Monitoring report form
(Version 04.0)

MONITORING REPORT	
Title of the project activity	Caieiras landfill gas emission reduction
Reference number of the project activity	0171
Version number of the monitoring report	1
Completion date of the monitoring report	10/10/2014
Registration date of the project activity	09/03/2006
Monitoring period number and duration of this monitoring period	Monitoring period: #8 01/10/2012 – 30/03/2013
Project participant(s)	Essencis Soluções Ambientais S.A.
Host Party(ies)	Brazil
Sectoral scope and selected methodology(ies), and where applicable, applied standardized baseline(s)	CDM Sectoral Scope 13 – Waste handling and disposal. ACM0001 – Consolidated baseline methodology for landfill gas project activities (version 2)
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	731,058 tCO_2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	497,711 tCO_2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable)	233,498 tCO_2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).	264,213 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>>

The CDM project activity "Caieiras landfill gas emission reduction" is implemented at the CTR Caieiras landfill. The project activity promotes real and measureable greenhouse gas (GHG) emission reductions through collection and destruction of landfill gas (LFG) which is rich in methane (CH_4). LFG is generated as a result of anaerobic decomposition of organic content of municipal solid waste (MSW) disposed in the landfill. The project activity so far encompasses capturing of LFG and its destruction through combustion (in high temperature enclosed flares).

The CTR Caieiras landfill was built in year 2002. This landfill has been operated by Essencis Soluções Ambientais S.A. since its commissioning date also in September 2002. The project's LFG collection and destruction system was completely implemented in February 2007.

As indicated in the Project Design Document valid for the 1st 7-year crediting period (PDD), the project design also includes, as an alternative, share of collected LFG being supplied/exported as gaseous fuel to a local industry (in order to be combusted in boilers). Also as per the PDD valid for the 1st 7-year crediting period, share of collected LFG could eventually be used as fuel for electricity generation (for meeting the electricity demand of the project activity as well as for meeting electricity demand for the CTR Caierias landfill) as part of the project design. However, these 2 LFG utilization alternatives were not implemented and currently there are no plans to implement such alternatives.

By the end of the monitoring period from 01/10/2012 to 30/03/2013, the implemented project's LFG collection system encompassed about 264 operational vertical LFG collection wells which were all interconnected through perforated concrete pipes surrounded by gravel. No horizontal LFG collection trenches have so far been utilized for collecting LFG.

During the considered monitoring period, LFG was collected at the CTR Caieiras landfill with the utilization of centrifugal blowers which are installed at the project's LFG collecting main pipeline at the project's LFG destruction facility.

As part of the operation of the project activity, all collected LFG is conducted to a main pipeline and sent to enclosed high temperature flares for combustion under controlled conditions. As required by CDM baseline and monitoring methodology ACM0001 (version 2), the amount and quality of collected LFG that is sent to the flares is continuously measured, recorded and reported. Monitoring includes LFG flow, CH_4 content of collected LFG, temperature of LFG and pressure of LFG.
During the considered monitoring period, all collected LFG was directed to 4 enclosed high temperature flares for combustion. The temperature of the exhaust gases of the flares have also been continuously measured, recorded and reported in order to confirm whether flares were operating above 500^{o}C whenever related GHG emission destructions of methane destruction are claimed.

All LFG related monitoring instruments/equipment (LFG flow meter, LFG pressure sensor, LFG temperature sensor, LFG $CH_4/O_2/CO_2$ content gas analyzer) are installed in the main LFG pipeline. Thermocouples for measuring temperature of the exhaust gas of the flares are installed in the upper section of each flare. All LFG related continuous measurements and continuous measurements of temperature of the exhaust gas of the flares are recorded and stored in a computerized database located in the project's control room within an every minute recording and reporting frequency.

During the monitoring period from 01/10/2012 to 30/03/2013 the project activity was implemented and has operated under the following configuration:

- 3 centrifugal blowers with LFG collection capacity of up to 4,000 Nm^3/h each and 2 centrifugal blowers with LFG collection capacity of up to 7,000 Nm^3/h each
- 4 enclosed high temperature flares.
- All monitoring instruments/equipment which are required for measuring LFG related parameters, temperature of the exhaust gas of the flares and grid electricity consumption.
- MSW disposal area at the CTR Caieiras landfill, which is covered by the project's LFG collection wells, with about 567,000 square meters (area where about 2,050,000 ton of MSW are disposed). The project's LFG collection well network included approximately 185 wells connected to high density polyethylene (HDPE) LFG collection pipeline network at the end of the considered monitoring period. During the considered monitoring period, more than 70% of the existing LFG wells were actually connected to the project's LFG collecting pipeline (in the average)[1].

Further details about installed equipment and instruments are included in Section B.1 and D.2.

Essencis Soluções Ambientais S.A. has a quality and control (QA/QC) and environmental management (EMS) system. The company's ISO 9001 and ISO 14001 certified QA/QC/EMS system was earlier implanted on 08/06/2006. The boundary/scope of this QA/QC/EMS system currently also encompasses applicable work procedures valid for the operation of the project activity.

GHG emission reductions achieved by the project activity during the considered monitoring period from 01/10/2012 to 30/03/2013: 497,711 tCO_2e

A.2. Location of project activity

>>

The project activity is implemented at the CTR Caieiras landfill. This landfill (which is managed and operated by Essencis Soluções Ambientais S.A.) is located at Bandeirantes highway, km 33 in the municipality of Caieiras, São Paulo State, in Brazil.

The project site is located in the extreme Northeast region of Caieiras municipality. Caieiras is one of the municipalities encompassing the Metropolitan Region of São Paulo (RMSP).
The project site has the following geographical coordinates:

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

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	Essencis Soluções Ambientais S.A.	No
Norway	Nordic Environment Finance Corporation	No

[1] As part of the normal operation of the CTR Caieiras landfill (and also as part of the normal operation of the project activity), some of the project's LFG collecting wells are often temporarily disconnected from the project's LFG collection pipeline in order to facilitate continuous activities of MSW disposal and compacting, thus allowing transit of machinery (wheel loaders and excavators) and trucks as part of the normal operations of the CTR Caieiras landfill. Furthermore, sometimes some of the project's LFG extracting wells are often temporarily disconnected from the LFG collection pipeline due to repair and maintenance reasons. (welding and other repair services at the wells and/or pipeline, repositioning of the LFG pipeline, maintenance in the head of the LFG wells, etc.).

A.4. Reference of applied methodology and standardized baseline

>>

The project activity applies the baseline and monitoring methodology ACM0001 - ”Consolidated baseline methodology for landfill gas project activities” (version 2).
(http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_JIVCJD2PTI9976ZOV4A8KRO8T9QUWW)

For the considered monitoring period, as also established in the registered PDD, the following methodological tools are also applied for the determination of project emissions due to the consumption of grid electricity and liquefied petroleum gas (LPG) by the project activity respectively:

- “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” (version 01)
  (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf)

- “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion” (version 02)
  (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf)

A.5. Crediting period of project activity

>>

From 31/03/2006 to 30/03/2013 (7-year renewable crediting period).

A.6. Contact information of responsible persons/ entities

>>

Completion date for the application of the CDM-MR-FORM: 10/10/2014
Responsible entity / person:
Nuno Barbosa
nuno@unicarbo.com.br
UniCarbo Energia e Biogás Ltda.
São Paulo, Brazil

UniCarbo Energia e Biogás Ltda. is a CDM consulting company hired by Essencis Soluções Ambientais S.A. and is not a project participant.

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

>>

The total technical MSW disposal capacity for the CTR Caieiras landfill is defined as about 60,000,000 ton of MSW. By the end of the considered monitoring period, an accumulated amount of about 26,160,000 ton of MSW was disposed in this landfill. Within the monitoring period, MSW has been disposed with an average rate of about 1,600,000 ton of MSW per year[2]. The CTR Caieiras landfill is currently not expected to close prior to year 2030.

[2] As further discussed in Section E.2, since March 2007, as a result of unexpected problems in two other landfills serving the city of São Paulo (which resulted in the permanent closure of these two landfills), a significant increase in the amount of MSW being disposed in the CTR Caieiras landfill occurred and this landfill reached a MSW disposal rate to about 10,000 ton of MSW per day (by the end of the considered monitoring period). It is important to note that such dramatic increase in the MSW disposal rate at CTR Caieiras landfill (when compared against estimates earlier made available in the registered PDD) would also happen in the absence of the project activity (baseline scenario).

At the end of the considered monitoring period, the implemented project's LFG collection system consisted of about 264 operational LFG collecting wells interconnected through a high density polyethylene pipeline network. The LFG collecting wells are used to extract LFG from inner section of the landfill. Captured LFG is transported to the project's LFG destruction facility (enclosed high temperature flares) through the high density polyethylene pipeline passing through condensation pots (where most of the humidity is removed by condensation).

Collected LFG is sucked by 5 centrifugal blowers. After passing through the centrifugal blowers, temperature of collected LFG is significantly increased (typical temperature increment of about 30°C or more). The quantity and quality of captured LFG are measured as per the applicable requirements of ACM0001 (version 2).

Fraction of CH_4 in collected LFG stream as well as LFG flow (parameters $w_{CH4,y}$ and $LFG_{flare,y}$ respectively) are assumed as monitored on the same basis. This is a requirement of most recent version of ACM0001 methodology for the determination of amount (mass) of methane which is sent to the flares[3].

As per the construction and operational design of the CTR Caieiras landfill, a geo-membrane of PVC or similar material is expected be installed to cover disposed MSW by the time of the closure of the cells of the landfill. While no cell of the CTR landfill has achieved it is final configuration, no geo-membrane has been installed to cover disposed MSW so far[4].

During the whole monitoring period from 01/10/2012 to 30/03/2013, the project's LFG destruction facility operated under the following equipment/instrument configuration:

- 3 condensation trap to separate liquids in the collected LFG (leachate and condensate);
- 1 centrifugal blower manufactured by Anton Blaselbauer Artécnica Ltda. powered by electric motor with nameplate power of 125 HP.
- 2 centrifugal blower manufactured by Anton Blaselbauer Artécnica Ltda. powered by electric motors with nameplate power of 100 HP.
- 2 centrifugal blower manufactured by Anton Blaselbauer Artécnica Ltda. powered by electric motors with nameplate power of 200 HP.
- LFG monitoring equipment/instruments:
    - 1 LFG flow meter,
    - 1 LFG temperature sensor,
    - 1 LFG pressure sensor,
    - 1 $CH_4/O_2/CO_2$ content gas analyzer,

---

[3] E.g. The most recent version of ACM0001 (version 15) refers to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". As per this tool, it is assumed that moisture is not relevant when gas temperature is relative low (within the range of 60°C), Further UNFCCC's guidance as per the Requests of Clarification AM_CLA 0092 and AM_CLA_116 are also taken into account in the context of project's monitoring and related emission reduction calculations. These Requests for Clarification for the application of ACM0001 were earlier raised in the context of verifications of other LFG collection and destruction/utilization CDM project activities:

- AM_CLA_0116: Further clarification on AM_ CLA_ 0092 – Alternatives for the correction of measured flow rate of the residual gas from wet basis to dry basis
- AM_CLA_0092: Clarification on a conflict between ACM0001 and the 'Tool to determine project emissions from flaring gases containing methane' relating to the measurement of methane fraction and flow rate of landfill gas (wet or dry basis).

As per the CDM-EB responses for such Requests for clarification "(…) *for temperatures below 60°C, moisture could be neglected due to its very low influence on final results. In such cases, the basis adopted for measurements is not important. The rationale for adopting dry basis is linked to the fact that most gas analysers operate in dry basis and thus no corrections would be necessary.*"

[4] It is important to note that as per the design of the CTR Caieiras landfill, geo-membrane is actually placed in the bottom and sides of the cells of the landfill (prior of disposing MSW in the cell area) for sealing purposes.

  - 1 thermocouple in each enclosed flare (to measure temperature in the exhaust gases of the flare).
- 4 high temperature enclosed flares manufactured by BTS - Termodinâmica de Sistemas Ltda.
- 2 electricity meters (one of the electricity meters is used for measuring electricity consumption of the fourth blower only). Installed electricity meters are manufactured by Kron Medidores Ltda. These electricity meters are used to measure the consumption of grid electricity by the project's related equipment.

Further details about monitoring instruments/equipment are included in Section D.2.

The project activity was implemented and remains being operated without having any share of collected LFG being sold as gaseous fuel to a local industry (in order to be combusted in boilers) or being used as fuel to power a thermal desorption unit or an electricity generation facility.

The following pictures illustrate the project related equipment and instrumentation utilized during the considered monitoring period.

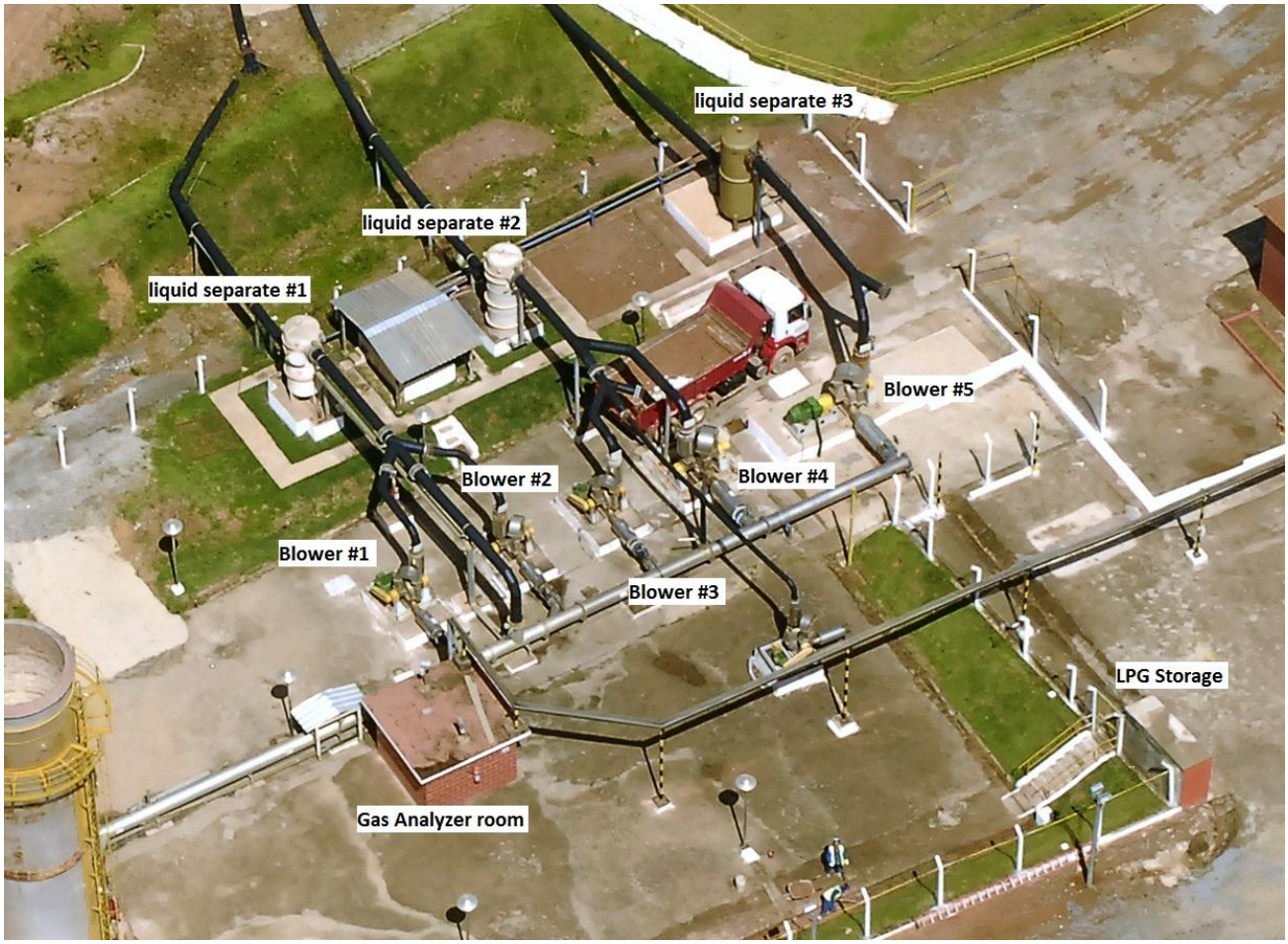

Figure 1 – Partial view of the LFG destruction station (LFG pipeline, blowers and condensation traps)

Figure 2 – Partial view of the project's LFG destruction plant (picture dated January 2012).

Figure 3 – Aerial view of the project's LFG destruction plant (picture dated April 2013).

In general, the project activity was implemented and has operated in accordance with the earlier conceived project design (as described in the PDD) with no permanent utilization of LFG as gaseous fuel occurring.

The construction of the entire LFG capture and destruction system (by flaring) was initiated in March 2006 and was finished in December 2006. Related testing and commissioning phases occurred in January 2007. The official starting of monitoring data measurement and recording initiated on 1/02/2007.

During the monitoring period from 01/10/2012 to 30/03/2013, the following failures or unpredicted events have occurred in the operation of the project activity:

- During the considered monitoring period, the project activity was out of operation for a total of 52 hours and 42 minutes due to different reasons (incl. temporarily interruption in the supply of grid electricity, planned equipment maintenance, regular calibration events, drainage of condensate from the project's LFG pipeline, unexpected problems in the PLC panel, etc.),

- As outlined in the box below, during the period from April 2009 to June 2009 (thus prior to the verification period covered by this Monitoring Report), a portable 200 kW electricity generation station was installed in the project site and has operated during a very limited time fuelled by LFG collected by the project activity. This portable off-grid electricity generation equipment was installed in the project site as part of a scientific investigation initiative in order to allow renewable energy experts/scholars from the Biomass Center Institute (CENBIO) of University of São Paulo (USP) CEMBIO/USP performing field tests/analysis related to the use of collected LFG as gaseous fuel in internal combustion engine-generator set for generating electricity. All related equipment previously used in the context of such scientific investigation initiative remains in the project site. Such academic tests/researches were performed in the framework of a technical cooperation agreement established between CENBIO/USP and Essencis Soluções Ambientais S.A. The box below provides more details about such initiative.

Box 1 - Occurred pilot tests/evaluation of a portable electricity generation facility fuelled by collected LFG at CTR Caieiras Landfill (using LFG collected by the project activity "Caieiras landfill gas emission reduction)"

During the period from April 2009 to June 2009 (thus before the monitoring period covered by this Monitoring Report) a portable 200 kW electricity generation station was installed in the project site in order to have renewable energy experts/scholars performing some field tests/analysis related to the use of collected LFG as fuel for electricity generation in the framework of a technical cooperation agreement set between the Biomass Center Institute (CENBIO) of University of São Paulo (USP) and Essencis Soluções Ambientais S.A.

Testing/evaluation of electricity generation using LFG as gaseous fuel was performed by using a portable 200 kW electricity generation station (Model LANDSET 200) assembled by Brasmetano Ind. e Com. Ltda.) with the following general specifications:

- Engine: Brasmetano (based on the Mercedes-Benz 447-LA engine with a modified cylinder head)
- Generator: WEG
- Output voltage: 440 V / 60Hz

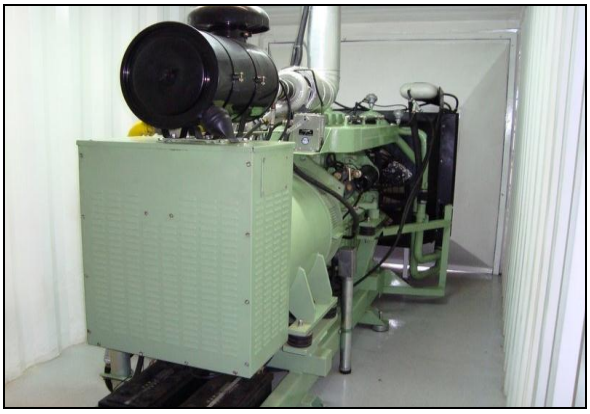

Figure 4 – View of the portable 200 kW electricity generation station installed in the project site during the period from April 2009 to June 2009 (thus before the monitoring period covered by this Monitoring Report)

In the context of the performed field research, a relative small amount of LFG collected by the project activity ended up being consumed for testing purposes. It is crucial to note that all amount of LFG which was consumed under the academic test/evaluation was collected by installing a temporary "T" junction in a section of the project's LFG pipeline which is located prior to the installed LFG flow meter which measures amount of LFG collected by the project activity and sent to the installed high temperature enclosed flares. Thus, no amount of LFG measured by the project activity (on the basis of monitoring records for parameter LFG_{flare}) was actually utilized as gaseous fuel for electricity generation under the occurred temporarily and non-continuous field academic research/testing events. Furthermore, all electricity which was generated under the test/evaluation activities was discharged in a resistive load bank. Thus, in accordance with applicable rules and regulations of the Brazilian power market, no generated electricity was consumed internally by the project activity or by other facilities of the CTR Caieiras landfill or exported to the grid.

Detailed information about the whole field research initiative performed by CEMBIO/USP are available on-line at http://cenbio.iee.usp.br/projetos/biogas_aterro/aterro.htm

In November 2013, more than 4 years after the finalization of the field research by the scholars/researchers of CENBIO/USP, the installed equipment was still left in the project site, but without any utilization. Since the finalization of the performed experiments in June 2009, the equipment remain completely disconnected from the project's LFG collection pipeline . It is also relevant to note that this power generation equipment is currently under very bad conditions (without any maintenance service, with several components rusted and even damaged). The equipment is probably not even under conditions to operate again unless a major overhauling work is performed. Essencis Soluções Ambientais S.A. is still awaiting the decision/position from CENBIO regarding the date of removal of such equipment from the project site. Moreover, further developments in the framework of technical cooperation agreement earlier set between Essencis Soluções Ambientais S.A. and CENBIO/USP are also uncertain.

Essencis Soluções Ambientais S.A. highlights that the occurred research/tests performed by CENBIO/USP in the project site do not represent a change in the design and or operation of the project activity "Caieiras landfill gas emission reduction" (that, as per the current CDM rules, would need to be addressed via applicable procedure for addressing post registration changes) due to the following aspects:

- The temporary and non-continuous operation of the experimental small- scale electricity generation facility as part of the CENBIO/USP's research initiative consumed LFG which was indeed collected by the project activity. However such relative small stream of consumed LFG was not measured and accounted in the context of the monitored quantity of LFG collected and combusted by the project activity.
- Essencis Soluções Ambientais S.A. (and the other project participant for the project activity) did not have any economic benefit by allowing CENBIO/USB to use a very small fraction of collected LFG for testing/evaluation purposes under the established technical cooperation agreement: no sale of LFG occurred, no use of generated electricity occurred (as all electricity was generated by using a resistive load bank connected to the power generation equipment), no renting of space occurred either.
- The whole concept of the temporary and not continuous operation of the experimental small-scale electricity generation facility was under a technical research and testing focus (not commercial). The interest of the academics and scholars in the issue of utilization of biogas/LFG generated in landfills and waste water treatment plants (WWTP) as gaseous fuel for electricity generation was actually trigged by the CDM. This is one of the positive externalities of the CDM in Brazil: promoting investigations (at least at academic level) of the use of non-conventional renewable energy sources.

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

>>
Not applicable.

B.2.2. Corrections

>>
Not applicable.

B.2.3. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

>>
Not applicable.

B.2.4. Changes to project design of registered project activity

>>
Not applicable.

B.2.5. Changes to start date of crediting period

>>
Not applicable.

B.2.6. Types of changes specific to afforestation or reforestation project activity

>>
Not applicable.

SECTION C. Description of monitoring system

>>

As part of the application of the previously designed monitoring plan as reported in the registered PDD, LFG related monitoring data is automatically measured, processed and recorded with the use of related monitoring instruments/equipment + a PLC unit + a SQL database (with customized design) + a customized data supervisory system. The data supervisor system was designed by Elipse Software Ltda. (model: e3).

Within an every-minute frequency, continuous measurement of LFG flow, LFG pressure, LFG temperature, LFG CH_4 content, LFG O_2 content, LFG CO_2 content[5] and temperature of the exhaust gas of the each operational flare are processed by the project's PLC unit and are recorded by SQL format database (which is available at project's control room). The project's SQL based database was designed by Doxor Serviços de Instalações e Montagens Industriais Ltda.

As part of the implemented data reporting and emission reduction calculation procedures, two sets of data files (with LFG related monitoring records) are monthly generated as follows:

- One MS-Excel spreadsheet file and one PDF format file containing all LFG related monitoring records for the period are generated by the project's operational staff.
- While data in MS-Excel format is handled as a primary data input for the emission reduction calculations, the PDF format files (which also lists/reports all LFG related monitoring records in a table format within an every-minute frequency are kept as proof of authenticity of MS-Excel based data which is actually used as primary data source / data input for emission reduction calculations. Every-minute LFG monitoring data are recorded in both pdf format and MS-Excel format files. The PDF format data is thus used as proof of authenticity of MS-Excel data used in the context of the emission reduction calculations[6].

The project's data supervisory system (which is connected to the SQL database) includes in its user interface functionalities (controls) for generating a MS-Excel spreadsheet data file and a PDF data file with every minute monitoring records upon request of the system user.

As per the project's operational procedure the following steps are monthly performed by the project operational staff in order to report monitoring records:

1) Every month a MS-Excel spreadsheet data file with LFG related monitoring records (raw data files) is generated.
2) The content of every monthly raw data file (in MS-Excel format) is copied and pasted into a customized monthly MS-Excel based emission reduction calculation spreadsheet template/model (designed by Essencis Soluções Ambientais S.A). This MS-Excel template is internally denominated as "IMP 403". In this spreadsheet, all LFG related monitoring data records for every month of the monitoring period in question are reported as follows:
    - Values for LFG volume (in Nm^3) for every minute and accumulated monthly values are calculated and reported by using every-minute monitoring records of LFG flow (in m^3/h), LFG Pressure (in mbar) and LFG Temperature (in ^oC);
    - Every-minute and accumulated values for CH_4 volume (in Nm^3) are also determined (by using every-minute records for LFG volume and every minute records for LFG CH_4 fraction (%));
    - Every-minute and accumulated values for CH_4 mass (in ton CH_4) are calculated and reported by using every-minute records of CH_4 volume and ex-ante determined value for methane density (D_{CH4})

[5] Monitoring of LFG O_2 and CO_2 contents is not required as per ACM0001 (version 2) and monitoring plan of the PDD. LFG O_2 and CO_2 contents are measured due to safety and operational requirements.

- By considering the ex-ante determined values of AF and GWP_{CH4} as well as determined values of FE, it is calculated and reported every-minute and accumulated values for MD_{flared} (which is equal to $MD_{project}$).

As per applicable documented working procedures, the project activity is managed by the CDM Project Superintendent at Essencis Soluções Ambientais S.A. The CDM Project Superintendent supervises the CDM Project supervisor who is the one in charge of all monitoring related activities (handling of data, preparation of the Monitoring Report and emission reduction calculation spreadsheet).

The operation of the project activity and the application of the monitoring plan is responsibility of the CDM Project Supervisor, who reports all relevant project related issues to the CDM Project Superintendent (operation status of the project activity, results and events, collection and storage of monitoring data, calibration events, and maintenance of equipment).

The CDM Consultant also supports the project team in operational and monitoring technical issues.

The diagram bellow shows the hierarchy for the project management.

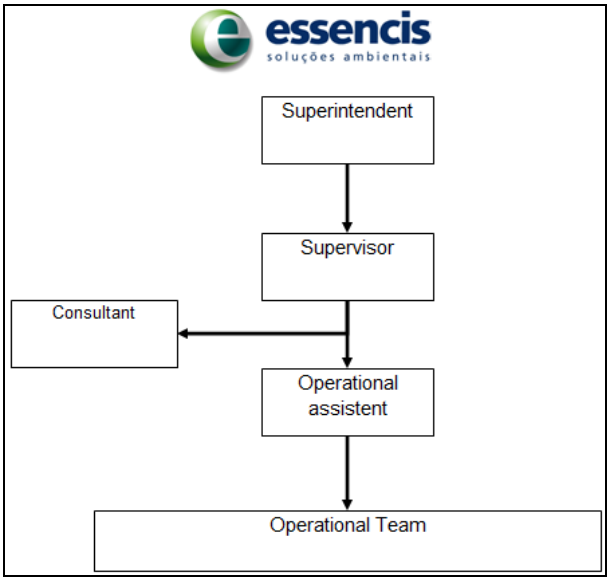

Figure 5 - Hierarchy for the project management

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data / Parameter:	**D_{CH4}**
Unit:	tCH_4/ m^3CH_4 (STP)
Description:	Density of methane.
Source of data:	Default value (as per consolidated baseline and monitoring methodology ACM0001 (version 2)).
Value(s) applied):	0.0007168
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment:	-

Data / Parameter:	AF
Unit:	-
Description:	Adjustment Factor
Source of data:	Determined considering the assumed amount of methane that would be collected and destroyed in the absence of the project activity (baseline scenario).
Value(s) applied):	20%
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment:	-

Data / Parameter:	GWP_{CH4}
Unit:	tCO_2e/ tCH_4
Description:	Global Warming Potential (GWP) for methane
Source of data:	IPCC Second Assessment Report (SAR), 1995 and "Global Warming Potential for Given Time Horizon" in table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, based on the effects of greenhouse gases over a 100-year time horizon. Available at: www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14 The applied values are also in accordance with the "Standard for application of the global warming potential to clean development mechanism project activities and programmes of activities for the second commitment period of the Kyoto Protocol".
Value(s) applied):	21 (period from 31/03/2006 to 31/12/2012) 25 (period from 01/01/2013 to 30/11/2013)
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment:	-

D.2. Data and parameters monitored

Data / Parameter:	**$LFG_{flare,y}$**[7]
Unit:	Nm^3
Description:	Amount of landfill gas flared (parameter I.D 3.2 in the monitoring plan of the PDD)
Measured/ Calculated / Default:	Continuously measured by a LFG flow meter
Source of data:	Measurements performed by a LFG flow meter located in the main LFG pipeline.
Value(s) of monitored parameter:	Values of LFG flow are recorded and reported in every-minute basis in the monthly emission reduction calculation spreadsheets ("IMP 403" spreadsheet files which are enclosed to the Monitoring Report).

[7] While no collected LFG was utilized for electricity generation and/or in the context of the commercialization of LFG with an external company (industry), the parameter $LFG_{flare,y}$ is thus equal to the parameter "Total amount of landfill gas captured" ($LFG_{total,y}$) (parameter I.D 3.1 in the monitoring plan of the PDD).

Monitoring equipment:	Measurements are performed by a LFG flow meter with the following specifications: *Specifications and calibration details for the installed LFG flow meter:* The installed flow meter set includes 2 main components: • An annubar element (differential pressure measurement principle device (which is installed inside the LFG pipeline)) • A data converter/transmitter which is coupled to the annubar element. Manufacturer: • The data converter/transmitters are manufactured by SMAR Equipamentos Industriais Ltda. • The annubar element is manufactured by Digimat Montagem e Instrumentação Ltda. Model: • Data converer/transmitter: D1/LD301 • Annubar element: Sonda 6 Accuracy: • Data converter/transmitter: ± 0.075% • Annubar element: ±2% (annubar element) Serial number (S/N): • Data converter/transmitter: U468667 • Annubar element: There is no S/N for the installed annubar element. Instrument internal identification number: FT01 Calibration frequency and/or maintenance requirements[8]: • Data converter/transmitter: calibration is to be performed yearly (as established by the equipment manufacturer). • Annubar element: the instrument manufacturer recommends the performance of a calibration event or metrology analysis in the annubar element every 5 years. The metrology analysis, as an alternative to the calibration procedure, aims to confirm the dimensional integrity of the instrument (which is a required condition for its proper functioning). Calibration events valid for the monitoring period from 01/10/2012 to 30/03/2013: • Data converter/transmitter: • FT01: An initial calibration event was performed on 05/04/2012 by Elus Serviços de Instrmentação Ltda. Calibration certificate: Elus E0831/12. A sequential calibration event was performed on 11/03/2013 by Naka Comércio e Indústria de Instrumentação Industrial Ltda. Calibration Certificate: CR - 087/13. • Annubar element: A calibration event was performed on 18/05/2011 by Elus Serviços de Instrumentação Ltda. (Certificate of Calibration No. E1194/11). The annubar element was supplied by its manufacturer/distributor already calibrated prior to be installed in the project site.
Measuring/ Reading/ Recording frequency:	Continuously measurements are recorded and reported every minute.

[8] The calibration frequencies adopted for the installed LFG flow meter, LFG pressure sensor and LFG temperature sensor are as per the recommendations of related equipment/instrument manufacturers. The PDD and ACM0001 methodology do not specify any frequency for the calibration of such equipment/instruments. Moreover, the PDD and ACM0001 methodology do not specify any accuracy or other specification requirement for such instruments/equipment either.

Calculation method (if applicable):	Not applicable.
QA/QC procedures:	As per the implemented maintenance/calibration procedure at Essencis Soluções Ambientais S.A., the LFG flow meter's data converter/transmitter D1/LD301 and the annubar element are to be calibrated annually and every 5 years respectively. Related data collection, data recording and data reporting procedures are implemented as per company's ISO 9001 and 14001 certified quality and environmental management system.
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment:	-

Data / Parameter:	**FE**
Unit:	-
Description:	Flare combustion/efficiency (parameter I.D 3.5 in the monitoring plan of the PDD)
Measured/ Calculated / Default:	FE is determined *inter-alia* on the basis of quarterly measurements of the amount of residual methane content in the exhaust gas of the flare, which are performed by a third party independent inspection service company. The operational status of the flare (which is also considered in the context of the determination of adopted FE values for every minute of the considered monitoring period) is also determined based on continuous monitoring of the temperature of exhaust gas of the flares (T_{flare}). Whenever temperature in the flares is lower than 500^{o}C, no emission reduction is claimed for the time instant in question.
Source of data:	Related measurements and calculations applicable for the determination of periodical values for FE were performed by the third party independent inspection service company "Ecosampling Ambiental Ltda." As part of each FE determination event, the efficiency of the flares (FE) was determined on basis of the following: - measurements of residual concentration of methane in collected samples of the exhaust gas of the flares. - out flow of exhaust gas in the flare being evaluated - inflow of methane in the flare being evaluated
Value(s) of monitored parameter:	Applicable values for FE are always determined as the lowest calculated value on each performed flaring efficiency test. A maximum and a minimum value for FE were determined as part of each performed test event. During the considered monitoring period, 5 sets of measurement + calculation events were performed as summarized below. Results for the 5 set of measurement/calculation events for the determination of FE valid for the considered monitoring period are presented below:

Test Number	Date of performed test section	Determined value for FE
1st FE periodic test	10-11/05/2012	99.9849 %
2nd FE periodic test	15-16/10/2012	99.9946 %
3rd FE periodic test	22-23/11/2012	99.9965 %
4th FE periodic test	07-08/12/2012	99.9965 %
5th FE periodic test	05-06/03/2013	99.9938 %

Each one of the determined values of FE is applied in the calculation of the parameter $MD_{project,y}$ during the time period within the considered monitoring period starting on the day when the related set of measurements + calculation was performed and ending in the day prior to the day related set of measurements + calculations were performed in the context of the next sequential FE determination test event. For the considered monitoring period, the determined values for FE were applied in the context of the determination of emission reductions achieved by the project activity (determination of every-minute values for $MD_{project,y}$) as follows:

Test event number (set of measurements + calculations)	**Determined value for FE**	**Time interval of consideration of the determined value of FE within the considered monitoring period**
1st FE periodic test event within the considered monitoring period	99.9849 %	From 01/10/2012 to 14/10/2012
2nd FE periodic test event within the considered monitoring period	99.9946 %	From 15/10/2012 to 21/11/2012
3rd FE periodic test event within the considered monitoring period	99.9965 %	From 22/11/2012 to 06/12/2012
4th FE periodic test event within the considered monitoring period	99.9965 %	From 07/12/2012 to 04/03/2013
5th FE periodic test event within the considered monitoring period	99.9938 %	From 05/03/2013 to 30/03/2013

Monitoring equipment:	As per information made available in the test/evaluation technical reports issued by the third party independent inspection service company "Ecosampling Ambiental Ltda.", the measurements of residual methane in the flare were performed by using a gas analyzer manufactured by FID / California Analytical Instruments (CAI), model 300 HFID. The methodology applied in the analysis is as per the Method 3 – "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air and Dry Molecular Weight", Method 4 - "Determination of Moisture in Stack Gases", Method 25A – "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer". All these methods are from the US EPA – United States Environmental Protection Agency. For determining the speed of exhaust gas flow in the flare (in order to calculate the flow of outgoing exhaust gas of the flare), an appropriate Pitot tube was used. Two different thermocouples were used for monitoring temperature of exhaust gas on Flare 1 (TT11) during the considered monitoring period. Their specifications are as follows: ➢ Thermocouple used from 01/08/2012 to 11/03/2013: - Manufacturer: Naka Comércio e Indústria de Instrumentação Industrial Ltda. - Model: NKTC-3000, type K - Accuracy: ±0.75% - Serial Number: 51748 - Instrument internal identification number: TT 11 - Calibration frequency (as specified by the monitoring methodology/tool): periodically calibrated by an officially accredited entity - Calibration frequency (as per the application of the monitoring plan): yearly - Calibration Date: 12/03/2012 (Calibration Certificate: 3901-12) - Entity/company responsible for the calibrations: Contemp Laboratório de Metrologia ➢ Thermocouple used from 11/03/2013 to 30/03/2013: - Manufacturer: Naka Comércio e Indústria de Instrumentação Industrial Ltda. - Model: NKTC-3000, type N - Accuracy: ±0.75% - Serial Number: 099156 - Instrument internal identification number: TT11 - Calibration frequency (as specified by the monitoring methodology/tool): periodically calibrated by an officially accredited entity - Calibration frequency (as per the application of the monitoring plan): yearly - Calibration Date: 11/03/2013 (Calibration Certificate: T0197-13) - Entity/company responsible for the calibrations: Naka Comércio e Indústria de Instrumentação Industrial Ltda. Two different thermocouples were used for monitoring temperature of exhaust gas on Flare 2 (TT12) during the considered monitoring period. Their specifications are as follows: ➢ Thermocouple used from 01/08/2012 to 11/03/2013: - Manufacturer: Naka Comércio e Indústria de Instrumentação Industrial Ltda. - Model: NKTC-3000, type S - Accuracy: ±0.5% - Serial Number: 79656 - Instrument internal identification number: TT112 - Calibration frequency (as specified by the monitoring methodology/tool): Periodically calibrated by an officially accredited entity - Calibration frequency (as per the application of the monitoring plan):

	yearly - Calibration Date: 12/03/2012 (Calibration Certificate: 3911-12) - Entity/company responsible for the performed calibration events: Contemp Laboratório de Metrologia Ltda. ➢ Thermocouple used from 11/03/2013 to 30/03/2013: - Manufacturer: Naka Comércio e Indústria de Instrumentação Industrial Ltda. - Model: NKTC-3000, type N - Accuracy: ±0.75% - Serial Number: 099157 - Instrument internal identification number: TT12 - Calibration frequency (as specified by the monitoring methodology/tool): periodically calibrated by an officially accredited entity - Calibration frequency (as per the application of the monitoring plan): yearly - Calibration Date: 11/03/2013 (Calibration Certificate: T0198-13) - Entity/company responsible for the calibrations: Naka Comércio e Indústria de Instrumentação Industrial Ltda. Two different thermocouples were used for monitoring temperature of exhaust gas on Flare 3 (TT13) during the considered monitoring period. Their specifications are as follows: ➢ Thermocouple used from 01/08/2012 to 11/03/2013: - Manufacturer: Naka Comércio e Indústria de Instrumentação Industrial Ltda. - Model: NKTC-3000, type K - Accuracy: ±0.75% - Serial Number: 51747 - Instrument internal identification number: TT13 - Calibration frequency (as specified by the monitoring methodology/tool): Periodically calibrated by an officially accredited entity - Calibration frequency (as per the application of the monitoring plan): yearly - Calibration Date: 12/03/2012 (Calibration Certificate: 3905-12) - Entity/company responsible for the calibration events: Contemp Laboratório de Metrologia Ltda. ➢ Thermocouple used from 11/03/2013 to 30/03/2013: - Manufacturer: Naka Comércio e Indústria de Instrumentação Industrial Ltda. - Model: NKTC-3000, type N - Accuracy: ±0.75% - Serial Number: 099158 - Instrument internal identification number: TT13 - Calibration frequency (as specified by the monitoring methodology/tool): periodically calibrated by an officially accredited entity - Calibration frequency (as per the application of the monitoring plan): yearly - Calibration Date: 11/03/2013 (Calibration Certificate: T0199-13) - Entity/company responsible for the calibrations: Naka Comércio e Indústria de Instrumentação Industrial Ltda. Two different thermocouples were used for monitoring temperature of exhaust gas on Flare 4 (TT14) during the considered monitoring period. Their specifications are as follows: ➢ Thermocouple used from 01/08/2012 to 11/03/2013: - Manufacturer: Naka Comércio e Indústria de Instrumentação Industrial Ltda. - Model: NKTC-3000, type S - Accuracy: ±0.5% - Serial Number: 53316 - Instrument internal identification number: TT14

	- Calibration frequency (as specified by the monitoring methodology/tool): Periodically calibrated by an officially accredited entity - Calibration frequency (as per the application of the monitoring plan): yearly - Calibration Date: 12/03/2012 (Calibration Certificate: 3902-12) - Entity/company responsible for the calibration events: Contemp Laboratório de Metrologia Ltda. ➢ Thermocouple used from 11/03/2013 to 30/03/2013: - Manufacturer: Naka Comércio e Indústria de Instrumentação Industrial Ltda. - Model: NKTC-3000, type N - Accuracy: ±0.75% - Serial Number: 099159 - Instrument internal identification number: TT14 - Calibration frequency (as specified by the monitoring methodology/tool): periodically calibrated by an officially accredited entity - Calibration frequency (as per the application of the monitoring plan): yearly - Calibration Date: 11/03/2013 (Calibration Certificate: T0200-13) - Entity/company responsible for the calibrations: Naka Comércio e Indústria de Instrumentação Industrial Ltda.
Measuring/ Reading/ Recording frequency:	Measurement frequency: FE related measurements and calculations are to be performed quarterly. Temperature of exhaust gas of the flares (T_{flare}): continuously measurements are recorded/reported every minute.
Calculation method (if applicable):	See Section E.1.
QA/QC procedures:	
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment:	-

Data / Parameter:	**$w_{CH4,y}$**
Unit:	%
Description:	Methane fraction in the landfill gas (parameter I.D 3.6 in the monitoring plan of the PDD)
Measured/ Calculated / Default:	Continuously measured with a CH_4 content gas analyzer.
Source of data:	Monitored in the main LFG pipeline before the flares.
Value(s) of monitored parameter:	Monitoring records (with every-minute frequency) are presented in the monthly emission reduction calculation spreadsheets.

Monitoring equipment:	*Specifications and calibration details for the installed CH_4 content gas analyzer:* - Manufacturer: Yokogawa Instrument Corporation - Model: IR200 - Accuracy: ±2.0% - Serial Number: 6EG5195 - Instrument internal identification number: GA - Calibration frequency (as specified by the monitoring methodology/tool and/or in the PDD): no calibration frequency is specified. - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibrated every 15 days by a qualified operator - Dates for performed calibration events valid for the considered monitoring period: 24/09/2012; 08/10/2012; 21/10/2012; 05/11/2012, 19/11/2012; 03/12/2012; 17/12/2012; 30/12/2012; 14/01/2013; 25/01/2013; 08/02/2013; 11/02/2013; 23/02/2013; 01/03/2013; 11/03/2013; 19/03/2013; 13/12/2013. - Entity/company responsible for the calibrations: all calibrations were performed by trained responsible staff of Essencis Soluções Ambientais S.A. by following the applicable working procedure "PRO 405 Calibração Analisador de Gases". Calibration events were performed by using certified span gas cylinders with a known composition. Certified span gases utilized for the calibration events valid for the monitoring period: - Gas cylinders with 60% CH_4 span gas: cylinder n° 11916 Gas cylinders with 60% $_CH_4$ span gas: cylinder n° 13874F - Gas cylinders with 60% CH_4 span gas: cylinder n° 14028D All certified span gas cylinders were supplied by White Martins Gases Industriais Ltda.
Measuring/ Reading/ Recording frequency:	Continuously measurements are recorded/reported every minute.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Regular maintenance and testing regime to ensure accuracy. One of the results of calibrations performed in the $CH_4/CO_2/O_2$ gas analyzer revealed a positive deviation/error beyond the maximum permissible error of the measuring instrument (±2.0). A deduction factor was applied by following the guidance of the "Clean development mechanism validation and verification standard" in order to correct this inconsistency on the following period: - 14/01/2013 to 25/01/2013;
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment:	-

Data / Parameter:	**T**
Unit:	ºC
Description:	Temperature of the landfill gas (parameter I.D 3.7 in the monitoring plan of the PDD) .
Measured/	Continuously measured by a LFG temperature sensor

Calculated / Default:	
Source of data:	Monitored in the main LFG pipeline before the flares.
Value(s) of monitored parameter:	Monitoring records (with every-minute frequency) are presented in the monthly emission reduction calculation spreadsheets.
Monitoring equipment:	*Specifications and calibration details for the LFG temperature sensor:* - Manufacturer: Pressgage Instrumentos de Medição e Controle - Model: PT-100 - Accuracy: ±1.0% - Serial Number (S/N): 32057 - Instrument internal identification number: TT02 - Calibration frequency: as specified by the monitoring methodology/tool): Periodically calibrated by an officially accredited entity. - Calibration frequency (as per the application of the monitoring plan): yearly - Date for performed calibration events valid for the considered monitoring period: 12/03/2012 and 11/03/2013 (Calibration Certificates 3913-12 and R-0208-13, respectively) - Entity/company responsible for the calibrations: Contemp Laboratório de Metrologia Ltda. (calibration event of 12/03/2012) and Naka Comércio e Indústria de Instrumentação Industrial Ltda. (calibration event of 11/03/2013)
Measuring/ Reading/ Recording frequency:	Continuously measurements are recorded/reported every minute.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	-
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment:	-

Data / Parameter:	**P**
Unit:	Pa
Description:	Pressure of the landfill gas (parameter I.D 3.8 in the monitoring plan of the PDD)
Measured/ Calculated / Default:	Continuously measured by a LFG pressure sensor
Source of data:	Monitored in the main LFG pipeline before the flares.
Value(s) of monitored parameter:	Monitoring records (with every-minute frequency) are presented in the monthly emission reduction calculation spreadsheets.

Monitoring equipment:	*Specifications and calibration details for the LFG pressure sensor:* - Manufacturer: Pressgage Instrumentos de Medição e Controle - Model: TPI-PRESS - Accuracy: ±1.5% - Serial Number: 43608 - Instrument internal identification number: PT02 - Calibration frequency (as specified by the monitoring methodology/tool): Periodically calibrated by an officially accredited entity - Calibration frequency (as per the application of the monitoring plan): yearly - Equipment: Pressure Meter - Date for performed calibration events valid for the considered monitoring period: 12/03/2012 and 11/03/2013 (Calibration Certificates: 3917-12 and CR-089/13, respectively) - Entity/company responsible for the calibrations: Contemp Laboratório de Metrologia Ltda. (calibration event of 12/03/2012) and Naka Comércio e Indústria de Instrumentação Industrial Ltda. (calibration event of 11/03/2013)
Measuring/ Reading/ Recording frequency:	Continuously measurements are recorded/reported every minute.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	-
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment:	-

Data / Parameter:	**HE**
Unit:	-
Description:	Regulatory requirements relating to landfill gas projects
Measured/ Calculated / Default:	Not applicable
Source of data:	Publicly available information of the Brazil's regulatory requirements related to landfill gas.
Value(s) of monitored parameter:	-
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	-
Calculation method (if applicable):	-
QA/QC procedures:	Not applicable.
Purpose of data:	Calculation of baseline emissions or baseline net GHG removals by sinks;
Additional comment:	This parameter is to be considered for the confirmation of the baseline scenario and determination baseline emissions as part of the renewal of the crediting

period for the project activity. So far no new regulatory requirements relating to LFG projects went into force during the crediting period. Eventual changes in the current status for regulatory requirements relating to LFG managements in landfills will be used for changes to the adjustment factor (AF) at renewal of the credit period.

The Brazilian Regulation of the National Policy on Waste Management, established by Decree No. 7,404/10 (the Decree), was published on 23/12/2010. In force since its publication, this decree regulates the National Policy on Waste Management (PNRS), established by Federal Law No. 12,305/10 (the LPNRS), and creates the Steering Committee for the Implementation of Reverse Logistics Systems (Steering Committee) and the PNRS Interministerial Committee. This new Brazilian Regulation of the National Policy on Waste Management does not establish any requirement, obligation or recommendation related to LFG management at landfills in Brazil.

As outlined in paper issued by the law firm "Tauil & Chequer Advogados":

"The Regulation of the National Policy on Waste Management, established by Decree No. 7,404/10 (the Decree), was published on December 23, 2010. In force since its publication, the Decree regulates the National Policy on Waste Management (PNRS), established by Federal Law No. 12,305/10 (the LPNRS), and creates the Steering Committee for the Implementation of Reverse Logistics Systems (Steering Committee) and the PNRS Interministerial Committee.

The main purpose of the PNRS Interministerial Committee is to support the PNRS structuring and implementation, in order to enable the accomplishment of the provisions and goals set forth by the LPNRS. The Steering Committee has the basic function of guiding the implementation of reverse logistics.

Among the instruments regulated by the Decree are the Reverse Logistics Systems, the Waste Management Plans (PGRS) and the National Registry for Hazardous Waste Operators.

The Decree lists three specific instruments for the implementation and operation of the reverse logistic systems: (i) sectorial agreements, executed between public authorities and the industry; (ii) regulations, issued by the executive branch; and (iii) commitment agreements—which are to be adopted in the absence of sectorial agreements and regulations and when specific circumstances require more restrictive obligations—to be approved by the competent environmental agency.

Regarding the obligation to prepare a PGRS, which should be required within environmental permitting proceedings, the Decree mentions the possibility of jointly submitting the PGRS under specific conditions and in cases where activities are conducted in the same condominium, municipality, micro-region or metropolitan/urban areas. Additionally, the Decree establishes that small companies that generate household waste, as provided for by article 30 of the LPNRS, are not required to submit a PGRS.

Regarding the National Registry for Hazardous Waste Operators, which must be integrated to the already existing Federal Technical Registry of IBAMA, the Decree establishes a registration obligation for companies that manipulate or operate hazardous waste. The Decree also describes those who are considered generators or operators of hazardous waste, establishing several requirements for their authorization or permitting. These include the preparation of hazardous waste management plan, the demonstration of technical and economic capacity and the obtaining of civil liability insurance for environmental damages."

<table>
<tr><td>Data / Parameter:</td><td>Energy</td></tr>
<tr><td>Unit:</td><td>- MWh for the amount of consumed grid electricity ($EC_{PJ,grid,y}$)
- ton_{LPG} for the amount of consumed LPG ($FC_{LPG,y}$)</td></tr>
<tr><td>Description:</td><td>Total amount of electricity and/or other energy carriers used in the project for gas pumping and heat transport (not derived from the gas)
(parameter I.D 3.9 in the monitoring plan of the PDD. This parameter refers to the amount of grid electricity and LPG consumed by the project activity)

This parameter is associated with two sub-parameters:
- Amount of consumed grid electricity ($EC_{PJ,grid,y}$)
- Amount of consumed LPG ($FC_{LPG,y}$)</td></tr>
<tr><td>Measured/
Calculated /
Default:</td><td>Measured.</td></tr>
<tr><td>Source of data:</td><td>Monitored values for $EC_{PJ,grid,y}$ are based on measurements made by Elektro Eletricidade e Serviços S.A. (a Brazilian power distribution company) thorugh installed electricity meters and monitored values of $FC_{LPG,y}$ are based on measurements performed by the local LPG distribution company Cia Ultragas S.A. as part of LPG delivery events.</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td>Amount of consumed grid electricity ($EC_{PJ,grid,y}$):

Monthly records of grid electricity consumption valid for the considered monitoring period:
<table>
<tr><th>Month</th><th>Amount of consumed grid electricity</th></tr>
<tr><td>Oct. 2012</td><td>234.558 MWh</td></tr>
<tr><td>Nov. 2012</td><td>235.398 MWh</td></tr>
<tr><td>Dec. 2012</td><td>176.915 MWh</td></tr>
<tr><td>Jan. 2013</td><td>353.729 MWh</td></tr>
<tr><td>Feb. 2013</td><td>225.066 MWh</td></tr>
<tr><td>Mar. 2013</td><td>181.236 MWh</td></tr>
</table>

Amount of consumed LPG ($FC_{LPG,y}$): As per the adopted monitoring procedure, the total amount of LPG consumed by the project activity during the considered monitoring period is 225 kg (0.225 ton) of LPG. Thus,

$FC_{LPG,y} = 0.225\ ton_{LPG}$

LPG was consumed for lighting/igniting the flares (flare pilot). The reported value corresponds to twice the total amount of LPG consumed at the CTR Caieiras landfill. Some reduced share of consumed LPG corresponds to LPG consumption at the employees' kitchen facility of CTR Caieiras landfill. As a conservative approach, apart of assuming the amount of consumed LPG was 100% higher, it is also assumed that all LPG was consumed by the project activity.</td></tr>
</table>

Monitoring equipment:	*Monitoring details for "Amount of consumed grid electricity ($EC_{PJ,grid,y}$)":* Electricity consumption by the project activity was measured by electricity meters. *Specifications and calibration details for the installed electricity meters for measurements of $EC_{PJ,grid,y}$:* Electricity meter 01: - Manufacturer: KRON Instrumentos Elétricos Ltda. - Model: MULT-K - Accuracy: ±0.2% - Serial Number: 234215 - Instrument internal identification number: ME Plant Electricity meter 02 (Blower 4) - Manufacturer: Manufacturer: KRON Instrumentos Elétricos Ltda. - Model: MULT-K - Accuracy: ±0.2 % - Serial Number: 465025 - Instrument internal identification number: ME Blower 4 Calibration requirements for Electricity meter 01 and 02: - Calibration frequency (as specified by the monitoring methodology/tool): The monitoring plan of the PDD and ACM0001 (version 2) do not specify any calibration frequency requirements for the electricity meters. As per the PDD, all monitoring equipment must be calibrated periodically. The "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" establishes the following regarding maintenance and calibration for electricity meters: "*(...) meters should be installed, maintained and calibrated according to equipment manufacturer instructions and be in line with national standards, or, if these are not available, international standards (e.g. IEC, ISO)*". - Calibration frequency (as per the recommendation of the meter manufacturer): it is important to note that the installed meters are approved/certified by INMETRO (The Brazilian national authority for metrology and standardization issues), and they are thus in conformance with INMETRO's requirements for maintenance and testing of electricity meters. According to the instrument manufacturer, the meters are to be calibrated every 5 years. A calibration frequency of 5 years was adopted. - Date of valid calibration events: Electricity meter 01: 02/03/2007 and 19/03/2012 (Calibration Certificates: 518/07 and R-0701/12, issued by KRON Instrumentos Elétricos Ltda. and Naka Comércio e Indústria de Instrumentação Industrial Ltda., respectively) Electricity meter 02: 03/10/2008 and 19/03/2012 (Calibration Certificates: 2600/08 and R-0702/12, issued by KRON Instrumentos Elétricos Ltda. and Naka Comércio e Indústria de Instrumentação Industrial Ltda., respectively) *Monitoring details for "Amount of consumed LPG" ($FC_{LPG,y}$)*: LPG consumption was monitored based on measurements performed by the local LPG distribution company Cia Ultragaz S.A. using the weight scale of which specifications are provided below. The adopted weighing procedure is as per working procedure IT-CO.61.0008 of the ISO9001 certified QA/QC management system of Cia Ultragaz S.A. *Specifications and calibration details for the installed weight scale for measurements of $FC_{LPG,y}$:* - Manufacturer: Mettler-Toledo Inc. - Model: 2180

	- Capacity: max. 250 kg - Accuracy: ± 50g - Serial Number: 10423008 - Calibration frequency (as specified by the monitoring methodology/tool): The monitoring plan of the PDD and ACM0001 (version 2) do not specify any calibration frequency requirements for the weight scales. As per the PDD, all equipment must be calibrated periodically. As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" [9], meters should be installed, maintained and calibrated according to equipment manufacturer instructions and be in line with national standards, or, if these are not available, international standards (e.g. IEC, ISO). - Date of valid calibrations: 06/05/2010 and 14/06/2012 (Calibration Certificates 905/10 and MA124/2012, respectively). - Entity/company responsible for the performed calibration events: Caieiras Balanças Comércio e Serviços Ltda. (calibration event of 06/05/2010) and Instituto de Pesos e Medidas do Estado de São Paulo IPEM-SP (calibration event of 14/06/2012).
Measuring/ Reading/ Recording frequency:	Accumulated values for continuous measurements of electricity consumption are recorded once a month. Amount of LPG is measured upon the supply of cylinders of LPG with 45 kg capacity each.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	The amount of consumed LPG is cross-checked with internal records of cost expenditures for fuel LPG as per the internal financial/accounting management system of Essencis Soluções Ambientais S.A. Data collection and reporting procedures for consumption of grid electricity and LPG by the project activity are implemented as per company's ISO 9001/ISO14001 certified QA/QC and environmental management system.
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks;
Additional comment:	-

Data / Parameter:	**CO2emission**
Unit:	- tCO_2/MWh for emission factor for consumed electricity ($EF_{grid,CM,y}$) - tCO_2/ ton emission factor for consumed LPG ($COEF_{LPG,y}$)
Description:	CO_2 emission intensity of the electricity and/or other energy carriers (parameter I.D 3.10 in the monitoring plan of the PDD) This parameter is associated with two sub-parameters: - Emission Factor for consumed grid electricity ($EF_{grid,CM,y}$)

[9] It is important to note that while the PDD does not include any provision for the determination of project emissions due to the consumption of LPG by the project activity, the PDD and ACM0001 (version 2) methodology do not refer to the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" either. While the application of such tool is currently assumed as the correct approach to determine related emissions due to consumption of LPG by a CDM project activity respectively, the project participants assumes as appropriate the use of such tool (regardless of the fact the PDD does not refer to it).

	- Emission factor for consumed LPG ($COEF_{LPG,y}$) (in mass basis)
Measured/ Calculated / Default:	Both $COEF_{LPG,y}$ and $EF_{grid,CM,y}$ are determined on the basis of default values.
Source of data:	$EF_{grid,CM,y}$: The applicable conservative default value as established by the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" is selected.[10] $COEF_{LPG,y}$: Determined as the product between Net Calorific Value (NCV) for consumed LPG ($NCV_{LPG,y}$) and CO_2 emission factor for consumed LPG (in energy basis) ($EF_{CO2,LPG,y}$) where: - $NCV_{LPG,y}$ = 0.0492 TJ/ton (source: Brazilian Energetic Balance 2012) - $EF_{CO2,LPG,y}$ = 65.6 tCO_2/TJ (source: IPCCC 2006)
Value(s) of monitored parameter:	$EF_{grid,CM,y}$: 1.3 tCO_2e/MWh $COEF_{LPG,y}$: 3.23 tCO_2/ton
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Not applicable
Calculation method (if applicable):	$EF_{grid,CM,y}$: conservative default value as established by the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". $COEF_{LPG,y}$: Determined as the product between $NCV_{LPG,y}$ and $EF_{CO2,LPG,y}$. *The issue about the impossibility of reporting and validating the official calculation of the CO2 emission factor for the national electricity grid of Brazil:* It is important to observe that since year 2008 the Designated National Authority (DNA) of Brazil has published only results of the calculated value for the so called official combined margin CO_2 emission factor for the national electricity grid of Brazil. Due to confidentiality reasons detailed input data and related calculations (using the dispatch analysis calculation method as per the "Tool to calculate the emission factor for an electricity system") are not made publicly available. Moreover, the Brazilian entity Operador Nacional do Sistema (ONS) does not make any dispatch data publicly available either. ONS is the entity who coordinates the dispatch of electricity by the power generation sources (power plants) connected to the electricity grid of Brazil. Thus, while detailed input data and related calculations for the ex-post monitored parameter "Combined margin emission factor for consumed grid electricity" ($EF_{grid,CM,y}$) are not possible to be enclosed to this Monitoring Report (as explicitly required by CDM rules and by the "Tool to calculate the emission factor for an electricity system"), it is not possible to the DOE in charge of the verification assessment for the considered monitoring period to confirm whether the determination of the value for the grid emission factor for the National Electricity Grid of Brazil (as declared by the Brazilian DNA) is or is not in full compliance with the requirements of the "Tool to calculate the emission factor for an electricity system" either (as required by applicable CDM rules).

[10] It is important to note that while the PDD does not include any provision for the determination of project emissions due to the consumption of grid electricity by the project activity, the PDD and ACM0001 (version 2) methodology do not refer to the "Tool to calculated baseline, project and/or leakage emissions from electricity consumption" either. While the application of such tool is currently assumed as the correct approach to determine related emissions due to consumption of electricity by a CDM project activity respectively, the project participants assumes as appropriate the use of such tool (regardless of the fact the PDD does not refer to it).

	It is crucial to note currently it is not possible for project participants of any grid-connected CDM project activity hosted in Brazil to make such calculation details enclosed to the Monitoring Report as established by "Tool to calculate the emission factor for an electricity system" (for cases where the CO_2 grid emission factor is monitored ex-post).During several relatively recent meetings of the CDM-EB, the issue of how DOEs are to validate ex-post determined emission factor of the electricity grids (for cases where calculations are based on confidential data such as the case of the electricity grid of Brazil) has been extensively discussed by the members of the CDM-EB. However, currently, there is still no clear procedural or methodological solution for this issue. In order to address this issue involving lack of data for monitoring $EF_{grid,CM,y,}$ as a conservative approach, project emissions due to the consumption of grid electricity by the project activity are thus determined by fully following the applicable guidance of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". In this context, the conservative default values of "CO_2 emission factor for grid electricity" and "Transmission and Distribution losses" are selected in order to address the lack of data which is outlined above. The adoption of such conservative approach results in a relative increment in project emissions due to consumption of grid electricity in more than 2,100 tCO_2 for the considered monitoring period. It is crucial to note that the PDD does not refer to the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". For future monitoring periods, if issue of complete lack of publicly available data which is required for calculating $EF_{grid,CM,y}$ (and reporting related calculations) as per the "Tool to calculate the emission factor for an electricity system" be finally addressed, the applicable guidance of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" will not be used. Thus $TDL_{grid,y}$ will not be any longer considered in the context of the determination of related project emissions.
QA/QC procedures:	Not applicable
Purpose of data:	Calculation of project emissions or actual net GHG removals by sinks;
Additional comment:	-

The following monitoring parameters (which are also included in the monitoring plan of the registered PDD) were not monitored as no collected LFG was utilized for electricity generation and/or exported/sold as gaseous fuel for an external company (industry).

- Total amount of landfill gas captured ($LFG_{total,y}$) (parameter I.D 3.1 in the monitoring plan of the PDD)
- Amount of landfill gas going into electricity generator ($LFG_{electricity,y}$) (parameter I.D 3.3 in the monitoring plan of the PDD)
- Amount of methane combusted in boiler ($LFG_{thermal,y}$) (parameter I.D 3.4 in the monitoring plan of the PDD)
- Amount of methane sold to industry, $MD_{industry,y}$ (parameter I.D 3.12 in the monitoring plan of the PDD)

D.3. Implementation of sampling plan

>>
Not applicable.

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

>>

As per the registered PDD valid for the 1st crediting period, baseline emissions (BE) are determined (in tCO_2e) as follows:[11]

$$BE = ER_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH4}$$

Where:

GWP_{CH4} Global Warming Potential value for methane. For the share of the 1st 7-year crediting period encompassing the period from 31/03/2006 to 31/12/2012, GWP_{CH4} is ex-ante determined as 21. For the share of the 1st 7-year crediting period encompassing the period from 01/01/2013 to 30/03/2013, GWP_{CH4} is ex-ante determined as 25.

ER_y Baseline emissions (in tCO_2e). While project emissions due to the consumption of grid electricity and LPG by the project activity are also accounted for the determination of emission reductions, differently than indicated in ACM0001 (version 2) ER_y actually represents baseline emissions and not emission reductions.

$MD_{reg,y}$ Amount of methane assumed as destroyed in the absence of the project activity (in tCH_4). $MD_{reg,y}$ is determined as follows:

$$MD_{reg,y} = MD_{project,y} * AF$$[12]

Where:

AF Adjustment factor. AF is ex-ante selected as 20%.

$MD_{project,y}$ Amount of methane destroyed by the project acticity (in tCH_4). $MD_{project,y}$ is determined as follows:

$$MD_{project,y} = MD_{flared,y}$$[13]

---

[11] While project emissions due to the consumption of grid electricity and LPG by the project activity are also accounted for the determination of emission reductions, differently than indicated in ACM0001 (version 2) and in the PDD, ER_y actually represents baseline emissions and not emission reductions. Note that "Baseline Emissions" (BE) is not explicitly referred in the PDD as equivalent to the equation "$ER_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH4}$"

[12] By following applicable guidance in the PDD, $MD_{reg,y}$ is selected as the higher quantity of methane between the potential methane to be sold to industry ($MD_{industry,y}$) or 20% of the methane collected by the project activity as follows:

If $MD_{industry,y} < MD_{project,y} * AF\ (20\%)$	*then* $MD_{reg,y} = MD_{project,y} * AF\ (20\%)$
If $MD_{industry,y} > MD_{project,y} * AF\ (20\%)$	*then* $MD_{reg,y} = MD_{industry,y}$

During the monitoring period from 01/10/2012 to 30/03/2013, no collected LFG was sold as gaseous fuel to a local industry ($MD_{industry,y} = 0$), thus "$MD_{reg,y} = MD_{project,y} * AF$"

[13] As per ACM0001 (version 2) and the PDD, the amount of methane destroyed by the project activity ($MD_{project,y}$) is determined as follows:

$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} + MD_{thermal,y}$

Where:

$MD_{flared,y}$ Quantity of methane destroyed by flaring,

$MD_{electricity,y}$ Quantity of methane destroyed by combustion of collected LFG in equipment for electricity generation ,

$MD_{thermal,y}$ Quantity of methane destroyed by combustion of collected LFG for thermal applications.

Where:

$MD_{flared,y}$ Quantity of methane destroyed by flaring, $LFG_{flare,y}$ is the quantity of landfill gas flared during the year measured in cubic meters (Nm^3), is calculated as follows:

$MD_{flare,y} = LFG_{flare,y} * w_{CH4y} * FE * D_{CH4}$

Where:

$LFG_{flare,y}$ Quantity of LFG flared (in Nm^3). Monitoring details for $LFG_{flare,y}$ are outlined in Section D.2.

Conversion of values of $LFG_{flare,y}$ into Normal cubic meters (Nm^3/h):

The installed flow meter measures LFG flow in m^3/hour by considering fixed reference values for Pressure and Temperature. In order to convert the measured values in Nm/h^3 monitored values of LFG Temperature and LFG Pressure are considered as follows:

$Qn = Q1 * (TN/T2 * P2/PN) * (T2/T1 *P1/P2)$

Where:

Qn LFG Flow in Normal cubic meters (Nm^3) = $LFG_{flare,y}$
Q1 LFG Flow in cubic meters (Nm^3) using the fixed reference value of temperature and pressure
T2 Temperature reference fixed value of the instrument (50º C)
P2 Pressure referenced fixed value of instrument (1.135 kgf/cm^2)
T1 LFG Temperature (in ºC)
P1 LFG Pressure transmitter (in mbar)

w_{CH4y} Methane fraction of the LFG and expressed as a fraction (%CH_4). Monitoring details for w_{CH4y} are outlined in Section D.2.

D_{CH4} Density of methane. D_{CH4} is ex-ante determined as 0.0007168 tCH_4/m^3CH_4 (STP)

FE Flare combustion efficiency.

No emission reduction is accounted for the time instants when the flare operated with exhaust temperature lower than 500ºC. (T_{flare} < 500ºC). For such cases the calculated value of $MD_{flared,y}$ is accounted as zero.[14]

In the context of the implementation and operation of the project activity, $MD_{electricity,y}$ and $MD_{thermal,y}$ are equal to zero as during the considered monitoring period no collected LFG was used as fuel for electricity generation or as fuel for any thermal application. Hence, the final equation results in: $MD_{project,y} = MD_{flared,y}$

[14] It is important to note the following operational flare aspects/procedures:
- It is acknowledged the installed flares can not properly operate (operations under stable and sustainable conditions) whenever temperature of exhaust gases is below 500ºC.
- During the monitoring period the flares have basically operated with temperature below 500ºC during a very limited time periods (e.g. during flare heating periods right after the flare operation is re-initiated after flare maintenance, repair or unexpected interruptions).

Determination of Flare combustion/efficiency (FE):
Measurements of residual methane in the exhaust gas of the flares and measurements of speed of exhaust gas of the flares (for the determination of flow of exhaust gas of the flares) were periodically performed by the third part inspection service company Ecosampling Avaliações Ambientais Ltda. The performed tests/evaluations aimed the determination of the combustion efficiency of the flares (in terms of destruction of methane during the combustion process). Ecosampling Avaliações Ambientais Ltda. is an inspection service company which is specialized in emission measurements and air pollution inspections.

As per the adopted procedure, the regular determination of applicable values of FE (4 times per year) can be summarized as follows:

(a) measurements of residual concentration of methane in collected sample the exhaust gas of the flares ($wCH4_{residual,n,f}$)
(b) perform the determination of flow of exhaust gas in the flares ($Flow\_Exhaust\_Gas\_flare_{n,f}$)
(c) perform the calculations of FE values based on (a) and (b) and also using monitored data of inflow of methane to the flare[15]

There are five test/evaluations valid for the considered monitoring period: test evaluations were performed on 10-11/05/2012, 15-16/10/2012, 22-23/11/2012, 07-08/12/2012 and 05-06/03/2013 respectively. As per requirements of ACM0001 (version 2) and monitoring plan of the registered PDD the evaluations/tests should be performed at least four times per year (quarterly).

As per information available in the flare efficiency analysis reports issued by the third party inspection services company "Ecosampling Avaliações Ambientais Ltda.", for each individual performed evaluation/test, the lowest and highest measurements of residual CH_4 concentration in collected sample of exhaust gas of the flares ($Min.\_wCH4_{residual,n,f}$ and $Max.\_wCH4_{residual,n,f}$) were determined using a gas analyzer FID / California Analytical Instruments (CAI), model HFID for determining the amount of residual methane in the flare. A Pilot tube was also utilized for determining the speed of exhaust gas in the flare (in order to calculate the out flow of exhaust gas of the flare).

For each flare evaluation/test, the minimum and maximum values for the Methane combustion efficiency (FE) were determined/calculated as follows:

- $Min.\_FE_{n,f} = 1- (Max.\_CH4_{residual,n,f} / Average\text{-}CH4_{Flared,n,f})$
- $Max.\_FE_{n,f} = 1- (Min.\_CH4_{residual,n,f} / Average\text{-}CH4_{Flared,n,f})$

($Min.\_FE_{n,f}$ is the lowest calculated value for $FE_{n,f}$ and $Max.\_FE_{n,f}$ is the highest calculated value for $FE_{n,f}$)

Where:

f	Flare number identification. Three enclosed flares were used during the considered monitoring period. f = 1: Flare 01 f = 2: Flare 02 f = 3: Flare 03 f = 4: Flare 04

[15] The monitoring plan of the PDD does not include any reference about how to perform the related measurement and how to actually calculate the values of FE. ACM0001 (version 2) merely establishes that "*the methane content of the flare emissions will be analyzed quarterly*".

n	Number of evaluation. Four evaluations were performed which are valid for the considered monitoring period n = 1: evaluation dated 10-11/05/2012 n = 2: evaluation dated 15-16/10/2012 n = 3: evaluation dated 22-23/11/2012 n = 4: evaluation dated 07-08/12/2012 n = 5: evaluation dated 05-06/03/2013
Average-$CH4_{Flared,n,f}$	Average flow of methane sent to the flare "f" during the evaluation number n (in kg CH_4/h) The analysis period is the same time period of which measurements of $wCH4_{residual,n,f}$ were performed. As per the calculation method adopted by "Ecosampling Avaliações Ambientais Ltda.", records for $MD_{project,y}$ (methane destroyed by flaring) were also considered.
Min._$CH4_{residual,n,f}$	Minimum of residual flow of methane in the exhaust gas of the flare "f" in the context of evaluation "n" during the selected test/evaluation (in kg CH_4/h).
Max._$CH4_{residual,n,f}$	Maximum of residual flow of methane in the exhaust gas of the flare "f" in the context of evaluation "n" during the selected test/evaluation (in kg CH_4/h).

Min._$CH4_{residual,n,f}$ and Max._$CH4_{residual,n,f}$ are determined as follows:

- $Min.\_CH4_{residual,,n,f} = Flow\_Exhaust\_Gas\_flare_{n,f} * Min.\_wCH4_{residual,n,f} * CF$
- $Max.\_CH4_{residual,,n,f} = Flow\_Exhaust\_Gas\_flare_{n,f} * Max.\_wCH4_{residual,n,f} * CF$

Where:

CF	Density of CH_4 (Conversion Factor). As indicated in the flare efficiency analysis reports issued by the inspection service company "Ecosampling Avaliações Ambientais Ltda., the assumed value for density of methane is 0.7168 kg / m^3. This value is equal to the value selected in the PDD for the ex-ante determined parameter Density of Methane (D_{CH4}): 0.0007168 tCH_4/ m^3CH_4STP.
$Flow\_Exhaust\_Gas\_flare_{n,f}$	Determined accumulated flow of exhaust gas of the flare "f" in the context of evaluation "n" (in Nm^3 exhaust gas/h).
$Min.\_wCH4_{residual,n,f}$	Minimum measurement of residual CH_4 concentration in the exhaust gas of the flare "f" in the context of evaluation "n" (in ppm CH_4)

Max._$wCH4_{residual,n,f}$	Maximum measurement of residual CH_4 concentration in the exhaust gas of the flare f in the context of evaluation n (in ppm CH_4)

Min._$wCH4_{residual,n,f}$ and Max._$wCH4_{residual,n,f}$ are determined based on performed measurements using a gas analyzer FID / California Analytical Instruments (CAI), model HFID (in ppm CH_4). During the selected period a set of measurements of residual CH_4 concentration in the exhaust gas of the flare f was performed for each one of the four performed tests/evaluations.

As indicated in the technical testing reports issued by "Ecosampling Avaliações Ambientais Ltda.", the resulted calculated values of FE for each one of the third-part evaluations are as follows:

1st periodic determination of the value of FE:
Min._$FE_{1,1}$ = 99.9948%
Max._$FE_{1,1}$ = 99.9978%

Min._$FE_{1,2}$ = 99.9913%
Max._$FE_{1,2}$ = 99.9942%

Min._$FE_{1,3}$ = 99.9896%
Max._$FE_{1,3}$ = 99.9995%

Min._$FE_{1,4}$ = 99.9849%
Max._$FE_{1,4}$ = 99.9950%

2nd periodic determination of the value of FE:
Min._$FE_{2,1}$ = 99.9966%
Max._$FE_{2,1}$ = 99.9979%

Min._$FE_{2,2}$ = 99.9953%
Max._$FE_{2,2}$ = 99.9961%

Min._$FE_{2,3}$ = 99.9953%
Max._$FE_{2,3}$ = 99.9972%

Min._$FE_{2,4}$ = 99.9946%
Max._$FE_{2,4}$ = 99.9966%

3rd periodic determination of the value of FE:
Min._$FE_{3,1}$ = 99.9973%
Max._$FE_{3,1}$ = 99.9986%

Min._$FE_{3,2}$ = 99.9965%
Max._$FE_{3,2}$ = 99.9981%

Min._$FE_{3,3}$ = 99.9972%

Max._$FE_{3,3}$ = 99.9984%

Min._$FE_{3,4}$ = 99.9966%
Max._$FE_{3,4}$ = 99.9984%
4th periodic determination of the value of FE:
Min._$FE_{4,1}$ = 99.9981%
Max._$FE_{4,1}$ = 99.9990%

Min._$FE_{4,2}$ = 99.9965%
Max._$FE_{4,2}$ = 99.9978%

Min._$FE_{4,3}$ = 99.9977%
Max._$FE_{4,3}$ = 99.9987%

Min._$FE_{4,4}$ = 99.9973%
Max._$FE_{4,4}$ = 99.9987%

5th periodic determination of the value of FE:
Min._$FE_{5,1}$ = 99.9961%
Max._$FE_{5,1}$ = 99.9972%

Min._$FE_{5,2}$ = 99.9970%
Max._$FE_{5,2}$ = 99.9975%

Min._$FE_{5,3}$ = 99.9938%
Max._$FE_{5,3}$ = 99.9950%

Min._$FE_{5,4}$ = 99.9965%
Max._$FE_{5,4}$ = 99.9973%

As a conservative approach the calculated values of Min._$FE_{n,f}$[16] (lowest value) were considered for application of values of FE for the determination of the calculation parameter $MD_{project,y}$ as follows:

Date of performance of measurements	Entity / company responsible for performing the measurements	Considered value for FE	**Time interval of utilization of the determined value of FE within the considered monitoring period**
10-11/05/2012	Ecosampling Avaliações Ambientais Ltda.	0.999849	From 01/10/2012 to 14/10/2012

[16] The same conservative calculation approach (FE is equal to the lowest of the four calculated values for Min._$FE_{n,f}$) was previously used in the context of the CER issuance request for the previous monitoring period (from 01/04/2012 to 30/09/2012).

15-16/10/2012	Ecosampling Avaliações Ambientais Ltda.	0.999946	From 15/10/2012 to 21/11/2012
22-23/11/2012	Ecosampling Avaliações Ambientais Ltda.	0.999965	From 22/11/2012 to 06/12/2012
07-08/12/2012	Ecosampling Avaliações Ambientais Ltda.	0.999965	From 07/12/2012 to 04/03/2013
05-06/03/2013	Ecosampling Avaliações Ambientais Ltda.	0.999938	From 05/03/2013 to 30/03/2013

Result of the determination of the value for the calculation parameter $MD_{project,y}$ for the considered monitoring period:
The calculated value for accumulated quantity of CH_4 destroyed "$MD_{project,y}$" for the monitoring period from 01/10/2012 to 30/03/2013 (by accounting the application of the conservative deduction factors) is 27,258 tCH_4.

E.2. Calculation of project emissions or actual net GHG removals by sinks

>>
During the considered monitoring period, the operation of the project activity required consumption of grid electricity and LPG. Project emissions due to consumption of grid electricity and LPG are determined by following the applicable guidance of the "Tool to calculated baseline, project and/or leakage emissions from electricity consumption" and the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" respectively.

Project emissions due to the consumption of grid electricity by the project activity:

Project emissions due to the consumption of grid electricity by the project activity are calculated as per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 01) as follows:

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

$EC_{PJ,grid,y}$ Amount of grid electricity consumed by the project activity.

Monthly records of grid electricity consumption valid for the considered monitoring period:

Month	Amount of consumed grid electricity
Oct. 2012	234.558 MWh
Nov. 2012	235.398 MWh
Dec. 2012	176.915 MWh
Jan. 2013	353.729 MWh
Feb. 2013	225.066 MWh
Mar. 2013	181.236 MWh

Additional monitoring details for $EC_{PJ,grid,y}$ are outlined in Section D.2 (under the monitoring details table for parameter "Energy").

$EF_{grid,CM,y}$ Combined margin CO_2 emission factor for grid electricity. The default value of the emission factor for electricity consumption (as per the applicable "Tool to calculate baseline, project and/or leakage emissions from electricity consumption") was used this period: $EF_{grid,CM,y}$ = 1.3 tCO_2e/MWh.

$TDL_{grid,y}$ Transmission and distribution losses. As the approach to calculate project emissions due to grid electricity consumption by the project activity is applied by following applicable provisions of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (which actually refers to $TDL_{grid,y}$), this parameter was thus also considered in the context of project emissions calculation[17]. The applicable default value as per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" of 20% is selected.

Project emissions due to the consumption of grid electricity by the project activity ($PE_{EC,y}$) are thus calculated as:

$PE_{EC,y}$ = 1,406.90 (MWh) * 1.30 (tCO_2/MWh) * (1 + 0.2) = 2,194.77 tCO_2 (rounded value: 2,195 tCO_2).

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

Project emissions due to the consumption of LPG by the project activity are calculated as per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 02) as follows:

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

Where:

$FC_{LPG,y}$ Total consumption of LPG in period (ton). As per the adopted monitoring procedure, the total amount of LPG consumed by the project activity during the considered monitoring period is reported as 225 kg (0.225 ton) of LPG. Thus, $FC_{LPG,y}$ = 0.225 $ton_{LPG.}$
Additional monitoring details for $FC_{LPG,y}$ are outlined in Section D.2 (under the monitoring details table for parameter "Energy").

$COEF_{LPG,y}$ Emission factor for consumed LPG (tCO_2/ton) which is calculated as:

$COEF_{LPG,y} = EF_{CO2,LPG,y} * NCV_{LPG,y}$

Where:

$EF_{CO2,LPG,y}$ Emission factor for LPG (in energy basis). $EF_{CO2,LPG,y}$ is determined as 65.6 tCO_2/TJ (source: IPCC Guidelines for National Greenhouse Gas Inventories, 2006, Chapter 1, Volume 2, Table 1.4)

$NCV_{LPG,y}$ Net calorific value for LPG. $NCV_{LPG,y}$ is determined as 0.0492 TJ/ton (source: Brazilian Energetic Balance Report, year 2011)

Thus, $COEF_{LPG,y}$ = 65.6 tCO_2/TJ * 0.0492 TJ/ton = 3.23 tCO_2/ton

[17] This parameter is not included in the monitoring plan of the PDD.

As a summary, $PE_{FC,y}$ is calculated as follows: $PE_{FC,y}$ = 0.225 (ton LPG) * 3.23 (tCO_2/ton LPG) = 0.73 tCO_2

Project emissions due to the consumption of LPG are thus determined as 1 tCO_2 (rounded value).

E.3. Calculation of leakage

>>

Not applicable.

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Calculations of baseline emissions (BE) are presented in Section E.1.

Calculations of project emissions (PE) are presented in Section E.2.

Emission reductions are determined as the difference between baseline emissions (BE) and project emissions (PE). During the monitoring period from 01/10/2012 to 30/03/2013, emission reductions are calculated and reported as 497,711 tCO_2e (rounded value). Further details are presented in the table below:

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO_2e)
Total	499,907	2,196	-	497,711

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO_2e)	731,058[18]	497,711

[18] The 731,058 tCO_2e value is calculated as the sum of the estimated share of emission reductions for the 3-month period within year 2012 (calculated as 1,382,469 tCO_2e * 3/12) and the estimated share of emission reductions for the 3-month period within year 2013 (calculated as 385,441 tCO_2e in the registered PDD, as the 1st 7-year crediting period ends on the same day as the present monitoring period (30 March 2013)).

1,382,469 tCO_2e is the ex-ante estimated emission reductions for year 2012 (as per the registered PDD).

E.6. Remarks on difference from estimated value in registered PDD

>>

For the share of the monitoring period including the 3-month period within year 2012 (from 01/10/2012 to 31/12/2012), the achieved emission reductions for the project activity are about ~32% lower than the comparable value for the *ex-ante* estimation of emission reductions as per the PDD which is assumed as applicable for such 3-month period.

For the share of the monitoring period including the 3-month period within year 2013 (from 01/01/2013 to 30/03/2013), the achieved emission reductions for the project activity are about ~31 % lower than the comparable value for the *ex-ante* estimation of emission reductions as per the PDD which is assumed as applicable for such 3-month period.

The following aspects justify and explain the relative difference between the *ex-ante* estimation of emission reductions in the PDD and emission reductions actually achieved during the monitoring period from 01/10/2012 to 30/03/2013:

1) Aspects/conditions that represent relative increment factors of reported achieved emission reductions for the considered monitoring period when compared against the *ex-ante* estimation of emission reduction for the same period in the PDD:

- *No use of any share of collected LFG as fuel by a local industry:* As per the ex-ante estimation of emission reductions in the PDD, a total of 15,698 tCH_4 was earlier assumed as being annually sold to a local industry as gaseous fuel (to be combusted in industrial boilers) without having associated GHG emission reductions (due to destruction of methane) being claimed as CERs by the project activity (parameter $MD_{industry,y}$). In the context of the earlier determination of the ex-ante estimation of emission reduction in the PDD, as per the emission reduction calculation requirements also set in the PDD, the parameter $MD_{reg,y}$ was thus assumed as equal to $MD_{industry,y}$. During the considered monitoring period, $MD_{reg,y}$ is determined as $MD_{project,y}$ * 20% (where 20% is the ex-ante determined value for parameter AF in cases where $MD_{industry,y}$ = zero). As the determined value for "$MD_{project,y}$ * 20%" for the 6-month length monitoring period (= 5,475 tCH_4) is lower than 7,849 tCH_4 (equivalent amount for the considered monitoring period encompassing 6 months for the earlier considered annual value of 15,698 tCH_4 [19]), the difference between such figures represents a relative increase of reported emission reductions when compared to earlier related estimations in the PDD.

2) Aspects/conditions which represent a decrease factor of reported emission reductions for the considered monitoring period when compared against the *ex-ante* estimation of emission reduction for the same period in the PDD:

- *Uncertainties associated with the application of First Order Decay (FOD) multi-phased model for estimating the emission reductions in the PDD:* Like other CDM project activities encompassing LFG collection and destruction/utilization, the amount of methane to be generated by decomposition of MSW is the case of the CTR Caieiras landfill was derived by using the FOD model in the context of the determination of ex-ante estimated emission reductions in the PDD.
  By taking in account all potential uncertainties associated with the application of the FOD multi-phased model, it is reasonable to assume the application of this model overestimated the amount of LFG to be actually generated and later collected by the project activity.

[19] The 7,849 tCH_4 value is calculated as 15,698 * 6/12 months.

- *Accounting of project emissions:* While as per the ex-ante estimation of emission reductions in the PDD no project emissions due to grid electricity and LPG consumption is accounted, 2,196 tCO_2 (about 0.5% of total reported emission reductions) are accounted as project emissions valid for the considered monitoring period.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO_2e)	233,498 (during the monitoring period from 1 October 2012 to 31 December 2012)	221,749 (during the monitoring period from 1 January 2013 to 30 March 2013)

- - - - -

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for completing the CDM-MR-FORM
Organization name	Essencis Soluções Ambientais S.A.
Street/P.O. Box	Rodovia dos Bandeirantes, km 33
Building	
City	Caieiras
State/Region	São Paulo
Postcode	07803-970
Country	Brasil
Telephone	+55 11 4442 7300
Fax	+55 11 4442 7300
E-mail	ffreitas@essencis.com.br
Website	www.essencis.com.br
Contact person	Mr. Fernando Freitas
Title	Project Manager
Salutation	Mr.
Last name	Freitas
Middle name	
First name	Fernando
Department	Biogas
Mobile	+55 11 8187-2405
Direct fax	+55 11 3124-3621
Direct tel.	+55 11 3124-3620
Personal e-mail	ffreitas@essencis.com.br

Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for completing the CDM-MR-FORM
Organization name	UniCarbo Energia e Biogás Ltda.
Street/P.O. Box	Alameda Joaquim Eugênio de Lima, 598 – 53
Building	
City	São Paulo
State/Region	São Paulo, SP
Postcode	01403-000
Country	Brazil
Telephone	+ 55 11 9 8596 0950
Fax	+ 55 11 9 8596 0950
E-mail	nuno@unicarbo.com.br
Website	www.unicarbo.com.br
Contact person	
Title	Mr.
Salutation	
Last name	Barbosa
Middle name	
First name	Nuno
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

- - - - -

Document information

Version	*Date*	*Description*
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

Decision Class: Regulatory
Document Type: Form
Business Function: Issuance
Keywords: monitoring report