Verification and certification report form for CDM project activities

(Version 03.0)

BASIC INFORMATION	
Title and UNFCCC reference number of the project activity	Embralixo/Araúna – Bragança Landfill Gas Project UNFCCC reference number 1179
Scale of the project activity	☒ Large-scale ☐ Small-scale
Version number of the verification and certification report	3.0
Completion date of the verification and certification report	01/02/2020
Monitoring period number and duration of this monitoring period	6th monitoring period 01/04/2019 – 31/03/2019
Version number of the monitoring report to which this report applies	3.0
Crediting period of the project activity corresponding to this monitoring period	2nd 7-year renewable crediting period (from 01/01/2015 to 31/12/2021)
Project participants	Araúna Participações e Investimentos Ltda. Embralixo – Empresa Bragantina de Varrição e Coleta de Lixo Ltda. First Climate (Switzerland) AG
Host Party	Brazil
Applied methodologies and standardized baselines	ACM0001 - “Flaring or use of landfill gas” (version 18.0)
Mandatory sectoral scopes linked to the applied methodologies	13 - Waste handling and disposal
Conditional sectoral scopes, if applicable	Not applicable.
Estimated amount of GHG emission reductions or GHG removals for this monitoring duration in the registered PDD	35,872 tCO_2e
Certified amount of GHG emission reductions or GHG removals for this monitoring period	31,544 tCO_2e
Name and UNFCCC reference number of the DOE	EPIC Sustainability Services Pvt. Ltd. (EPIC); UNFCCC reference number E-0062
Name, position and signature of the approver of the verification and certification report	 K.Suryanarayana Murthy, Managing Director

SECTION A. Executive summary

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Brief summary of the project activity and performed verification assessment:

EPIC Sustainability Services Pvt. Ltd. (EPIC) performed the 6th periodic verification assessment (2nd periodic verification within the 2nd 7-year crediting period) for the registered CDM project activity titled "Embralixo/Araúna – Bragança Landfill Gas Project", hereafter termed the "project activity". The project activity was registered by the UNFCCC on 15/10/2007 as CDM project activity with registration no. 1179 and it is currently under its 2nd 7-year renewable crediting period (period from 01/01/2015 to 31/12/2021).

The performed verification assessment encompassed the monitoring period from 01/04/2018 to 31/03/2019 (including both days) and it was performed on the basis of (i) document comprehensive review of the Monitoring Report, registered version of the Project Design Document (PDD) valid for the 2nd 7-year renewable crediting period of the project activity + supporting documents; (ii) performed on-site assessment; (iii) conducted interviews with representatives of the host-country project participant and project owner/operator Araúna Participações e Investimentos Ltda.; (iv) resolution of all identified outstanding issues (identified Corrective Action Requests (CARs) and Clarification Requests (CLs)) and finally (v) issuance of the Verification Report.

During the considered monitoring period, the project design encompassed collection and destruction (through combustion) of landfill gas (LFG) under efficient and controlled conditions at the Bragança landfill. As part of the operation of the project activity, LFG has been combusted in the installed high temperature enclosed flare for the unique purposes of avoiding emissions of methane (CH_4) into the atmosphere (that would otherwise occur in the absence of the project activity (baseline scenario)). CH_4 is a powerful greenhouse gas (GHG). In accordance with the project design as per the PDD, no commercial or economic utilization of collected LFG was promoted as a result of the operation of the project activity prior or during the considered monitoring period other than the potential generation of Certified Emission Reductions (CERs).

LFG (which is rich in CH_4) has been historically generated at the Bragança landfill as result of the anaerobic decomposition of municipal solid waste (MSW) disposed in the site using appropriate MSW landfilling techniques and procedures.

Also in accordance to the project design, all project's electricity demand has been met during the considered monitoring period through imports of electricity sourced by the National Electricity Grid of Brazil.

The Bragança landfill is located in the city of Bragança Paulista at the Estrada Municipal do Campo Novo, São Paulo, Brazil. The geographical coordinates of the project site are as follows:

- -22.9453 S
- -46.5736 W

Scope of the verification:

The verification assessment shall ensure that reported GHG emission reductions are deemed complete and sufficiently accurate in order to be certified. The verification assessment, as an independent and objective review, shall verify and confirm that the implementation of the project activity as well as measures taken to monitor and report emission reductions for a considered monitoring period comply with applicable CDM criteria/rules and relevant guidance provided by the CMP and the CDM Executive Board (CDM-EB). The verification assessment of the registered CDM project activity is based on comprehensive and detailed review of information made available in (i) the PDD version 8.0, dated 04/08/2017 /2/), (ii) the Monitoring Report /3/ (incl. emission reduction calculation spreadsheets /5/ that are enclosed to the Monitoring Report) and (iii) all other supporting documents made available to the EPIC verification team + review of information collected through performance of interviews and/or collected as part of the performed on-site visit.

Furthermore, as part of the verification assessment, publicly available information is considered and reviewed as far as available and required.

The verification assessment was carried out on the basis of the following rules and requirements that are applicable for the CDM project activity:

- Article 12 of the Kyoto Protocol /9/,
- Guidelines for the implementation of Article 12 of the Kyoto Protocol as presented in the Marrakech Accords under decision 3/CMP.1 /9/ and subsequent decisions made by the Executive Board and COP/MOP,
- Other relevant rules, including applicable and valid host country legislation/regulations,
- The CDM validation and verification standard for project activities (CDM-VVS-PA) version 02.0 /1/,
- The monitoring plan of the latest version of the PDD applicable for the 2nd 7-year renewable crediting period (PDD version 8.0, dated 04/08/2017 /2/).
- The CDM baseline and monitoring methodology ACM0001 “Flaring or use of landfill gas” (version 18.0) /7/,
- Monitoring Report (all versions) /3/ /4/,
- The following methodological tools, which are referred in the Monitoring Report /3/:
    - “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” (version 02.0) /13/
    - "Tool to calculate the emission factor for an electricity system” (version 05.0 /17/)
    - "Project emissions from flaring" (version 02.0.0) /12/
    - "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) /14/

Verification process:

The verification process is based on applicable verification guidelines described in the latest version of the CDM validation and verification standard for project activities (CDM-VVS-PA) /1/. In addition to that, standard auditing techniques have been applied by the appointed EPIC verification team. As part of the verification assessment, the EPIC verification team initially performed a desk review on all verification related documents, followed by an on-site visit to the project site in order to review the project implementation and its operation. For all identified inconsistencies and lack of clarity, related findings (list of outstanding issues) are raised. The next steps are to close out the findings through direct communication with the project participants and receipt of updated version of the Monitoring Report /3/ and/or supporting documents and finally preparing the Verification Report. The draft version of the Verification Report undergoes a technical review by EPIC prior to its submission to the CDM-EB.

Verification assessment conclusion and summary of the verification opinion:

As part of the conducted verification assessment, the EPIC verification team identified outstanding issues that were appropriately/sufficiently addressed and resolved by the host-country PP Araúna Participações e Investimentos Ltda. (*inter alia* through revision of the Monitoring Report and supporting documents) as part of the performed verification assessment.

As an outcome of the performed assessment, the EPIC verification team was able to confirm that GHG emission reductions achieved by the project activity during the considered monitoring period are correctly calculated and reported in the latest version of the Monitoring Report (version 3.0, dated 31/01/2020). As outlined in such latest version of the Monitoring Report, reported emission reductions are correctly determined in accordance with applicable monitoring requirements and GHG calculation approaches as per the registered PDD and applied CDM baseline and monitoring methodology and methodological tools.

Therefore, EPIC certifies the emission reductions for the monitoring period from 01/04/2018 to 31/03/2019 (including both days) are correctly determined and reported as 31,544 tCO_2e. EPIC thus requests the CDM Executive Board (CDM-EB) to issue equivalent amount of CERs for the project activity.

SECTION B. Verification team, technical reviewer and approver

B.1. Verification team member

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)	Involvement in			
						Desk/document review	On-site inspection	Interviews	Verification findings
1.	Team Leader / Technical Expert	EI	Ratton	Marco	EPIC - Central Office	X	X	X	X
2.	Auditor	IR	Radhamadhavan	Vijayaraghavan	EPIC - Central Office	X	-	-	X

EI: External individual

Demonstration how the appointed verification team meets the competence required for the performance of the verification assessment is included in Appendix 2.

B.2. Technical reviewer and approver of the verification and certification report

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)
1.	Technical reviewer	IR	Prabu Das	Anbazhagan	EPIC - Central office
2.	Approver	IR	Murthy	Suryanarayana	EPIC - Central office

IR: Internal resource

Demonstration how the appointed technical reviewer and approver of the Verification Report meet the competence required for the performance of the verification assessment is included in Appendix 2.

SECTION C. Application of materiality

C.1. Consideration of materiality in planning the verification

By acknowledging that an individual or an aggregate of undetected errors, omissions and misinterpretations could potentially undermine the possibility of achieving a verification opinion under reasonable and fair level assurance as an outcome of the verification assessment, aspects of the concept of materiality were thus considered in the context of the verification assessment in line with the requirements of both the "Guideline - Application of materiality in verification" (version 02.0) /35/ and the CDM validation and verification standard for project activities (CDM-VVS-PA) version 02.0 /1/.

In the context of the verification planning, while aiming to minimize the risk that material discrepancies not being detected (detection risk) in the course of the verification assessment, EPIC performed an identification of risks that could lead to quantitative material errors, omissions and misstatements in its verification opinion.

Furthermore, the identification of actions to be performed by the appointed EPIC verification team during the verification assessment as responses to such identified risks were also included/considered in both the verification planning and later performed in the subsequent phases of the verification assessments (document desk review, on-site visit, identification/addressing of findings and reporting).

In order to ensure a deemed complete, transparent and timely execution of the verification assessment, the appointed EPIC verification team (that holds sufficient experience and expertise in CDM verification assessments for project activities encompassing LFG collection and destruction/utilization) planned a complete sequence of assessment events that were regarded as necessary to detect potentially existent major potential material errors, omissions and discrepancies and, upon addressing of such outstanding issues, arrive at a substantiated and reasonable final verification opinion (with the risks that could lead to quantitative material errors, omissions and misstatements in its verification opinion being thus sufficiently identified and addressed).

By taking into account applicable guidance from both the "Guideline - Application of materiality in verification" (version 02.0) /35/ and the CDM-VVS-PA version 02.0 /1/, the threshold of materiality for the performed verification assessment was evaluated and it was concluded that such threshold applicable to the project activity (based on actual emission reductions reported as achieved during the considered monitoring period as per the initial version of the Monitoring Report and the length of the considered monitoring period) is defined as 2.0%[1].

[1] As indicated in the PDD valid the 2nd 7-year renewable crediting of the project activity, ex-ante emission reductions are lower than 300,000 tCO_2e / year for all the years encompassed by the 2nd 7-year renewable crediting period of the project activity. Such annual emission reduction estimates result in a threshold of materiality of 2.0%. This assumption is in accordance with applicable guidance of the "Guideline - Application of materiality in verifications"

As part of the verification planning, no sampling approach was considered as required for monitoring and cross-checking of data against primary data source (no sampling based-monitoring or no data cross-checking based on sampling)[2]. While it was later confirmed that no sampling approach was indeed required in the context of assessment of monitoring data, risks related to sampling for these particular aspects were thus not identified and, therefore, no design of sampling plan for addressing such aspects was considered in the context of the verification planning.

The table below summarizes the following elements of the verification planning:

- Identified risks that could lead to material errors, omissions or misstatements (including their assessment details)

- Summary of the responses/actions to such identified risks that were later considered during the performance of the verification assessment.

No.	Risk that could lead to material errors, omissions or misstatements	Assessment of the risk		Response to the risk in the verification plan and/or sampling plan
		Risk level	Justification	
1.	Inadequate installation/configuration or malfunction in measuring instruments/equipment (e.g. insufficient accuracy or inappropriateness of installed equipment/instruments)	High	Potential generation of measurement and data errors/inconstancies due to inappropriate installation/configuration or malfunction in related measuring instruments/equipment. This risk might lead to material error in calculation and reporting of achieved emission reductions.	The EPIC verification team shall confirm whether modern/state-of-the art and/or best-practice monitoring instruments/equipment are appropriately installed/configured as part of the implementation and operation of the project activity. By taking into account the significantly rate of monitoring data being recorded (LFG and flaring related measurements being recorded/reported with an every-minute frequency), ideally, it is expected that a reliable process control automation is in place for typical CDM project activities encompassing LFG collection and destruction/utilization. Moreover, it should be confirmed whether trained personnel staff are in charge of operation of the project's monitoring system and that there are related QA/QC

[2] The EPIC verification team was also able to confirm that no sampling approach for monitoring and cross-checking of data against primary data source was applicable/required for the verification assessment covered by this Verification Report since:

- (i) as per the monitoring and GHG calculation approaches applied for the project activity (as established in the registered PDD and applied CDM baseline and monitoring methodology + applicable methodological tools) no sampling procedure and no sampling-based monitoring are valid/required for the determination of emission reductions achieved by the project activity during a given monitoring period;
- (ii) there is a possibility for cross-checking/reproducing all reported LFG and flaring measurement records valid for the considered monitoring period against the related primary data sources (with all reported related monitoring data being cross-checked/reproduced (instead of having selected samples of data being cross-checked/reproduced)). Further related assessment details valid for the performed verification assessment encompassed by this Verification Report are included in Section E.6.2, under *Data authenticity checking*.

				procedures in place. Moreover, for minimizing the risk 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 ideally shall encompass a comprehensive and deemed sufficient checking of all reported data (e.g. checking of authenticity of monitoring data). Finally, it shall also be ensured that, in case of identification of uncertainties related to correctness/reasonability of reported monitoring data for a particular time period (e.g. measurements of LFG or flaring related monitoring for a particular minute), no emission reductions for such particular time period are accounted/claimed under such circumstances (thus minimizing risks of overestimations of claimed GHG emission reductions).
2.	Inadequate accuracy and lack of correctness of monitoring data and or evaluations supplied by independent 3rd parties (e.g. measurements of residual outgoing methane in the flare for the determination of project emissions of methane through the flare; evaluation of the compliance of management practices of the landfill as per previously established design and operation requirements for the landfill)	High	Potential generation of measurement and data errors/inconsistencies due to inappropriate installation / configuration or malfunction in related measuring instruments and/or inappropriate evaluation procedures being applied by company(ies) in charge of related measurements and evaluations to be performed by independent 3rd party inspection service company(ies). These risks might lead to material error in calculation/determination and reporting of baseline emissions.	The EPIC verification team shall confirm whether all measurements performed by independent 3rd parties are performed by company (ies) with required accreditation. It shall also be confirmed whether modern/state-of-the art and/or best-practice equipment/instruments and/or procedures are appropriately applied for related 3rd party measurements and/or evaluations. Moreover, it should be confirmed whether there are related QA/QC procedures in place. Finally, it shall also be ensured that, in case of identification of uncertainties related to correctness/reasonability of reported monitoring data for a particular time period (e.g. measurements of residual outgoing methane in the flare for the determination of project emissions of methane through the flare valid for a particular

				time period); no emission reductions for such particular time period are accounted/claimed under such circumstances (thus minimizing risks of overestimations of claimed GHG emission reductions).
3.	Inadequate installation/configuration or malfunction in installation/configuration of data processing/management equipment such as programmable logic controller unit (PLC unit) and data storage infrastructure (database for monitoring records).	High	Potential recording and reporting of monitoring data with errors and/or inconsistencies due to inappropriate installation/configuration or malfunction in related data management/processing equipment (PLC unit and/or database for monitoring records). This risk might lead to material error in calculation and reporting of achieved emission reductions.	The EPIC verification team shall confirm whether modern, state-of-the art and best practice data management/processing infrastructure (PLC unit and database for monitoring records) is appropriately installed/configured as part of the project activity implementation and operation. By taking into account the significantly rate of monitoring data being recorded (LFG and flaring related measurements being recorded/reported with an every-minute frequency), ideally, the risk response details included under item 1 above (risk of "*Inadequate installation/configuration or malfunction in measuring instruments/equipment*") related to process control automation, training of personnel staff in charge of operation of the project's monitoring system and related QA/QC procedures are all also applicable. Moreover, for minimizing the risk 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 risk response details included under item 1 above (risk of "*Inadequate installation/configuration or malfunction in measuring instruments/equipment*") related to comprehensive and deemed sufficient checking of all reported data (e.g. checking of authenticity of monitoring data) are also applicable. Finally, it shall also be ensured

				that, in case of identification of uncertainties related to correctness/reasonability of reported monitoring data for a particular time period (e.g. measurements of LFG or flaring related monitoring for a particular minute), no emission reductions for such particular time period are accounted/claimed under such circumstances (thus minimizing risks of overestimations of claimed GHG emission reductions).
4.	Errors and inconsistencies in the procedure(s) of transferring of monitoring data to monthly and summarized aggregated reporting forms/spreadsheets used for the determination of emission reductions.	High	Potential recording and reporting of monitoring data with errors and/or inconsistencies due to occurrence of errors and inconsistencies in the procedure(s) of transferring of monitoring data to monthly and summarized aggregated reporting forms/spreadsheets used for the determination of emission reductions. This risk might lead to material error in calculation and reporting of achieved emission reductions.	The EPIC verification team shall confirm whether appropriate and reliable procedure(s) of transferring of monitoring data to monthly and summarized aggregated reporting forms/spreadsheets are in place. By taking into account the significantly rate of monitoring data being recorded (LFG and flaring related measurements being recorded/reported with an every-minute frequency), ideally, it is expected that a reliable process control automation (or at least a semi-automated procedure(s)) are in place for transferring of monitoring data to monthly and summarized aggregated reporting forms/spreadsheets used for the determination of emission reductions. Moreover, it should be confirmed whether trained personnel staff are in charge of transferring of monitoring data to monthly and summarized aggregated reporting forms/spreadsheets and that there are related QA/QC procedures in place. Moreover, for minimizing the risk 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 risk response details included under item 1 above (risk of "*Inadequate*

				installation/configuration or malfunction in measuring instruments/equipment") related to comprehensive and deemed sufficient checking of all reported data (e.g. checking of authenticity of monitoring data) are also applicable. Finally, it shall also be ensured that, in case of identification of uncertainties related to correctness/reasonability of reported monitoring data for a particular time period (e.g. measurements of LFG or flaring related monitoring for a particular minute), no emission reductions for such particular time period are accounted/claimed under such circumstances (thus minimizing risks of overestimations of claimed GHG emission reductions).
5.	Errors and/or inconsistencies (e.g. human mistakes) in the procedure(s) for entering the values of ex-ante determined parameters and entering/applying calculation formulas to monthly and summarized aggregated reporting forms/spreadsheets used for the determination of emission reductions + reporting of such information in the Monitoring Report.	High	Potential reporting of monitoring data and GHG calculations with errors and/or inconsistencies due to occurrence of errors and/or inconsistencies (e.g. human mistakes) in the procedure(s) for entering the values of ex-ante determined parameters and entering/applying calculation formulas to monthly and summarized aggregated reporting forms/spreadsheets used for the determination of emission reductions + reporting of such information in the Monitoring Report. This risk might lead to material error in calculation and reporting of achieved emission reductions.	The EPIC verification team shall confirm whether appropriate and reliable procedure(s) for entering the values of ex-ante determined parameters and entering/applying calculation formulas to monthly and summarized aggregated reporting forms/spreadsheets used for the determination of emission reductions are in place. The EPIC verification team shall also confirm whether appropriate and reliable procedure(s) for checking the correctness of such data entries and /or application of calculation formulas are in place. This may be checked through evaluation of the project's related working/operational procedures (incl. QA/QC procedures) and through performance of recalculations and detailed inspection in such forms/spreadsheets by the verification team. Moreover, it should be confirmed whether trained personnel staff are in charge of

				entering the values of ex-ante determined parameters and entering/applying calculation formulas to such monthly and summarized aggregated reporting forms/spreadsheets.

C.2. Consideration of materiality in conducting the verification

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By taking into account applicable guidance from the "Guideline - Application of materiality in verifications" (version 02.0) /35/, materiality was considered in conducting the verification.

As part of the performance of the verification assessment, the previously elaborated verification plan was applied without being revised for having 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, on-site visit, identification and resolution of outstanding issues (CARs and CLs), etc.).

As per the monitoring and QA/QC procedures adopted as part of operation of the project activity, as confirmed by the EPIC verification team, emission reductions are per se 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 EPIC 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 project activity, the monitoring procedure applied by the project participant Araúna Participações e Investimentos 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 PDD /2/ and applied CDM baseline and monitoring methodology + applicable methodological tools /13/ /17/ /12/ /14/) 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 LFG and LFG flaring/utilization related monitoring data.

Data authentic check: As part of the performed verification assessment, the EPIC verification team was able to confirm that the main emission reduction calculation spreadsheet /5/ completed by the host country project participant Araúna Participações e Investimentos Ltda. is basically a MS-Excel spreadsheet 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 participant 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 /6/ and measurement records reported in the main emission reduction spreadsheet were not intentionally or unintentionally edited/modified during the generation or handling of these files). Assessment details for the performed data authenticity check are included in Section E.6.2, under *Data authenticity checking.*

SECTION D. Means of verification

D.1. Desk/document review

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The EPIC verification team conducted a comprehensive and detailed desk review of all documents initially provided by Araúna Participações e Investimentos Ltda. + other publicly available documents that are relevant for the verification assessment. The main assessed documents are listed below:

- The latest version of the PDD /2/ for the 2nd 7-year renewable crediting period of the CDM project activity "Embralixo/Araúna – Bragança Landfill Gas Project", including the corresponding Validation Report for the Renewal of crediting period /10/;

- The initial version of the Monitoring Report for the 6th verification of the project activity /4/;

- The applied CDM baseline and monitoring methodology ACM0001 "Flaring or use of landfill gas" (version 18.0) /7/ + the following methodological tools:

    - "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 02.0) /13/

    - "Tool to calculate the emission factor for an electricity system" (version 05.0 /17/)

    - "Project emissions from flaring" (version 02.0.0) /12/

    - "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) /14/

- 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 EPIC verification team also assessed other additional documents that were required to assess the accuracy of the emission reduction calculations presented in the Monitoring Report /3/. A detailed list of all assessed documents is included in Appendix 3 (Documents reviewed or referenced) of this Verification Report.

The desk review for the initial version of the Monitoring Report for the 6th verification of the project activity /4/ and the registered version of the PDD /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 of the latest version of the registered PDD /2/ and applied CDM baseline and monitoring methodology (ACM0001 (version 18.0) /7/), 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.

Through the process of the verification, the latest version of the Monitoring Report /3/ + registered version of the PDD /2/ + supporting documents were evaluated to confirm the actions taken by the project participants to address the raised CARs and CLs.

D.2. On-site inspection

Duration of on-site inspection: 14/08/2019				
No.	**Activity performed on-site**	**Site location**	**Date**	**Team member**
1.	Opening meeting for the on-site visit. During such initial meeting the verification team was introduced, it was confirmed/outlined the objectives and scope of the on-site visit and it was confirmed the previously planned agenda for the on-site visit. The representatives of the project participants also introduced themselves and completed/signed the EPIC list of participants form for the on-site visit.	Project's data storage and control room	14/08/2019	Marco A. Ratton
2.	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 and registered PDD regarding the implementation (project design) and operation of the project activity.	Landfill cells	14/08/2019	Marco A. Ratton
3.	Visual inspection of the flaring station (set of instruments/equipment comprising high temperature enclosed flare, centrifugal blowers and all LFG / flaring monitoring instruments/equipment) and confirmation of correctness of related information presented in the Monitoring Report and registered PDD regarding the implementation (project design) and operation of the project activity.	LFG flaring station	14/08/2019	Marco A. Ratton
4.	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 project's monitoring infrastructure as well as correctness of related information included in the Monitoring Report and registered PDD.	LFG flaring station / project's data storage and control room	14/08/2019	Marco A. Ratton
5.	Visual inspection and checking/confirmation of the correctness and appropriateness of the data 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 and registered PDD. In the context of the performed checking, measurement figures of selected LFG and flaring monitoring parameter as visualized by the	LFG flaring station / project's data storage and control room	14/08/2019	Marco A. Ratton

	EPIC verification team in the screen of the project's data supervisory system (in the project activity's control room) were compared with figures displayed in displays existent in selected monitoring equipment/instruments (for the same time instant) at the time of the on-site visit. Such data checking/comparison confirmed correct data processing and recording by the project's PLC unit and monitoring equipment respectively (at the time of the performed on-site visit to the project site). Further assessment details are included in Section E.6.2.			

6.	Checking of the documented evidences provided by the host-country project participant (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. 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 project activity (incl. assessment of authorities and responsibilities of project management and training related issues).	LFG flaring station / project's data storage and control room	14/08/2019	Marco A. Ratton
7.	Performance of the *data authenticity checking* for LFG and flaring related monitoring data. A *data authenticity checking* was performed for all every minute basis measurement records for selected LFG and flaring related monitoring parameters (incl. sub-parameters) in order 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. 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 spreadsheets /5/ include only authentic monitoring records. Details about the performed *data authenticity checking* related monitoring data) are included in the end of this Section E.6.2.	Project's data storage and control room	14/08/2019	Marco A. Ratton
8.	Closure meeting for the on-site visit. During such closure meeting the verification team summarized the main observations and finding from the performed on-site visit and indicated the next steps for the verification assessment.	Project's data storage and control room	14/08/2019	Marco A. Ratton

D.3. Interviews

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	Fonseca	Ailton (Mr.)	Araúna Participações e Investimentos Ltda.	14/08/2019	In-person interviews performed during the conducted on-site visit encompassing the following topics: - General implementation and operational aspects of the project activity; - Technical equipment and operational issues for installed equipment; - Changes in the project activity since CDM validation and commissioning dates; - Specifications and operation of monitoring and measurement equipment/instruments ; - Remaining issues from the previously performed validation and verifications assessments; - Calibration procedures for installed monitoring instruments/equipmet; - Quality management system and related compliance with valid QA/QC procedures; - Involved operational and management personnel and responsibilities; - Training and practice of the operational and management personnel; - Implementation and operation of the project's monitoring plan; - Monitoring data handling and management (incl. data gathering,	Marco A. Ratton
2.	Barbosa	Nuno (Mr.)	UniCarbo - Energia e Biogás Ltda. [3]	14/08/2019		

[3] As appropriately outlined in the latest version of the Monitoring Report, UniCarbo Energia e Biogás Ltda. is a CDM consulting and advisory service company that has supported the host-country project participant Araúna Participações e Investimentos Ltda. with CDM related issues (inter alia completion of the Monitoring Report). This CDM consulting and advisory service company is not a project participant.

					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; - Compilation of CDM documentation (incl. the Monitoring Report).	

D.4. Sampling approach

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Not applicable. No sampling approach was applied for the verification assessment[4].

D.5. Clarification requests (CLs), corrective action requests (CARs) and forward action requests (FARs) raised

Areas of verification findings	No. of CL	No. of CAR	No. of FAR
Compliance of the monitoring report with the monitoring report form	-	-	-
Compliance of the project implementation and operation with the registered PDD	-	CAR 2	-
Post-registration changes	-	-	-
Compliance of the registered monitoring plan with the methodologies including applicable tools and standardized baselines	-	-	-
Compliance of monitoring activities with the registered monitoring plan	-	-	-
Compliance with the calibration frequency requirements for measuring instruments	-	CAR 1	-
Assessment of data and calculation of emission reductions or net removals	-		-
Assessment of reported sustainable development co-benefits	-	-	-
Global stakeholder consultation	-	-	-
Others (please specify)	-	-	-
Total	-	2	-

[4] As confirmed by the EPIC verification team, as per the monitoring and GHG calculation approaches that are valid for the project activity (as established in the PDD and 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. Moreover, as assessed in Section E.6.2 (under *Data authenticity checking*), cross-checking/reproducing for all reported LFG and flaring measurement records valid for the considered monitoring period against primary data sources was performed (with all reported related monitoring data being cross-checked/reproduced instead of having selected samples of data being cross-checked/reproduced).

SECTION E. Verification findings

E.1. Compliance of the monitoring report with the monitoring report form

Means of verification	The EPIC verification team has assessed whether the latest and valid version of the Monitoring Report Form (CDM-MR-FORM, version 07.0) /37/ was applied and was correctly completed as part of the elaboration of the Monitoring Report /3/. The EPIC assessment included checking whether the form was not changed in its formatting.
Findings	No findings (CARs, CLs or FARs) were raised regarding the compliance of the Monitoring Report with the Monitoring Report form (incl. compliance with guidelines/instructions for the completion of the Monitoring Report form):
Conclusion	The EPIC verification team confirmed that the latest version of the Monitoring Report /3/ was correctly completed by applying the latest and valid version of the Monitoring Report Form /37/ and by also sufficiently taking into consideration all applicable requirements and guidance for its completion.

E.2. Remaining forward action requests from validation and/or previous verifications

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By assessing the Validation Report for Renewal of of Crediting Period for the Embralixo/Araúna – Bragança Landfill Gas Project /10/ that was previously issued by the DOE responsible for the validation assessment for renewal of crediting period of the project, the EPIC verification team identified no missing steps or open issues from the validation phases (including validation assessment for renewal of the crediting period for the project activity) that would need to be addressed or observed in the context of subsequent verification assessments within the 2nd 7-year renewable crediting period for the project activity.

Furthermore, through review of the available Verification Reports for the previous 1st and 2nd periodic verifications for the project activity /27/ /28/, the EPIC verification team identified no FARs to be considered/addressed in the context of the 6th verification of the project activity.

E.3. Compliance of the project implementation and operation with the registered project design document

Means of verification	During the performed document desk review and on-site visit, the EPIC verification team assessed whether all physical features of the project activity (including, technology, project equipment and monitoring and metering equipment) as described in the registered PDD /2/ were in place and that project activity has been operated by Araúna Participações e Investimentos Ltda. during the considered monitoring period under conformance with its technical design description as outlined in the PDD.
Findings	A CAR was raised regarding the regarding the compliance of the occurred project implementation with project design details as per the registered PDD /2/: **CAR 2:** While the registered PDD refers to an operational license for the Bragança landfill which was expired on 16/06/2018, the Monitoring Report does not present details regarding the operation of the Bragança landfill in conformity with applicable legal environmental requirements.
Conclusion	As a result of the performed document desk review and on-site visit, the EPIC verification team was able to confirm that all physical features of the project activity (including, technology, project equipment and monitoring and metering equipment) were in place as described in both the registered PDD /2/ and the latest version of the Monitoring Report /3/.

	The EPIC verification has also confirmed that the project activity was operated during the considered monitoring period under conformance with its technical design description as outlined in both the registered PDD and the latest version of the Monitoring Report /3/. EPIC has also assessed the latest issued version of the operational license for the Bragança landfill (license No. 60003873, issued by the local environmental authority named Companhia Ambiental do Estado de São Paulo - CETESB (São Paulo State Environmental Agency) on 27/04/2015 and valid until 27/04/2020 /55/), which confirms that the Bragança landfill is in conformance with applicable local environmental requirements. Moreover, the EPIC verification team was informed in further details about the overall operational performance of the project activity during the latest 10 years (with detailed assessment being performed regarding the project's operational performance during the considered monitoring period). As confirmed by the EPIC verification team, the project activity was temporarily out of operation during different short time periods along the considered monitoring period due to different operational reasons (e.g. scheduled equipment maintenance, performance of calibration events in monitoring instruments/equipment, draining of accumulated condensate in LFG pipeline, etc.). Such temporary interruptions in the project activity operation were confirmed by the EPIC verification team through assessment of a service and maintenance log book /24/ (with historical of service and maintenance interventions in the project activity infrastructure). As also established by the PDD /2/, the project activity's electricity demand was entirely met by imports of grid-sourced electricity during the considered monitoring period. In summary, upon closure of the raised CAR, the EPIC verification team was able to confirm that the project activity was implemented and has operated during the considered monitoring period under conformance with project design details as per the registered PDD /2/.

E.4. Post-registration changes

E.4.1. Temporary deviations from the registered monitoring plan, applied methodologies or applied standardized baselines

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The EPIC verification team has confirmed that, as correctly outlined in Section B.2.1. of the Monitoring Report /3/, there are no temporary deviations from the registered monitoring plan and/or applied methodology applicable for the considered monitoring period. EPIC has also confirmed that there are no temporary deviations from the registered monitoring plan that are applicable/valid for previous monitoring periods.

E.4.2. Corrections

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The EPIC verification team has confirmed that, as correctly outlined in Section B.2.2. of the Monitoring Report /3/, there are no Corrections (in information that do not affect the project design) applicable specifically for the considered monitoring period. EPIC has also confirmed that there are no corrections that are applicable/valid for previous monitoring periods.

E.4.3. Change to the start date of the crediting period of the project activity

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There are no changes to the start date of the crediting period of the project activity.

E.4.4. Inclusion of a monitoring plan

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There is no inclusion of a monitoring plan applicable for the project activity.

E.4.5. Permanent changes from registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines or other methodological regulatory documents

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The EPIC verification team has confirmed that, as correctly outlined in Section B.2.2. of the Monitoring Report /3/, there are no changes from registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines or other methodological regulatory documents applicable specifically for the considered monitoring period. EPIC has also confirmed that there are no permanent changes to the registered monitoring plan (revision of the monitoring plan) that are applicable/valid for previous monitoring periods.

E.4.6. Changes to the project design

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The EPIC verification team has confirmed that, as correctly outlined in Section B.2.2. of the Monitoring Report /3/, there are no changes to the project design applicable specifically for the considered monitoring period. EPIC has also confirmed that there are no changes to the project design that are applicable/valid for previous monitoring periods.

E.4.7. Changes specific to afforestation and reforestation project activities

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Not applicable.

E.5. Compliance of the registered monitoring plan with applied methodologies, applied standardized baselines, and other applied methodological regulatory documents

Means of verification	As part of the performed document review and on-site visit, the EPIC verification team has reviewed the application of the implemented monitoring plan along the monitoring period from 01/04/2018 to 31/03/2019 vis-à-vis the monitoring requirements of the registered PDD /2/. The application of the monitoring plan during the considered monitoring period was also verified against all applicable requirements of the monitoring methodology ACM0001 (version 18.0) /7/ and applied methodological tools /12/ /13/ /14/ /15/ in order to confirm its compliance.
Findings	As part of its verification assessment, the EPIC verification team was able to confirm that the monitoring plan was correctly implemented and was operationalized during the monitoring period from 01/04/2018 to 31/03/2019 under full compliance with applicable requirements of the monitoring methodology ACM0001 (version 18.0) /7/ and applied methodological tools /12/ /13/ /14/ /15/. No findings (CARs, CLs or FARs) were raised regarding the compliance of the monitoring plan with applied monitoring methodology and methodological tools.
Conclusion	Based on the performed document desk review and performed on-site visit, the EPIC verification team confirms that the monitoring plan was applied during the period from 01/04/2018 to 31/03/2019 in conformance with the provisions of the PDD /2/. Moreover, the applied monitoring plan also sufficiently meets all applicable requirements of the baseline and monitoring methodology ACM0001 (version 18.0) /7/ and applicable methodological tools /12/ /13/ /14/ /15/.

E.6. Compliance of monitoring activities with the registered monitoring plan

E.6.1. Data and parameters fixed ex ante or at renewal of crediting period

Means of verification

The EPIC verification team assessed the Monitoring Report /3/ and emission reduction calculation spreadsheets /5/ in order to confirm whether all ex-ante determined parameters (that are applicable for the calculations of achieved emission reductions by the project activity) were correctly reported in the latest version of the Monitoring Report /3/ and correctly applied/considered (as per the provisions of the PDD) in related emission reduction calculations.

The following ex-ante determined parameters were correctly applied/considered in the context of emission reduction calculations for the considered monitoring period:

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
Historical amount of methane in the LFG which is captured and destroyed in the year prior to the implementation of the project activity (2007) ($F_{CH4,BL,x-1}$)	71.20
Global Warming Potential of CH_4 (GWP_{CH4})	25 tCO_2e/tCH_4
Universal ideal gases constant (R_u)	8,314 $Pa.m^3/kmol.K$
Molecular mass of gas *k* (MM_k) (For the particular case of the project activity, $k = N_2$)	28.01 kg/kmol
Molecular mass of greenhouse gas *i* (MM_i) (For the particular case of the project activity, $i = CH_4$)	16.04 kg/kmol
Total pressure at normal conditions (P_n)	101,325 Pa
Temperature at normal conditions (T_n)	273.15 K
Molecular mass of water (MM_{H2O})	18.0152 kg/kmol
Average technical transmission and distribution losses for providing electricity to the grid and for grid sourced electricity consumed by the project activity ($TDL_{grid,y}$)	0.20 (20%)
Weighting of build margin emissions factor (w_{BM})	0.75 (75%)
Weighting of operating margin emissions factor (w_{OM})	0.25 (25%)
Build margin CO_2 emission factor in year *y* ($EF_{grid,BM,y}$)	0.1581 tCO_2/MWh

Operating margin CO_2 emission factor in year *y* ($EF_{grid,OM,adj,y} = EF_{grid,OM,y}$)	0.4979 tCO_2/MWh
Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval ($SPEC_{flare}$)	

$SPEC_{flare}$	Min.	Max.
Operational LFG flow for each flare (for continuous operation)	200 Nm^3/h	1,500 Nm^3/h
Required temperature of the exhaust gas of the flare (to ensure LFG destruction (combustion) under high CH_4 destruction efficiency):	500 ^oC	1,000 ^oC
Required minimum frequency for inspection and maintenance service in each flare:	1 year	
Required/recommended minimum frequency for replacement of the flare isolation ceramics revetment material	10 years	

Moreover, the EPIC verification team has also assessed that the following ex-ante determined parameters (which are also included/listed in the PDD) were not considered/used for the purpose of ex-post determination of baseline emissions and/or project emissions achieved by the 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 model correction factor to account for model uncertainties ($\varphi_{default}$)
- Oxidation factor (reflecting the amount of methane from the considered SWDS that is oxidized in the soil (or other material covering the waste)) (OX)
- Fraction of methane in the SWDS gas (volume fraction) (F)

	- Fraction of degradable organic carbon (DOC) in MSW that decomposes in the considered 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) As also appropriately outlined in the Monitoring Report /3/ and the PDD /2/, the above-listed parameters are only used in the context of ex-ante estimation of emission reductions to be achieved by the project activity during the 2nd 7-year renewable crediting period.
Findings	No findings (CARs, CLs or FARs) were raised by the EPIC verification team regarding the reporting and application/consideration (as per related provisions of the PDD) of parameters fixed ex-ante:
Conclusion	The EPIC verification team has confirmed that all parameters fixed ex ante (which are applicable for the calculations of achieved emission reductions by the project activity) were correctly applied as per the PDD during the monitoring period from 01/04/2018 to 31/03/2019.

E.6.2. Data and parameters monitored

Means of verification	The EPIC verification team has assessed whether all monitoring parameters of which monitoring is required as per the monitoring plan of the registered PDD were correctly monitored during the considered monitoring period. The following tables include assessment details for parameters monitored ex post during the monitoring period from 01/04/2018 to 31/03/2019: *Assessment details for the monitoring parameter "Management of the SWDS" (Management of SWDS):*

Data / Parameter: (as per the monitoring plan of the PDD):	Management of the 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 /3/, management aspects of the Bragança 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 Bragança landfill (including relevant aspects related to landfilling practice) were not intentionally modified with the unique aim of increasing generation of methane on site.
Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Yes. As per the monitoring plan of the PDD /2/, monitoring for the parameter "Management of the SWDS" is to be performed on the basis of a technical assessment of the overall management and operation of the Bragança landfill with an every year frequency. The evaluation assessments performed by the independent 3rd party engineering company

		"Carrer Engenharia" on 12/12/2017, 06/04/2018 and 01/04/2019 as the applicable monitoring procedure for the parameter Management of the SWDS valid for the considered monitoring period 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 PDD /2/ and ACM0001 (version 18.0) /7/. While the registered PDD establishes monitoring frequency for the parameter "Management of the SWDS" of every one-year (12 months), evaluation assessments 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 PDD /2/, the performed technical assessments which are referred to in the Monitoring Report are thus correctly assumed as being valid until 01/04/2019.
	Type of monitoring equipment/instrument:	Not applicable. While monitoring of the parameter "Management of the SWDS" is not performed based on measurements, there are no monitoring equipment/instruments utilized.
	Is the accuracy of the monitoring equipment/instrument as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment/instrument, does the utilization of the monitoring equipment/instrument represents good monitoring practice?	Not applicable. While monitoring of the parameter "Management of the SWDS" is not performed based on measurements, there are no monitoring equipment/instruments utilized.
	If applicable, has the reported monitoring data been cross-checked with other available data or source?	The outcome of the technical evaluations that were performed by the independent 3rd party engineering company "Carrer Engenharia" are reported in the technical reports /51/ issued by this company that are dated 12/12/2017, 06/04/2018 and 01/04/2019. These documents were made available and was assessed by the EPIC verification team. The following is appropriately outlined in the latest version of the Monitoring Report /3/: *"(…) As part of the performed evaluation, the current configuration and operational conditions of the Bragança landfill were compared against the previously conceived design and operational conditions of the landfill prior of the occurred implementation of the project activity on the basis of different sources and assessments including inter alia:* *- The original design documents of the*

		landfill (as described in the documentation required for all phases of the environmental licensing and operational permitting for the Bragança landfill); - *Applicable local or national regulations;(…)"* The EPIC verification team has verified that both the issued technical reports /51/ sufficiently confirm that the original conceived design of the Bragança landfill has so far not been modified. No changes in the aspects, conditions and circumstances related to management of the landfill (e.g. operations related to waste disposal, waste covering, waste compacting, management of leachate, draining of rainwater, etc.) were promoted with an aim to increase methane generation on the project site.	
	How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	The EPIC verification team was able to verify that related information included in the Monitoring Report /3/ is fully in accordance with the content of the technical reports issued by Carrer Engenharia dated 12/12/2017, 06/04/2018 and 01/04/2019 /51/. These technical reports were made available and were assessed by the EPIC 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 in 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 Bragança 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 Bragança landfill (including relevant aspects related to landfilling practice) were not intentionally modified with the unique aim of increasing generation of methane on site; is a monitoring requisite. As required by ACM0001 (version 18.0) /7/, 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 PDD (in terms of operation and management conditions of the landfill from which LFG is combusted).	

Assessment details for the monitoring parameter "Volumetric flow of LFG stream in time interval t on a wet basis" ($V_{t,wb}$):

Data / Parameter: (as per the monitoring plan of the PDD):	Volumetric flow of LFG stream in time interval *t* on a wet basis ($V_{t,wb}$) (monitored as per Option C of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0.0) /14/).
Measuring, recording and reporting frequencies:	Continuously measurements of the monitoring parameter $V_{t,wb}$ were recorded/reported with an every minute frequency. It is important to note that, as further assessed in Section E.8.1., while measurements for $V_{t,wb}$ are performed by the installed LFG flow meter in Nm^3/h, such parameter is thus equivalent to the calculation parameter $V_{t,wb,n.}$
Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	As per the PDD /2/, continuous measurements of $V_{t,wb}$ are to be recorded and reported every minute. Moreover, as per the applicable guidance of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) /14/ (which is applied in accordance to ACM0001 (version 18.0) /7/), monitoring of $V_{t,wb}$ should be performed continuously if not specified in the underlying methodology. While ACM0001 (version 18.0) /7/ does not specify any monitoring frequency for $V_{t,wb}$, the applied measuring, recording and reporting frequencies for Volumetric flow of the gaseous stream in time interval *t* on a wet basis are thus in accordance with both ACM0001 (version 18.0) /7/ and the PDD /2/.
Type of monitoring equipment/instrument:	Measurements of $V_{t,wb}$ are performed by an installed LFG flow meter with the following specifications: Specifications of the flow meter used for measuring the parameter $V_{t,wb}$ Manufacturer: Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. Model: FT-2 Serial Number: 1306018 Accuracy: ±1.0% Source: /40/
Is the accuracy of the monitoring equipment/instrument as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment/instrument, does the utilization of the	The PDD /2/ and ACM0001 (version 18.0) /7/ do not specify any accuracy requirement for the LFG flow meter installed at the project site. The accuracy range for the installed LFG flow meter is ±1.0%. Based on its sectoral expertise and experience with other similar project-based initiative under the CDM promoting collection + destruction and/or utilization of LFG, it is EPIC

	monitoring equipment/instrument represents good monitoring practice?	opinion that the use of the installed flow meter represents good practice for monitoring LFG flow.
	If applicable, has the reported monitoring data been cross-checked with other available data or source?	Not applicable.
	How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	Figures of LFG flow sent to the flare as visualized by the EPIC verification team in the screen of the project's data supervisory system (in the project activity's control room) were compared with figures displayed in the display of the installed LFG flow meter (for the same time instant) at the time of the on-site visit. Such data checking/comparison confirmed correct data processing and recording by the project's PLC unit and monitoring equipment respectively (at the time of the performed on-site visit to the project site). Further assessment details about recording of values measured at the project site are included in the end of this Section. Furthermore, a *data authenticity checking* was performed for all every minute basis measurement records of the following LFG and flaring related monitoring parameters (incl. sub-parameters) in order 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 LFG stream in time interval *t* on a wet basis ($V_{t,wb}$) - Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a wet basis ($v_{CH4,t,wb}$) - 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 /5/ includes only authentic monitoring records. Details about the performed *data authenticity checking* (which is valid for

	above-listed LFG and flaring related monitoring data) are included in the end of this Section.
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 the end of this Section. Further details for monitoring management and quality assurance related aspects for the project activity are also included in the end of this Section.

Assessment details for the monitoring parameter "Volumetric fraction of CH_4 in the collected LFG in time interval t on a wet basis" ($v_{CH4,t,wb}$):

Data / Parameter: (as per the monitoring plan of the PDD):	Volumetric fraction of CH_4 in the collected LFG in time interval t on a wet basis ($v_{CH4,t,wb}$) (monitored as per Option C of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) /14/)
Measuring, recording and reporting frequencies:	Continuously measurements for the monitoring parameter $v_{CH4,t,wb}$ were recorded/reported with an every minute frequency. As part of performed continuous measurements, samples of collected LFG continuously pass through the infrared cell of the installed continuous CH_4 content gas analyzer unit as a gas stream. Each every-minute reported value of $v_{CH4,t,wb}$ corresponds to a measurement actually performed at the last time instant the minute in question. While it takes about 5 seconds for the collected gas to go through the filtering/cooling process prior of reaching the infra-red cell (according to information provided by the equipment manufacturer), each individual every-minute measurement that is recorded/reported for a specific time instant (for example, 12:03:00) actually represents the concentration of the gas that entered the gas analyzer pump five seconds before (e.g. 12:02:55). This is deemed reasonable and acceptable.
Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	As per the PDD /2/, continuous measurements of $v_{CH4,t,wb}$ are to be recorded and reported every minute. Moreover, as per the applicable guidance of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) /14/ (which is applied in accordance to ACM0001 (version 18.0) /7/), monitoring of $v_{CH4,t,wb}$ should be performed continuously if not specified in the underlying methodology. While ACM0001

		(version 18.0) [7] does not specify any monitoring frequency for $v_{CH4,t,wb}$, the applied measuring, recording and reporting frequencies for $v_{CH4,t,wb}$ are thus in accordance with both ACM0001 (version 18.0) [7] and the PDD [2].
	Type of monitoring equipment/instrument:	Continuous measurements of the monitoring parameter $v_{CH4,t,wb}$ were performed by an installed continuous CH_4 content gas analyzer unit for which main specifications are summarized below: Specifications of installed continuous CH_4 content gas analyzer unit Manufacturer: Landtec Model: AEMS Serial Number: GM08642/06 Accuracy: ±1.0% Source: [4][7] It is important to note that EPIC was able to confirm during the performed on-site visit that the implemented LFG collection process ensures that LFG passing through the installed flow meters and through the installed continuous CH_4 content gas analyzer unit are measured on the same basis/conditions (wet basis).The installed CH_4 content gas analyzer unit is installed in the main LFG collection pipeline right before it is directed to the high temperature flare, where the LFG flow meter is installed.
	Is the accuracy of the monitoring equipment/instrument as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment/instrument, does the utilization of the monitoring equipment/instrument represents good monitoring practice?	The PDD [2] and ACM0001 (version 18.0) [7] do not specify any accuracy requirement for the CH_4 content gas analyzer unit installed at the project site. The accuracy range for the installed instrument is ±1.0%. Based on its sectoral expertise and experience with other similar project-based initiative under the CDM promoting collection + destruction and/or utilization of LFG, it is EPIC opinion that the use of the installed CH_4 content gas analyzer unit represents good practice for monitoring CH_4 content of LFG.
	If applicable, has the reported monitoring data been cross-checked with other available data or source?	Not applicable.
	How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	Figures of CH_4 content in the collected LFG as visualized by the EPIC verification team in the screen of the project's data supervisory system (in the project activity's control room) were compared with figures displayed in the display of the installed CH_4 content gas analyzer unit (for

		the same time instant) at the time of the on-site visit. Such data checking/comparison confirmed correct data processing and recording by the project's PLC unit and monitoring equipment respectively (at the time of the performed on-site visit to the project site). Further assessment details about recording of values measured at the project site are included in the end of this Section. Furthermore, a *data authenticity checking* was performed for all every minute basis measurement records of the following LFG and flaring related monitoring parameters (incl. sub-parameters) in order 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 LFG stream in time interval *t* on a wet basis ($V_{t,wb}$) - Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a wet basis ($v_{CH4,t,wb}$) - 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 spreadsheets /5/ include only authentic monitoring records. Details about the performed *data authenticity checking* (which is valid for above-listed LFG and flaring related monitoring data) are included in the end of this Section.	
	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 assessed in the end of this Section. Further details for monitoring management and quality assurance related aspects for the project activity are also included in the end of this Section.	

Are necessary/applicable QA/QC processes in place?	

Assessment details for the monitoring parameter "Temperature of the LFG stream in time interval t" (T_t):

Data / Parameter: (as per the monitoring plan of the PDD):	Temperature of the LFG stream in time interval *t* (T_t)
Measuring, recording and reporting frequencies:	Continuously measurements of the monitoring parameter T_t were recorded/reported with an every-minute frequency. It is noteworthy that, while the installed LFG flow meter automatically converts and reports values of LFG flow in normalized cubic meters (Nm^3) by considering standard temperature and pressure (STP) conditions, monitoring of T_t is thus not required as per the monitoring plan of the PDD /2/. Nonetheless, continuously measurements of T_t were recorded/reported for sake of completeness.
Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	As per the PDD /2/, continuous measurements of T_t are to be recorded and reported every minute. Moreover, as per the applicable guidance of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) /14/ (which is applied in accordance to ACM0001 (version 18.0) /7/), monitoring of T_t should be performed continuously if not specified in the underlying methodology. While ACM0001 (version 18.0) /7/ does not specify any monitoring frequency for T_t, the applied measuring, recording and reporting frequencies for T_t are thus in accordance with both ACM0001 (version 18.0) /7/ and the PDD /2/.
Type of monitoring equipment/instrument:	Continuously measurements of T_t were performed by an installed LFG temperature sensor of which main specifications details are summarized below: Specifications of installed LFG temperature sensor Manufacturer: Warme do Brasil Instrumentação e Automação Industrial Model: PT-100 Serial Number: 48419 Accuracy: ±1.0ºC Source: /45/
Is the accuracy of the monitoring equipment/instrument as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment/instrument,	The PDD /2/ and ACM0001 (version 18.0) /7/ do not specify any accuracy requirement for the LFG temperature sensor installed at the project site. The accuracy range for the installed instrument is ±1.0ºC. Based on its sectoral expertise and experience with other similar project-based initiative under the CDM

	does the utilization of the monitoring equipment/instrument represents good monitoring practice?	promoting collection + destruction and/or utilization of LFG, it is EPIC opinion that the use of the installed temperature sensor represents good practice for monitoring of LFG temperature.
	If applicable, has the reported monitoring data been cross-checked with other available data or source?	Not applicable.
	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 the end of this Section. Furthermore, a *data authenticity checking* was performed for all every minute basis measurement records of the following LFG and flaring related monitoring parameters (incl. sub-parameters) in order 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 LFG stream in time interval *t* on a wet basis ($V_{t,wb}$) - Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a wet basis ($v_{CH4,t,wb}$) - 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 spreadsheets /5/ include only authentic monitoring records. Details about the performed *data authenticity checking* (which is valid for above-listed LFG and flaring related monitoring data) are included in the end of this Section.
	Does the applied monitoring data management process (from monitoring equipment/instrument to emission reduction	Yes. Details for data transfer and reporting of emission reductions (incl. relevant QA/QC process) are assessed in the end of this Section. Further details for monitoring management and quality assurance related aspects for the project activity are also included in the end of this

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?	Section.

Assessment details for the monitoring parameter "Pressure of the LFG stream in time interval t" (P_t):

Data / Parameter: (as per the monitoring plan of the PDD):	Pressure of the LFG stream in time interval *t* (P_t)
Measuring, recording and reporting frequencies:	Continuously measurements of the monitoring parameter P_t were recorded/reported with an every-minute frequency. It is noteworthy that, while the installed LFG flow meter automatically converts and reports values of LFG flow into normalized cubic meters (Nm^3) by considering standard temperature and pressure (STP) conditions, monitoring of P_t is not required as per the monitoring plan of the PDD /2/. Nonetheless, continuously measurements of P_t were recorded/reported for sake of completeness.
Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	As per the PDD /2/, continuous measurements of P_t are to be recorded and reported every minute. Moreover, as per the applicable guidance of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) /14/ (which is applied in accordance to ACM0001 (version 18.0) /7/), monitoring of P_t should be performed continuously if not specified in the underlying methodology. While ACM0001 (version 18.0) /7/ does not specify any monitoring frequency for P_t, the applied measuring, recording and reporting frequencies for P_t are thus in accordance with both ACM0001 (version 18.0) /7/ and the PDD /2/.
Type of monitoring equipment/instrument:	Continuous measurements of Pressure of the gaseous stream in time interval *t* (P_t) were performed by an installed LFG pressure sensor of which main specifications are presented below: Specifications of installed LFG pressure sensor Manufacturer: Warme do Brasil Instrumentação e Automação Industrial Model: WTP-4010 Serial Number: 41645 Accuracy: ±0.5% Source: /44/
Is the accuracy of the monitoring	The PDD /2/ and ACM0001 (version 18.0) /7/ do not specify any accuracy requirement for the

	equipment/instrument as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment/instrument, does the utilization of the monitoring equipment/instrument represents good monitoring practice?	LFG pressure sensor installed at the project site. The accuracy range for the installed instrument is ±0.5%. Based on its sectoral expertise and experience with other similar project-based initiative under the CDM promoting collection + destruction and/or utilization of LFG, it is EPIC opinion that the use of the installed pressure sensor represents good practice for monitoring of LFG pressure.
	If applicable, has the reported monitoring data been cross-checked with other available data or source?	Not applicable.
	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 the end of this Section. Furthermore, a *data authenticity checking* was performed for all every minute basis measurement records of the following LFG and flaring related monitoring parameters (incl. sub-parameters) in order 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 LFG stream in time interval *t* on a wet basis ($V_{t,wb}$) - Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a wet basis ($v_{CH4,t,wb}$) - 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 spreadsheets /5/ include only authentic monitoring records. Details about the performed *data authenticity checking* (which is valid for above-listed LFG and flaring related monitoring data) are included in the end of this Section.
	Does the applied	Yes. Details for data transfer and reporting of

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?	emission reductions (incl. relevant QA/QC process) are assessed in the end of this Section. Further details for monitoring management and quality assurance related aspects for the project activity are also included in the end of this Section.

Assessment details for the monitoring parameter "Amount of grid electricity consumed by the project activity during the year y" ($EC_{PJ,grid,y}$):

Data / Parameter: (as per the monitoring plan of the PDD):	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 continuously measurements of the monitoring parameter $EC_{PJ,grid,y}$ were aggregated and recorded/reported monthly by the staff of Araúna Participações e Investimentos Ltda.
Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	As per the PDD /2/, continuous measurements of $EC_{PJ,grid,y}$ are to be recorded and reported at least with an every week frequency. The methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" /13/, and ACM0001 (version 18.0) /7/ 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 is assumed as in accordance with the monitoring plan of the PDD /2/, the tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" /13/ and ACM0001 (version 18.0) /7/.
Type of monitoring equipment/instrument:	During the considered monitoring period, continuously measurements of the monitoring parameter $EC_{PJ,grid,y}$ were performed by the installed electricity meter of which main specifications are presented below: Specifications of installed electricity meter Manufacturer: Itron Inc. Model: MY202A Serial Number (S/N): 1321986 Accuracy: ±2.0% Source: /38/
Is the accuracy of the monitoring	The PDD /2/, the tool "Baseline, project and/or leakage emissions from electricity consumption

equipment/instrument as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment/instrument, does the utilization of the monitoring equipment/instrument represents good monitoring practice?	and monitoring of electricity generation" /13/ and ACM0001 (version 18.0) /7/ do not specify any accuracy requirement for the electricity meter installed at the project site. The accuracy range for the installed instrument is ±2.0%. Based on its sectoral expertise and experience with other similar project-based initiative under the CDM promoting collection + destruction and/or utilization of LFG, it is EPIC opinion that the use of the installed electricity meter represents good practice for monitoring consumption of grid-sourced electricity by the project activity.
If applicable, has the reported monitoring data been cross-checked with other available data or source?	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 EPIC verification team has confirmed that values for the monitoring parameter $EC_{PJ,grid,y}$ as reported in the summarized emission reduction calculation spreadsheet /5/ and Monitoring Report /3/ are as per the primary monitoring records.
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.

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

Data / Parameter: (as per the monitoring plan of the PDD):	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, two valid measurements for the monitoring parameter $F_{CH4,EG,t}$ were performed by a third party accredited entity. The independent 3rd party inspection service company IST - Tecnologia Internacional em Sensores Ltda. was selected by Araúna Participações e Investimentos Ltda. for performing all measurements related to the determination of the biannual values for $F_{CH4,EG,t}$ for the flare. As outlined in the test/evaluation technical

		reports /42/ /43/ issued by IST - Tecnologia Internacional em Sensores Ltda., performance of measurements for the determination of the values for $F_{CH4,EG,t}$ for the flare valid for the considered monitoring period occurred in the following dates: - 18/03/2018 (measurements performed by IST - Tecnologia Internacional em Sensores Ltda.) - 11/01/2019 (measurements performed by IST - Tecnologia Internacional em Sensores Ltda.)
	Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	As per the PDD /2/, measurements and calculations for the determination of values for the monitoring parameter $F_{CH4,EG,t}$ for the flare are to be performed biannually. Applicable guidance of the methodological tool "Project emissions from flaring" (version 02.0.0) /12/ establishes the following: "*(…) 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 performed measurements events as indicated above are deemed correct and the most representatives available.
	Type of monitoring equipment/instrument:	As outlined in the Monitoring Report /3/ and in the test/evaluation reports /42/ /43/ issued for the valid performed measurements and calculations for the regular determination of the values of $F_{CH4,EG,t}$, for performing the measurements of amount of residual methane in the exhaust gas of the flare, the following measuring instruments were used: - Measurements performed by IST - Tecnologia Internacional em Sensores Ltda. on 18/03/2018 and 11/01/2019: for performing the measurements of amount of residual methane in the exhaust gas of the flare, an appropriated chromatographer was utilized by the independent 3rd party inspection service company IST - Tecnologia Internacional em Sensores Ltda. Moreover, 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 of type S was used by IST - Tecnologia Internacional em Sensores Ltda. As per information made available in the technical evaluation/testing report issued by IST - Tecnologia Internacional em Sensores 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"
	Is the accuracy of the monitoring equipment/instrument as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment/instrument, does the utilization of the monitoring equipment/instrument represents good monitoring practice?	The PDD [2] and ACM0001 (version 18.0) [7] do not specify any equipment or procedural requirement for performing the related measurements and calculations for the determination of values for $F_{CH4,EG,t}$. The methodological tool "Project emissions from flaring" (version 02.0.0) [12] establishes that *"(…) under Option B.1 the measurement is conducted by an accredited entity on a biannual basis".* The following disclaimer about the entity that performed the set of measurements for $F_{CH4,EG,t}$ that are valid for the considered monitoring period is appropriately included in Section D.2. of the Monitoring Report [3]: *"IST - Tecnologia Internacional em Sensores Ltda. is an independent third party inspections services company specialized in inspections and testing of air emissions from stationary sources."* In summary, based on its sectoral expertise and experience with other similar project-based initiative under the CDM promoting collection + destruction and/or utilization of LFG, it is EPIC opinion that having IST Tecnologia Internacional em Sensores Ltda. performing related measurements with the measurement instruments indicated above and following the applicable measurement and test methodologies of the US-EPA and CETESB represents a good practice for the determination of $F_{CH4,EG,t}$.

		Licensing information/status for the inspection service company IST - Tecnologia Internacional em Sensores Ltda. /50/ as per accreditation requirements from INMETRO were made available and were assessed by the EPIC verification team.
	If applicable, has the reported monitoring data been cross-checked with other available data or source?	The related technical test/evaluation reports /42/ /43/ for the performed measurements of $F_{CH4,EG,t}$ issued by the inspection service company IST - Tecnologia Internacional em Sensores Ltda. were made available and assessed by the EPIC verification team. Information made available in the Monitoring Report /3/ are in line with measurement details outlined in these technical reports /42/ /43/. As confirmed by the EPIC verification team through review of the technical test/evaluation reports issued by IST - Tecnologia Internacional em Sensores Ltda., guidance and requirements from the US-EPA Method 18 – Measurement of Gaseous Organic Compound Emission by Gas Chromatography were followed and met as part of performed biannual determination of $F_{CH4,EG,t}$ for the installed flare within the considered monitoring period. Based on its sectoral expertise, the EPIC verification team acknowledges that, as appropriately outlined in the Monitoring Report /3/, such method has been widely internationally recognized and/or accepted by different national and international organizations as a standard/method for performance of emission measurements from stationary emission sources in a wide range of industries. The EPIC verification team also confirmed that, as also outlined in the Monitoring Report /3/, different agencies in the United States (USA) and in other countries require or recommend that determination of concentration of VOC portion in landfill gas is to be performed by applying US-EPA Method 18. The US-EPA Method 18 was also confirmed by the EPIC verification team as being refereed in the most popular and acknowledged pollution control handbooks and guides (i.e. Pollution Control Handbook for Oil and Gas Engineering, 2016, published by John Wiley & Sons, Inc. – USA, US-EPA Guidance for evaluating landfill gas emissions from closed or abandoned facilities, SEPA Guidance for monitoring landfill gas engine emissions, Pollution Prevention and Abatement Handbook 1998 – The World Bank Group, etc.) as also claimed in the Monitoring Report /3/. The EPIC verification team also confirmed that technical test/evaluation reports issued by IST - Tecnologia Internacional em Sensores Ltda. for

		the performed biannual determination of $F_{CH4,EG,t}$ for the installed flare within the considered monitoring period also refers to methods recommended by the environmental authority of São Paulo State in Brazil. In summary, the EPIC verification team confirmed that $F_{CH4,EG,t}$ is measured according to an appropriate national or international standard as required by the methodological tool "Project emissions from flaring" (version 02.0.0) /12/ for the application of its Option B.1. It is also important to note that, as outlined in the latest version of the Monitoring Report /3/, the flare efficiency calculation spreadsheet /5/ also includes determination of the average flow of LFG sent to the flare within a 6-month period prior to each one of evaluation assessments performed by the independent 3rd party inspection service company IST - Tecnologia Internacional em Sensores Ltda. The EPIC verification team has confirmed that, as required by the methodological tool "Project emissions from flaring", such calculated average values of LFG flow sent to the flare within the 6-month period prior to the performance of measurements related to the determination of the biannual values for $F_{CH4,EG,t}$ are lower than the average values of flow of LFG sent to the flare during each 1-hour periods for which the measurements of mass flow of methane in the exhaust gas of the flare were performed as part of the determination of the biannual values for $F_{CH4,EG,t}$. In summary, the EPIC verification team confirmed that the average flow rate to the flare during the period in which measurements for $F_{CH4,EG,t}$ were made are greater than the average flow rate observed for the previous six months as required by the methodological tool "Project emissions from flaring" (version 02.0.0) /12/ for the application of its Option B.1.
	How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	The EPIC verification team compared the results of all measurements and calculations as outlined in the test/evaluation technical reports /42/ /43/ issued by IST - Tecnologia Internacional em Sensores Ltda. against description of measurements and calculations as presented in the latest version of the Monitoring Report /3/ and spreadsheet including the calculation of flare efficiency values valid for the considered monitoring period /5/.
	Does the applied monitoring data management process (from monitoring equipment/instrument to emission reduction calculation) ensure correct	Details for monitoring management and quality assurance related aspects for the project activity are also included in the end of this Section.

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

Assessment details for the monitoring parameter "Saturation pressure of H_2O at temperature T_t in time interval t" ($P_{H2O,t,sat}$):

Data / Parameter: (as per the monitoring plan of the PDD):	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 /3/, $P_{H2O,t,Sat}$ 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 $F_{CH4,RG,t}$).
Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Not applicable. The determination of applicable value for the monitoring parameter $P_{H2O,t,sat}$ is not based on measurements.
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.
Is the accuracy of the monitoring equipment/instrument as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment/instrument, does the utilization of the monitoring equipment/instrument represents good monitoring practice?	Not applicable. The determination of applicable value for the monitoring parameter $P_{H2O,t,sat}$ is not based on measurements.
If applicable, has the reported monitoring data been cross-checked with other available data or source?	Not applicable.
How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	EPIC verification team has confirmed that the values of $P_{H2O,t,sat}$ as reported in the FE calculation spreadsheet /5/ and Monitoring Report /3/ were indeed calculated as per the applicable guidance of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version

	03.0) [14], which refers to the literature "Fundamentals of Classical Thermodynamics" [49].
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.

Assessment details for the monitoring parameter "Temperature in the exhaust gas of the enclosed flare in minute m" ($T_{EG,m}$):

Data / Parameter: (as per the monitoring plan of the PDD):	Temperature in the exhaust gas of the enclosed flare in minute *m* ($T_{EG,m}$)
Measuring, recording and reporting frequencies:	Continuous measurements of the monitoring parameter $T_{EG,m}$ were recorded/reported with an every minute frequency.
Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	As per the PDD [2], continuous measurements of the monitoring parameter $T_{EG,m}$ are to be recorded and reported every minute. Moreover, as per the applicable guidance of the methodological tool "Project emissions from flaring" (version 02.0.0) [12], (which is applied in accordance ACM0001 (version 18.0) [7]), values of $T_{EG,m}$ shall be recorded once per minute. Thus, the applied measuring, recording and reporting frequencies for $T_{EG,m}$ are thus in accordance with both ACM0001 (version 18.0) [7] and the PDD [2].
Type of monitoring equipment/instrument:	Measurements of $T_{EG,m}$ are continuously performed by an installed thermocouple with the following specifications: Specifications of the thermocouple installed on the flare Manufacturer: Warme do Brasil Instrumentação e Automação Industrial Model: WTT 5000, type K Serial Number: 67894 Accuracy: ±0.15% Source: [48]
Is the accuracy of the monitoring equipment/instrument as	The PDD [2] and ACM0001 (version 18.0) [7] do not specify any accuracy requirement for the thermocouples installed at the project site. The

	stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment/instrument, does the utilization of the monitoring equipment/instrument represents good monitoring practice?	accuracy ranges for the installed instrument is: ±0.15% of measured value. Based on its sectoral expertise and experience with other similar project-based initiative under the CDM promoting collection + destruction and/or utilization of LFG, it is EPIC opinion that the use of the installed thermocouple represents good practice for monitoring temperature of exhaust gas of the flare.
	If applicable, has the reported monitoring data been cross-checked with other available data or source?	Not applicable.
	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 the end of this Section. Furthermore, a *data authenticity checking* was performed for all every minute basis measurement records of the following LFG and flaring related monitoring parameters (incl. sub-parameters) in order 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 LFG stream in time interval *t* on a wet basis ($V_{t,wb}$) - Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a wet basis ($v_{CH4,t,wb}$) - 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 spreadsheets /5/ include only authentic monitoring records. Details about the performed *data authenticity checking* (which is valid for above-listed LFG and flaring related monitoring data) are included in the end of this Section.
	Does the applied	Yes. Details for data transfer and reporting of

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?	emission reductions (incl. relevant QA/QC process) are assessed in the end of this Section. Further details for monitoring management and quality assurance related aspects for the project activity are also included in the end of this Section.

Assessment details for the monitoring parameter "Flame detection of flare in the minute m" ($Flame_m$):

Data / Parameter: (as per the monitoring plan of the PDD):	Flame detection of flare in the minute *m* ($Flame_m$)
Measuring, recording and reporting frequencies:	The operational status of the flare was recorded and reported every-minute on the basis of continuous measurements of the status of flame in the flare. As confirmed by the EPIC verification team through assessment of the emission reduction calculation spreadsheet /5/, for every minute *m* during which flame was detected in the flare, the flame status of the flare for each minute is set as "*ON*" (Flame "*on*"), otherwise the flame status of the flare for the given minute is set to "*OFF*" (Flame "*off*").
Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	As per both the PDD /2/ and the methodological tool "Project emissions from flaring" (version 02.0.0) /12/, (which is applied in accordance to ACM0001 (version 18.0) /7/), 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 18.0) /7/ and the PDD /2/.
Type of monitoring equipment/instrument:	Monitoring of the operational status of the flare is performed by an installed UV flame detector with the following specifications: Specifications of the UV Flame detector installed on the flare Manufacturer: Honeywell Analytics Ltd. Model: C7061A Dynamic Self-Check Ultra-Violet Flame Detector Serial Number: 1170 Source: /33/
Is the accuracy of the monitoring equipment/instrument as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment/instrument,	Not applicable. There are no measured values for Flame detection of flare in the minute *m*.

	does the utilization of the monitoring equipment/instrument represents good monitoring practice?	
	If applicable, has the reported monitoring data been cross-checked with other available data or source?	Not applicable.
	How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	A *data authenticity checking* was performed for all every minute basis measurement records of the following LFG and flaring related monitoring parameters (incl. sub-parameters) in order 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 LFG stream in time interval *t* on a wet basis ($V_{t,wb}$) - Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a wet basis ($v_{CH4,t,wb}$) - 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 spreadsheets /5/ include only authentic monitoring records. Details about the performed *data authenticity checking* (which is valid for above-listed LFG and flaring related monitoring data) are included in the end of this Section.
	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 assessed in the end of this Section. Further details for monitoring management and quality assurance related aspects for the project activity are also included in the end of this Section.

Are necessary/applicable QA/QC processes in place?	

Assessment details for the monitoring parameter "Maintenance events completed in year y as monitored by the project participant*" (Maintenance$_y$):*

Data / Parameter: (as per the monitoring plan of the PDD):	Maintenance events completed in year *y* as monitored by the project participant (Maintenance$_y$)
Measuring, recording and reporting frequencies:	As per the implemented monitoring procedure adopted at Araúna Participações e Investimentos Ltda., all the maintenance events at the project site are performed by the technical staff of the project participant and project operator Araúna Participações e Investimentos Ltda. and are recorded in a customized maintenance log book (with details about historical of performed interventions (repair, maintenance and calibration services) /24/. As established in the PDD /2/, the latest version of the Monitoring Report /3/ summarizes the maintenance events (inspection and maintenance services) that were performed in the installed flare which are valid for the considered monitoring period. The listed events (dated 17/10/2017 and 20/07/2018) 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 thermocouple, 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). General inspection/maintenance services on the flare are opportunely performed during planned or unplanned interruptions of operation of the flare. Moreover, as also highlighted in the Monitoring Report /3/, the isolation ceramics revetment material of the flare was replaced once in June 2017. As indicated in the PDD /2/, the expected lifetime for the isolation ceramics revetment material for the flare is of at least 10 years (as established in details for the ex-ante determined parameter "Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval" (SPEC$_{flare}$)).
Are measuring, recording and reporting frequencies in accordance with the	As per both the PDD /2/ and the methodological tool "Project emissions from flaring" (version 02.0.0) /12/, (which is applied in accordance to

	monitoring plan and monitoring methodology? (Yes / No)	ACM0001 (version 18.0) [7], 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 18.0) [7] and the PDD [2].
	Type of monitoring equipment/instrument:	Not applicable. There are no measurements involved in the monitoring of $Maintenance_y$.
	Is the accuracy of the monitoring equipment/instrument as stated in the PDD? If the PDD does not specify the accuracy of the monitoring equipment/instrument, does the utilization of the monitoring equipment/instrument represents good monitoring practice?	Not applicable. There are no measurements involved in the monitoring of $Maintenance_y$.
	If applicable, has the reported monitoring data been cross-checked with other available data or source?	Yes. The EPIC verification team compared details included in the Monitoring Report [3] for the monitoring parameter $Maintenance_y$ against all available documented evidences for performed maintenance services at the flare installed as part of the project activity (incl. log book with details about historical of performed interventions (repair, maintenance and calibration services) at the flare [24]).
	How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	Not applicable. 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 $Maintenance_y$.
	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.

Assessment details for the monitoring parameter "Operational status of biogas destruction device" (Status of biogas destruction device):

Data / Parameter: (as per the monitoring plan of the PDD):	Operational status of biogas destruction device (Status of biogas destruction device)
Measuring, recording and reporting frequencies:	The operational status of the flare was recorded and reported every-minute on the basis of continuous measurements of the status of flame in the flare. As confirmed by the EPIC verification team through assessment of the main emission reduction calculation spreadsheet /5/, for every minute *m* during which flame was detected in the flare, the flame status of the flare for each minute is set as "on" (Flame "*on*"), otherwise the flame status of the flare for the given minute is set to "off" (Flame "*off*"). The registered PDD /2/ defines the following regarding monitoring of operational status of biogas destruction device: "*(…) Monitoring and documenting may be undertaken through monitoring of the operation of the flare (by means of a flame detector) in order to demonstrate the actual destruction of methane in such uniquely installed biogas destruction device."* EPIC has also confirmed that an additional column of the emission reduction calculation spreadsheet /5/ reports the Status of biogas destruction device for every minute *m* on the basis of every-minute records for the parameter $Flame_m$ (Status of biogas destruction device is set as "on" whenever flame status of the flare for the given minute is set to "on" and Status of biogas destruction device is set as "off" whenever flame status of the flare for the given minute is set to "off").
Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	As per both the PDD /2/ and the methodological tool "Project emissions from flaring" (version 02.0.0) /12/, (which is applied in accordance to ACM0001 (version 18.0) /7/), the Status of biogas destruction device shall be recorded once per minute. The applied measuring, recording and reporting frequencies for Status of biogas destruction device are thus in accordance with both ACM0001 (version 18.0) /7/ and the PDD /2/.
Type of monitoring equipment/instrument:	Specification details for the UV flame detector of the flare are presented in the applicable table for the parameter $Flame_m$.
Is the accuracy of the monitoring equipment/instrument as stated in the PDD? If the PDD does not specify the accuracy of the monitoring	Not applicable. There are no measured values for Status of biogas destruction device.

	equipment/instrument, does the utilization of the monitoring equipment/instrument represents good monitoring practice?	
	If applicable, has the reported monitoring data been cross-checked with other available data or source?	Not applicable.
	How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	A *data authenticity checking* was performed for all every minute basis measurement records of the following LFG and flaring related monitoring parameters (incl. sub-parameters) in order 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 LFG stream in time interval *t* on a wet basis ($V_{t,wb}$) - Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a wet basis ($v_{CH4,t,wb}$) - 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 spreadsheets /5/ include only authentic monitoring records. Details about the performed *data authenticity checking* (which is valid for above-listed LFG and flaring related monitoring data) are included in the end of this Section.
	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	Yes. Details for data transfer and reporting of emission reductions (incl. relevant QA/QC process) are assessed in the end of this Section. Further details for monitoring management and quality assurance related aspects for the project activity are also included in the end of this Section.

reductions calculations? Are necessary/applicable QA/QC processes in place?	

It is important to note that the monitoring plan of the PDD /2/ also includes the following monitoring parameters of which monitoring was not required during the considered monitoring period since the methodological options for which they are applicable were not selected during the considered monitoring period[5].

Parameter not monitored during the considered monitoring period
Volumetric flow of LFG stream in time interval *t* on a dry basis ($V_{t,db}$)
Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a dry basis ($v_{CH4,t,db}$)
Mass flow of the LFG stream in time interval t on dry basis for ($M_{t,db}$)
Volumetric fraction of component *i* in the residual gas on a dry basis in the minute m where *i* = CH_4, CO, CO_2, O_2, H_2, H_2S, NH_4, N_2 ($v_{i,RG,m}$)
Mass flow of the residual gas on a dry basis at reference conditions in the minute *m* ($M_{RG,m}$)
Volumetric fraction of O_2 in the exhaust gas on a dry basis at reference conditions in the minute *m* ($v_{O2,EG,m}$)
Concentration of methane in the exhaust gas of the flare on a dry basis at reference conditions in the minute *m* ($fc_{CH4,EG,m}$)

Handling of records for both parameters monitored ex-post and ex-ante determined parameters in the context of determination of achieved emission reductions:
As part of the applied monitoring procedure, measurements for the following LFG and flaring related monitoring parameters were automatically processed by the project's Programmable Logic Controller (PLC) unit and recorded in a customized Access database with a data recording/reporting frequency of every one minute:

- Volumetric flow of LFG stream in time interval *t* on a wet basis ($V_{t,wb}$),
- Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a wet basis ($v_{CH4,t,wb}$),
- 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* ($T_{EG,m}$)

[5] While Option C of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) was selected for the determination of $F_{CH4,flared,y}$ during the considered monitoring period, it is important to note the following:

- $V_{t,db}$ was not monitored as Option A of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) was not selected.
- $v_{CH4,t,db}$ was not monitored as Options A and D of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) was not selected.

- Flame detection of flare in the minute *m* ($Flame_m$)

As confirmed by the EPIC verification team, the project's customized Access based data-server is directly connected to the project's data supervisor system which was implemented by the company Carrer Engenharia Ltda.

IBased on its sectoral expertise and experience with other similar project-based initiative under the CDM promoting collection + destruction and/or utilization of LFG, it is EPIC opinion that the use of the installed data supervisor system and the customized Access data base for recording monitoring details for the project activity represents good practice in terms of data acquisition and data archiving. EPIC was also able to verify that a reliable and robust monitoring mechanism was established, implemented and has been followed by Araúna Participações e Investimentos Ltda.

Data transmission, data export/conversion and creation of "raw data" input files for the emission reduction calculations:

Access-format data with values of the measured records at the LFG extracting and flaring station has been regularly retrieved from the data base through the available interface in the data supervisor system SCADA.

As per the implemented monitoring procedure, at regular time intervals, the monitoring manager for the project activity exports/converts data from Access-format into an MS-Excel-format (.xls files) by using the customized data acquisition and management system of the project activity. These data exports/conversions into MS-Excel formats are performed by selecting the related functions (buttons) in the user graphical interface of the data supervisor system.

Also as part of the implemented project's monitoring procedure, 12 monthly MS-Excel format "raw-data" files /6/ 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 Araúna Participações e Investimentos Ltda.).

For the monitoring period from 01/04/2018 to 31/03/2019, as per the adopted work procedures, a set of 12 monthly "raw-data" MS-Excel-format files were generated. The set of 12 MS-Excel "raw-data" files /6/ were used as primary monitoring data input for the compilation of the emission reduction calculation spreadsheets as follows:

Period	File Names
April 2018	*"APR_18.xls"*
May 2018	*"MAY_18.xls"*
June 2018	*"JUN_18.xls"*
July 2018	*"JUL_18.xls"*
August 2018	*"AUG_18.xls"*
September 2018	*"SEP_18.xls"*
October 2018	*"OCT_18.xls"*
November 2018	*"NOV_18.xls"*
December 2018	*"DEC_18.xls"*
January 2019	*"JAN_19.xls"*
February 2019	*"FEB_19.xls"*
March 2019	*"MAR_19.xls"*

The set of generated MS-Excel-format "raw-data" files /6/ were made available and assessed by the EPIC verification team. All raw data files contain, for each minute of the considered monitoring period, historical monitoring records for LFG flow sent to the flare, LFG pressure, LFG temperature, CH_4 content of LFG, temperature of the exhaust gas of the flare and flame status of the flare, which are used for the calculation of GHG emission reductions. As verified by EPIC, for each individual

MS-Excel format "raw-data" spreadsheet file /6/ the number of records exceeds 42,000 rows for a full month period. It is crucial to note that when generating such files in MS-Excel format, data could be eventually intentionally or unintentionally edited/modified. Thus, in order to ensure that only authentic (not edited /not modified) "raw data" were used as a basis for the emission reduction calculations, a systematic *data authenticity checking* was performed by the EPIC verification team for all the monitored data as described and assessed below under the sub-section "*Data authenticity checking".*

As part of the adopted project's monitoring procedure, in order to compile the emission reduction spreadsheet /5/ valid for the considered monitoring period, every-minute measurement records, as presented in the raw-data files, were used as input data for the compilation of the MS-Excel format emission reduction calculation spreadsheet /5/.

As per the adopted monitoring procedure and in accordance with the requirements of ACM0001 (version 18.0) /7/ and related provisions of the PDD, 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 parameter as presented below:

Parameter	Value
Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline ($OX_{top\ layer}$)	0.1
Historical amount of methane in the LFG which is captured and destroyed in the year prior to the implementation of the project activity (2007) ($F_{CH4,BL,x-1}$)	71.20
Global Warming Potential of CH_4 (GWP_{CH4})	25 tCO_2e/tCH_4
Universal ideal gases constant (R_u)	8,314 $Pa.m^3/kmol.K$
Molecular mass of gas *k* (MM_k) (For the particular case of the project activity, $k = N_2$)	28.01 kg/kmol
Molecular mass of greenhouse gas *i* (MM_i) (For the particular case of the project activity, $i = CH_4$)	16.04 kg/kmol
Total pressure at normal conditions (P_n)	101,325 Pa
Temperature at normal conditions (T_n)	273.15 K
Molecular mass of water (MM_{H2O})	18.0152 kg/kmol
Average technical transmission and distribution losses for providing electricity to the grid and for grid sourced electricity consumed by the project activity ($TDL_{grid,y}$)	0.20 (20%)
Weighting of build margin emissions factor (w_{BM})	0.75 (75%)

Weighting of operating margin emissions factor (w_{OM})	0.25 (25%)
Build margin CO_2 emission factor in year *y* ($EF_{grid,BM,y}$)	0.1581 tCO_2/MWh
Operating margin CO_2 emission factor in year *y* ($EF_{grid,OM,adj,y} = EF_{grid,OM,y}$)	0.4979 tCO_2/MWh

Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval ($SPEC_{flare}$)

$SPEC_{flare}$	Min.	Max.
Operational LFG flow for each flare (for continuous operation)	200 Nm^3/h	1,500 Nm^3/h
Required temperature of the exhaust gas of the flare (to ensure LFG destruction (combustion) under high CH_4 destruction efficiency):	500 ^oC	1,000 ^oC
Required minimum frequency for inspection and maintenance service in each flare:	1 year	
Required/recommended minimum frequency for replacement of the flare isolation ceramics revetment material	10 years	

It is noteworthy that values of the fixed parameters indicated in the table above were selected ex-ante in the PDD [2].

Baseline emissions for the monitoring period were partially calculated through

application of the *blank* version of the spreadsheet template that is developed by the project participant Araúna Participações e Investimentos Ltda. and termed "emission reduction calculation spreadsheet template" /23/. This calculation spreadsheet template uses the following data/information as input data for the determination of every-minute and accumulated values for the calculation parameters "Amount of methane in the LFG which is flared and/or used in the project activity in year *y*" ($F_{CH4,PJ,y}$):

- Monitoring records included in the MS-Excel format "raw-data" spreadsheet files /6/ valid for the monitoring period
- the *ex-ante* determined parameters presented in the table above
- the calculated values of Flare efficiency (parameter $\eta_{flare,calc,m}$)

It is noteworthy that the calculations for the determination of the applicable values for the monitoring parameter Flare efficiency ($\eta_{flare,calc,m}$) are performed in a separate calculation spreadsheet termed "*MR 6* - Embralixo - *V.2* - *FE.xls*" /5/). Further assessment for the determination of $\eta_{flare,calc,m}$ is presented on Section E.8.1.

For the monitoring period from 01/04/2018 to 31/03/2019, one calculation spreadsheet /5/ was thus generated and it aggregates (reports) the following recorded monitoring data on an every-minute recording/reporting frequency (folder "Output"):

- Volumetric flow of LFG sent to the high temperature enclosed flare (monitoring parameter "Volumetric flow of LFG stream in time interval *t* on a wet basis" ($V_{t,wb}$)
- Methane fraction in the LFG (monitoring parameter "Volumetric fraction of CH_4 in collected LFG in time interval *t* on a wet basis" ($v_{CH4,t,wb}$));
- Temperature of landfill gas (monitoring parameter "Temperature of the LFG stream in time interval *t* " (T_t));
- Pressure of the landfill gas (monitoring parameter "Pressure of the LFG stream in time interval *t* " (P_t));
- Temperature of the flare (monitoring parameter "Temperature in the exhaust gas of the enclosed flare in minute *m*" ($T_{EG,m}$),
- Flame status of the flare (monitoring parameter "Flame detection of flare in the minute *m*" ($Flame_m$).

An additional calculation spreadsheet (termed "Summarized emission reduction calculation spreadsheet") (file name "*MR 6 – Embralixo - V.2.xls*") /5/ correctly summarizes the achieved emission reductions by the project activity during the considered monitoring period (by considering the accumulated values for the calculation parameters $F_{CH4,PJ,y}$ and $F_{CH4,BL,y}$ from the emission reduction spreadsheet /5/). Further assessment details about the calculation of baseline emissions are included in Section E.8.1.

Project emissions are also calculated in the summarized emission reduction calculation spreadsheet /5/ on the basis of monitoring records (input data) for (i) monitoring parameters that are not automatically recorded/reported by the project's PLC unit (Amount of grid electricity consumed by the project activity during the year *y* ($EC_{PJ,grid,y}$)) and (ii) related *ex-ante* determined parameters (Weighting of build margin emissions factor (w_{BM}), Weighting of operating margin emissions factor (w_{OM}), Build margin CO_2 emission factor in year *y* ($EF_{grid,BM,y}$) and Operating margin CO_2 emission factor in year *y* ($EF_{grid,OM-adj,y} = EF_{grid,OM,y}$). Further assessment details about the calculation of project emissions are included in Section E.8.2.

The MS-Excel-format emission reduction calculation spreadsheet file /5/ and the summarized emission reduction calculation spreadsheet /5/ were made available and assessed by the EPIC verification team.

In summary, the EPIC 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 PDD /2/, monitoring methodology and applicable tools /12/ /13/ /14/ /15/ as described and assessed in Section E.8.

All calculations are thus confirmed by the EPIC verification team to be under conformance with applicable requirements from:

- CDM baseline and monitoring methodology ACM0001 – "Flaring or use of landfill gas" (version 18.0) /7/,
- "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 02.0) /13/,
- "Tool to calculate the emission factor for an electricity system" (version 05.0) /17/,
- "Project emissions from flaring" (version 02.0.0) /12/,
- "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) /14/,
- Monitoring plan of the PDD /2/.

The table below presents the reported results of the generated emission reduction spreadsheet and the summarized emission reduction calculation spreadsheet:

File name for the emission reduction calculation spreadsheets	Period	Reported amount of methane flared ($F_{CH4,PJ,y} = F_{CH4,flared,y}$) ($tCH_4$)
"2018_2019.xls"	From 01/04/2018 to 31/03/2019	1,450 tCH_4
"MR 6 – Embralixo – V.2.xls" (Summarized emission reduction calculation spreadsheet for the whole monitoring period)	From 01/04/2018 to 31/03/2019	1,450 tCH_4

It is crucial to note that, as earlier highlighted in this section, when generating the "raw-data" spreadsheet files (which are used as primary input data for the emission reduction spreadsheet /5/), data could be eventually intentionally or unintentionally edited/modified (by using MS-Excel application). Thus, in order to ensure that only authentic (not edited /not modified) data were used as a basis for the emission reduction calculations, a systematic *data authenticity checking* was performed by the EPIC verification team for all the monitored data as detailed below under the sub-section "*Data authenticity checking".*

Monitoring Management and Quality Assurance:
The EPIC verification team was able to confirm that quality control and quality assurance (QA/QC) procedures are implemented by the project participant and project operator Araúna Participações e Investimentos Ltda. for preventing or identifying and correct eventual errors or omissions in the reported monitoring parameters.

As verified by the EPIC verification team, competent and sufficiently trained staff are recruited for operating the project activity and handling related monitoring data. Such employees are found with knowledge not only about the operation of the project activity, but also with sufficient knowledge and competence to ensure the

application of all related QA/QC procedures for data recording and storage.

Furthermore, for the 6th periodic verification, the host-country project participant and project operator Araúna Participações e Investimentos Ltda. was also supported with consultancy and advisory services in CDM and LFG management related issues by the consultancy service company named UniCarbo Energia e Biogás Ltda. As confirmed by the EPIC verification team, the technical team from UniCarbo Energia e Biogás Ltda. has contributed for the development of related documentation (e.g. Monitoring Report /3/ and emission reduction calculation spreadsheets /5/) and also supported Araúna Participações e Investimentos Ltda. for addressing all raised outstanding issues (raised CAR).

As also assessed by the EPIC verification team, the project activity has been operated by sufficiently trained staff by correctly following guidance and instructions of internal documented working procedures and with high quality technical support from external CDM and LFG management consultants.

As confirmed by the EPIC 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 host-country project participant and project operator Araúna Participações e Investimentos Ltda. During the conducted on-site visit to the project site, the EPIC verification team was also able to verify that the operational structure of the project activity is also in line with the information made available in the PDD /2/ and in the Monitoring Report /3/. In summary, EPIC was also able to verify that detailed management and operational work procedures are in place and confirmed that an operational structure for the project activity is established with responsibilities clearly identified. Moreover, trained staff is employed to ensure data quality.

<u>*Data authenticity checking:*</u>
As part of the performed verification assessment, the EPIC verification team was able to confirm that the emission reduction calculation spreadsheet /5/ completed by Araúna Participações e Investimentos Ltda. is basically a MS-Excel spreadsheet that, in theory, could have recorded data being easily edited/modified (intentionally or unintentionally). Thus, this spreadsheet, 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 participant Araúna Participações e Investimentos 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 /6/ and measurement records reported in the emission reduction spreadsheet were not intentionally or unintentionally edited/modified during the generation or handling of these files).

The performed *data authenticity check* 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 and flaring related monitoring records for the whole month period encompassed by the considered monitoring period, the EPIC verification team has retrieved from the project's data supervisor system a set of comparative files in MS-Excel format (with primary data inputs from the project's data supervisor system). These comparative files were termed by the EPIC verification team as "*raw-data for checking*" files /22/.

STEP 2: Re-calculation of emission reductions:

	By using the set of 12 MS-Excel format "*raw-data for checking*" comparative files /22/ (that were generated under STEP 1) as input data, the procedure for emission reductions calculation for the whole monitoring period was reproduced by the EPIC verification team for all 12 months encompassed by the considered monitoring period. The content of the "*raw-data for checking*" comparative files /22/ was used as input data for the compilation of the comparative emission reduction calculation spreadsheet /21/ by applying a *blank* version of the emission reduction calculation spreadsheet /5/ that was made available by the project participant and was assessed by the EPIC verification team. Moreover, correct values for the applicable *ex-ante* determined parameters were also inserted in the *blank* version of the emission reduction calculation spreadsheet /5/ as input data. As a result of this step, a comparative emission reduction spreadsheet /21/ was thus created. *STEP 3 – Comparison of emission reduction calculation spreadsheet developed* by the project participant Araúna Participações e Investimentos Ltda. against *the created comparative emission reduction calculation spreadsheet and analysis of the results:* The calculated accumulated value of the parameter $F_{CH4,PJ,y}$ in the comparative emission reduction spreadsheet /21/ (file generated under STEP 2) was compared against the corresponding accumulated value for the parameter $F_{CH4,PJ,y}$ in the emission reduction calculation spreadsheet /5/ previously created by the project participants as part of the monitoring/reporting process. As a result of STEP 3, by comparing the file previously generated by the project participants against the file generated under STEP 2, the EPIC verification team was able to confirm that the generated comparative checking spreadsheet /21/ is identical to the emission reduction calculation spreadsheet /5/ previously created by the project participants. 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 supervisory system represent credible and authentic monitoring data, the performed *data authenticity check* thus successfully and sufficiently confirmed that only authentic and not-modified monitored measurement data (from the installed data supervisory system) were previously used by the project participants for the calculation of emission reductions as reported in the Monitoring Report /3/.
Findings	No findings (CARs, CLs or FARs) were raised regarding the compliance of monitoring activities valid for the considered monitoring period with monitoring requirements as per the monitoring plan from the PDD.
Conclusion	In summary, the EPIC verification team was able to confirm that monitoring plan has been implemented in accordance with the monitoring plan. The monitoring mechanism is effective and reliable. The EPIC verification team sufficiently confirmed that: - The monitoring plan and the applied methodology had been properly implemented and related monitoring activities have been correctly performed. - The responsibilities and authorities for monitoring and reporting were in accordance with the general responsibilities and authorities for the monitoring plan as outlined in the latest version of the Monitoring Report /3/. - QA/QC procedures are implemented for preventing or identifying and correct eventual errors or omissions in the reported monitoring parameters. - All parameters for which monitoring were required (by taking into account the monitoring approaches and calculation options selected for the considered monitoring period) were sufficiently and appropriately monitored during the considered monitoring period. For each monitored parameter, sufficient details about data generation, aggregation, recording and reporting are included in the latest version of the Monitoring Report /3/.

E.6.3. Implementation of sampling plan

Means of verification	Not applicable[6].
Findings	Not applicable.
Conclusion	Not applicable.

E.7. Compliance with the calibration frequency requirements for measuring instruments

Means of verification	The EPIC verification team has assessed whether all monitoring instruments/equipment installed at the project site have operated during the monitoring period from 01/04/2018 to 31/03/2019 under full compliance with calibration requirements as per both related provisions from the PDD /2/ and recommendations/guidance from the instrument/equipment manufacturers. The following tables include assessment details for calibration events performed on the monitoring instruments/equipment used for performance of measurements monitoring the ex-post determined parameters during the considered monitoring period: *Assessment of performed calibration event(s) for equipment/instrument(s) used for monitoring the parameter "Management of the SWDS":*

Data / Parameter: (as per the monitoring plan of the PDD):	Management of the SWDS (Management of SWDS)
Calibration frequency /interval for the monitoring equipment/instrument:	Not applicable. While monitoring of the parameter "Management of the SWDS" is not performed based on measurements, there are no monitoring equipment/instruments utilized. Thus, there are no compliance with applicable calibration frequency/intervals of monitoring equipment/instruments to be assessed.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Not applicable. While monitoring of the parameter Management of the SWDS is not performed based on measurements, there are no monitoring equipment/instruments utilized. Thus, there are no compliance with applicable calibration frequency/intervals of monitoring equipment/instruments to be assessed.
Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Not applicable. While monitoring of the parameter Management of the SWDS is not performed based on measurements, there are no monitoring equipment/instruments utilized. Thus, there are no compliance with applicable calibration frequency/intervals of monitoring equipment/instruments to be assessed.
Is(are) the performed calibration(s) valid for the	Not applicable. While monitoring of the parameter Management of the SWDS is not performed based

[6] As per the monitoring and GHG calculation approaches that are valid for the project activity (as established in the PDD and 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. Moreover, as further assessed in Section E.6.2, under *Data authenticity checking*, cross-checking/reproducing all reported LFG and flaring measurement records valid for the considered monitoring period against the related primary data sources were performed (with all reported related monitoring data being cross-checked/reproduced instead of having selected samples of data being cross-checked/reproduced).

whole reporting period?	on measurements, there are no monitoring equipment/instruments utilized. Thus, there are no compliance with applicable calibration frequency/intervals of monitoring equipment/instruments to be assessed.

Assessment of performed calibration event(s) for equipment/instrument(s) used for monitoring the parameter "Volumetric flow of LFG stream in time interval t on a wet basis" ($V_{t,wb}$):

Data / Parameter: (as per the monitoring plan of the PDD):	Volumetric flow of LFG stream in time interval *t* on a wet basis ($V_{t,wb}$) (monitored as per Option C of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) /14/).
Calibration frequency /interval for the monitoring equipment/instrument:	As per the implemented monitoring procedure at Araúna Participações e Investimentos Ltda. and recommendations from the equipment's manufacturer, the installed LFG flow meter is calibrated every 2 years by a third party independent accredited calibration laboratory. *Calibration details for the flow meter used for measuring the parameter $V_{t,wb}$:* For the LFG flow meter with S/N 1306018, a valid calibration event was performed on 26/04/2017 as indicated in the Certificate of Calibration No. FC-1479/15 /34/ issued by Field Serviços de Instrumentação Ltda. This Certificate of Calibration was made available and was assessed by the EPIC verification team. A sequential calibration event was performed on 26/04/2018 as indicated in the Certificate of Calibration No. FC-1479/18 /34/ issued by Field Serviços de Instrumentação Ltda. This Certificate of Calibration was made available and was assessed by the EPIC verification team
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	As per both the PDD /2/ and ACM0001 (version 18.0) /7/, the installed LFG flow meter is to be calibrated in a frequency as per the instrument's specifications and/or instrument manufacturer's recommendations. Thus, the applied calibration frequency (every 2 years, as per recommendations from the equipment's manufacturer) is under full conformance with both the monitoring plan of the PDD /2/ and ACM0001 (version 18.0) /7/.
Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Yes. The performed calibration events for the installed LFG flow meter confirms proper functioning of this monitoring instrument.
Is(are) the performed calibration(s) valid for the whole reporting period?	Yes. The performed calibration events for the installed LFG flow meter are valid for the whole considered monitoring period from 01/04/2018 to 31/03/2019. EPIC was able to confirm the validity of the performed calibration event for the installed LFG

	flow meter as follows: - Calibration event performed on 26/04/2017, valid until 25/04/2019 (2 years) - Calibration event performed on 26/04/2018, valid until 25/04/2020 (2 years)

Assessment of performed calibration event(s) for equipment/instrument(s) used for monitoring the parameter "Volumetric fraction CH_4 in the collected LFG in time interval t on a wet basis" ($v_{CH4,t,wb}$):

Data / Parameter: (as per the monitoring plan of the PDD):	Volumetric fraction of CH_4 in collected LFG in time interval *t* on a wet basis ($v_{CH4,t,wb}$)
Calibration frequency /interval for the monitoring equipment/instrument:	As per the implemented monitoring procedure at Araúna Participações e Investimentos Ltda., the installed CH_4 content gas analyzer unit is to be calibrated every year by a 3rd party entity. This is confirmed by the EPIC verification team to be in accordance with recommendations from the equipment's manufacturer. The performed calibration event which are valid for the monitoring period from 01/04/2018 to 31/03/2019 were correctly performed by comparison with canisters of calibrated span gases purchased from a certified gas supplier. An initial valid calibration event was performed on 23/07/2017, as indicated in the Calibration Certificate 129/2017 /52/ issued by Souza Engenharia). This Certificate of Calibration was made available and was assessed by the EPIC verification team. A sequential calibration event was performed on 20/07/2018, as indicated in the Calibration Certificate 129/2018 /52/ issued by Souza Engenharia). This Certificate of Calibration was made available and was assessed by the EPIC verification team
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	As per the PDD /2/, ACM0001 (version 18.0) /7/ and the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) /14/, the installed continuous CH_4 content gas analyzer unit is to be calibrated in a frequency to be established under conformance with instrument's specifications and/or instrument manufacturer's recommendations. Thus, the adopted calibration frequency (every year, as per recommendations from the equipment's manufacturer) is in line with the monitoring plan of the PDD /2/, ACM0001 (version 18.0) /7/ and the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) /14/. Based on its sectoral expertise and experience with other similar project-based initiative under the CDM promoting collection + destruction and/or utilization of LFG, it is EPIC opinion that the adopted calibration frequency represents good practice.

Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Yes. The performed calibration event for the CH_4 content gas analyzer unit confirmed proper functioning of this equipment.
Is(are) the performed calibration(s) valid for the whole reporting period?	Yes. The performed calibration events for the installed CH_4 content gas analyser are valid for the whole considered monitoring period from 01/04/2018 to 31/03/2019. EPIC was able to confirm the validity of the performed calibration event for the installed CH_4 content gas analyzer unit as follows: - Calibration event performed on 23/07/2017, valid until 22/07/2018 (1 year) - Calibration event performed on 20/07/2018, valid until 19/07/2019 (1 year)

Assessment of performed calibration event(s) for equipment/instrument(s) used for monitoring the parameter "Temperature of the LFG stream in time interval t" (T_t):

Data / Parameter: (as per the monitoring plan of the PDD):	Temperature of the LFG stream in time interval *t* (T_t)
Calibration frequency /interval for the monitoring equipment/instrument:	As per the implemented monitoring procedure at Araúna Participações e Investimentos Ltda. and recommendations from the equipment's manufacturer, the installed LFG temperature sensor is to be calibrated every year. As confirmed by the EPIC verification team through assessment of the specification sheet for the installed LFG temperature sensor, the selected calibration frequency is as per the recommendations of the instrument manufacturer. A valid calibration event was performed on 04/05/2017 as indicated in the Certificate No. FC-1484-17 /41/, issued by Field Serviços de Instrumentação Ltda. The Calibration Certificate was made available and assessed by the EPIC verification team. A sequential calibration event was performed on 02/04/2018 as indicated in the Certificate No. FC-1484-17 /41/, issued by Field Serviços de Instrumentação Ltda. The Calibration Certificate was made available and assessed by the EPIC verification team.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	As per both the PDD /2/ and ACM0001 (version 18.0) /7/, the installed LFG temperature sensor is to be calibrated in a frequency as per the instrument's specifications and/or instrument manufacturer's recommendations. Thus, the adopted calibration frequency (every year, as per recommendations from the equipment's manufacturer) is in line with the both the monitoring plan of the PDD /2/ and ACM0001 (version 18.0) /7/.
Did the performed calibration(s) confirm proper functioning of monitoring	Yes. The performed calibration event for the LFG temperature sensor confirms proper functioning of the measurement instrument.

equipment/instrument? (Yes / No):	
Is(are) the performed calibration(s) valid for the whole reporting period?	Yes. The performed calibration events for the installed temperature sensor are valid for the whole considered monitoring period from 01/04/2018 to 31/03/2019. EPIC was able to confirm the validity of the performed calibration event for the installed LFG temperature sensor as follows: - Calibration event performed on 04/05/2017 - valid until 03/05/2018 (1 year) - Calibration event performed on 02/04/2018 – valid until 01/04/2019 (1 year)

Assessment of performed calibration event(s) for equipment/instrument(s) used for monitoring the parameter "Pressure of the LFG stream in time interval t" (P_t):

Data / Parameter: (as per the monitoring plan of the PDD):	Pressure of the gaseous stream in time interval *t* (P_t)
Calibration frequency /interval for the monitoring equipment/instrument:	As per the implemented monitoring procedure at Araúna Participações e Investimentos Ltda. and recommendations from the equipment's manufacturer, the installed LFG pressure sensor is to be calibrated every year. As confirmed by the EPIC verification team through assessment of the specification sheet for the installed LFG pressure sensor, the selected calibration frequency is as per the recommendations of the instrument manufacturer. A valid calibration event was performed on 03/04/2017 as indicated in the Certificate No. FC-1481-17 /39/, issued by Field Serviços de Instrumentação Ltda. The Calibration Certificate was made available and assessed by the EPIC verification team. A sequential calibration event was performed on 02/04/2018 as indicated in the Certificate No. FC-1483/2018 /39/, issued by Field Serviços de Instrumentação Ltda. The Calibration Certificate was made available and assessed by the EPIC verification team.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	As per both the PDD /2/ and ACM0001 (version 18.0) /7/, the installed LFG pressure sensor is to be calibrated in a frequency as per the instrument's specifications and/or instrument manufacturer's recommendations. Thus, the adopted calibration frequency (every year, as per recommendations from the equipment's manufacturer) is in line with the both the monitoring plan of the PDD /2/ and ACM0001 (version 18.0) /7/.
Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Yes. The performed calibration event for the LFG pressure sensor confirms proper functioning of the measurement instrument.

Is(are) the performed calibration(s) valid for the whole reporting period?	Yes. The performed calibration events for the installed temperature sensor are valid for the whole considered monitoring period from 01/04/2018 to 31/03/2019. EPIC was able to confirm the validity of the performed calibration event for the installed LFG pressure sensor as follows: - Calibration event performed on 03/04/2017, valid until 02/04/2018 (1 year) - Calibration event performed on 02/04/2018, valid until 01/04/2019 (1 year)

Assessment of performed calibration event(s) for equipment/instrument(s) used for monitoring the parameter "Amount of grid electricity consumed by the project activity during the year y" ($EC_{PJ,grid,y}$):

Data / Parameter: (as per the monitoring plan of the PDD):	Amount of grid electricity consumed by the project activity during the year *y* ($EC_{PJ,grid,y}$)
Calibration frequency /interval for the monitoring equipment/instrument:	As per the implemented monitoring procedure at Araúna Participações e Investimentos Ltda. and recommendations from the equipment's manufacturer, the installed electricity meter is to be calibrated every 5 years. As confirmed by the EPIC verification team through assessment of the specification sheet for the installed electricity meter /38/, the selected calibration frequency is as per the recommendations of the instrument manufacturer. A valid calibration event was performed on 21/10/2014 (Calibration Certificate 1321986/14 /36/, issued by CEIME Calibração e Comércio de Instrumentos Ltda.). The Calibration Certificate was made available and assessed by the EPIC verification team.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Both the monitoring plan of the PDD /2/ and ACM0001 (version 18.0) /7/ do not specify any calibration frequency requirements for the electricity meters. The PDD /2/ states the following: *"(...) Periodic calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations.* *Instruments will be subject to a regular maintenance and testing regime in accordance to appropriate national/international standards/requirements and/or best practice."* As per the tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" /13/, the following requirement is established regarding maintenance and calibration for electricity meter:

	"(...) meters should be installed, maintained and calibrated according to equipment manufacturer instructions and be in line with national standards, or, if these are not available, international standards (e.g. IEC, ISO)". It is important to note that the installed electricity meter is approved/certified by the Brazilian national authority for metrology and standardization affairs (INMETRO). The meter is thus in conformance with INMETRO's requirements for maintenance and testing of electricity meter. Furthermore, the adopted calibration frequency is confirmed to be in accordance with related requirements/recommendations as established by the meter manufacturers. As confirmed by the EPIC verification team, in accordance with the instrument manufacturers a calibration frequency of 5 years is applied for the installed electricity meter.
Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Yes. The performed calibration events confirm proper functioning of the electricity meter (at the time the calibration event was performed).
Is(are) the performed calibration(s) valid for the whole reporting period?	Yes. The performed calibration events are valid for the whole considered monitoring period. EPIC was able to confirm the validity of the performed calibration event for the installed electricity meter as follows: - Calibration event performed on 21/10/2014, valid until 20/10/2019 (5 years)

Assessment of performed calibration event(s) for equipment/instrument(s) used for monitoring the parameter "Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period t" ($F_{CH4,EG,t}$):

Data / Parameter: (as per the monitoring plan of the PDD):	Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period *t* ($F_{CH4,EG,t}$)
Calibration frequency /interval for the monitoring equipment/instrument:	The technical test/evaluation reports [42] [43] issued by the third party independent inspection service company IST - Tecnologia Internacional em Sensores Ltda. highlight that the utilized chromatographers and Pitot tubes were in full conformance with calibration requirements applicable for these instruments/equipment.
Is the calibration interval in line with the monitoring plan of the PDD? If the	The PDD [2] and ACM0001 (version 18.0) [1] do not specify any equipment or procedural requirement for performing the related measurements and

PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	calculations for the determination of values for $F_{CH4,EG,t}$. The methodological tool "Project emissions from flaring" (version 02.0.0) /12/ establishes that *"(…) under Option B.1 the measurement is conducted by an accredited entity on a biannual basis".* Thus, no calibration frequency requirement for related instruments/equipment is specified by such methodological tool either. It was not made available to the EPIC verification team any evidence/proof (e.g. Certificates of Calibration, description of applied calibration procedures, etc.) outlining the adopted calibration intervals for the equipment/instruments utilized by the inspection service company IST - Tecnologia Internacional em Sensores Ltda. The technical valid test/evaluation reports /42/ /43/ issued by the third party independent inspection service company IST - Tecnologia Internacional em Sensores Ltda. highlight that the utilized chromatographer and Pitot tube were in conformance with calibration requirements applicable for these instruments.
Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	No information, evidences/proof for performed calibration events in equipment/instruments utilized by the inspection service company IST - Tecnologia Internacional em Sensores Ltda. were made available to the EPIC verification team.
Is(are) the performed calibration(s) valid for the whole reporting period?	No information, evidences/proof for performed calibration events in equipment/instruments utilized by the inspection service company IST - Tecnologia Internacional em Sensores Ltda. were made available to the EPIC verification team.

Assessment of performed calibration event(s) for equipment/instrument(s) used for monitoring the parameter "Saturation pressure of H_2O at temperature T_t in time interval t" ($p_{H2O,t,sat}$):

Data / Parameter: (as per the monitoring plan of the PDD):	Saturation pressure of H_2O at temperature T_t in time interval *t* ($p_{H2O,t,sat}$)
Calibration frequency /interval for the monitoring equipment/instrument:	Not applicable. The determination of applicable value for the monitoring parameter $p_{H2O,t,sat}$ is not based on measurements.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Not applicable. The determination of applicable value for the monitoring parameter $p_{H2O,t,sat}$ is not based on measurements.
Did the performed calibration(s) confirm proper functioning of	Not applicable. The determination of applicable value for the monitoring parameter $p_{H2O,t,sat}$ is not based on measurements.

monitoring equipment/instrument? (Yes / No):	
Is(are) the performed calibration(s) valid for the whole reporting period?	Not applicable. The determination of applicable value for the monitoring parameter $p_{H2O,t,sat}$ is not based on measurements.

Assessment of performed calibration event(s) for equipment/instrument(s) used for monitoring the parameter "Temperature in the exhaust gas of the enclosed flare in minute m" ($T_{EG,m}$):

Data / Parameter: (as per the monitoring plan of the PDD):	Temperature in the exhaust gas of the enclosed flare in minute *m* ($T_{EG,m}$)
Calibration frequency /interval for the monitoring equipment/instrument:	As per the implemented monitoring procedure at Araúna Participações e Investimentos Ltda. and recommendations from the equipment's manufacturer, the installed thermocouple is to be calibrated every year. As confirmed by the EPIC verification team through assessment of the specification sheet for the installed thermocouple **Error! Reference source not found.**, the selected calibration frequency is as per the recommendations of the instrument manufacturer. A valid calibration event was performed on 03/04/2017 as indicated in the Certificate of Calibration No. 128/2017 /46/ issued by Souza Engenharia. The Calibration Certificate /46/ was made available and assessed by the EPIC verification team. A sequential calibration event was performed on 03/05/2018 as indicated in the Certificate of Calibration No. 1484-18 /46/ issued by Field Serviços de Instrumentação Ltda. The Calibration Certificate /46/ was made available and assessed by the EPIC verification team
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	As per both the PDD /2/ and the methodological tool "Project emissions from flaring" (version 02.0.0) /12/, the installed thermocouple is to be replaced or calibrated in a frequency as per the instrument's specifications and/or instrument manufacturer's recommendations. Thus, the adopted calibration frequency (every year, as per recommendations from the equipment's manufacturer) is in line with the both the monitoring plan of the PDD /2/ and ACM0001 (version 18.0) /7/.
Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Yes. The performed calibration event for the installed thermocouple confirms proper functioning of this measurement instruments.
Is(are) the performed calibration(s) valid for the whole reporting period?	Not completely. As outlined in the Monitoring Report /3/, a relative delay on performing the calibration events for the installed thermocouple occurred. While the initial calibration event performed on 03/04/2017 was only valid until 02/04/2018 and the sequential calibration event was only performed on 03/05/2018, there is no

	valid calibration event for the period from 03/04/2018 to 03/05/2018. Thus, a conservative deduction factor of ±0.15% was systematically applied in all related every-minute measurement records for the monitoring parameter $T_{EG,m}$ valid for the period from 03/04/2018 to 02/05/2018 as part of the calculation of baseline emissions for the considered monitoring period. This value represents the assumed maximum permissible error of the measurement instrument. EPIC was able to confirm the validity of the performed calibration events for the installed thermocouple as follows: - Calibration event performed on 03/04/2017, valid until 02/04/2018 (1 year) - Calibration event performed on 03/05/2018, valid until 02/05/2019 (1 year)

Assessment of performed calibration event(s) for equipment/instrument(s) used for monitoring the parameter "Flame detection of flare in the minute m" ($Flame_m$):

Data / Parameter: (as per the monitoring plan of the PDD):	Flame detection of flare in the minute *m* ($Flame_m$)
Calibration frequency /interval for the monitoring equipment/instrument:	Not applicable. As confirmed by the EPIC verification team through assessment of the specification sheet for the UV Flame detector installed at the project site [33], the installed UV Flame detectors have a self-checking function and thus do not require any calibration.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Not applicable.
Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Not applicable.
Is(are) the performed calibration(s) valid for the whole reporting period?	Not applicable.

Assessment of performed calibration event(s) for equipment/instrument(s) used for monitoring the parameter "Maintenance events completed in year y" ($Maintenance_y$):

Data / Parameter: (as per the monitoring plan of the PDD):	Maintenance events completed in year *y* ($Maintenance_y$)

Calibration frequency /interval for the monitoring equipment/instrument:	Not applicable. There are no measurements involved in the monitoring of the parameter $Maintenance_{y.}$
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Not applicable. There are no measurements involved in the monitoring of the parameter $Maintenance_{y.}$
Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Not applicable. There are no measurements involved in the monitoring of the parameter $Maintenance_{y.}$
Is(are) the performed calibration(s) valid for the whole reporting period?	Not applicable. There are no measurements involved in the monitoring of the parameter $Maintenance_{y.}$

Assessment of performed calibration event(s) for equipment/instrument(s) used for monitoring the parameter "Operational status of biogas destruction devices" (Status of biogas destruction device):

Data / Parameter: (as per the monitoring plan of the PDD):	Operational status of biogas destruction devices (Status of biogas destruction device)
Calibration frequency /interval for the monitoring equipment/instrument:	Not applicable. There are no measurements involved in the monitoring of the parameter Status of biogas destruction device.
Is the calibration interval in line with the monitoring plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	Not applicable. There are no measurements involved in the monitoring of the parameter Status of biogas destruction device.
Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Not applicable. There are no measurements involved in the monitoring of the parameter Status of biogas destruction device.
Is(are) the performed calibration(s) valid for the whole reporting period?	Not applicable. There are no measurements involved in the monitoring of the parameter Status of biogas destruction device.

It is important to note that, as further assessed in Section E.6.2., the monitoring plan of the PDD [2] also includes the following monitoring parameters of which monitoring was not required during the considered monitoring period (since the methodological calculation and/or monitoring options for which they are applicable were not selected):

	Parameter not monitored during the considered monitoring period Volumetric flow of LFG stream in time interval *t* on a dry basis ($V_{t,db}$) Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a dry basis ($v_{CH4,t,db}$) Mass flow of the LFG stream in time interval t on dry basis for ($M_{t,db}$) No assessment details are thus included for the parameters listed above.
Findings	A CAR was raised regarding the compliance of monitoring activities valid for the considered monitoring period with calibration requirements as per the monitoring plan from the PDD: **CAR 1:** While a relative delay in the performance of calibration events for the installed thermocouple used for measuring temperature in the exhaust gas of the high temperature flare has occurred, details about the conservative deduction factors applied in baseline emissions calculations for addressing such delay are not included in the initial version of the Monitoring Report.
Conclusion	As a conclusion, upon closure of the raised CAR, the EPIC verification team was able to confirm that the calibration events performed for the monitoring instruments of the project activity were conducted in accordance with the monitoring plan from the registered PDD /2/, ACM0001 (version 18.0) /7/) and applicable tools during the considered monitoring period. Documented evidences for performed calibration events allowed the EPIC verification team to confirm that applied monitoring instruments/equipped operated under appropriate manner during the considered monitoring period. Moreover, the EPIC verification team was able to confirm that conservative deductions were systematically applied in emission reduction calculations for addressing the acknowledged delays in the performance of calibration events for the installed LFG thermocouple by the project participants.

E.8. Assessment of data and calculation of emission reductions or net removals

E.8.1. Calculation of baseline GHG emissions or baseline net GHG removals by sinks

Means of verification	The EPIC verification team assessed whether the methods and formulae used to determine baseline emissions for the considered monitoring period are appropriate. The performed assessment encompassed checking whether applied methods and formulae as described in the registered monitoring plan and applicable methodology + methodological tools were correctly applied, including confirmation whether the Monitoring Report includes all parameters and monitored data at the intervals required by the applied methodology + methodological tools as per the PDD /2/). The correct application of emission factor and default values (ex-ante determined/fixed parameters as per the registered PDD) /2/ was also verified. The EPIC verification team was able to verity that, as correctly indicated in the Monitoring Report /3/ and also as established by ACM0001 (version 18.0) /7/, applied methodological tools and the PDD /2/, baseline emissions (BE_y) for the considered monitoring period are calculated as follows: $BE_y = BE_{CH4,y}$ Where: $BE_{CH4,y}$ Baseline emissions of methane from the SWDS. $BE_{CH4,y}$ is determined as follows: $BE_{CH4,y} = ((1 - OX_{top\_layer}) * F_{CH4,PJ,y} - F_{CH4,BL,y}) * GWP_{CH4}$ 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 indicated in the PDD /2/, OX_{top_layer} is *ex-ante* determined as 10%.

$GWP_{CH4,y}$ Global warming potential of CH_4. As indicated in the registered PDD /2/, $GWP_{CH4,y}$ is *ex-ante* determined as 25.

$F_{CH4,BL,y}$ Amount of methane in the LFG that would be flared in the baseline in year *y*. $F_{CH4,BL,y}$ is calculated as follows:

$$F_{CH4,BL,y} = F_{CH4,hist,y} = F_{CH4,BL,x-1} / F_{CH4,x-1} * F_{CH4,PJ,y}$$

Where:

$F_{CH4,hist,y}$ Historical amount of methane in the LFG which is captured and destroyed (in t CH_4/yr).

$F_{CH4,BL,x-1}$ Historical amount of methane in the LFG which is captured and destroyed in the year prior to the implementation of the project activity. $F_{CH4,BL,x-1}$ is ex-ante determined as 71.20 t CH_4/yr.

$F_{CH,x-1}$ Amount of methane in the LFG generated in the SWDS in the year prior to the implementation of the project activity. $F_{CH4,BL,x-1}$ is ex-ante determined as 2,430.66 t CH_4/yr (year 2007).

$F_{CH4,PJ,y}$ Amount of methane in the LFG which is flared and/or used in the project activity. Details about the determination of $F_{CH4,PJ,y}$ are included below.

As confirmed by the EPIC verification team, the calculated accumulated value for $F_{CH4,BL,y}$ for the considered monitoring period is correctly determined as 43 tCH_4.

$F_{CH4,PJ,y}$ 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 /3/ and in accordance with the PDD /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 flared by the project activity in year *y*. In accordance with requirements from the PDD /2/ and by correctly following the applicable guidance of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /14/, every-minute values of $F_{CH4,flared,y}$ are determined for the flare within the considered monitoring period 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. Details for

the determination of every-minute values for $F_{CH4,sent\_flare,y}$ for the flare are presented below (under "*Assessment details of the determination of every-minute values for the calculation parameter $F_{CH4,sent\_flare,y}$*").

$PE_{flare,y}$ Project emissions from flaring of the residual gas stream in year *y*. Details for the determination of every-minute values for $PE_{flare,y}$ for the flare are presented below (under "*Assessment details for determination of every-minute values for $PE_{flare,y}$*").

Assessment details for the determination of every-minute values for the calculation parameter $F_{CH4,sent\_flare,y}$:

In accordance with ACM0001 version 18.0) [7], the amount of methane in the LFG which is sent to the flare in year *y* ($F_{CH4,sent,flare,y}$) is determined by following the applicable guidance of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" [14]. For the considered monitoring period, Option 2 / C (Simplified calculation without measurement of the moisture content / volume flow of LFG and volumetric fraction of CH_4 in collected LFG being measured in wet basis) of this methodological tool is selected. As per Option C of this methodological tool, the amount of methane in the LFG which is sent to the flare is determined as follows:

$F_{CH4,sent\_flare,y} = F_{CH4,t} = V_{t,wb,n} * v_{CH4,t,wb} * \rho_{CH4,n}$

Where:

$V_{t,wb,n}$ Volumetric flow of the gaseous stream (LFG) to the flare in time interval *t* on a wet basis at normal conditions. As confirmed by the EPIC verification team, while the monitoring parameter $V_{t,wb}$ is already measured in normal conditions, there are no need to calculate every-minute values of the calculation parameter $V_{t,wb,n}$ by using LFG pressure and LFG temperature data. As correctly outlined in the Monitoring Report [3], while the installed LFG flow meter already measures volumetric flow of LFG in Nm³ wet gas/h (normal conditions), the following assumption is valid:

$V_{t,wb,n}$ is equivalent to $V_{t,wb}$

Where:

$V_{t,wb}$ Volumetric flow of the gaseous stream (LFG) sent to the flare in time interval *t* on a wet basis (in actual conditions).

$v_{CH4,t,wb}$ Volumetric fraction of CH_4 in the gaseous stream in time interval *t* on a wet basis.

$\rho_{CH4,n}$ Density of CH_4 in the gaseous stream (LFG) at normal conditions. As per the selected determination procedure of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" [14], $\rho_{CH4,n}$ is calculated as follows:

$\rho_{CH4,n} = (P_n * MM_i) / (R_u * T_n)$

Where:

P_n Absolute pressure at normal conditions. *Ex-ante* determined as 101,325 Pa.

T_n Temperature at normal conditions. *Ex-ante* determined as 273.15 Kelvin.

MM_i Molecular mass of greenhouse gas *i* (*i* = CH_4). *Ex-ante* determined as 16.04 kg/mol.

R_u Universal ideal gases constant. *Ex-ante* determined as 8,314 $Pa.m^3$ /kmol.K.

The EPIC verification team was able to verify that the value of the parameter $\rho_{CH4,n}$ was correctly calculated and reported as 0.7156650 $kgCH_4/m^3CH_4$.

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

In accordance with applicable guidance from both the methodological tool "Project emissions from flaring" /12/ and from the PDD /2/, every-minute values of $PE_{flare,y}$ for the installed flare are determined as a function of every-minute records of mass flow of methane sent to the flare as well as based on *ex-post* calculated values for flare efficiency for the flare ($\eta_{flare,m} = \eta_{flare,calc,m}$). Values of $PE_{flare,y}$ are correctly calculated for the considered monitoring period as follows:

$$PE_{flare,y} = GWP_{CH4} * \sum_{m=1}^{525,600} F_{CH4,RG,m} * \left(1 - \eta_{flare,m}\right) * 10^{-3}$$

Where:

$F_{CH4,RG,m}$ Mass flow of methane in the residual gas in the minute *m*. 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 the monitoring parameter "Amount of methane in the LFG which is sent to the flare" ($F_{CH4,sent\_flare,y}$).

$\eta_{flare,m}$ Flare efficiency in minute *m*. For the considered monitoring period, as confirmed by the EPIC verification team, $\eta_{flare,m}$ is determined based on performed measurements by following applicable guidance of Option B B.1 of the methodological tool Project emissions from flaring" /12/. As required by this determination option, related measurements to determine the efficiency of the flare (measurement for monitoring parameter $F_{CH4,EG,t}$) were performed by an 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 two performed measurements within the year encompassed by the considered monitoring period as follows:

$$\eta_{flare,calc,y} = 1 - \frac{1}{2}\sum_{t=1}^{2}\left(\frac{F_{CH4,EG,t}}{F_{CH4,RG,t}}\right)$$

Where:

$F_{CH4,EG,t}$ 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 $F_{CH4,EG,t}$, 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 flare were performed by the third party inspection service company IST - Tecnologia Internacional em Sensores 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 $F_{CH4,EG,t}$ are included in Section E.6.2.

t The two time periods in year *y* during which the flare efficiency is measured. 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 E.6.2.

$F_{CH4,RG,t}$ 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 $F_{CH4,RG,t}$:
As per the applicable guidance of the methodological tool "Project emissions from flaring" /12/ and also as per the PDD /2/, values of $F_{CH4,RG,t}$ shall be calculated by following the applicable guidance of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /14/. Values for the parameter $F_{CH4,RG,t}$ valid for the flare are thus calculated as follows:

$$F_{CH4,RG,t} = V_{t,db,n} * v_{CH4,t,db} * \rho_{CH4,n}$$

Where:

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

$v_{CH4,t,db}$ Volumetric fraction of greenhouse gas *i* (*i* = CH_4) in the gaseous stream in a time interval *t* on a dry basis. As confirmed by the EPIC verification team, Footnote 3 of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /14/: 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 analyzers and dry basis analyzers and both types can be used indistinctly for calculation Options A and D*."

Thus, every-minute values of $v_{CH4,t,db}$ are regarded as equal to every-minute values of the monitoring parameter $v_{CH4,t,wb}$ (for which further details are presented above under the sub-section "*Determination of every-minute values for the calculation parameter $F_{CH4,sent\_flare,y}$*").

$V_{t,db,n}$ Volumetric flow of the gaseous stream (LFG) in time interval *t* on a dry basis which is sent to the flare. As per Option B of the applicable methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /14/, the volumetric flow of the gaseous stream on a dry basis for the flare is determined by converting the measured volumetric flow from wet basis to dry basis as follows:

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

Where:

$V_{t,wb,n}$ Volumetric flow of the gaseous stream (LFG) in time interval *t* on a wet basis at normal conditions. Further details of $V_{t,wb,n}$ 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" /14/, $v_{H2O,t,db}$ 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" /14/, $MM_{t,db}$ 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 EPIC verification team, applicable guidance of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /14/ 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 EPIC

verification team, ACM0001 (version 18.0) [7] 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 CH_4 in the gaseous stream ($V_{k,t,db}$ = $v_{CH4,t,db}$) are presented above under the calculation parameter $v_{CH4,t,db}$.

MM_k Molecular mass of gas *k* (*k* = CH_4 and N_2). As indicated in the PDD [2], the molecular mass of CH_4 and N_2 are ex-ante determined as 16.04 and 28.01 respectively.

$m_{H2O,t,db}$ Absolute humidity in the gaseous stream in time interval *t* n a dry basis. As per Option 2 of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" [14], by conservatively assuming that the gaseous stream is saturated ($m_{H2O,t,db}$ = $m_{H2O,t,db,Sat}$), $m_{H2O,t,db}$ is calculated as follows [7]:

$$m_{H2O,t,db,Sat} = \frac{p_{H2O,t,Sat} * MM_{H2O}}{(P_t - p_{H2O,t,Sat}) * MM_{t,db}}$$

Where:

MM_{H2O} Molecular mass of H_2O. As indicated in the PDD [2], MM_{H2O} is *ex-ante* determined as 18.0152.

P_t Absolute pressure of the gaseous stream in time interval *t*. Further assessment

[7] It is important to note that the simplified calculation for the absolute humidity of the gaseous stream ($m_{H2O,t,db}$) 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 EPIC verification team, Footnote 4 of the "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 I 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, $m_{H2O,t,db}$ is calculated for the determination of the mass flow of methane in the residual gas on a dry basis during the time period *t* ($F_{CH4,RG,t}$). While $F_{CH4,RG,t}$ 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 flare, thus resulting in a reduction of $PE_{flare,y}$ and consequent increment of emission reductions.

details for the monitoring parameter P_t are included in Section E.6.2.

$MM_{t,db}$ 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.

$p_{H2O,t,Sat}$ Saturation pressure of H_2O at temperature T in time *t*, Further assessment details for the monitoring parameter $p_{H2O,t,Sat}$ are included in Section E.6.2.

As correctly outlined in the latest version of the Monitoring Report /3/, the calculated value for $\eta_{flare,calc,y}$ for the installed high temperature enclosed flare and valid for the considered monitoring is 0.8999220.

The EPIC verification team has confirmed that the calculated value of $\eta_{flare,calc,y}$ correctly incorporates a deduction factor of 0.1 by taking into account the dimensions of the flare (ratio between height and diameter) as established by the methodological tool "Project emissions from flaring" /12/

Assessment details for (i) compliance with operational and maintenance requirements for the flare (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 EPIC verification team by assessing the emission reduction calculation spreadsheet /5/, in accordance with the applied monitoring procedure for the project activity, compliance with operational and maintenance requirements for the flare, 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 the value of $\eta_{flare,m}$ for calculating every-minute values of $F_{CH4,PJ,y} = F_{CH4,flared,y}$ along the considered monitoring period[8]. As also confirmed by the EPIC verification team through assessment of the main emission reduction calculation spreadsheet /5/, data records for the monitoring parameter "Flame detection of flare in the minute *m*" ($Flame_m$) are also considered for the determination and application of the value 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 emission reduction calculation spreadsheet /5/. As also assessed by the EPIC 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 flare + temperature of exhaust gas of the flare + meeting of maintenance requirements)) are also correctly considered in the context of the determination and application of the value for $\eta_{flare,m}$ for calculating every-minute values of $F_{CH4,PJ,y} = F_{CH4,flared,y}$ along the considered monitoring

[8] While all performed maintenance events in the installed flare (including regular inspections of the flare) 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 $Maintenance_y$.

	period. As also confirmed through assessment of the emission reduction calculation spreadsheet [5], 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 accounted for the flare as part of the calculation of every-minute values for $F_{CH4,PJ,y} = F_{CH4,flared,y.}$ This is under full compliance with related requirements from the PDD [2]. The calculated accumulated value for $F_{CH4,PJ,y} = F_{CH4,flared,y}$ for the considered monitoring period is correctly determined as 1,450 tCH_4. The calculated value for BE_y for the monitoring period from 01/04/2018 to 31/03/2019 is correctly determined as 31,550 tCO_2e.
Findings	No findings (CARs, CLs or FARs) were raised regarding the calculation of baseline GHG emissions.
Conclusion	The EPIC verification team was able to confirm that all related calculations for the determination of baseline emissions are provided in the emission reduction calculation spreadsheet file [5] as well as the FE calculation spreadsheet [5] and the summarized emission reduction calculation spreadsheet [5] in a deemed correct and transparent manner. All performed calculations for baseline emissions, as reported in the latest version of the Monitoring Report [3] and emission reduction calculation spreadsheet [5], were verified to be performed under full conformance with applicable requirements of the PDD [2], ACM0001 (version 18.0) [7] and applicable methodological tools [12] [13] [14] [15]. Applied methods and formulae, as described in the monitoring plan from the PDD [2] and applicable methodology + methodological tools, were correctly applied. It is important to note that, as result of performed corrections in the emission reduction calculation spreadsheet in order to address the raised CAR, the accumulated value for the calculation parameter $F_{CH4,BL,y}$ for the whole monitoring period was reduced. As a consequence, there was an increase in reported emission reductions in the revised version of the Monitoring Report (version 3.0, dated 31/01/2020) when compared with reported emission reductions in the initial published version (version 1, dated 11/06/2019). The calculated value for BE_y for the monitoring period from 01/04/2018 to 31/03/2019 is correctly determined as 31,550 tCO_2e.

E.8.2. Calculation of project GHG emissions or actual net anthropogenic GHG removals by sinks

Means of verification	The EPIC verification team assessed whether the methods and formulae used to determine project emissions for the considered monitoring period are appropriate. The performed assessment encompassed checking whether applied methods and formulae as described in the registered monitoring plan and applicable methodology + methodological tools were correctly applied, including confirmation whether the Monitoring Report includes all parameters and monitored data at the intervals required by the applied methodology + methodological tools as per the PDD [2]. The correct application of emission factor and default values (ex-ante determined/fixed parameters as per the PDD [2]) was also verified. Through assessment of the Monitoring Report, the EPIC verification team was able to verity that as correctly indicated in the Monitoring Report [3], project emissions for the whole monitoring period due to the operation of the project activity are determined as follows: $PE_y = PE_{EC,grid,y}$

Where:

$PE_{EC,grid,y}$ Project emissions due to the consumption of grid-sourced electricity by the project activity. As correctly outlined in the latest version of the Monitoring Report /3/, for the whole considered monitoring period, emissions due to the consumption of grid-sourced electricity by the project activity ($PE_{EC,grid,y}$) are correctly determined by following applicable guidance of the methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" /13/ as follows:

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

Where:

$EC_{PJ,grid,y}$ Quantity of grid-sourced electricity consumed by the project activity in year *y*. For the considered monitoring period, $EC_{PJgrid,y}$ is monitored as 18.258 MWh. The following monthly values for consumption of grid-sourced electricity ($EC_{PJ,grid,y}$) within the considered monitoring period are correctly reported in the Monitoring Report /3/:

- April 2018: 1.658 MWh
- May 2018: 1.658 MWh
- June 2018: 1.475 MWh
- July/2018: 1.188 MWh
- August/2018: 1.569 MWh
- September/2018: 1.568 MWh
- October/2018: 1.455 MWh
- November/2018: 1.478 MWh
- December/2018: 1.598 MWh
- January/2019: 1.541 MWh
- February/2019: 1.587 MWh
- March/2019: 1.483 MWh

Assessment details for the monitoring parameter $EC_{PJgrid,y}$ valid for the considered monitoring period are included in Section E.6.2.

$TDL_{grid,y}$ Average technical transmission and distribution losses for grid-sourced electricity consumed by the project activity in year *y*. As indicated in the PDD /2/, $TDL_{grid,y}$ is *ex-ante* determined as 20%.

$EF_{EL,grid,y}$ Emission factor for grid sourced electricity in year *y*. $EF_{EL,grid,y}$ is determined as the Combined margin CO_2 emission factor ($EF_{grid<CM,y}$) that is calculated as the weighted average of the previously determined and validated values for the *ex-ante* determined parameters "Operating margin CO_2 emission factor in year *y*" ($EF_{grid,OM,y}$) and "Build margin CO_2 emission factor in year *y*" ($EF_{grid,BM,y}$). In order to appropriately weight these two factors, the also previously determined and validated default values for the *ex-ante* determined parameters "Weighting of operating margin emission factor" (w_{OM}) and "Weighting of build margin emission factor" (w_{BM}) are applied. For the considered monitoring period, $EF_{grid,CM,y}$ is thus determined as follows:

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

Where:

w_{OM} Weighting of operating margin emissions factor. As established in the PDD /2/, w_{OM} is ex-an*te* determined as 0.25%.

	w_{BM} Weighting of build margin emissions factor. As established in the PDD [2], w_{BM} is *ex-ante* determined as 0.75%. $EF_{grid,OM,y}$ Operating margin CO_2 emission factor in year *y*. As indicated in the PDD [2], for the 2nd 7-year crediting period of the project activity, $EF_{grid,OM}$ is *ex-ante* determined as 0.4979 tCO_2/MWh. $EF_{grid,BM,y}$ Build margin CO_2 emission factor in year *y*. As indicated in the PDD [2], for the 2nd 7-year crediting period of the project activity, $EF_{grid,BM}$ is *ex-ante* determined as 0.1581 tCO_2/MWh. Based on the above-summarized ex-ante determined parameters, $EF_{EL,grid,y}$ is correctly calculated as 0.2431 tCO_2/MWh. The calculated value for $PE_{EC,grid,y}$ for the considered monitoring period from 01/04/2018 to 31/03/2019 is correctly determined as 6 tCO_2 (rounded value). Total project emissions ($PE_y = PE_{EC,grid,y}$) are correctly calculated and reported as 6 tCO_2 (rounded value) and are correctly considered in the context of the emission reduction calculations.
Findings	No findings (CARs, CLs or FARs) were raised regarding the calculation of project GHG emissions.
Conclusion	The EPIC verification team was able to confirm that all related calculations for the determination of project emissions are provided in the summarized emission reduction calculation spreadsheet [5] in a deemed correct and transparent manner. All performed calculations for project emissions, as reported in the latest version of the Monitoring Report [3] and summarized emission reduction calculation spreadsheet [5], were verified to be performed under full conformance with applicable requirements of the PDD [2], ACM0001 (version 18.0) [7] and applicable methodological tools [13] [14] [17]. Applied methods and formulae, as described in the monitoring plan from the PDD [2] and applicable methodology + methodological tools, were correctly applied. The calculated value for PE_y for the monitoring period from 01/04/2018 to 31/03/2019 is correctly determined as 6 tCO_2 (rounded value).

E.8.3. Calculation of leakage GHG emissions

Means of verification	Not applicable. In accordance with the applied CDM baseline and monitoring methodology ACM0001 (version 18.0) [7], the PDD [2] indicates that no leakage emissions are to be considered in the context of emission reduction calculations.
Findings	Not applicable.
Conclusion	Not applicable.

E.8.4. Summary calculation of GHG emission reductions or net anthropogenic GHG removals by sinks

Means of verification	The EPIC verification team assessed whether calculation and reporting of achieved GHG emission reductions for the considered monitoring period are correct. As a result of the performed verification assessment, the EPIC verification team was able to confirm that the determination of achieved GHG emission reductions for the considered monitoring period are performed and reported in a correct, objective and transparent manner. As confirmed by the EPIC verification team,

	determination of baseline and project emissions are in accordance with the applicable requirements from the following reference and methodological documents: - Monitoring plan and other related provisions of the PDD /2/. - CDM baseline and monitoring methodology ACM0001 - 'Flaring or use of landfill gas" (version 18.0) /7/, - Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (version 02.0) /13/. - "Tool to calculate the emission factor for an electricity system" (version 05.0 /17/) - "Project emissions from flaring" (version 02.0.0) /12/ - "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0) /14/ All figures and input data as well as all performed calculations were checked by the EPIC verification team and were found to be reported in a deemed correct, appropriate and transparent manner in the latest versions of the Monitoring Report /3/ and emission reduction calculation spreadsheets /5/. EPIC was thus able to confirm that the emission reductions reported for the monitoring period from 01/04/2018 to 31/03/2019 are based on authentic measurements of LFG and flaring related monitoring data and are also based on the application of a semi-automatic and systematic data monitoring procedure for LFG and flaring related monitoring data as well as data related to the consumption of grid–sourced electricity by the project activity. Moreover, as also assessed by the EPIC verification team, monitoring data records were correctly retrieved and utilized in the emission reduction calculation spreadsheet /5/ for performing related calculation and reporting of achieved emission reductions for the considered monitoring period. EPIC was thus able to verify that, in general, all calculation and reporting procedures were adopted in a deemed transparent, correct and reliable manner.
Findings	No findings (CARs, CLs or FARs) were raised regarding reporting and calculations of summary of calculation of GHG emission reductions.
Conclusion	The EPIC verification team was able to confirm that reported achieved emission reductions for monitoring period from 01/04/2018 to 31/03/2019 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 PDD /2/, monitoring and baseline methodology ACM0001 - 'Flaring or use of landfill gas" (version 18.0) /7/ and applicable methodological tools /13/ /14/ /17/.

E.8.5. Comparison of actual GHG emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Means of verification	The EPIC verification team assessed the comparison of achieved GHG emission reductions with related estimates as per the PDD /2/. As part of the performed verification assessment, reported and verified emission reductions achieved by the project activity during the monitoring period (encompassing 365 days within years 2018 and 2019) were compared against the equivalent related *ex-ante* estimation of emission reductions for yeas 2018 and 2019 as per the PDD /2/. The results of such comparisons are summarized and assessed below:

	<table><tr><th>Period</th><th>Ex-ante estimation of emission reductions as per the PDD (in tCO_2e)</th><th>Achieved emission reductions (in tCO_2e)</th></tr><tr><td>Period from 01/04/2018 to 31/03/2019 (considered monitoring period)</td><td>35,872</td><td>31,544</td></tr></table>
Findings	No findings (CARs, CLs or FARs) were raised regarding the comparison of achieved emission reductions against related *ex-ante* estimation of emission reductions as per the PDD:
Conclusion	As confirmed by the EPIC verification team, for the 365-day length monitoring period from 01/04/2018 to 31/03/2019, achieved emission reductions are correctly indicated in the latest version of the Monitoring Report as about ~12% lower than the comparable value of *ex-ante* estimation of emission reductions as per the PDD /2/ valid for such period. As further assessed in Section E.8.6., the Monitoring Report presents a set of factors and aspects that sufficiently explains the occurred differences between achieved/verified emission reductions during the considered monitoring period and the comparable value for *ex-ante* estimation of emission reductions as per the PDD /2/ for the same time period. This is deemed correct and in accordance with applicable verification requirements.

E.8.6. Remarks on difference from estimated value in registered PDD

Means of verification	The EPIC verification team assessed the remarks on the difference between achieved GHG emission reductions and applicable estimated value in PDD /2/. As appropriately indicated in Section E.6 of the latest version of the Monitoring Report /3/, there are a set of factors and aspects that sufficiently explain the occurred difference between verified emission reductions achieved during the considered monitoring period and the comparable value for *ex-ante* estimation of emission reductions as per the PDD /2/ for the same time period. Assessment for such factors and aspects are summarized below: *Aspects/conditions that represent a decrease factor of reported emission reductions for the considered monitoring period when compared against the ex-ante estimation of emission reduction for the same period in the registered PDD:* *<u>1. Uncertainties associated with the application of First Order Decay (FOD) multi-phased model for estimating the emission reductions in the registered PDD:</u>* Like any other CDM project activity encompassing LFG collection and destruction/utilization, all potential uncertainties associated with the application of the First Order Decay (FOD) multi-phased model in the context of the *ex-ante* estimation of emission reductions in the registered PDD /2/ are applicable for the *ex-ante* estimation of emission reductions for the "Embralixo/Araúna – Bragança Landfill Gas Project". The EPIC verification team acknowledges that the LFG collection efficiency in a LFG collection and destruction initiative such as project activity plays an important role in differences between the achieved emission reductions and related ex-ante estimations of emission reductions as per the PDD /2/. Recently published literature on the topic /30/ /31/ /32/ has shown that LFG collection efficiency for well-engineered landfills with forced LFG extracting systems ranges from 50% up to 90%

	(depending on the design and operation of the LFG collection system). While the EPIC verification team also acknowledges that there are indeed several operational and performance aspects for a typical LFG collection and destruction project activity that negatively influence the potentially achieved average LFG collection and destruction efficiency, in the particular context of the operation of the CDM project activity "Embralixo/Araúna – Bragança Landfill Gas Project", it is reasonable to assume that achieved average LFG collection efficiency for the project activity during the considered monitoring period was lower than the one earlier assumed in the context of the ex-ante estimation of emission reductions (75%).
Findings	No findings (CARs, CLs or FARs) were raised regarding remarks on difference from estimated value from registered PDD.
Conclusion	Based on the performed document desk review and performed on-site visit, the EPIC verification team confirms that remarks on difference from estimated value from registered PDD are under conformance with the provisions of the PDD /2/.

E.8.7. Actual GHG emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Means of verification	As the monitoring period covered by this Verification Report (01/04/2018 to 31/03/2019) started after 01/01/2013, this verification does not include assessment of GHG emission reductions occurred during the first commitment period. Achieved emission GHG emission reductions as reported in the Monitoring Report /3/ occurred after 01/01/2013.
Findings	No findings (CARs, CLs or FARs) were raised regarding reporting and calculations of GHG emission reductions during the first commitment period and the period from 01/01/2013 onwards.
Conclusion	As a conclusion, EPIC thus confirms that the reported achieved emission reductions for monitoring period from 01/04/2018 to 31/03/2019 are in accordance with all measurement, reporting and calculation requirements of the monitoring plan of the PDD /2/, monitoring and baseline methodology ACM0001 - 'Flaring or use of landfill gas" (version 18.0) /7/ and applicable methodological tools /13/ /14/ /17/. No emission reductions occurred prior 01/01/2013 were considered in the current verification.

E.9. Assessment of reported sustainable development co-benefits

Means of verification	Not applicable. The project activity does not encompass monitoring of sustainable development co-benefits.
Findings	Not applicable.
Conclusion	Not applicable.

E.10. Global stakeholder consultation

Means of verification	Not applicable. This verification report does not encompass assessment of the first monitoring period of the project activity.
Findings	Not applicable.
Conclusion	Not applicable.

SECTION F. Internal quality control

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As part of EPIC internal quality control system, after the completion of assessment by the verification team, all the relevant documentation is submitted to a qualified, independent technical review team. The technical review team (with at least one member) is appointed to review the draft final verification report (Draft FVR). The technical review team assesses whether all the reporting requirements have been fulfilled and whether all the issues raised were satisfactorily addressed. The technical reviewer team either accepts or rejects element of the Draft FVR included by the verification team. The comments made by the technical review team are taken into consideration and incorporated in the final FVR. The final report (after resolutions of all findings) is then submitted to the head of operations for review and approval.

SECTION G. Verification opinion

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It is the opinion of EPIC that reported GHG emission reductions for the CDM project activity "Embralixo/Araúna – Bragança Landfill Gas Project" for the monitoring period from 01/04/2018 to 31/03/2019, as reported in the latest version of the Monitoring Report issued on 31/01/2020 (version 3.0), are calculated and reported without material misstatements and in a correct manner. Moreover, EPIC has confirmed that all information presented in the latest version of the Monitoring Report /3/ and all applied calculations for the determination of emission reductions achieved during the considered monitoring period are under full conformance with provisions and requirements of the registered PDD /2/, monitoring and baseline methodology ACM0001 - 'Flaring or use of landfill gas" (version 18.0) /7/ and applicable methodological tools /13/ /14/ /17/.

EPIC thus confirms the following regarding verified emission reductions:

Project title:	Embralixo/Araúna – Bragança Landfill Gas Project
UNFCCC ref no:	1179
PDD Monitoring Report	Version 8.0, dated 04/08/2017 Version 3.0, dated 31/01/2020
Methodology used for verification:	ACM0001 (version 18.0)
Applicable monitoring period:	01/04/2018 to 31/03/2019 (first and last day included)
Achieved emission reductions:	31,544 tCO_2e

SECTION H. Certification statement

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EPIC Sustainability Services Pvt. Ltd. (EPIC) has performed the 6th periodic verification assessment of the registered CDM project activity titled "Embralixo/Araúna – Bragança Landfill Gas Project". The project activity was registered by the UNFCCC on 14/10/2007 as CDM project activity with registration no. 1179 and it is currently under its 2nd 7-year renewable crediting period (period from 01/01/2015 to 31/12/2021).

The performed CDM verification assessment covered the monitoring period from 01/04/2018 to 31/03/2019 (including both days) and represents the 6th periodic verification for the project activity.

It is EPIC responsibility to express an independent verification statement and opinion on the reported GHG emission reductions from the project activity during the covered monitoring period.

The project activity is implemented and has operated at the Bragança landfill. In accordance with related project design information made available in the registered version of the Project Design Document (PDD) for the 2nd 7-year crediting period, the operation of the project activity resulted in permanent and real mitigation of methane (CH_4) emissions during the considered monitoring period through collection and destruction of landfill gas (LFG) by combustion under controlled conditions in a high temperature enclosed flare. While LFG is rich in CH_4, as established in the

PDD for the project activity, in the absence of the project activity (baseline scenario) it is assumed that the largest share of LFG collected and destroyed by the project activity would be directly emitted into the atmosphere.

The host-country project participant and project operator Araúna Participações e Investimentos Ltda. has been responsible for gathering of monitoring data in accordance with the monitoring plan of the PDD. While supported by hired external CDM consultants, Araúna Participações e Investimentos Ltda. has been responsible for calculating and reporting GHG emissions reductions achieved by the project activity during the considered monitoring period.

The EPIC verification team performed the verification assessment and provided its verification opinion on the basis of the provisions and requirements of the CDM baseline and monitoring methodology ACM0001 - "Flaring or use of landfill gas" (version 18.0), the monitoring plan included in the registered version of the PDD /2/ for the 2nd 7-year crediting period of the project activity (version 8.0, dated 04/08/2017) and also as per the latest version of Monitoring Report for the considered monitoring period (version 3.0, dated 31/01/2020). The verification assessment performed by EPIC included:

i) checking whether the project activity was implemented and has operated in accordance with related project design details as described in the Project Design Document (PDD) for the project activity;
ii) checking whether the provisions of both the applied CDM baseline and monitoring methodology and the monitoring plan (as per the PDD) were consistently and appropriately applied;
iii) assessment of all documented evidences which supports the reported data and claimed emission reductions during the considered monitoring period;
iv) checking whether the installed monitoring equipment/instrument required for measuring *ex-post* determined parameters required for calculating emission reductions were calibrated and have operated appropriately.

The EPIC verification approach draws on an understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these. EPIC planned and performed the verification assessment by obtaining evidence, information and explanations that were considered necessary for providing reasonable assurance that reported GHG emission reductions are fairly stated. All Corrective Action Requests (CARs) and/or Clarification Actions (CL) raised by EPIC as part of the performed verification assessment were confirmed to be adequately resolved.

It is the opinion of EPIC that reported GHG emission reductions for the CDM project activity "Embralixo/Araúna – Bragança Landfill Gas Project" for the monitoring period from 01/04/2018 to 31/03/2019, as reported in the latest version of the Monitoring Report issued on 31/01/2020 (version 3.0), are calculated and reported without material misstatements and in a correct manner. Moreover, EPIC has confirmed that all information presented in the latest version of the Monitoring Report and all applied calculations for the determination of emission reductions achieved during the considered monitoring period are under full conformance with provisions and requirements of the registered version of the PDD, monitoring and baseline methodology ACM0001 - 'Flaring or use of landfill gas" (version 18.0) and applicable methodological tools.

EPIC Sustainability Services Pvt. Ltd. (EPIC) herewith confirms that GHG emission reductions were achieved by the CDM project activity "Embralixo/Araúna – Bragança Landfill Gas Project" during the monitoring period from 01/04/2018 to 31/03/2019 as follows:

Emission reductions achieved by the project activity during the monitoring period from 01/04/2018 to 31/03/2019:	31,544 tCO_2e

Prepared and submitted by
 (Marco A. Ratton) Verification Team Leader

Appendix 1. Abbreviations

Abreviations	Full texts
ACM	Approved Consolidated Methodology (CDM baseline and monitoring methodology)
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDM-EB	Clean Development Mechanism Executive Board
CDM-M&P	Modalities and Procedures for Clean Development Mechanism
CDM-PCP-PA	Clean Development Mechanism Project Cycle Procedures for project activites
CDM-PS-PA	Clean Development Mechanism Project Standard for project activities
CDM-VVS-PA	Clean Development Mechanism Validation and Verification Standard for project activities
CER	Certified Emission Reduction
CETESB	Companhia Ambiental do Estado de São Paulo (Environmental Agency/Authority for São Paulo State in Brazil)
CGR	*Centro de Gerenciamento de Resíduos* ("Waste Management Facility" when translated into English language)
CH_4	Methane
CL	Clarification Request
CMP	Meeting of Parties to the Kyoto Protocol
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
COP/MOP	The Conference of the Parties to the United Nations Framework Convention on Climate Change serving as the Meeting of the Parties to the Kyoto Protocol
DNA	Designated National Authority
DOE	Designated Operational Entity
ER	Emission Reduction
FAR	Forward Action Request
GHG	Greenhouse Gas
HDPE	High Density Polyethylene
INMETRO	*Instituto Nacional de Metrologia, Normalização e Qualidade Industrial* (Brazilian "Institute for Metrology, Standardization and Industrial quality" when translated into English language). INMETRO is the Brazilian official agency for metrology and certification affairs
LFG	Landfill gas
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
MR	Monitoring Report
MSW	Municipals solid waste
ONS	*Operador Nacional do Sistema* (Brazilian entity responsible for the coordination of the dispatch of power plants connected to the National Electricity Grid of Brazil)
PDD	Project Design Document
PLC	Programmable logic controller
PNRS	Política Nacional de Resíduos Sólidos (Brazilian National Policy on Waste Management as established by Federal Law No. 12,305/10 (the LPNRS).
PP	Project Participant
QA/QC	Quality Assurance / Quality Control
UNFCCC	United Nations Framework Convention for Climate Change
UV	Ultra violet

Appendix 2. Competence of team members and technical reviewers

All personnel being engaged in CDM verification assessments performed by EPIC are qualified based on the established procedures of EPIC to assure the resource requirements that satisfy all the requirements of competence criteria of the CDM Accreditation Standard for operational entities. EPIC is accredited as a DOE and holds the full responsibility on decision-making regarding the verification in accordance with the accreditation requirements of the CDM-EB.

The following verification team has been assigned to carry out the verification of the project.

Name	**Mr Marco A. Ratton**	**Mr. R. Vijayaraghavan**	**Mr. Prabu Das Anbazhagan**
Role	Lead Auditor	Auditor	Technical Reviewer
Competence in relevant sectoral scope(s):	Sectors 1 and 13	N/A	Sectors 1 and 13
Responsibility	Performance of document review, performance of on-site visit, preparation of initial list of findings, assessment of responses from the project participants for all list of findings and assessment of updated/corrected documents, preparation of the and draft Verification Report, addressing comments from the performed technical review and preparation of final Verification Report.	Review of documents, assistance in report preparation	Performance of Technical review

Mr. Marco A. Ratton is based in Brazil and has acted as a CDM auditor since 2007. He holds vast experience with independent assessments of CDM project activities within the area of 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 & manufacturing technologies, economics and environmental management & policy. He has undergone extensive training on CDM validation and verification and is a qualified Lead Auditor for Sectoral Scope 13 under Technical Area “Waste handling and disposal” and Sector Scope 1 in accordance with procedures of EPIC sustainability services Pvt. Ltd. He also has previous experience on conducting ISO 9001/14001 assessments.

Mr. R. Vijayaraghavan holds BE in Mechanical Engineering, M.Tech in Energy Conservation and Management and MBA in Technology Management. He is certified as Energy Auditor by Bureau of Energy Efficiency (BEE), Government of India. He has 10 years of working experience in energy sector including validation / verification of fifty CDM and VCS/GS projects and has undergone

extensive training on CDM validation and verification and has been qualified as Lead Auditor with Sectoral Scope 1 and 13. He is also an ISO 26000 lead auditor certified by Professional Evaluation and Certification Board (PECB).

Mr. Prabu Das holds a M. Tech Degree in Energy Conservation and Management and B. Tech Degree in Petro-chemical Technology. He is a certified Energy Auditor by Bureau of Energy Efficiency (BEE), Government of India. He has around 10 years of work experience in design of biomass power plants, preparing Techno Economic Feasibility Reports (TEFR), carrying out energy audits, of which last six years have been in CDM consultancy and validation services. He has undergone extensive training on CDM validation and verification and he is a qualified lead auditor for CDM Sectoral Scopes 1 and 13 in accordance with procedures of EPIC Sustainability Services Pvt. Ltd. He is also an ISO 26000 lead auditor certified by Professional Evaluation and Certification Board (PECB).

Appendix 3. Documents reviewed or referenced

No.	Author	Title	References to the document	Provider
/1/	UNFCCC/CDM-EB	Clean Development Mechanism validation and verification standard for project activities (CDM-VVS-PA), version 02.0 as per EB 101.	Dated 29/11/2018. Available online: https://cdm.unfccc.int/Reference/Standards/index.html	Others
/2/	Araúna Participações e Investimentos Ltda.	Project Design Document (PDD) for the 2nd 7-year renewable crediting period for the CDM project activity: "Embralixo/Araúna – Bragança Landfill Gas Project", version 8.0 -	Dated 03/11/2017 Available online: https://cdm.unfccc.int/Projects/DB/DNV-CUK1185017358.24/view	Project Participants[9]
/3/	Araúna Participações e Investimentos Ltda.	Monitoring Report for the CDM project activity "Embralixo/Araúna – Bragança Landfill Gas Project" - monitoring period from 01/04/2018 to 31/03/2019, version 2.0.	Dated 31/01/2020.	Project Participants
/4/	Araúna Participações e Investimentos Ltda.	Monitoring Report for the CDM project activity "Embralixo/Araúna – Bragança Landfill Gas Project" - monitoring period from 01/04/2018 to 31/03/2019, version 1.	Dated 11/06/2019. Available online: https://cdm.unfccc.int/Projects/DB/DNV-CUK1182151832.44/view	Project Participants
/5/	Araúna Participações e Investimentos Ltda.	Emission reduction calculation spreadsheets for the CDM project activity "Embralixo/Araúna – Bragança Landfill Gas Project" - monitoring period from 01/04/2018 to 31/03/2019. One	Dated 20/08/2019.	Project Participants

[9] All document with provider indicated as "Project Participants" were sourced by the host-country project participant and project owner Araúna Participações e Investimentos Ltda..

		emission reduction spreadsheet + flare efficiency calculation spreadsheet + summarized emission reduction spreadsheet. File names: *"2018_2019.xls"* *"MR 6 – Embralixo – V.2.xls"* *"MR 6 – Embralixo – V.2 - FE.xls"*		
/6/	Araúna Participações e Investimentos Ltda.	Input data for the emission reduction calculation spreadsheet for the project activity "Embralixo/Araúna – Bragança Landfill Gas Project" - monitoring period from 01/04/2018 to 31/03/2019. File names: "*APR_18.xls*" "*MAY_18.xls*" "*JUN_18.xls*" "*JUL_18.xls*" "AUG_*18.xls*" "SEP_*18.xls*" "OCT_*18.xls*" "NOV_*18.xls*" "DEC_*18.xls*" "JAN_*19.xls*" "FEB_*19.xls*" "MAR_*19.xls*"	Dated 11/06/2019.	Project Participants
/7/	UNFCCC/CDM-EB	Consolidated baseline and monitoring methodology ACM0001 - "Flaring or use of landfill gas¨, version 18.0 as per EB 94.	Dated 04/05/2017. Available online: https://cdm.unfccc.int/methodologies/DB/Y88077XT5O83TZ2PYEZ36LFIAMAODR	Others
/8/	UNFCCC	Kyoto Protocol to the United Nations Framework Convention on Climate Change	Dated 1998. Available online: http://unfccc.int/resource/docs/convkp/kpeng.pdf	Others
/9/	UNFCCC	Decision 3/CMP. 1 (Marrakesh – Accords)	Dated 30/03/2006. Available online: https://cdm.unfccc.int/Reference/COPMOP/08a01.pdf	Others
/10/	LGAI Technological Center, S.A. (Applus+ LGAI)	"Validation of the renewal of crediting period of an existing CDM-project" for the project activity Embralixo/Araúna – Bragança Landfill Gas Project, Version 2.0.	Dated 21/08/2017. Available online: https://cdm.unfccc.int/Projects/DB/DNV-CUK1182151832.44/view	Others
/11/	IPCC	1996 IPCC Guidelines for National Greenhouse Gas Inventories: work book; 2006 IPCC Guidelines for National Greenhouse Gas Inventories: work book.	Available online: http://www.ipcc-nggip.iges.or.jp/public/gl/invs5.html	Others

/12/	UNFCCC/CDM-EB	"Project emissions from flaring", version 02.0.0 as per EB 68.	Dated 20/07/2012. Available online: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v2.0.pdf/history_view	Others
/13/	UNFCCC/CDM-EB	"Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation", version 03.0 as per EB 96.	Dated 22/09/2017. Available online: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf/history_view	Others
/14/	UNFCCC/CDM-EB	¨Tool to determine the mass flow of a greenhouse gas in a gaseous stream¨, version 03.0 as per EB 87.	Dated 27/09/2015. Available online: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v1.pdf/history_view	Others
/15/	UNFCCC/CDM-EB	"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", version 02 as per EB 41.	Dated 02/08/2008. Available online: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf/history_view	Others
/16/	UNFCCC/CDM-EB	"Tool to calculate the emission factor for an electricity system", version 03.0.0 as per EB 70.	Dated 23/11/2012. Available online: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v1.1.pdf/history_view	Others
/17/	UNFCCC/CDM-EB	"Tool to calculate the emission factor for an electricity system", version 05.0 as per EB 87.	Dated 04/10/2013. Available online: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf	Others
/18/	UNFCCC/CDM-EB	Clean Development Mechanism project standard for project activities (CDM-PS-PA), version 02.0 as per EB 101.	Dated 29/11/2018. Available online: https://cdm.unfccc.int/Reference/new_reg.html	Others
/19/	UNFCCC/CDM-EB	Clean Development Mechanism project cycle procedure for project activities (CDM-PCP-PA), version 02.0 as per EB 101	Dated 29/11/2018. Available online: https://cdm.unfccc.int/Reference/new_reg.html	Others
/20/	Araúna Participações e Investimentos Ltda.	Emission reduction calculation spreadsheet for the CDM project activity "Embralixo/Araúna – Bragança Landfill Gas Project" - monitoring period from 01/04/2018 to 31/03/2019. One emission reduction spreadsheet + flare efficiency calculation spreadsheet + summarized emission reduction spreadsheet.	Dated 11/06/2019.	Project Participants

		File names: *"2018_2019.xls"* *"MR 6 – Embralixo – V.1.xls"* *"MR 6 – Embralixo – V.1 - FE.xls"*		
/21/	EPIC / Araúna Participações e Investimentos Ltda.	Comparative emission reduction calculation spreadsheets for the project activity "Embralixo/Araúna – Bragança Landfill Gas Project" - monitoring period from 01/04/2018 to 31/03/2019. Created as part of the *Data authenticity checking* procedure performed during the verification. File names: *"2018_2019 - for checking.xls"* *"MR 6 – Embralixo – V.1 - for checking.xls"* *"MR 6 – Embralixo – V.1 - FE.xls"*	Dated 23/09/2019.	Project Participants
/22/	EPIC / Araúna Participações e Investimentos Ltda.	Comparative spreadsheets with monitoring records for the project activity "Embralixo/Araúna – Bragança Landfill Gas Project" – monitoring period from 01/04/2018 to 31/03/2019. Created as part of the *Data authenticity checking* procedure performed during the on-site visit. File names: "*APR_18 – for checking.xls*" "*MAY_18 – for checking.xls*" "*JUN_18 – for checking.xls*" "*JUL_18 – for checking.xls*" "AUG_*18 – for checking.xls*" "SEP_*18 – for checking.xls*" "OCT_*18 – for checking.xls*" "NOV_*18 – for checking.xls*" "DEC_*18 – for checking.xls*" "JAN_*19 – for checking.xls*" "FEB_*19 – for checking.xls*" "MAR_*19 – for checking.xls*"	Dated 14/08/2019.	Project Participants
/23/	Araúna Participações e Investimentos Ltda.	Blank version of the emission reduction calculation spreadsheet applied for the project activity "Embralixo/Araúna – Bragança Landfill Gas Project" - monitoring period from 01/04/2018 to 31/03/2019. File names: "*YYYY - blank.xls* "	Dated 11/06/2019.	Project Participants

		"MR 6 – Embralixo – V.1 - blank.xls" *"MR 6 – Embralixo – V.1 - FE - blank.xls"*		
/24/	Araúna Participações e Investimentos Ltda.	Internal service and maintenance log book (with details about historical of interventions, service and instrument/equipment calibration and replacement in the project activity "Embralixo/Araúna – Bragança Landfill Gas Project").	Available at the project's data control room.	Project Participants
/25/	Araúna Participações e Investimentos Ltda.	Completed Modalities of Communication (MoC) form for the CDM project activity "Embralixo/Araúna – Bragança Landfill Gas Project"	Dated 07/12/2017. Available online: https://cdm.unfccc.int/Projects/DB/DNV-CUK1182151832.44/view?cp=1	Project Participants
/26/	EPIC	EPIC: Working procedures for performance of CDM verification assessments, Issue No. 2, Rev No. 1.	Dated 01/08/2014.	Others
/27/	Lloyd's Register Quality Assurance Ltd	Verification and Certification Report for the registered CDM project activity "Embralixo/Araúna – Bragança Landfill Gas Project". Monitoring Period from 01/01/2008 to 31/10/2009 (1st verification).	Dated 29/04/2010. Available online: https://cdm.unfccc.int/ https://cdm.unfccc.int/Projects/DB/DNV-CUK1182151832.44/iProcess/LRQA%20Ltd1260370846.43/view	Others
/28/	Lloyd's Register Quality Assurance Ltd	Verification and Certification Report for the registered CDM project activity "Embralixo/Araúna – Bragança Landfill Gas Project". Monitoring Period from 01/11/2009 to 31/10/2010 (2nd verification).	Dated 13/05/2011. Available online: https://cdm.unfccc.int/Projects/DB/DNV-CUK1182151832.44/iProcess/LRQA%20Ltd1290698691.99/view	Others
/29/	Intermountain CHP Application Center	Designing a Landfill Gas to Energy Project: Rules of Thumb and Questions to Ask. Intermountain Workshop. CHP Bioenergy for Landfills and for and Wastewater Treatment Plants. SCS Engineers.	Dated 11/08/2005.	Others
/30/	Solid Waste Association of North America (SWANA)	Landfill Gas Collection System Efficiencies (2007).	Report dated 2007.	Others
/31/	California Environmental Protection Agency	Evaluation of Landfill Gas Collection Efficiency. Appendix D.	Dated year 2009. Available online: http://www.arb.ca.gov/regact/2009/landfills09/appd.pdf	Others
/32/	Mayer-Brown / Tauil & Chequer	Legal update / interpretation: Regulation of Brazil's National Policy on Waste Management	Available online: http://www.tauilchequer.com.br/publications/article.asp?id=10261&nid=13012	Others

/33/	Honeywell Analytics Ltd.	Specification sheet for the C7061A Dynamic Self-Check Ultra-Violet Flame Detector.	Available online: https://customer.honeywell.com/resources/techlit/TechLitDocuments/65-0000s/65-0223.pdf	Others
/34/	Field Serviços de Instrumentação Ltda.	Certificate of Calibration for the installed LFG flow meter. Calibration event performed on 26/04/2017. Certificate No. FC-1479/15. Certificate of Calibration for the installed LFG flow meter. Calibration event performed on 26/04/2018. Certificate No. FC-1479/18.	Certificate issuance date: 26/04/2017 and 26/04/2018.	Others
/35/	UNFCCC/CDM-EB	"Guideline – Application of materiality in verifications", version 02.0, as per EB82.	Dated 20/02/2015.	Others
/36/	CEIME Calibração e Comércio de Instrumentos Ltda.	Calibration certificate for electricity meter. Certificate No. 1321986/14. Calibration event date: 21/10/2014.	Certificate issuance date: 21/10/2014	Others
/37/	UNFCCC / CDM-EB	Monitoring Report Form (CDM-MR-FORM). Version 07.0.	Dated 31/05/2019. Available online: https://cdm.unfccc.int/Reference/new_reg.html	Others
/38/	Itron Soluções para Energia e Água Ltda.	Technical specification sheet for the installed electricity meter.	Available online: https://www.itron.com/brasil/pt/Pages/default.aspx	Others
/39/	Field Serviços de Instrumentação Ltda.	Calibration certificate for the installed pressure sensor. Certificate No. FC-1481-17. Calibration event date: 03/04/2017. Calibration certificate for the installed pressure sensor. Certificate No. FC-1483/2018. Calibration event date: 02/04/2018.	Certificate issuance date: 03/04/2017 and 02/04/2018.	Others
/40/	Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda.	Operation and maintenance instruction / manual for the FT-2 flow meter.	Available online: http://www.contechind.com.br/catalogos/medidor-de-vazao-tipo-thermal.pdf	Others
/41/	Field Serviços de Instrumentação Ltda..	Calibration certificate for the installed temperature sensor. Certificate No. FC-1484-17. Calibration event date: 04/05/2017. Calibration certificate for the installed temperature sensor. Certificate No. FC-1484-17. Calibration event date: 02/04/2018.	Certificate issuance date: 04/05/2017 and 02/04/2018.	Others
/42/	IST - Tecnologia	Technical Report for the	Report dated 18/09/2017.	Others

	Internacional em Sensores Ltda.	determination of methane destruction efficiency in the flare of the project activity "Embralixo/Araúna – Bragança Landfill Gas Project".		
/43/	IST - Tecnologia Internacional em Sensores Ltda.	Technical Report for the determination of methane destruction efficiency in the flare of the project activity.	Reports dated 18/03/2018.	Others
/44/	Warme do Brasil Instrumentação e Automação Industrial	Technical specification sheet for the WTP-4010 pressure sensor.	Available online: http://www.warme.com.br/manuais/WTP-4010-NOVO.pdf	Others
/45/	Warme do Brasil Instrumentação e Automação Industrial	Technical specification sheet for the PT-100 temperature sensor.	Available online: http://warme.com.br/files/folhasTecnicas/wtt5000.pdf	Others
/46/	Souza Engenharia.	Calibration certificate for the installed thermocouple. Calibration Certificate No. 128/2017. Calibration event date: 03/04/2017.	Certificate issuance date: 03/04/2017.	Others
/47/	Landtec	Technical specification sheet for the AEMS gas analyzer unit.	-	Others
/48/	Warme do Brasil Instrumentação e Automação Industrial	Technical specification sheet for the WTT 5000 thermocouple.	Available online: http://www.warme.com.br/produtos/temperatura/transmissor-temperatura-wtt5000.html	Others
/49/	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.	Available online: https://pt.scribd.com/doc/133363365/Fundamentals-of-Engineering-Thermodynamics-4th-Ed-Solutions-Manual-M-J-Moran-H-N-Shapiro	Others
/50/	INMETRO	Accreditation scopes of the inspection service company Mérieux NutriSciences Brasil / Bioagri Ambiental Ltda. vis-a-vis accreditation requirements from INMETRO.	-	Others
/51/	Carrer Engenharia	Declaration documents reporting the outcome of the technical evaluations performed at the URBAM landfill comparing the management practices at the URBAM landfill vis-a-vis the previously conceived design of the landfill.	Documents dated 12/12/2017 (first evaluation) and 06/04/2018 (second evaluation).	Others
/52/	Souza Engenharia	Calibration certificate for the installed CH_4 gas analyzer unit. Certificate No. 129/2017. Calibration event date: 23/07/2017. Calibration certificate for the installed CH_4	Certificate issuance date: 23/07/2017 and 20/07/2018.	Others

		gas analyzer unit. Certificate No. 129/2018. Calibration event date: 20/07/2018.		
/53/	Field Serviços de Instrumentação Ltda.	Calibration certificate for the installed thermocouple. Calibration Certificate No. 1484-18. Calibration event date: 03/05/2018.	Certificate issuance date: 03/05/2018.	Others
/54/	Araúna Participações e Investimentos Ltda.	Monitoring Report for the CDM project activity "Embralixo/Araúna – Bragança Landfill Gas Project" - monitoring period from 01/04/2018 to 31/03/2019, version 2.0.	Dated 20/08/2019.	Project Participants
/55/	CETESB	Operational license for the Bragança landfill. License number 60003873, valid until 27/04/2020.	Dated 27/04/2015.	Others

Appendix 4. Clarification requests, corrective action requests and forward action requests

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

FAR ID	xx	**Section no.**	E.2	**Date:** DD/MM/YYYY
Description of FAR				
There are no remaining FARs from validation and/or previous verifications.				
Project participant response				**Date:** DD/MM/YYYY
Documentation provided by project participant				
DOE assessment				**Date:** DD/MM/YYYY

Table 2. CL from this verification

CL ID	xx	**Section no.**		**Date:** DD/MM/YYYY
Description of CL				
No CLs were raised.				
Project participant response				**Date:** DD/MM/YYYY
Documentation provided by project participant				
DOE assessment				**Date:** DD/MM/YYYY

Table 3. CAR from this verification

CAR ID	1	**Section no.**	E.7.	**Date:** 14/08/2019
Description of CAR				

While a relative delay in the performance of calibration events for the installed thermocouple used for measuring temperature in the exhaust gas of the high temperature flare has occurred, details about the conservative deduction factors applied in baseline emissions calculations for addressing such delay are not included in the initial version of the Monitoring Report.
Project participant response **Date:** 20/08/2019
Details about the conservative deduction factors which were systematically applied in baseline emissions calculations for addressing the acknowledged delays in the performance of calibration events for the installed gas analyzer unit and thermocouples were included in the revised version of the Monitoring Report.
Documentation provided by project participant
No additional documentation was provided.
DOE assessment **Date:** 24/09/2019
The EPIC verification team confirmed that performed related amendments in the Monitoring Report are deemed reasonable, correct and sufficiently address the raised CAR. This CAR is thus successfully closed.

Table 4. CAR from this verification

CAR ID	2	**Section no.**	E.7.	**Date:** 30/01/2020
Description of CAR				
While the registered PDD refers to an operational license for the Bragança landfill which was expired on 16/06/2018, the Monitoring Report does not present details regarding the operation of the Bragança landfill in conformity with applicable legal environmental requirements.				
Project participant response				**Date:** 31/01/2020
Details about the most recent version of the operational license for the Bragança landfill issued by the local environmental authority named Companhia Ambiental do Estado de São Paulo - CETESB (São Paulo State Environmental Agency) were included in the revised version of the Monitoring Report.				
Documentation provided by project participant				
- Operational license for the Bragança landfill (valid until 27/04/2020) [5]				
DOE assessment				**Date:** 01/02/2020
The EPIC verification team confirmed that performed related amendments in the Monitoring Report are deemed reasonable, correct and sufficiently address the raised CAR. This CAR is thus successfully closed.				

Table 5. FAR from this verification

FAR ID	xx	**Section No.**		**Date:** DD/MM/YYYY
Description of FAR				
No FARs were raised.				
Project participant response				**Date:** DD/MM/YYYY
Documentation provided by project participant				
DOE assessment				**Date:** DD/MM/YYYY

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Document information

Version	*Date*	*Description*
03.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM validation and verification standard for project activities" (CDM-EB93-A05-STAN); • Make structural and editorial improvements.
02.1	11 January 2018	Editorial revision to correct the numbering of appendices in the instructions.
02.0	31 October 2017	Revision to align with the requirements of the "CDM validation and verification standard for project activities" (version 01.0).
01.0	23 March 2015	Initial publication.

Decision Class: Regulatory
Document Type: Form
Business Function: Issuance
Keywords: project activities, verifying and certifying