Verification and certification report form for CDM project activities

(Version 01.0)

VERICATION AND CERTIFICATION REPORT	
Title of the project activity	Caieiras landfill gas emission reduction
Reference number of the project activity	0171
Version number of the verification and certification report	1.0
Completion date of the verification and certification report	10/06/2016
Monitoring period number and duration of this monitoring period	12th monitoring period 16/05/2015 - 31/12/2015
Version number of monitoring report to which this report applies	2.0; dated 17/05/2016
Crediting period of the project activity corresponding to this monitoring period	2nd 7-year renewable crediting period (period from 13/12/2013 to 30/03/2020)
Project participant(s)	Essencis Soluções Ambientais S.A. Nordic Environment Finance Corporation
Host Party	Brazil
Sectoral scope(s), selected methodology(ies), and where applicable, selected standardized baseline(s)	Sectoral Scope: 13 - Waste handling and disposal Selected Methodology: ACM0001 - “Flaring or use of landfill gas” (version 13.0.0)
Estimated GHG emission reductions or net anthropogenic GHG removals for this monitoring period in the registered PDD	692,343 tCO_2e
Certified GHG emission reductions or net anthropogenic GHG removals for this monitoring period	374,022 tCO_2e
Name of DOE	EPIC Sustainability Services Pvt. Ltd. (EPIC) Report no: ESSPL/CDM/2015/040
Name, position and signature of the approver of the verification and certification report	Mr. Krishnachar Sudheendra (Director & Head - Operations)

SECTION A. Executive summary

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Brief summary of the project activity and performed verification assessment:

EPIC Sustainability Services Pvt. Ltd. (EPIC) has performed the 12th periodic verification assessment (4th periodic verification within the 2nd 7-year crediting period) for the registered CDM project activity titled "Caieiras landfill gas emission reduction". The project activity was registered by the UNFCCC on 09/03/2006 as CDM project activity with registration no. 0171 and it is currently under its 2nd 7-year renewable crediting period (period from 13/12/2013 to 30/03/2020).

The performed verification assessment encompassed the monitoring period from 16/05/2015 to 31/12/2015 (including both days) and it was performed on the basis of (i) document comprehensive review of the Monitoring Report, registered and revised versions of the Project Design Document (PDD) + supporting documents; (ii) performed on-site assessment; (iii) conducted interviews with representatives of the host-country project participant and project owner/operator Essencis Soluções Ambientais S.A.; (iv) resolution of all identified outstanding issues (corrective and clarification action requests) 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 CTR Caieiras landfill in the installed 4 high temperature enclosed flares[1] for the unique purposes of avoiding emissions of methane (CH_4) into the atmosphere (that would 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 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 CTR Caieiras 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. This electricity grid is the one for which the project activity is connected to. As also confirmed by the EPIC verification team, no backup captive off-grid electricity generator has ever been used for meeting the project's electricity demand under circumstances/situations of planned or unplanned temporary interruption of supply of grid-sourced electricity to the project activity. As confirmed by the EPIC verification team, whenever the supply of grid-sourced electricity to the project activity is interrupted, the whole operation of the project activity (collection and destruction of LFG) is also interrupted.

The CTR Caieiras landfill is located in the extreme Northeast region of Caieiras municipality at the Bandeirantes highway, km 33. Caieiras is one of the municipalities which encompass the Metropolitan Region of São Paulo (RMSP) that is located in São Paulo State in the South-East region of Brazil. The geographical coordinates of the project site are as follows:

- 23°20'40" S (-23.3444)
- 46°46'20" W (-46.7722)

[1] As outlined in Box 1 of the latest version of the Monitoring Report, a gradual moving of the project's LFG flaring facility (including the 4 installed high temperature enclosed flares) occured during the considered monitoring period. Due to such gradual moving, the project activity operated with reduced capacity (with only 2 of the 4 installed high temeprature enclosed flares under regular operation) during the whole monitoring period from 16/05/2015 to 31/12/2015. As also outlined in the Monitoring Report, in order to address the occurred permanent post-registration design changes of the project activity (including the gradual moving of the project's LFG flaring station), a revised PDD was compiled (PDD version 6.0, dated 17/05/2016). Detailed assessment for the occurred permanent post-registration design changes of the project activity are included in the Validation Opinion Report for Post-Registration Changes for the project activity (version 1.0 dated 10/06/2016)

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, as an independent and objective review, shall assess and verify that the implementation of the project activity and the measures taken to monitor and report emission reductions for a considered monitoring period comply with the CDM criteria 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 (both the revised version (PDD version 6.0, dated 17/05/2016 /2/) and the registered version (PDD version 5.9, dated 05/09/2013 /38/)), (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 (CDM-VVS) version 9.0.0 /1/,
- The monitoring plan of both registered and revised PDDs applicable for the 2nd 7-year renewable crediting period (PDD version 5.9, dated 05/09/2013 /38/ and PDD version 6.0, dated 17/05/2016 /2/, respectively).
- The CDM baseline and monitoring methodology ACM0001 “Flaring or use of landfill gas” (version 13.0.0) /7/,
- Monitoring Report (all versions) /3/ /4/,
- The following methodological tools, which are referred in the Monitoring Report /3/:
    - “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 01) /13/
    - “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion” (version 02) /15/
    - "Tool to calculate the emission factor for an electricity system” (versions 3.0.0 /16/ and 04.0 /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 02.0.0) /14/

Verification process:

The verification process is based on applicable verification guidelines described in the latest version of the CDM validation and verification standard (CDM-VVS) /1/. In addition to that, standard auditing techniques have been applied by the 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. As part of the verification process, the verification findings and observations from the performed document desk review and on-site visit are collected and are described in a Verification Questionnaire that is included in the Verification Protocol adopted by EPIC /28/. The Verification Protocol is termed "EPIC Verification Checklist" and it is included in the end of this document. 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 (10 Correction Action Requests (CARs)) that were appropriately/sufficiently addressed and resolved by the host-country PP Essencis Soluções Ambientais S.A. (*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 2.0, dated 17/05/2016). Reported emission reductions are correctly determined and in accordance with applicable monitoring requirements and GHG calculation approaches as per the PDD and applied CDM baseline and monitoring methodology and methodological tools. Therefore, EPIC certifies the emission reductions for the monitoring period from 16/05/2015 to 31/12/2015 (including both days) are correctly determined and reported as 374,022 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 review	On-site inspection	Interview(s)	Verification findings
1.	Team Leader / Technical Expert	EI	Ratton	Marco	EPIC- Central Office	X	X	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	Radhamadhavan	Vijayaraghavan	EPIC - Central office
2.	Approver	IR	Krishnachar	Sudheendra	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) /97/ and the CDM validation and verification standard (CDM-VVS) version 9.0.0 /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) /97/ and the CDM-VVS version 9.0.0 /1/, the threshold of materiality for the performed verification assessment was evaluated and it was concluded that the materiality 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 1%[2].

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)[3].

While it was later considered that no sampling approach was 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.

[2] While as per the PDD valid the 2nd 7-year renewable crediting of the project activity, ex-ante emission reductions for the whole year of 2015 were previously estimated as 1,098,719 tCO_2e (which would result in a threshold of 0.5 % as per the applicable guidance of the CDM-VVS), due to the overall low operational activity/performance level of the project activity during the considered monitoring period, emission reductions achieved by the project activity during the considered monitoring period are thus significant lower than the equivalent amount of ex-ante estimated emission reductions valid for the same time period within year 2015 (230 days). By considering 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), a materiality threshold of 1% was thus selected by EPIC.

[3] 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 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*.

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 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 flares for the determination of project emissions of methane through the flares; 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 flares for the determination of project emissions of methane through the flares 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	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),

			reporting of achieved emission reductions.	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	High	Potential reporting of monitoring data and GHG calculations with errors and/or inconsistencies due to occurrence of errors	The EPIC verification team shall confirm whether appropriate and reliable procedure(s) for entering the values of ex-ante determined

	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.		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.	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) /97/, 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 Essencis Soluções Ambientais S.A. 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/ /15/ /17/ /12/ /14/ /16/) 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 monthly emission reduction calculation spreadsheets /5/ completed by the host country project participant Essencis Soluções Ambientais S.A. are basically MS-Excel spreadsheets that, in theory, could have recorded data being easily edited/modified (intentionally or unintentionally). Thus, these spreadsheets, if inappropriately edited, could potentially tamper reported monitoring records, thus resulting in unreal and incorrect calculation and reporting of emission reductions achieved by the project activity during the considered monitoring period. In order to ensure that all emission reductions calculations are entirely and correctly based on authentic and real monitoring records valid for the considered monitoring period, a *data authentic 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 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 monthly emission reduction spreadsheets 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 review

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The EPIC verification team conducted a comprehensive and detailed desk review of all documents initially provided by Essencis Soluções Ambientais S.A. + other publicly available documents that are relevant for the verification assessment. The main assessed documents are listed below:

- The PDD /2/ for the 2nd 7-year renewable crediting period of the CDM project activity "Caieiras landfill gas emission reduction", including the corresponding Validation Report for the Renewal of crediting period /10/;

- The revised version of the PDD /2/ that includes the occurred changes to the project design (for which assessment is available in the Validation Opinion Report for Post-Registration Changes for the project activity (version 1.0 dated 10/06/2016) /40/).

- The initial version of the Monitoring Report for the 12th verification of the project activity /4/;

- The applied CDM baseline and monitoring methodology ACM0001 "Flaring or use of landfill gas" (version 13.0.0) /7/ + the following methodological tools:

    - "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 01) /13/

- "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 02) /15/
- "Tool to calculate the emission factor for an electricity system" (versions 3.0.0 /16/ and 04.0 /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 02.0.0) /14/

- The findings from the 9th, 10th and 11th verifications /31/ /32/ /42/ for the project activity (which are the previously performed verification assessments for the project activity valid for the 2nd 7-year crediting period).
- 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 12th verification of the project activity /4/ and the revised 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 PDD /2/ and applied CDM baseline and monitoring methodology (ACM0001 (version 13.0.0) /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/ + revised 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: 16/03/2016 to 17/03/2016				
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	16/03/2016	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	16/03/2016	Marco A. Ratton
3.	Visual inspection of the flaring station (set of instruments/equipment comprising high temperature enclosed flares, 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	16/03/2016	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	16/03/2016	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	16/03/2016	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	17/03/2016	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	17/03/2016	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	17/03/2016	Marco A. Ratton

D.3. Interviews

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	Silva	Leandro, (Mr.)	Essencis Soluções Ambientais S.A.	17/03/2016	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/equipment; - 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, recording and reporting); - Data uncertainty and residual risks;	Marco A. Ratton
2	Barbosa	Nuno, (Mr.)	UniCarbo - Energia e Biogás Ltda. [4]	17/03/2016		

[4] 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 Essencis Soluções Ambientais S.A. with CDM related issues (inter alia completion of the Monitoring Report). This CDM consulting and advisory service company is not a project participant.

					- 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).	
3.	Barbosa	Nuno	UniCarbo - Energia e Biogás Ltda.	17/05/2016	Phone call to discuss the performed corrections in the Monitoring Report in order to address Corrective Action Requests (CARs) raised as outcome of the verification assessment.	Marco A. Ratton

D.4. Sampling approach

>>

Not applicable. No sampling approach was applied for the verification assessment[5].

D.5. Clarification requests, corrective action requests and forward action requests raised

Areas of verification findings	No. of CL	No. of CAR	No. of FAR
Compliance of the monitoring report with the monitoring report form	CL 1	-	-
Compliance of the project implementation with the registered PDD	-	-	-
Post-registration changes	-	-	-
Compliance of the monitoring plan with the monitoring methodology including applicable tool and standardized baseline	-	-	-
Compliance of monitoring activities with the registered monitoring plan	-	CAR 1, CAR 2, CAR 3	-
Compliance with the calibration frequency requirements for measuring instruments	-	-	-
Assessment of data and calculation of emission reductions or net removals	-	-	-
Others (remarks of the occurred difference of reported emission reductions for the considered monitoring period against equivalent ex-ante estimation of emission reductions valid for the same period in the PDD)	-	CAR 4	-
Total	1	4	

[5] 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 05.1) /89/ was applied and was correctly completed for the elaboration of the Monitoring Report /3/. The EPIC assessment included checking whether the form was not changed in its formatting.
Findings	A CL was raised regarding the compliance of the of the Monitoring Report with the Monitoring Report form (incl. compliance with guidelines/instructions for the completion of the Monitoring Report form): **CL 1 (17/03/2016):** Information details related to the internal references (numbering) of the installed high temperature enclosed flares as reported in the initial version of the Monitoring Report are unclear. The representatives of the project participant Essencis Soluções Ambientais S.A. were requested to address the above-summarized raised CL by including further related clarifications through performance sufficient modification (improvements) in the initial version of the Monitoring Report and/or enclosed calculation spreadsheets if applicable.
Conclusion	As a conclusion of its assessment, upon closure of the raised CL, 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 /89/ 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 verification

>>

By assessing the previously issued report "*Validation of the Renewal of Crediting Period of an Existing CDM-Project: Caieiras landfill gas emission reduction*" /10/ that was issued by the DOE responsible for the validation assessment for renewal of crediting period of the project activity (Validation Report for renewal of crediting period), 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 in the context of the verification assessments within the 2nd 7-year renewable crediting period for the project activity.

Furthermore, through review of the Verification Reports for the previous 1st to the 11th periodic verifications for the project activity /33/ /29/ /30/ /90/ /91/ /92/ /93/ /94/ /31/ /32/ /42/ (where the 9th, 10th and 11th periodic verifications are the verification assessments performed within the 2nd 7-year renewable crediting period for the projec activity (monitoring periods from 13/12/2013 to 12/06/2014, from 13/06/2014 to 31/12/2014 and from 01/01/2015 to 15/05/2015, respectively); the EPIC verification team identified no FARs to be considered/addressed in the context of the 12th.

E.3. Compliance of the project implementation 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 revised PDD /2/ were in place and that project activity has been operated by Essencis Soluções Ambientais S.A. during the considered monitoring period under conformance with its technical design description as outlined in the PDD. As assessed in Section E.4.6, permanent post-registration changes in the project design occurred and such changes are addressed in a revised version of the PDD that was also assessed by EPIC in the context of the performed verification

	assessment.
Findings	As part of its verification assessment, the EPIC verification team was able to confirm that the implementation of the project activity during the considered monitoring period is under full compliance with the description of the project design as outlined in the revised version of the PDD [/2/]. The assessment of the revised version of the PDD [/2/] addressing the occurred changes is described in the Validation Opinion Report for Post-Registration Changes for the project activity (version 1.0 dated 10/06/2016) [/40/]) Thus, no CARs and CLs 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 project implementation is under full conformance with provisions of the revised version of the PDD [/2/].

E.4. Post-registration changes

E.4.1. Temporary deviations from the registered monitoring plan, monitoring methodology or standardized baseline

>>
Not applicable. The verification assessment for the considered monitoring period does not include any post-registration changes.

E.4.2. Corrections

>>
The verification assessment for the considered monitoring period includes post-registration changes under the category “Corrections”.

The following corrections (as appropriately outlined in Appendix 6 of the revised version of the PDD [/2/]) were made:

“(…)

Correction in information (that do not affect the project design):

- *Duplicated table with details for the monitoring parameter “Temperature in the exhaust gas of the enclosed flare in minute m“ ($T_{EG,m}$) was deleted from Section B.7.1.*
- *Typo and grammar errors and mistakes were corrected in different sections of the PDD.*

(…)”

Assessment details about the performed corrections (in information that do not affect the project design) as reflected in the revised version of the PDD [/2/] are included in the Validation Opinion Report for Post-Registration Changes for the project activity (version 1.0 dated 10/06/2016) [/40/])

E.4.3. Changes to the start date of the crediting period

>>
Not applicable. The verification assessment for the considered monitoring period does not include any post-registration changes.

E.4.4. Inclusion of a monitoring plan to a registered project activity

>>
Not applicable. The verification assessment for the considered monitoring period does not include any post-registration changes.

E.4.5. Permanent changes from registered monitoring plan, monitoring methodology or standardized baseline

>>

Not applicable. The verification assessment for the considered monitoring period does not include any post-registration changes.

E.4.6. Changes to the project design of a registered project activity

>>

The verification assessment for the considered monitoring period includes post-registration changes under the category "Changes to the project design of a registered project activity".
The following permanent post-registration changes in the project design (as appropriately outlined in Appendix 6 of the revised version of the PDD [12]) occurred:

"(…)

Permanent changes in the design of the project activity:

- *Occurred gradual moving of the whole installed project's LFG destruction infrastructure (project's LFG flaring facility) to other area/region within the CTR Caieiras landfill during the period from mid 2015 to 12/04/2016:*
  As result of a previously taken decision of Essencis Soluções Ambientais S.A. to convert the area/region within the CTR Caieiras landfill where the project's LFG destruction infrastructure (project's LFG flaring facility) was previously implemented and has operated (since year 2007) as a new MSW disposal area, such project's facility was thus required to be moved to other area/region within the landfill. The project activity's LFG flaring facility moving process was initiated in June 2015 and was concluded on 14/02/2016. In the context of the occurred moving process of the LFG destruction facility, 3 new 4-stage and more efficient centrifugal blowers were purchased and were installed in the new location of the facility together transferred equipment/instruments (thus replacing the 4 previously installed and currently worn 3-stage centrifugal blowers that have operated since the start of operations of the project activity in year 2007). Furthermore, a new programmable logic controller (PLC) unit and new database for storing/archiving of monitoring records were also installed (with operation starting on 18/12/2015 (with the old database being kept available for sake of historical monitoring data archiving)).

- *Performed service intervention in each one of the installed 4 high temperature enclosed flares for addressing previously detected undesirable and abnormal intermittent/sporadic vibration + noise problems in the flares (resulting in higher nameplate LFG flaring capacity for each flare):*
  A service intervention was performed in each one of the project's 4 high temperature enclosed flares on 08/06/2015 and aimed addressing previously detected undesirable and abnormal intermittent/sporadic vibration + noise problems in the installed flares. This service intervention was performed by technical service representatives authorized by the flares' designer and manufacturer BTS - Termodinâmica de Sistemas Ltda. and included re-design of the LFG burner unit in each flare (through the replacement of the previously installed 5 LFG injectors in each flare burner unit by 5 new injectors (with slightly larger dimensions and slightly higher LFG firing capacity)) + related inspection/testing/commissioning services. By making use of slightly larger LFG injectors in the burner unit of the flares, the performed service intervention resulted in slight increase of the maximum nameplate LFG flaring capacity for each one of the installed flares (7,500 Nm^3/h (and not any longer 6,500 Nm^3/h) as defined by the designer and manufacturer of the flares. Such flare specification change requires update in the previously defined value of maximum Operational LFG flow (for continuous operation) (in the context of the ex-ante defined parameter "Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval" ($SPEC_{flare}$)).

(…)"

Assessment details about the occurred permanent post-registration changes in the project design as reflected in the revised version of the PDD /2/ are included in the Validation Opinion Report for Post-Registration Changes for the project activity (version 1.0 dated 10/06/2016) /40/)

E.4.7. Types of changes specific to afforestation and reforestation project activities

>>
Not applicable.

E.5. Compliance of monitoring plan with the monitoring methodology including applicable tool and standardized baseline

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 16/05/2015 to 31/12/2015 vis-à-vis the monitoring requirements of the 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 13.0.0) /7/ and applied methodological tools /12/ /13/ /14/ /15/ in order to confirm 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 16/05/2015 to 31/12/2015 under full compliance with applicable requirements of the monitoring methodology ACM0001 (version 13.0.0) /7/ and applied methodological tools /12/ /13/ /14/ /15/. Thus, no CARs and CLs 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 16/05/2015 to 31/12/2015 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 13.0.0) /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
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 grid sourced electricity consumed by the project activity ($TDL_{grid,y}$)	20%
Weighting of build margin emissions factor (w_{BM})	75%
Weighting of operating margin emissions factor (w_{OM})	25%
Build margin CO_2 emission factor in year *y* ($EF_{grid,BM,y}$)	0.2010 tCO_2/MWh

		Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval ($SPEC_{flare}$)[6]	$SPEC_{flare,\ Flare\ 1}$ $SPEC_{flare,\ Flare\ 2}$ $SPEC_{flare,\ Flare\ 3}$ $SPEC_{flare,\ Flare\ 4}$	Min.	Max.		
			Operational LFG flow for each flare (for continuous operation) until the occurred performance of service intervention on 08/06/2015	650 Nm^3/h	6,500 Nm^3/h		

[6] As confirmed by the EPIC verification team, Section D.1 of the latest version of the Monitoring Report appropriately and correctly include a disclaimer about the performed service intervention in each one of the installed 4 high temperature enclosed flares on 08/06/2015 (aiming to address/solve previously detected undesirable and abnormal intermittent/sporadic vibration + noise problems in the flares) and its impact over the flares value for maximum operational LFG flow for each flare (for continuous operation) under the ex-ante determined parameter "Manufacturer's specification for the flare" ($SPEC_{flare}$). This disclaimer also appropriately and correctly includes related explanations for the criteria/conditions taken into account for the determination of the flare efficiency (in the context of determination of project emissions from flaring during the considered monitoring period) by taking account the occurred change in the value for maximum operational LFG flow for each flare (for continuous operation) that is valid from 08/05/2015 onwards.

				Operational LFG flow for each flare (for continuous operation) after the occurred performance of service intervention on 08/06/2015	650 Nm^3/h	7,500 Nm^3/h[7]		

[7] The following disclaimer is appropriately and correctly included in Section D.1 of the latest version of the Monitoring Report regarding the validity of the 6,500 Nm^3/h and 7,500 Nm^3/h values for maximum operational LFG flow for each flare (for continuous operation) within the considered monitoring period:

"By taking into account the performed service intervention in the flares on 08/06/2015 and its impact over the ex-ante determined parameter "Manufacturer's specification for the flare" ($SPEC_{flare}$), the following criteria/conditions are taken into account for the determination of the flare efficiency in the context of determination of project emissions from flaring during the considered monitoring period:

- Until 08/06/0215 at 08:59, for each minute m, the flow rate LFG sent to the flares referred as "Flare 2" and "Flare 3" (sub-monitoring parameters $F_{CH4,RG,m,flare-2} = F_{CH4,sent\_flare,y,flare-2}$ and $F_{CH4,RG,m,flare-3} = F_{CH4,sent\_flare,y,flare-3}$) should not be higher than 6,500 Nm^3/h; otherwise flare efficiency is assumed as 0% and no emission reductions are therefore accounted for LFG combusted in these flares in the minute m in question.

- Until 08/06/0215 at 13:59, for each minute m, the flow rate LFG sent to the flares referred as "Flare 1" and "Flare 4" (sub-monitoring parameters $F_{CH4,RG,m,flare-1} = F_{CH4,sent\_flare,y,flare-1}$ and $F_{CH4,RG,m,flare-4} = F_{CH4,sent\_flare,y,flare-4}$) should not be higher than 6,500 Nm^3/h; otherwise flare efficiency is assumed as 0% and no emission reductions are therefore accounted for LFG combusted in these flares in the minute m in question.

- From 09:00 of 08/06/0215 onwards, for each minute m, the flow rate LFG sent to the flares referred as "Flare 2" and "Flare 3" (sub-monitoring parameters $F_{CH4,RG,m,flare-2} = F_{CH4,sent\_flare,y,flare-2}$ and $F_{CH4,RG,m,flare-3} = F_{CH4,sent\_flare,y,flare-3}$) should not be higher than 7,500 Nm^3/h; otherwise flare efficiency is assumed as 0% and no emission reductions are therefore accounted for LFG combusted in these flares in the minute m in question.

- From 14:00 of 08/06/0215 onwards, for each minute m, the flow rate LFG sent to the flares referred as "Flare 1" and "Flare 4" (sub-monitoring parameters $F_{CH4,RG,m,flare-1} = F_{CH4,sent\_flare,y,flare-1}$ and $F_{CH4,RG,m,flare-4} = F_{CH4,sent\_flare,y,flare-4}$) should not be higher than 7,500 Nm^3/h; otherwise flare efficiency is assumed as 0% and no emission reductions therefore are accounted for LFG combusted in these flares in the minute m in question.

In the particular case of the considered monitoring period, it is however noteworthy the following:

- During the largest 216-day share of the considered monitoring period from 16/05/2015 to 17/12/2015, the project activity operated mostly with collected LFG being flared on the basis of operation of the 2 flares referred as "Flare 1" and "Flare 4" (Note: an exception for this fact is a short period encompassing about 5 hours in June 2015 (from about 09:00 AM to about 02:00 PM on 08/06/2015) where, as part of the testing and commissioning work in the context of the performed service intervention in the flares, the project activity operated on the basis of the flares referred as "Flare 2" and "Flare 3" during such short period (instead of the flares referred as "Flare 1" and "Flare 4")).

- During the shortest 14-day share of the considered monitoring period from 18/12/2015 to 31/12/2015 the project activity thus operated with collected LFG being flared on the basis of operation of the 2 flares referred as "Flare 2" and "Flare 3". (…)"

Required temperature of the exhaust gas of the flare (to ensure LFG destruction (combustion) under high CH_4 destruction efficiency):	500 °C	1,200 °C
Required minimum frequency for inspection and maintenance service in each flare (incl. inspection in the conditions of the flare isolation ceramics revetment material):	Min. every 6 months	
Required/ recommended minimum frequency for replacement of the flare isolation ceramics revetment material in each flare:	After 10 years of regular and appropriate operation	

Moreover, EPIC verification tem 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)
- 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 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	A CAR was raised by the EPIC verification team regarding the application of data and parameters fixed ex-ante at the renewal of crediting period: **CAR 1 (17/03/2016):** The manufacturer's operational specifications for the installed high temperature enclosed flare (as per details for the ex-ante parameter $SPEC_{flare}$) as indicated in the Monitoring Report are not correct. The representatives of the project participant Essencis Soluções Ambientais S.A. were requested to address the above-summarized raised CAR by providing to the EPIC verification team sufficient evidences to determine that the applicable CDM requirements have been met and/or through performance sufficient modification (corrections/improvements) in the initial version of the Monitoring Report and/or enclosed calculation spreadsheets if applicable.
Conclusion	The EPIC verification tem has confirmed, upon closure of the raised CAR, 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 revised PDD /2/ during the monitoring period from 16/05/2015 to 31/12/2015.

E.6.2. Data and parameters monitored

Means of verification	The EPIC verification team has assessed that all monitoring parameters of which monitoring is required as per the monitoring plan of the PDD /2/ and by considering the applied calculation options for the determination of baseline and project emissions achieved during the monitoring period from 16/05/2015 to 31/12/2015. The following tables include assessment details for parameters monitored ex post during the monitoring period from 16/05/2015 to 31/12/2015: *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 CTR Caieiras landfill are annually compared against defined landfill management practices as per the previously conceived original construction and operational design of the landfill. This comparison aims to confirm that management and operation of the CTR Caieiras 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 evaluation assessment of the overall management and operation of the CTR landfill with an every year frequency. The performance of an evaluation assessment by the independent 3rd party engineering company "Cepollina Engenheiros Consultores Ltda." on 29/01/2016

		as the applicable monitoring procedure for the parameter Management of the SWDS is deemed reasonable and acceptable. That sufficiently confirms that the applied monitoring frequency is in accordance with both the monitoring plan of the PDD /2/ and ACM0001 (version 13.0.0) /7/. The performed evaluation has one-year validity. It is thus valid until 29/01/2017. A previous technical evaluation was also performed by the independent 3rd party engineering company "Cepollina Engenheiros Consultores Ltda." on 20/05/2015. This previously performed evaluation has also one-year validity.
	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 latest technical evaluation performed by the independent 3rd party engineering company "Cepollina Engenheiros Consultores Ltda." is reported in a technical evaluation/declaration report /78/ issued this company that is dated 29/01/2016. This document was made available and was assessed by the EPIC verification team. As appropriately outlined in the latest version of the Monitoring Report /3/: "*(...) As part of the performed technical evaluation, the current configuration and operational conditions of the CTR Caieiras landfill were compared against the previously conceived design and operational conditions of the landfill prior to the implementation of the project activity on the basis of different sources, including inter alia:* *- Original design documents of the landfill (as described in the documentation required for all phases of the environmental licensing for the CTR Caieiras landfill);* *- Applicable local or national regulations* *- Expertise and experience of "Cepollina Engenheiros Consultores Ltda." with the CTR Caieiras landfill. Since January 2007 "Cepollina Engenheiros Consultores has performed regular technical*

		inspections at the CTR Caieiras landfill as part of the continuously performed assessment of geotechnical stability monitoring for the landfill cells. Such regular assessments are required by the competent environmental authority from São Paulo State (Companhia de Tecnologia de Saneamento Ambiental - CETESB) for the validity of the environmental and safety permit/licensing for the CTR Caieiras landfill. (…)" The EPIC verification team has verified that the both issued technical evaluation/declaration reports /78/ sufficiently confirms that the original conceived design of the CTR Caieiras 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 evaluation/declaration reports issued by Cepollina Engenheiros Consultores Ltda. dated 20/05/2015 and 29/01/2016 /78/. 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 CTR Caieiras 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 CTR Caieiras 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 13.0.0) /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 02.0.0) /14/).
Measuring, recording and reporting frequencies:	During the considered monitoring period, continuously measurements of the monitoring parameter $V_{t,wb}$ were recorded/reported with an every minute frequency. As correctly outlined in the latest version of the Monitoring Report /3/, while measurements for $V_{t,wb}$ are performed by the installed 4 LFG flow meters (one flow meter for each individual installed flare), the monitoring parameter is thus measured, recorded and reported on the basis of the following sub-parameters: - $V_{t,wb,flare-1}$: Volumetric flow of LFG to Flare 1 - $V_{t,wb,flare-2}$: Volumetric flow of LFG to Flare 2 - $V_{t,wb,flare-3}$: Volumetric flow of LFG to Flare 3 - $V_{t,wb,flare-4}$: Volumetric flow of LFG to Flare 4 This is deemed correct, acceptable and under conformance with the requirements of ACM0001 (version 13.0.0) /7/ and the applicable methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /14/. 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 4 LFG flow meters in Nm^3/h on the basis of the sub-parameters $V_{t,wb,flare-1}$, $V_{t,wb,flare-2}$ $V_{t,wb,flare-3}$ and $V_{t,wb,flare-4}$, such sub-parameters are thus equivalent to the calculation sub-parameters $V_{t,wb,n,flare-1}$, $V_{t,wb,n,flare-2}$, $V_{t,wb,n,flare-3}$ and $V_{t,wb,n,flare-4}$. It is also important to note project activity operated on the basis of 2 operational flares during the considered monitoring due to inter-alia

		the occurred gradual moving of the whole installed project's LFG destruction infrastructure (project's LFG flaring facility) to other area/region within the CTR Caieiras landfill. The following is appropriately and correctly outlined in the latest version of the Monitoring Report [3]: *"(…)* *As per a previously taken decision by Essencis Soluções Ambientais S.A., the project's LFG destruction infrastructure (project's LFG flaring facility incl. high temperature enclosed flares, centrifugal blowers, valves, safety system/equipment and other ancillary and monitoring equipment/instruments) has moved to other area/region within the CTR Caieiras landfill in (with moving of two of the flares + ancillary equipment starting in mid-June 2015 and with the whole moving process (incl. all related phased testing and commissioning events) being later concluded on 12/04/2016 (thus after the end of the considered monitoring period). During this about 8-month length period, the project's LFG flaring facility operated under reduced activity level in 2 different locations within the CTR Caieiras landfill limits:* *- until 17/12/2015: the project's LFG flaring facility operated from its former location with two flares under operation.* *- from 18/12/2015 onwards: the project's LFG flaring facility has operated from its new and current location (on the basis of operation of only 2 flares during the period from 18/12/2015 to 12/04/2016 and later with the 4 flares in place since 12/04/2016).* *(…)* *In the particular case of the considered monitoring period, it is however noteworthy the following:* *- During the largest 216-day share of the considered monitoring period from 16/05/2015 to 17/12/2015, the project activity operated mostly with collected LFG being flared on the basis of operation of the 2 flares referred as "Flare 1" and "Flare 4" (Note: an exception for this fact is a short period encompassing about 5 hours in June 2015 (from about 09:00 AM to about 02:00 PM on 08/06/2015) where, as part of the testing and commissioning work in the context of the performed service intervention in the flares, the project activity operated on the basis of the flares referred as "Flare 2" and "Flare 3" during such short period (instead of the flares referred as "Flare 1" and "Flare 4")).* *- During the shortest 14-day share of the considered monitoring period from 18/12/2015 to 31/12/2015 the project activity thus operated with collected LFG being flared on the basis of operation of the 2 flares referred as "Flare 2" and "Flare 3".* *(…)"*
	Are measuring, recording	As per the PDD [2], continuous measurements of

	and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	$V_{t,wb}$ 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 02.0.0) /14/ (which is applied in accordance to ACM0001 (version 13.0.0) /7/), monitoring of Volumetric flow of LFG stream in time interval *t* on a wet basis should be performed continuously if not specified in the underlying methodology. While ACM0001 (version 13.0.0) /7/ does not specify any monitoring frequency for Volumetric flow of LFG stream in time interval *t* on a wet basis, the applied measuring, recording and reporting frequencies for Volumetric flow of LFG stream in time interval *t* on a wet basis are thus in accordance with both ACM0001 (version 13.0.0) /7/ and the PDD /2/.
	Type of monitoring equipment/instrument:	Measurements of Volumetric flow of LFG stream in time interval *t* on a wet basis are performed by 4 installed LFG flow meters (one for each installed high temperature enclosed flare) on the basis of the sub-parameters $V_{t,wb,flare-1}$, $V_{t,wb,flare-2}$, $V_{t,wb,flare-3}$ and $V_{t,wb,flare-4}$. Instruments with the following specifications were applied for performing measurements of $V_{t,wb}$ (on the basis of measurements of the sub-parameters $V_{t,wb,flare-1}$, $V_{t,wb,flare-2}$ $V_{t,wb,flare-3}$ and $V_{t,wb,flare-4}$) during the considered monitoring period: *Flow meter used for measuring the sub-parameter $V_{t,wb,flare-1}$*:

Specifications of the flow meter used for measuring the sub-parameter $V_{t,wb,flare-1}$	
Manufacturer	Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda.
Model	FT-2
Serial Number	1412000235
Internal instrument/ equipment identification	FT-01
Accuracy:	±1.0%

Source: /63/

Flow meter used for measuring the sub-parameter $V_{t,wb,flare-2}$:

Specifications of the flow meter used for measuring the sub-parameter $V_{t,wb,flare-2}$	
Manufacturer	Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda.
Model	FT-2
Serial Number	1412000236
Internal instrument/	FT-02

		equipment identification	
		Accuracy:	±1.0%

Source: [63]

Flow meter used for measuring the sub-parameter $V_{t,wb,flare-3}$:

Specifications of the flow meter used for measuring the sub-parameter $V_{t,wb,flare-3}$	
Manufacturer	Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda.
Model	FT-2
Serial Number	1412000237
Internal instrument/ equipment identification	FT-03
Accuracy:	±1.0%

Source: [63]

Flow meter used for measuring the sub-parameter $V_{t,wb,flare-4}$:

Specifications of the flow meter used for measuring the sub-parameter $V_{t,wb,flare-4}$	
Manufacturer	Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda.
Model	FT-2
Serial Number	1412000238
Internal instrument/ equipment identification	FT-04
Accuracy:	±1.0%

Source: [63]

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 13.0.0) [7] do not specify any accuracy requirement for the LFG flow meters installed at the project site. The accuracy range for the installed 4 LFG flow meters is ±1.0%. It is EPIC contention that the use of the installed instruments represents good practice for monitoring of LFG flow.
If applicable, has the reported monitoring data been cross-checked with other available data or	Not applicable.

	source?	
	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 each flare (sub-parameters $V_{t,wb,flare-1}$, $V_{t,wb,flare-2}$, $V_{t,wb,flare-3}$ and $V_{t,wb,flare-4}$) 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 by each one of the installed 4 LFG flow meters (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 ($V_{t,wb}$) (sub-parameters $V_{t,wb,flare-1}$, $V_{t,wb,flare-2}$, $V_{t,wb,flare-3}$ and $V_{t,wb,flare-4}$) - 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* ($T_{EG,m}$) (sub-parameters $T_{EG,m,flare-1}$, $T_{EG,m,flare-2}$, $T_{EG,m,flare-3}$ and $T_{EG,m,flare-4}$) - Flame detection of flare in the minute *m* ($Flame_m$) (sub-parameters $Flame_{m,flare-1}$, $Flame_{m,flare-2}$, $Flame_{m,flare-3}$ and $Flame_{m,flare-4}$) 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? 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 02.0.0) /14/)
Measuring, recording and reporting frequencies:	During the monitoring period from 16/05/2015 to 31/12/2015, 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 02.0.0) /14/ (which is applied in accordance to ACM0001 (version 13.0.0) /7/), monitoring of $v_{CH4,t,wb}$ should be performed continuously if not specified in the

		underlying methodology. While ACM0001 (version 13.0.0) [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 13.0.0) [7] and the PDD [2].
	Type of monitoring equipment/instrument:	During the monitoring period from 16/05/2015 to 31/12/2015, continuously 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: BGM Instrumentação Controle e Automação Ltda. Model: CENTRUM AG 4000 Serial Number: NS 53159 Internal instrument/ equipment identification: GA01 Accuracy: ±2.0% Source: [70] 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 splits to the 4 high temperature flares, where the LFG flow meters are 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 13.0.0) [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 ±2.0%. It is EPIC contention that the use of the installed instrument represents good practice for monitoring of 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)	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

	verified and/or compared?	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 ($V_{t,wb}$) (sub-parameters $V_{t,wb,flare-1}$, $V_{t,wb,flare-2}$, $V_{t,wb,flare-3}$ and $V_{t,wb,flare-4}$) - 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* ($T_{EG,m}$) (sub-parameters $T_{EG,m,flare-1}$, $T_{EG,m,flare-2}$, $T_{EG,m,flare-3}$ and $T_{EG,m,flare-4}$) - Flame detection of flare in the minute *m* ($Flame_m$) (sub-parameters $Flame_{m,flare-1}$, $Flame_{m,flare-2,}$ $Flame_{m,flare-3}$ and $Flame_{m,flare-4}$) 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	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

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?	quality assurance related aspects for the project activity are also included in the end of this Section.

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:	During the considered monitoring period, 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 meters automatically convert and report 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 02.0.0) /14/ (which is applied in accordance to ACM0001 (version 13.0.0) /7/), monitoring of T_t should be performed continuously if not specified in the underlying methodology. While ACM0001 (version 13.0.0) /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 13.0.0) /7/ and the PDD /2/.
Type of monitoring equipment/instrument:	During the considered monitoring period, 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	Pressgage instrumentos de Medição e Controle Ltda.
Model	STP-100
Serial Number	45519
Internal	TT02

		instrument / equipment identification | Accuracy | ±1.0% Source: [69]
	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 13.0.0) [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 ±1.0%. It is EPIC contention that the use of the installed instrument 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?	Figures of LFG temperature 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 by LFG temperature indicators (which are located next to the LFG temperature sensor) (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 ($V_{t,wb}$) (sub-parameters $V_{t,wb,flare-1}$, $V_{t,wb,flare-2}$, $V_{t,wb,flare-3}$ and $V_{t,wb,flare-4}$) - 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* ($T_{EG,m}$) (sub-parameters $T_{EG,m,flare-1}$, $T_{EG,m,flare-2}$, $T_{EG,m,flare-3}$ and $T_{EG,m,flare-4}$) - Flame detection of flare in the minute *m* ($Flame_m$) (sub-parameters $Flame_{m,flare-1}$, $Flame_{m,flare-2,}$ $Flame_{m,flare-3}$ and $Flame_{m,flare-4}$) 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? Are necessary/applicable QA/QC processes in place?	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.

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:	During the considered monitoring period, 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 meters automatically convert and report 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	As per the PDD /2/, continuous measurements of

	and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	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 02.0.0) /14/ (which is applied in accordance to ACM0001 (version 13.0.0) /7/), monitoring of P_t should be performed continuously if not specified in the underlying methodology. While ACM0001 (version 13.0.0) /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 13.0.0) /7/ and the PDD /2/.
	Type of monitoring equipment/instrument:	During the considered monitoring period, continuous measurements of Pressure of the LFG 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: Pressgage instrumentos de Medição e Controle Ltda. Model: TPI-PRESS Serial Number: 43608 Internal instrument/ equipment identification: PT002 Accuracy: ±1.5% Source: /68/
	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 13.0.0) /7/ do not specify any accuracy requirement for the LFG pressure sensor installed at the project site. The accuracy range for the installed instrument is ±1.5%. It is EPIC contention that the use of the installed instrument 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?	Figures of LFG pressure 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 by LFG pressure indicators (which are located next to the LFG pressure sensor) (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 ($V_{t,wb}$) (sub-parameters $V_{t,wb,flare-1}$, $V_{t,wb,flare-2}$, $V_{t,wb,flare-3}$ and $V_{t,wb,flare-4}$) - 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* ($T_{EG,m}$) (sub-parameters $T_{EG,m,flare-1}$, $T_{EG,m,flare-2}$, $T_{EG,m,flare-3}$ and $T_{EG,m,flare-4}$) - Flame detection of flare in the minute *m* ($Flame_m$) (sub-parameters $Flame_{m,flare-1}$, $Flame_{m,flare-2}$, $Flame_{m,flare-3}$ and $Flame_{m,flare-4}$) 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	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.

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

Data / Parameter: (as per the monitoring plan of the PDD):	Amount of grid electricity consumed by the project activity during the year *y* ($EC_{PJ,y}$)
Measuring, recording and reporting frequencies:	During the considered monitoring period, accumulated values of continuously measurements of the monitoring parameter $EC_{PJ,y}$ were aggregated and recorded/reported monthly by the staff of Essencis Soluções Ambientais S.A.
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 $EC_{PJ,y}$ are to be recorded and reported at least with an every month frequency. The "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" /13/, and ACM0001 (version 13.0.0) /7/ do not clearly indicate recording and reporting frequencies for continuous measurements for the parameter $EC_{PJ,y}$. Thus, the adopted measuring, recording and reporting frequencies are assumed as in accordance with the monitoring plan of the PDD /2/, the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" /13/ and ACM0001 (version 13.0.0) /7/.
Type of monitoring equipment/instrument:	During the considered monitoring period, continuously measurements of the monitoring parameter $EC_{PJ,y}$ were performed by two installed electricity meters of the same model/specifications (with one being used exclusively for measuring the consumption of grid-sourced electricity by the Blower 04) of which main specifications are presented below: Specifications of installed electricity meters Manufacturer: KRON Instrumentos Elétricos Ltda. Model: MULT-K Serial Number (S/N): Electricity meter 01 (Blower 1,2,3,5 and landfill installations: 234215 Electricity meter 02 (Blower 4): 465025 Internal instrument / equipment identification: Electricity meter 01: ME Plant Electricity meter 02: ME Blower 4 Accuracy: ±0.2% Source: /61/
Is the accuracy of the	The PDD /2/, the "Tool to calculate baseline,

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?	project and/or leakage emissions from electricity consumption" /13/ and ACM0001 (version 13.0.0) /7/ do not specify any accuracy requirement for the electricity meters installed at the project site. The accuracy range for the installed instruments is ±0.2%. It is EPIC contention that the use of the installed instruments represents good practice for monitoring of 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?	Records of grid-sourced electricity consumed by the project activity during the considered monitoring period, as reported in the summarized emission reduction calculation spreadsheet /5/ and Monitoring Report /3/ were cross-checked with monthly invoices of grid-sourced electricity purchase issued by Elektro Eletricidade e Serviços S.A. /64/ (the local power distribution company) which were made available and assessed by the EPIC verification team during the performed on-site visit. Such cross-checking confirmed correctness of reported data for $EC_{PJ,y}$ during the considered monitoring period. It is noteworthy that, for the particular case of the month of May 2015, the reported value of electricity consumed by the project activity during the period from 01/05/2015 to 15/05/2015 was compared with the equivalent value of grid electricity presented in the monthly invoice of May 2015 for a 15-day period.
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 $EC_{PJ,y}$ 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 "Operation margin CO_2 emission factor in year = Dispatch data analysis operating margin CO_2 emission factor in year y" ($EF_{grid,OM,y} = EF_{grid,OM-DD,y}$)

Data / Parameter: (as per the monitoring plan	Operation margin CO_2 emission factor in year *y* = Dispatch data analysis operating margin CO_2

	of the PDD):	emission factor in year *y* ($EF_{grid,OM,y}$ = $EF_{grid,OM\text{-}DD,y}$)
	Measuring, recording and reporting frequencies:	Not applicable. The selected value for $EF_{grid,OM,y}$ = $EF_{grid,OM\text{-}DD,y}$ (0.5580 tCO_2/MWh) is the recently calculated value valid for year 2015 as published by the DNA of Brazil /73/..
	Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	Not applicable. There are no measurements or measurement instruments/equipment involved for the definition of $EF_{grid,OM,y}$ = $EF_{grid,OM\text{-}DD,y}$. As established in the PDD /2/, the annual ex-post determined value for $EF_{grid,OM,y}$ = $EF_{grid,OM\text{-}DD,y}$ is considered.
	Type of monitoring equipment/instrument:	Not applicable. There are no measurements or measurement instruments/equipment involved for the definition of $EF_{grid,OM,y}$ = $EF_{grid,OM\text{-}DD,y}$.
	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 or measurement instruments/equipment involved for the definition of $EF_{grid,OM,y}$ = $EF_{grid,OM\text{-}DD,y}$.
	If applicable, has the reported monitoring data been cross-checked with other available data or source?	Not applicable. The selected value is the recently calculated value valid for year 2015 as published by the DNA of Brazil /73/.
	How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	As confirmed by the EPIC verification team, the DNA of Brazil has regularly calculated values of $EF_{grid,OM,y}$ for the National Electricity Grid of Brazil by applying classified information and data on dispatch of electricity by grid-connected power plants within the National Electricity Grid of Brazil and by following calculation guidance applicable for "Dispatch data analysis operating margin CO_2 emission factor" ($EF_{grid,OM\text{-}DD,y}$) (based on dispatch merit order data for grid-connected power plants) as established by the methodological tool "Tool to calculate the emission factor for an electricity system" (version 3.0.0 /16/ as per the PDD /2/ and version 04.0 /17/ (latest version)). Related clarifications and details for the determination of $EF_{grid,OM,y}$ = $EF_{grid,OM\text{-}DD,y}$ by the DNA of Brazil are made available at a specific section of the website of the DNAx of Brazil /73/. Information made available in the website of the DNA of Brazil /73/ confirms the correctness of the selected value for $EF_{grid,OM,y}$ = $EF_{grid,OM\text{-}DD,y}$. The EPIC verification team also confirmed as part of its performed assessment that *ex-post*

		determined values for both $EF_{grid,OM,y}$ = $EF_{grid,OM-DD,y}$ and Build margin CO_2 emission factor ($EF_{grid,BM,y}$) on the basis of information published by the DNA of Brazil /73/ have been selected and applied for the determination of both baseline and project emissions related to electricity generation and consumption respectively in CDM projects hosted in Brazil with full acceptance both from the DOEs involved in the assessments and from the CDM-EB. The selected 2015 vintage value for the monitoring parameter $EF_{grid,OM,y}$ = $EF_{grid,OM-DD,y}$ (0.5580 tCO_2/MWh) was confirmed by the EPIC verification to correctly represent the official value for $EF_{grid,OM,y}$ = $EF_{grid,OM-DD,y}$ for year 2015 as published by the DNA of Brazil /73/. In summary, it is EPIC opinion that the selection and reporting of the monitoring parameter $EF_{grid,OM,y}$ = $EF_{grid,OM-DD,y}$ is deemed correct and acceptable.
	Does the applied monitoring data management process (from monitoring equipment/instrument to emission reduction calculation) ensure correct recording, transfer and reporting of data to be used for the emission reductions calculations? Are necessary/applicable QA/QC processes in place?	Not applicable. There are no measurements or measurement instruments/equipment involved for the definition of $EF_{grid,OM,y}$ = $EF_{grid,OM-DD,y}$.

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 and for each individual flare, 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 companies Ecosampling Ambiental Ltda. and Merieux NutriSciences / Bioagri Ambiental Ltda. were selected by Essencis Soluções Ambientais S.A. for performing all measurements related to the determination of the set of biannual values for $F_{CH4,EG,t}$ for each individual flare. As outlined in the test/evaluation technical reports /71/ /72/ issued by Ecosampling Ambiental Ltda. and Merieux NutriSciences / Bioagri

		Ambiental Ltda., performance of measurements for the determination of the set of values for $F_{CH4,EG,t}$ for each flare (calculation sub-parameters $F_{CH4,EG,t,flare-1}$, $F_{CH4,EG,t,flare-2}$, $F_{CH4,EG,t,flare-3}$ and $F_{CH4,EG,t,flare-4}$) valid for the considered monitoring period occurred in the following dates: - Flares 1, 2, 3 and 4: 08/06/2015 (measurements performed by Ecosampling Ambiental Ltda.) - Flare 4: 01/12/2015 (measurements performed by Merieux NutriSciences / Bioagri Ambiental Ltda.) - Flares 1 and 2: 22/12/2015 (measurements performed by Merieux NutriSciences / Bioagri Ambiental Ltda.) - Flare 3: 22/02/2016 (measurements performed by Merieux NutriSciences / Bioagri Ambiental Ltda.)
	Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	As per the PDD /72/, measurements and calculations for the determination of values for the monitoring parameter $F_{CH4,EG,t}$ for each individual flare are to be performed biannually. As per the applicable guidance of the methodological tool "Project emissions from flaring" (version 02.0.0) /12/, "*(…) 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* ". While the considered monitoring period encompasses 230 days, 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 /73/ and in the test/evaluation reports /71/ /72/ 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 flares, the following measuring instruments were used: - Measurements performed by Ecosampling Ambiental Ltda. on 08/06/2015 (Flares 1, 2, 3 and 4): for performing the measurements of amount of residual methane in the exhaust gas of the flare, an analyzer FID / California Analytical Instruments (CAI) model 600 MHFID was utilized by the independent 3rd party inspection service company Ecosampling Ambiental Ltda. Moreover, for determining the speed of exhaust gas in the flare (in order to calculate the flow of exhaust gas of the flares), an appropriated Pitot tube was used by Ecosampling Ambiental Ltda. as part of the measurements.

		As per information made available in the technical evaluation/testing report /71/ issued by Ecosampling Ambiental Ltda., applicable measurement and test methodologies of U.S.A. Environmental Protection Agency (US-EPA) and CETESB (Companhia Ambiental do Estado de São Paulo (Environmental Agency for São Paulo State in Brazil)) were applied as follows: • US-EPA Method 25A – "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer" • CETESB L9.221 – "Stacks and chimneys in stationary emission sources - Sampling points determination procedure" • CETESB L9.222 - "Stacks and chimneys in stationary emission sources – Determination of speed and outflow of gases" - Measurements performed by Merieux NutriSciences / Bioagri Ambiental Ltda. on 01/12/2015 (Flare 4), 22/12/2015 (Flares 1 and 2) and 22/02/2016 (Flare 3): for performing the measurements of amount of residual methane in the exhaust gas of the flare a chromatographer Itron C13I0021574D (manufactured by Itron Soluções para Energia e Água Ltda.) was utilized by the independent 3rd party inspection service company BIOAGRI Ambiental Ltda. / Mérieux NutriSciences Brasil. 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 manufactured by APEX Instruments was used by BIOAGRI Ambiental Ltda. / Mérieux NutriSciences Brasil as part of the measurements. As per information made available in the technical evaluation/testing report /72/ issued by Merieux NutriSciences / Bioagri Ambiental Ltda., applicable measurement and test methodologies of U.S.A. Environmental Protection Agency (US-EPA) and CETESB (Companhia Ambiental do Estado de São Paulo (Environmental Agency for São Paulo State in Brazil)) were applied as follows: • US-EPA Method 18 – "Measurement of Gaseous Organic Compound Emission by Gas Chromatography" • CETESB L9.221 - "Pipelines and chimneys in stationary emission	

		sources - Sampling points determination procedure" • CETESB L9.222 - "Pipeline and chimneys in stationary emission sources – Determination of speed and outflow of gases" • CETESB L9.223 – "Pipeline and chimneys in stationary emission sources – Determination of dry molecular mass and the excess of the air flow gas" • CETESB L9.224 - "Pipeline and chimneys in stationary emission sources – "Determination of humidity of effluents"
	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 [12] and ACM0001 (version 13.0.0) [17] 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]: *"Both independent 3rd party inspection service companies Ecosampling Ambiental Ltda. and Merieux NutriSciences / Bioagri Ambiental Ltda.. are licensed independent third party inspections services companies specialized in inspections and testing of air emissions from stationary sources. In Brazil, operation of inspection entities and labs are regulated by the Instituto Nacional de Metrologia, Qualidade e Tecnologia (INMETRO) (the Brazilian national authority for metrology and certification affairs).*" In summary, it is the opinion of EPIC that Ecosampling Ambiental Ltda. and Merieux NutriSciences / Bioagri Ambiental Ltda. performing related measurements with the measurement instruments indicates above and following the applicable measurement and test methodologies of the US-EPA and CETESB represent a good practice for the determination of $F_{CH4,EG,t}$. The EPIC verification team has assessed the Technical specifications sheets for the gas analyzer 600 MHFID California Analytical Instruments (CAI) [75] utilized by Ecosampling Ambiental Ltda. and for the chromatographer Itron C13I0021574D utilized by

		Merieux NutriSciences / Bioagri Ambiental Ltda. /43/ and was able to confirm this type of gas analyzer is appropriate for performing gas related analysis and measurements in enclosed high temperature flares. Licensing information/status for the inspection service companies Ecosampling Ambiental Ltda. /88/ and Merieux NutriSciences / Bioagri Ambiental Ltda. /44// vis-a-vis 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 /71/ /72/ for the performed measurements of $F_{CH4,EG,t}$ issued by the inspection service companies Ecosampling Ambiental Ltda. and Merieux NutriSciences / Bioagri Ambiental 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 /71/ /72/.
	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 /71/ /72/ issued by Ecosampling Ambiental Ltda. and Merieux NutriSciences / Bioagri Ambiental 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 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 "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:	During the considered monitoring period, continuous measurements of the monitoring parameter $T_{EG,m}$ were recorded/reported with an every minute frequency.

		As correctly outlined in the latest version of the Monitoring Report [3], while measurements for the monitoring parameter $T_{EG,m}$ are performed by the installed 4 thermocouples (one thermocouple for each individual installed flare), this monitoring parameter is thus measured, recorded and reported on the basis of the following sub-parameters: - $T_{EG,m,flare-1}$: Temperature of exhaust gas in Flare 1 - $T_{EG,m,flare-2}$: Temperature of exhaust gas in Flare 2 - $T_{EG,m,flare-3}$: Temperature of exhaust gas in Flare 3 - $T_{EG,m,flare-4}$: Temperature of exhaust gas in Flare 4 This is deemed correct, acceptable and under conformance with requirements of ACM0001 (version 13.0.0) [7] and applicable methodological tools.
	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 13.0.0) [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 13.0.0) [7] and the PDD [2].
	Type of monitoring equipment/instrument:	Measurements of $T_{EG,m,flare-1}$, $T_{EG,m,flare-2}$, $T_{EG,m,flare-3}$ and $T_{EG,m,flare-4}$ are continuously performed by 4 installed thermocouples (one for each installed high temperature enclosed flare). *Thermocouples used for measuring the sub-parameter $T_{EG,m,flare-1}$*: The specifications of the thermocouples installed on Flare 1 to measure $T_{EG,m,flare-1}$ during the considered monitoring period are presented below:

Specifications of the first thermocouple installed on Flare 1 (measurements for the sub-parameter $T_{EG,m,flare-1}$)	
Manufacturer	Naka Comércio e Indústria de Instrumentação Industrial Ltda.
Model	NKTC-3000, type N
Serial Number	099160

Internal instrument/ equipment identification	TT11
Accuracy	±0.75%

Source: [74]

Thermocouple used for measuring the sub-parameter $T_{EG,m,flare-2}$:
The specifications of the thermocouple installed on Flare 2 to measure $T_{EG,m,flare-2}$ during the considered monitoring period are presented below:

Specifications of the thermocouple installed on Flare 2 (measurements for the sub-parameter $T_{EG,m,flare-2}$)	
Manufacturer	Naka Comércio e Indústria de Instrumentação Industrial Ltda.
Model	NKTC-3000, type N
Serial Number	099157
Internal instrument/ equipment identification	TT12
Accuracy	±0.75%

Source: [74]

Thermocouple used for measuring the sub-parameter $T_{EG,m,flare-3}$:
The specifications of the thermocouple installed on Flare 3 to measure $T_{EG,m,flare-3}$ during the considered monitoring period are presented below:

Specifications of the thermocouple installed on Flare 3 (measurements for the sub-parameter $T_{EG,m,flare-3}$)	
Manufacturer	Naka Comércio e Indústria de Instrumentação Industrial Ltda.
Model	NKTC-3000, type N
Serial Number	099158
Internal instrument/ equipment identification	TT13
Accuracy	±0.75%

Source: [74]

Thermocouple used for measuring the sub-parameter $T_{EG,m,flare-4}$:
The specifications of the thermocouple installed on Flare 4 to measure $T_{EG,m,flare-4}$ during the considered monitoring period are presented below:

		Specifications of the thermocouple installed on Flare 4 (measurements for the sub-parameter $T_{EG,m,flare-4}$) Manufacturer: Naka Comércio e Indústria de Instrumentação Industrial Ltda. Model: NKTC-3000, type N Serial Number: 099159 Internal instrument/ equipment identification: TT14 Accuracy: ±0.75% Source: [74]
	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 13.0.0) [7] do not specify any accuracy requirement for the thermocouples installed at the project site. The accuracy range for the installed instruments is ±0.75%. It is EPIC contention that the use of the installed instruments represents good practice for monitoring of temperature in the exhaust gas of the flares.
	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 temperature in the exhaust gas of each flare (calculation sub-parameters $T_{EG,m,flare-1}$, $T_{EG,m,flare-2}$, $T_{EG,m,flare-3}$ and $T_{EG,m,flare-4}$.) 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 by a display existent in the flare control panel (which are located next to the flares) (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 ($V_{t,wb}$) (sub-parameters $V_{t,wb,flare-1}$, $V_{t,wb,flare-2}$, $V_{t,wb,flare-3}$ and $V_{t,wb,flare-4}$) - 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* ($T_{EG,m}$) (sub-parameters $T_{EG,m,flare-1}$, $T_{EG,m,flare-2}$, $T_{EG,m,flare-3}$ and $T_{EG,m,flare-4}$) - Flame detection of flare in the minute *m* ($Flame_m$) (sub-parameters $Flame_{m,flare-1}$, $Flame_{m,flare-2,}$ $Flame_{m,flare-3}$ and $Flame_{m,flare-4}$) 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? Are necessary/applicable QA/QC processes in place?	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.

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:	During the considered monitoring period, the operational status of the flares was recorded and reported every-minute on the basis of continuous measurements of the status of flame in the flares. As correctly outlined in the latest version of the Monitoring Report [/3/], while measurements for $Flame_m$ are performed by the installed 4 UV flame detectors (one flame detector for each individual installed flare), this monitoring parameter is thus measured, recorded and reported on the basis of the following sub-parameters: - $Flame_{m,flare-1}$: Flame detection status for Flare 1 - $Flame_{m,flare-2}$: Flame detection status for Flare 2 - $Flame_{m,flare-3}$: Flame detection status for Flare 3 - $Flame_{m,flare-4}$: Flame detection status for Flare 4 This is deemed correct, acceptable and under conformance with requirements of ACM0001 (version 13.0.0) [/7/] and applicable methodological tools. As confirmed by the EPIC verification team through assessment of the 5 monthly emission reduction calculation spreadsheets [/5/], for every minute *m* during which flame was detected in the flare *n* (where n = 1, 2, 3 and 4), the flame status of the measured flare for each minute is set as 1 (1 = Flame "*on*"), otherwise the flame status of this flare for the given minute is set to 0 (0 = 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 13.0.0) [/7/]), the operational status of each flare (calculation sub-parameters $Flame_{m,flare-1}$, $Flame_{m,flare-2}$, $Flame_{m,flare-3}$ and $Flame_{m,flare-4}$) 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 13.0.0) [/7/] and the PDD [/2/].
	Type of monitoring equipment/instrument:	Monitoring of the operational status of each flare (calculation sub-parameters $Flame_{m,flare-1}$, $Flame_{m,flare-2}$, $Flame_{m,flare-3}$ and $Flame_{m,flare-4}$) is performed by 4 installed UV flame detectors (one for each installed high temperature enclosed flare). *UV Flame detector used for monitoring $Flame_{m,flare-1}$*: Specifications of the UV Flame detector

installed on Flare 1	
Manufacturer	SELCON Sistemas Eletrônicos de Controle Ltda.
Model	SEL-SV-UL-K4
Serial Number	323730808
Internal instrument/ equipment identification	UV01
Working hours (lifetime)	50,000 h

Source: [50]

UV Flame detector used for monitoring $Flame_{m,flare\text{-}2}$:

Specifications of the UV Flame detector installed on Flare 2	
Manufacturer	SELCON Sistemas Eletrônicos de Controle Ltda.
Model	SEL-SV-UL-K4
Serial Number	55600905
Internal instrument/ equipment identification	UV02
Working hours (lifetime)	50,000 h

Source: [50]

UV Flame detector used for monitoring $Flame_{m,flare\text{-}3}$:

Specifications of the UV Flame detector installed on Flare 3	
Manufacturer	Honeywell Analytics Ltd
Model	C7061
Serial Number	R7861
Internal instrument/ equipment identification	UV03
Working hours (lifetime)	40,000 h

Source: [52]

UV Flame detector used for monitoring $Flame_{m,flare\text{-}4}$:

Specifications of the UV Flame detector installed on Flare 4	
Manufacturer	SELCON Sistemas Eletrônicos de Controle Ltda.
Model	SEL-SV-210230-K6
Serial Number	565400312
Internal instrument/ equipment	UV04

		identification | Working hours (lifetime) | 50,000 h Source: [51]
	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 measured values for Flame detection of flare in the minute *m*.
	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 ($V_{t,wb}$) (sub-parameters $V_{t,wb,flare-1}$, $V_{t,wb,flare-2}$, $V_{t,wb,flare-3}$ and $V_{t,wb,flare-4}$) - 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* ($T_{EG,m}$) (sub-parameters $T_{EG,m,flare-1}$, $T_{EG,m,flare-2}$, $T_{EG,m,flare-3}$ and $T_{EG,m,flare-4}$) - Flame detection of flare in the minute *m* ($Flame_m$) (sub-parameters $Flame_{m,flare-1}$, $Flame_{m,flare-2}$, $Flame_{m,flare-3}$ and $Flame_{m,flare-4}$) 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? Are necessary/applicable QA/QC processes in place?	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.

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

Data / Parameter: (as per the monitoring plan of the PDD):	Maintenance events completed in year *y* as monitored by the project participants ($Maintenance_y$)
Measuring, recording and reporting frequencies:	As per the implemented monitoring procedure adopted at Essencis Soluções Ambientais S.A., all the maintenance events performed at the project site are by the staff of the project participant and project operator Essencis Soluções Ambientais S.A. 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 4 installed flares during the considered monitoring period. The listed events (dated 07/02/2015, 07/06/2015, 08/06/2015 and 03/08/2015) encompass general inspection/maintenance services (incl. inspection of the condition of the flare isolation ceramics revetment material, checking of conditions of the LPG supply valve for pilot flame, checking of condition/function of the air inlet dumpers, checking of the conditions of the thermocouples, checking of the condition of the UV flame detector, checking of the condition of the flame arrester valve, checking of the conditions of the LFG injectors, checking of painting conditions). As also appropriately outlined in the Monitoring Report /3/, general inspection/maintenance services on the flares are opportunely performed during planned or unplanned interruptions of

		operation of the flares. Moreover, as also highlighted in the Monitoring Report, the isolation ceramics revetment material of the Flare 1 and Flare 2 were replaced once in February 2009 and February 2012 respectively. For the Flare 3 and Flare 4 (which were installed in July 2011 and February 2012 respectively), the isolation ceramics revetment material was not yet replaced. As indicated in the PDD /2/, the expected lifetime for the isolation ceramics revetment material for the flares 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" ($SPEC_{flare}$)). It is also important to note that a service intervention was also performed on 08/06/2015 for each one of the 4 installed high temperature enclosed flares in order to address previously detected undesirable and abnormal intermittent/sporadic vibration + noise problems in the flares.	
	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 13.0.0) /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 13.0.0) /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 flares installed as part of the project activity (incl. log book with details about historical of performed interventions (repair, maintenance and calibration services) at the flares /24/).	
	How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction	Not applicable. While all performed maintenance events in the installed flares (including inspection and/or replacement of flare revetment material) were performed in accordance with requirements	

calculation spreadsheet) verified and/or compared?	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 "Quantity of LPG consumed by the project activity in year y" ($FC_{LPG,y}$):

Data / Parameter: (as per the monitoring plan of the PDD):	Quantity of LPG consumed by the project activity in year *y* ($FC_{LPG,y}$)
Measuring, recording and reporting frequencies:	During the monitoring period from 16/05/2015 to 31/12/2015, measurements of $FC_{LPG,y}$ were performed by the local LPG distribution company Cia Ultragas S.A. as part of each LPG delivery event.
Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	As per the PDD [12], continuous measurements of $FC_{LPG,y}$ are to be monitored with a frequency not lower than once a month.
Type of monitoring equipment/instrument:	Monitoring records for $FC_{LPG,y}$ were measured by a weight scale with the specifications provided below. Specifications of the weight scale used for measuring LPG mass Manufacturer: Mettler-Toledo Inc. Model: 2180 Serial Number: 10423008 Capacity: Max. 250 kg Accuracy: ± 50 grams Source: [62]
Is the accuracy of the monitoring	The PDD [12] and ACM0001 (version 13.0.0) [17] do not specify any measurement requirement for

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?	monitoring consumption of LPG. The accuracy for the installed scale is ± 50 grams. It is EPIC opinion that the use of this kind of weight scale represents good practice for measuring consumption of LPG by the project activity.
If applicable, has the reported monitoring data been cross-checked with other available data or source?	EPIC verification team has compared the records of LPG delivered to the CTR Caieiras landfill as reported in the summarized emission reduction calculation spreadsheet /5/ and Monitoring Report /3/ with declaration/communication /60/ issued by the local LPG distribution company Cia. Ultragaz S.A. confirming the quantities of LPG supplied to Essencis Soluções Ambientais S.A. during the period from May 2015 to December 2015. Declared values valid for the monitoring period from 16/05/2015 to 31/12/2015 were compared against values for LPG cost expenditures and notes of delivery events of LPG in the project site as per available records in the financial/accounting management system of Essencis Soluções Ambientais S.A. /76/.
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 values for $FC_{LPG,y}$ as reported in the summarized emission reduction calculation spreadsheet /5/ and Monitoring Report /3/ are in accordance with provided evidences of primary records /60/ /76/.
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 "Net calorific value of the fuel LPG" ($NCV_{LPG,y}$):

Data / Parameter: (as per the monitoring plan of the PDD):	Net calorific value of the fuel LPG ($NCV_{LPG,y}$)
Measuring, recording and reporting frequencies:	Not applicable. The selected value for $NCV_{LPG,y}$ (46.5 GJ/ton_{LPG}) corresponds to the National default value as per the Brazilian National Energetic Balance Report for year 2015 (Balanço Energético Nacional (BEN) – 2015) / Table VIII.9 – Specific Mass and Heating Values

		(Higher Heating Value) [77]. The determination of $NCV_{LPG,y}$ is also in accordance with applicable guidance of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" [15]. No measurement or calculation was performed in the context of the determination of the parameter and no monitoring equipment/instrument was used either.
	Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	As per the PDD [2], "*(…) In case regional or national default values or IPCC default values are considered an every year monitoring frequency is applied."*. The adopted monitoring frequency (annual national default value) is thus in accordance with the PDD [2].
	Type of monitoring equipment/instrument:	Not applicable. No measuring instrument was used for determining the value of the parameter during the considered monitoring period.
	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. No measuring instrument was used for determining the value of the parameter during the considered monitoring period.
	If applicable, has the reported monitoring data been cross-checked with other available data or source?	In order to confirm that the selected value for $NCV_{LPG,y}$ indeed corresponds to the value as per the default values published in the Brazilian Energetic Balance Report 2015 [77], EPIC verification team assessed this report. Moreover, as part of its verification assessment, the EPIC verification team also confirms that the determination of $NCV_{LPG,y}$ is indeed in accordance with applicable guidance of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" [15]. Moreover, EPIC has also confirmed that the reported value is within the uncertainty range of the IPCC default value (as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines [11]).
	How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	See above.
	Does the applied monitoring data management process (from monitoring equipment/instrument to	Not applicable.

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

Assessment details for the monitoring parameter "CO_2 emission factor of fuel LPG in year y" ($EF_{CO2,LPG,y}$):

Data / Parameter: (as per the monitoring plan of the PDD):	CO_2 emission factor of fuel LPG in year *y* ($EF_{CO2,LPG,y}$)
Measuring, recording and reporting frequencies:	Not applicable. The value for the monitoring parameter $EF_{CO2,LPG,y}$ is selected as 0.0656 tCO_2/GJ which corresponds to the default value as per the IPCC Guidelines for National Greenhouse Gas Inventories, 2006 (IPCC, 2006), Chapter 1, Volume 2, Table 1.4 (value at the upper limit of the uncertainty at 95% confidence interval) /11/. The determination of $EF_{CO2,LPG,y}$ is in accordance with applicable guidance of the Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" /15/. No measurement or calculation was performed in the context of the determination of the parameter $EF_{CO2,LPG,y}$ and no monitoring equipment/instrument was used either.
Are measuring, recording and reporting frequencies in accordance with the monitoring plan and monitoring methodology? (Yes / No)	As per the PDD /2/, "*(…) In case regional or national default values or IPCC default values are considered an every year monitoring frequency is applied."*. The adopted monitoring frequency (annual IPCC default value) is thus in accordance with the PDD /2/.
Type of monitoring equipment/instrument:	Not applicable. No measuring instrument was used for determining the value of the parameter during the considered monitoring period.
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. No measuring instrument was used for determining the value of the parameter during the considered monitoring period.
If applicable, has the reported monitoring data been cross-checked with other available data or source?	In order to confirm that the selected value for $EF_{CO2,LPG,y}$ indeed corresponds to the default value as per the IPCC Guidelines for National Greenhouse Gas Inventories, 2006, Volume 2, Chapter 1, Table 1.4 /11/ (value at the upper limit of the uncertainty at 95% confidence interval),

	the EPIC Assessment Team assessed these IPCC guidelines. Moreover, as part of its verification assessment, the EPIC verification team also confirms that the determination of $EF_{CO2,LPG,y}$ is indeed in accordance with applicable guidance of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" /15/.
How were the values in the Monitoring Report (and/or supporting documents, i.e emission reduction calculation spreadsheet) verified and/or compared?	See above.
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 "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	Not applicable. The determination of applicable value for the monitoring parameter $p_{H2O,t,sat}$ is not based on measurements.

	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?	
	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 02.0.0) /14/, which refers to the literature "Fundamentals of Classical Thermodynamics" /87/.
	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.

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[8].

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 ($v_{CH4,t,db}$)

[8] While Option C of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0) 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 02.0.0) 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 02.0.0) was not selected.
- $M_{t,db}$ was not monitored as Option D of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0) was not selected.

	Mass flow of the LFG stream in time interval *t* on dry basis ($M_{t,db}$) *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 SQL based database with a data recording/reporting frequency of every one minute: - Volumetric flow of LFG stream in time interval *t* on a wet basis ($V_{t,wb}$) (sub-parameters $V_{t,wb,flare-1}$, $V_{t,wb,flare-2}$, $V_{t,wb,flare-3}$ and $V_{t,wb,flare-4}$), - 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* ($T_{EG,m}$) (sub-parameters $T_{EG,m,flare-1}$, $T_{EG,m,flare-2}$, $T_{EG,m,flare-3}$ and $T_{EG,m,flare-4}$) - Flame detection of flare in the minute *m* ($Flame_m$) (sub-parameters $Flame_{m,flare-1}$, $Flame_{m,flare-2,}$ $Flame_{m,flare-3}$ and $Flame_{m,flare-4}$) As confirmed by the EPIC verification team, the project's customized SQL based data-server is directly connected to the project's data supervisor system model E3. The project's data supervisor system was designed by the IT solution/provider company Elipse Software Ltda. As per the operational of the customized E3 data supervisor platform, two data files are generated every week (with summarized files being registered in the end of each month) as follows: - a MS-Excel format spreadsheet file /6/ with every one-minute values for $V_{t,wb}$ (sub-parameters $V_{t,wb,flare-1}$, $V_{t,wb,flare-2}$, $V_{t,wb,flare-3}$ and $V_{t,wb,flare-4}$, $w_{CH4,y}$), $v_{CH4,t,wb}$, T_t, P_t, $T_{EG,m}$ (sub- parameters $T_{EG,m,flare-1}$, $T_{EG,m,flare-2}$, $T_{EG,m,flare-3}$ and $T_{EG,m,flare-4}$) and $Flame_m$ (sub-parameters $Flame_{m,flare-1}$, $Flame_{m,flare-2}$, $Flame_{m,flare-3}$ and $Flame_{m,flare-4}$) are generated - a PDF format file with the same monitoring recording details made available at the MS-Excel spreadsheet [9]. It is EPIC opinion that the use of the E3 data supervisor system and the customized SQL[10] based 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 Essencis Soluções Ambientais S.A. As also confirmed by the EPIC verification team, as an additional improvement in the project activity in the context of the occurred gradual moving of the whole installed project's LFG destruction infrastructure (project's LFG flaring facility) to other area/region within the CTR Caieiras landfill, a new programmable logic controller (PLC) unit and new electronic database for monitoring records were also

[9] While each monthly MS-Excel format and PDF format data files contain identical every-minute LFG and flaring related monitoring records for the whole month period encompassed by the considered monitoring period, the PDF format files are used for storage of monitoring data as the project's SQL database have limited data storage capacity. This was confirmed by the EPIC verification team.

[10] SQL (sometimes also referred to as Structured Query Language) is a programming language designed for managing data in relational database management systems. SQL is currently the most widely used database language.

installed for the project activity and also started to operate on 18/12/2015 (with the old database being kept available for sake of historical monitoring data archiving).

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

SQL-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 model E3.

As per the implemented monitoring procedure, at regular time intervals, the monitoring manager for the project activity exports/converts data from SQL-format into an MS-Excel-format (.xls files) by using the data supervisor system model E3. Data is also exported/converted into a PDF-format to ensure a backup file in the data base. These data exports/conversions into PDF and MS-Excel formats are performed by selecting the related functions (buttons) in the user graphical interface of the data supervisor system model E3.

Also as part of the implemented project's monitoring procedure, 8 monthly generated MS-Excel format "raw-data" files /6/ resulted from regular data exports were thus used as primary monitoring input data for the emission reduction calculations (as established in the applicable work procedure of Essencis Soluções Ambientais S.A.).

For the monitoring period from 16/05/2015 to 31/12/2015, as per the adopted work procedures, a set of 8 monthly "raw-data" MS-Excel-format files were generated. Moreover, a set of 8 "PDF-format" files were also generated. As outlined in the Monitoring Report /3/, the "raw-data" files /6/ in PDF format were generated for checking purposes. The set of 8 MS-Excel "raw-data" files /6/ were used as primary monitoring data input for the compilation of the 5 monthly emission reduction calculations as follows:

Period	File Names
May 2015	*"may-15.xls"*
June 2015	*"jun-15.xls"*
July 2015	*"jul-15.xls"*
August 2015	*"aug-15.xls"*
September 2015	*"sep-15.xls"*
October 2015	*"oct-15.xls"*
November 2015	*"nov-15.xls"*
December 2015	*"dec-15.xls"*

The set of 8 generated MS-Excel-format "raw-data" files /6/ and the set of generated 8 PDF-format "raw data" files /95/ were made available and assessed by EPIC verification team. All raw data files contains, for each minute of the considered monitoring period, historical monitoring records for LFG flow sent to each flare, LFG pressure, LFG temperature, CH_4 content of LFG, temperature of the exhaust gas of the flares as well as flame status of each flare, which are used for the calculation of GHG emission reductions. As verified by EPIC, while 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 and PDF formats, 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 set of 8 monthly emission reduction spreadsheets /5/ valid for the considered monitoring period, every-minute measurement records of the set of LFG and flaring related

parameter, as presented in the raw-data files, were used as input data for the compilation of the 8 monthly MS-Excel format emission reduction calculation spreadsheets /5/.

As per the adopted monitoring procedure and in accordance with the requirements of ACM0001 (version 13.0.0) /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
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 grid sourced electricity consumed by the project activity ($TDL_{grid,y}$)	20%
Weighting of build margin emissions factor (w_{BM})	75%
Weighting of operating margin emissions factor (w_{OM})	25%
Build margin CO2 emission factor in year *y* ($EF_{grid,BM,y}$)	0.2010 tCO_2/MWh
Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval ($SPEC_{flare}$)[11]	$SPEC_{flare,\ Flare\ 1}$ $SPEC_{flare,\ Flare\ 2}$ $SPEC_{flare,\ Flare\ 3}$ $SPEC_{flare,\ Flare\ 4}$ — Min. — Max.

[11] Section E.6.1 includes relevant and additional assessment details valid for the ex-ante determined parameter Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval ($SPEC_{flare}$) valid for the considered monitoring period.

Operational LFG flow for each flare (for continuous operation) until the occurred performance of service intervention on 08/06/2015	650 Nm^3/h	6,500 Nm^3/h
Operational LFG flow for each flare (for continuous operation) after the occurred performance of service intervention on 08/06/2015	650 Nm^3/h	7,500 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	1,200 ^oC
Required minimum frequency for inspection and maintenance service in each flare (incl. inspection in the conditions of the flare isolation ceramics revetment material):	Min. every 6 months	
Required/recommended minimum frequency for replacement of the flare isolation ceramics revetment material in each flare:	after 10 years of regular and appropriate operation	

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 each one of the 8 months of the monitoring period were partially calculated through application of the *blank* version of the spreadsheet template that is developed by the project participant Essencis Soluções Ambientais S.A. and termed "monthly 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 monthly values for the calculation parameters "Amount of methane in the LFG which is flared and/or used in the project activity" ($F_{CH4,PJ,y}$) and "Amount of methane in the LFG that would be flared in the baseline scenario (absence of project activity)" ($F_{CH4,BL,y}$):

- Monitoring records included in the 8 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 "*FE calculation spreadsheet*" (file name "*MR 12 - Caieiras - V.2 - 17.05.2016 - 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 16/05/2015 to 31/12/2015 encompassing 8 months of years 2015, 8 monthly calculated spreadsheets /5/ were thus generated as a result of the use of the spreadsheet template for each individual month encompassed by the considered monitoring period. Each one of the elaborated 8 monthly emission reduction calculation spreadsheet files /5/ aggregates (reports) the following recorded monitoring data on an every-minute recording/reporting frequency (folder "Output"):

- Volumetric flow of LFG sent to each high temperature enclosed flare (monitoring parameter "Volumetric flow of LFG stream in time interval *t* on a wet basis" ($V_{t,wb}$) on the basis of the sub-parameters $V_{t,wb,flare-1}$, $V_{t,wb,flare-2}$ $V_{t,wb,flare-3}$ and $V_{t,wb,flare-4}$);

- Methane fraction in the LFG (monitoring parameter "Volumetric fraction of CH_4 in the 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 flares (monitoring parameter "Temperature in the exhaust gas of the enclosed flare in minute *m*" ($T_{EG,m}$) on the basis of the sub-parameters $T_{EG,m,flare-1}$, $T_{EG,m,flare-2}$, $T_{EG,m,flare-3}$ and $T_{EG,m,flare-4}$);

- Flame status of the flares (monitoring parameter "Flame detection of flare in the minute *m*" ($Flame_m$) on the basis of the sub-parameters $Flame_{m,flare-1}$, $Flame_{m,flare-2}$, $Flame_{m,flare-3}$ and $Flame_{m,flare-4}$).

An additional calculation spreadsheet (termed "Summarized emission reduction calculation spreadsheet") (file name "*MR 12 - Caieiras - V.2 - 17.05.2016.xls*") /5/ correctly summarizes the achieved baseline emissions due to destruction of methane by the project activity during the considered monitoring period (by summing the accumulated monthly values for the calculation parameters $F_{CH4,PJ,y}$ and also summing the accumulated monthly values for the calculation parameters $F_{CH4,BL,y}$ from each one of the 8 monthly emission reduction spreadsheets /5/). Further assessment details about the calculation of baseline emissions are included in Section E.8.1.

Project emissions due to consumption of both LPG and grid-sourced electricity by the project activity 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 in the year *y* ($EC_{PJ,y}$), Operation margin CO_2 emission factor in year *y* = Dispatch data analysis operating margin CO_2 emission factor in year *y* ($EF_{grid,OM,y}$ = $EF_{grid,OM-DD,y}$), Quantity of LPG consumed by the project activity in year *y* ($FC_{LPG,y}$), Net calorific value of the fuel LPG ($NCV_{LPG,y}$) and CO_2 emission factor of fuel LPG in year *y* ($EF_{CO2,LPG,y}$)) and (ii) related *ex-ante* determined parameters (Average technical transmission and distribution losses for grid sourced electricity consumed by the project activity ($TDL_{grid,y}$), Weighting of build margin emissions factor (w_{BM}), Weighting of operating margin emissions factor (w_{OM}) and Build margin CO_2 emission factor in year *y* ($EF_{grid,BM,y}$)). Further assessment details about the calculation of project emissions are included in Section E.8.2.

The 8 MS-Excel-format monthly emission reduction calculation spreadsheets files /5/ and the summarized emission reduction calculation spreadsheet /5/ were all made available and assessed by the EPIC verification team.

While the EPIC verification team was able to confirm that such 8 monthly emission reduction spreadsheets /5/ correctly calculate and report the accumulated values of the calculation parameters "Amount of methane in the LFG which is flared and/or used in the project activity" ($F_{CH4,PJ,y}$) and "Amount of methane in the LFG that would be flared in the baseline scenario (absence of project activity)" ($F_{CH4,BL,y}$) for each individual month encompassed by the considered monitoring period, the summarized emission reduction calculation spreadsheet /5/ correctly summarizes the emission reductions for the whole monitoring period (by correctly considering selected accumulated values of $F_{CH4,PJ,y}$ and $F_{CH4,BL,y}$ from the 8 monthly emission reduction spreadsheets /5/ + *ex-ante* determined parameters as input data + monitoring records for the monitoring parameters which are not automatically recorded/reported by the project's PLC unit).

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 13.0.0) /7/,
- "Tool to calculate baseline, project and/or leakage CO_2 emissions from fossil fuel combustion" (version 02) /15/,
- "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 01) /13/,
- "Tool to calculate the emission factor for an electricity system" (versions 3.0.0 /16/ and 04.0) /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 02.0.0) /14/,
- Monitoring plan of the PDD /2/.

The table below presents the reported results of the generated 8 monthly emission reduction spreadsheets and the summarized emission reduction calculation spreadsheet:

File name for the monthly emission reduction calculation spreadsheets	Period	Reported amount of methane flared ($F_{CH4,PJ,y}$)
"052015.xls"	16/05/2015 - 31/05/2015	1,369 tCH_4
"062015.xls"		2,696 tCH_4
"072015.xls"		3,216 tCH_4
"082015.xls"		3,409 tCH_4
"092015.xls"		3,111 tCH_4
"102015.xls"		3,070 tCH_4
"112015.xls"		2,002 tCH_4
"122015.xls"		1,985 tCH_4

"MR 12 - Caieiras - V.2 - 17.05.2016x.ls" (Summarized emission reduction calculation spreadsheet for the whole monitoring period)	From 16/05/2015 to 31/12/2015	20,849 tCH_4

As verified by the EPIC verification team, while the number of records exceeds 42,000 rows in for each individual MS-Excel format monthly emission reduction spreadsheet [/5/], 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 each one of the monthly emission reduction spreadsheets [/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 Essencis Soluções Ambientais S.A. 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 12th periodic verification, the host-country project participant and project operator Essencis Soluções Ambientais S.A. 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 Essencis Soluções Ambientais for addressing all raised outstanding issues (raised CARs).

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 Essencis Soluções Ambientais S.A. 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.

Data authenticity checking:
As part of the performed verification assessment, the EPIC verification team was able to confirm that the 8 monthly emission reduction calculation spreadsheets [/5/] completed by Essencis Soluções Ambientais S.A. are basically MS-Excel

spreadsheets that, in theory, could have recorded data being easily edited/modified (intentionally or unintentionally). Thus, these spreadsheets, if inappropriately edited, could potentially tamper reported monitoring records, thus resulting in unreal and incorrect calculation and reporting of emission reductions achieved by the project activity during the considered monitoring period. In order to ensure that all emission reductions calculations are entirely and correctly based on authentic and real monitoring records valid for the considered monitoring period, a *data authentic 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 Essencis Soluções Ambientais S.A. 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 8 monthly emission reduction spreadsheets 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 in PDF-format:
As appropriately outlined in the latest version of the Monitoring Report /3/, as part of the implemented data reporting and emission reduction calculation procedures applicable for the 2nd 7-year crediting period of the project activity, two sets of data files (with LFG and flaring related monitoring records) are regularly generated for each month of considered monitoring period as follows:

- One MS-Excel format spreadsheet file
- One PDF format data file

While each monthly MS-Excel format and PDF format data files contain identical every-minute LFG and flaring related monitoring records for the whole month period encompassed by the considered monitoring period, the PDF format files are used for storage of monitoring data as the project's SQL database have limited data storage capacity. The EPIC verification team has assessed the 8 monthly PDF format files valid for the considered monitoring period (which were previously retrieved from the data supervisor system model E3 unit of the LFG extracting and flaring station as part of the implemented monitoring procedure at Essencis Soluções Ambientais S.A.) and converted them into a format appropriate for handling data in MS-Excel application: files were converted into .txt format. The content of the .txt files was converted into MS-Excel format.

As an outcome of STEP 1, a new set of comparative files in MS-Excel format (with primary data inputs from the project's data supervisor system model E3 valid for the whole monitoring period) were generated. 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 8 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 8 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 set of 8 comparative monthly emission reduction calculation spreadsheets /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 set of 8 comparative monthly emission reduction spreadsheets /21/ was thus created. *STEP 3 – Comparison of emission reduction calculation spreadsheets developed by the project participant Essencis Soluções Ambientais S.A. against the created comparative monthly emission reduction spreadsheets and analysis of the results:* The calculated accumulated monthly values of the parameter $F_{CH4,PJ,y}$ in each one of the comparative monthly emission reduction spreadsheets /21/ (files generated under STEP 2) were compared against the corresponding accumulated values for the parameter $F_{CH4,PJ,y}$ in each one of the emission reduction spreadsheets /5/ previously created by the project participants as part of the monitoring/reporting process. As a result of STEP 3, by comparing files previously generated by the project participants against the files generated under STEP 2, the EPIC verification team was able to confirm that the generated set of 8 comparative monthly checking spreadsheets /21/ are identical to the 8 monthly emission reduction calculation spreadsheets /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 supervisor system model E3 and stored in PDF format 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 supervisor system model E3) were previously used by the project participants for the calculation of emission reductions as reported in the Monitoring Report /3/.
Findings	Two CARs 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: **CAR 2 (17/05/2016);** Specifications of the monitoring instruments installed during the considered monitoring period for measuring the monitoring parameters “Volumetric flow of LFG stream in time interval *t* on a wet basis” ($V_{t,wb}$) and “Temperature in the exhaust gas of the enclosed flare in minute *m*” ($T_{EG,m}$) are not in accordance with provided evidences. **CAR 3 (17/05/2016);** Information about the third-party inspection services company selected/hired by the project participants to perform the measurements and calculations 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”* ($F_{CH4,EG,t}$) are not in accordance with provided evidences.
Conclusion	In summary, upon closure of the raised related CARs, 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[12].
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 that all monitoring instruments/equipment installed at the project site have operated during the monitoring period from 16/05/2015 to 31/12/2015 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 events for equipment/instruments 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.
Company which has performed the applicable calibration events:	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.

[12] 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).

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 whole reporting period?	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.

Assessment of performed calibration events for equipment/instruments 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 02.0.0) /14/).
Calibration frequency /interval for the monitoring equipment/instrument:	As per the implemented monitoring procedure at Essencis Soluções Ambientais S.A. and recommendations from the equipment's manufacturer, the installed 4 LFG flow meters are calibrated every 2 years by a third party independent accredited calibration laboratory. *Calibration details for the flow meter used for measuring the sub-parameter $V_{t,wb,flare-1}$:* For the LFG flow meter with S/N 1412000235, a valid calibration event was performed on 04/06/2014 as indicated in the Certificate of Calibration No. 1412000235 1214 C7 /34/ issued by Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. This Certificate of Calibration was made available and was assessed by the EPIC verification team. *Calibration details for the flow meter used for measuring the sub-parameter $V_{t,wb,flare-2}$:* For the 1412000236 flow meter, a valid calibration event was performed on 04/06/2014 as indicated in the Certificate of Calibration No. 1412000236 1214 C7 /35/ issued by Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. This Certificate of Calibration was made available and was assessed by the EPIC verification team. *Calibration details for the flow meter used for measuring the sub-parameter $V_{t,wb,flare-3}$:*

		For the 1412000237 flow meter, a valid calibration event was performed on 04/06/2014 as indicated in the Certificate of Calibration No. 1412000237 1214 C7 /36/ issued by Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. This Certificate of Calibration was made available and was assessed by the EPIC verification team. *Calibration details for the flow meter used for measuring the sub-parameter $V_{t,wb,flare-4}$:* For the 1412000238 flow meter, a valid calibration event was performed on 04/06/2014 as indicated in the Certificate of Calibration No. 1412000238 1214 C7 /37/ issued by Contech Indústria e Comércio de Equipamentos Eletrônicos 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 13.0.0) /7/, the installed LFG flow meters are 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 13.0.0) /7/.	
	Company which has performed the applicable calibration events:	The calibration events performed for the installed 4 LFG flow meters that are valid for the considered monitoring period were all performed by Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. (manufacturer of the LFG flow meters).	
	Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Yes. The performed calibration events for the installed 4 LFG flow meters confirm proper functioning of these monitoring instruments.	
	Is(are) the performed calibration(s) valid for the whole reporting period?	Yes. The performed calibration events for the installed 4 LFG flow meters are valid for the whole considered monitoring period from 16/05/2015 to 31/12/2015. EPIC was able to confirm the validity of the performed calibration events for the installed LFG flow meters as follows: - Flow meter FT-01 with Serial Number 1412000235: calibration event performed on 04/06/2014, valid until 04/06/2016 (2 years) - Flow meter FT-02 with Serial Number 1412000236: calibration event performed on 04/06/2014, valid until 04/06/2016 (2 years)	

	- Flow meter FT-03 with Serial Number 1412000237: calibration event performed on 04/06/2014, valid until 04/06/2016 (2 years) - Flow meter FT-04 with Serial Number 1412000238: calibration event performed on 04/06/2014, valid until 04/06/2016 (2 years)

Assessment of performed calibration events for equipment/instruments used for monitoring the 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 ($v_{CH4,t,wb}$)
Calibration frequency /interval for the monitoring equipment/instrument:	As per the implemented monitoring procedure at Essencis Soluções Ambientais S.A., the installed CH_4 content gas analyzer unit is to be calibrated every 3 months by trained project activity's operational staff. This is confirmed by the EPIC verification team to be in accordance with recommendations from the equipment's manufacturer. Related Certificates of staff training /79/ were made available to the EPIC verification team. The performed 32 calibration events which are valid for the monitoring period from 16/05/2015 to 31/12/2015 were correctly performed by comparison with canisters of calibrated span gases purchased from a certified gas supplier. Two of the valid calibrations were performed on 15/05/2015 and 14/01/2016, which are dates prior and after the monitoring period. The certified span gases utilized for the calibration events of the CH_4 gas analyzer unit are summarized below: Set of certificates for the cylinder of span gases used for the calibration of the CH_4 content gas analyzer unit: - Gas cylinders with 99.999% N_2 span gas: cylinder n° 395939 /56/ (supplied by IBG – Indústria Brasileira de Gases Ltda.) - Gas cylinders with 99.999% N_2 span gas: cylinder n° 1507099 /45/ (supplied by IBG – Indústria Brasileira de Gases Ltda.) - Gas cylinders with 5.01% O_2 span gas: cylinder n° 3933516 /57/ (supplied by IBG – Indústria Brasileira de Gases Ltda.) - Gas cylinders with 59.95% CO_2 span gas: cylinder n° 4849733 /58/ (supplied by IBG – Indústria Brasileira de Gases Ltda.) - Gas cylinders with 60.01% CH_4 span gas: cylinder n° 4849720 /59/ (supplied by IBG – Indústria Brasileira de Gases Ltda.) As part of the performed calibration events, the

relationship (measurement deviation/error) between the measurements of CH_4 content performed in the utilized span standard with known/certified CH_4 content is established. Through this procedure, the potential measurement error/deviation for CH_4 content of collected LFG is identified and expressed as a percentage. Such measurement deviation/errors are indicated in the calibration notes. Information available in the calibration notes /53/ were assessed by EPIC. As outlined in the calibration notes /53/, the calibration events were performed in the dates indicated in the table below. Moreover, for each individual calibration event, measurement deviation/error for CH_4 content was identified as also indicated below:

CH_4 content gas analyzer unit	
Calibration Results/findings:	
Date of performed calibration events	Identified measurement deviation/error for CH_4 content measurements- Span - %)
15/05/2015	+0.17%
22/05/2015	+0.45%
29/05/2015	-0.01%
05/06/2015	+0.79%
12/06/2015	+0.05%
19/06/2015	+0.01%
26/06/2015	+0.59%
03/07/2015	+0.40%
10/07/2015	+0.50%
17/07/2015	-0.84%
24/07/2015	+0.75%
31/07/2015	+0.70%
07/08/2015	+0.57%
14/08/2015	+0.75%
21/08/2015	+1.64%
28/08/2015	+0.40%
11/09/2015	+0.04%
18/09/2015	+0.10%
24/09/2015	+0.13%
01/10/2015	+0.95%
08/10/2015	+0.29%
15/10/2015	-0.32%
22/10/2015	+0.19%
29/10/2015	+0.40%
05/11/2015	+0.10%
13/11/2015	+0.18%
19/11/2015	+0.35%
27/11/2015	+0.97%
04/12/2015	+0.16%
10/12/2015	+1.46%
17/12/2015	+0.82%
14/01/2015	+0.36%

Source: /53/

The EPIC verification team has assessed the certificates /56/ /57/ /58/ /59/ /45/ of the utilized span gas cylinders and calibration notes in order to confirm the correctness of information provided above. Moreover, by assessing the reported details for the 32 valid calibration events, the EPIC verification

		team was able to confirm that the composition of the utilized span gases were properly considered in the context of the determination of the measurement deviations/errors for CH_4 content measurements (Span).
	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 13.0.0) /7/ and the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0) /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 3 months, as per recommendations from the equipment's manufacturer) is in line with the monitoring plan of the PDD /2/, ACM0001 (version 13.0.0) /7/ and the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0) /14/. A communication issued by the service representative of the equipment manufacturer in Brazil confirms their approval for the internal working procedure CA.BG.01.05 of Essencis Soluções Ambientais S.A. As assessed by the EPIC verification team, the latest version of the internal working procedure "*CA.BG.01.05-Rev 09 – Calibração Analisador de Gases"* (Gas analyzer calibration) /81/ details the procedure for performing calibration events the installed CH_4 content gas analyzer unit and specifies a calibration frequency of every 3 months. It is the opinion of the EPIC verification team that the adopted calibration frequency represents good practice.
	Company which has performed the applicable calibration events:	All the 32 calibration events valid for the monitoring period from 16/05/2015 to 31/12/2015 were performed by the own staff of Essencis Soluções Ambientais S.A.. The staff responsible for the calibrations received previous training following the applicable procedure "*CA.BG.01.05-Rev 08 - Calibração Analisador de Gases"* (Gas analyzer calibration) /81/. Moreover, related Certificates of training /79/ were made available to the EPIC verification team. Moreover, the EPIC verification team was also able to verify that the work procedure CA.BG.01.05 was approved by equipment manufacturer and that it is available in the project site. As informed by the project participants, the main reason for performing the calibrations internally is the relatively remote location of the project site and difficulties on scheduling a 3rd party for performing such relatively easy calibration events.
	Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Yes. The performed calibration events 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 32 calibration events for the installed CH_4 content gas analyzer unit that are referred in the Monitoring Report /3/ are valid for the whole monitoring period from 16/05/2015 to 31/12/2015. EPIC was able to confirm the validity of the performed calibration events for the installed CH_4 gas analyzer unit as follows: - Calibration event performed on 15/05/2015, valid until 15/08/2015 (3 months) - Calibration event performed on 22/05/2015, valid until 22/08/2015 (3 months) - Calibration event performed on 29/05/2015, valid until 29/08/2015 (3 months) - Calibration event performed on 05/06/2015, valid until 05/09/2015 (3 months) - Calibration event performed on 12/06/2015, valid until 12/09/2015 (3 months) - Calibration event performed on 19/06/2015, valid until 19/09/2015 (3 months) - Calibration event performed on 26/06/2015, valid until 26/09/2015 (3 months) - Calibration event performed on 03/07/2015, valid until 03/10/2015 (3 months) - Calibration event performed on 10/07/2015, valid until 10/10/2015 (3 months) - Calibration event performed on 17/07/2015, valid until 17/10/2015 (3 months) - Calibration event performed on 24/07/2015, valid until 24/10/2015 (3 months) - Calibration event performed on 31/07/2015, valid until 31/10/2015 (3 months) - Calibration event performed on 07/08/2015, valid until 07/11/2015 (3 months) - Calibration event performed on 14/08/2015, valid until 14/11/2015 (3 months) - Calibration event performed on 21/08/2015, valid until 21/11/2015 (3 months) - Calibration event performed on 28/08/2015, valid until 28/11/2015 (3 months) - Calibration event performed on 11/09/2015, valid until 11/12/2015 (3 months) - Calibration event performed on 18/09/2015, valid until 18/12/2015 (3 months) - Calibration event performed on 24/09/2015, valid until 24/12/2015 (3 months) - Calibration event performed on 01/10/2015, valid until 01/01/2016 (3 months) - Calibration event performed on 08/10/2015, valid until 08/01/2016 (3 months) - Calibration event performed on 15/10/2015, valid until 15/01/2016 (3 months) - Calibration event performed on 22/10/2015, valid until 22/01/2016 (3 months) - Calibration event performed on 29/10/2015, valid until 29/01/2016 (3 months) - Calibration event performed on 05/11/2015, valid until 05/02/2016 (3 months) - Calibration event performed on 13/11/2015, valid until 13/02/2016 (3 months) - Calibration event performed on 19/11/2015,	

	valid until 19/02/2016 (3 months) - Calibration event performed on 27/11/2015, valid until 27/02/2016 (3 months) - Calibration event performed on 04/12/2015, valid until 04/03/2016 (3 months) - Calibration event performed on 10/12/2015, valid until 10/03/2016 (3 months) - Calibration event performed on 17/12/2015, valid until 17/12/2016 (3 months) - Calibration event performed on 14/01/2015, valid until 14/04/2016 (3 months)

Assessment of performed calibration events for equipment/instruments 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 Essencis Soluções Ambientais S.A. 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 27/02/2015 as indicated in the Certificate No. 7765/2015 /41/, issued by Pakari Indústria e Serviços 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 13.0.0) /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 13.0.0) /7/.
Company which has performed the applicable calibration events:	The valid calibration event for the LFG temperature sensor was performed by Pakari Indústria e Serviços LTDA.
Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Yes. The performed calibration event for the LFG temperature sensor confirms proper functioning of the measurement instrument.
Is(are) the performed calibration(s) valid for the whole reporting period?	Yes. The performed calibration event referred in the Monitoring Report /3/ is valid for the whole monitoring period from 16/05/2015 to 31/12/2015.

	EPIC was able to confirm the validity of the performed calibration event for the installed LFG temperature sensor as follows: - Calibration event performed on 27/02/2015 - valid until 27/02/2016 (1 year)

Assessment of performed calibration events for equipment/instruments 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 LFG stream in time interval *t* (P_t)
Calibration frequency /interval for the monitoring equipment/instrument:	As per the implemented monitoring procedure at Essencis Soluções Ambientais S.A. 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 27/02/2015 as indicated in the Certificate No. 7759/2015 /39/, issued by Pakari Indústria e Serviços 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 13.0.0) /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 13.0.0) /7/.
Company which has performed the applicable calibration events:	The valid calibration event for the LFG pressure sensor was performed by Pakari Indústria e Serviços Ltda.
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 event referred in the Monitoring Report /3/ is valid for the whole monitoring period from 16/05/2015 to 31/12/2015. EPIC was able to confirm the validity of the

		performed calibration event for the installed LFG pressure sensor as follows: - Calibration event performed on 27/02/2015, valid until 27/02/2016 (1 year)

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

Data / Parameter: (as per the monitoring plan of the PDD):	Amount of grid electricity consumed by the project activity during the year *y* ($EC_{PJ,y}$)
Calibration frequency /interval for the monitoring equipment/instrument:	As per the implemented monitoring procedure at Essencis Soluções Ambientais S.A. and recommendations from the equipment's manufacturer, the installed electricity meters are to be calibrated every 5 years. As confirmed by the EPIC verification team through assessment of the specification sheet for the installed electricity meters /61/, the selected calibration frequency is as per the recommendations of the instrument manufacturer. For the electricity meter with S/N 234215, a calibration event was performed on 19/03/2012 (Calibration Certificate R-0701/12 /54/, issued by Naka Comércio e Indústria de Instrumentação Industrial Ltda.). For the electricity meter with S/N 465025, a calibration event was performed on 19/03/2012 (Calibration Certificate R-0702/12 /55/, also issued by Naka Comércio e Indústria de Instrumentação Industrial Ltda.).
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 13.0.0) /7/ do not specify any calibration frequency requirements for the electricity meters. The PDD /2/ states the following: *"Instrument 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 to calculate baseline, project and/or leakage emissions from electricity consumption" /13/, the following requirement is established regarding maintenance and calibration for electricity meters: *"(...) 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 meters are approved/certified by the Brazilian national authority for metrology and standardization affairs (INMETRO). The meters are thus in conformance with INMETRO's requirements for maintenance and testing of electricity meters. Furthermore, the adopted calibration frequency is confirmed to be in accordance with related requirements/recommendations as established by the meters manufacturer. While, as confirmed by the EPIC verification team, as per the instrument manufacturer, the meters are to be calibrated every 5 years, a calibration frequency of 5 years is applied for the installed electricity meters.
Company which has performed the applicable calibration events:	Both installed electricity meters were calibrated by Naka Instrumentação Industrial Ltda.
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 meters (at the time the calibration events were performed).
Is(are) the performed calibration(s) valid for the whole reporting period?	Yes. The performed calibration events dated 19/03/2012 (for both meters /54/ /55/) as correctly outlined in the Monitoring Report /3/, are valid for the whole considered monitoring period. EPIC was able to confirm the validity of the performed calibration events for the installed LFG flow meters as follows: - Electricity meter ME Plant with Serial Number 234215: calibration event performed on 19/03/2012, valid until 19/03/2017 (5 years) - Electricity meter ME Blower 4 with Serial Number 465025: calibration event performed on 19/03/2012, valid until 19/03/2017 (5 years)

Assessment of performed calibration events for equipment/instruments used for monitoring the parameter "Operation margin CO_2 emission factor in year y = Dispatch data analysis operating margin CO_2 emission factor in year y" ($EF_{grid,OM,y}$ = $EF_{grid,OM\text{-}DD,y}$):

Data / Parameter: (as per the monitoring plan of the PDD):	Operation margin CO_2 emission factor in year *y* = Dispatch data analysis operating margin CO_2 emission factor in year *y* ($EF_{grid,OM,y}$ = $EF_{grid,OM\text{-}DD,y}$)
Calibration frequency /interval for the monitoring equipment/instrument:	Not applicable. There are no measurements or measurement instruments/equipment involved for the definition of $EF_{grid,OM,y}$ = $EF_{grid,OM\text{-}DD,y}$.
Is the calibration interval in line with the monitoring	Not applicable. There are no measurements or measurement instruments/equipment involved

plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	for the definition of $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$.
Company which has performed the applicable calibration events:	Not applicable. There are no measurements or measurement instruments/equipment involved for the definition of $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$.
Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Not applicable. There are no measurements or measurement instruments/equipment involved for the definition of $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$.
Is(are) the performed calibration(s) valid for the whole reporting period?	Not applicable. There are no measurements or measurement instruments/equipment involved for the definition of $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$.

Assessment of performed calibration events for equipment/instruments 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 /71/ /72/ issued by the third party independent inspection service companies Ecosampling Ambiental Ltda. and Merieux NutriSciences / Bioagri Ambiental 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 PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	The PDD /2/ and ACM0001 (version 13.0.0) /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".* 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 companies Ecosampling Ambiental Ltda. and Merieux NutriSciences / Bioagri Ambiental Ltda. The technical valid test/evaluation reports /71/ /72/ issued by the third party independent inspection service companies

	Ecosampling Ambiental Ltda. and Merieux NutriSciences / Bioagri Ambiental Ltda. highlight that the utilized chromatographers Pitot tubes were in conformance with calibration requirements applicable for these instruments.
Company which has performed the applicable calibration events:	No information, evidences/proof for performed calibration events in equipment/instruments utilized by the inspection service companies Ecosampling Ambiental Ltda. and Merieux NutriSciences / Bioagri Ambiental Ltda. were made available to the EPIC verification team.
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 companies Ecosampling Ambiental Ltda. and Merieux NutriSciences / Bioagri Ambiental 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 companies Ecosampling Ambiental Ltda. and Merieux NutriSciences / Bioagri Ambiental Ltda. were made available to the EPIC verification team.

Assessment of performed calibration events for equipment/instruments 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 Essencis Soluções Ambientais S.A. and recommendations from the equipment's manufacturer, the installed thermocouples are to be calibrated every year. As confirmed by the EPIC verification team through assessment of the specification sheet for the installed thermocouples /74/, the selected calibration frequency is as per the recommendations of the instrument manufacturer. *Calibration details for the thermocouples used for measuring the sub-parameter $T_{EG,m,flare-1}$:* For the 099160 thermocouple, a valid calibration event was performed on 27/02/2015 (Certificate of Calibration No. 7755/2015 /46/ issued by Pakari Indústria e Serviços LTDA.). *Calibration details for the thermocouple used for measuring the sub-parameter $T_{EG,m,flare-2}$:* For the 099157 thermocouple, a valid calibration event was performed on 27/02/2015 Certificate of Calibration No. 7753/2015 /47/, issued by Pakari Indústria e Serviços LTDA.) *Calibration details for the thermocouple used for measuring the sub-parameter $T_{EG,m,flare-3}$:*

		For the 099158 thermocouple, a valid calibration event was performed on 11/03/2015 Certificate of Calibration No. 7751/2015 /48/, issued by Pakari Indústria e Serviços LTDA.) *Calibration details for the thermocouple used for measuring the sub-parameter $T_{EG,m,flare-4}$:* For the 099159 thermocouple, a valid calibration event was performed on 11/03/2015 Certificate of Calibration No. 7752/2015 /49/, issued by Pakari Indústria e Serviços Ltda.) The Calibration Certificates /46/ /47/ /48/ /49/ were 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 thermocouples are 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 13.0.0) /7/.
	Company which has performed the applicable calibration events:	All the valid calibration events for the installed thermocouples were performed by Pakari Indústria e Serviços Ltda.
	Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Yes. The performed calibration events for the installed thermocouples confirm proper functioning of these measurement instruments.
	Is(are) the performed calibration(s) valid for the whole reporting period?	Yes. The performed calibration events referred in the Monitoring Report /3/ are valid for the whole monitoring period from 16/05/2015 to 31/12/2015. EPIC was able to confirm the validity of the performed calibration events for the installed thermocouples as follows: - Thermocouple TT11 with Serial Number 099160: calibration event performed on 27/02/2015, valid until 27/02/2016 (1 year) - Thermocouple TT12 with Serial Number 099157: calibration event performed on 27/02/2015, valid until 27/02/2016 (1 year) and calibration event performed on 27/02/2015, valid until 27/02/2016 (1 year) - Thermocouple TT13 with Serial Number 099158: calibration event performed on 11/03/2015, valid until 11/03/2016 (1 year) and calibration event performed on 11/03/2015, valid until 11/03/2016 (1

	year) - Thermocouple TT14 with Serial Number 099159: calibration event performed on 11/03/2015, valid until 11/03/2016 (1 year)

Assessment of performed calibration events for equipment/instruments 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 sheets for the UV Flame detectors installed at the project site /50/ /51/ /52/, 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.
Company which has performed the applicable calibration events:	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 events for equipment/instruments used for monitoring the parameter "Maintenance events completed in year y as monitored by the project participants" ($Maintenance_y$):

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

Company which has performed the applicable calibration events:	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 events for equipment/instruments used for monitoring the parameter "Quantity of LPG consumed by the project activity in year y" ($FC_{LPG,y}$):

Data / Parameter: (as per the monitoring plan of the PDD):	Quantity of LPG consumed by the project activity in year *y* ($FC_{LPG,y}$)
Calibration frequency /interval for the monitoring equipment/instrument:	The EPIC verification team was able to confirm that the Brazilian National Agency of Petroleum, Natural Gas and Biofuels (*Agência Nacional do Petróleo, Gás Natural e Biocombustíveis - ANP*), as the federal government agency responsible for the regulation of the oil sector (including production and distribution of petroleum fuels) defines in its Resolution 15 (dated 18/05/2005) /80/ that any LPG distributor operating in Brazil should have a functioning weight scale for checking the weight of LPG commercialized in 45 kg cylinders. As also established by the Resolution 15, related weight scales should be regularly calibrated by a certification/calibration company with accreditation from the Brazilian national authority for metrology and standardization issues (INMETRO). Moreover, it was made available to the EPIC verification team a declaration/communication issued by the local LPG distribution company Cia Ultragaz S.A. (dated 10/02/2015) /60/ confirming that: - Cia Ultragaz S.A. has historically calibrated weight scales as per the Internal working procedure "Monitoramento dos equipamentos de envazamento e controle" (*Monitoring of measurement/control and bottling equipment*). Doc. Code: IT-CO-61.0008; Rev. 4 /94/. - The weight scale Mettler-Toledo - model 2180 – S/N 10423008 has been regularly calibrated as per internal working procedure IT-CO-61.0008 /94/. A copy of the working procedure IT-CO-61.0008 /85/ was also made available and was assessed

	by the EPIC verification team. Moreover, Certificates of Calibration /93/ for the pattern standard weights internally used by Cia Ultragaz S.A. (used for the performance of regular calibration events of weight scales) and a Calibration Certificate for the weight scale 10423008 (calibration event performed on 14/06/2012, Certificate No. MA038/2014 /93/, dated 27/08/2014 and issued by Instituto de Pesos e Medidas do Estado de São Paulo IPEM-SP) were also made available and assessed by the 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/ *"(…) Periodic calibration events will be performed in the mass meters by a third party independent accredited calibration laboratory in a frequency as per instrument specifications and/or instrument manufacturer's recommendations.*" As per Resolution 15 /80/ of ANP, any LPG distributor operating in Brazil should have a functioning weight scale for checking the weight of LPG commercialized in 45 kg cylinders. As also established by the Resolution 15, related weight scales should be regularly calibrated by a certification/calibration company with accreditation from the Brazilian national authority for metrology and standardization issues (INMETRO). The adopted calibration frequency is in accordance with national requirements and also with related requirements/recommendations as established by the weight scale manufacturer.
Company which has performed the applicable calibration events:	The weight scale used by the local LPG distribution company Cia Ultragaz S.A. was calibrated by Instituto de Pesos e Medidas do Estado de São Paulo IPEM-SP.
Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Yes. The performed calibration event for the weight scale confirm proper functioning of the measurement instrument.
Is(are) the performed calibration(s) valid for the whole reporting period?	Yes. The performed calibration event referred in the Monitoring Report /3/ is valid for the whole monitoring period from 16/05/2015 to 31/12/2015.

Assessment of performed calibration events for equipment/instruments used for monitoring the parameter "Net calorific value of the fuel LPG" ($NCV_{LPG,y}$):

Data / Parameter: (as per the monitoring plan of the PDD):	Net calorific value of the fuel LPG ($NCV_{LPG,y}$)
Calibration frequency /interval for the monitoring equipment/instrument:	Not applicable. No measuring instrument was used for determining the value of the parameter during the considered monitoring period.
Is the calibration interval in line with the monitoring	Not applicable. No measuring instrument was used for determining the value of the parameter

plan of the PDD? If the PDD does not specify the frequency of calibration, does the selected frequency represent good monitoring practice?	during the considered monitoring period.
Company which has performed the applicable calibration events:	Not applicable. No measuring instrument was used for determining the value of the parameter during the considered monitoring period.
Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Not applicable. No measuring instrument was used for determining the value of the parameter during the considered monitoring period.
Is(are) the performed calibration(s) valid for the whole reporting period?	Not applicable. No measuring instrument was used for determining the value of the parameter during the considered monitoring period.

Assessment of performed calibration events for equipment/instruments used for monitoring the parameter "CO_2 emission factor of fuel LPG in year y" ($EF_{CO2,LPG,y}$):

Data / Parameter: (as per the monitoring plan of the PDD):	CO_2 emission factor of fuel LPG in year *y* ($EF_{CO2,LPG,y}$)
Calibration frequency /interval for the monitoring equipment/instrument:	Not applicable. No measuring instrument was used for determining the value of the parameter during the considered monitoring period.
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. No measuring instrument was used for determining the value of the parameter during the considered monitoring period.
Company which has performed the applicable calibration events:	Not applicable. No measuring instrument was used for determining the value of the parameter during the considered monitoring period.
Did the performed calibration(s) confirm proper functioning of monitoring equipment/instrument? (Yes / No):	Not applicable. No measuring instrument was used for determining the value of the parameter during the considered monitoring period.
Is(are) the performed calibration(s) valid for the whole reporting period?	Not applicable. No measuring instrument was used for determining the value of the parameter during the considered monitoring period.

Assessment of performed calibration events for equipment/instruments 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.
	Company which has performed the applicable calibration events:	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 monitoring equipment/instrument? (Yes / No):	Not applicable. The determination of applicable value for the monitoring parameter $p_{H2O,t,sat}$ is not based on measurements.
	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.

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 ($M_{t,db}$)

No assessment details are thus included for the parameters listed above.

Findings	No CARs were raised regarding compliance with the calibration frequency requirements for measuring instruments/equipment:
Conclusion	As a conclusion, the EPIC verification team was able to confirm that the calibration events performed for all monitoring instruments of the project activity were conducted in accordance with the monitoring plan of the PDD [/2/], ACM0001 (version 13.0.0) [/7/]) and applicable tools during the monitoring period from 16/05/2015 to 31/12/2015. 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 has also confirmed that no calibration event valid for the monitoring period from 16/05/2015 to 31/12/2015 has identified an error beyond the maximum permissible error of the respective measuring instrument.

	In summary, compliance with applicable calibration frequency requirements was confirmed for all monitoring instruments/equipment.

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 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/ and also as established by ACM0001 (version 13.0.0) /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 scenario. 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 scenario (absence of project activity). $F_{CH4,BL,y}$ is calculated as follows:

$$F_{CH4,BL,y} = 0.2 * F_{CH4,PJ,capt,y}$$

Where:

$F_{CH4,PJ,capt,y}$ Amount of methane collected by the project activity. In the particular case of the project activity, $F_{CH4,PJ,capt,y}$ is determined as follows:

$$F_{CH4,PJ,capt,y} = F_{CH4,sent,flare,y}$$

Where:

$F_{CH4,sent,flare,y}$ Amount of methane in the LFG which is sent to the flares. Details for the determination of every-minute values for $F_{CH4,sent\_flare,y}$ are presented below (under *"Assessment details for the*

determination of every-minute values for the calculation parameter $F_{CH4,sent\_flare,y}$").

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 4,200 tCH_4.

$F_{CH4,PJ,y}$ Amount of methane in the LFG which is flared and/or used in the project activity. 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 tCH_4). 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 each individual flare within the considered monitoring period as the difference between the amount of methane supplied to the particular flare and residual methane project emissions from combustion of LFG for each corresponding 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 flares. Details for the determination of every-minute values for $F_{CH4,sent\_flare,y}$ for each individual 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. Details for the determination of every-minute values for $PE_{flare,y}$ for each individual 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 13.0.0) /7/, the amount of methane in the LFG which is sent to the flares ($F_{CH4,sent,flare,y}$) is determined for each individual flare (calculation sub-parameters $F_{CH4,sent\_flare,y,flare-1}$, $F_{CH4,sent\_flare,y,flare-2}$, $F_{CH4,sent\_flare,y,flare-3}$ and $F_{CH4,sent\_flare,y,flare-4}$) 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[13]. As per Option C of this methodological tool, the amount of methane in the LFG which is sent to each installed flare is determined as follows:

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

Where:

Sulfix "*Flare-n*": Flare number: Flare 1, Flare 2, Flare 3 and Flare 4

$V_{t,wb,n,flare\text{-}n}$ Volumetric flow of the gaseous stream (LFG) in time interval *t* on a wet basis at normal conditions. As confirmed by the EPIC verification team, while the sub-parameters for the monitoring parameter $V_{t,wb,flare\text{-}n}$ are already measured in normal conditions, there are no need to calculate every-minute values of the calculation parameter $V_{t,wb,n,flare\text{-}n}$ valid for each flare (calculation sub-parameters $V_{t,wb,n,flare\text{-}1}$, $V_{t,wb,n,flare\text{-}2}$, $V_{t,wb,n,flare\text{-}3}$ and $V_{t,wb,n,flare\text{-}4}$) by using LFG pressure and LFG temperature data. As correctly outlined in the Monitoring Report /3/, while the installed LFG flow meters already measure volumetric flow of LFG in Nm³ wet gas/h (normal conditions), the following assumption is valid:

$V_{t,wb,n,flare\text{-}n}$ is equivalent to $V_{t,wb,flare\text{-}n}$

Where:

$V_{t,wb,flare\text{-}n}$ Volumetric flow of the gaseous stream (LFG) in time interval *t* on a wet basis for flare *n* (n = 1, 2, 3 and 4)[14]. As previously described in Section E.6.2. and correctly indicated in the Monitoring Report /3/, as the installed LFG flow meters already measure volumetric flow of LFG in Nm³ wet gas/h (normal conditions), no measurements of "Temperature of the LFG stream in time interval *t*" (T_t), "Pressure of the LFG stream in time interval *t*" (P_t) are required for the determination of every-minute values of $V_{t,wb,n,flare\text{-}n}$.

$v_{CH4,t,wb}$ 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

[13] The PDD /2/ states the following regarding the determination of values for $F_{CH4,sent\_flare,y}$:

> "*(…) Applicable guidance of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" will be applied to determine $F_{CH4,sent\_flare,y}$ by using Option 2: Simplified calculation without measurement of the moisture content, and one of the options A, C or D. The selection of the determination option will depend on project conditions and equipment to be installed."*,

The adopted calculation approach for determination of every-minute values for the calculation parameter $F_{CH4,sent\_flare,y}$ during the considered monitoring period is thus in accordance with both ACM0001 (version 13.0.0) and the PDD.

[14] As correctly outlined in the latest version of the Monitoring Report, while measurements for $V_{t,wb}$ are performed by the installed 4 LFG flow meters in Nm^3/h (one flow meter for each individual installed flare), the monitoring parameter $V_{t,wb}$ is thus measured, recorded and reported on the basis of the sub-parameters $V_{t,wb,flare\text{-}1}$, $V_{t,wb,flare\text{-}2}$ $V_{t,wb,flare\text{-}3}$ and $V_{t,wb,flare\text{-}4}$ with such sub-parameters being equivalent to the calculation sub-parameters $V_{t,wb,n,flare\text{-}1}$, $V_{t,wb,n,flare\text{-}2}$, $V_{t,wb,n,flare\text{-}3}$ and $V_{t,wb,n,flare\text{-}4}$.

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 each of the installed flares (calculation sub-parameters $PE_{flare,y,flare-1}$, $PE_{flare,y,flare-2}$, $PE_{flare,y,flare-3}$ and $PE_{flare,y,flare-4}$) are determined as a function of every-minute records of mass flow of methane sent to the flare in question (for each flare n, $F_{CH4,RG,m,flare-n} = F_{CH4,sent\_flare,y,flare-n}$, where *n* = 1, 2, 3 and 4) as well as based on *ex-post* calculated values for flare efficiency for the flare *n* ($\eta_{flare,m} = \eta_{flare,calc,m}$).. Values of $PE_{flare,y}$ are correctly calculated for the considered monitoring period as follows:

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

Where:

$F_{CH4,RG,m}$ Methane mass flow in the residual gas for the considered flare. For each minute *m* of the considered monitoring period and for each individual flare *n*, 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 flares" ($F_{CH4,sent\_flare,y}$) for the flare in question (calculation sub-parameters $F_{CH4,sent\_flare,y,flare-1}$, $F_{CH4,sent\_flare,y,flare-2}$, $F_{CH4,sent\_flare,y,flare-3}$ and $F_{CH4,sent\_flare,y,flare-4}$)).

$\eta_{flare,m}$ 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 each one of the flares (measurement for monitoring parameter $F_{CH4,EG,t}$) were performed by an accredited independent third party entity (e.g. an independent inspection/analysis service company) on a biannual basis. The calculated flare efficiency ($\eta_{flare,calc,m}$) for each 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 flares during a considered time and measurements of speed of exhaust gas of the flares were performed by the third party inspection service companies Ecosampling Avaliações Ambientais Ltda. and Merieux NutriSciences / Bioagri Ambiental Ltda. Theses inspection service companies are both 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 each flare (calculation sub-parameters $F_{CH4,RG,t,flare-1}$, $F_{CH4,RG,t,flare-2}$, $F_{CH4,RG,t,flare-3}$ and $F_{CH4,RG,t,flare-4}$) are thus calculated as follows:

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

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 $F_{CH4,sent\_flare,y}$*").

$V_{t,db,n,flare-n}$ Volumetric flow of the gaseous stream (LFG) in time interval *t* on a dry basis for flare *n* (n = 1, 2, 3 and 4). 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 each flare (calculation sub-parameters $V_{t,db,n,flare-1}$, $V_{t,db,n,flare-2}$, $V_{t,db,n,flare-3}$ and $V_{t,db,n,flare-4}$) is determined by converting the measured volumetric flow from wet basis to dry basis as follows:

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

Where:

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

$v_{H2O,t,db}$ Volumetric fraction of H_2O in the gaseous stream in time interval *t* on a dry basis. As per applicable guidance of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /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 13.0.0) /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 [15]:

[15] 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).*"

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

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 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], calculated values for $\eta_{flare,calc,y}$ for each one of the installed high temperature enclosed flares and valid for the considered monitoring period are summarized in the table below:

Calculated values of $\eta_{flare,calc,v}$ for each flare valid for the considered monitoring period	Flare 1 ($\eta_{flare,calc,y,flare-1}$)	Flare 2 ($\eta_{flare,calc,y,flare-1}$)	Flare 3 ($\eta_{flare,calc,y,flare-1}$)	Flare 4 ($\eta_{flare,calc,y,flare-1}$)
	0.9999397	0.9979330	0.9999716	0.9999589

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

As also confirmed by the EPIC verification team by assessing the 8 monthly emission reduction spreadsheets [5], in accordance with the applied monitoring procedure for the project activity, compliance with operational and maintenance requirements for the flares, as established by the *ex-ante* determined parameter "Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval" ($SPEC_{flare}$),

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 flares, thus resulting in a reduction of $PE_{flare,y}$ and consequent increment of emission reductions.

	was correctly considered for the determination and application of values of $\eta_{flare,m}$ for calculating every-minute values of $F_{CH4,PJ,y} = F_{CH4,flared,y}$ along the considered monitoring period[16]. As also confirmed by the EPIC verification team through assessment of the 5 monthly emission reduction calculation spreadsheets /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 values of $\eta_{flare,m}$ along the considered monitoring period. For each installed flare, the time the flare has operated is monitored through every-minute monitoring the flame combustion status/condition by using an UV flame detector (of which status signal (flame status "*on*" or "*off*") is recorded and reported in the monthly emission reduction calculation spreadsheets /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 set of flares + temperature of exhaust gas of the flares + meeting of maintenance requirements)) are also correctly considered in the context of the determination and application of values for $\eta_{flare,m}$ for calculating every-minute values of $F_{CH4,PJ,y} = F_{CH4,flared,y}$ along the considered monitoring period. As also confirmed through assessment of the 5 monthly emission reduction calculation spreadsheets /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 20,849 tCH_4. The calculated value for BE_y for the monitoring period from 16/05/2015 to 31/12/2015 is correctly determined as 374,603 tCO_2e.
Findings	No findings (CARs/CLs) 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 8 monthly emission reduction calculation spreadsheets files /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 spreadsheets /5/, were verified to be performed under full conformance with applicable requirements of the PDD /2/, ACM0001 (version 13.0.0) /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. The calculated value for BE_y for the monitoring period from 16/05/2015 to 31/12/2015 is correctly determined as 374,603 tCO_2e.

[16] While all performed maintenance events in the installed flares (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 $Maintenance_y$.

E.8.2. Calculation of project GHG emissions or actual net 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: $PE_y = PE_{EC,grid,y} + PE_{LPG,y}$ Where: $PE_{EC,grid,y}$ Project emissions due to the consumption of grid-sourced electricity by the project activity $PE_{LPG,y}$ Project emissions due to the consumption of LPG by the project activity *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 ($PE_{EC,y}$) are correctly determined by following applicable guidance of the methodological tool "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 01) /13/ as follows: $PE_{EC,y} = EC_{PJ,y} * EF_{EL,grid,y} * (1 + TDL_{grid,y})$ Where: $EC_{PJ,y}$ Quantity of grid-sourced electricity consumed by the project activity in year *y*. For the considered monitoring period, $EC_{PJ,grid,y}$ is monitored as 1,665 MWh (rounded value). The following monthly values for consumption of grid-sourced electricity ($EC_{PJ,y}$) within the considered monitoring period are correctly reported in the Monitoring Report /3/ and summarized emission reduction calculation spreadsheet /5/: - 16 May 2015 to 31 May 2015: 188.425 MWh - June 2015: 265.992 MWh - July 2015: 228.391 MWh - August 2015: 198.985 MWh - September 2015: 208.642 MWh - October 2015: 219.714 MWh - November 2015: 176.593 MWh

- December 2015: 178.625 MWh

Assessment details for the monitoring parameter $EC_{PJ,y}$ 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*. For the considered monitoring period, $EF_{EL,grid}$ is determined ex-post as the Combined margin CO_2 emission factor ($EF_{grid,CM,y}$) that is calculated as the weighted average of the ex-post determined value valid for the year of 2015 for the monitoring parameter "Operating margin CO_2 emission factor in year *y*" ($EF_{grid,CM,y}$) and the previously determined and validated value for the *ex-ante* determined parameter "Build margin CO_2 emission factors" ($EF_{grid,BM,y}$). 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 operating 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 per the applied monitoring procedure, the selected value for $EF_{grid,OM}$ (0.5580 tCO_2/MWh) correctly represents the official average values for year (vintage) 2015 as calculated and made public available by the DNA of Brazil /73/. Further assessment details for the monitoring parameter $EF_{grid,OM,y}$ are included in Section E.6.2.

$EF_{grid,BM,y}$ 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 0.2010 tCO_2/MWh.

The calculated value for $PE_{EC,y}$ for the considered monitoring period from 16/05/2015 to 31/12/2015 is correctly determined as 580 tCO_2 (rounded value).

Project emissions due to the consumption of LPG by the project activity:

Project emissions due to the consumption of LPG by the project activity ($PE_{LPG,y}$) are correctly determined by following the applicable guidance of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 02) /15/ as follows:

$$PE_{LPG,y} = FC_{LPG,y} * COEF_{LPG,y}$$

	Where: $FC_{LPG,y}$ Quantity of LPG consumed by the project activity in year *y*. $FC_{LPG,y}$ is correctly reported as 270 kg (0.270 ton). Detailed assessment for monitoring of $FC_{LPG,y}$ is presented in Section E.6.2. $COEF_{LPG,y}$ CO_2 emission coefficient for LPG. $COEF_{LPG,y}$ is calculated as follows: $COEF_{LPG,y} = NCV_{LPG,y} * EF_{CO2,LPG,y}$ Where: $EF_{CO2,LPG,y}$ CO2 emission factor of fuel LPG (in energy basis). A default value of 0.0656 tCO_2/GJ is selected for the considered monitoring period (value sourced by IPCC Guidelines for National Greenhouse Gas Inventories, 2006 /11/, Chapter 1, Volume 2, Table 1.4). Further details about the monitoring parameter $EF_{CO2,LPG,y}$ are included in Section E.6.2. $NCV_{LPG,y}$ Net calorific value of the fuel LPG. A default value of 49.2 GJ/ton is selected for the considered monitoring period (value sourced by the Brazilian Energetic Balance Report, year 2015 /77/). The calculated value for $PE_{LPG,y}$ for the monitoring period from 16/05/2015 to 31/12/2015 is correctly determined as 1 tCO_2 (rounded value). Total project emissions (PE_y) are correctly calculated and reported as 581 tCO_2 (rounded value) and are correctly considered in the context of the emission reduction calculations.
Findings	No findings (CARs/CLs) 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 13.0.0) /7/ and applicable methodological tools /13/ /15/ /16/ /17/. Applied methods and formulae, as described in the monitoring plan from the PDD /2/ and applicable methodology + methodolofical tools, were correctly applied. The calculated value for PE_y for the monitoring period from 16/05/2015 to 31/12/2015 is correctly determined as 581 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 13.0.0) /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 of 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 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 13.0.0) /7/, - Tool to calculate baseline, project and/or leakage emissions from electricity consumption (version 01) /13/. - Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 02) /15/ - "Tool to calculate the emission factor for an electricity system" (versions 3.0.0 /16/ and 04.0 /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 02.0.0) /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 16/05/2015 to 31/12/2015 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 both LPG and 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 spreadsheets /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) 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 16/05/2015 to 31/12/2015 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 13.0.0) /7/ and applicable methodological tools /13/ /14/ /15/ /16/ /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 7.5 months (230 days) within year 2015 were compared against the related *ex-ante* estimation of emission reductions for year 2015 as per the PDD /2/. The results of such comparisons are summarized and assessed below:

Period	Ex-ante estimation of emission reductions as per the PDD (in tCO_2e)	Achieved emission reductions (in tCO_2e)
Period from 16/05/2015 to 31/12/2015 (considered monitoring period)	692,343 (share of ex-ante estimation of emission reductions within year 2015 valid/equivalent for the 230-day period length considered) monitoring period)	374,022
Period from 01/01/2015 to 31/12/2015 (period encompassing year 2015)	1,098,719	-

Findings

No findings (CARs, CLs) 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 230-day length monitoring period from 16/05/2015 to 31/12/2015, achieved emission reductions are correctly indicated as about ~54% lower than the comparable value of *ex-ante* estimation of emission reductions as per the PDD /2/ valid for such period (692,343 tCO_2e). 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

[17]The 692,343 tCO2e value is appropriately calculated as 1,097,719 tCO_2e * 230/365, where 1,097,719 tCO_2e is ex-ante estimated GHG emissions to be achieved in year 2015 as per the PDD.

	for the considered monitoring period when compared against the ex-ante estimation of emission reduction for the same period in the PDD: *1. Uncertainties associated with the application of First Order Decay (FOD) multi-phased model for estimating the emission reductions in the PDD:* 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 PDD /2/ are applicable for the *ex-ante* estimation of emission reductions for the "Caieiras landfill gas emission reduction". 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 /65/ /66/ /67/ 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 "Caieiras landfill gas emission reduction", it is reasonable to assume that achieved average LFG collection efficiency for the project activity during the considered monitoring period was significantly lower than the one earlier assumed in the context of the ex-ante estimation of emission reductions (92.80%). *2. Lack of LFG collection infrastructure covering all area of the very large CTR Caieiras landfill:* The EPIC verification team was able to verify that, as correctly indicated in the Monitoring Report /3/, a significant share of LFG rich in methane generated at the CTR Caieiras landfill has not been collected by the project activity due to the lack of LFG collection infrastructure covering the whole are of the landfill. At the time of the performed on-site visit, many of the existent LFG collection wells were not connected to the project activity's LFG collecting pipeline network. As also assessed by the EPIC verification team, the PDD /2/ indicates that there are areas of the CTR landfill not yet covered by the project's LFG collection infrastructure. Moreover, EPIC verification team has also confirmed during the performed on-site assessment that 2 of the 4 installed high temperature enclosed flares have not operated during most part of the considered monitoring period due to the lack of LFG collection infrastructure and consequent reduction in the amount of LFG sent to the flares. 1) *3. Occurred gradual moving of the whole installed project's LFG destruction (combustion) infrastructure (project's LFG flaring facility) to other area/region within the CTR Caieiras landfill during the period from mid-June 2015 to 12/04/2016:* The Epic verification team has confirmed that, while the occurred planned moving of the project's LFG flaring station was gradually performed over the considered monitoring period, during such gradually moving the project activity has operated with a reduced LFG flaring activity level, which affected negatively emission reductions achieved by the project activity.
Findings	A CAR was raised regarding remarks on the difference of achieved emissions reductions for the considered monitoring period and related estimations of emission reductions as per the PDD:

	CAR 4 (17/03/2016) As confirmed by the EPIC assessment team, while the project activity operated with a reduced LFG flaring activity level during the considered monitoring period due to the occurred gradual moving of the project's LFG flaring station (which represents an aspect/condition which is to be regarded as 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 PDD)), this aspect is not listed in Section E.6 of the initial version of the Monitoring Report.
Conclusion	As a conclusion, upon closure of the raised CAR, by taking into account all the factors/aspects listed above, it is the opinion of the EPIC verification team that the occurred relative difference between achieved emission reductions during the considered monitoring period and calculated comparable PDD's ex-ante estimation of emission reductions for the same period is deemed acceptable, plausible and reasonable.

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 (16/05/2015 to 31/12/2015) 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) 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 16/05/2015 to 31/12/2015 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 13.0.0) /7/ and applicable methodological tools /13/ /14/ /15/ /16/ /17/. No emission reductions occurred prior 01/01/2013 were considered in the current verification.

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 "Caieiras landfill gas emission reduction" for the monitoring period from 16/05/2015 to 31/12/2015, as reported in the latest version of the Monitoring Report issued on 17/05/2016 (version 2.0), 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 13.0.0) /7/ and applicable methodological tools /13/ /14/ /15/ /16/ /17/.

EPIC thus confirms the following regarding verified emission reductions:

Project title:	Caieiras landfill gas emission reduction
UNFCCC ref no:	0171
PDD Monitoring Report	Version 5.9, dated 05/09/2013 (currently registered version). Version 6.0, dated 17/05/2016 (revised version addressing post-registration changes)
Methodology used for verification:	ACM0001 (version 13.0.0)
Applicable monitoring period:	16/05/2015 to 31/12/2015 (first and last day included)
Achieved emission reductions:	374,022 tCO_2e

SECTION H. Certification statement

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EPIC Sustainability Services Pvt. Ltd. (EPIC) has performed the 12th periodic verification assessment of the registered CDM project activity titled "Caieiras landfill gas emission reduction". The project activity was registered by the UNFCCC on 09/03/2006 as CDM project activity with registration no. 0171 and it is currently under its 2nd 7-year renewable crediting period (period from 13/12/2013 to 30/03/2020).

The performed CDM verification assessment covered the monitoring period from 16/05/2015 to 31/12/2015 (including both days) and represents the 4th periodic verification within the 2nd 7-year crediting period 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 CTR Caieiras landfill. In accordance with related project design information made available in the revised 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 four high temperature enclosed flares. 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 Essencis Soluções Ambientais S.A. has been responsible for gathering of monitoring data in accordance with the monitoring plan of the PDD. While supported by hired external CDM consultants, Essencis Soluções Ambientais S.A. 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 13.0.0), the monitoring plan included in the revised version of the PDD /2/ for the 2nd 7-year crediting period of the project activity (version 6.0, dated 17/05/2016) and also as per the latest version of Monitoring Report for

the considered monitoring period (version 2.0, dated 17/05/2016). 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 "Caieiras landfill gas emission reduction" for the monitoring period from 16/05/2015 to 31/12/2015, as reported in the latest version of the Monitoring Report issued on 17/05/2016 (version 2.0), 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 revised version of the PDD, monitoring and baseline methodology ACM0001 - 'Flaring or use of landfill gas" (version 13.0.0) and applicable methodological tools.

The performed verification assessment included post-registration changes under the category "Changes to the project design of a registered project activity" and "Corrections" (in information that do not affect the project design) that were correctly and appropriately addressed in a revised version of the PDD (version 6.0, dated 17/05/2016). Assessment details about the occurred permanent post-registration changes in the project design as reflected in the revised version of the PDD are included in the Validation Opinion Report for Post-Registration Changes for the project activity (version 1.0 dated 10/06/2016)

EPIC Sustainability Services Pvt. Ltd. (EPIC) herewith confirms that GHG emission reductions were achieved by the CDM project activity "Caieiras landfill gas emission reduction" during the monitoring period from 16/05/2015 to 31/12/2015 as follows:

Emission reductions for the monitoring period from 16/05/2015 to 31/12/2015:	374,022 tCO_2e

Prepared by	Approved by :

 (Marco A. Ratton) Verification Team Leader	 (Krishnachar Sudheendra) Director & Head-Operations

Appendix 1. Abbreviations

Abbreviations	Full texts
ACM	Approved Consolidated Methodology (CDM baseline and monitoring methodology)
ANP	Brazilian National Agency of Petroleum, Natural Gas and Biofuels (*Agência Nacional do Petróleo, Gás Natural e Biocombustíveis)*
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	Clean Development Mechanism Project Cycle Procedures
CDM-PS	Clean Development Mechanism Project Standard
CDM-VVS	Clean Development Mechanism Validation and Verification Standard
CER	Certified Emission Reduction
CETESB	Companhia Ambiental do Estado de São Paulo (Environmental Agency/Authority for São Paulo State in Brazil)
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
CTR	*Central de Tratamento de Resíduos* ("Waste Treatment Facility" when translated into English language)
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
LPG	Liquefied petroleum 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
RMSP	Região Metropolitana de São Paulo (São Paulo's Metropolitan Region)
SQL	Structured query language
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**
Role	Lead Auditor	Technical Reviewer
Competence in relevant sectoral scope(s):	Sectoral scope 13	Sectoral scope 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.	Performance of Technical review

Mr. Marco A. Ratton is based in Brazil and has acted as a CDM auditor/assessor since 2007. He holds vast experience with independent assessments of CDM project activities within the area of solid waste management and effluent treatment 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. He also has 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 and Technical Reviewer with Sectoral Scope 1 and 13. 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 (CDM-VVS), version 09.0 as per EB 82	Dated 20/02/2015. Available online: http://cdm.unfccc.int/Reference/Standards/index.html	Others
/2/	Essencis Soluções Ambientais S.A.	Project Design Document (PDD) for the 2nd 7-year renewable crediting period for the CDM project activity: "Caieiras landfill gas emission reduction", version 6.0 -	Dated 17/05/2016	Project Participants [18]
/3/	Essencis Soluções Ambientais S.A.	Monitoring Report for the CDM project activity "Caieiras landfill gas emission reduction" - monitoring period from 16/05/2015 to 31/12/2015, version 2.0.	Dated 17/05/2016.	Project Participants
/4/	Essencis Soluções Ambientais S.A.	Monitoring Report for the CDM project activity "Caieiras landfill gas emission reduction" - monitoring period from 16/05/2015 to 31/12/2015, version 1.	Dated 11/02/2016. Available online: http://cdm.unfccc.int/Projects/DB/DNV-CUK1134509951.62/view	Project Participants
/5/	Essencis Soluções Ambientais S.A.	Emission reduction calculation spreadsheet for the CDM project activity "Caieiras landfill gas emission reduction" - monitoring period from 16/05/2015 to 31/12/2015. Set of 8 monthly emission reduction spreadsheets (one for each month of the monitoring period) + flare efficiency calculation spreadsheet + summarized emission reduction spreadsheet. File names: *"052015.xls"* *"062015.xls"* *"072015.xls"* *"082015.xls"* *"092015.xls"* *"102015.xls"* *"112015.xls"* *"122015.xls"* *"MR 12 - Caieiras - V.2 - 17.05.2016 – FE.xls"* *"MR 12 - Caieiras - V.2 - 17.05.2016.xls"*	Dated 17/05/2016.	Project Participants

[18] All document with provider indicated as "Project Participants" were sourced by the host-country project participant and project owner Essencis Soluções Ambientais S.A.

/6/	Essencis Soluções Ambientais S.A.	Input data for the emission reduction calculation spreadsheets for the project activity "Caieiras landfill gas emission reduction" - monitoring period from 16/05/2015 to 31/12/2015. File names: *"may-15.xls"* *"jun-15.xls"* *"jul-15.xls"* *"aug-15.xls"* *"sep-15.xls"* *"oct-15.xls"* *"nov-15.xls"* *"dec-15.xls"*	Dated 08/02/2016.	Project Participants
/7/	UNFCCC/CDM-EB	Consolidated baseline and monitoring methodology ACM0001 - "Flaring or use of landfill gas¨, version 13.0.0 as per EB 67.	Dated 11/05/2012. Available online: http://cdm.unfccc.int/methodologies/DB/D44X8FH8SFCXREE6037AXJSBGGFVDO	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/	TÜV SÜD South Asia Pvt. Ltd.	"Validation of the Renewal of Crediting Period of an Existing CDM-Project: Caieiras landfill gas emission reduction", Report No. 600501161, Revision No. 03.	Dated 24/09/2013. Available online: http://cdm.unfccc.int/Projects/DB/DNV-CUK1134509951.62/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 http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol5.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	"Tool to calculate baseline, project and/or leakage emissions from electricity	Dated 16/05/2008. Available online: https://cdm.unfccc.int/method	Others

		consumption", version 01 as per EB 39.	ologies/PAmethodologies/tools/am-tool-05-v1.pdf/history_view	
/14/	UNFCCC/CDM-EB	¨Tool to determine the mass flow of a greenhouse gas in a gaseous stream¨, version 02.0.0 as per EB 61.	Dated 03/06/2011. Available online: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v2.0.0.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 04.0 as per EB 75.	Dated 04/10/2013. Available online: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v1.1.pdf/history_view	Others
/18/	UNFCCC/CDM-EB	Clean Development Mechanism Project Standard (CDM-PS), version 09.0 as per EB 82	Dated 20/02/2015. Available online: http://cdm.unfccc.int/Reference/Standards/index.html	Others
/19/	UNFCCC/CDM-EB	Clean Development Mechanism Project Cycle Procedure (CDM-PCP), version 09.0 as per EB 82	Dated 20/02/2015. Available online: http://cdm.unfccc.int/Reference/Procedures/index.html#proj_cycle	Others
/20/	Essencis Soluções Ambientais S.A.	Emission reduction calculation spreadsheet for the CDM project activity "Caieiras landfill gas emission reduction" - monitoring period from 16/05/2015 to 31/12/2015. Set of 8 monthly emission reduction spreadsheets (one for each month of the monitoring period) + flare efficiency calculation spreadsheet + summarized emission reduction spreadsheet. File names: *"052015.xls"* *"062015.xls"* *"072015.xls"* *"082015.xls"*	Dated 11/02/2016.	Project Participants

		"092015.xls" *"102015.xls"* *"112015.xls"* *"122015.xls"* *"MR 12 - Caieiras - V.1 - 11.02.2016 – FE.xls"* *"MR 12 - Caieiras - V.1 - 11.02.2016.xls"*		
/21/	EPIC / Essencis Soluções Ambientais S.A.	Comparative emission reduction calculation spreadsheets for the project activity "Caieiras landfill gas emission reduction" - monitoring period from 16/05/2015 to 31/12/2015. Created as part of the *Data authenticity checking* procedure performed during the verification. File names: *"052015 - for checking.xls"* *"062015 - for checking.xls"* *"072015 - for checking.xls"* *"082015 - for checking.xls"* *"092015 - for checking.xls"* *"102015 - for checking.xls"* *"112015 - for checking.xls"* *"122015 - for checking.xls"* *"MR 12 - Caieiras - V.1 - 11.02.2016 – FE - for checking.xls"* *"MR 12 - Caieiras - V.1 - 11.02.2016 - for checking.xls"*	Dated 17/03/2016.	Project Participants
/22/	EPIC / Essencis Soluções Ambientais S.A.	Comparative spreadsheets with monitoring records for the project activity "Caieiras landfill gas emission reduction" – monitoring period from 16/05/2015 to 31/12/2015. Created as part of the *Data authenticity checking* procedure performed during the on-site visit. File names: *"may-15 - for checking.xls"* *"jun-15 - for checking.xls"* *"jul-15 - for checking.xls"* *"aug-15 - for checking.xls"* *"sep-15 - for checking.xls"* *"oct-15 - for checking.xls"* *"nov-15 - for checking.xls"* *"dec-15 - for checking.xls"*	Dated 17/03/2016.	Project Participants
/23/	Essencis Soluções Ambientais S.A.	Blank version of the emission reduction calculation spreadsheets applied for the project activity "Caieiras landfill gas emission reduction" - monitoring period from	Dated 11/02/2016.	Project Participants

		16/05/2015 to 31/12/2015. File names: "*MMYYYY - blank.xls* " *"MR 11 - Caieiras - V.1 - 11.02.2016 - FE - blank.xls"* *"MR 11 - Caieiras - V.1 - 11.02.2016 - blank.xls"*		
/24/	Essencis Soluções Ambientais S.A.	Internal service and maintenance log book (with details about historical of interventions, service and instrument/equipment calibration and replacement in the project activity "Caieiras landfill gas emission reduction").	Available at the project's data control room.	Project Participants
/25/	Essencis Soluções Ambientais S.A.	Completed Modalities of Communication (MoC) form for the CDM project activity "Caieiras landfill gas emission reduction"	Latest version dated 29/10/2014. Available online: http://cdm.unfccc.int/Projects/DB/DNV-CUK1134509951.62/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/	EPIC	List of Findings for the 12th verification of the CDM project activity "Caieiras landfill gas emission reduction".	Dated 17/03/2016.	Others
/28/	EPIC	Verification Questionnaire (EPIC Verification Checklist) for the 12th verification of the CDM project activity "Caieiras landfill gas emission reduction".	Dated 17/03/2016.	Others
/29/	Germanischer Lloyd Certification GmbH	CDM Verification and Certification Report for the CDM project activity "Caieiras landfill gas emission reduction". 2nd periodic verifications (monitoring period from 01/11/2007 to 30/06/2008). GLC Report No. 081, Rev 15.	Dated 10/07/2012. Available online: http://cdm.unfccc.int/Projects/DB/DNV-CUK1134509951.62/iProcess/Germanischer1286456614.85/view	Others
/30/	EPIC	CDM Verification and Certification Report for the CDM project activity "Caieiras landfill gas emission reduction". 8th verification (monitoring period from 01/10/2012 to 30/03/2013, draft/working version.	-	Others

/31/	EPIC	CDM Verification and Certification Report for the CDM project activity "Caieiras landfill gas emission reduction". 9th verification (monitoring period from 13/12/2013 to 12/06/2014, Report No. : ESSPL/CDM/2015/021, version 01.	Dated 14/05/2015.	Others
/32/	EPIC	CDM Verification and Certification Report for the CDM project activity "Caieiras landfill gas emission reduction". 10th verification (monitoring period from 13/06/2014 to 31/12/2014, Report No.: ESSPL/CDM/2015/023, version 01.	Dated 28/03/2015. Available online: http://cdm.unfccc.int/Projects/DB/DNV-CUK1134509951.62/CP/KLUXCAFK29DIMF605IHFIWIHE49O30/iProcess/EPIC_Sust1423574478.26/view	Others
/33/	SGS United Kingdom Ltd	CDM Verification and Certification Report for the CDM project activity "Caieiras landfill gas emission reduction". 1st verification (verification period from 2006-03-31 to 2007-10-31. Issue 3 CDM.VER0241.	Dated 18/01/2011. Available online: http://cdm.unfccc.int/Projects/DB/DNV-CUK1134509951.62/iProcess/SGS-UKL1195228146.42/view	Others
/34/	Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda.	Certificate of Calibration for the installed LFG flow meter with S/N 1412000235 - calibration event performed on 04/06/2014. Certificate No. 1412000235 1214 C7.	Certificate issuance date: 09/06/2014.	Others
/35/	Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda.	Certificate of Calibration for the installed LFG flow meter with S/N 1412000236 - calibration event performed on 04/06/2014. Certificate No. 1412000236 1214 C7.	Certificate issuance date: 09/06/2014.	Others
/36/	Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda.	Certificate of Calibration for the installed LFG flow meter with S/N 1412000237 - calibration event performed on 04/06/2014. Certificate No. 1412000237 1214 C7.	Certificate issuance date: 09/06/2014.	Others
/37/	Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda.	Certificate of Calibration for the installed LFG flow meter with S/N 1412000238 - calibration event performed on 04/06/2014. Certificate No. 1412000238 1214 C7.	Certificate issuance date: 09/06/2014.	Others
/38/	Essencis Soluções Ambientais S.A.	Currently registered version of the Project Design Document (PDD) for the 2nd 7-year renewable crediting period for the CDM project activity: "Caieiras landfill gas emission	Dated 05/09/2013. Available online: http://cdm.unfccc.int/Projects/DB/DNV-CUK1134509951.62/view	Project Participants

		reduction", version 5.9.		
/39/	Pakari Indústria e Serviços LTDA.	Calibration certificate for Pressgage pressure sensor (Serial No. 43608). Certificate No. 7759/2015. Calibration event date: 27/03/2015.	Certificate issuance date: 27/02/2015.	Others
/40/	EPIC	Validation Opinion Report on Post-registration changes for the CDM project activity: "Caieiras landfill gas emission reduction", version 1.0	Dated 10/06/2016.	Others
/41/	Pakari Indústria e Serviços LTDA.	Calibration certificate for Pressgage STP-100 temperature sensor. Certificate No. 7765/2015. Calibration event date: 27/02/2015.	Certificate issuance date: 27/03/2015.	Others
/42/	EPIC	CDM Verification and Certification Report for the CDM project activity "Caieiras landfill gas emission reduction". 11th verification (monitoring period from 01/01/2015 to 15/05/2015, Report No.: ESSPL/CDM/2015/040, version 2.0.	Dated 08/08/2015. Available online: http://cdm.unfccc.int/Projects/DB/DNV-CUK1134509951.62/CP/KLUXCAFK29DIMF605IHFIWIHE49O30/iProcess/EPIC_Sust1432980064.86/view	Others
/43/	Itron Soluções para Energia e Água Ltda.	Technical specification sheet for the chromatographer Itron C13I0021574D.	Available online: https://www.itron.com/brasil/pt/Pages/default.aspx	Others
/44/	INMETRO	Accreditation scopes of the inspection service company BIOAGRI Ambiental Ltda. / Mérieux NutriSciences Brasil vis-a-vis accreditation requirements from INMETRO.	Available online: http://inmetro.gov.br/laboratorios/rble/docs/CRL0172.pdf	Others
/45/	IBG – Indústria Brasileira de Gases Ltda.	Certificate for the cylinder of pattern gases used for the calibration of the CH_4 content gas analyzer unit: - Gas cylinders with 99.999% N_2 pattern gas: cylinder n° 1507099 (supplied by IBG – Indústria Brasileira de Gases Ltda.). Certificate Number IBG02390815.	Certificate issuance date: 10/08/2015.	Others
/46/	Pakari Indústria e Serviços LTDA.	Calibration certificate for the installed thermocouple with S/N 099160 (installed on Flare 1). Calibration Certificate No. 7755/2015. Calibration event date: 27/02/2015.	Certificate issuance date: 27/03/2015.	Others
/47/	Pakari Indústria e	Calibration certificate for the	Certificate issuance date:	Others

	Serviços LTDA.	installed thermocouple with S/N 099157 (installed on Flare 2). Calibration Certificate No. 7753/2015. Calibration event date: 27/02/2015.	26/03/2015.	
/48/	Pakari Indústria e Serviços LTDA.	Calibration certificate for the installed thermocouple with S/N 0991588 (installed on Flare 3). Calibration Certificate No. 7751/2015. Calibration event date: 11/03/2015.	Certificate issuance date: 16/03/2015.	Others
/49/	Pakari Indústria e Serviços LTDA.	Calibration certificate for the installed thermocouple with S/N 099159 (installed on Flare 4). Calibration Certificate No. 7752/2015. Calibration event date: 11/03/2015.	Certificate issuance date: 16/03/2015.	Others
/50/	SELCON Sistemas Eletrônicos de Controle Ltda.	Specification sheet for the UV Flame detector SEL-SV-UL-K4.	Available online: http://www.selcon.com.br/produtos/sensores/SELUO2K4.pdf	Others
/51/	SELCON Sistemas Eletrônicos de Controle Ltda.	Specification sheet for the UV Flame detector SEL-SV-210230-K6.	Available online: http://www.selcon.com.br/produtos/sensores/SEL-SV.....K6_ft.pdf	Others
/52/	Honeywell Analytics Ltd.	Specification sheet for the UV Flame detector C7061.	Available online: https://eccap.honeywell.cn/CatalogDocuments/Combu%20C7061-65-0223.pdf	Others
/53/	Essencis Soluções Ambientais S.A.	Set of 32 internal calibration notes for the Infrared CH_4 content gas analyzer unit CENTRUM AG 4000 with serial number NS 53159. Dates of the performed calibration events: - 15/05/2015 - 22/05/2015 - 29/05/2015 - 05/06/2015 - 12/06/2015 - 19/06/2015 - 26/06/2015 - 03/07/2015 - 10/07/2015 - 17/07/2015 - 24/07/2015 - 31/07/2015 - 07/08/2015 - 14/08/2015 - 21/08/2015 - 28/08/2015 - 11/09/2015 - 18/09/2015	-	Project Participants

		- 24/09/2015 - 01/10/2015 - 08/10/2015 - 15/10/2015 - 22/10/2015 - 29/10/2015 - 05/11/2015 - 13/11/2015 - 19/11/2015 - 27/11/2015 - 04/12/2015 - 10/12/2015 - 17/12/2015 - 14/01/2016		
/54/	Naka Comércio e Indústria de Instrumentação Ltda.	Calibration certificate for electricity meter model MULT K (Serial No. 234215) “ME Plant”, manufactured by KRON Instrumentos Elétricos Ltda. Certificate No. R-0701/12. Calibration event date: 19/03/2012.	Certificate issuance date: 03/04/2012.	Others
/55/	Naka Comércio e Indústria de Instrumentação Ltda.	Calibration certificate for electricity meter model MULT K (Serial No. 465025) “ME Blower 4”, manufactured by KRON Instrumentos Elétricos Ltda. Certificate No. R-0702/12. Calibration event date: 19/03/2012.	Certificate issuance date: 03/04/2012	Others
/56/	IBG – Indústria Brasileira de Gases Ltda.	Certificate for the cylinder of pattern gases used for the calibration of the CH_4 content gas analyzer unit: - Gas cylinders with 99.999% N_2 pattern gas: cylinder n° 395939 (supplied by IBG – Indústria Brasileira de Gases Ltda.). Certificate Number IBG04220814.	Certificate issuance date: 04/08/2014	Others
/57/	IBG – Indústria Brasileira de Gases Ltda.	Certificate for the cylinder of pattern gases used for the calibration of the CH_4 content gas analyzer unit: - Gas cylinders with 5.01% O_2 pattern gas: cylinder n° 3933516 (supplied by IBG – Indústria Brasileira de Gases Ltda.). Certificate Number IBG00590114.	Certificate issuance date: 30/01/2014.	Others
/58/	IBG – Indústria Brasileira de Gases Ltda.	Certificate for the cylinder of pattern gases used for the calibration of the CH_4 content gas analyzer unit: - Gas cylinders with 59.95% CO_2 pattern gas: cylinder n°	Certificate issuance date: 04/08/2014.	Others

		4849733 (supplied by IBG – Indústria Brasileira de Gases Ltda.). Certificate Number IBG04170814.		
/59/	IBG – Indústria Brasileira de Gases Ltda.	Certificate for the cylinder of pattern gases used for the calibration of the CH_4 content gas analyzer unit: - Gas cylinders with 60.01% CH_4 pattern gas: cylinder n° 4849720 (supplied by IBG - Indústria Brasileira de Gases Ltda.). Certificate Number IBG05801014.	Certificate issuance date: 28/10/2014.	Others
/60/	Cia. Ultragaz S.A.	Communication explaining the adopted procedure at Cia Ultragaz S.A. for measuring quantity of LPG regularly delivered to Essencis Soluções Ambientais S.A. including confirmation of supplied amoun't of LPG during the period from March 2013 to December 2014.	Dated December 10/02/2015.	Others
/61/	KRON Instrumentos Elétricos Ltda.	Technical Specification sheet for the electricity meters MULT K. "Multimedidor Mult-K / Ficha técnica – K0001", rev. 6.	Dated 17/02/2009. Available online: http://www.bagarel.com.br/coel/boletins%20tecnicos/Boletim_MICO.pdf	Others
/62/	Mettler-Toledo Inc.	User manual for the weight scale 2180.	Available online: http://www.toledobrasil.com.br/files/manuais/MU_2180_Portatil.pdf	Others
/63/	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
/64/	Elektro Eletricidade e Serviços S.A.	Monthly invoices/sales receipts of grid-sourced electricity purchase by Essencis Soluções Ambientais S.A. (months May 2015, June 2015, July 2015, August 2015, September 2015, October 2015, November 2015, December 2015).	-	Others
/65/	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

/66/	Solid Waste Association of North America (SWANA)	Landfill Gas Collection System Efficiencies (2007).	Report dated 2007.	Others
/67/	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
/68/	Pressgage instrumentos de Medição e Controle	Specification details for the pressure sensor model TPI-PRESS.	Available online: http://www.pressgage.com.br/wp-content/uploads/2015/02/transmissor-de-press%C3%A3o.pdf	Others
/69/	Pressgage instrumentos de Medição e Controle Ltda.	Specification details for the temperature sensor model STP-100.	Available online: http://www.pressgage.com.br/wp-content/uploads/2015/01/Sensor-de-temperatura.pdf	Others
/70/	BGM Instrumentação Controle e Automação Ltda.	Gas Analyzer CENTRUM AG 4000, User Manual 1st edition.	Dated March 2012. Available online: http://www.bgm.com.br/?r=produtos/view&id=4	Others
/71/	Ecosampling Ambiental Ltda.	Technical Report for the determination of methane destruction efficiency in the flares of the project activity "Caieiras landfill gas emission reduction". Report title: *"Teste de eficiência jun 15.pdf".*	Dated June 2015.	Others
/72/	Merieux NutriSciences / Bioagri Ambiental Ltda.	Technical Reports for the determination of methane destruction efficiency in the flares of the project activity "Caieiras landfill gas emission reduction". Report titles: "*Teste de eficiência dez 15 (flare 4).pdf".* "*Teste de eficiência dez 15 (flares 1 e 2).pdf".* "*Teste de eficiência fev 16 (flare 3).pdf".*	Reports dated 30/12/2015, 11/01/2016 and 02/03/2016.	Others
/73/	Brazil's Interministerial Commission on Global Climate Change (DNA of Brazil)	CO_2 emission factors for electricity generation in Brazil National Interconnected System – Base year 2015.	Available online: http://www.mct.gov.br/upd_blob/0238/238520.htm	Others
/74/	Naka Comércio e Indústria de Instrumentação Industrial Ltda.	Specification sheet for the thermocouple NKTC-3000.	Available online: http://nakainstrumentacao.com.br/docs/8001395759135termopar_nktc.pdf	Others

/75/	California Analytical Instruments, Inc.	Technical specification sheet for the gas analyzer 600 MHFID.	Available online: http://www.rental.cleanair.com/californiaanalyticalinstruments600mhfidmethanethcanalyzer	Others
/76/	Essencis Soluções Ambientais S.A.	Internal records of expenditures with fuel type LPG during the period from May 2015 to December 2015 + dates of delivery of fuel LPG at the project site.	Data retrieved from the financial/accounting management financial system of Essencis Soluções Ambientais S.A on 17/03/2016.	Project Participants
/77/	Empresa Brasileira de Pesquisa Energética (EPE)	Balanço Energético Nacional 2015 | Ano base 2014. Brazilian Energetic Balance Report year 2015 (base year 2014).	Available online: https://ben.epe.gov.br/BENRelatorioFinal.aspx?anoColeta=2015&anoFimColeta=2014	Others
/78/	Cepollina Engenheiros Consultores Ltda.	Declaration documents reporting the outcome of the technical evaluations performed at the CTR Caieiras landfill comparing the management practices at the CTR Caieiras landfill vis-a-vis the previously conceived design of the landfill.	Documents dated 20/05/2015 (first evaluation) and 29/01/2016 (second evaluation).	Others
/79/	Essencis Soluções Ambientais S.A.	Internal Certificates of Training for performance of calibration events in the CH_4 content gas analyzer CENTRUM AG 4000 manufactured by BGM Instrumentação Controle e Automação Ltda.	Dated January 2014.	Project Participants
/80/	Brazilian National Agency of Petroleum, Natural Gas and Biofuels (*Agência Nacional do Petróleo, Gás Natural e Biocombustíveis - ANP*)	Resolution 15.	Dated 18/05/2005. Available online: http://nxt.anp.gov.br/nxt/gateway.dll/leg/resolucoes_anp/2005/maio/ranp%2015%20-%202005.xml	Others
/81/	BGM Instrumentação Controle e Automação Ltda.	Communication with ref.: "*CA.BG.01.05-Rev 09 – Calibração Analisador de Gases*" Submitted to Essencis Soluções Ambientais S.A..	Dated 08/07/2014.	Others
/82/	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
/83/	Instituto de Pesos e Medidas do Estado de São Paulo IPEM-SP	Certificate of Calibration No. MA124/2012 valid for weight scale used by Cia Ultragaz S.A. for measuring mass of delivered LPG cylinders in years 2012,	Dated 21/06/2012.	Others

		2013 and 2014 (as per communication/clarification issued by Cia Ultragaz S.A.).		
/84/	CETEC – Centro Tecnológico do Instituto de Pesos e Medidas do Estado de São Paulo	Certificates of calibration for the pattern standard weights internally used by Cia Ultragaz S.A. for the performance of regular calibration events of weight scales. Certificate No. MA038/2014.	Dated 27/08/2014.	Others
/85/	Cia Ultragaz S.A.	Internal working procedure ”Monitoramento dos equipamentos de envazamento e controle” (*Monitoring of measurement/control and bottleing equipment*). Doc. Code: IT-CO-61.0008; Rev. 4.	-	Others
/86/	Chapple, Mike.	SQL Fundamentals.	-	Others
/87/	Gordon J. Van Wylen, Richard E. Sonntag and Borgnakke:	Fundamentals of Classical Thermodynamics; 3rd Edition, John Wiley & Sons, Inc. Table A-4: Saturated Water-Temperature.	Dated 1996. Available online: http://fireflylabs.com/disted/courses/m275-data(all%20years)/SaturatedWaterTables-T&P.pdf	Others
/88/	INMETRO	Licensing information/status for the inspection service company “Ecosampling Ambiental Ltda.” vis-a-vis accreditation requirements from INMETRO.	Available online: http://www.feam.br/images/stories/rafael/Laboratorios/planilhacompletasitelaboratorioshomologadosouacreditados2806.xls	Others
/89/	UNFCCC / CDM-EB	Monitoring Report Form (CDM-MR-FORM). Version 05.1.	Dated 04/05/2015. Available online: https://cdm.unfccc.int/Reference/PDDs_Forms/index.html#proj_cycle	Others
/90/	Germanischer Lloyd Certification GmbH	CDM Verification and Certification Report for the CDM project activity “Caieiras landfill gas emission reduction”. 3rd periodic verification (monitoring period from 01/07/2008 to 31/12/2009). GLC Report No. 066, Rev 10.	Dated 10/07/2012. Available online: http://cdm.unfccc.int/Projects/DB/DNV-CUK1134509951.62/iProcess/Germanischer1263394812.51/view	Others
/91/	Germanischer Lloyd Certification GmbH	CDM Verification and Certification Report for the CDM project activity “Caieiras landfill gas emission reduction”. 4th periodic verification (monitoring period from 01/01/2010 to 30/09/2010). GLC Report No. 071, Rev 12.	Dated 10/07/2012. Available online: http://cdm.unfccc.int/Projects/DB/DNV-CUK1134509951.62/iProcess/Germanischer1290670603.74/view	Others
/92/	Germanischer Lloyd Certification	CDM Verification and Certification Report for the CDM	Dated 18/03/2013. Available online:	Others

	GmbH	project activity "Caieiras landfill gas emission reduction". 5th periodic verification (monitoring period from 01/10/2010 to 31/08/2011). GLC Report No. 253, Rev 05.	http://cdm.unfccc.int/Projects/DB/DNV-CUK1134509951.62/iProcess/Germanischer1337093851.53/view	
/93/	Germanischer Lloyd Certification GmbH	CDM Verification and Certification Report for the CDM project activity "Caieiras landfill gas emission reduction". 6th periodic verification (monitoring period from 01/09/2011 to 31/03/2012). GLC Report No. 258, Rev 10.	Dated 19/01/2015. Available online: http://cdm.unfccc.int/Projects/DB/DNV-CUK1134509951.62/iProcess/Germanischer1337095440.2/view	Others
/94/	Germanischer Lloyd Certification GmbH	CDM Verification and Certification Reports for the CDM project activity "Caieiras landfill gas emission reduction". 7th periodic verification (monitoring period from 01/04/2012 to 30/09/2012). GLC Report No. 303, Rev 03.	Dated 11/04/2013. Available online: http://cdm.unfccc.int/Projects/DB/DNV-CUK1134509951.62/iProcess/Germanischer1358348284.53/view	Others
/95/	Essencis Soluções Ambientais S.A.	PDF-format "raw data" files containing all monitoring data for the monitoring period from 16/05/2015 to 31/12/2015. File names: *"may-15.pdf"* *"jun-15.pdf"* *"jul-15.pdf"* *"aug-15.pdf"* *"sep-15.pdf"* *"oct-15.pdf"* *"nov-15.pdf"* *"dec-15.pdf"*	Dated 08/02/2016.	Project Participants
/96/	Arquipélago Engenharia Ambiental	Commissioning Report for the project activity's flaring station.	Dated December 2007.	Others
/97/	UNFCCC/CDM-EB	"Guideline – Application of materiality in verifications", version 02.0, as per EB82.	Dated 20/02/2015.	Others

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

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

FAR ID		**Section no.**		**Date:**
Description of FAR				
No FARs were identified from the validation phase nor from previous verifications for the project activity.				
Project participant response				**Date:**

-
Documentation provided by project participant
-
DOE assessment **Date:**
-

Table 2. CL from this verification

CL ID	1	**Section no.**	E.1	**Date:** 17/03/2016
Description of CL				
Information details related to the internal references (numbering) of the installed high temperature enclosed flares as reported in the initial version of the Monitoring Report are unclear.				
Project participant response				**Date:** 17/05/2016
As a response to the raised CL, all details related to the internal references (numbering) of the installed high temperature enclosed flares were improved.				
Documentation provided by project participant				
No additional documentation was provided.				
DOE assessment				**Date:** 17/03/2016
It is the opinion of the EPIC verification team performed related text improvements in the revised version of the Monitoring Report are reasonable, correct and sufficiently address the raised CL. This CL is closed.				

Table 3. CAR from this verification

CAR ID	1	**Section no.**	E.6.1	**Date:** 17/03/2016
Description of CAR				
The manufacturer's operational specifications for the installed high temperature enclosed flare (as per details for the ex-ante parameter $SPEC_{flare}$) as indicated in the Monitoring Report are not correct.				
Project participant response				**Date:** 17/05/2016
As a response to the raised CAR, manufacturer's operational specifications for the installed high temperature enclosed flare (as per details for the ex-ante parameter $SPEC_{flare}$) were corrected in the revised version of the Monitoring Report.				
Documentation provided by project participant				
DOE assessment				**Date:** 07/06/2016

CAR ID	2	**Section no.**	E.6.2	**Date:** 17/03/2016
Description of CAR				
Specifications of the monitoring instruments installed during the considered monitoring period for measuring the monitoring parameters "Volumetric flow of LFG stream in time interval *t* on a wet basis" ($V_{t,wb}$) and "Temperature in the exhaust gas of the enclosed flare in minute *m*" ($T_{EG,m}$) are not in accordance with provided evidences.				
Project participant response				**Date:** 17/05/2016
As a response to the raised CAR, details about the LFG flow meters used for measuring Volumetric flow of LFG stream in time interval *t* on a wet basis ($V_{t,wb}$) and the thermocouples used for measuring Temperature in the exhaust gas of the enclosed flare in minute *m* ($T_{EG,m}$) during the considered monitoring period were corrected in the revised version of the Monitoring Report.				
Documentation provided by project participant				
No additional documentation was provided.				
DOE assessment				**Date:** 07/06/2016

It is the opinion of the EPIC verification team performed related corrections in the Monitoring Report are reasonable, correct and sufficiently address the raised CAR. This CAR is closed.

CAR ID	3	**Section no.**	E.6.2	**Date:** 17/03/2016
Description of CAR				
Information about the third-party inspection services company selected/hired by the project participants to perform the measurements and calculations 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"* ($F_{CH4,EG,t}$) are not in accordance with provided evidences.				
Project participant response				**Date:** 17/05/2016
As a response to the raised CAR, all relevant details about the performed measurements and calculations 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*" ($F_{CH4,EG,t}$) were corrected in the revised version of the Monitoring Report accordingly. References to measurements and calculations for the determination of the monitoring parameter $F_{CH4,EG,t}$ performed in December 2015 and Februart 2016 by the third-party inspection services company Merieux NutriSciences / Bioagri Ambiental Ltda. were included in the revised version of the Monitoring Report.				
Documentation provided by project participant				
No additional documentation was provided.				
DOE assessment				**Date:** 07/06/2016
It is the opinion of the EPIC verification team performed related corrections in the Monitoring Report are reasonable, correct and sufficiently address the raised CAR. This CAR is closed.				

CAR ID	4	**Section no.**	E.8.6	**Date:** 17/03/2016
Description of CAR				
As confirmed by the EPIC assessment team, while the project activity operated with a reduced LFG flaring activity level during the considered monitoring period due to the occurred gradual moving of the project's LFG flaring station (which represents an aspect/condition which is to be regarded as 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 PDD)), this aspect is not listed in Section E.6 of the initial version of the Monitoring Report.				
Project participant response				**Date:** 17/05/2016
As a response to the raised CAR, the list with aspects/conditions which represent a decrease factor of reported emission reductions for the considered monitoring period (when compared against the ex-ante estimation of emission reductions for the same period in the PDD) was revised accordingly in Section E.6 of the revised version of the Monitoring Report. Moreover, further relevant details about the occurred gradual moving of the project's LFG flaring station were also included in the revised version of the Monitoring Report.				
Documentation provided by project participant				
No additional documentation was provided.				
DOE assessment				**Date:** 07/06/2016
It is the opinion of the EPIC verification team performed related corrections in the Monitoring Report are reasonable, correct and sufficiently address the raised CAR. This CAR is closed.				

Table 4. FAR from this verification

FAR ID		**Section No.**		**Date:**
Description of FAR				
No FARs were raised during this verification.				
Project participant response				**Date:**

Documentation provided by project participant	
DOE assessment	**Date:**

Document information

Version	*Date*	*Description*
01.0	23 March 2015	Initial publication.

Decision Class: Regulatory
Document Type: Form
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