,wb,j}$)										
Measuring, recording and reporting frequencies:	During the considered monitoring period, continuous measurements of the monitoring parameter $V_{t,wb,j}$ were recorded and reported with an every minute frequency. As per the registered VCS PD ^{/2/} for the VCS project activity, measurements of $V_{t,wb,j}$ are to be continuously performed by the use of appropriate LFG flow meters. Moreover, ACM0001 (version 19.0) ^{/6/} does not specify any monitoring frequency for $V_{t,wb,j}$. The applied measuring, recording and reporting frequencies are thus in accordance with both ACM0001 (version 19.0) ^{/6/} and the registered VCS PD ^{/2/} for the VCS project activity.										
Type of monitoring equipment/instrument:	Continuously measurements of $V_{t,wb,j}$ were confirmed as being performed by installed pressure signal processing + data transmission unit and the measurement elements (annubar) of which main specifications details are summarized below: <table border="1"> <thead> <tr> <th colspan="2">Specifications of the utilized measurement element (annubar)</th></tr> </thead> <tbody> <tr> <td>Serial number</td><td>0153225</td></tr> <tr> <td>Accuracy</td><td>$\pm 1.0\%$</td></tr> <tr> <td>Model</td><td>Rosemount 485 Annubar Primary Element</td></tr> <tr> <td>Manufacturer</td><td>Emerson Electric Co. (former Rosemount Inc.)</td></tr> </tbody> </table> Source: ^{/33/}	Specifications of the utilized measurement element (annubar)		Serial number	0153225	Accuracy	$\pm 1.0\%$	Model	Rosemount 485 Annubar Primary Element	Manufacturer	Emerson Electric Co. (former Rosemount Inc.)
Specifications of the utilized measurement element (annubar)											
Serial number	0153225										
Accuracy	$\pm 1.0\%$										
Model	Rosemount 485 Annubar Primary Element										
Manufacturer	Emerson Electric Co. (former Rosemount Inc.)										

Specifications of the utilized pressure signal processing + data transmission unit (in operation from 11-July-2022 to 22-November-2023)

Serial number	3K646621050136
Accuracy	±0.075%
Model	2600T
Manufacturer	ABB S.p.A.

Source: /33/

Specifications of the utilized pressure signal processing + data transmission unit (in operation from 22-November-2023 to 31-December-2023)

Serial number	3K646621050137
Accuracy	±0.075%
Model	2600T
Manufacturer	ABB S.p.A.

Source: /33/

The registered VCS PD /2/ for the VCS project activity and ACM0001 (version 19.0) /6/ do not specify any accuracy requirement for the pressure signal processing + data transmission unit and the measurement element (annubar) installed at the project site. Based on its sectoral expertise and experience with similar project-based initiatives promoting LFG collection and destruction/utilization, it is the opinion of the Applus+ Certification's verification team that the use of the installed instruments represents good practice for monitoring of total amount of LFG captured and destroyed by flaring.

Calibration frequency

As per the implemented monitoring procedure at Brusque landfill and recommendations from the equipment's manufacturer, the installed pressure signal processing + data transmission unit are to be calibrated yearly and the measurement elements (annubar) are to be calibrated every 5 years. As confirmed by the Applus+ Certification's verification

team through assessment of the specification sheet for the installed pressure signal processing + data transmission unit and the measurement elements (annubar), the selected calibration frequency is as per the recommendations of the instrument manufacturer.

According to the Monitoring Report ^{/1/}, no calibration is required, only a dimensional checking (metrology analysis) and cleaning in the annubar element with an every 5-year frequency. Also, as per the Monitoring Report ^{/1/}: “While the measurement element has been installed and operational since July/2022 and no abnormal functioning has so far been detected, a dimensional checking and cleaning of the sensor element is thus currently expected to be performed only by July/2027”, thus no performance checking + annubar element cleaning is required until July 2027.

Calibration events valid for pressure signal processing + data transmission unit (in operation from 11-July-2022 to 22-November-2023) (S/N 3K646621050136):

Calibration date	Certificate number	Company performing the calibration event	Validity
11-November-2021	1001178832	ABB S.p.A.	10-November-2022
07-November-2022	14809221107	Tecnoiso Instrumentação e Calibração	06-November-2023

Source: ^{/7/}

Calibration events valid for pressure signal processing + data transmission unit (in operation from 23-November-2023 to 31-December-2023) (S/N 3K646621050137):

Calibration date	Certificate number	Company performing the calibration event	Validity
23-November-2022	15103221122	Tecnoiso Instrumentação e Calibração	22-November-2023
31-October-2023	11509231031	Tecnoiso Instrumentação e Calibração	30-October-2024

Source: /7/

Calibration Certificates for the above-summarized calibration events were made available and assessed by the Applus+ Certification's verification team.

As per both the registered VCS PD /2/ for the VCS project activity and ACM0001 (version 19.0) /6/, the installed pressure signal processing + data transmission units and the measurement elements (annubar) are to be calibrated in a frequency as per the instrument's specifications and/or instrument manufacturer's recommendations. Thus, the adopted calibration frequencies (1 year for the pressure signal processing + data transmission units and 5 years for the annubar element (metrology analysis and cleaning), as per recommendations from the equipment's manufacturers) is in line with both the monitoring plan of the registered VCS PD /2/ for the VCS project activity and ACM0001 (version 19.0) /6/.

As also confirmed by Applus+ Certification's verification team the performed calibration events for the pressure signal processing + data transmission units and the measurement elements (annubar) confirmed proper functioning of the measurement instruments.

As outlined in the Monitoring Report /1/, a relative delay was identified, since no calibration event was identified for the above-mentioned pressure signal processing + data transmission unit, thus, a conservative correction factor was systematically applied in all related measurement records for the monitoring parameter $V_{t,wb,j}$ as follows:

	Serial Number	Correction factor applied	Period when the correction factor is applied
	3K6466210 50136	-1.075%	From 06-November-2022 to 22-November-2022
	±1.075% represents the assumed maximum permissible error of the measurement instruments (measurement element (annubar) and pressure signal processing data + data transmission unit), which is higher than the measurement deviation error which was obtained as a result of the performed delayed calibration event in the instrument. The total maximum permissible error of the measurement instruments was applied in order to be conservative.		
How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified, compared and/or cross-checked?	Assessment details about recording of values measured at the project site are included in Section “<i>Assessment of handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission reductions achieved by the VCS project activity during the considered monitoring period</i>”. Furthermore, a data authenticity checking was performed for all measurement records of the following LFG and LFG flaring/utilization related monitoring parameters to demonstrate and ensure that only authentic/not modified monitoring data was used as input data for the emission reduction calculations for the considered monitoring period: - Volumetric flow of the LFG stream in time interval t on a wet basis (where j is the LFG delivery pipeline to the flare and/or to each engine-generator set) ($V_{t,wb,j}$) - Volumetric fraction of CH₄ in the collected LFG in time interval t on a wet basis j (where j is the LFG delivery pipeline to the flare and/or to each engine-generator set). ($V_{CH_4,t,wb,j}$) - Temperature of the LFG stream in time interval t (T_t) - Pressure of the LFG stream in time interval t (P_t)		

	- Temperature in the exhaust gas of the enclosed flare in minute m ($T_{EG,m}$) - Flame detection of flare in the minute m ($Flame_m$) The performed checking aimed to ensure that monitoring data were not intentionally or unintentionally edited/modified by anyone prior of being used as primary data input for the processing of emission reduction calculations. The performed checking also aimed to ensure that the emission reduction calculation spreadsheet ^{/20/} includes only authentic monitoring records. Details about the performed data authenticity checking (which is valid for listed LFG and LFG flaring/utilization related monitoring data) are included in Section “<i>Data Authenticity Checking</i>”.
Does the applied monitoring data management process (from monitoring equipment/instrument to emission reduction calculation) ensure correct recording, transfer and reporting of data to be used for the emission reductions calculations? Are necessary/applicable QA/QC processes in place?	Yes. Details for data transfer and reporting of emission reductions (incl. relevant QA/QC process) are further assessed in Section “<i>Assessment of handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission reductions achieved by the VCS project activity during the considered monitoring period</i>”.

Data / Parameter:	Volumetric fraction of CH₄ in the collected LFG in interval t on a wet basis for j (where j is the LFG delivery pipeline to the flare and/or to each engine-generator set). ($v_{CH_4,t,wb,j}$)
Measuring, recording and reporting frequencies:	During the considered monitoring period, continuous measurements of the monitoring parameter $v_{CH_4,t,wb,j}$ were recorded and reported with an every minute frequency. As per the registered VCS PD ^{/2/} for the VCS project activity, measurements of $v_{CH_4,t,wb,j}$ are to be performed continuously. Moreover, ACM0001 (version 19.0) ^{/6/} does not specify any

	monitoring frequency for $v_{CH_4,t,wb,j}$ the applied measuring, recording and reporting frequencies are thus in accordance with both ACM0001 (version 19.0) ^{/6/} and the registered VCS PD ^{/2/} for the VCS project activity.			
Type of monitoring equipment/instrument:	Continuously measurements of $v_{CH_4,t,wb,j}$ were confirmed as being performed by an installed continuous CH ₄ /O ₂ fraction gas analyser unit of which main specifications details are summarized below:			
	Specifications of the utilized continuous CH ₄ /O ₂ fraction gas analyser unit			
	Serial number	N1NN247		
	Accuracy	±0.5%		
	Model	Ultramat 23		
	Manufacturer	Siemens		
	Source: ^{/34/}			
	The registered VCS PD ^{/2/} for the VCS project activity and ACM0001 (version 19.0) ^{/6/} do not specify any accuracy requirement for the installed continuous CH ₄ /O ₂ fraction gas analyser unit at the project site. The accuracy range for the installed instrument is ±0.5%. Based on its sectoral expertise and experience with similar project-based initiatives promoting LFG collection and destruction/utilization, it is the opinion of the Applus+ Certification’s verification team that the use of the Installed instrument represents good practice for monitoring of methane fraction in the LFG.			
Calibration frequency	As per the implemented monitoring procedure at Brusque landfill and recommendations from the equipment’s manufacturer, the installed continuous CH ₄ /O ₂ fraction gas analyser unit is to be calibrated every year. As confirmed by the Applus+ Certification’s verification team through assessment of the specification sheet for the installed continuous CH ₄ /O ₂ fraction gas analyser unit, the selected calibration frequency is as per the recommendations of the instrument manufacturer.			
	Calibration date	Certificate number	Company performing the	Validity

		calibration event	
01-December-2021	4518557368	Siemens AG	30-November-2022
15-February-2022	007B.22	Bioteconogas s.r.l.	14-February-2023
14-February-2023	14205230214	Tecnoiso Instrumentação e Calibração	13-February-2024

Source: /35/

Calibration Certificates for the above-summarized calibration events were made available and assessed by the Applus+ Certification's verification team.

As per both the registered VCS PD /2/ for the VCS project activity and ACM0001 (version 19.0) /6/, the installed continuous CH₄/O₂ fraction gas analyser unit is to be calibrated in a frequency as per the instrument's specifications and/or instrument manufacturer's recommendations. Thus, the adopted calibration frequency 1-year, as per recommendations from the equipment's manufacturer) is in line with both the monitoring plan of the registered VCS PD /2/ for the VCS project activity and ACM0001 (version 19.0) /6/.

As also confirmed by Applus+ Certification's verification team the performed calibration events for the continuous CH₄/O₂ fraction gas analyser unit confirmed proper functioning of the measurement instruments.

How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?

Assessment details about recording of values measured at the project site are included in Section "Assessment of handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission reductions achieved by the VCS project activity during the considered monitoring period".

Furthermore, a data authenticity checking was performed for all measurement records of the following LFG and LFG flaring/utilization related monitoring parameters to demonstrate and ensure that only authentic/not modified

	monitoring data was used as input data for the emission reduction calculations for the considered monitoring period: - Volumetric flow of the LFG stream in time interval t on a wet basis (where j is the LFG delivery pipeline to the flare and/or to each engine-generator set) ($V_{t,wb,j}$) - Volumetric fraction of CH_4 in the collected LFG in time interval t on a wet basis j (where j is the LFG delivery pipeline to the flare and/or to each engine-generator set). ($V_{CH_4,t,wb,j}$) - Temperature of the LFG stream in time interval t (T_t) - Pressure of the LFG stream in time interval t (P_t) - Temperature in the exhaust gas of the enclosed flare in minute m ($T_{EG,m}$) - Flame detection of flare in the minute m ($Flame_m$) The performed checking aimed to ensure that monitoring data were not intentionally or unintentionally edited/modified by anyone prior of being used as primary data input for the processing of emission reduction calculations. The performed checking also aimed to ensure that the emission reduction calculation spreadsheet /20/ includes only authentic monitoring records. Details about the performed data authenticity checking (which is valid for listed LFG and LFG flaring/utilization related monitoring data) are included in Section “Data Authenticity Checking”.
Does the applied monitoring data management process (from monitoring equipment/instrument to emission reduction calculation) ensure correct recording, transfer and reporting of data to be used for the emission reductions calculations?	Yes. Details for data transfer and reporting of emission reductions (incl. relevant QA/QC process) are further assessed in Section “Assessment of handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission reductions achieved by the VCS project activity during the considered monitoring period”.

Are necessary/applicable
QA/QC processes in place?

Data / Parameter:

Temperature of the LFG stream in time interval t (T_t)

Measuring, recording and
reporting frequencies:

During the considered monitoring period, continuous measurements of the monitoring parameter T_t were recorded and reported with every minute frequency.

As per the registered VCS PD ^{/2/} for the VCS project activity, measurements of T_t are to be continuously performed by the use of appropriate temperature meters. Moreover, ACM0001 (version 19.0) ^{/6/} does not specify any monitoring frequency for T_t . The applied measuring, recording and reporting frequencies are thus in accordance with both ACM0001 (version 19.0) ^{/6/} and the registered VCS PD ^{/2/} for the VCS project activity.

Type of monitoring
equipment/instrument:

Continuously measurements of T_t were confirmed as being performed by installed temperature meters of which main specifications details are summarized below:

Specifications of the utilized temperature meter

Serial number	E22TP0013
Accuracy	$\pm 1.0\%$
Model	Y1-SEM203/P
Manufacturer	ELSI S.R.L.

Source: ^{/36/}

The registered VCS PD ^{/2/} for the VCS project activity and ACM0001 (version 19.0) ^{/6/} do not specify any accuracy requirement for the temperature meter installed at the project site. Based on its sectoral expertise and experience with similar project-based initiatives promoting LFG collection and destruction/utilization, it is the opinion of the Applus+ Certification's verification team that the use of the installed instrument represents good practice for monitoring of the temperature of LFG.

Calibration frequency

As per the implemented monitoring procedure at Brusque landfill and recommendations from the equipment's

manufacturer, the installed temperature meter is to be calibrated every year. As confirmed by the Applus+ Certification's verification team through assessment of the specification sheet for the installed temperature meter, the selected calibration frequency is as per the recommendations of the instrument manufacturer.

Calibration date	Certificate number	Company performing the calibration event	Validity
18-January-2022	EL22/0013	ELSI s.r.l.	17-January-2023
23-October-2023	11502231031	Tecnoiso Instrumentação e Calibração	22-October-2024

Source: /39/

Calibration Certificates for the above-summarized calibration events were made available and assessed by the Applus+ Certification's verification team.

As per both the registered VCS PD /2/ for the VCS project activity and ACM0001 (version 19.0) /6/, the installed temperature meter is to be calibrated in a frequency as per the instrument's specifications and/or instrument manufacturer's recommendations.

Thus, the adopted calibration frequency (1 year, as per recommendations from the equipment's manufacturer) is in line with both the monitoring plan of the registered VCS PD /2/ for the VCS project activity and ACM0001 (version 19.0) /6/.

As also confirmed by Applus+ Certification's verification team the performed calibration events for the temperature meter confirmed proper functioning of the measurement instrument.

As outlined in the Monitoring Report /4/, a relative delay was identified, since no calibration event was identified for the above-mentioned temperature meter, thus, a conservative correction factor was systematically applied in all related measurement records for the monitoring parameter T_t as follows:

	Serial Number	Correction factor applied	Period when the correction factor is applied
	E22TP0013	-1.0%	From 17-January-2023 to 22-October-2023
	The $\pm 1.0\%$ represents the assumed maximum permissible error of the measurement instrument, which is higher than the measurement deviation error which was obtained as a result of the performed delayed calibration event in the instrument.		
How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified, compared and/or cross-checked?	Assessment details about recording of values measured at the project site are included in Section “<i>Assessment of handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission reductions achieved by the VCS project activity during the considered monitoring period</i>”. Furthermore, a data authenticity checking was performed for all measurement records of the following LFG and LFG flaring/utilization related monitoring parameters to demonstrate and ensure that only authentic/not modified monitoring data was used as input data for the emission reduction calculations for the considered monitoring period: - Volumetric flow of the LFG stream in time interval t on a wet basis (where j is the LFG delivery pipeline to the flare and/or to each engine-generator set) ($V_{t,wb,j}$) - Volumetric fraction of CH_4 in the collected LFG in time interval t on a wet basis j (where j is the LFG delivery pipeline to the flare and/or to each engine-generator set). ($V_{CH_4,t,wb,j}$) - Temperature of the LFG stream in time interval t (T_t) - Pressure of the LFG stream in time interval t (P_t) - Temperature in the exhaust gas of the enclosed flare in minute m ($T_{EG,m}$) - Flame detection of flare in the minute m ($Flame_m$)		

	The performed checking aimed to ensure that monitoring data were not intentionally or unintentionally edited/modified by anyone prior of being used as primary data input for the processing of emission reduction calculations. The performed checking also aimed to ensure that the emission reduction calculation spreadsheet ^{/20/} includes only authentic monitoring records. Details about the performed data authenticity checking (which is valid for listed LFG and LFG flaring/utilization related monitoring data) are included in Section “<i>Data Authenticity Checking</i>”.
Does the applied monitoring data management process (from monitoring equipment/instrument to emission reduction calculation) ensure correct recording, transfer and reporting of data to be used for the emission reductions calculations? Are necessary/applicable QA/QC processes in place?	Yes. Details for data transfer and reporting of emission reductions (incl. relevant QA/QC process) are further assessed in Section “<i>Assessment of handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission reductions achieved by the VCS project activity during the considered monitoring period</i>”.
Data / Parameter:	Pressure of the LFG stream in time interval t (P_t)
Measuring, recording and reporting frequencies:	During the considered monitoring period, continuous measurements of the monitoring parameter P_t were recorded and reported with every minute frequency. As per the registered VCS PD ^{/2/} for the VCS project activity, measurements of P_t are to be continuously performed by the use of appropriate pressure meters. Moreover, ACM0001 (version 19.0) ^{/6/} does not specify any monitoring frequency for P_t. The applied measuring, recording and reporting frequencies are thus in accordance with both ACM0001 (version 19.0) ^{/6/} and the Registered VCS PD ^{/2/} for the VCS project activity.

Type of monitoring equipment/instrument:

Continuously measurements of P_t were confirmed as being performed by installed pressure meters of which main specifications details are summarized below:

Specifications of the utilized pressure meter

Serial number	3K646622000904
Accuracy	$\pm 0.06\%$
Model	266HSH
Manufacturer	ABB S.p.A.

Source: /36/

The registered VCS PD /2/ for the VCS project activity and ACM0001 (version 19.0) /6/ do not specify any accuracy requirement for the pressure meter installed at the project site. Based on its sectoral expertise and experience with similar project-based initiatives promoting LFG collection and destruction/utilization, it is the opinion of the Applus+ Certification's verification team that the use of the installed instrument represents good practice for monitoring of the pressure of the gaseous stream.

Calibration frequency

As per the implemented monitoring procedure at Brusque landfill and recommendations from the equipment's manufacturer, the installed pressure meter is to be calibrated every 2 years. As confirmed by the Applus+ Certification's verification team through assessment of the specification sheet for the installed pressure meter, the selected calibration frequency is as per the recommendations of the instrument manufacturer.

Calibration date	Certificate number	Company performing the calibration event	Validity
10-January-2022	1001189752	ABB S.p.A.	09-January-2024
07-November-2022	14806221107	Tecnoiso Instrumentação e Calibração	06-November-2024

	<table><tr><td>31-October-2023</td><td>11506231031</td><td>Tecnoiso Instrumentação e Calibração</td><td>30-October-2025</td></tr></table>	31-October-2023	11506231031	Tecnoiso Instrumentação e Calibração	30-October-2025
31-October-2023	11506231031	Tecnoiso Instrumentação e Calibração	30-October-2025		
	Source: ^{/37/} Calibration Certificates for the above-summarized calibration events were made available and assessed by the Applus+ Certification's verification team. As per both the registered VCS PD ^{/2/} for the VCS project activity and ACM0001 (version 19.0) ^{/6/}, the installed pressure meter is to be calibrated in a frequency as per the instrument's specifications and/or instrument manufacturer's recommendations. Thus, the adopted calibration frequency (2 years, as per recommendations from the equipment's manufacturer) is in line with both the monitoring plan of the registered VCS PD ^{/2/} for the VCS project activity and ACM0001 (version 19.0) ^{/6/}. As also confirmed by Applus+ Certification's verification team the performed calibration events for the pressure meter confirmed proper functioning of the measurement instrument.				
How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	Assessment details about recording of values measured at the project site are included in Section “Assessment of handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission reductions achieved by the VCS project activity during the considered monitoring period”. Furthermore, a data authenticity checking was performed for all measurement records of the following LFG and LFG flaring/utilization related monitoring parameters to demonstrate and ensure that only authentic/not modified monitoring data was used as input data for the emission reduction calculations for the considered monitoring period: - Volumetric flow of the LFG stream in time interval t on a wet basis (where j is the LFG delivery pipeline to the flare and/or to each engine-generator set) ($V_{t,wb,j}$) - Volumetric fraction of CH₄ in the collected LFG in time interval t on a wet basis j (where j is the LFG delivery				

	pipeline to the flare and/or to each engine-generator set). ($V_{CH4,t,wb,j}$) - Temperature of the LFG stream in time interval t (T_t) - Pressure of the LFG stream in time interval t (P_t) - Temperature in the exhaust gas of the enclosed flare in minute m ($T_{EG,m}$) - Flame detection of flare in the minute m ($Flame_m$) The performed checking aimed to ensure that monitoring data were not intentionally or unintentionally edited/modified by anyone prior of being used as primary data input for the processing of emission reduction calculations. The performed checking also aimed to ensure that the emission reduction calculation spreadsheet ^{/20/} includes only authentic monitoring records. Details about the performed data authenticity checking (which is valid for listed LFG and LFG flaring/utilization related monitoring data) are included in Section “<i>Data Authenticity Checking</i>”.
Does the applied monitoring data management process (from monitoring equipment/instrument to emission reduction calculation) ensure correct recording, transfer and reporting of data to be used for the emission reductions calculations? Are necessary/applicable QA/QC processes in place?	Yes. Details for data transfer and reporting of emission reductions (incl. relevant QA/QC process) are further assessed in Section “<i>Assessment of handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission reductions achieved by the VCS project activity during the considered monitoring period</i>”.
Data / Parameter:	Saturation pressure of H_2O at temperature T_t in time interval t ($P_{H2O,t,sat}$)

Measuring, recording and reporting frequencies:	The determination of applicable value for the monitoring parameter $P_{H2O,t,sat}$ is not based on measurements. As correctly indicated in the Monitoring Report ^{/1/}, $P_{H2O,t,Sat}$ is determined as a function of the LFG temperature (T_t) and it is only used in the context of the determination of the methane mass flow in the residual gas (in a dry basis) for each minute m of the two time periods in year y during which the flare efficiency is measured (parameter $F_{CH4,RG,t}$).
Type of monitoring equipment/instrument:	Not applicable. The determination of applicable value for the monitoring parameter $P_{H2O,t,sat}$ is not based on measurements.
Calibration frequency	Not applicable. The determination of applicable value for the monitoring parameter $P_{H2O,t,sat}$ is not based on measurements.
How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	Applus+ Certification's verification team has confirmed that the values of $P_{H2O,t,sat}$ as reported in the FE calculation spreadsheet ^{/22/} and Monitoring Report ^{/1/} were indeed calculated as per the applicable guidance of the CDM methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) ^{/29/}, which refers to the literature "Fundamentals of Classical Thermodynamics" ^{/43/}.
Does the applied monitoring data management process (from monitoring equipment/instrument to emission reduction calculation) ensure correct recording, transfer and reporting of data to be used for the emission reductions calculations? Are necessary/applicable QA/QC processes in place?	Not applicable.
Data / Parameter:	Amount of grid electricity consumed by the project activity during the year y ($EC_{PJ,grid,y}$)

Measuring, recording and reporting frequencies:

During the considered monitoring period, accumulated values of continuous measurements of $EC_{PJ,grid,y}$ were aggregated and recorded/reported monthly by the monitoring staff of the VCS project activity.

As per the as per the registered VCS PD ^{/2/} for the VCS project activity, the parameter $EC_{PJ,grid,y}$ is to be monitored continuously. ACM0001 (version 19.0) ^{/6/} and the CDM methodological tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0) ^{/27/} do not clearly indicate recording and reporting frequencies for continuous measurements for the parameter $EC_{PJ,grid,y}$. Thus, the adopted measuring, recording and reporting frequency for $EC_{PJ,grid,y}$ is assumed as in accordance with the monitoring plan of the registered VCS PD ^{/2/} for the VCS project activity, the Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion and ACM0001 (version 19.0) ^{/6/}.

Type of monitoring equipment/instrument:

During the considered monitoring period, measurements of $EC_{PJ,grid,y}$ were confirmed as being performed by an electricity meter of which main technical specifications are presented below:

Specifications of the utilized electricity meter

Manufacturer	Kron Instrumentos Eléctricos Ltda.
Model	Multi-K-Plus
Serial Number (S/N)	2310978
Accuracy	±0.2%

Source: ^{/40/}

The registered VCS PD ^{/2/} and/or ACM0001 (version 19.0) ^{/6/} do not specify any accuracy requirement for the electricity meter. The accuracy range for the installed measuring instrument is ±0.5%. Based on its expertise and experience with similar project-based initiatives promoting LFG collection and destruction/utilization, it is Applus+ Certification’s verification team opinion that the use of the installed instrument represents

	good practice for monitoring of consumption of grid-sourced electricity.		
Calibration frequency	As per the implemented monitoring procedure at Brusque landfill and recommendations from the equipment's manufacturer, the installed electricity meter is to be calibrated every 5 years by CELESC - Centrais Elétricas de Santa Catarina (local electricity distribution company). As confirmed by the Applus+ Certification's verification team through assessment of the specification sheet for the installed electricity meter, the selected calibration frequency is as per the recommendations of the instrument manufacturer ^{/40/}. As per both the registered VCS PD for the VCS project activity and ACM0001 (version 19.0) ^{/6/}, the installed electricity meter is to be calibrated in a frequency as per the instrument's specifications. Thus, the adopted calibration frequency (5 years, as per recommendations from the equipment's manufacturer) is in line with both the monitoring plan of the registered VCS PD ^{/2/} for the VCS project activity and ACM0001 (version 19.0) ^{/6/}. As also confirmed by Applus+ Certification's verification team and appropriately outlined in the Monitoring Report ^{/1/}, the installed electricity meter was purchased and installed by CELESC - Centrais Elétricas de Santa Catarina during the year of 2021 (when the project's electricity generation infrastructure was under construction). As per the implemented monitoring procedure at Brusque landfill and recommendations from the equipment's manufacturer, the installed electricity meter is to be calibrated every 5 years. As confirmed by the Applus+ Certification's verification team through assessment of the specification sheet for the installed electricity meter, the selected calibration frequency is as per the recommendations of the instrument manufacturer.		
	Calibration date	Certificate number	Company performing the calibration event
			Validity

	02-May-2022	787/22	Kron Instrumentos Elétricos Ltda.	01-May-2027
	17-February-2023	14204230217	Tecnoiso Instrumentação e Calibração	16-February-2028
How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared? Does the applied monitoring data management process (from monitoring equipment/instrument to emission reduction	Source: /56/ Calibration Certificates for the above-summarized calibration events were made available and assessed by the Applus+ Certification's verification team. As per both the registered VCS PD /2/ for the VCS project activity and ACM0001 (version 19.0) /6/, the installed electricity meter is to be calibrated in a frequency as per the instrument's specifications and/or instrument manufacturer's recommendations. Thus, the adopted calibration frequency (5 years, as per recommendations from the equipment's manufacturer) is in line with both the monitoring plan of the registered VCS PD /2/ for the VCS project activity and ACM0001 (version 19.0) /6/. As also confirmed by Applus+ Certification's verification team the performed calibration events for the electricity meter confirmed proper functioning of the measurement instrument.			
	Records of grid-sourced electricity consumed during the considered monitoring period, as reported in the emission reduction calculation spreadsheet /20/ and Monitoring Report /4/ were cross-checked with monthly reports of grid-sourced electricity purchase issued by CELESC - Centrais Elétricas de Santa Catarina (Electric distribution company) /42/ which were made available and assessed by the Applus+ Certification's verification team. Such cross-checking confirmed correctness of reported data for $EC_{PJ,grid,y}$ during the considered monitoring period.			
	Yes. Details for data transfer and reporting of emission reductions (incl. relevant QA/QC process) are further assessed in Section "Assessment of handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission			

calculation) ensure correct recording, transfer and reporting of data to be used for the emission reductions calculations? Are necessary/applicable QA/QC processes in place?	reductions achieved by the VCS project activity during the considered monitoring period”.
Data / Parameter:	Operating margin CO₂ emission factor in year y = Dispatch data analysis operating margin CO₂ emission factor in year y ($EF_{grid,OM,y} = EF_{grid,OM-DD,y}$)
Measuring, recording and reporting frequencies:	While the monitoring parameter $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$ is required to be monitored yearly, for the considered monitoring period within years 2022 and 2023, the applicable values for this monitoring period are selected. As per the registered VCS PD ^{/2/} for the VCS project activity, monitoring of $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$ is to be performed yearly. Moreover, the CDM methodological tool “Tool to calculate the emission factor for an electricity system” (version 07.0) ^{/30/} specifies the monitoring frequency for $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$ as yearly. Thus, the applied monitoring frequency is thus in accordance with both the CDM methodological tool “Tool to calculate the emission factor for an electricity system” (version 07.0) ^{/30/} and the registered VCS PD ^{/2/} for the VCS project activity. For the considered monitoring period, $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$ is correctly selected as follows: - 0.4069 tCO₂/MWh (calculated value applicable for year 2022 as published by the CDM’s Designated National Authority (DNA) for Brazil). - 0.3786 tCO₂/MWh (calculated value applicable for year 2023 as published by the CDM’s Designated National Authority (DNA) for Brazil).
Type of monitoring equipment/instrument:	Not applicable
Calibration frequency	Not applicable

How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?

As confirmed by the Applus+ Certification's verification team, the DNA of Brazil has regularly calculated values of $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$ for the National Electricity Grid of Brazil by applying classified information and data on dispatch of electricity by grid-connected power plants within the National Electricity Grid of Brazil and by following the applicable guidance of the CDM methodological tool "Tool to calculate the emission factor for an electricity system" (version 07.0) ^{/30/}. Related clarifications and details for the determination of $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$ by the DNA of Brazil are made available at a specific section of the website of the DNA of Brazil ^{/44/}. Information made available in the website of the DNA of Brazil confirms the correctness of the selected value for $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$.

The Applus+ Certification's verification team also confirmed as part of its performed assessment that *ex-post* determined values for both $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$ and Build margin CO₂ emission factor ($EF_{grid,BM,y}$) on the basis of information published by the DNA of Brazil have been selected and applied for the determination of both baseline and project emissions related to electricity generation and consumption respectively in projects hosted in Brazil with full acceptance from the DOEs involved in the assessments and from Verra/VCS.

The selected values for the monitoring parameter $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$ valid for the of years 2022 and 2023 were confirmed by the Applus+ Certification verification to correctly represent the official values as published by the DNA of Brazil (available online: <https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/dados-e-ferramentas/fatores-de-emissao>).

In summary, it is Applus+ Certification opinion that the selection and reporting of the monitoring parameter $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$ is deemed correct and acceptable.

Does the applied monitoring data management process (from monitoring equipment/instrument to emission reduction calculation) ensure correct recording, transfer and

As confirmed by the Applus+ Certification's verification team, the DNA of Brazil has regularly calculated values of $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$ and $EF_{grid,BM,y}$ for the National Electricity Grid of Brazil by applying classified information and data on dispatch of electricity by grid-connected power plants within the National Electricity Grid of Brazil.

reporting of data to be used for the emission reductions calculations? Are necessary/applicable QA/QC processes in place?

The Applus+ Certification's verification team also confirmed as part of its performed assessment that, for applicable cases, *ex-post* monitored values for $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$ and the *ex-ante* determined value for $EF_{grid,BM,y}$ based on information published by the DNA of Brazil ^{/44/} have been systematically selected and applied for the determination of both baseline and project emissions related to electricity generation and consumption respectively in VCS projects hosted in Brazil with full acceptance both from the DOEs involved in the assessments and from Verra/VCS.

The selected values for the monitoring parameter $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$ and the selected 2021 vintage value for the *ex-ante* determined parameter $EF_{grid,BM,y}$ were confirmed by the Applus+ Certification's verification team to correctly represent the official values as published by the DNA of Brazil ^{/44/}.

In summary, it is Applus+ Certification opinion that the selection and reporting of the monitoring parameter $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$ is deemed correct and acceptable.

Data / Parameter:

Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period t ($F_{CH4,EG,t}$)

Measuring, recording and reporting frequencies:

For the considered monitoring period, 3 sets of valid measurements for the monitoring parameter $F_{CH4,EG,t}$ were performed by a third party accredited entity for the installed enclosed flare.

The independent 3rd party inspection service company Start5g Tecnologia Ambiental Ltda. was selected by Recicle Catarinense de Resíduos Ltda. for performing the set of measurements required for the determination of the 3 sets of values for $F_{CH4,EG,t}$.

As outlined in the test/evaluation technical reports issued by Start5g Tecnologia Ambiental Ltda. ^{/22/}, performance of measurements for the determination of the set of valid values for $F_{CH4,EG,t}$ valid for the considered monitoring period occurred in the following dates:

- 28-December-2022
- 29-June-2023

	- 18-April-2024 As per the VCS PD /2/, measurements and calculations for the determination of values for the monitoring parameter $F_{CH_4,EG,t}$ are to be performed biannually with the following conditions of the CDM methodological tool “Project emissions from flaring” (version 04.0) being considered: <i>“The calculated flare efficiency $\eta_{flare,calc,m}$ is determined as the average of at least two measurements of the flare efficiency made in year y ($\eta_{flare,calc,y}$), adjusted by an uncertainty factor of 5 percentile points”.</i> (...) <i>“The two-time periods in year y during which the flare efficiency is measured, each a minimum of one hour and separated by at least six months”.</i>
Type of monitoring equipment/instrument:	As outlined in the Monitoring Report /1/ and in the test/evaluation reports /22/ issued for the valid performed measurements and calculations for the regular determination of the values of $F_{CH_4,EG,t}$, for performing the measurements of amount of residual methane in the exhaust gas of the flare, the following measuring instruments were used: - For performing the measurements of amount of residual methane in the exhaust gas of the flare a chromatographer was utilized by the independent 3rd party inspection service company Start5g Tecnologia Ambiental Ltda. - For determining the speed of exhaust gas in the flare (in order to calculate the flow of exhaust gas of the flare), an appropriated Pitot tube was used by Start5g Tecnologia Ambiental Ltda. as part of the measurements. As per information made available in the technical evaluation/testing report issued by Start5g Tecnologia Ambiental Ltda., applicable measurement and test methodologies of U.S.A. Environmental Protection Agency (US-EPA) and CETESB (Companhia Ambiental do Estado de São

Paulo (Environmental Agency for São Paulo State in Brazil)) were applied as follows:

- US-EPA Method 18 – “Measurement of Gaseous Organic Compound Emission by Gas Chromatography”
- CETESB L9.221 – “Pipelines and chimneys in stationary emission sources – Sampling points determination procedure”
- CETESB L9.222 – “Pipeline and chimneys in stationary emission sources – Determination of speed and outflow of gases”
- CETESB L9.223 – “Pipeline and chimneys in stationary emission sources – Determination of dry molecular mass and the excess of the air flow gas”
- CETESB L9.224 – “Pipeline and chimneys in stationary emission sources – “Determination of humidity of effluents”

The VCS PD ^{/2/} and ACM0001 (version 19.0) ^{/7/} do not specify any equipment or procedural requirement for performing the related measurements and calculations for the determination of values for $F_{CH_4,EG,t}$.

The CDM methodological tool “Project emissions from flaring” (version 04.0) ^{/12/} establishes the following:

“(…) under Option B.1 the measurement is conducted by an accredited entity at least on a biannual basis”.

“The two-time periods in year y during which the flare efficiency is measured, each a minimum of one hour and separated by at least six months”.

The following disclaimer about the entity that performed the set of measurements for $F_{CH_4,EG,t}$ that are valid for the considered monitoring period is appropriately included in Section 4.2. of the Monitoring Report ^{/1/}:

“Start5g Tecnologia Ambiental Ltda. is an independent third-party inspections services company specialized in inspections and testing of air emissions from stationary sources accredited by the Instituto Nacional de Metrologia, Qualidade e Tecnologia (INMETRO) (the Brazilian national authority for metrology and certification affairs), which is responsible for the regulation of operation of inspection entities and labs.”

	In summary, it is the opinion of Applus+ Certification's verification team that Start5g Tecnologia Ambiental Ltda. Performing related measurements with the measurement instruments indicates above and following the applicable measurement and test methodologies of the US-EPA and CETESB represent a good practice for the determination of $F_{CH_4,EG,t}$. The accreditation certificate for Start5g Tecnologia Ambiental Ltda. from INMETRO is attached to the test/evaluation reports /22/ and was assessed by the Applus+ Certification's verification team.
Calibration frequency	The technical test/evaluation reports issued by the third-party independent inspection service company Start5g Tecnologia Ambiental Ltda. highlight that the utilized chromatographers and Pitot tubes were in full conformance with calibration requirements applicable for this instruments/equipment. The registered VCS PD /2/ and ACM0001 (version 19.0) /7/ do not specify any equipment or procedural requirement for performing the related measurements and calculations for the determination of values for $F_{CH_4,EG,t}$. No calibration frequency requirement for related instruments/equipment used by accredited entities is specified by the CDM methodological tool "Project emissions from flaring" (version 04.0) /12/. As indicated in the technical valid test/evaluation reports issued by the third-party independent inspection service company Start5g Tecnologia Ambiental Ltda., the performed calibration events for both the utilized chromatographer and the Pitot tube were under conformance with calibration requirements applicable for these instruments. No information, evidence/proof for performed calibration events in equipment/instruments utilized by the inspection service company Start5g Tecnologia Ambiental Ltda. were made available to the Applus+ Certification's verification team.
How were the values in the Monitoring Report (and/or supporting documents, i.e	The Applus+ Certification's verification team compared the results of all measurements and calculations as outlined in the test/evaluation technical reports issued by Start5g Tecnologia

emission reduction calculation spreadsheet) verified and/or compared?	Ambiental Ltda. against description of measurements and calculations as presented in the latest version of the Monitoring Report ^{/4/} and spreadsheet including the calculation of flare efficiency values valid for the considered monitoring period ^{/11/} .
Does the applied monitoring data management process (from monitoring equipment/instrument to emission reduction calculation) ensure correct recording, transfer and reporting of data to be used for the emission reductions calculations? Are necessary/applicable QA/QC processes in place?	Details for monitoring management and quality assurance related aspects for the project activity are also included in the end of this Section.

Data / Parameter:	Temperature in the exhaust gas of the enclosed flare in minute m ($T_{EG,m}$)						
Measuring, recording and reporting frequencies:	During the considered monitoring period, continuous measurements of the monitoring parameter $T_{EG,m}$ were recorded and reported with an every minute frequency. As per the registered VCS PD ^{/2/} for the VCS project activity, measurements of $T_{EG,m}$ are to be performed continuously. Moreover, ACM0001 (version 19.0) ^{/6/} does not specify any monitoring frequency for $T_{EG,m}$ the applied measuring, recording and reporting frequencies are thus in accordance with both ACM0001 (version 19.0) ^{/6/} and the registered VCS PD ^{/2/} for the VCS project activity.						
Type of monitoring equipment/instrument:	Continuously measurements of $T_{EG,m}$ were confirmed as being performed by installed thermocouples of which main specifications details are summarized below: <table border="1"> <thead> <tr> <th colspan="2">Specifications of the utilized thermocouple</th></tr> </thead> <tbody> <tr> <td>Serial number</td><td>E22TS0015</td></tr> <tr> <td>Accuracy</td><td>$\pm 0.5^{\circ}\text{C}$</td></tr> </tbody> </table>	Specifications of the utilized thermocouple		Serial number	E22TS0015	Accuracy	$\pm 0.5^{\circ}\text{C}$
Specifications of the utilized thermocouple							
Serial number	E22TS0015						
Accuracy	$\pm 0.5^{\circ}\text{C}$						

	Model	Y1-TT33CX/S		
	Manufacturer	ELSI s.r.l.		
	Source: /45/			
	The registered VCS PD /2/ for the VCS project activity and ACM0001 (version 19.0) /6/ do not specify any accuracy requirement for the thermocouple installed at the project site. Based on its sectoral expertise and experience with similar project-based initiatives promoting LFG collection and destruction/utilization, it is the opinion of the Applus+ Certification’s verification team that the use of the installed instruments represents good practice for monitoring of temperature in the exhaust gas of the enclosed flare.			
Calibration frequency	As per the implemented monitoring procedure at Brusque landfill and recommendations from the equipment’s manufacturer, the installed thermocouple is to be calibrated in a yearly frequency. As confirmed by the Applus+ Certification’s verification team through assessment of the specification sheet for the installed thermocouple, the selected calibration frequency is as per the recommendations of the instrument manufacturer.			
	Calibration date	Certificate number	Company performing the calibration event	Validity
	18-January-2022	EL22/0015	ELSI s.r.l.	17-January-2023
	31-October-2023	11508231031	Tecnoiso Instrumentação e Calibração	30-October-2024
	Source: /46/			
	Calibration Certificates for the above-summarized calibration events were made available and assessed by the Applus+ Certification’s verification team.			
	As per both the registered VCS PD /2/ for the VCS project activity and ACM0001 (version 19.0) /6/, the installed thermocouple is to be calibrated in a frequency as per the instrument’s specifications and/or instrument manufacturer’s			

recommendations. Thus, the adopted calibration frequency (1 year, as per recommendations from the equipment's manufacturer) is in line with both the monitoring plan of the registered VCS PD ^{/2/} for the VCS project activity and ACM0001 (version 19.0) ^{/6/}.

As also confirmed by Applus+ Certification's verification team the performed calibration events for the thermocouple confirmed proper functioning of the measurement instrument.

As outlined in the Monitoring Report ^{/1/}, a relative delay was identified, since no calibration event was identified for the above-mentioned thermocouple, thus, a conservative correction factor was systematically applied in all related measurement records for the monitoring parameter T_{EG} as follows:

Serial Number	Correction factor applied	Period when the correction factor is applied
E22TS0015	-0.5°C	From 17-January-2023 to 30-October-2023

The -0.5°C represents the assumed maximum permissible error of the measurement instrument, which is higher than the measurement deviation error which was obtained as a result of the performed delayed calibration event in the instrument.

How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?

Assessment details about recording of values measured at the project site are included in Section "*Assessment of handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission reductions achieved by the VCS project activity during the considered monitoring period*".

Furthermore, a data authenticity checking was performed for all measurement records of the following LFG and LFG flaring/utilization related monitoring parameters to demonstrate and ensure that only authentic/not modified monitoring data was used as input data for the emission reduction calculations for the considered monitoring period:

	- Volumetric flow of the LFG stream in time interval t on a wet basis (where j is the LFG delivery pipeline to the flare and/or to each engine-generator set) ($V_{t,wb,j}$) - Volumetric fraction of CH_4 in the collected LFG in time interval t on a wet basis ($V_{CH_4,t,wb,j}$) - Temperature of the LFG stream in time interval t (T_t) - Pressure of the LFG stream in time interval t (P_t) - Temperature in the exhaust gas of the enclosed flare in minute m ($T_{EG,m}$) - Flame detection of flare in the minute m ($Flame_m$) The performed checking aimed to ensure that monitoring data were not intentionally or unintentionally edited/modified by anyone prior of being used as primary data input for the processing of emission reduction calculations. The performed checking also aimed to ensure that the emission reduction calculation spreadsheet /20/ includes only authentic monitoring records. Details about the performed data authenticity checking (which is valid for listed LFG and LFG flaring/utilization related monitoring data) are included in Section “Data Authenticity Checking”.
Does the applied monitoring data management process (from monitoring equipment/instrument to emission reduction calculation) ensure correct recording, transfer and reporting of data to be used for the emission reductions calculations? Are necessary/applicable QA/QC processes in place?	Yes. Details for data transfer and reporting of emission reductions (incl. relevant QA/QC process) are further assessed in Section “Assessment of handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission reductions achieved by the VCS project activity during the considered monitoring period”.

Data / Parameter:	Flame detection of flare in the minute m (Flame _m)								
Measuring, recording and reporting frequencies:	During the considered monitoring period, the operational status of the flares was recorded and reported every minute on the basis of continuous measurements of the status of flame in the flares. As correctly outlined in the latest version of the Monitoring Report^{/1/}, while measurements for Flame_m are performed by the installed UV flame detector. This is deemed correct, acceptable and in conformance with requirements of ACM0001 (version 19.0)^{/6/} and applicable methodological tools. As confirmed by the Applus+ Certification verification team through assessment of the monthly emission reduction calculation spreadsheets^{/20/}, for every minute m during which flame was detected in the flare, the flame status of the measured flare for each minute is set as “ON” (Flame “on”), otherwise the flame status of this flare for the given minute is set to “OFF” (Flame “off”). As per both the registered VCS PD^{/2/} for the VCS project activity and the CDM methodological tool “Project emissions from flaring” (version 04.0)^{/28/}, (which is applied in accordance with ACM0001 (version 19.0)^{/6/}), the operational status of the flare shall be recorded once per minute. Thus, the applied measuring, recording and reporting frequencies for Flame_m are thus in accordance with both ACM0001 (version 19.0)^{/6/} and the registered VCS PD^{/2/} for the VCS project activity.								
Type of monitoring equipment/instrument:	Monitoring of the operational status of the flare is confirmed as being performed by installed UV flame detector as follows: <table border="1"> <thead> <tr> <th colspan="2">Specifications of the UV Flame detector</th></tr> </thead> <tbody> <tr> <td>Manufacturer</td><td>Krom Schroder</td></tr> <tr> <td>Model</td><td>UVS 10D0G1</td></tr> <tr> <td>Serial Number</td><td>84315200</td></tr> </tbody> </table>	Specifications of the UV Flame detector		Manufacturer	Krom Schroder	Model	UVS 10D0G1	Serial Number	84315200
Specifications of the UV Flame detector									
Manufacturer	Krom Schroder								
Model	UVS 10D0G1								
Serial Number	84315200								

	Source: /47/
Calibration frequency	Not applicable. As confirmed by the Applus+ Certification verification team through assessment of the specification sheets /47/ for the UV Flame detector installed at the project site, the installed UV Flame detector has a self-checking function and thus does not require any calibration.
How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	Assessment details about recording of values measured at the project site are included in Section “<i>Assessment of handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission reductions achieved by the VCS project activity during the considered monitoring period</i>”. Furthermore, a data authenticity checking was performed for all measurement records of the following LFG and LFG flaring/utilization related monitoring parameters to demonstrate and ensure that only authentic/not modified monitoring data was used as input data for the emission reduction calculations for the considered monitoring period: - Volumetric flow of the LFG stream in time interval t on a wet basis (where j is the LFG delivery pipeline to the flare and/or to each engine-generator set) ($V_{t,wb,j}$) - Volumetric fraction of CH_4 in the collected LFG in time interval t on a wet basis ($V_{CH_4,t,wb,j}$) - Temperature of the LFG stream in time interval t (T_t) - Pressure of the LFG stream in time interval t (P_t) - Temperature in the exhaust gas of the enclosed flare in minute m ($T_{EG,m}$) - Flame detection of flare in the minute m ($Flame_m$) The performed checking aimed to ensure that monitoring data were not intentionally or unintentionally edited/modified by anyone prior of being used as primary data input for the processing of emission reduction calculations. The performed checking also aimed to ensure that the emission reduction calculation spreadsheet /20/ includes only authentic monitoring records.

	Details about the performed data authenticity checking (which is valid for listed LFG and LFG flaring/utilization related monitoring data) are included in Section <i>"Data Authenticity Checking"</i> .
Does the applied monitoring data management process (from monitoring equipment/instrument to emission reduction calculation) ensure correct recording, transfer and reporting of data to be used for the emission reductions calculations? Are necessary/applicable QA/QC processes in place?	Yes. Details for data transfer and reporting of emission reductions (incl. relevant QA/QC process) are further assessed in Section <i>"Assessment of handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission reductions achieved by the VCS project activity during the considered monitoring period"</i> .

Data / Parameter:	Maintenance events completed in year y as monitored by the project participants. (Maintenance _y)
Measuring, recording and reporting frequencies:	As per the implemented monitoring procedure adopted at Recicle Catarinense de Resíduos Ltda., all the maintenance events performed at the project site are by the staff of the project proponent and project operator Recicle Catarinense de Resíduos Ltda. in a customized maintenance logbook (with details about historical of performed interventions (repair, maintenance and calibration services) ^{/19/}. As established in the registered VCS PD ^{/2/}, the latest version of the Monitoring Report ^{/1/} summarizes the maintenance events (inspection and maintenance services) that were performed in the installed flare during the considered monitoring period. The listed events (dated 01-January-2023 and 27-December-2023) encompass general inspection/maintenance services (incl. inspection of the condition of the flare isolation ceramics revetment material, checking of condition/function of the air inlet dumpers, checking of the conditions of the thermocouples, checking of the condition of the UV flame detector, checking of the condition of the flame arrester valve, checking of the

	conditions of the LFG injectors, checking of painting conditions). As also appropriately outlined in the Monitoring Report ^{/1/}, general inspection/maintenance services on the flare are opportunely performed during planned or unplanned interruptions of operation of the flare. As per both the registered VCS PD ^{/2/} and the CDM methodological tool “Project emissions from flaring” (version 04.0) ^{/28/}, (which is applied in accordance with ACM0001 (version 19.0) ^{/6/}), monitoring of the parameter Maintenance_y is to be performed annually. Thus, the applied monitoring frequency for the parameter (with maintenance events being registered at the date when the event is performed) is thus in accordance with both ACM0001 (version 19.0) ^{/6/} and the registered VCS PD ^{/2/}.
Type of monitoring equipment/instrument:	Not applicable. There are no measurements involved in the monitoring of Maintenance _y .
Calibration frequency	Not applicable. There are no measurements involved in the monitoring of Maintenance _y .
How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	Assessment details about recording of values measured at the project site are included in Section “<i>Assessment of handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission reductions achieved by the VCS project activity during the considered monitoring period</i>”. Furthermore, a data authenticity checking was performed for all measurement records of the following LFG and LFG flaring/utilization related monitoring parameters to demonstrate and ensure that only authentic/not modified monitoring data was used as input data for the emission reduction calculations for the considered monitoring period: - Volumetric flow of the LFG stream in time interval t on a wet basis (where j is the LFG delivery pipeline to the flare and/or to each engine-generator set) ($V_{t,wb,j}$) - Volumetric fraction of CH₄ in the collected LFG in time interval t on a wet basis ($V_{CH_4,t,wb,j}$) - Temperature of the LFG stream in time interval t (T_t)

	- Pressure of the LFG stream in time interval t (P_t) - Temperature in the exhaust gas of the enclosed flare in minute m ($T_{EG,m}$) - Flame detection of flare in the minute m ($Flame_m$) The performed checking aimed to ensure that monitoring data were not intentionally or unintentionally edited/modified by anyone prior of being used as primary data input for the processing of emission reduction calculations. The performed checking also aimed to ensure that the emission reduction calculation spreadsheet ^{/20/} includes only authentic monitoring records. Details about the performed data authenticity checking (which is valid for listed LFG and LFG flaring/utilization related monitoring data) are included in Section “Data Authenticity Checking”.
Does the applied monitoring data management process (from monitoring equipment/instrument to emission reduction calculation) ensure correct recording, transfer and reporting of data to be used for the emission reductions calculations? Are necessary/applicable QA/QC processes in place?	Not applicable
Data / Parameter:	Average technical transmission and distribution losses for providing electricity to the grid and/or for grid-sourced electricity consumed by the VCS project activity ($TDL_{grid,y}$)
Measuring, recording and reporting frequencies:	The value for the monitoring parameter $TDL_{grid,y}$ is selected as 20%. Selected value corresponds to applicable default values as per the CDM methodological tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0) ^{/27/}. The determination

	of $TDL_{grid,y}$ is confirmed as being under conformance with applicable guidance of the CDM methodological tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0) ^{/27/}. No measurement was performed in the context of the determination of the parameter $TDL_{grid,y}$ and no monitoring equipment/instrument was used either. Default values as per the CDM methodological tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0) ^{/27/} is considered every year monitoring frequency is thus assumed as being applied. This is confirmed as being in conformance with the registered VCS PD ^{/2/}.
Type of monitoring equipment/instrument:	Not applicable.
Calibration frequency	Not applicable.
How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	The Applus+ Certification’s verification team confirmed as part of its performed assessment that <i>ex-post</i> determined value for $TDL_{grid,y}$ on the basis of information of the CDM methodological tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0) ^{/27/} has been selected and applied for the determination of project emissions related to consumption of grid-sourced electricity by different project-based projects hosted in Brazil with full acceptance both from the DOEs/VVBs involved in the assessments and from VERRA/VCS. The selected value for the monitoring parameter $TDL_{grid,y}$ was confirmed by the Applus+ Certification verification to correctly represent the default value according to the CDM methodological tool “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0) ^{/27/}. In summary, it is Applus+ Certification verification team opinion that the selection and reporting of the monitoring parameter $TDL_{grid,y}$ is deemed correct and acceptable.
Does the applied monitoring data management process	Not applicable

(from monitoring equipment/instrument to emission reduction calculation) ensure correct recording, transfer and reporting of data to be used for the emission reductions calculations? Are necessary/applicable QA/QC processes in place?	
Data / Parameter:	Status of biogas destruction devices (Operational status of biogas destruction devices)
Measuring, recording and reporting frequencies:	The operational status of the installed high temperature enclosed flare is recorded/reported every minute on the basis of the signal from the UV flame detectors. It is relevant to note that, for the particular case of the installed high temperature enclosed flare, the parameter “Status of biogas destruction device” is monitored on the same basis as the monitoring parameter “Flame detection of flare in the minute m” (Flame_m) as reported in the monthly emission reductions calculation spreadsheets.” As per both the registered registered VCS PD ^{/2/} and ACM0001 (version 19.0) ^{/6/}, the operational status of the installed high enclosed flare shall be recorded once per minute. Thus, the applied measuring, recording and reporting frequency for Status of biogas destruction device are thus in accordance with both ACM0001 (version 19.0) ^{/6/} and the registered VCS PD ^{/2/}.
Type of monitoring equipment/instrument:	Not applicable. Information details about the UV flame detector installed on the high temperature enclosed flare used to monitor the operational status of the installed high temperature enclosed flare is presented in the applicable table for the monitoring parameter “Flame detection of flare in the minute m” (Flame_m).
Calibration frequency	Not applicable
How were the values in the Monitoring Report (and/or	Assessment details about recording of values measured at the project site are included in Section “<i>Assessment of handling of</i>

supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	<i>records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission reductions achieved by the VCS project activity during the considered monitoring period”.</i> Furthermore, a data authenticity checking was performed for all measurement records of the following LFG and LFG flaring/utilization related monitoring parameters to demonstrate and ensure that only authentic/not modified monitoring data was used as input data for the emission reduction calculations for the considered monitoring period: - Volumetric flow of the LFG stream in time interval t on a wet basis (where j is the LFG delivery pipeline to the flare and/or to each engine-generator set) ($V_{t,wb,j}$) - Volumetric fraction of CH_4 in the collected LFG in time interval t on a wet basis ($V_{CH_4,t,wb,j}$) - Temperature of the LFG stream in time interval t (T_t) - Pressure of the LFG stream in time interval t (P_t) - Temperature in the exhaust gas of the enclosed flare in minute m ($T_{EG,m}$) - Flame detection of flare in the minute m ($Flame_m$) The performed checking aimed to ensure that monitoring data were not intentionally or unintentionally edited/modified by anyone prior of being used as primary data input for the processing of emission reduction calculations. The performed checking also aimed to ensure that the emission reduction calculation spreadsheet /20/ includes only authentic monitoring records. Details about the performed data authenticity checking (which is valid for listed LFG and LFG flaring/utilization related monitoring data) are included in Section “Data Authenticity Checking”.
Does the applied monitoring data management process (from monitoring	Not applicable

equipment/instrument to emission reduction calculation) ensure correct recording, transfer and reporting of data to be used for the emission reductions calculations? Are necessary/applicable QA/QC processes in place?

Assessment of handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of emission reductions achieved by the VCS project activity during the considered monitoring period:

As part of the applied monitoring procedure, measurements for the following LFG and flaring related monitoring parameters were automatically processed by the Programmable Logic Controller (PLC) unit and recorded in a customized database with a data recording/reporting frequency of every one minute along the considered monitoring period:

- Volumetric flow of the LFG stream in time interval t on a wet basis (where j is the LFG delivery pipeline to the flare and/or to each engine-generator set) ($V_{t,wb,j}$)
- Volumetric fraction of CH_4 in the collected LFG in time interval t on a wet basis ($V_{CH_4,t,wb,j}$)
- Temperature of the LFG stream in time interval t (T_t)
- Pressure of the LFG stream in time interval t (P_t)
- Temperature in the exhaust gas of the enclosed flare in minute m ($T_{EG,m}$)
- Flame detection of flare in the minute m ($Flame_m$)

Moreover, as appropriately outlined in the Monitoring Report ^{/1/}, while the project's electricity generation infrastructure was not implemented and operational during the considered monitoring period, the following monitoring parameters (which are related to such project component and are also included in the monitoring plan) were also not used during the considered monitoring period:

- Operation of the equipment that consumes LFG (engine-generator sets of the electricity generation infrastructure) ($Op_{j,h}$)
- Amount of electricity generated using LFG by the project activity in year y ($EC_{BL,y}$)
- Tariff of the electricity exported
- Total investment to implement the project and total cost to operate the project (CAPEX and OPEX)

It is the opinion of Applus+ Certification that the use of the applied data supervisor system and data base for recording monitoring details for LFG collection and utilization at the Brusque landfill represents good practice in terms of data acquisition and data archiving. Applus+ Certification's verification team was also able to verify that a reliable and robust monitoring mechanism was established, implemented and has been followed by the project developer.

As per the implemented monitoring procedure, at regular time intervals, the monitoring manager for LFG collection and utilization at the Brusque landfill exports/converts data into an MS-Excel-format (.xls files) by using available function from the VCS project activity's data supervisor system.

Also, as part of the implemented monitoring procedure, monthly MS-Excel format "raw-data" files ^{/16/} (containing every-minute measurement data for the above-quoted monitoring parameters) resulted from regular data exports were used as primary monitoring input data for the emission reduction calculations (as established in the applicable work procedure of the VCS project activity).

For the considered monitoring period, as per the adopted working procedures, monthly "raw-data" MS-Excel-format files were generated for the considered monitoring period from 11-July-2022 to 31-December-2023. The MS-Excel "raw-data" files were used as primary monitoring data input for the compilation of the emission reduction calculations.

The generated MS-Excel-format "raw-data" files were made available and assessed by the Applus+ Certification's verification team.

As per the adopted monitoring procedure and in accordance with the requirements of ACM0001 (version 19.0) ^{/6/} and related provisions of the registered VCS PD ^{/2/} for the VCS project activity for LFG collection and utilization at the Brusque landfill, GHG emission reductions are calculated based on measurement records and selected default values of the ex-post monitored parameters (of which monitoring details are presented in the tables above) and also using the values for the ex-ante determined parameters presented in Section "Assessment of ex-ante determined parameters".

In summary, the Applus+ Certification's verification team was able to confirm that calculations of baseline emissions and project emissions were correctly performed as per the formulae and

methods stated in the registered VCS PD ^{/2/} for the VCS project activity for LFG collection and utilization at the Brusque landfill, monitoring methodology and applicable tools.

All calculations are thus confirmed by the Applus+ Certification's verification team to be under conformance with applicable requirements from:

- CDM baseline and monitoring methodology ACM0001 – “Flaring or use of landfill gas” (version 19.0) ^{/6/}
- Methodological tool “Emissions from solid waste disposal sites” (version 08.0) ^{/26/}
- “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 03.0) ^{/27/}
- “Project emissions from flaring” (version 04.0) ^{/28/}
- “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 03.0) ^{/29/}
- “Tool to calculate the emission factor for an electricity system (version 07.0) ^{/30/}
- Monitoring plan as per the registered VCS PD ^{/2/} for the VCS project activity for LFG collection and utilization at the Brusque landfill

Data Authenticity Checking

As part of the performed verification assessment, the Applus+ Certification verification team was able to confirm that the 18 MS-Excel-format monthly calculation spreadsheet ^{/20/} completed by the project proponent Recicle Catarinense de Resíduos Ltda. are all basically MS-Excel spreadsheets that, in theory, could have recorded data being easily edited/modified (intentionally or unintentionally). Thus, these spreadsheets, if inappropriately edited, could potentially tamper reported monitoring records, thus resulting in unreal and incorrect calculation and reporting of emission reductions achieved by the project activity during the considered monitoring period. In order to ensure that all emission reductions calculations are entirely and correctly based on authentic and real monitoring records valid for the considered monitoring period, a data authentic check was performed as part of the verification assessment.

Such checking aimed to ensure that only authentic and unmodified monitoring data records were used by the host-country project proponent Recicle Catarinense de Resíduos Ltda. for performing the emission reduction calculation for the considered monitoring period (thus ensuring that measurement records made available in the MS-Excel format “raw data” input files ^{/16/} and measurement records reported in the 18 monthly emission reduction spreadsheets ^{/20/} were not intentionally or unintentionally edited/modified during the generation or handling of these files).

The performed data authenticity checking involved the following steps:

STEP 1: Assessment and handling of the measurement data:

While each monthly MS-Excel format raw data contains identical every-minute LFG related monitoring records for the whole month period encompassed by the considered monitoring period, the Applus+ Certification verification team has assessed the set of 18 monthly files in MS-Excel format (with primary data inputs from the project's data supervisor system) during the performed on site visit. These comparative files were termed by the Applus+ Certification verification team as “raw data for checking” files ^{/17/}.

STEP 2: Re-calculation of emission reductions:

By using the set of 18 MS-Excel format “raw-data for checking” comparative files ^{/17/} (that were generated under STEP 1) as input data, the procedure for emission reductions calculation for the whole monitoring period was reproduced by the Applus+ Certification verification team for all months encompassed by the considered monitoring period. The content of the “raw data for checking” comparative files ^{/17/} was used as input data for the 18 comparative monthly emission reduction calculation spreadsheets ^{/10/} by applying blank versions ^{/12/} of the emission reduction calculation spreadsheet that were both made available by the project proponent. Moreover, correct values for the applicable ex-ante determined parameters were also inserted in the blank version ^{/12/} of the emission reduction calculation spreadsheet ^{/20/} as input data. As a result of this step, a set of 18 comparative monthly emission reduction spreadsheets ^{/24/} was thus created.

STEP 3 – Comparison of emission reduction calculation spreadsheets developed by the project proponent Recicle Catarinense de Resíduos Ltda. against the created comparative monthly emission reduction spreadsheets and analysis of the results:

As a result of STEP 3, by comparing files previously generated by the project proponent against the files generated under STEP 2, the Applus+ Certification verification team was able to confirm that the generated set of 18 comparative monthly checking spreadsheets ^{/24/} are identical to the 18 monthly emission reduction calculation spreadsheets ^{/20/} previously created by the project proponent. While no quantitative deviations or differences were identified when comparing the accumulated values for the calculation parameters presented in these files, and by assuming that all encrypted data stored in the project's data supervisor system represent credible and authentic monitoring data, the performed data authenticity checking thus successfully and sufficiently confirmed that only authentic and not-modified monitored measurement data (from the project's data supervisor system) were previously used by the project proponent Recicle Catarinense de Resíduos Ltda. for the calculation of emission reductions as reported in the Monitoring Report ^{/1/}.

Assessment of GHG Calculations

Assessment of baseline emissions

The Applus+ Certification's verification team assessed whether the methods and formulae applied to determine baseline emissions of the VCS project activity for the considered monitoring period are appropriate and under conformance with applicable requirements.

The performed assessment encompassed checking whether applied methods and formulae (as defined in the monitoring plan as per the registered VCS PD ^{/2/} for the VCS project activity and applied CDM baseline and monitoring methodology + applied CDM methodological tools were correctly applied and reported, including confirmation whether the Monitoring Report ^{/1/} includes all parameters and monitored data at the required intervals.

The correct application of emission factor and default values (ex-ante determined/fixed parameters) as per the registered VCS PD ^{/2/} for the VCS project activity was also verified.

The Applus+ Certification's verification team was able to verify that, as correctly reported in the Monitoring Report and under conformance with ACM0001 (version 19.0) ^{/6/} and applied CDM methodological tools and also under conformance with the registered VCS PD ^{/2/} for the VCS project activity, baseline emissions during the considered monitoring period are correctly calculated as follows (as defined by the registered VCS PD ^{/2/} for the VCS project activity):

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

Assessment of Baseline emissions of methane from the SWDS in year y:

$$BE_{CH_4,y} = ((1 - OX_{top_layer}) * F_{CH_4,PJ,y}) - F_{CH_4,BL,y}) * GWP_{CH_4}$$

Where:

OX_{top_layer}	Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline. As outlined in the Monitoring Report, OX_{top_layer} is <i>ex-ante</i> determined as 10%. This value is confirmed to represent the <i>ex-ante</i> determined value as per the registered VCS PD for the VCS project activity.
$GWP_{CH_4,y}$	Global warming potential of CH_4 . As outlined in the Monitoring Report ^{/1/} , $GWP_{CH_4,y}$ is <i>ex-ante</i> determined as 28 tCO ₂ e/tCH ₄ . This value is confirmed to represent the <i>ex-ante</i> determined value as per the registered VCS PD ^{/2/} for the VCS project activity.
$F_{CH_4,BL,y}$	Amount of methane in the LFG that would be flared in the baseline in year y. $F_{CH_4,BL,y}$ is calculated as follows:

$$F_{CH4,BL,y} = 0^5$$

$F_{CH4,PJ,y}$

Amount of methane in the LFG which is flared and/or used in the project activity in year y . As outlined in the latest version of the Monitoring Report and in accordance with the registered VCS PD ^{/2/}, $F_{CH4,PJ,y}$ is correctly determined as follows:

$$F_{CH4,PJ,y} = F_{CH4,flared,y}$$

Where:

$F_{CH4,flared,y}$

Amount of methane in the LFG which is destroyed by flaring in year y . Under conformance with applicable requirements from the registered VCS PD ^{/2/} and by correctly following the applicable guidance of the CDM methodological tool “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 03.0) ^{/29/}, each value is correctly determined as the difference between the amount of methane supplied to the flare and residual methane project emissions from combustion of LFG for the flare as follows:

$$F_{CH4,flared,y} = F_{CH4,sent_flare,y} - (PE_{flare,y} / GWP_{CH4})$$

Where:

$F_{CH4,sent_flare,y}$

Amount of methane in the LFG which is sent to the flare in year y . The Applus+ Certification’s verification team was able to verify that every minute values of the calculation parameter $F_{CH4,sent_flare,y}$, were determined by correctly following the applicable guidance of the CDM methodological tool “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 03.0) ^{/29/} as also established in the registered VCS PD ^{/2/}. All formulae of the CDM methodological tool “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 03.0) ^{/29/} were correctly applied in the emission reduction calculation spreadsheet and presented in the Monitoring Report.

⁵ As explained and determined in the VCS PD, it is assumed that in the absence of the VCS project activity (baseline scenario) no LFG would be destroyed in previously existent rudimentary and conventional LFG venting drains.

$PE_{flare,y}$ Project emissions from flaring of the residual gas stream in year y . The Applus+ Certification's verification team was able to verify that every minute values of the calculation parameter $PE_{flare,y}$, were determined by correctly following the applicable guidance of the CDM methodological tool "Project emissions from flaring" (version 04.0) /28/ as also established in the registered VCS PD /2/ for the VCS project activity. All formulae of the CDM methodological tool "Project emissions from flaring" (version 04.0) /28/ were correctly applied in the context of flare efficiency calculation in the emission reduction calculation spreadsheet and presented in the Monitoring Report.

Assessment details for determination of every-minute values for $PE_{flare,y}$:

In accordance with applicable guidance from both the CDM methodological tool "Project emissions from flaring" (version 04.0) /28/ and from the registered VCS PD /2/, every-minute values of $PE_{flare,y}$ the operational flare are determined as a function of every-minute records of mass flow of methane sent to the flare ($F_{CH4,RG,m} = F_{CH4,sent_flare}$) as well as based on *ex-post* calculated values for flare efficiency for the flare n ($\eta_{flare,m}$). As assessed by the Applus+ Certification verification team, values of $PE_{flare,y}$ are correctly calculated for the considered monitoring period as follows:

$$PE_{flare,y} = GWP_{CH4} * \sum F_{CH4,RG,m} * (1 - \eta_{flare,m}) * 10^{-3}$$

Where:

$F_{CH4,RG,m}$ Methane mass flow in the residual gas. For each minute m of the considered monitoring period values for $F_{CH4,RG,m}$ are equal to the measured and reported every-minute values of $F_{CH4,sent_flare}$.

$\eta_{flare,m}$ Flare efficiency in minute m .

Assessment details for determination of biannual values of $\eta_{flare,m}$:

For the considered monitoring period, as confirmed by the Applus+ Certification's verification team, biannual values of $\eta_{flare,m} = \eta_{flare,calc,m}$ for the installed flare (based on performed related measurements $\eta_{flare,calc,y}$) are determined based on performed measurements by following applicable guidance of Option B.1 of the

CDM methodological tool “Project emissions from flaring” (version 04.0) *[Error! No se encuentra el origen de la referencia.]*. As required by this determination option, related measurements to determine the efficiency of the flare (measurements for the monitoring parameter $F_{CH_4,EG,t}$) were performed by an accredited independent third party entity (e.g. an independent inspection/analysis service company) on a biannual basis. The calculated flare efficiency ($\eta_{flare,calc,m}$) for the flare is determined as the average of the performed measurements within the considered monitoring period, adjusted by an uncertainty factor of 5 percentile points as follows:

$$\eta_{flare,calc,y} = 1 - \frac{1}{2} \sum_{t=1}^2 \left(\frac{F_{CH_4,EG,t}}{F_{CH_4,RG,t}} \right) - 0.05$$

Where:

$F_{CH_4,EG,t}$ Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period t . For determining $F_{CH_4,EG,t}$, biannual measurements of residual methane in the exhaust gas of the flare during a considered time and measurements of speed of exhaust gas of the flares were performed by the third party inspection service company Start5g Tecnologia Ambiental Ltda. This inspection service company is specialized in measurements of air emissions and inspections for air pollutants. Further assessment details for the ex-post determination of values for $F_{CH_4,EG,t}$ are included in Section 4.3.

t The time periods during which the flare efficiency is measured. As also established by the CDM methodological tool “Project emissions from flaring” (version 04.0), if the monitoring period is shorter than one year, the measurement should be at least twice in a monitoring period and in a maximum timeframe of six months between each measurement. Each measurement event takes a minimum duration of one hour. The time interval between the measurement events is at least six months. Further assessment details are included in Section 4.3.

$F_{CH_4,RG,t}$ Mass flow of methane in the residual gas on a dry basis at reference conditions in the time period t .

Assessment details for the determination of $F_{CH_4,RG,t}$:

As per the applicable guidance of the CDM methodological tool “Project emissions from flaring” (version 04.0) *[Error! No se encuentra el origen de la referencia.]* and also as per the VCS PD *[Error! No se encuentra el*

origen de la referencia., values of $F_{CH_4, RG, t}$ shall be calculated by following the applicable guidance of the CDM methodological tool “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” *Error! No se encuentra el origen de la referencia.* Values for the parameter $F_{CH_4, RG, t}$ are thus calculated as follows:

$$F_{CH_4, RG, t, flare-n} = V_{t, db, n, flare-n} * v_{CH_4, t, db} * \rho_{CH_4, n}$$

Where:

$\rho_{CH_4, n}$ Density of greenhouse gas *vis-à-vis* (*vis-à-vis* = CH₄) in the gaseous stream (LFG) at reference conditions. Further details for the determination of $\rho_{CH_4, n}$ are presented above under the sub-section “*Determination of every-minute values for the calculation parameter $F_{CH_4, sent_flare, y}$* ”.

$v_{CH_4, t, db}$ Volumetric fraction of greenhouse gas *vis-à-vis* (*vis-à-vis* = CH₄) in the gaseous stream in a time interval *t* on a dry basis. As confirmed by the Applus+ Certification’s verification team, Footnote 3 of the CDM methodological tool “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” *Error! No se encuentra el origen de la referencia.*; states the following:

“(...) Flow measurement on a dry basis is not feasible at reasonable costs for a wet gaseous stream, so there will be no difference in the readings for volumetric fraction in wet basis analysers and dry basis analysers and both types can be used indistinctly for calculation Options A and D.”

Thus, every-minute values of $v_{CH_4, t, db}$ are regarded as equal to every-minute values of the monitoring parameter $v_{i, t, wb}$ (for which further details are presented above under the sub-section “*Determination of every-minute values for the calculation parameter $F_{CH_4, sent_flare, y}$* ”).

$V_{t, db, n, flare-n}$ Volumetric flow of the gaseous stream (LFG) in time interval *t* on a dry basis for the flare. As per Option B of the applicable methodological “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” *Error! No se encuentra el origen de la referencia.*, the volumetric flow of the gaseous stream on a dry basis for the installed high

enclosed flare is determined by converting the measured volumetric flow from wet basis to dry basis as follows:

$$V_{t,db,n,flare-n} = V_{t,wb,n,flare-n} / (1 + V_{H2O,t,db})$$

Where:

$V_{t,wb,n,flare-n}$ Volumetric flow of the gaseous stream (LFG) in time interval t on a wet basis at reference conditions. Further details of $V_{t,wb,n,flare-n}$ are presented above under the sub-section “*Determination of every-minute values for the calculation parameter $F_{CH4,sent_flare,y}$* ”.

$V_{H2O,t,db}$ Volumetric fraction of H_2O in the gaseous stream in time interval t on a dry basis. As per applicable guidance of the methodological “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” *Error! No se encuentra el origen de la referencia.*, $V_{H2O,t,db}$ is calculated as follows:

$$V_{H2O,t,db} = \frac{m_{H2O,t,db} * MM_{t,db}}{MM_{H2O}}$$

Where:

MM_{H2O} Molecular mass of H_2O . *Ex-ante* determined as 18.0152 kg/kmol.

$MM_{t,db}$ Molecular mass of the gaseous stream in time interval t on a dry basis. As per applicable guidance of the methodological “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” *Error! No se encuentra el origen de la referencia.*, $MM_{t,db}$ is calculated as follows:

$$MM_{t,db} = \sum_k (v_{k,t,db} * MM_k)$$

Where:

k All gases, except H_2O , contained in the gaseous stream (e.g. N_2 , CO_2 , O_2 , CO , H_2 , CH_4 , N_2O , NO , NO_2 , SO_2 , SF_6 and PFCs). See simplification below.

$V_{k,t,db}$ Volumetric fraction of gas k in the gaseous stream in time interval t on a dry basis. As confirmed by the Applus+ Certification's verification team, applicable guidance of the CDM methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) *[Error! No se encuentra el origen de la referencia.]* established the following:

"(...) The determination of the molecular mass of the gaseous stream ($MM_{t,db}$) requires measuring the volumetric fraction of all gases (k) in the gaseous stream. However, as a simplification, the volumetric fraction of only the gases k that are greenhouse gases and are considered in the emission reduction calculation in the underlying methodology must be monitored and the difference to 100% may be considered as pure nitrogen."

As also confirmed by the Applus+ Certification's verification team, ACM0001 (version 19.0) *[Error! No se encuentra el origen de la referencia.]* does not include any restriction to such simplification. Thus, only the volumetric fraction of gases that are greenhouse gases and are correctly considered in related calculations (CH_4 in the particular case of the project activity) should be measured and the difference to 100% is just considered as pure nitrogen. Further details for the determination of the volumetric fraction

of CH₄ in the gaseous stream ($V_{k,t,db} = v_{CH_4,t,db}$) are presented above under the calculation parameter $v_{CH_4,t,db}$.

MM_k Molecular mass of gas k ($k = CH_4$ and N_2). As indicated in the PDD *[Error! No se encuentra el origen de la referencia.]*, the molecular mass of CH₄ and N₂ are ex-ante determined as 16.04 and 28.01 respectively.

$M_{H_2O,t,db}$ Absolute humidity in the gaseous stream in time interval t on a dry basis. As per Option 2 of the methodological “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” *[Error! No se encuentra el origen de la referencia.]*, by conservatively assuming that the gaseous stream is saturated ($m_{H_2O,t,db} = m_{H_2O,t,db,Sat}$), $m_{H_2O,t,db}$ is calculated as follows ⁶:

$$m_{H_2O,t,db,Sat} = \frac{P_{H_2O,t,Sat} * MM_{H_2O}}{(P_t - P_{H_2O,t,Sat}) * MM_{t,db}}$$

Where:

MM_{H_2O} Molecular mass of H₂O. As indicated in the PDD *[Error! No se encuentra el o*

⁶ It is important to note that the simplified calculation for the absolute humidity of the gaseous stream ($m_{H_2O,t,db}$) presented in Option 2 of the methodological “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” shall be applied by assuming the gaseous stream is dry or saturated depending on which is the conservative situation.

As confirmed by the Applus+ Certification’s Verification team, Footnote 4 of the CDM methodological tool “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” states the following:

“An assumption that the gaseous stream is saturated is conservative for the situation that the mass flow of greenhouse gas l is underestimated (applicable for calculating baseline emissions). Conversely, an assumption that the gas stream is dry is conservative for the situation that the greenhouse gas t is overestimated (applicable for calculating project emissions).”

In this particular case, $m_{H_2O,t,db}$ is calculated for the determination of the mass flow of methane in the residual gas on a dry basis during the time period t ($F_{CH_4,RG,t}$). While $F_{CH_4,RG,t}$ is used for the determination of the parameter $PE_{flare,y}$ (project emissions from flaring the residual gas), the assumption that the gaseous stream is dry (conservatively applicable for calculating project emissions) would not be conservative in this case as an overestimation of the amount of methane in the residual gas would actually increase the calculated efficiency of the flares, thus resulting in a reduction of $PE_{flare,y}$ and consequent increment of emission reductions.

rigen de la referencia., MM_{H_2O} is ex-ante determined as 18.0152. Further assessment details for the monitoring parameter MM_{H_2O} are included above in this Section under “Assessment of ex-ante determined parameters”.

P_t Absolute pressure of the gaseous stream in time interval t . Further assessment details for the monitoring parameter P_t are included above in this Section under “Assessment of ex-ante determined parameters”.

$MM_{t,db}$ Molecular mass of the gaseous stream in a time interval t on a dry basis. Further assessment details for the determination of $MM_{t,db}$ are presented above in this Section under “Assessment of ex-ante determined parameters”.

$P_{H_2O,t,Sat}$ Saturation pressure of H_2O at temperature T in time t , Further assessment details for the monitoring parameter $p_{H_2O,t,Sat}$ are included above in this Section under “Assessment of ex-ante determined parameters”.

As also confirmed by the Applus+ Certification’s verification team, while the installed flare is regarded as low height flare, the determined value of flare efficiency is correctly adjusted, as a conservative approach, by subtracting 10 percentile points as established by the CDM methodological tool “Project emissions from flaring” (version 04.0) /28/.

Applus+ Certification’s verification team has confirmed that, as highlighted in the Monitoring Report, from 11-July-2022 to 28-December-2022, $\eta_{flare,m}$ is determined based on the selection of default value by following applicable guidance of Option A (application of default value for flare efficiency) of the CDM methodological tool “Project emissions from flaring” (version 04.0). From which the following related guidance of the registered VCS PD is confirmed as being consistently applied for every minute m of the considered monitoring period:

“(…)

Option A: Default value

For each one of the high temperature enclosed flares installed as part of the project activity, the flare efficiency for each minute m ($\eta_{\text{flare},m}$) is 90% when the following two operational conditions/requirements are simultaneously met (in order to demonstrate that the flare is operating as per the recommendations and requirements set by the equipment manufacturer for the minute m in question):

(1) The temperature of the exhaust gases of the flare (monitoring parameter $T_{\text{EG},m}$) and the flow rate of LFG to the flare (monitoring parameter $F_{\text{RG},m}$) is within the manufacturer's specification/requirements for the flare (monitoring parameter $\text{SPEC}_{\text{flare}}$) in minute m ;

(2) Flame is detected in the flare in minute m (monitoring parameter Flame_m).

If for the minute m , conditions (1) and/or (2) are not met, $\eta_{\text{flare},m}$ is set as 0% for the minute in question.

(...)"

As also confirmed by the Applus+ Certification's verification team, while the installed enclosed flare is also regarded as low height flares, the determined values of flare efficiency for this particular flare is correctly adjusted, as a conservative approach, by subtracting 10 percentile points as established by the CDM methodological tool "Project emissions from flaring" (version 04.0).

As confirmed by the Applus+ Certification's verification team, for every minute m within the considered monitoring period, $\eta_{\text{flare},m} = 0.90$ (90%) - 10% = 0.80 (80%) (upon effective demonstration of full compliance with operational and maintenance requirements for the flare) or 0% (in case full compliance with operational and maintenance requirements for the flare is not demonstrated).

As correctly outlined in the latest version of the Monitoring Report [\[Error! No se encuentra el origen de la referencia.\]](#), determined values for $\eta_{\text{flare},\text{calc},y}$ for the installed high temperature enclosed flare valid for the considered monitoring period are summarized in the table below:

Determined values of $\eta_{\text{flare},\text{calc},y}$ for the considered monitoring period	Value applied during the period from 11-July-2022 to 28-December-2022	Value applied during the period from 29-December-2022 to 28-December-2023	Value applied during the period from 29-December-2023 to 31-December-2023
	0.80 (default value)	0.8499785	0.8499335

Assessment details for (i) compliance with operational and maintenance requirements for the flares (as established by the ex-ante determined parameter “Manufacturer’s flare specifications for temperature, flow rate and maintenance schedule interval” ($SPEC_{flare}$)) and (ii) consideration of data records for the monitoring parameter “Flame detection of flare in the minute m ” ($Flame_m$) for the calculation of every-minute values:

As also confirmed by the Applus+ Certification verification team by assessing the monthly emission reduction spreadsheets, in accordance with the applied monitoring procedure for the project activity, compliance with operational and maintenance requirements for the flares, as established by the ex-ante determined parameter “Manufacturer’s flare specifications for temperature, flow rate and maintenance schedule interval” ($SPEC_{flare}$), was correctly considered for the determination and application of values of $\eta_{flare,m}$ for calculating every-minute values of $F_{CH4,flared,y}$ along the considered monitoring period⁷.

As also confirmed by the Applus+ Certification verification team through assessment of the monthly emission reduction calculation spreadsheets, data records for the monitoring parameter “Flame detection of flare in the minute m ” ($Flame_m$) are also effectively considered for the determination and application of the values of $\eta_{flare,m}$ along the considered monitoring period. The time the flare has operated is monitored through every-minute monitoring the flame combustion status/condition by using an UV flame detector (of which status signal (flame status “on” or “off”) is recorded and reported in the monthly emission reduction calculation spreadsheets valid for the considered monitoring period.

As also assessed by the Applus+ Certification verification team, monitoring requirements related to operational requirements/conditions for the flare (as provided by the manufacturer’s specifications for operating conditions as per the ex-ante determined parameter $SPEC_{flare}$ (min. and max. flow of LFG to the set of flare + temperature of exhaust gas of the flare + meeting of maintenance requirements)) are also effectively correctly considered in the context of the determination and application of values for $\eta_{flare,m}$ for calculating every-minute values of $F_{CH4,flared,y}$ along the considered monitoring period. As also confirmed through assessment of the monthly emission reduction calculation spreadsheets, for each minute m within the considered monitoring period when the flare have combusted LFG by not operating in accordance with the operational criteria as established by the ex-ante estimated parameter $SPEC_{flare}$ (in terms of LFG flow, temperature of exhaust gas or maintenance practice), no destruction of methane is

⁷ While all performed maintenance events in the installed flare (including inspection and/or replacement of flare revetment material) were performed in accordance with requirements established in details for the ex-ante determined parameter “Manufacturer’s flare specifications for temperature, flow rate and maintenance schedule interval” ($SPEC_{flare}$)), the determination of emission reductions achieved by the project activity during the considered monitoring period are thus not negatively impacted by the records for the monitoring parameter Maintenance_y.

accounted for the flare as part of the calculation of every-minute values $F_{CH_4,flared,y}$. This is under full compliance with related requirements from the registered VCS PD ^{/2/}.

The calculated accumulated value for $F_{CH_4,PJ,y} = F_{CH_4,flared,y}$ for the considered monitoring period is confirmed by the Applus+ Certification's verification team as correctly determined as 4,904 tCH₄.

The calculated value for BE_y for the considered monitoring period is also confirmed as being correctly determined as 123,573 tCO₂e. The emission reduction calculation spreadsheet ^{/20/} (that is enclosed to this Monitoring Report ^{/4/}) includes all calculations related to the determination of BE_{CH₄,y} for the considered monitoring period.

Assessment of project emissions

Project emissions for the considered monitoring period are thus calculated as follows:

$$PE_y = PE_{EC,grid,y}$$

Where:

PE_{EC,grid,y} Emissions from consumption of electricity due to the project activity in year y (tCO₂/year)

Emissions from consumption of electricity due to the project activity in year y (PE_{EC,grid,y}):

As correctly outlined in the latest version of the Monitoring Report ^{/1/}, during the considered monitoring period, Emissions from consumption of electricity due to the project activity in year y (PE_{EC,grid,y}) are correctly determined by following applicable guidance of the CDM methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0) ^{/27/} as follows:

$$PE_{EC,grid,y} = EC_{PJ,y} * EF_{EL,grid,y} * (1 + TDL_{grid,y})$$

Where:

EC_{PJ,y} Quantity of grid sourced electricity consumed by the project activity in year y. The following monthly values for consumption of grid-sourced electricity (EC_{PJ,y}) within the considered monitoring period are correctly reported in the Monitoring Report ^{/4/} and emission reduction calculation spreadsheet ^{/20/}:

Month	Amount of grid-sourced electricity consumed by the project activity (MWh)
-------	---

July-2022 (From 11-July-2022 to 31-July-2022)	0.108
August-2022	0.115
September-2022	0.128
October-2022	0.130
November-2022	0.135
December-2022	0.139
January-2023	0.143
February-2023	0.136
March-2023	0.141
April-2023	0.165
May-2023	0.178
June-2023	0.185
July-2023	0.192
August-2023	0.224
September-2023	0.246
October-2023	0.235
November-2023	0.249
December-2023	0.249

Assessment details for the monitoring parameter $EC_{PJ,y}$ valid for the considered monitoring period are included above in this Section under “Assessment of parameters monitored ex-post”.

$TDL_{grid,y}$

Average technical transmission and distribution losses in the grid in year y for the voltage level at which electricity is obtained from the grid at the project site. $TDL_{grid,y}$ is selected as 20%. Further details about the selection of the value and related assessment details for $TDL_{grid,y}$ are included in the registered VCS PD ^{/2/} for the VCS project activity and above in this Section under “Assessment of ex-ante determined parameters”.

$EF_{EL,grid,y}$

CO₂ emission factor of the Brazilian grid electricity during the year y . As per Option A.1 of the CDM methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (Version 03.0) ^{/27/}, $EF_{EL,grid,y}$ is to be determined as the combined margin emission factor

($EF_{grid,CM,y}$) that is calculated as the weighted average of the operating margin and build margin emission factors as follows:

$$EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM}$$

Where:

w_{OM}	Weighting of operating margin emissions factor. w_{OM} is ex-ante selected as 0.50. Further details about the selection of the value and related assessment details for w_{OM} are included in the registered VCS PD ^{/2/} for the VCS project activity and above in this Section under “Assessment of ex-ante determined parameters”.
w_{BM}	Weighting of operating margin emissions factor. w_{BM} is ex-ante selected as 0.50. Further details about the selection of the value and related assessment details for w_{BM} are included in the registered VCS PD ^{/2/} for the VCS project activity and above in this Section under “Assessment of ex-ante determined parameters”.
$EF_{grid,BM,y}$	Build margin CO ₂ emission factor in year y. $EF_{grid,BM}$ is ex-ante selected as 0.0540 tCO ₂ /MWh. Further details about the selection of the value and related assessment details for $EF_{grid,BM,y}$ are included in the registered VCS PD ^{/2/} for the VCS project activity and above in this Section under “Assessment of ex-ante determined parameters”.
$EF_{grid,OM,y}$	Operating margin CO ₂ emission factor in year y (in tCO ₂ /MWh). $EF_{grid,OM}$ is determined as 0.4069 tCO ₂ /MWh for year 2022 and 0.3786 tCO ₂ /MWh for year 2023. Further details about the selection of the value and related assessment details for $EF_{grid,BM,y}$ are included in the registered VCS PD ^{/2/} for the VCS project activity and above in this Section under “Assessment of parameters monitored ex-post”.

The calculated value for $PE_{EC,grid,y}$ for the considered monitoring period is correctly determined as 18 tCO₂.

Assessment of achieved emission reductions:

The Applus+ Certification's verification team was able to confirm that reported achieved emission reductions for monitoring period from 11-July-2022 to 31-December-2023 are correctly calculated and reported as the difference between determined accumulated values for baseline emissions and project emissions for the period.

Reported achieved emission reductions are in accordance with all applicable measurement, reporting and calculation requirements as per the monitoring plan of the registered VCS PD, CDM monitoring and baseline methodology ACM0001 - 'Flaring or use of landfill gas' (version 19.0) /6/ and applicable methodological tools.

As verified by the Applus+ Certification's verification team, emission reductions achieved during the considered monitoring period from 11-July-2022 to 31-December-2023 are correctly calculated and reported as 123,555 tCO_{2e}.

Assessment of related monitoring management and quality assurance procedures for the VCS project activity

The Applus+ Certification's verification team was able to confirm that robust quality control and quality assurance (QA/QC) procedures are implemented by the project proponent and project operator for preventing or identifying and correct eventual errors or omissions in reported values for the monitoring parameters.

As verified by the Applus+ Certification's verification team, competent and sufficiently trained staff are recruited for operating the VCS project activity and handling related monitoring data. Such employees are found with knowledge not only about the operation of the VCS project activity, but also with sufficient knowledge and competence to ensure the application of all related QA/QC procedures for data recording and storage.

As also assessed by the Applus+ Certification's verification team, the VCS project activity has been operated by sufficiently trained staff by correctly following guidance and instructions of internal documented working procedures.

As confirmed by the Applus+ Certification's verification team, the applied procedures for data collection, data reporting, performance of calibration events and other aspects related to the applied procedures for determining the emission reductions are systematically implemented and have been appropriately followed by the project proponent. Applus+ Certification's verification team was also able to verify that the operational structure of the VCS project activity is also in line with the information made available in the registered VCS PD /2/ and in the Monitoring Report /4/.

In summary, Applus+ Certification was also able to verify that detailed management and operational work procedures are in place and confirmed that an operational structure for the VCS project activity is established with responsibilities clearly identified. Moreover, trained staff are employed to ensure data quality.

4.4 Quality of Evidence to Determine Reductions and Removals

Monitoring related activities for the VCS project activity were confirmed by the Applus+ Certification's verification team as being carried out under sufficient conformance with the monitoring plan as per the registered VCS PD ^{/2/} for the project activity (Version 3.0, dated 14-April-2023).

As a result of performed verification assessment for the considered monitoring period, Applus+ Certification's verification team was able to confirm that relevant details for all parameters required for the ex-post determination of emission reductions are sufficiently included in the Monitoring Report ^{/1/} and emission reduction calculation spreadsheet ^{/20/} with all figures, assumptions and calculations being consistent and under conformance with applicable requirements and/or guidance of the applied CDM baseline and monitoring methodology ACM0001 (version 19.0) ^{/6/} and the monitoring plan contained in the registered VCS PD.

After verifying the reported figures with the raw data sources, it's confirmed that the values of the parameters from the raw data sources are consistent with those quoted in the ER Calculation Spreadsheet and the Monitoring Report. The verification process for the same has been clearly described above in Section "Assessment of parameters monitored ex-post". of the report.

4.5 Non-Permanence Risk Analysis

Not applicable as this is a renewable project type.

5 VERIFICATION OPINION

5.1 Verification Summary

LGAI Technological Center, S.A. (referred to as “Applus+ Certification” or the VVB) was contracted by Recicle Catarinense de Resíduos Ltda. (referred to as the Client) to perform the 1st periodic verification of GHG Emission Reductions for the VCS project activity “Brusque landfill Gas Project” (VCS project ID #4138) (referred to as the project activity or PA). The monitoring period included in the Monitoring Report ^{/4/} for which this verification applies is: 11-July-2022 to 31-December-2023.

The management team of the project proponent Recicle Catarinense de Resíduos Ltda. is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project’s Monitoring Plan in the registered VCS PD ^{/2/}.

Operation project staff of the project proponents Recicle Catarinense de Resíduos Ltda. and also the environmental consultancy Unicarbo – Energia e Biogás Ltda. are responsible for the previously occurred implementation of the VCS project activity and monitoring related activities since its starting of operations, including measurement, recording and reporting of monitoring data and determination of GHG emission reductions achieved by the VCS project activity within the considered monitoring period on the basis applicable monitoring procedures and requirements which are established in the project’s monitoring plan as per the registered VCS PD.

The verification assessment performed by Applus+ Certification is based on the approach defined as per applicable guidance and requirements of VCS rules and/or relevant UNFCCC requirements (whenever applicable). The performed verification assessment applied a risk-based approach, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. As part of the performed verification assessment, Applus+ Certification was able to confirm the following:

- The VCS project activity is implemented and has operated during the considered monitoring period under conformance with its previously defined design and with monitoring related activities/tasks being performed under sufficient compliance with monitoring requirements defined in the monitoring plan as per registered VCS PD for the project activity ^{/2/}.
- The monitoring plan for the VCS project activity as previously defined in the registered VCS PD was designed and has been operated under full conformance with the applied CDM Baseline and monitoring methodology ACM0001 “Flaring or use of Landfill Gas” (version 19.0) ^{/6/}.
- The Monitoring Report ^{/1/} and other supporting documents provided are confirmed as being sufficiently complete, verifiable and with texts, assumptions, descriptions and calculation under full conformance with the applicable VCS requirements.
- Monitoring instruments required for measurements which are instrumental for the determination of ex-post GHG emission reductions achieved by the VCS project activity during the considered monitoring period were confirmed to be under correct and reliable operation with related maintenance and calibration being appropriately and timely performed.
- GHG emission reductions achieved by the VCS project activity during the considered monitoring period are confirmed as being calculated without material misstatements.

The GHG verification assessment performed by Applus+ Certification is based on the approach defined as per applicable guidance and requirements of ISO 14064-3:2019 (whenever applicable). The performed verification assessment applied a risk-based approach, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these.

5.2 Verification Conclusion

In summary, Applus+ Certification was able to confirm that information included in the Monitoring Report ^{/1/} is deemed complete and correct and that the emission reductions achieved by the VCS project activity during the monitoring period from 11-July-2022 to 31-December-2023 are correctly determined and fairly stated and were calculated without material misstatements. Applus+ Certification hereby confirms and certifies that GHG emission reductions achieved by the VCS project activity “Brusque landfill Gas Project” during the monitoring period from 11-July-2022 to 31-December-2023 as reported in the latest version of the Monitoring Report (version 2.1, dated 10-October-2024) ^{/1/} represents the figures summarized below.

Verification period: From 11-July-2022 to 31-December-2023

Verified GHG emission reductions and carbon dioxide removals in the above verification period:

Vintage period	Baseline emissions (tCO ₂ e)	Project emissions (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Reduction VCU (tCO ₂ e)	Removal VCU (tCO ₂ e)	Total VCUs (tCO ₂ e)
2022 (11-July 2022 to 31-December-2022)	28,977	6	0	28,971	0	28,971
2023 (01-January-2023 to 31-December-2023)	94,596	12	0	94,584	0	94,584
Total	123,573	18	0	123,555	0	123,555

5.3 Ex-ante vs Ex-post ERR Comparison

Vintage period	Ex-ante estimated reductions/removals	Achieved reductions/removals	Percent difference	Explanation for the difference
2022 (11-July 2022 to 31-December-2022)	64,399	28,971	-55%	Please see below
2023 (01-January-2023 to 31-December-2023)	139,396	94,584	-32%	Please see below
Total	203,795	123,555	-39%	Please see below

As assessed and verified by Applus+ Certification verification team, like other similar project activities encompassing LFG collection and destruction/utilization, the amount of methane to be generated by decomposition of MSW disposed at the Brusque landfill and collected by the VCS project activity was derived by applying the First Order Decay (FOD) model as per the CDM methodological tool “Emissions from Solid Waste Disposal Sites” (version 08.0) in the context of the determination of ex-ante estimated emission reductions to be achieved by the VCS project activity. By taking in account all potential uncertainties associated with the application of such multi-phased decay model, it is reasonable to assume that, in the particular case of the VCS project activity during the considered monitoring period, the application of this model somehow overestimated the amount of LFG to be actually generated and collected by the VCS project activity.

APPENDIX 1: REFERENCE LIST

1	Recicle Catarinense de Resíduos Ltda.: Monitoring reports for the VCS project activity “Brusque landfill Gas Project” / monitoring period from 11-July-2022 to 31-December-2023, (version 1.0, dated 07-February-2024, version 2.0, dated 20-May-2024, version 2.1 dated 10-October-2024).
2	Recicle Catarinense de Resíduos Ltda.: Registered VCS PD the VCS project activity “Brusque landfill Gas Project” (version 3.0, dated 14-April-2023)
3	LGAI Technological Center, S.A. (Applus+ Certification): Validation report for the VCS project activity “Brusque landfill Gas Project” (version 2.0, dated 20-April-2023)
4	VCS/VERRA: Validation and verification manual (version 3.2) dated 19-October-2016. https://verra.org/wp-content/uploads/2018/03/VCS_Validation_Verification_Manual_v3.2.pdf
5	VCS/VERRA: VCS standard version 4.7 (dated 16-August-2024). Available online: https://verra.org/programs/verified-carbon-standard/vcs-program-details/#rules-and-requirements
6	UNFCCC / CDM: Baseline and monitoring methodology ACM0001 “Flaring or use of Landfill Gas”; Version 19.0. Available online: https://cdm.unfccc.int/methodologies/DB/JPYB4DYQUXQPZLBDVPHA87479EMY9M
7	ABB S.p.A.: Calibration event performed on Pressure signal processing + data transmission unit S/N 3K646621050136. Certificate number 1001178832. Dated: 11-November-2021

	Tecnoiso Instrumentação e Calibração: Calibration event performed on Pressure signal processing + data transmission unit S/N 3K646621050136. Certificate number 14809221107. Dated: 07-November-2022 Tecnoiso Instrumentação e Calibração: Calibration event performed on Pressure signal processing + data transmission unit S/N 3K646621050137. Certificate number 15103221122. Dated: 23-November-2021 Tecnoiso Instrumentação e Calibração: Calibration event performed on Pressure signal processing + data transmission unit S/N 3K646621050137. Certificate number 11509231031. Dated: 30-October-2023
8	International Organization for Standardization (ISO) Standard ISO 14064-3:2019
9	Recicle Catarinense de Resíduos Ltda.: Set of sequential live videos (movies) + photographs (pictures) of the VCS project activity “Brusque landfill Gas Project” produced/generated on 24-April-2024 and 25-April-2024
10	Comparative emission reduction calculation spreadsheet for the VCS project activity “Brusque landfill Gas Project” – monitoring period from 11-July-2022 to 31-December-2023. Created as part of the Data authenticity checking procedure performed during the on-site visit. Files name: “202207_comparative” “202208_comparative” “202209_comparative” “202210_comparative” “202211_comparative” “202212_comparative” “202301_comparative” “202302_comparative” “202303_comparative” “202304_comparative”

	“202305_comparative” “202306_comparative” “202307_comparative” “202308_comparative” “202309_comparative” “202310_comparative” “202311_comparative” “202312_comparative”
11	Recicle Catarinense de Resíduos Ltda.: Spreadsheet including the calculation of flare efficiency values valid for the considered monitoring period
12	Blank version of the emission reduction calculation spreadsheet for the VCS project activity “Brusque landfill Gas Project” – monitoring period from 1-July-2022 to 31-December-2023. Created as part of the Data authenticity checking procedure performed during the on-site visit.
13	VCS/VERRA: Validation and verification manual (version 3.2) dated 19-October-2016. https://verra.org/wp-content/uploads/2018/03/VCS_Validation_Verification_Manual_v3.2.pdf
14	UNFCCC / CDM: ACM0001 “Flaring or use of Landfill Gas” Available online: https://cdm.unfccc.int/methodologies/DB/JPYB4DYQUXQPZLBDVPHA87479EMY9M
15	Schneider Electric: ION 8650 Technical Data Sheet of the main electricity meter. Available online: https://www.se.com/br/pt/product-range/61053-ion8650/
16	Recicle Catarinense de Resíduos Ltda.: Input raw-data for the monitoring period from 11-July-2022 to 31-December-2023. Files name:

	"202207_raw-data" "202208_raw-data" "202209_raw-data" "202210_raw-data" "202211_raw-data" "202212_raw-data" "202301_raw-data" "202302_raw-data" "202303_raw-data" "202304_raw-data" "202305_raw-data" "202306_raw-data" "202307_raw-data" "202308_raw-data" "202309_raw-data" "202310_raw-data" "202311_raw-data" "202312_raw-data"
17	Input raw-data for checking for the monitoring period from 11-July-2022 to 31-December-2023. Files name: "202207_raw-data-for checking" "202208_raw-data-for checking" "202209_raw-data-for checking" "202210_raw-data-for checking" "202211_raw-data-for checking" "202212_raw-data-for checking"

	“202301_raw-data-for checking” “202302_raw-data-for checking” “202303_raw-data-for checking” “202304_raw-data-for checking” “202305_raw-data-for checking” “202306_raw-data-for checking” “202307_raw-data-for checking” “202308_raw-data-for checking” “202309_raw-data-for checking” “202310_raw-data-for checking” “202311_raw-data-for checking” “202312_raw-data-for checking”
18	UNFCCC/CDM: “Guideline – Application of materiality in verifications”, version 02.0. Available online: https://cdm.unfccc.int/filestorage/e/x/t/extfile-20150225171039012-iss_guid08.pdf/iss_guid08.pdf?t=Nnd8cjhpNm1nfDCyUV7i5kNG_5KRiOiEzL_k
19	Internal service and maintenance logbook (with details about historical of interventions, service and instrument/equipment calibration and replacement) for the VCS project activity “Brusque landfill Gas Project” during the considered monitoring period.
20	Recicle Catarinense de Resíduos Ltda.: Emission reduction spreadsheet “MR#1 - Brusque - V.2.0” Monthly emission reduction calculation spreadsheets: “202207” “202208” “202209” “202210” “202211”

	“202212” “202301” “202302” “202303” “202304” “202305” “202306” “202307” “202308” “202309” “202310” “202311” “202312”
21	UNFCCC/CDM: CDM Validation and Verification Standard for project activities (version 03.0) Available online: https://cdm.unfccc.int/Reference/Standards/index.html
22	Start5g Tecnologia Ambiental: Atmospheric emissions monitoring report from stationary sources. ID 0239-22. Dated 28-December-2022 Start5g Tecnologia Ambiental: Atmospheric emissions monitoring report from stationary sources. ID 0087-23 Dated 29-June-2023 Start5g Tecnologia Ambiental: Atmospheric emissions monitoring report from stationary sources. ID 0092-24. Dated 18-April-2024
23	LGAI Technological Center, S.A. (Applus+ Certification):

	VCS – Verification Work Plan: Landfill gas collection and utilization at the Brusque landfill Gas Project dated 16-April-2024
24	Monthly emission reduction calculation comparative spreadsheets: “202207-comparative” “202208-comparative” “202209-comparative” “202210-comparative” “202211-comparative” “202212-comparative” “202301-comparative” “202302-comparative” “202303-comparative” “202304-comparative” “202305-comparative” “202306-comparative” “202307-comparative” “202308-comparative” “202309-comparative” “202310-comparative” “202311-comparative” “202312-comparative”
25	Applus+ Certification: Verification plan for the 1st Monitoring period of VCS project activity Brusque landfill Gas Project, dated 16-April-2024.
26	UNFCCC/CDM: Emissions from solid waste disposal sites (version 08.0) Available online:

	https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v6.0.1.pdf/history_view
27	UNFCCC/CDM: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (version 03.0) Available online: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf/history_view
28	UNFCCC/CDM: Project emissions from flaring (version 04.0) Available online: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v1.pdf/history_view
29	UNFCCC/CDM: Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 03.0) Available online: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v1.pdf/history_view
30	UNFCCC/CDM: Tool to calculate the emission factor for an electricity system (version 07.0) Available online: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v1.1.pdf/history_view
31	Instituto de Meio Ambiente (IMA) - Environmental Authority of Santa Catarina state: Environmental operational license no. 1383/2022, dated 20-April-2022
32	GSA Engenharia Ltda.: Evaluation/declaration reports for the monitoring parameter “Management of SWDS”, valid from 11-July-2022 to 10-July-2023.
33	Specification details for the measurement element (annubar) manufactured by Rosemount Inc., model 485 Annubar.

	Available online: https://www.emerson.com/en-us/catalog/rosemount-sku-485-annubar-primary-element?fetchFacets=true#facet:&partsFacet:&modelsFacet:&facetLimit:&searchTerm:&partSearchTerm:&modelsSearchTerm:&productBeginIndex:0&partsBeginIndex:0&modelsBeginIndex:0&orderBy:&partsOrderBy:&modelsOrderBy:&pageView:list&minPrice:&maxPrice:&pageSize:&facetRange:& Specification details for the pressure signal processing + data transmission unit manufactured by ABB S.p.A., model 2600T. Available online: https://library.e.abb.com/public/d250be36d4b841ebb6590da7676dd7f4/RB_2600T-EN_D.pdf
34	Specification details for the continuous CH₄/O₂ fraction gas analyser unit manufactured by Siemens, model Ultramat 23. Available online: https://www.siemens.com/global/en/products/automation/process-analytics/extraktive-continuous-process-gas-analytics/ultramat-23.html
35	Siemens AG: Calibration event performed on continuous CH₄/O₂ fraction gas analyser unit S/N N1NN247. Certificate number 4518557368. Dated: 01-December-2021 Biotechnogas s.r.l.: Calibration event performed on continuous CH₄/O₂ fraction gas analyser unit S/N N1NN247. Certificate number 007B.22. Dated: 15-February-2022 Tecnoiso Instrumentação e Calibração: Calibration event performed on continuous CH₄/O₂ fraction gas analyser unit S/N N1NN247. Certificate number 14205230214. Dated: 14-February-2023
36	Specification details for the pressure meter manufactured by ABB S.p.A., model 266HSH. Available online: https://library.e.abb.com/public/b29423206ccc40479151a099809582e5/DS_266HSH_LowP-EN_D.pdf
37	ABB S.p.A.:

	Calibration event performed on pressure meter 3K646622000904. Certificate number 1001189752. Dated: 10-January-2022 Tecnoiso Instrumentação e Calibração: Calibration event performed on pressure meter 3K646622000904. Certificate number 14806221107. Dated: 07-November-2022 Tecnoiso Instrumentação e Calibração: Calibration event performed on pressure meter 3K646622000904. Certificate number 11506231031. Dated: 31-October-2023
38	Specification details for the temperature meter manufactured by ELSI S.R.L., model Y1-SEM203/P. Available online: https://www.tecnisis.pt/docs/data203.pdf
39	ELSI S.R.L.: Calibration event performed on temperature meter E22TP0013. Certificate number EL22/0013. Dated: 18-January-2022 Tecnoiso Instrumentação e Calibração: Calibration event performed on temperature meter E22TP0013. Certificate number 11502231031. Dated: 23-October-2023
40	Specification details for the electricity meter manufactured by Kron Instrumentos Elétricos Ltda., model Multi-K-Plus. Available online: https://kron.com.br/produto/mult-k-plus/
41	GE/INNIO Jenbacher GmbH & Co OHG: Specification sheet for the installed GE/INNIO Jenbacher engine-generator set model JGS416.
42	CELESC - Centrais Elétricas de Santa Catarina (Electric distribution company): Monthly electricity consumption receipts (period from 11-July-2022 to 31-December-2023) for the VCS project activity “Brusque landfill Gas Project”
43	Gordon J. Van Wylen, Richard E. Sonntag and Borgnakke: Fundamentals of Classical Thermodynamics; 4th Edition, John Wiley & Sons, Inc. Table A-4: Saturated Water-Temperature. Dated 1994.

44	CO₂ emission factor for electricity generation in Brazil National Interconnected System, annual values. Available online: https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/sirene/dados-e-ferramentas/fatores-de-emissao
45	Specification details for the thermocouple manufactured by ELSI s.r.l., model Y1-TT33CX/S. Available online: http://elsi.it/en/thermocouple.php
46	ELSI s.r.l.: Calibration event performed on thermocouple Y1-TT33CX/S. Certificate number EL22/0015. Dated 18-January-2022 Tecnoiso Instrumentação e Calibração: Calibration event performed on thermocouple Y1-TT33CX/S. Certificate number 11508231031. Dated: 31-October-2023
47	Specification details for the UV flame detector manufactured by Krom Schroder, model UVS 10DOG1. Available online: https://docuthek.kromschroeder.com/documents/download.php?lang=de&doc=29135
48	Biotechogas s.r.l.: O&M Training course dated October 2021. Veolia Environnement: Occupational Health and Control Medical Control Program, dated 15-November-2023. Veolia Environnement: Environmental Risk Assessment Report, dated 15-December-2023. GSST Segurança e Saúde do Trabalho Ltda-ME: Occupational Health Certificate, dated 28-June-2023

	Gympass: Proof of registration Biotechnogas s.r.l.: O&M Training course Attendance list dated October 2021. Recicle Catarinense de Resíduos S.A.: Registration form, dated 01-January-2022 Recicle Catarinense de Resíduos S.A.: Statement of payment, dated 12/2023
49	Positive list of technologies (version 03.0) Available online: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-32-v1.pdf/history_view
50	ACQUA Engenharia e Consultoria em Meio Ambiente: Environmental Compliance Report (ECR), dated April-2013.
51	Email sent by the project developer on 28-February-2024 to all stakeholders invited to the previously conducted physical Stakeholder Consultation meeting containing general details about the overall operation of the project activity during the considered monitoring and a weblink with the initial version of the Monitoring Report and an evaluation form to be filled by any interested stakeholder.
52	Weblinks containing the initial version of the Monitoring Report and an evaluation form were made available to all the stakeholders (sent to the identified stakeholders via email as part of the communication of monitored results). Available online: https://drive.google.com/drive/folders/1c4E-1VAUHqHftx7XpNiPhSDZyyqOVlpD?usp=sharing https://forms.gle/obbDScTzbujdMaMM7

53	Written procedures elaborated by the project proponent Recicle Catarinense de Resíduos S.A. for addressing stakeholder's grievances and inputs. Available at the project's control room.
54	Recicle Catarinense de Resíduos Ltda.: Risk Management Program, dated 15-December-2023
55	Recicle Catarinense de Resíduos Ltda.: Medical Control Program of Occupational Health, dated 15-December-2023
56	Kron Instrumentos Elétricos Ltda.: Calibration event performed on the electricity meter with Serial Number 2310978. Certificate number 787/22, dated 02-May-2022 Tecnoiso Instrumentação e Calibração: Calibration event performed on the electricity meter with Serial Number 2310978. Certificate number 14204230217, dated 17-February-2023

APPENDIX 2: LIST OF RAISED CORRECTIVE ACTION REQUESTS (CAR)

The descriptions of Correction Action Requests (CARs) issued by the Applus+ Certification's verification team as part of the performed verification assessment are summarized in the tables below, which also includes the summary of the actions and responses from the project proponent for successfully addressing and closing the raised CARs.

CAR ID	01	Date: 15-May-2024
Description of CAR		
The Monitoring Report was not completed by applying the requirements of the latest applicable valid version of the VCS Standard (version 4.7).		
Project proponent response		Date: 20-May-2024
As a response to the raised CAR, the content of the Monitoring Report was corrected by meeting all requirements of the latest applicable valid version of the VCS Standard (version 4.7).		
WB assessment		Date: 27-May-2024
As confirmed by the Applus+ Certification's verification team, related amendments/corrections made in the revised version of the Monitoring Report sufficiently address the raised CAR. This CAR is thus closed.		

CAR ID	02	Date: 15-May-2024
Description of CAR		
The Monitoring Report does not apply the latest version of the VCS Monitoring Report template.		
Project proponent response		Date: 20-May-2024
As a response to the raised CAR, the Monitoring Report was revised by applying the latest valid version of the VCS Monitoring Report template (version 4.4).		
WB assessment		Date: 27-May-2024

As confirmed by the Applus+ Certification's verification team, related amendments/corrections made in the revised version of the Monitoring Report sufficiently address the raised CAR. This CAR is thus closed.

CAR ID	03	Date: 15-May-2024
Description of CAR		
The technical evaluations performed for monitoring the parameter "Management of SWDS", as presented in Section 4.2. of the Monitoring Report, do not cover the entire considered monitoring period.		
Project proponent response		Date: 20-May-2024
As a response to the raised CAR, information details about the technical evaluations performed for monitoring the parameter "Management of SWDS" were revised in Section 4.2 of the Monitoring Report.		
WB assessment		Date: 27-May-2024
As confirmed by the Applus+ Certification's verification team, related amendments/corrections made in the revised version of the Monitoring Report sufficiently address the raised CAR. This CAR is thus closed.		

CAR ID	04	Date: 15-May-2024
Description of CAR		
Section 4.2 of the Monitoring Report does not include complete/correct details about the monitoring parameter $F_{CH4,EG,t}$ during the considered monitoring period.		
Project proponent response		Date: 20-May-2024
As a response to the raised CAR, information details about the determination of the monitoring parameter $F_{CH4,EG,t}$ during the considered monitoring period were revised in the Monitoring Report.		
WB assessment		Date: 27-May-2024
As confirmed by the Applus+ Certification's verification team, related amendments/corrections made in the revised version of the Monitoring Report sufficiently address the raised CAR. This CAR is thus closed.		

CAR ID	05	Date: 15-May-2024
Description of CAR		
Monitoring parameters that are also included in the registered VCS PD, but not used for the purpose of ex-post determination of baseline emissions and project emissions achieved by the project activity during the considered monitoring period, are not listed correctly in Section 4.2.		
Project proponent response		Date: 20-May-2024
As a response to the raised CAR, the monitoring parameters which were not used for the purpose of ex-post determination of baseline emissions and project emissions achieved by the project activity during the considered monitoring period were listed at the of Section 4.2 of the Monitoring Report.		
VVB assessment		Date: 27-May-2024
As confirmed by the Applus+ Certification's verification team, related amendments/corrections made in the revised version of the Monitoring Report sufficiently address the raised CAR. This CAR is thus closed.		

CAR ID	06	Date: 15-May-2024
Description of CAR		
Section 5.1 of the Monitoring Report wrongly indicates the values of ex-ante determined parameters w_{BM} and w_{OM} .		
Project proponent response		Date: 20-May-2024
As a response to the raised CAR, values for the ex-ante determined parameters w_{BM} and w_{OM} were corrected in the revised version of the Monitoring Report.		
VVB assessment		Date: 27-May-2024
As confirmed by the Applus+ Certification's verification team, related amendments/corrections made in the revised version of the Monitoring Report sufficiently address the raised CAR. This CAR is thus closed.		