



Verification and certification report form for CDM project activities

(Version 01.0)

Complete this form in accordance with the "Attachment: Instructions for filling out the verification and certification report form for CDM project activities" at the end of this form.

VERIFICATION AND CERTIFICATION REPORT

| | |
|---|--|
| Title of the project activity | ESTRE'S Paulinia Landfill Gas Project (EPLGP) |
| Reference number of the project activity | 0165 |
| Version number of the verification and certification report | 1.1 Aa |
| Completion date of the verification and certification report | 03/08/2016 |
| Monitoring period number and duration of this monitoring period | Monitoring period: #17 01/10/2014 to 31/07/2015 |
| Version number of monitoring report to which this report applies | 3 |
| Crediting period of the project activity corresponding to this monitoring period | 14/09/2013 to 13/09/2020 |
| Project participant(s) | ESTRE Ambiental 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 ACM0001, "Flaring or use of landfill gas" version 13.0.0 of 11/05/2012 |
| Estimated GHG emission reductions or net anthropogenic GHG removals for this monitoring period in the registered PDD | 433,154 tCO ₂ e (equivalent to the days of the current monitoring period) |
| Certified GHG emission reductions or net anthropogenic GHG removals for this monitoring period | 310,883 tCO ₂ e |
| Name of DOE | RINA Services S.p.A. (RINA) |
| Name, position and signature of the approver of the verification and certification report |  Laura Severino – Sector Manager; Sustainability, Environment & Climate Change |

SECTION A. Executive summary

General description and purpose of the project activity.

ESTRE's Paulínia Landfill Gas Project (EPLGP) is a landfill gas collection and flare project in Brazil. The project's core idea is to avoid methane emissions from the landfill managed by ESTRE in Paulínia municipality. This goal will be achieved through installing an active gas recovery with a flaring system in the landfill

The project was validated by Det Norske Veritas Certification Ltd. (DNV) validation report N° 2005-0105 issued on 16/12/2005 and TÜV SÜD Industrie Service GmbH validation of the renewal of crediting period Report n°. 10074KM, version 02 of 12/07/2013, and it was registered on 03/03/2006 under the CDM registration reference N°0165. A post registration changes was approved on EB90 meeting

The GHG emission reductions were calculated on the basis of the approved methodology ACM0001, "Flaring or use of landfill gas" version 13.0.0 of 11/05/2012 and the monitoring plan included in the registered revised Project Design Document, version 04.5 of 29/02/2016 (approved on EB90 meeting)

Scope of verification

Verification is the periodic independent review and ex-post determination by a DOE of the monitored reductions in GHG emissions that have occurred as a result of the registered CDM project activity during a defined monitoring period. Certification is the written assurance by a DOE that, during a specific period in time, a project activity achieved the emission reductions as verified.

The verification scope is to verify that:

- The project activity has been implemented and operated in accordance with the registered PDD;
- the actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan;
- the GHG emission reduction data and calculation have been assessed to correctly support the emission reductions being claimed and that the reported GHG emission reduction data is free from material misstatement;
- to verify that reported GHG emission data is sufficiently supported by evidence.

Verification shall ensure that reported emission reductions are complete and accurate in accordance with applicable UNFCCC criteria for CDM in order to be certified.

Verification process.

Verification was conducted using RINA procedures in line with the requirements specified in the CDM M&P, the latest version of the CDM Validation and Verification Standard, and relevant decisions of the COP/MOP and the CDM EB and applying standard auditing techniques.

The verification consisted of the following three phases:

- Desk review;
- On-site assessment:
- The resolution of outstanding issues and the issuance of the final verification report and certification.

Verification is not meant to provide any consultancy towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the monitoring.

Conclusion

RINA Services S.p.A. (RINA), commissioned by ESTRE Ambiental S/A, verified the greenhouse gas emission reductions reported for the project activity "ESTRE'S Paulínia Landfill Gas Project (EPLGP)" in Brazil, CDM Registration Reference N° 0165, for the period 01/10/2014 to 31/07/2015, with regard to the relevant requirements for CDM activities.

In conclusion, it is RINA's opinion that the project activity ESTRE'S Paulínia Landfill Gas Project (EPLGP), in Brazil, as described in the Monitoring Report version 3 of 26/07/2016, meets all relevant requirements for CDM activities and all relevant host Party criteria and correctly applies the baseline and monitoring ACM0001, "Flaring or use of landfill gas" version 13.0.0 of 11/05/2012. In our opinion the GHG emission reductions reported for the project in the monitoring report are fairly stated.

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 TA 13.1 | IR | De Lima Carvalho | Thaís | RINA Brazil | x | x | x | x |
| 2. | Verifier | IR | Principe Branco Saettoni | Geisa Maria | RINA Brazil | x | x | x | |

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 TA 13.1 | IR | VALOROSO | Rita | RINA Central Office |
| 2. | Approver | IR | SEVERINO | Laura | RINA Central Office |

SECTION C. Application of materiality**C.1. Consideration of materiality in planning the verification**

| 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. | The qualification and capability of the human resource | L | <i>Personnel qualified to monitor the project activity. Procedure available.</i> | <i>Interview personnel during the onsite visit</i> |
| 2 | Raw data collection, transfer and storage process | M | <i>Data is automatically measure and transferred manually to the spreadsheet. Errors in the data transference have direct impact in the CERs calculation</i> | <i>Check all the inputs for monitored parameters.</i> |
| 3 | Measuring and recording method | L | <i>Data is measured and recorded automatically</i> | <i>Check all the inputs for monitored parameters.</i> |
| 4 | Calibration records for monitoring equipment | L | <i>Calibration is conducted</i> | <i>Check calibration certificates</i> |
| 5 | Metering records | L | <i>Check the meters</i> | <i>Check all the inputs for monitored parameters.</i> |

C.2. Consideration of materiality in conducting the verification

In accordance with the VVS, para 361 the threshold applied for the project activity is (a) 0.5 per cent of the emission reductions or removals for registered CDM project activities achieving a total emission reduction or removal equal to or more than 500,000 tonnes of carbon dioxide equivalent per year (based on the annual estimative of the revised registered PDD).

During the verification, RINA identified an post registration change with prior approval (please, refer to (please refer to CAR 1 and CAR 2). The post registration changes were approved in the EB 90 meeting and the revised MR version 3 of 26/07/2016 was assessed taking into account the revised PDD and temporary deviation approved, considering a conservative approach to calculate the CERs.

An onsite inspection has been performed on 28/09/2015 and it is confirmed that the monitoring arrangements in the monitoring plan are feasible within the project design. The monitoring is based only on data measured.

The CERs calculation /10/ is based only in data obtained through the monitoring. Verified during the onsite visit that Estre and UniCarbon are responsible for the monitoring of the project activity. All data is automatically monitored and registered in the PLC system. Personnel were interviewed during the onsite visit and demonstrate a good knowledge. In addition, it was verified during the onsite visit that the biogas plant is ISO 14001 certified /53/. PP has established procedures to monitor the project activity /54/ /55/

Therefore, it is RINA's opinion that the claimed emission reductions are free from material errors, omissions or misstatements, with reasonable level of assurance

SECTION D. Means of verification

D.1. Desk review

The monitoring report, version 3 of 26/07/2016 and the previous versions /02/, the emission reduction calculations provided in the form of a spreadsheet, "MR 17 - Paulinia - V.3 - 26.07.2016.xlsx" version 3 of 26/07/2016 and previous versions /10/, were assessed as part of the verification. In addition the revised Project Design Document (PDD) /01/ in particular the baseline estimations and the monitoring plan, the previous verification report number 2014-BQ-05-MD version 1.1Aa for the monitoring period 15: 01/10/2012 to 13/09/2013 /7/ and the validation report on the renewal crediting period n°. 10074KM version 02 of 12/07/2013 /12/ and validation opinion on changes version 1.2 Aa /62/ for the project were reviewed.

The monitoring report version 1 of 01/09/2015 /02/ was made publicly available on the CDM UNFCCC website on 04/09/2015. The Appendix 3 lists the documentation that was reviewed during the verification.

D.2. On-site inspection

| Duration of on-site inspection: 28/09/2015 | | | | |
|--|--|-------------------------|------------|----------------------------------|
| No. | Activity performed on-site | Site location | Date | Team member |
| 1. | Implementation and operation of the proposed project activity, | Estre Paulinia landfill | 28/09/2015 | Thaís Carvalho Geisa Principe |
| 2. | Reviewed the information flows for generating, aggregating and reporting the monitoring parameters, interviewed key personnel of the plant to confirm the operational and data collection procedures | Estre Paulinia landfill | 28/09/2015 | Thaís Carvalho Geisa Principe |
| 3. | Checked the monitoring equipment including calibration performance, reviewed calculations and assumptions made in determining the GHG data and emission reductions | Estre Paulinia landfill | 28/09/2015 | Thaís Carvalho Geisa Principe |
| 4. | Checked the quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters | Estre Paulinia landfill | 28/09/2015 | Thaís Carvalho Geisa Principe |
| 5. | Cross-checked between information provided in the monitoring report and raw data | Estre Paulinia landfill | 28/09/2015 | Thaís Carvalho Geisa Principe |
| 6 | Check the calibration certificates | Estre Paulinia landfill | 28/09/2015 | Thaís Carvalho Geisa Principe |

D.3. Interviews

| No. | Interviewee | | | Date | Subject | Team member |
|-----|---------------------|------------|-------------|------------|---|----------------------------------|
| | Last name | First name | Affiliation | | | |
| 1. | Barbosa | Nuno | Unicarbo | 28/09/2015 | Consultant: Emission Reductions calculation; Monitoring report | Thaís Carvalho Geisa Principe |
| 2 | Nascimento Silva | Tiago | Estre | 28/09/2015 | Operational manager: Monitoring plan Monitoring methodology Monitoring data Implementation status of the project Monitoring equipment and operation Calibration of equipment's | Thaís Carvalho Geisa Principe |
| 3 | Cavalcanti | Raul | Estre | 28/09/2015 | Biogas Operational Lider: monitored data, Implementation status of the project; calibration of equipemnts, | Thaís Carvalho Geisa Principe |
| 4 | Bicalho Novais | Henrique | Estre | 28/09/2015 | Implementation status of the project | Thaís Carvalho Geisa Principe |
| 5 | Almeida | Adriano | Estre | 28/09/2015 | Biogas Specislist: Monitoring plan Monitoring methodology Monitoring data Implementation status of the project Monitoring equipment and operation Calibration of equipment's | Thaís Carvalho Geisa Principe |

D.4. Sampling approach

>> Not applicable.

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 | - | - | - |
| 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 | - | 2 | - |
| Compliance of monitoring activities with the registered monitoring plan | - | 4 | - |
| Compliance with the calibration frequency requirements for measuring instruments | 1 | - | - |
| Assessment of data and calculation of emission reductions or net removals | 1 | 1 | - |
| Others (please specify) | - | - | - |
| Total | 2 | 7 | 0 |

SECTION E. Verification findings**E.1. Compliance of the monitoring report with the monitoring report form**

| | |
|------------------------------|---|
| Means of verification | The monitoring report version 01 /02/ submitted by the PP has been the basis for starting the verification process. RINA confirms that the Monitoring report is based on the currently valid MR template and complies with "Instructions for filling out the monitoring report form /08/. |
| Findings | N/A |
| Conclusion | RINA verified that the monitoring report was completed in accordance with the CDM-MR-FORM - Monitoring report form, including its Attachment: Instructions for filling out the monitoring report form, version 5.1. |

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

By checking the validation report /12/ and the previous verification reports /07/, RINA confirms that no remaining FARs were identified to be addressed during this verification

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

| | |
|------------------------------|--|
| Means of verification | <p>Verified the following installed equipment's during the onsite visit:</p> <p>Flares</p> <ul style="list-style-type: none"> - Flare 1: 2000 Nm3/h, serial number 133/05A - Flare 2: 2000 Nm3/h, serial number 133/05B - Flare 3: 2500 Nm3/h, serial number 110/07-C - Flare 4: 2500 Nm3/h, serial number 076/09-D - Flare 5: 2500 Nm3/h, serial number 076/09-E - Flare 6: 2500 Nm3/h, serial number 046/11 <p>Blowers</p> <ul style="list-style-type: none"> - Blower 1: 5000 Nm3/h, serial number 0677A051 - Blower 2: 5000 Nm3/h, serial number 0677A050 - Blower 3: 5000 Nm3/h, serial number 0977A084 - Blower 4: 5000 Nm3/h, serial number 0977A083 <p>Generators</p> <ul style="list-style-type: none"> -Generator 450 kVA, serial number 0450533001 -Generator 512 kVA, serial number 9P063 <p>LFG monitoring equipment/instruments:</p> |
|------------------------------|--|

| | |
|-------------------|---|
| | <ul style="list-style-type: none"> - 1 LFG mass flow meter - 1 LFG temperature sensor, - 1 LFG pressure sensor, - 1 CH₄/O₂ content gas analyzer, - 6 Thermocouples (1 thermocouple for each installed high temperature enclosed flare in order to measure temperature in the exhaust gases of each installed flare) - 6 UV flame detectors (1 flame detector in each installed flare in order to monitor the operational and flame status of each one of the installed flares) <p>(For the mass flow meter, a temporary deviation was approved on EB 90 meeting)</p> <p>The following environmental licenses /13/ were assessed:</p> <ul style="list-style-type: none"> * Cetesb partial operational license number 37002080 for the landfill, dated 25/02/2014 valid until 25/02/2019 * Cetesb operational license number 37001297 for biogas plant (flare 1 and 2) , dated 30/09/2011 valid until 30/09/2016 * Cetesb operational license number 37002348 for the flare 3 , dated 23/12/2014 valid until 23/12/2019 * Cetesb operational license number 37001298 for the flare 4 and 5 , dated 30/09/2011 valid until 30/09/2016 * Cetesb operational license number 37002536 for the flare 6 , dated 31/07/2015 valid until 31/07/2020. |
| Findings | N/A |
| Conclusion | It is RINA's opinion, based on the site visit, that technology, project equipment and monitoring and metering equipment is implemented and operational in accordance with the revised registered PDD /01/, considering the deviation approved in the EB 90 meeting for the mass flow meter, reference PRC-0165-001. |

E.4. Post-registration changes

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

A temporary deviation has been approved by the Board in the EB 90 meeting for this monitoring period, under reference PRC-0165-001. /63/ /62/

E.4.2. Corrections

Corrections that do not affect the project design are described in the PDD version 04.5 of 29/02/2016 approved by the Board in the EB 90 meeting, under reference PRC-0165-001. /63/ /62/

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

Not applicable

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

Not applicable

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

Permanent changes from registered monitoring plan have been approved by the Board in the EB 90 meeting for this monitoring period, under reference PRC-0165-001. /63/ /62/

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

Changes to the project design of a registered project activity have been approved by the Board in the EB 90 meeting for this monitoring period, under reference PRC-0165-001. /63/ /62/

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 | <p>The project applies the approved methodologies ACM0001, "Flaring or use of landfill gas" version 13.0.0 of 11/05/2012</p> <p>Registered PDD also refers to the following tools:</p> <ul style="list-style-type: none"> - "Emissions from solid waste disposal sites" version 06.0.1 of 02/03/2014 /16/ - "Tool to calculate baseline, project and/or leakage emissions from electricity consumption, version 1 dated 16/05/2008 /17/ - "Tool to calculate the emission factor for an electricity system" – version 03.0.0 dated 23/11/2012 /18/ - "Project emissions from flaring", version 2.0.0 dated 20/07/2012 /19/ - "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" version 2.0.0 dated 03/06/2011 /20/. |
| Findings | <p>CAR 1: Registered PDD version 4.2 describes that option B.1 Biannual measurement of the flare efficiency is chosen for project activity, however MR describes that the default value is applied. PP is requested to follow the provisions described in the Project Standard</p> <p>CAR 2: In accordance with the applied methodology, ACM0001 "Flaring or use of landfill gas" version 13.0.0 of 11/05/2012/06/, PE_{flare,y} shall be determined using the methodological tool "Tool to determine project emissions from flaring gases containing methane". If LFG is flared through more than one flare, then PE_{flare,y} is the sum of the emissions for each flare determined separately. However registered PDD does not reflect this condition. PP is requested to follow the provisions described in the Project Standard.</p> <p>To close out CAR 1 and CAR 2 a post registration changes with prior approval was submitted under reference PRC-0165-001. The positive outcome is described in the EB 90 meeting.</p> |
| Conclusion | The monitoring plan in the revised registered PDD /01/ is in accordance with the monitoring methodology ACM0001, "Flaring or use of landfill gas" version 13.0.0 of 11/05/2012 and applicable methodological tools . |

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

The monitoring has been carried out in accordance with the monitoring plan contained in the revised monitoring plan /01/. The following tables describe for each parameter which is to be measured according to the monitoring plan and how RINA has verified that the actual monitoring complies with the monitoring plan and that data have been assessed to correctly support the emission reductions being claimed.

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

| | |
|------------------------------|---|
| Means of verification | <p>The parameters were available at the validation stage, which do not need to monitor during the crediting period, as per the revised registered PDD version 04.5 of 29/02/2016:</p> <p>OX_{top_layer} (Dimensionless): Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline= 0.1. RINA verified that the value is described in the registered PDD /01/ in accordance with the default value described in the ACM0001 /06/</p> <p>GWP_{CH4} (tCO₂e/tCH₄): Global Warming Potential of CH₄= 25. RINA verified that the value is described in the registered PDD /01/ in accordance IPCC Fourth Assessment Report: Climate Change 2007, item 2.10.2: Direct Global Warming Potentials, Table 2.14 /09/ and Standard for application of the global warming potentials to clean development mechanism project activities and programmes of</p> |
|------------------------------|---|

activities for the second commitment period of the Kyoto protocol" /15/

SPEC_{flare}: Manufacturer's flare specifications for temperature, flow rate and maintenance schedule. Flare model: 2000 HT (flare 1 and 2):

Temperature: 850°C

Minimum flow: 400 Nm³/h; Maximum flow: 2,000 Nm³/h

Maintenance: 7 days

Flare model: 2500 HT

Temperature: 850°C

Minimum flow: 500 Nm³/h; Maximum flow: 2,500 Nm³/h

Maintenance: 7 days

RINA verified that the registered PDD /01/ describes that the values are from manufacturer.

Ru (Pa.m³/kmol.K): Universal ideal gases constant= 8,314 (RINA verified that the value is described in the registered PDD /01/ in accordance with the default value described in the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /20/

P_{ref} (Pa): Atmospheric pressure at reference conditions= 101,325. RINA verified that the value is described in the registered PDD /01/ in accordance with the default value described in the "Project emissions from flaring" /19/.

T_{ref} (K): Temperature at reference conditions= 273.15. RINA verified that the value is described in the registered PDD /01/ in accordance with the default value described in the "Project emissions from flaring" /19/.

MM_i (kg/kmol). Molecular mass of greenhouse gas *i*. (for methane)= 16.04. RINA verified that the value is described in the registered PDD /01/ in accordance with the default value described in the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /20/

MM_k (kg/kmol). Molecular mass of greenhouse gas *k*. (for Nitrogen)= 28.01. RINA verified that the value is described in the registered PDD /01/ in accordance with the default value described in the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /20/

MM_{H2O} (kg/kmol). Molecular mass of water= 18.0152. RINA verified that the value is described in the registered PDD /01/ in accordance with the default value described in the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /20/

EF_{BM,2012} (tCO₂/MWh). Build Margin CO₂ emission factor in year *y*. Ex ante option chosen. Data for the year 2012 = 0.2010. RINA verified that the value is in accordance with the registered PDD /01/. Data publicly available by the Brazilian DNA /21/

w_{BM} (%) Weighting of build margin emissions factor= 0.75 during the 2nd 7-year crediting period in accordance with the default value as per the "Tool to calculate the emission factor for an electricity system" (version 03.0.0) /18/

w_{OM} (%) Weighting of operating margin emissions factor, 0.25 during the 2nd 7-year crediting period in accordance with the default value as per the "Tool to calculate the emission factor for an electricity system" (version 03.0.0) /18/

The following ex-ante determined parameters (that are also included in the PDD) are not used for the purpose of ex-post determination of baseline emissions and project emissions achieved by the project activity during the considered monitoring period:

- Waste composition

- Efficiency of the LFG capture system that will be installed in the project activity (η_{PJ})

| | |
|-------------------|--|
| | <ul style="list-style-type: none"> - Default value for model correction factor to account for model uncertainties (φ_{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) - Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS ($\text{DOC}_{f,\text{default}}$) - Methane correction factor ($\text{MCF}_{\text{default}}$) - Fraction of degradable organic carbon in the waste type j (weight fraction) (DOC_j) - Decay rate for the waste type j (k_j) |
| Findings | <p>CAR 3: The flow specification (maximum and minimum) for the flare model 2000 HT is not in accordance with the registered PDD.</p> <p>In order to close CAR 3, PP revised the MR to include the description in accordance with the PDD.</p> |
| Conclusion | RINA confirms that the parameters listed above are fixed ex-ante and used for the baseline and project emissions calculation in accordance with the applied methodology and methodological tool and that they are the same used at the validation stage and in the previous verifications in accordance with the registered revised PDD /01/ |

E.6.2. Data and parameters monitored

| | | |
|------------------------------|---|---|
| Means of verification | The following parameters are monitored in accordance with the revised registered PDD /01/ | |
| | Data/Parameter | Management of SWDS |
| | Data Unit | dimensionless |
| | Description | Management of SWDS |
| | Source of data to be used | Use different sources of data: Original design of the landfill; Technical specifications for the management of the SWDS; Local or national regulations |
| | Value of monitored parameter for the monitoring period | <p>An internal report confirms that no practices to increase methane generation at the CGR Paulinia landfill have occurred /57/. Moreover the landfill and biogas plant have the applicable environmental licenses /13/</p> <p>Cross check: RINA verified during the onsite visit, internal report /57/ and operation licenses /13/ that no practices to increase methane generation at the CGR Paulinia landfill have occurred</p> |
| | Monitoring equipment, accuracy | Not applicable |
| | Measuring/Reading/Recording frequency | registered PDD describes the monitoring frequency annually |
| | Calculation method (if applicable) | Not applicable |
| | Data/Parameter | $O_{pi,h}$ |
| | Data Unit | - |
| | Description | Operation of the equipment that consumes the LFG |
| | Source of data to be used | the operation of the flares is monitored continuously on the basis of measurements of temperature in the exhaust gas of the flares (measurements performed by the installed 6 |

| | | |
|--|--|--|
| | | thermocouples (1 for each enclosed flare)). Verified during the site visit that data is measured by the thermocouples and is registered automatically in the PLC system |
| | Value of monitored parameter for the monitoring period | Data is registered every minute presented in the monthly calculation spreadsheet /58/. Cross check: RINA cross checked the values presented in the monthly calculation spreadsheet /58/ /10/ against the raw data from the PCL system /59/. |
| | Monitoring accuracy equipment, | The following equipment was confirmed during the on site visit: Flare 1 Manufacturer: ELSI /34/ Model: Type S Range: 0-1600°C Accuracy class: Accuracy class: $[2.704 + (0.0025 \times \text{measured temperature})]$ °C, if measured temperature is equal or higher than 600°C Serial Number: 118583 Flare 2 Manufacturer: ELSI /34/ Model: Type S Range: 0-1600°C Accuracy class: Accuracy class: $[2.704 + (0.0025 \times \text{measured temperature})]$ °C, if measured temperature is equal or higher than 600°C Serial Number: 11-09/5207 Flare 3 Manufacturer: ELSI /34/ (until 19/12/2014 /52/) Model: Type S Range: 0-1600°C Accuracy class: Accuracy class: $[2.704 + (0.0025 \times \text{measured temperature})]$ °C, if measured temperature is equal or higher than 600°C Serial Number: 05-06/0619 Manufacturer: Alutal /60/ (from 19/12/2014 onwards /52/) Model: Type S Range: 0-1480°C Accuracy class: ± 1.5 °C or $\pm 0.25\%$ of measured value (where the highest value is considered) Serial Number: 12-12491 Flare 4 Manufacturer: ELSI /34/ Model: Type S Range: 0-1600°C Accuracy class: Accuracy class: $[2.704 + (0.0025 \times \text{measured temperature})]$ °C, if measured temperature is equal or higher than 600°C Serial Number: 11-09/5208 |

| | | | |
|--|--|--|---|
| | | | <p>Flare 5 Manufacturer: ELSI /34/ Model: Type S Range: 0-1600°C Accuracy class: Accuracy class: [2.704 + (0.0025 x measured temperature)] °C, if measured temperature is equal or higher than 600°C Serial Number: 11-09/5209</p> <p>Flare 6 Manufacturer: Alutal /60/ Model: Type S Range: 0-1480°C Accuracy class: ±1.5 °C or ±0.25% of measured value (where the highest value is considered) Serial Number: 177621</p> |
| Measuring/Reading/Recording frequency | | | PDD describes that data is monitored hourly. Verified during the onsite visit that data is continuously measured and registered every minute. |
| Calculation method (if applicable) | | | Not applicable |
| Data/Parameter | | | $V_{t,wb}$ |
| Data Unit | | | m ³ wet gas/h (Observation: verified during the onsite visit that data is automatically converted to Nm ³ /h) |
| Description | | | * $V_{t,wb}$ = Volumetric flow of the gaseous stream in time interval t on a wet basis; |
| Source of data to be used | | | verified during the site visit that data is measured by a flow meter and is registered automatically in the PLC system /59/ |
| Value of monitored parameter for the monitoring period | | | Data is registered every minute presented in the monthly calculation spreadsheet /58/. Cross check: RINA cross checked the values presented in the monthly calculation spreadsheet /58/ /10/ against raw data from the PCL system, /59/. No error was found. |
| Monitoring equipment, accuracy | | | The following equipment was confirmed during the onsite visit: <u>Flow meter:</u> Manufacturer: ABB Model: S-4000 Serial Number: 240297184/X001 Accuracy +/- 0.5% /35/ |
| Measuring/Reading/Recording frequency | | | Yes, data is continuously measured and registered every minute. |
| Calculation method (if applicable) | | | Not applicable |
| Data/Parameter | | | $V_{CH4,t,wb} = V_{t,RG,m}$ |
| Data Unit | | | m ³ CH ₄ /m ³ wet gas |
| Description | | | Volumetric fraction of greenhouse gas |

| | | |
|--|--|---|
| | | methane in a hourly time interval t on a wet basis |
| Source of data to be used | | verified during the site visit that data is measured by an gas analyser and is registered automatically in the PLC system |
| Value of monitored parameter for the monitoring period | | Data is registered every minute presented in the monthly calculation spreadsheet /58/. Cross check: RINA cross checked the values presented in the monthly calculation spreadsheet /58/ /10/ against raw data from the PCL system, /59/ |
| Monitoring equipment, accuracy | | The following equipment was confirmed during the onsite visit: Manufacturer: SIEMENS Model: ULTRAMAT 23 Range: CH4 0-100% Serial Number: N1-U4-0790 Accuracy: +/- 0.5%/39/ |
| Measuring/Reading/Recording frequency | | Data is continuously measured and registered every minute. |
| Calculation method (if applicable) | | Not applicable |

| | |
|--|--|
| Data/Parameter | Tt |
| Data Unit | K |
| Description | Temperature of the gaseous stream in time interval t |
| Source of data to be used | Verified during the site visit that data is measured by an temperature sensor and is registered automatically in the PLC system |
| Value of monitored parameter for the monitoring period | Data is registered every minute presented in the monthly calculation spreadsheet /58/. Cross check: RINA cross checked the values presented in the monthly calculation spreadsheet /58/ /10/ against raw data from the PCL system, /59/. |
| Monitoring equipment | The following equipment was verified during the onsite visit: <u>Temperature sensor:</u> Manufacturer: ABB Model: TSP321 Serial Number: 210000516854001 Accuracy: +/- 0.35% /42/ |
| Measuring/Reading/Recording frequency | Data is continuously measured and registered every minute. |
| Calculation method (if applicable) | Not applicable |

| | |
|----------------|---|
| Data/Parameter | Pt |
| Data Unit | Pa |
| Description | Pressure of the LFG stream in time interval t |

| | | |
|--|--|---|
| | Source of data to be used | Verified during the site visit that data is measured by a LFG pressure sensor and is registered automatically in the PLC system. |
| | Value of monitored parameter for the monitoring period | Data is registered every minute presented in the monthly calculation spreadsheet /58/. Cross check: RINA cross checked the values presented in the monthly calculation spreadsheet /58/ /10/ against raw data from the PCL system /59/. |
| | Monitoring equipment | The following equipment was verified during the onsite visit: <u>Pressure transmitter:</u> Manufacturer: ABB /45/ Model: 2600T Serial Number: 6410001002 Accuracy: +/- 0.075% /45/ |
| | Measuring/Reading/Recording frequency | Data is continuously measured and registered every minute. |
| | Calculation method (if applicable) | Not applicable |
| | Data/Parameter | EF_{grid,CM,y} |
| | Data Unit | tCO ₂ /MWh |
| | Description | Combined margin CO ₂ emission factor for the project electricity system in year y Data Unit: tCO ₂ /MWh |
| | Source of data to be used | Data provided by the Brazilian DNA |
| | Value of monitored parameter for the monitoring period | 0.2967 Cross check: RINA has cross checked the value in accordance with the Brazilian DNA web site /48/. |
| | Monitoring equipment | Not applicable, data provided by the Brazilian DNA |
| | Measuring/Reading/Recording frequency | Annual, PP has used the latest data available from 2014. |
| | Calculation method (if applicable) | Data is provided by the Brazilian DNA calculated in accordance with the "Tool to calculate the emission factor for an electricity system" |
| | Data/Parameter | EF_{grid,OM,y} |
| | Data Unit | tCO ₂ /MWh |
| Description | Operating margin CO ₂ emission factor for the project electricity system in year y | |
| Source of data to be used | Data provided by the Brazilian DNA | |
| Value of monitored parameter for the monitoring period | 0.5837 Cross check: RINA has cross checked the value in accordance with the Brazilian DNA web site /48/. | |

| | Monitoring equipment | Not applicable, data provided by the Brazilian DNA | | | | | | | | | | | | | | | | | | | | | | |
|--|--|--|-------|-------|--------------|-------|---------------|-------|---------------|-------|--------------|-------|---------------|-------|------------|-------|------------|-------|----------|-------|-----------|-------|-----------|-------|
| | Measuring/Reading/Recording frequency | Annual, PP has used the latest data available from 2014. | | | | | | | | | | | | | | | | | | | | | | |
| | Calculation method (if applicable) | Data is provided by the Brazilian DNA calculated in accordance with the "Tool to calculate the emission factor for an electricity system" | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| | Data/Parameter | TDL_{i,y} | | | | | | | | | | | | | | | | | | | | | | |
| | Data Unit | - | | | | | | | | | | | | | | | | | | | | | | |
| | Description | Average technical transmission and distribution losses for providing electricity to source j in year y | | | | | | | | | | | | | | | | | | | | | | |
| | Source of data to be used | Default value chosen | | | | | | | | | | | | | | | | | | | | | | |
| | Value of monitored parameter for the monitoring period | 0.2 (20%) Cross check: RINA verified that the value is in accordance with the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption /17/. | | | | | | | | | | | | | | | | | | | | | | |
| | Monitoring equipment, accuracy | Not applicable | | | | | | | | | | | | | | | | | | | | | | |
| Measuring/Reading/Recording frequency | Annually | | | | | | | | | | | | | | | | | | | | | | | |
| Calculation method (if applicable) | Not applicable | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| Data/Parameter | EG_{EC1,y} = EC_{PJ1,y} | | | | | | | | | | | | | | | | | | | | | | | |
| Data Unit | MWh/y | | | | | | | | | | | | | | | | | | | | | | | |
| Description | Quantity of electricity consumed from the grid by the project activity during the year y | | | | | | | | | | | | | | | | | | | | | | | |
| Source of data to be used | Data is measured by an electricity meter and is registered automatically in the PLC system | | | | | | | | | | | | | | | | | | | | | | | |
| Value of monitored parameter for the monitoring period | <table border="1"> <thead> <tr> <th>Month</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>October 2014</td> <td>61.97</td> </tr> <tr> <td>November 2014</td> <td>66.87</td> </tr> <tr> <td>December 2014</td> <td>70.82</td> </tr> <tr> <td>January 2015</td> <td>68.19</td> </tr> <tr> <td>February 2015</td> <td>66.24</td> </tr> <tr> <td>March 2015</td> <td>74.71</td> </tr> <tr> <td>April 2015</td> <td>67.54</td> </tr> <tr> <td>May 2015</td> <td>68.47</td> </tr> <tr> <td>June 2015</td> <td>67.48</td> </tr> <tr> <td>July 2015</td> <td>72.28</td> </tr> </tbody> </table> Cross check: RINA cross checked the values presented in the monthly calculation spreadsheet /58/ /10/ against raw data from the PCL system /59/. | | Month | Value | October 2014 | 61.97 | November 2014 | 66.87 | December 2014 | 70.82 | January 2015 | 68.19 | February 2015 | 66.24 | March 2015 | 74.71 | April 2015 | 67.54 | May 2015 | 68.47 | June 2015 | 67.48 | July 2015 | 72.28 |
| Month | Value | | | | | | | | | | | | | | | | | | | | | | | |
| October 2014 | 61.97 | | | | | | | | | | | | | | | | | | | | | | | |
| November 2014 | 66.87 | | | | | | | | | | | | | | | | | | | | | | | |
| December 2014 | 70.82 | | | | | | | | | | | | | | | | | | | | | | | |
| January 2015 | 68.19 | | | | | | | | | | | | | | | | | | | | | | | |
| February 2015 | 66.24 | | | | | | | | | | | | | | | | | | | | | | | |
| March 2015 | 74.71 | | | | | | | | | | | | | | | | | | | | | | | |
| April 2015 | 67.54 | | | | | | | | | | | | | | | | | | | | | | | |
| May 2015 | 68.47 | | | | | | | | | | | | | | | | | | | | | | | |
| June 2015 | 67.48 | | | | | | | | | | | | | | | | | | | | | | | |
| July 2015 | 72.28 | | | | | | | | | | | | | | | | | | | | | | | |
| Monitoring equipment, accuracy | The following equipment was verified during the onsite visit: Manufacturer: CIBER Model: UPD200-2480M Range: maximum 300V and 5 A; | | | | | | | | | | | | | | | | | | | | | | | |

| | | |
|---------------------------------------|--|--|
| | | Serial Number: 40964200869 Accuracy: +/- 0.5% /49/ |
| Measuring/Reading/Recording frequency | | Data is continuously measured and registered every minute. |
| Calculation method (if applicable) | | Not applicable |

| Data/Parameter | $EG_{EC2,y} = EC_{PJ2,y}$ | | | | | | | | | | | | | | | | | | | | | | |
|--|--|-------|-------|--------------|------|---------------|------|---------------|------|--------------|------|---------------|------|------------|------|------------|------|----------|------|-----------|------|-----------|------|
| Data Unit | MWh/y | | | | | | | | | | | | | | | | | | | | | | |
| Description | Quantity of electricity consumed from diesel generators by the project activity during the year y | | | | | | | | | | | | | | | | | | | | | | |
| Source of data to be used | Data is measured by an electricity meter and is registered automatically in the PLC system | | | | | | | | | | | | | | | | | | | | | | |
| Value of monitored parameter for the monitoring period | <table border="1"> <thead> <tr> <th>Month</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>October 2014</td> <td>0.19</td> </tr> <tr> <td>November 2014</td> <td>0.21</td> </tr> <tr> <td>December 2014</td> <td>0.01</td> </tr> <tr> <td>January 2015</td> <td>0.60</td> </tr> <tr> <td>February 2015</td> <td>0.03</td> </tr> <tr> <td>March 2015</td> <td>0.04</td> </tr> <tr> <td>April 2015</td> <td>0.01</td> </tr> <tr> <td>May 2015</td> <td>0.00</td> </tr> <tr> <td>June 2015</td> <td>0.08</td> </tr> <tr> <td>July 2015</td> <td>0.00</td> </tr> </tbody> </table> <p>Cross check: RINA cross checked the values presented in the monthly calculation spreadsheet /58/ /10/ against raw data from the PCL system /59/.</p> | Month | Value | October 2014 | 0.19 | November 2014 | 0.21 | December 2014 | 0.01 | January 2015 | 0.60 | February 2015 | 0.03 | March 2015 | 0.04 | April 2015 | 0.01 | May 2015 | 0.00 | June 2015 | 0.08 | July 2015 | 0.00 |
| Month | Value | | | | | | | | | | | | | | | | | | | | | | |
| October 2014 | 0.19 | | | | | | | | | | | | | | | | | | | | | | |
| November 2014 | 0.21 | | | | | | | | | | | | | | | | | | | | | | |
| December 2014 | 0.01 | | | | | | | | | | | | | | | | | | | | | | |
| January 2015 | 0.60 | | | | | | | | | | | | | | | | | | | | | | |
| February 2015 | 0.03 | | | | | | | | | | | | | | | | | | | | | | |
| March 2015 | 0.04 | | | | | | | | | | | | | | | | | | | | | | |
| April 2015 | 0.01 | | | | | | | | | | | | | | | | | | | | | | |
| May 2015 | 0.00 | | | | | | | | | | | | | | | | | | | | | | |
| June 2015 | 0.08 | | | | | | | | | | | | | | | | | | | | | | |
| July 2015 | 0.00 | | | | | | | | | | | | | | | | | | | | | | |
| Monitoring equipment, accuracy | The following equipment was verified during the onsite visit: Manufacturer: CIBER Model: UPD200-2480M Range: maximum 300V and 5 A; Serial Number: 40962200082 Accuracy: +/- 0.5% /49/ | | | | | | | | | | | | | | | | | | | | | | |
| Measuring/Reading/Recording frequency | Data is continuously measured and registered every minute. | | | | | | | | | | | | | | | | | | | | | | |
| Calculation method (if applicable) | Not applicable | | | | | | | | | | | | | | | | | | | | | | |

| | |
|---------------------------|--|
| Data/Parameter | $T_{EG,m}$ |
| Data Unit | °C |
| Description | Temperature in the exhaust gas of the enclosed flare in minute m |
| Source of data to be used | Verified during the site visit that data is measured by the thermocouples and is registered automatically in the PLC system. |

| | | |
|--|--|---|
| | Value of monitored parameter for the monitoring period | <p>Data is registered every minute presented in the monthly calculation spreadsheet /58/.</p> <p>Cross check: RINA cross checked the values presented in the monthly calculation spreadsheet /58/ /10/ against raw data from the PCL system, /59/.</p> |
| | Monitoring equipment, accuracy | <p>The following equipment was confirmed during the on site visit:</p> <p>Flare 1 Manufacturer: ELSI /34/ Model: Type S Range: 0-1600°C Accuracy class: Accuracy class: [2.704 + (0.0025 x measured temperature)] °C, if measured temperature is equal or higher than 600°C Serial Number: 118583</p> <p>Flare 2 Manufacturer: ELSI /34/ Model: Type S Range: 0-1600°C Accuracy class: Accuracy class: [2.704 + (0.0025 x measured temperature)] °C, if measured temperature is equal or higher than 600°C Serial Number: 11-09/5207</p> <p>Flare 3 Manufacturer: ELSI /34/ (until 19/12/2014 /52/) Model: Type S Range: 0-1600°C Accuracy class: Accuracy class: [2.704 + (0.0025 x measured temperature)] °C, if measured temperature is equal or higher than 600°C Serial Number: 05-06/0619</p> <p>Manufacturer: Alutal /60/ (from 19/12/2014 onwards /52/) Model: Type S Range: 0-1480°C Accuracy class: ±1.5 °C or ±0.25% of measured value (where the highest value is considered) Serial Number: 12-12491</p> <p>Flare 4 Manufacturer: ELSI /34/ Model: Type S Range: 0-1600°C Accuracy class: Accuracy class: [2.704 + (0.0025 x measured temperature)] °C, if measured temperature is equal or higher than 600°C Serial Number: 11-09/5208</p> <p>Flare 5 Manufacturer: ELSI /34/ Model: Type S Range: 0-1600°C Accuracy class: Accuracy class: [2.704 +</p> |

| | | |
|---------------------------------------|--|--|
| | | (0.0025 x measured temperature)] °C, if measured temperature is equal or higher than 600°C Serial Number: 11-09/5209 Flare 6 Manufacturer: Alutal /60/ Model: Type S Range: 0-1480°C Accuracy class: ±1.5 °C or ±0.25% of measured value (where the highest value is considered) Serial Number: 177621 |
| Measuring/Reading/Recording frequency | | Data is continuously measured and registered every minute. |
| Calculation method (if applicable) | | Not applicable |

| Data/Parameter | Flame _m |
|--|---|
| Data Unit | Flame on or Flame off |
| Description | Flame detection of flare in the minute m |
| Source of data to be used | Ultra violet (UV) flame detectors (For each one of the flares, whenever flame is detected in the flare, flame status "on" or "1" value is attributed. Whenever no flame is detected in the flare, flame status "off" or "0" is attributed) |
| Value of monitored parameter for the monitoring period | data is registered every minute presented in the monthly calculation spreadsheet /58/. |
| Monitoring equipment, accuracy | Not applicable |
| Measuring/Reading/Recording frequency | Data is continuously measured and registered every minute. |
| Calculation method (if applicable) | Not applicable |

| Data/Parameter | Maintenance |
|--|---|
| Data Unit | calendar dates |
| Description | Maintenance events completed in year y |
| Source of data to be used | maintenance logs |
| Value of monitored parameter for the monitoring period | maintenance checks Cross check: Rina verified the Estre form SGA 096 "Preventive maintenance program" registers of the flare maintenance check, with weekly, semester and annually checks performed during the monitoring period /56/ |
| Monitoring equipment, accuracy | Not applicable |
| Measuring/Reading/Recording frequency | weekly, semester and annually checks performed during the monitoring period /56/ |
| Calculation method (if applicable) | Not applicable |

| | |
|-------------------|--|
| Findings | <p>CAR 4: Verified during the onsite visit that the thermocouple of the flare 3 05-06/0619 was substituted by the thermocouple 12-12491 /52/. However MR version 1 does not reflect the thermocouple's substitution in the flare 3</p> <p>CAR 5: Verified during the onsite visit that the thermocouple of the flare 6 is from manufacturer Alutal. PP did not include the equipments' specification in accordance with the equipment installed</p> <p>CAR 6: Verified in the monthly calculation spreadsheet /58/ that the values of the energy consumption ($EG_{EC1,y} = EC_{PJ1,y}$ and $EG_{EC2,y} = EC_{PJ2,y}$ are rounded down, not conservative.</p> <p>To close CAR 4 and CAR 5, MR was revised to present the correct information of the thermocouples. To close CAR 6, the energy consumed was conservatively rounded up.</p> |
| Conclusion | <p>RINA confirms:</p> <ul style="list-style-type: none"> - That all the parameters stated in the registered PDD have been monitored. For the mass flow, please, refer to the approved deviation /62/ /63/; - The responsibilities and authorities for monitoring and reporting are in accordance with those stated in the registered PDD - The monitoring results are consistently recorded as per the approved frequency. - Quality assurance and quality control procedure have been applied in accordance with the registered PDD. |

E.6.3. Implementation of sampling plan

| | |
|------------------------------|-----|
| Means of verification | N/A |
| Findings | N/A |
| Conclusion | N/A |

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

| | |
|------------------------------|--|
| Means of verification | <p>The following calibration certificates are applicable to the monitoring period:</p> <ul style="list-style-type: none"> - Management of SWDS: calibration is not applicable - $O_{pj,h}$; $T_{EG,m}$: calibration frequency is yearly, defined in the registered PDD /01/ <p>Flare 1 RINA verified the following calibration certificates: -CSouza Dias Instrumentação e Serviços Tecnológicos calibration certificate nº 000012/13, dated 20/12/2013, valid until 20/12/2015 for the thermocouple serial number 118583 /22/ -CSouza Dias Instrumentação e Serviços Tecnológicos calibration certificate nº 00003/14, dated 19/12/2014, valid until 19/12/2015 for the thermocouple serial number 118583 /23/</p> <p>Flare 2 RINA verified the following calibration certificates: -CSouza Dias Instrumentação e Serviços Tecnológicos calibration certificate nº 00008/13, dated 20/12/2013, valid until 20/12/2015 for the thermocouple serial number 11-09/5207 /24/ -CSouza Dias Instrumentação e Serviços Tecnológicos calibration certificate nº 00004/14, dated 19/12/2014, valid until 19/12/2015 for the thermocouple serial number 11-09/5207 /25/</p> <p>Flare 3 RINA verified the following calibration certificates: -CSouza Dias Instrumentação e Serviços Tecnológicos calibration certificate nº 00009/13, dated 20/12/2013, valid until 20/12/2015 for the thermocouple serial number 05-06/0619 /26/ -CSouza Dias Instrumentação e Serviços Tecnológicos calibration certificate nº 00002/14, dated 19/12/2014, valid until 19/12/2015 for the thermocouple serial number 12-12491 /27/</p> |
|------------------------------|--|

Flare 4

RINA verified the following calibration certificates:

-CSouza Dias Instrumentação e Serviços Tecnológicos calibration certificate nº 000010/13, dated 20/12/2013, valid until 20/12/2015 for the thermocouple serial number 11-09/5208 /28/

-CSouza Dias Instrumentação e Serviços Tecnológicos calibration certificate nº 00006/14, dated 19/12/2014, valid until 19/12/2015 for the thermocouple serial number 11-09/5208 /29/

Flare 5

RINA verified the following calibration certificates:

-CSouza Dias Instrumentação e Serviços Tecnológicos calibration certificate nº 000011/13, dated 20/12/2013, valid until 20/12/2015 for the thermocouple serial number 11-09/5209 /30/

-CSouza Dias Instrumentação e Serviços Tecnológicos calibration certificate nº 00007/14, dated 19/12/2014, valid until 19/12/2015 for the thermocouple serial number 11-09/5209 /31/

Flare 6

RINA verified the following calibration certificates:

-CSouza Dias Instrumentação e Serviços Tecnológicos calibration certificate nº 00006/13, dated 20/12/2013, valid until 20/12/2015 for the thermocouple serial number 177621 /32/

-CSouza Dias Instrumentação e Serviços Tecnológicos calibration certificate nº 00005/14, dated 19/12/2014, valid until 19/12/2015 for the thermocouple serial number 177621/33/

V_{t,wb}: Calibration frequency: 3 years. ABB provided a letter recommending the calibration between 3 to 5 years /36/. PP has conservatively adopted the calibration frequency of 3 years defined and registered in the Estre calibration plan SGA 088 /38/.

Verified the calibration certificate issued by CSouza Dias Instrumentação e Serviços Tecnológicos nº 000003/14, dated 06/02/2014 valid until 06/02/2017 /37/

V_{CH4,t,wb}: calibration is yearly

Verified the calibration certificates applicable to the monitoring period:

* CSouza Dias Instrumentação e Serviços Tecnológicos calibration certificate nº 000013/14, dated 20/12/2013 valid until 20/12/2014. White Martins Gases Industriales Ltda. gas cylinder calibration certificate 41019406 for the cylinder 479, dated 26/04/2013 valid until 26/04/2018 /40/

* CSouza Dias Instrumentação e Serviços Tecnológicos calibration certificate nº 000008/14, dated 19/12/2014 valid until 19/12/2015. White Martins Gases Industriales Ltda. gas cylinder calibration certificate 40834922 for the cylinder 521822, dated 13/01/2012 valid until 13/01/2017 /41/

Moreover Rina verified during the on site visit that PP has a programme of preventive maintenance SGA 096 that considers weekly inspection and semi-annual check with standard gases /61/

Tt: Calibration frequency: 3 years. ABB provided a letter recommending the calibration between 3 to 5 years /43/. PP has conservatively adopted the calibration frequency of 3 years defined and registered in the Estre calibration plan SGA 088 /38/.

Verified the calibration certificate issued by CSouza Dias Instrumentação e Serviços Tecnológicos nº 000001/14, dated 06/02/2014 valid until 06/02/2017 /44/

Pt: Calibration frequency: 3 years. The ABB data sheet refers to a stability of ten years /46/. PP has conservatively adopted the calibration frequency of 3 years defined and registered in the Estre calibration plan SGA 088 /38/.

Verified the calibration certificate issued by CSouza Dias Instrumentação e Serviços Tecnológicos dated 06/02/2014 valid until 06/02/2017 /47/

EF_{grid,CM,y}; **EF_{grid,OM,y}** : Not applicable, data provided by the Brazilian DNA

| | |
|-------------------|--|
| | <p>TDL_{j,y}: not applicable</p> <p>EG_{EC1,y} = EC_{PJ1,y}: calibration frequency is yearly. Verified the calibration certificate issued by IPT – Instituto de Pesquisas Tecnológicas calibration certificate number 140500-101, dated 18/09/2014 valid until 18/09/2015 /50/</p> <p>EG_{EC2,y} = EC_{PJ2,y}: calibration frequency is yearly Verified the calibration certificate issued by IPT – Instituto de Pesquisas Tecnológicas calibration certificate number 140501-101, dated 17/09/2014 valid until 17/09/2015 /51/</p> <p>Flame_m: not applicable</p> <p>Maintenance: Not applicable</p> <p>RINA verified that the calibrations for the monitoring period were conducted by CSouza Dias Instrumentação e Serviços Tecnológicos and IPT – Instituto de Pesquisas Tecnológicas. IPT is accredited by INMETRO and CSouza Dias Instrumentação e Serviços Tecnológicos is a regularly registered and licensed as an calibration, testing and inspection enterprise that used calibration standards certified by INMETRO (Brazilian National Institute for Metrology), in accordance with National Standards and the calibrations certificates describes the professional registry of the personnel. Therefore it is RINA's opinion all calibration events valid for the considered monitoring period were appropriately performed in accordance with the QA/QC procedures stated in the registered PDD.</p> |
| Findings | <p>CL 2: PP is requested to confirm/evidence that the calibration of the meters have be done by an accredited person or institution</p> <p>In order to close CL 2 PP has provided the evidences to confirm that the standard responsible for the meters calibration conference are certified by Inmetro (Brazilian National Institute for Metrology, in accordance with National Standards.</p> |
| Conclusion | RINA verified that the calibration of monitoring equipments' applicable to the project activity followed the frequency described in the registered PDD. |

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 | <p>In accordance with the approved temporary deviation of the applied methodology/registered monitoring plan (EB90 meeting), the Baseline emissions (BE_y) for the considered monitoring period are determined (in tCO₂e) as follows:</p> $BE_y = BE_{CH_4,y}$ <p>Where:</p> <p>BE_{CH₄,y} = Baseline emissions of methane from the SWDS, determined as follows:</p> $BE_{CH_4,y} = (1 - OX_{top_layer}) * (F_{CH_4,PJ,y} - F_{CH_4,BL,y}) * GWP_{CH_4}$ <p>Where:</p> <p>OX_{top_layer}= Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline scenario, determined ex-ante determined as 10% /01/.</p> <p>GWP_{CH₄,y}= Global warming potential of CH₄. GWP_{CH₄} is ex-ante determined as 25 /01/ /15/.</p> <p>F_{CH₄,BL,y}=Amount of methane in the LFG that would be flared in the baseline scenario (absence of project activity), calculated as follows:</p> $F_{CH_4,BL,y} = 0.2 * F_{CH_4,PJ,y}$ |
|------------------------------|---|

Where:

$F_{CH_4,PJ,y}$ = Amount of methane which is flared and/or used in the project activity .

For the considered monitoring period, the accumulated value for $F_{CH_4,BL,y}$ is calculated as 6,192 tCH₄ /10/

$F_{CH_4,PJ,y}$ =Amount of methane in the LFG which is flared and/or used in the project activity.

In the particular case of the project activity, $F_{CH_4,PJ,y}$ is determined as follows:

$$F_{CH_4,PJ,y} = F_{CH_4,flared,y}$$

Where:

$F_{CH_4,flared,y}$ Amount of methane in the LFG flared by the project activity (in tCH₄). In accordance with calculation guidance included in the PDD and by following applicable guidance of the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream”, every-minute values for $F_{CH_4,flared,y}$ are determined as the difference between the amount of methane supplied to the flares and residual methane emissions from combustion of LFG in the flares, as follows:

$$F_{CH_4,flared,y} = F_{CH_4,sent_flare,y} - (PE_{flare,y} / GWP_{CH_4})$$

Where:

$F_{CH_4,sent_flare,y}$ = Amount of methane in the LFG which is sent to the flares.

$PE_{flare,y}$ =Project emissions from flaring of the residual gas stream.

Determination of every-minute values for the calculation parameter $F_{CH_4,sent_flare,y}$:

$$F_{CH_4,sent_flare,y} = F_{CH_4,t} = V_{t,wb,n} * v_{CH_4,t,wb} * \rho_{CH_4,n}$$

Where:

$V_{t,wb,n}$ = Volumetric flow of the gaseous stream (LFG) in time interval t on a wet basis at normal conditions (considering the approved deviation, a conservative approach is applied for calculating project emissions from flaring ($PE_{flare,y}$) during the considered monitoring period). For the considered monitoring period, every-minute values of the calculation parameter $V_{t,wb,n}$ (in Nm³ wet gas/h) represents calculated and reported in the monthly emission reduction calculation spreadsheets valid for the considered monitoring period. $V_{t,wb,n}$ thus represents records for the monitoring parameter “Volumetric flow of the gaseous stream in time interval t on a wet basis” ($V_{t,wb}$). Since measurements of LFG flow to the flares are automatically converted and recorded in normalized cubic meters monitoring of pressure and temperature of the LFG is not required for the determination of $V_{t,wb,n}$.

$v_{CH_4,t,wb}$ = Volumetric fraction of CH₄ in the gaseous stream in time interval t on a wet basis. As per the applied monitoring procedure, every-minute values of the monitoring parameter $v_{CH_4,t,wb}$ (in m³ of CH₄ / m³ of wet LFG) are reported in the monthly emission reduction calculation spreadsheet valid for the considered monitoring period

$\rho_{CH_4,n}$ = Density of CH₄ in the gaseous stream (LFG) at normal conditions calculated as follows:

$$\rho_{CH_4,n} = (P_{ref} * MM_i) / (R_u * T_{ref})$$

Where:

P_{ref} = Absolute pressure at reference conditions= 101,325 Pa /01/

T_{ref} = Temperature at reference conditions =273.15 K /01/

MM_i = Molecular mass of greenhouse gas i ($i = CH_4$) = 16.04 kg/mol /01/

R_u = Universal ideal gases constant =. 8,314 Pa.m³/kmol.K./01/

| | |
|-------------------|--|
| | <p>$\rho_{CH_4,n} = 0.7156650 \text{ kgCH}_4 / \text{m}^3\text{CH}_4 / 10 / 58 /$.</p> <p><i>Determination of $PE_{flare,y}$:</i></p> <p>$PE_{flare,y}$ is determined by following applicable stepwise guidance of the methodological tool "Project emissions from flaring" (version 02.0.0):</p> $PE_{flare,y} = GWP_{CH_4} * \sum_{m=1}^{525,600} F_{CH_4,RG,m} * (1 - \eta_{flare,m}) * 10^{-3}$ <p>Where:</p> <p>$F_{CH_4,RG,m}$=Methane mass flow in the residual gas. For each minute m of the considered monitoring period, values for $F_{CH_4,RG,m}$ valid for the set of installed flares are equal to every-minute reported measurement records of the calculation sub-parameter "Amount of methane in the LFG which is sent to the flares" ($F_{CH_4,sent_flare,y}$).</p> <p>$\eta_{flare,m}$= Flare efficiency in minute m. For the considered monitoring period, the application of the default 80% value is selected for the determination of $\eta_{flare,m}$ for each individual minute m by following applicable guidance as per Option A (Default value) for low height flares of the methodological tool "Project emissions from flaring", considering the that the flares are with the manufacturer specifications.</p> <p>RINA verified in accordance with the approved temporary deviation (EB 90 meeting), a conservative approach was adopted to discount all the Emission Reductions generated by the LFG flaring facility during the periods where one or more flares operate outside the specified operational parameters, thus assuring that no Emission Reduction is claimed with the flares operating in non-conformity with the specified operational parameters for the LFG flow and temperature. Therefore if one of the flares is not operational in accordance with the manufacturer specifications for the temperature, all the flow (measured by one flow meter) is not considered in the emission reduction calculation.</p> <p>Therefore, for the current monitoring period $F_{CH_4,PJ,y} = F_{CH_4,flared,y}$ is equal 20,020 tCH₄ /10/ /58/</p> <p>The baseline emissions of methane from the SWDS ($BE_y = BE_{CH_4,y}$) is equal 311,130 tCO₂e. /10/ /58/</p> <p>RINA verified that the values and formulas for baseline emissions are correctly presented in the CERs spreadsheet /10/</p> |
| Findings | <p>CAR 7: In accordance with the registered PDD for enclosed flares that are defined as low height flares, which is the case of the project activity, the flare efficiency shall be adjusted, as a conservative approach, by subtracting 0.1 from the efficiency. Verified in the calculations /58/ /10/ that PP is not considering the discount. Moreover PP is requested to provide data in the sheet "input data" in English in the spreadsheet with monthly calculation.</p> <p>CL 1: A test is included in the monthly calculation spreadsheet to confirm if the flares are operational considering the manufacturer's flare specifications for temperature and flow rate (SPEC_{flare}). However it is not clear how the test is conducted, for example, in the spreadsheet "012015.xls" day 01/01/2015 minute 0:00 flare 1 had the temperature (826°C) bellow the manufacturer specification (850°C) and the test result is "1". In the same day, minute 0:01 flare 1 had the temperature (826°C) bellow the manufacturer specification (850°C) and the test result is "0".</p> <p>In order to close out CAR 7 and CL 1, PP revised the monthly spreadsheets to consider the calculations taking into account the discount of low height flares and the temperature of all flares, respectively.</p> |
| Conclusion | <p>RINA verified that the baseline emissions were calculated in accordance with the formulae and methods described in the registered PDD, the approved deviation, the applied methodology and methodological tools.</p> |

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

| | |
|------------------------------|---|
| Means of verification | <p>Project emissions (PE_y) for the monitoring period are determined (in tCO₂e) as follows:</p> $PE_y = PE_{EC,1} + PE_{EC,2}$ <p>Where:</p> <p>PE_{EC,1} = Project emissions due to the consumption of grid-sourced electricity by the project activity</p> <p>PE_{EC,2} = Project emissions due to the consumption electricity by the project activity of electricity sourced by captive off-grid backup electricity generators</p> <p>Project emissions due to the consumption of grid-sourced electricity by the project activity (PE_{EC,1}) are calculated as per the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” as follows:</p> $PE_{EC,1} = EC_{PJ,1} * EF_{EL,grid} * (1 + TDL_{j,y})$ <p>Where:</p> <p>TDL_{j,y}= Average technical transmission and distribution losses for providing electricity to source j in year y. TDL_{j,y} is determined as 20%, default value chosen /17/.</p> <p>EC_{PJ,1} = Quantity of electricity consumed from the grid by the project activity during the year y. RINA verified that the project activity consumed 685 MWh during the monitoring period. /10/</p> <p>EF_{EL,grid}= Emission factor for grid-sourced electricity in year y, determined as the combined margin emission factor (EF_{grid,CM,y}) as follow:</p> $EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y}$ <p>Where:</p> <p>w_{OM}= Weighting of operating margin emissions factor. w_{OM} is ex-ante selected as 0.25%, for the second crediting period.</p> <p>w_{BM}= Weighting of operating margin emissions factor. w_{BM} is ex-ante selected as 0.75%, for the second crediting period .</p> <p>EF_{grid,OM}= Operating margin CO₂ emission factor in year y. The value applied is in accordance with data provided by the Brazilian DNA= 0.5837 tCO₂/MWh (data year for 2014) /48/</p> <p>EF_{grid,BM}= Build margin CO₂ emission factor in year y. determined ex-ante in the registered PDD = 0.2010 tCO₂/MWh./01/</p> <p>Therefore, for the monitoring period, PE_{EC,1} = 244 tCO₂ (rounded value up value) /10/</p> <p>Project emissions due to the consumption by the project activity of electricity sourced by backup captive off-grid electricity generators (PE_{EC,2}) are calculated as follows:</p> $PE_{EC,2} = EC_{PJ,2} * EF_{EL,2}$ <p>Where:</p> <p>EC_{PJ,2}= Quantity of electricity sourced by backup captive off-grid electricity generators consumed by the project activity. EC_{PJ,2} is equal to 2 MWh /58/ /10/.</p> <p>EF_{EL,2}= Emission factor for electricity sourced by backup captive off-grid electricity generators EF_{EL,2} is determined as 1.3 tCO₂/MWh (conservative default value as per the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”.</p> <p>Therefore, PE_{EC,2} = 3 tCO₂ (rounded up value) /10/</p> |
|------------------------------|---|

| | |
|-------------------|---|
| | The total project emissions for the considered monitoring period are calculated as 247 tCO ₂ /10/ |
| Findings | N/A |
| Conclusion | RINA verified that the project emissions were calculated in accordance with the formulae and methods described in the registered PDD, the applied methodology and methodological tools. |

E.8.3. Calculation of leakage GHG emissions

| | |
|------------------------------|---|
| Means of verification | In accordance with the applied methodology Leakage is not applicable. |
| Findings | N/A |
| Conclusion | N/A |

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

| | |
|------------------------------|---|
| Means of verification | <p>The emissions reductions are calculated as follows: $ER_y = BE_y - PE_y$ Where, ER_y= Emission reductions in year y (tCO₂e/yr); BE_y= Baseline emissions in year y (tCO₂e/yr); PE_y= Project emissions in year y (tCO₂e/yr);</p> <p>The emission reduction calculations is provided in the spreadsheet /10/. The emission reductions from the project for the monitoring period as reported in the monitoring report version 3 of 26/07/2016 /02/ is equivalent to 310,883tCO₂e. The CERs calculation is based only on data available. RINA has cross checked data as described in the section E.6.2. As the monitoring period starts on 01/10/2014, the pro-rata approach is not applicable.</p> |
| Findings | N/A |
| Conclusion | <p>RINA confirms:</p> <ul style="list-style-type: none"> - All the data and parameters were monitored in accordance with the registered PDD - The data reported were cross-checked with the data recorded by PP and the values reported in the MR were verified against the raw data presented by the PP - The calculation of emission reductions have been carried out in accordance with the formulae and methods described in the registered PDD, the applied methodologies and methodological tools; - Emission factor and default values have been applied in the calculation in accordance to the registered PDD. |

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

| | |
|------------------------------|---|
| Means of verification | <p>The reported emission reductions are approximately 28 % lower than the estimated emission reduction of 433,154 tCO₂e for the period as per the registered PDD /01/. The data presented in the monitoring report /02/ were assessed by reviewing in detail project documentation, collection of monitored data, observation of established monitoring and reporting practices and assessment of the reliability of monitoring equipment. Sufficient evidence was presented and verified by RINA for the reported emission reductions as listed in the above sections.</p> |
| Findings | N/A |
| Conclusion | Verified during the onsite visit the reported emission reductions are lower than the estimated emission reduction in the registered PDD |

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

| | |
|------------------------------|-----|
| Means of verification | N/A |
| Findings | N/A |
| Conclusion | N/A |

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 | The emission reductions from the project for the monitoring period as reported in the monitoring report /02/ is equivalent to 310,883 tCO _{2e} and the monitoring period is from 01/10/2014 to 31/07/2015 |
| Findings | N/A |
| Conclusion | The actual monitoring period does not falls into the first commitment period. |

SECTION F. Internal quality control

The final draft revision of the verification report before being submitted to UNFCCC was subjected to an independent internal technical review to confirm that all verification activities had been completed according to the pertinent RINA instructions.

The technical review is performed by a technical reviewer(s) qualified in accordance with RINA's qualification scheme for CDM validation and verification.

SECTION G. Verification opinion

RINA Service Spa (RINA) has performed verification of the emission reductions reported for the project activity ESTRE'S Paulínia Landfill Gas Project (EPLGP) in Brazil, CDM Registration Reference N° 0165, for the period 01/10/2014 to 31/07/2015, with regard to the relevant requirements for CDM activities. It is RINA's opinion that project activity ESTRE'S Paulínia Landfill Gas Project (EPLGP) in Brazil as described in the revised PDD (version 04.5 of 29/02/2016 and the temporary deviation approved in the EB 90 meeting) and monitoring report (version 3 of 26/07/2016), meets all relevant requirements for CDM activities and all relevant host Party criteria and correctly applies the baseline and monitoring methodology ACM0001, "Flaring or use of landfill gas" version 13.0.0 of 11/05/2012. The verification is conducted in-line with the VVS requirements.

The project activity was correctly implemented according to selected monitoring methodology and monitoring plan. The monitoring equipment was installed, calibrated and maintained in a proper manner, while collected monitoring data are allowed to verify the amount of achieved GHG emission reductions. In conclusion, it is RINA's opinion that the project activity ESTRE'S Paulínia Landfill Gas Project (EPLGP), in Brazil, as described in the Monitoring Report version 3 of 26/07/2016, meets all relevant requirements for CDM activities and all relevant host Party criteria and correctly applies the baseline and monitoring methodologies ACM0001, "Flaring or use of landfill gas" version 13.0.0 of 11/05/2012. Hence RINA is able to issue a positive opinion in accordance with the certificate statement

SECTION H. Certification statement

RINA Service Spa (RINA) has performed verification of the emission reductions reported for the project activity ESTRE'S Paulínia Landfill Gas Project (EPLGP) in Brazil, CDM Registration Reference N° 0165, for the period 01/10/2014 to 31/07/2015, with regard to the relevant requirements for CDM activities.

The project participants of the ESTRE'S Paulínia Landfill Gas Project (EPLGP) project are responsible for:

- the preparation of greenhouses gas emissions data and the reported greenhouse gas emission reductions from the project on the basis set out in the monitoring plan contained in the revised project design document PDD (version 04.5 of 29/02/2016 and the temporary deviation approved in the EB 90 meeting)
- the development and maintenance of records and reporting procedures in accordance with that plan, including the calculation and determination of greenhouse gas emission reductions of the project

It is the responsibility of RINA to express an independent verification opinion about the project's conformity with the requirements of paragraph 62 of the CDM modalities and procedures and on the reported greenhouse gas emission reductions from the project.

Based on documented evidence and corroborated by an on-site assessment RINA can confirm that:

- the project has been implemented and operated as per the registered PDD;
- the monitoring report and other supporting documents provided are complete and verifiable and in accordance with the applicable CDM requirements;
- the monitoring is in place as per the applied baseline and monitoring methodology;
- the monitoring complies with the monitoring plan in the registered PDD;
- the monitoring plan in the registered PDD is as per the applied baseline and monitoring methodology.

It is RINA's opinion that the GHG emission reduction stated in the monitoring report version 3 of 26/07/2016 for the ESTRE'S Paulínia Landfill Gas Project (EPLGP) in Brazil for the period 01/10/2014 to 31/07/2015 are fairly stated. The GHG emission reductions were calculated correctly on the basis of the approved monitoring methodology ACM0001, "Flaring or use of landfill gas" version 13.0.0 of 11/05/2012 and the monitoring plan contained in the revised PDD.

As the monitoring period starts on 01/10/2014, the pro-rata approach is not applicable.

Hence RINA is able to certify that the emission reductions from the project during the monitoring period 01/10/2014 to 31/07/2015 amount to 310,883 tCO₂e

Appendix 1. Abbreviations

| Abbreviations | Full texts |
|-------------------|---|
| BE | Baseline Emissions |
| CAR | Corrective Action Request |
| CDM | Clean Development Mechanism |
| CDM M&P | Modalities and Procedures CDM |
| CER(s) | Certified Emission Reduction(s) |
| CH ₄ | Methane |
| CL | Clarification Request |
| CO ₂ | Carbon dioxide |
| CO ₂ e | Carbon dioxide equivalent |
| CRT | Coordination and Technical Control Staff |
| DCI | Certification Division of RINA Services Spa |
| DNA | Designated National Authority |
| DOE | Designated Operational Entity |
| EB | Executive Board |
| ER | Emission Reductions |
| FAR | Forward Action Request |
| GHG(s) | Greenhouse gas(es) |
| GWP | Global Warming Potential |
| IPCC | Intergovernmental Panel on Climate Change |
| LoA | Letter of Approval |
| MoV | Means of Verification |
| MR | Monitoring Report |
| NGO | Non-governmental Organization |
| ODA | Official Development Assistance |
| PDD | Project Design Document |
| PE | Project Emission |
| PP(s) | Project Participant(s) |
| Ref. | Document Reference |
| RINA | RINA Services Spa |
| SS(s) | Sectoral Scope(s) |
| TA(s) | Technical Area(s) |
| UNFCCC | United Nations Framework Convention on Climate Change |
| VVS | Validation and Verification Standard |

Appendix 2. Competence of team members and technical reviewers


RINA

CERTIFICATO DI QUALIFICA QUALIFICATION CERTIFICATE

Si attesta che il sig./sig.ra:
We declare that Mr/Mrs/Ms:

Thais De Lima Carvalho

è qualificato come¹:
is qualified as:

CDM -TEC, -VAL, -VER, -TL

per le seguenti aree tecniche:
for the following technical areas:

1.1, 1.2, 2.1, 13.1

| AREE TECNICHE TECHNICAL AREAS | DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION | SCOPO SETTORIALE SECTORAL SCOPE |
|----------------------------------|---|------------------------------------|
| 1.1 | Thermal energy generation | 1 |
| 1.2 | Renewables | 1 |
| 2.1 | Electricity distribution | 2 |
| 13.1 | Solid waste and wastewater | 13 |

in accordo alle istruzioni della Divisione Certificazione.
in accordance with the instructions of the Certification Division.

| REVISIONE REVISION | DATA DATE | MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION |
|-----------------------|--------------|---|
| 0 | 19-08-2009 | - |
| 12 | 15-01-2015 | Added TA 2.1 |

Il Resp. QPT
Head of QPT

¹ Legend

VAL: Validator
VER: Verifier
TEC: Technical Expert
TL: Team Leader
FIN-EXP: Financial Expert
DET: Determiner

CDM: Clean Development Mechanism
VCS: Verified Carbon Standard
GS: Gold Standard
SCS: SocialCarbon Standard
JI: Joint Implementation

RINA Services S.p.A. è accreditato da UNFCCC, quale Entità Operativa Designata (DOE), per condurre la Validazione e la Verifica di Progetti CDM, da VCSA per condurre la Validazione e la Verifica di Progetti VCS, da GS Foundation, per condurre la Validazione e la Verifica di Progetti GS, da Ecologica Institute per condurre la Validazione e la Verifica di rapporti SCS.

RINA Services S.p.A. is accredited by the UNFCCC, as Designated Operational Entity (DOE), to carry out Validation and Verification of CDM Projects, by the VCSA, to carry out Validation and Verification of VCS Projects, by the GS Foundation, to carry out Validation and Verification of GS Projects and by the Ecologica Institute, to carry out Validation and Verification of SCS Reports.

GHG_QUAL_CERT_EN_04_12

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RINA

**CERTIFICATO DI QUALIFICA
QUALIFICATION CERTIFICATE**

Si attesta che il sig./sig.ra:

Geisa Maria Principe Branco Satttoni

We declare that Mr/Mrs/Ms:

è qualificato come¹:
is qualified as:

CDM-TEC, VAL, VER, TL

per le seguenti aree tecniche:
for the following technical areas:

1.1, 1.2, 13.1

| AREE TECNICHE TECHNICAL AREAS | DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION | SCOPO SETTORIALE SECTORAL SCOPE |
|----------------------------------|---|------------------------------------|
| 1.1 | Thermal Energy generation | 1 |
| 1.2 | Energy generation from renewable energy sources | 1 |
| 13.1 | Waste Handling and Disposal | 13 |

in accordo alle istruzioni della Divisione Certificazione.

in accordance with the instructions of the Certification Division.

| REVISIONE REVISION | DATA DATE | MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION |
|-----------------------|--------------|---|
| 0 | 27-08-2009 | - |
| 9 | 17-07-2015 | Updating qualification according AS version 6 |

Il Resp. QPT
Head of QPT

¹ Legend:

VAL: Validator
VER: Verifier
TEC: Technical Expert
TL: Team Leader
FIN-EXP: Financial Expert
DET: Determiner

CDM: Clean Development Mechanism
VCS: Verified Carbon Standard
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RINA
**CERTIFICATO DI QUALIFICA
QUALIFICATION CERTIFICATE**

Si attesta che il sig./sig.ra:
We declare that Mr/Mrs/Ms:

Rita Valoroso

è qualificato come:
is qualified as:

CDM -TEC, -VAL, -VER, -TL
TECHNICAL REVIEWER

per le seguenti aree tecniche:
for the following technical areas:

1.2, 3.1, 13.1

| AREE TECNICHE TECHNICAL AREAS | DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION | SCOPO SETTORIALE SECTORAL SCOPE |
|----------------------------------|---|------------------------------------|
| 1.2 | Renewables | 1 |
| 3.1 | Energy demand | 3 |
| 13.1 | Solid Waste and waste water | 13 |

in accordo alle istruzioni della Divisione Certificazione.
in accordance with the instructions of the Certification Division.

| REVISIONE REVISION | DATA DATE | MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION |
|-----------------------|--------------|---|
| 0 | 18-01-10 | - |
| 10 | 08/04/2016 | Update qualification TA 3.1 |

Il Resp. QPT
Head of QPT

Rita Valoroso

¹ Legend:

VAL: Validator
VER: Verifier
TEC: Technical Expert
TL: Team Leader
FIN-EXP: Financial Expert
DET: Determiner

CDM: Clean Development Mechanism
VCS: Verified Carbon Standard
GS: Gold Standard
SCS: SocialCarbon Standard
JI: Joint Implementation

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RINA

**CERTIFICATO DI QUALIFICA
QUALIFICATION CERTIFICATE**

Si attesta che il sig./sig.ra:
We declare that Mr/Mrs/Ms:

Laura Severino

è qualificato come¹:
is qualified as:

CDM- TEC, CDM-VAL, ITRP

per le seguenti aree tecniche:
for the following technical areas:

5.1

| AREE TECNICHE TECHNICAL AREAS | DESCRIZIONE DELL'AREA TECNICA TECHNICAL AREA DESCRIPTION | SCOPO SETTORIALE SECTORAL SCOPE |
|----------------------------------|---|------------------------------------|
| 5.1 | Chemical industry | 5 |

in accordo alle istruzioni del Settore Sostenibilità, Ambiente & Cambiamenti Climatici.
in accordance with the instructions of the Sustainability, Environment & Climate Change Sector.

| REVISIONE REVISION | DATA DATE | MOTIVAZIONI PER LA REVISIONE REASON FOR THE REVISION |
|-----------------------|--------------|---|
| 0 | 09-04-2008 | - |
| 11 | 10-11-2015 | New revision of IS-QPT-GHG-20 |

Il Resp. di Schema
Scheme Leader

¹ Legend

VAL: Validator
VER: Verifier
TEC: Technical Expert
TL: Team Leader
FIN-EXP: Financial Expert
DET: Determiner

CDM: Clean Development Mechanism
VCS: Verified Carbon Standard
GS: Gold Standard
SCS: SodelCarbon Standard
JI: Joint Implementation

RINA Services S.p.A. è accreditato da UNFCCC, quale Entità Operativa Designata (DOE), per condurre la Validazione e la Verifica di Progetti CDM, da VCSA per condurre la Validazione e la Verifica di Progetti VCS, da GS Foundation, per condurre la Validazione e la Verifica di Progetti GS, da Ecologica Institute per condurre la Validazione e la Verifica di rapporti SCS.

RINA Services S.p.A. is accredited by the UNFCCC as Designated Operational Entity (DOE), to carry out Validation and Verification of CDM Projects, by the VCSA, to carry out Validation and Verification of VCS Projects, by the GS Foundation, to carry out Validation and Verification of GS Projects and by the Ecologica Institute, to carry out Validation and Verification of SCS Reports.

GHG_QUAL_CERT_EN_04_12

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Appendix 3. Documents reviewed or referenced

| No. | Author | Title | References to the document | Provider |
|-----|--|--|---|---------------------|
| 1 | UniCarbo Energia e Biogás Ltda. | *CDM-PDD for project activity ESTRE'S Paulínia Landfill Gas Project (EPLGP) in Brazil | Version 04.5 of 29/02/2016 version 4.2 of 26/04/2013 (renewal crediting period) version 3.1 of 18/01/2012 version 2b of 04/12/2005 | Project participant |
| 2 | UniCarbo Energia e Biogás Ltda. | Monitoring report for project activity "ESTRE'S Paulínia Landfill Gas Project (EPLGP)" in Brazil related to the monitoring period 01/10/2014 to 31/07/2015. | version 3 of 26/07/2016 Version 2 of 20/10/2015 version 1 of 01/09/2015 | Project participant |
| 3 | CDM Executive Board | Clean Development Mechanism Project Cycle Procedure | version 09 of 20/02/2015 | Others |
| 4 | CDM Executive Board | Clean Development Mechanism Project Standard | version 09 of 20/02/2015 | Others |
| 5 | CDM Executive Board | Clean Development Mechanism Validation and Verification Standard | version 09 of 20/02/2015 | Others |
| 6 | CDM Executive Board | CDM Executive Board: Baseline and monitoring methodology ACM0001, "Flaring or use of landfill gas" | version 13.0.0 of 11/05/2012 | Others |
| 7 | RINA | verification report number 2014-BQ-05-MD version 1.1Aa for the monitoring period 15: 01/10/2012 to 13/09/2013 | dated 25/05/2014 (lasted verification) | Others |
| 8 | CDM Executive Board | CDM-MR-FORM - Monitoring report form, including Attachment. Instructions for filling out the monitoring report form | version 5.1 | Other |
| 9 | IPCC | Fourth Assessment Report: Climate Change 2007, available in English at http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html | accessed on 08/12/2014 | Other |
| 10 | UniCarbo Energia e Biogás Ltda and ESTRE Ambiental S/A | CERs spreadsheet "MR 17 - Paulinia - V.1 - 01.09.2015.xlsx" MR 17 - Paulinia - V.2 - 20.10.2015.xlsx MR 17 - Paulinia - V.3 - 26.07.2016.xlsx | version 1 of 01/09/2015 version 2 of 20/10/2015 version 3 of 26/07/2016 | Project Participant |
| 11 | Det Norske Veritas Certification Ltd. (DNV) | Validation report N°2005-0105, | version 05 of 16/12/2005 | Other |

| | | | | |
|----|--|--|--|---------------------|
| 12 | TÜV SÜD Industrie Service GmbH | validation of the renewal of crediting period Report nº. 10074KM, | version 02 of 12/07/2013 | Other |
| 13 | Cetesb | * partial operational license number 37002080 for the landfill, * operational license number 37001297 for biogas plant (flare 1 and 2) , * operational license number 37002348 for the flare 3 , dated 23/12/2014 valid until 23/12/2019 * operational license number 37001298 for the flare 4 and 5 , * operational license number 37002536 for the flare 6 , | *dated 25/02/2014 valid until 25/02/2019 *dated 30/09/2011 valid until 30/09/2016 * dated 30/09/2011 valid until 30/09/2016 * dated 31/07/2005 valid until 31/07/2020 | Project Participant |
| 14 | UNFCCC | Global Warming Potentials available in English at http://unfccc.int/ghg_data/items/3825.php | assessed on 30/09/2015 | Other |
| 15 | CDM Executive Board: | "Standard for application of the global warming potentials to clean development mechanism project activities and programmes of activities for the second commitment period of the Kyoto protocol, | version 1 of 13/09/2012 | Other |
| 16 | CDM Executive Board: | "Emissions from solid waste disposal sites" | version 06.0.1 of 02/03/2014 | Other |
| 17 | CDM Executive Board: | "Tool to calculate baseline, project and/or leakage emissions from electricity consumption, | version 1 dated 16/05/2008 | Other |
| 18 | CDM Executive Board: | "Tool to calculate the emission factor for an electricity system" – | version 03.0.0 dated 23/11/2012 | Other |
| 19 | CDM Executive Board: | "Project emissions from flaring", | version 2.0.0 dated 20/07/2012 | Other |
| 20 | CDM Executive Board: | "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" | version 2.0.0 dated 03/06/2011 | Other |
| 21 | Brazilian DNA | emission factor data for the year 2012, available in Portuguese at http://www.mct.gov.br/index.php/content/view/338047.html#ancora | accessed on 16/09/2015 | Other |
| 22 | CSouza Dias Instrumentação e Serviços Tecnológicos | calibration certificate nº 000012/13, dated 20/12/2013, valid until 20/12/2015 for the thermocouple serial number 118583 (Termopar_118583_Cert_12_13.jpg) | dated 20/12/2013 | Project Participant |
| 23 | CSouza Dias Instrumentação e Serviços Tecnológicos | calibration certificate nº 00003/14, dated 19/12/2014, valid until 19/12/2015 for the thermocouple serial number 118583 (Termopar_118583_Cert_3_14.pdf) | dated 19/12/2014 | Project Participant |
| 24 | CSouza Dias | calibration certificate nº 00008/13, dated 20/12/2013, valid until 20/12/2015 for the | dated 20/12/2013 | Project Participant |

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| | Instrument ação e Serviços Tecnológico s | thermocouple serial number 11-09/5207 (Termopar_11095207_Cert_08_13.pdf) | | |
| 25 | CSouza Dias Instrument ação e Serviços Tecnológico s | calibration certificate nº 00004/14, dated 19/12/2014, valid until 19/12/2015 for the thermocouple serial number 11-09/5207 (Termopar_11095207_Cert_4_14.pdf) (the serial number of the sensor is described in the “código” fiel of the certificate) | dated 19/12/2014 | Project Participant |
| 26 | CSouza Dias Instrument ação e Serviços Tecnológico s | calibration certificate nº 00009/13, dated 20/12/2013, valid until 20/12/2015 for the thermocouple serial number 05-06/0619 (Termopar_05060619_Cert_9_13.pdf) | dated 20/12/2013 | Project Participant |
| 27 | CSouza Dias Instrument ação e Serviços Tecnológico s | calibration certificate nº 00002/14, dated 19/12/2014, valid until 19/12/2015 for the thermocouple serial number 12-12491 /27/ (Termopar_05060619_Cert_2_14.pdf) | dated 19/12/2014 | Project Participant |
| 28 | CSouza Dias Instrument ação e Serviços Tecnológico s | calibration certificate nº 000010/13, dated 20/12/2013, valid until 20/12/2015 for the thermocouple serial number 11-09/5208 (Termopar_11095208_Cert_10_13.pdf) | dated 20/12/2013 | Project Participant |
| 29 | CSouza Dias Instrument ação e Serviços Tecnológico s | calibration certificate nº 00006/14, dated 19/12/2014, valid until 19/12/2015 for the thermocouple serial number 11-09/5208 (Termopar_11095208_Cert_06_14.pdf) (the serial number of the sensor is described in the “código” fiel of the certificate) | dated 19/12/2014 | Project Participant |
| 30 | CSouza Dias Instrument ação e Serviços Tecnológico s | calibration certificate nº 000011/13, dated 20/12/2013, valid until 20/12/2015 for the thermocouple serial number 11-09/5209 (Termopar_11095209_Cert_11_13.pdf) | dated 20/12/2013 | Project Participant |
| 31 | CSouza Dias Instrument ação e Serviços Tecnológico s | calibration certificate nº 00007/14, dated 19/12/2014, valid until 19/12/2015 for the thermocouple serial number 11-09/5209 (Termopar_11095209_Cert_7_14.pdf) (the serial number of the sensor is described in the “código” fiel of the certificate) | dated 19/12/2014 | Project Participant |
| 32 | CSouza Dias Instrument ação e Serviços Tecnológico s | calibration certificate nº 00006/13, dated 20/12/2013, valid until 20/12/2015 for the thermocouple serial number 177621 (certificado 177621_N06_13.pdf) | dated 20/12/2013 | Project Participant |
| 33 | CSouza Dias | calibration certificate nº 00005/14, dated 19/12/2014, valid until 19/12/2015 for the | dated 19/12/2014 | Project Participant |

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| | Instrumentação e Serviços Tecnológicos | thermocouple serial number 177621 (certificado 177621_N05_14.pdf) | | |
| 34 | Bioteconogias | "Elsi thermocouple type S and thermoresistance pt100 equipment maximum permissible error computation." (Elsi maximum permissible error.pdf) | dated 08/04/2010 | Project Participant |
| 35 | ABB | Data Sheet D184S035U02 Rev. 12 FV4000, FS4000 Vortex Flowmeter / Swirl Flowmeter (Instrumento Data sheet.pdf) | Rev. 12 | Project Participant |
| 36 | ABB | letter regarding the calibration frequency of the flow meter (Swirl calibration frequency.pdf) | dated 13/04/2010 | Project Participant |
| 37 | CSouza Dias Instrumentação e Serviços Tecnológicos | calibration certificate nº 000003/14, dated 06/02/2014 valid until 06/02/2017 (Certificado N_3_14.pdf) | dated 06/02/2014 | Project Participant |
| 38 | ESTRE Ambiental S/A | calibration plan SGS088 rev 27 (SGA 088 rev 27 Plano de calibração Paulinia.pdf) | dated 23/07/2015 | Project Participant |
| 39 | Siemens | Operating instructions Edition 03/2005 , ULTRAMAT 23 Gas analyzers for IR-absorbing gases and oxygen 7MB2335, 7MB2337, 7MB2338 (Manual Ultramat 23.pdf) | Edition 03/2005 | Project Participant |
| 40 | CSouza Dias Instrumentação e Serviços Tecnológicos | calibration certificate nº 000013/14, dated 20/12/2013 valid until 20/12/2014 (Certificado N_13_13.pdf) White Martins Gases Industriais Ltda. gas cylinder calibration certificate 41019406 for the cylinder 479, dated 26/04/2013 valid until 26/04/2018 (Mistura padrao 2013.pdf) | dated 20/12/2013 | Project Participant |
| 41 | CSouza Dias Instrumentação e Serviços Tecnológicos | calibration certificate nº 000008/14, dated 19/12/2014 valid until 19/12/2015 (Certificado N_08_14.pdf). White Martins Gases Industriais Ltda. gas cylinder calibration certificate 40834922 for the cylinder 521822, dated 13/01/2012 valid until 13/01/2017 (Mistura padrao 2014.pdf) | dated 19/12/2014 | Project Participant |
| 42 | ABB | Data Sheet DS/TSP3X1-EN Temperature sensors SensyTemp TSP311, TSP321, TSP331 (ABB DS_TSP3X1-EN-04_2006.pdf;) | No date available | Project Participant |
| 43 | ABB | letter regarding the calibration frequency of the Temperature sensor TSP 321, (ABB_TSP_test0001.pdf) | no date available | Project Participant |
| 44 | CSouza Dias Instrumentação e Serviços Tecnológicos | calibration certificate nº 000001/14, dated 06/02/2014 valid until 06/02/2017 | dated 06/02/2014 | Project Participant |
| 45 | ABB | Data Sheet SS/264BS_5 2600T Series Pressure Transmitters (Manual ABB Line Flow Meter.pdf) | No date available | Project Participant |
| 46 | ABB | Data Sheet DS/266HSH/NSH-EN Model 266HSH Gauge, Model 266NSH Absolute 2600T Series Pressure Transmitters (DS_266HSH_NSH-EN_02_2010.pdf) | No date available | Project Participant |

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|----|--|---|---|---------------------|
| 47 | CSouza Dias Instrumentação e Serviços Tecnológicos | calibration certificate nº 000002/14, for the pressure transmitter serial number 6410001002 dated 06/02/2014 valid until 06/02/2017 (Certificado N_02_14.pdf) | dated 06/02/2014 | Project Participant |
| 48 | Brazilian DNA | data available for the emissions factor Data for 2014 available at http://www.mct.gov.br/upd_blob/0237/237010.htm | accessed on 18/09/2015 | Project Participant |
| 49 | Ciber | electricity meter manual UPD200-2480M, CMM4700-03. (manual upd200.pdf) | No date available | Project Participant |
| 50 | IPT – Instituto de Pesquisas Tecnológicas | calibration certificate number 140500-101, dated 18/09/2014 valid until 18/09/2015, for the energy meter serial number 40964200869 (Certificado Analisador de Energia Rede 140500-101.pdf) | dated 18/09/2014 | Project Participant |
| 51 | IPT – Instituto de Pesquisas Tecnológicas | calibration certificate number 140500-101, for the energy meter serial number 40962200082 (Certificado Analisador de Energia Gerador 140501-101.pdf) | dated 17/09/2014 valid until 17/09/2015 | Project Participant |
| 52 | Estre | form SGA 090 (board Diary), nº 096, thermosensor change in the flare number 3 (SGA090_096.pdf) | dated 19/12/2014 | Project Participant |
| 53 | GL Systems Certification | ISO 14.001:2004 certificate nº EM-7602-BR, including the biogas plant, (Certificado ISO 14001.pdf) | valid until 13/01/2016 | Project Participant |
| 54 | ESTRE Ambiental S/A | procedure PAT 4.4.6-24 “Preventive and Corrective Maintenance of equipments (PAT 446-24 rev03 Manutenção Biogas.pdf) | revision 03 of 20/07/2015 | Project Participant |
| 55 | ESTRE Ambiental S/A | procedure PAT 4.4.6-22 “Control and Operation of of the captation and flre of the landfill gas, (PAT 446-22 rev09 Operação Biogas.pdf) | revision 09 of 27/03/2013 | Project Participant |
| 56 | Estre | form SGA 096 “Preventive maintenance program” registers of the flare maintenance check, with weekly, semester and annually checks performed during the monitoring period (SET_14_JUN_15.pdf) | Monitoring period | Project Participant |
| 57 | ESTRE Ambiental S/A | report of attendance of the technical requiments of the operation license 37002080, (atendimentoLO37002080.docx) | no date available | Project Participant |
| 58 | UniCarbo Energia e Biogás Ltda and ESTRE Ambiental S/A | montly calculation spreadsheet, with data registered every minute: : 102014.xlsx; 112014.xlsx; 122014.xlsx; 012015.xlsx; 022015.xlsx; 032015.xlsx; 042015.xlsx; 052015.xlsx; 062015.xlsx; 072015.xlsx | Version 1 of 12/08/2015 version 2 of 20/10/2015 version 3 of 26/07/2016 | Project Participant |
| 59 | Este | LOG data parameters displayed daily “REPORT_LOG_YYYY_MM_DD.xlsx” and Montly spreadsheets “Periodo 2013_2014 - JUN_15.xls; Periodo 2013_2014 - MAI_15.xls; Periodo 2014_2015 - ABR_15.xls; Periodo 2014_2015 - DEZ_14.xls; Periodo 2014_2015 - FEV_15.xls; Periodo 2014_2015 - JUL_15.xls; Periodo 2014_2015 - MAR_15.xls; Periodo 2014_2015 - NOV_14.xls; Periodo 2014_2015 - OUT_14.xls; Periodo_2014_2015 - JAN – 15.xls” | Monitoring period | Project Participant |

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|----|---------------------|---|------------------------------|---------------------|
| 60 | Alutal | technical specification available in Portuguese at http://issuu.com/alutal/docs/catalogo-tecnico?e=2954820/2595652 , | accessed on 30/09/2015 | Project Participant |
| 61 | Estre | form SGA 096 "Preventive maintenance program" registers of the gas analyzer maintenance check, with weekly, semi-annual and annual checks performed during the monitoring period (Analizador de Gas_00.pdf; Analizador de Gas_01.pdf) | Monitoring period | Project Participant |
| 62 | RINA | Validation opinion post registration changes nº 2015-BQ-41-MD (Changes from the Registered PDD; changes from the registered monitoring plan, temporary deviation from the registered monitoring plan, monitoring methodology or standardized baseline | Revision 1.2Aa of 01/03/2016 | Other |
| 63 | Executive Board | EB 90 meeting report | 18 to 22 July 2016 | Other |
| 64 | CDM Executive Board | Guideline: Application of materiality in verifications | Version 2 of 20/02/2015 | Other |
| 65 | INMETRO | Accreditation status web page print screen Praxair - Specialty Gases & Equipment INMETRO REF#5.pdf Rede Brasileira de Calibração - RBC INMETRO Accreditation Ref#1.pdf Rede Brasileira de Calibração - RBC INMETRO Accreditation REF#2.pdf Rede Brasileira de Calibração - RBC INMETRO Accreditation REF#3.pdf Rede Brasileira de Calibração - RBC INMETRO Accreditation REF#4.pdf | - | Project Participant |

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

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

| | | | | |
|--|----|--------------------|-----|-------------------------|
| FAR ID | xx | Section no. | E.2 | Date: DD/MM/YYYY |
| Description of FAR | | | | |
| | | | | |
| Project participant response | | | | Date: DD/MM/YYYY |
| | | | | |
| Documentation provided by project participant | | | | |
| | | | | |
| DOE assessment | | | | Date: DD/MM/YYYY |
| | | | | |

Table 2. CL from this verification

| CL ID | 1 | Section no. | E.8.1 | Date: | 01/10/2015 |
|--|---|-------------|-------|-------|-------------------------|
| Description of CL | | | | | |
| A test is included in the monthly calculation spreadsheet to confirm if the flares are operational considering the manufacturer's flare specifications for temperature and flow rate (SPEC_{flare}). However it is not clear how the test is conducted, for example, in the spreadsheet "012015.xls" day 01/01/2015 minute 0:00 flare 1 had the temperature (826°C) below the manufacturer specification (850°C) and the test result is "1". In the same day, minute 0:01 flare 1 had the temperature (826°C) below the manufacturer specification (850°C) and the test result is "0". | | | | | |
| Project participant response | | | | | Date: 26/10/2015 |
| <p>The mentioned case occurs due to the (SPEC_{flare}) criteria.</p> <p>In minute 0:00 the temperature of flare 1 is 826°C, below the manufacturer specification, however flare 1 was not under operation as it can be seen in the item Flame=OFF for Flare 1 for the relevant minute. Thus LFG is being flared by Flares 2, 3, 4, 5 and 6 that are operating under the manufacturer specifications. Thus SPEC_{flare} criteria is valid (=1), and LFG being flared in that instant is considered for Emission Reduction calculations</p> <p>In the same day for minute 0:01 the SPEC_{flare} test is 0 (not valid) but for different reasons. In minute 0:01 there are 5 flares in operation, totalizing $2000+2500 \times 4=12,000$ Nm³/h of maximum flaring capacity and the flow being flared is equal to 12,000 Nm³/h.</p> <p>Conservatively the SPEC_{flare} criteria considers that when the flow is equal or higher (or equal or lower) than the maximum (or minimum) flow capacity of the flares under operation, the amount of LFG being flared in the time interval is not considered for Emission Reduction calculations.</p> | | | | | |
| <p><i>2nd response (26/07/2016)</i></p> <p><i>PP revised the spreadsheets and corrected the relevant data. The "Flame" test is no longer linked with the temperature but it is composed of ON/OFF data from the UV sensor of each flare.</i></p> | | | | | |
| Documentation provided by project participant | | | | | |
| <p>MR version 2</p> <p>CERs spreadsheet version 2</p> <p>Revised version of the Monitoring Report (version 3.0, dated 26/07/2016)</p> <p>Revised version of the CERs spreadsheet (version 3.0, dated 26/07/2016)</p> | | | | | |
| DOE assessment | | | | | Date: 03/11/2015 |
| <p>Verified in the spreadsheet that the "Flame" test is linked to the temperature =IF(I8>850;1;0) therefore it is not possible to confirm that the flare if the flare is not operational or it is operational out of the specifications. The temperature of 826°C is too high for a flare that is not operational. This CL remains open.</p> <p><i>2nd response (27/07/2016)</i></p> <p>RINA verified that the revised spreadsheets, considers the temperature of the flares. In accordance with the approved deviation, when one of the flares is operational but not under the specifications, no CERs are claimed. This CL is closed</p> | | | | | |

| CL ID | 2 | Section no. | E.7 | Date: | 01/10/2015 |
|--|---|-------------|-----|-------|-------------------------|
| Description of CL | | | | | |
| PP is requested to confirm/evidence that the calibration of the meters have been done by an accredited person or institution | | | | | |
| Project participant response | | | | | Date: 26/10/2015 |
| PP delivered the relevant evidence to the DOE regarding the persons involved in the calibration of the equipments. | | | | | |
| <p><i>2nd round (26/07/2016)</i></p> <p>The PP clarify that all calibration events in monitoring instruments/equipment valid for the considered monitoring period were performed by the following calibration, testing and inspection entities/companies:</p> <p>- IPT – Instituto de Pesquisas Tecnológicas</p> <p>The accreditation of the company is provided by INMETRO (Instituto Nacional de Metrologia) under the ABNT NBR ISO/IEC 17025:2005 standard. Copy of relevant accreditation certificates are available at a specific webpage at the web portal of the entity: http://www.ipt.br/institucional/qualidade/certificados .</p> <p>Further information is made available online at other webpage of the entity: http://www.ipt.br/institucional/qualidade</p> | | | | | |

- CSouza Dias Instrumentação e Serviços Tecnológicos

The entity/company CSouza Dias Instrumentação e Serviços Tecnológicos is regularly registered and licensed as an calibration, testing and inspection enterprise that offers/commercializes services of performance of calibration events in a range of measuring equipment and instruments for both private and public parties. The company has performed the calibration of the following instruments using accredited standards provided by INMETRO. Relevant accreditation standards are presented in the following tables for each instrument calibrated:

| <i>Methane analyser used for measuring</i> | Manufacturer | Calibration date | Laboratory | Name of Instrument and Standard used in the calibration | Traceable standard used and INMETRO Accreditation | |
|---|--------------|------------------|--|--|---|---|
| CH ₄ Content VCH ₄ | SIEMENS | 20/12/2013 | CSouza Dias Instrumentação e Serviços Tecnológicos | - Gas cylinders with a calibration mixture of 50.0 mol/mol of CH ₄ , 40 mol/mol CO ₂ and 2 mol/mol O ₂ ; cylinder n° 479, certificate number 41019406, supplied by White Martins Gases Industriais Ltda. | RBC-INMETRO n° M-40370/12 | Praxair - Specialty Gases & Equipment INMETRO REF#5 |
| | SIEMENS | 19/12/2014 | CSouza Dias Instrumentação e Serviços Tecnológicos | - Gas cylinders with a calibration mixture of 54.0 mol/mol of CH ₄ , 20 mol/mol CO ₂ and 2 mol/mol O ₂ ; cylinder n° 521822, certificate number 40834922, supplied by White Martins Gases Industriais Ltda. | RBC-INMETRO n° M-40370/12 | Praxair - Specialty Gases & Equipment INMETRO REF#5 |

| <i>Temperature sensor used for measuring</i> | Manufacturer | Calibration date | Laboratory | Name of Instrument and Standard used in the calibration | Traceable standard used and INMETRO Accreditation | |
|--|--------------|------------------|--|---|---|------------------------------|
| LFG Temperature T _t | ABB | 06/02/2014 | CSouza Dias Instrumentação e Serviços Tecnológicos | - Digital Multimeter PRT-0023 - RTD PT 100 PRT-0243 | RBC-13/0579 Metracal | INMETRO Accreditation Ref #3 |
| | | | | | 2641/12 ECIL | INMETRO Accreditation Ref #1 |

| <i>Pressure sensor used for measuring</i> | Manufacturer | Calibration date | Laboratory | Name of Instrument and Standard used in the calibration | Traceable standard used and INMETRO Accreditation | |
|---|--------------|------------------|--|---|---|------------------------------|
| LFG Pressure Pt | ABB | 06/02/2014 | CSouza Dias Instrumentação e Serviços Tecnológicos | - Digital Manometer PRT-0074 | CAL 89503/12 | INMETRO Accreditation Ref #2 |

| <i>Thermocouple used for measuring</i> | Manufacturer | Calibration date | Laboratory | Name of Instrument and Standard used in the calibration | Traceable standard used and INMETRO Accreditation | |
|--|--------------|------------------|-------------|---|---|---------|
| T _{EG,m,flare-1} | ELSI | 20/12/2013 | CSouza Dias | - Digital multi | - 8473/11 ECIL | INMETRO |

| | | | | | | |
|---|--------|------------|---|---|-------------------------------|-------------------------------|
| (Flare 1) | | | Instrumentação e Serviços Tecnológicos | calibrador PRT 0007 Thermocoupl e “R” PRT 0116 | - 7066/11 ECIL | Accreditatio n Ref #1 |
| | ELSI | 19/12/2014 | CSouza Dias Instrumentaçã o e Serviços Tecnológicos | - Digital calibrator port – PRT 0130 Thermocoupl e “R” PRT 0116 | - 6829-12 ECIL - 8059/14 ECIL | INMETRO Accreditatio n Ref #1 |
| $T_{EG,m,flare-2}$ (Flare 2) | ELSI | 20/12/2013 | CSouza Dias Instrumentaçã o e Serviços Tecnológicos | - Digital multi calibrator PRT 0007 Thermocoupl e “R” PRT 0116 | - 8473/11 ECIL - 7066/11 ECIL | INMETRO Accreditatio n Ref #1 |
| | ELSI | 19/12/2014 | CSouza Dias Instrumentaçã o e Serviços Tecnológicos | Digital multi calibrator PRT 0130 Thermocoupl e “S” PSD 0117 | - 6829-12 ECIL - 8059/14 ECIL | INMETRO Accreditatio n Ref #1 |
| $T_{EG,m,flare-3}$ (Flare 3) | ELSI | 20/12/2013 | CSouza Dias Instrumentaçã o e Serviços Tecnológicos | - Digital multi calibrator PRT 0007 Thermocoupl e “R” PRT 0116 | - 8473/11 ECIL - 7066/11 ECIL | INMETRO Accreditatio n Ref #1 |
| | Alutal | 19/12/2014 | CSouza Dias Instrumentaçã o e Serviços Tecnológicos | Digital multi calibrator PRT 0130 Thermocoupl e “S” PSD 0117 | - 6829-12 ECIL - 8059/14 ECIL | INMETRO Accreditatio n Ref #1 |
| $T_{EG,m,flare-4}$ (Flare 4) | ELSI | 20/12/2013 | CSouza Dias Instrumentaçã o e Serviços Tecnológicos | - Digital multi calibrator PRT 0007 Thermocoupl e “R” PRT 0116 | - 8473/11 ECIL - 7066/11 ECIL | INMETRO Accreditatio n Ref #1 |
| | ELSI | 19/12/2014 | CSouza Dias Instrumentaçã o e Serviços Tecnológicos | Digital multi calibrator PRT 0130 Thermocoupl e “S” PSD 0117 | - 6829-12 ECIL - 8059/14 ECIL | INMETRO Accreditatio n Ref #1 |
| $T_{EG,m,flare-5}$ (Flare 5) | ELSI | 20/12/2013 | CSouza Dias Instrumentaçã o e Serviços Tecnológicos | - Digital multi calibrator PRT 0007 Thermocoupl e “R” PRT 0116 | - 8473/11 ECIL - 7066/11 ECIL | INMETRO Accreditatio n Ref #1 |
| | ELSI | 19/12/2014 | CSouza Dias Instrumentaçã o e Serviços Tecnológicos | Digital multi calibrator PRT 0130 Thermocoupl e “S” PSD 0117 | - 6829-12 ECIL - 8059/14 ECIL | INMETRO Accreditatio n Ref #1 |
| $T_{EG,m,flare-6}$ (Flare 6) | ALUTAL | 19/12/2014 | CSouza Dias Instrumentaçã o e Serviços Tecnológicos | Digital multi calibrator PRT 0130 Thermocoupl e “S” PSD 0117 | - 6829-12 ECIL - 8059/14 ECIL | INMETRO Accreditatio n Ref #1 |
| | ALUTAL | 20/12/2013 | CSouza Dias Instrumentaçã o e Serviços Tecnológicos | Digital multi calibrator PRT 0130 Thermocoupl e “S” PSD 0117 | - 6829-12 ECIL - 8059/14 ECIL | INMETRO Accreditatio n Ref #1 |
| Documentation provided by project participant | | | | | | |

| | |
|---|-------------------------|
| <i>Praxair - Specialty Gases & Equipment INMETRO REF#5.pdf</i> <i>Rede Brasileira de Calibração - RBC INMETRO Accreditation Ref#1.pdf</i> <i>Rede Brasileira de Calibração - RBC INMETRO Accreditation REF#2.pdf</i> <i>Rede Brasileira de Calibração - RBC INMETRO Accreditation REF#3.pdf</i> <i>Rede Brasileira de Calibração - RBC INMETRO Accreditation REF#4.pdf</i> | |
| DOE assessment | Date: 03/11/2015 |
| The evidence was not attached. This CL remains open | |
| 2 nd response (27/07/2016) PP has provided the evidences to confirm that the calibrations were conducted using accredited standards provided by INMETRO. PP has provided the evidences to confirm the accreditation from the Brazilian national institute for metrology affairs named INMETRO (Instituto Nacional de Metrologia) under the ABNT NBR ISO/IEC 17025:2005 standard. This CL is closed. | |

Table 3. CAR from this verification

| | | | | |
|---|---|--------------------|-----|-------------------------|
| CAR ID | 1 | Section no. | E.5 | Date: 01/10/2015 |
| Description of CAR | | | | |
| Registered PDD version 4.2 describes that option B.1 Biannual measurement of the flare efficiency is chosen for project activity, however MR describes that the default value is applied. PP is requested to follow the provisions described in the Project Standard | | | | |
| Project participant response | | | | Date: 26/10/2015 |
| PP acknowledges that the registered PDD version 4.2 describes the option B.1 is chosen. PP requested a PRC process in order to include option A Default Value in a new version of the PDD. Following the approval of the new version of the PDD, PP will resubmit the Monitoring Report with the default value of Option A. | | | | |
| 2 nd response (26/07/2016) Upon approval of the related PRC process by the CDM Executive Board (CDM-EB), references to such approval of PRC is added in the revised version of the Monitoring Report for sake of completeness and transparency. | | | | |
| Documentation provided by project participant | | | | |
| Revised PDD Revised version of the Monitoring Report (version 3.0, dated 26/07/2016) | | | | |
| DOE assessment | | | | Date: 03/11/2015 |
| The validation opinion about the deviation will be submitted to the UNFCCC and it is subject to approval of the Board. This CAR is on holding. 2 nd response (27/07/2016) PRC was approved in the EB 90 meeting. This CAR is closed | | | | |

| | | | | |
|--|---|--------------------|-----|-------------------------|
| CAR ID | 2 | Section no. | E.5 | Date: 01/10/2015 |
| Description of CAR | | | | |
| In accordance with the applied methodology, ACM0001 "Flaring or use of landfill gas" version 13.0.0 of 11/05/2012/06/, $PE_{flare,y}$ shall be determined using the methodological tool "Tool to determine project emissions from flaring gases containing methane". If LFG is flared through more than one flare, then $PE_{flare,y}$ is the sum of the emissions for each flare determined separately. However registered PDD does not reflect this condition. PP is requested to follow the provisions described in the Project Standard. | | | | |
| Project participant response | | | | Date: 26/10/2015 |

PP acknowledges that the registered PDD describes the utilization of a flow meter for the determination of the flow sent to the set of 6 flares that compose the project activity.

In order to address the acknowledged non-compliance with related provisions/requirements of the applied CDM baseline and monitoring methodology + applicable methodological tools, the PP proposes an amended/revised version of the PDD under the applicable procedure for addressing post-registration changes, thus having the updated/revised PDD referring to one individual LFG flow meter for monitoring the amount of LFG sent to each one of the installed high temperature enclosed flares.

It is important to mention that using Option A (default value) of the Methodological Tool "Project emissions from flaring" Version 2.0.0 for the calculation of $PE_{flare,y}$, the calculation of $PE_{flare,y}$ individually or for the set of flares will present the same result, as demonstrated below:

Demonstration:

Equation 4 of the above referred methodology ACM0001 states:

$$F_{CH4,flared,y} = F_{CH4,sent,flare,y} - \frac{PE_{flare,y}}{GWP_{CH4}}$$

Equation 15 of the Methodological Tool "Project emissions from flaring" Version 2.0.0 states that:

$$PE_{flare,y} = GWP_{CH4} \times \sum_{m=1}^{525600} F_{CH4,RG,m} \times (1 - \eta_{flare,m}) \times 10^{-3}$$

Thus, by applying the default value of 0,80 for $\eta_{flare,m}$ (since the set of flares installed are low height flares) the final result for $PE_{flare,y}$ is the same independently of 1 or several flares due to the fact of $F_{CH4,RG,m}$ and $\eta_{flare,m}$ are the same for all the flares.

It is crucial to mention that the flares are equipped with individual flame detectors that in case of the flame not being detected in a flare will automatically and instantly close the individual valve of the flare were the flame is not detected, thus avoiding any possibility of LFG venting through the flare.

2nd response (26/07/2016):

Upon approval of the related PRC process by the CDM Executive Board (CDM-EB), references to such approval of PRC is added in the revised version of the Monitoring Report for sake of completeness and transparency.

Documentation provided by project participant

Revised PDD

Revised version of the Monitoring Report (version 3.0, dated 26/07/2016)

DOE assessment

Date: 03/11/2015

The validation opinion about the post registration changes will be submitted to the UNFCCC and it is subject to approval of the Board. This CAR is on holding.

2nd response (27/07/2016)

PRC was approved in the EB 90 meeting. This CAR is closed.

| | | | | |
|---|---|--------------------|-------|-------------------------|
| CAR ID | 3 | Section no. | E.6.1 | Date: 01/10/2015 |
| Description of CAR | | | | |
| The flow specification (maximum and minimum) for the flare model 2000 HT is not in accordance with the registered PDD. | | | | |
| Project participant response | | | | Date: 26/10/2015 |
| PP have corrected the flow specification of the flare model 2000 HT in the revised version 2 of the Monitoring Report. | | | | |
| Documentation provided by project participant | | | | |
| <i>MR version 2</i> | | | | |
| <i>CERs spreadsheet version 2</i> | | | | |
| DOE assessment | | | | Date: 03/11/2015 |
| Revised MR presents the correct flow specifications for the flare model 2000 HT: Minimum flow: 400 Nm ³ /h and maximum flow: 2,000 Nm ³ /h. This CAR is closed. | | | | |

| | | | | |
|--|---|--------------------|-------|-------------------------|
| CAR ID | 4 | Section no. | E.6.2 | Date: 01/10/2015 |
| Description of CAR | | | | |
| Verified during the onsite visit that the thermocouple of the flare 3 05-06/0619 was substituted by the thermocouple 12-12491 /52/. However MR version 1 does not reflect the thermocouple's substitution in the flare 3. | | | | |
| Project participant response | | | | Date: 26/10/2015 |
| PP have updated the version 2 of the Monitoring Report in order to reflect the thermocouple's substitution in the flare 3. | | | | |
| 2 nd response (26/07/2016) PP have updated the version 3 of the Monitoring Report in order to reflect the thermocouple's substitution in the flare 3. | | | | |
| Documentation provided by project participant | | | | |
| MR version 2 Revised version of the Monitoring Report (version 3.0, dated 26/07/2016) | | | | |
| DOE assessment | | | | Date: 03/11/2015 |
| Revised MR describes the thermocouple Alutal installed on 19/12/2014. However, the accuracy described is not in accordance with the technical specification and the calibration valid does not present the correct year. This CAR remains open | | | | |
| 2 nd response (27/07/2016) MR version 3 was revised considering the accuracy provided by the manufacturer. This CAR is closed. | | | | |

| | | | | |
|--|---|--------------------|-------|-------------------------|
| CAR ID | 5 | Section no. | E.6.2 | Date: 01/10/2015 |
| Description of CAR | | | | |
| Verified during the onsite visit that the thermocouple of the flare 6 is from manufacturer Alutal. PP did not include the equipments' specification in accordance with the equipment installed | | | | |
| Project participant response | | | | Date: 26/10/2015 |
| PP have updated the version 2 of the Monitoring Report in order to include the specification of the equipment. | | | | |
| Documentation provided by project participant | | | | |
| MR version 2. | | | | |
| DOE assessment | | | | Date: 03/11/2015 |
| MR was revised accordingly. This CAR is closed. | | | | |

| | | | | |
|--|---|--------------------|-------|-------------------------|
| CAR ID | 6 | Section no. | E.6.2 | Date: 01/10/2015 |
| Description of CAR | | | | |
| Verified in the monthly calculation spreadsheet /58/ that the values of the energy consumption ($EG_{EC1,y} = EC_{PJ1,y}$ and $EG_{EC2,y} = EC_{PJ2,y}$) are rounded down, not conservative. | | | | |
| Project participant response | | | | Date: 26/10/2015 |
| PP have updated the version 2 of the Monitoring Report in order to conservatively round down the values of energy consumption. | | | | |
| 2 nd response (26/07/2016) PP have updated the version 3 of the Monitoring Report in order to conservatively round up the values of energy consumption in the monthly spreadsheet "monthly calculation". | | | | |
| Documentation provided by project participant | | | | |
| MR version 2 CERs spreadsheet version 2 Revised version of the Monitoring Report (version 3.0, dated 26/07/2016) Revised version of the CERs spreadsheet (version 3.0, dated 26/07/2016) | | | | |
| DOE assessment | | | | Date: 03/11/2015 |
| The energy consumption in the CERs spreadsheet is rounded up; however, data consolidated in the monthly spreadsheet "monthly calculation" is not rounded up. This CAR remains open. | | | | |
| 2 nd response (27/07/2016) Revised documents presents the energy consumed rounded up. This CAR is closed. | | | | |

| | | | | |
|--|---|--------------------|-------|-------------------------|
| CAR ID | 7 | Section no. | E.8.1 | Date: 01/10/2015 |
| Description of CAR | | | | |
| In accordance with the registered PDD for enclosed flares that are defined as low height flares, which is the case of the project activity, the flare efficiency shall be adjusted, as a conservative approach, by subtracting 0.1 from the efficiency. Verified in the calculations /58/ /10/ that PP is not considering the discount. Moreover PP is requested to provide data in the sheet "input data" in English in the spreadsheet with monthly calculation. | | | | |
| Project participant response | | | | Date: 26/10/2015 |
| PP have updated the version 2 of the Monitoring Report in order to include such a discount and translated the data in the sheet "input data " to English. | | | | |
| Documentation provided by project participant | | | | |
| <i>MR version 2</i> | | | | |
| <i>CERs spreadsheet version 2</i> | | | | |
| DOE assessment | | | | Date: 03/11/2015 |
| Verified in the revised spreadsheets that the discount of 10% due to low height flare plus the discount of 10% for the flare efficiency are correctly considered. Moreover, data is presented in English. This CAR is closed. | | | | |

Table 4. FAR from this verification

| | | | | |
|--|----|--------------------|--|-------------------------|
| FAR ID | xx | Section No. | | Date: DD/MM/YYYY |
| Description of FAR | | | | |
| | | | | |
| Project participant response | | | | Date: DD/MM/YYYY |
| | | | | |
| Documentation provided by project participant | | | | |
| | | | | |
| DOE assessment | | | | Date: DD/MM/YYYY |
| | | | | |

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Document information

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