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	2
Completion date of the monitoring report	05/03/2015
Registration date of the project activity	09/03/2006
Monitoring period number and duration of this monitoring period	Monitoring period: #10 13/06/2014 – 31/12/2014
Project participant(s)	Essencis Soluções Ambientais S.A. Nordic Environment Finance Corporation
Host Party(ies)	Brazil
Sectoral scope and selected methodology(ies), and where applicable, applied standardized baseline(s)	Sectoral Scope: 13 - Waste handling and disposal Selected Methodology: ACM0001 - “Flaring or use of landfill gas” (version 13.0.0)
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	566,817 tCO_2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	360,815 tCO_2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable)	-
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).	360,815 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The CDM project activity "Caieiras landfill gas emission reduction" is implemented at the CTR Caieiras landfill. The project activity promotes real and measureable permanent greenhouse gas (GHG) emission reductions through collection and destruction (combustion in high temperature enclosed flares) of landfill gas (LFG) generated at this landfill. LFG is rich in methane (CH_4), a powerful GHG. The CTR Caieiras landfill was built in year 2002. This landfill has been operated by the project owner Essencis Soluções Ambientais S.A. since its commissioning date in September 2002. The LFG collection and destruction system was completely implemented at the landfill as part of the CDM project activity in February 2007.

The construction of the entire LFG capture and destruction system (using high temperature enclosed flares) 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 01/02/2007.

LFG is continuously generated at the CTR Caieiras landfill as a result of anaerobic decomposition of municipal solid waste (MSW) historically disposed at the landfill. The project activity so far encompasses the following components/infrastructure:

(i) Capturing of LFG through a set of LFG collecting wells that are interconnected through a LFG collection pipeline network

(ii) Destruction of all collected LFG (which is collected by the LFG collecting wells and transported through the LFG collection pipeline network) by combustion (in high temperature enclosed flares installed in the project's LFG destruction facility).

As indicated in the registered version of the PDD valid for the 2nd 7-year renewable crediting period of the project activity (hereafter denominated as PDD), the project design under its current configuration does not encompass any utilization of LFG. 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[1]. During the monitoring period from 13/06/2014 to 31/12/2014, no collected LFG was thus utilized as gaseous fuel for electricity generation, as gaseous fuel in boilers or for any purpose other than being destroyed through combustion in the installed high temperature enclosed flares.

[1] Regarding the currently not any longer considered potential utilization of collected LFG (as previously indicated in the PDD valid for the currently expired 1st 7-year crediting period), the PDD valid for the 2nd 7-year renewable crediting period includes relevant details in the following two explanative boxes:

- Section A.1 / Box 1 – *Further clarifications about the earlier expected (and currently not any longer expected) potential utilization of collected LFG as (a) gaseous fuel for electricity generation and/or (b) gaseous fuel in industrial boiler(s) (at industrial facility located outside the limits of the CTR Caieiras landfill) and/or (c) as gaseous fuel for a previously existing thermal desorption unit (TDU) under both the baseline and project scenarios.*

- Section A.3 / Box 2 - *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 a no longer than 3-month period within the 1st crediting period*

By the end of the considered monitoring period, the implemented project's LFG collection system encompassed about 320 vertical LFG collection wells[2]. No horizontal LFG collection trenches have so far been utilized for collecting LFG at the CTR Caieiras landfill. During the considered monitoring period, LFG was collected at the CTR Caieiras landfill with the utilization of 5 centrifugal blowers which are connected to the project's LFG collecting pipeline network.

As part of the operation of the project activity, all collected LFG is conducted within the LFG collecting pipeline network to 3 main pipelines that are interconnected in a main pipeline in the LFG destruction facility. This main pipeline is split into 4 pipelines (1 pipeline for each one of the 4 existing enclosed high temperature flares). LFG sent to the flares is combusted under high temperature and controlled conditions.

The amount and quality of collected LFG which is sent to each individual flare have been continuously measured, recorded and reported along the considered monitoring period. Monitoring activities encompass LFG flow sent to the each individual flare, CH_4 content of collected LFG sent to the flares, LFG temperature and LFG pressure. As also established in the project's monitoring procedure valid for the 2nd 7-year crediting period, the status/conditions of the high temperature enclosed flares and their compliance with operational requirements (as established by the flare equipment manufacturer) are also monitored[3].

All LFG related monitoring instruments/equipment (incl. LFG flow meters, LFG pressure sensor, LFG temperature sensor, LFG $CH_4/O_2/CO_2$ content gas analyser) 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. The installed four high temperature enclosed flares are also equipped with Ultra-violet (UV) flame detectors (of which status (flare "*on*" or flare "*off*") is also continuously monitored). The set of LFG and flaring related continuous measurements are recorded and reported with an every minute frequency. Data is stored in a computerized database located in the project's control room.

During the considered monitoring period, 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

[2] It is important to note that, as outlined in the Section B.6.1 of the PDD valid for the 2nd 7-year renewable crediting period, besides of having LFG being effectively collected and destroyed by the active (forced suction) LFG collection and destruction system that is implemented and has operated as part of the project activity (which currently comprises more than 320 LFG collection wells), there are still existing a set of conventional passive LFG venting/combustion drains spread around the landfill (about 90 units in December 2014). In these conventional and passive LFG venting/combustion drains, very small share of generated LFG has been sometimes combusted and sometimes just directly vented into the atmosphere. These remaining conventional LFG venting/combustion infrastructure are not connected to the project activity's LFG collection pipeline network. Unfortunately, venting of LFG has been a practice before and even after the implementation of the project. Although appropriately addressing safety and odor concerns are operational requirements for the CTR Caieiras landfill, the very large area/size of this landfill makes it difficult to keep every single existing conventional drains alight or even convert such drains into appropriate LFG collection wells (and get them connected to the project activity). Moreover, prior of the decision to implement the project activity, sporadic combustion under uncontrolled conditions of minor and not defined share of generated LFG by non-defined fraction of the existing LFG venting/combustion drains (that are not part of the project activity) has been assumed as per applicable design, construction and operational requirements for the CTR Caieiras landfill as a deemed sufficient practice to address safety and odor concerns. A relevant related explanative disclaimer titled "*Challenging/difficulties in converting all conventional and passive LFG venting/combustion drains into appropriated active LFG collecting well connected to the project activity*" is included under Footnote 63 in Section B.6.1 of the PDD. Footnote 79 (included in Section B.6.2) and "*Step A.2: Determination of $F_{CH4,BL,y}$* " under Section B.6.1 of the PDD also include further related explanations.

[3] As further explained in Section C.1 and D.2 of the PDD valid for the 2nd 7-year crediting period of the project activity, the project's monitoring procedures were revised (when compared to the practice and procedures applied during the 1st 7-year crediting period) in order to have the project activity meeting monitoring requirements as per the registered PDD valid for the 2nd crediting period (that applies the CDM baseline and monitoring methodology ACM0001 (version 13.0.0) + applicable methodological tools).

- 4 enclosed high temperature flares (of which specifications are presented in the PDD).
- All monitoring instruments/equipment which are required for measuring LFG related parameters, temperature of the exhaust gas of the flares, status of the flares and grid electricity consumption (of which specifications are presented in Section D.2).

The MSW disposal area at the CTR Caieiras landfill that is currently covered by the project's LFG collection well has about 567,000 square meters. About 27,000,000 ton of MSW are disposed in such area. During the considered monitoring period, about 63% of the project's existing LFG collecting wells were connected to the project's LFG collecting pipeline (in the average)[4].

Further details about installed GHG abatement equipment are included in Section B.1. Details about all installed monitoring equipment/instruments are made available in Section D.2.

Essencis Soluções Ambientais S.A. (one of the project participants for the project activity and the owner and operator of the CTR Caieiras landfill) has implemented a quality assurance and control (QA/QC) and environmental management (EMS) system for all activities undertaken at the CTR Caieiras landfill. The company's ISO 9001 and ISO 14001 certified QA/QC/EMS system was previously implemented in year 2006. The boundary/scope of this QA/QC/EMS system currently also encompasses applicable work procedures for the operation and monitoring of the project activity.

GHG emission reductions achieved by the project activity during the considered monitoring period from 13/06/2014 to 31/12/2014: 360,815 tCO_2e

A.2. Location of project activity

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The CTR Caieiras landfill 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)

[4] 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 also often temporarily disconnected from the LFG collection pipeline due to repair, operational and/or 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.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

A.4. Reference of applied methodology and standardized baseline

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The project activity applies the following large-scale CDM baseline and monitoring methodology:

- ACM0001 - ”Flaring or use of landfill gas” (version 13.0.0). (http://cdm.unfccc.int/filestorage/E/Y/F/EYFHCV3K4J5P06DTQSG9WLMOBNUX2I/EB67_repan12_ACM0001_ver13.0.0.pdf?t=aWV8bmVmZHlhfDAbkn62RDZuyjHVzDOMoxMx)

For the considered monitoring period, as also established in the PDD, the following methodological tools are also applied[5]:

- “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).

  The application of this tool refers to the ex-post application of the latest version of the “Tool to calculate the emission factor for an electricity system” (version 04.0) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.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)

- “Project emissions from flaring” (version 02.0.0, EB 68) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v2.0.pdf);

- “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” (version 02.0.0, EB 61) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v2.0.0.pdf);

A.5. Crediting period of project activity

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From 13/12/2013 to 30/03/2020 (2nd 7-year renewable crediting period).

[5] The PDD also refers to the methodological tool “Emissions from solid waste disposal sites” (version 06.0.1, EB66). However, it is crucial to note that, as outlined in the PDD, applicable guidance of this methodological tools is only applied in the context of ex-ante estimation of emission reductions to be achieved by the project activity during the 2nd 7-year crediting period. This methodological tool is not applied for the ex-post determination of emission reductions achieved by the project activity.

A.6. Contact information of responsible persons/ entities

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Completion date for the application of the CDM-MR-FORM: 13/01/2015
Responsible entity / person:

Mr. Nuno Barbosa
nuno@unicarbo.com.br
UniCarbo Energia e Biogás Ltda.
São Paulo, Brazil

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

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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The total technical Municipal Solid Waste (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 27,000,000 ton of MSW was disposed in this landfill. During the considered monitoring period, MSW has been disposed with an average rate of about 3,400,000 ton of MSW per year[6]. The CTR Caieiras landfill is currently not expected to close prior to year 2030.

At the end of the considered monitoring period, the implemented project's LFG collection system consisted of about 320 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. Collected LFG is transported to the project's LFG destruction facility (enclosed high temperature flares) through the high density polyethylene pipeline network passing through condensation pots (where most of the humidity in collected LFG is removed through condensation).

During the considered monitoring period, collected LFG has been sucked and pressurized by the installed 5 centrifugal blowers powered by electricity motors. 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 collected LFG that is sent to each one of the installed high temperature enclosed flares are measured by following applicable guidance of ACM0001 (version 13.0.0) and the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0) (with Option C being applied). Thus the determination of the absolute humidity of the gaseous stream is not required. Fraction of CH_4 in collected LFG stream as well as LFG flow for each individual flare (monitoring parameters "Volumetric flow of LFG stream in time interval *t* on a wet basis" ($V_{t,wb}$) and "Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a wet basis" ($v_{CH4,t,wb}$) respectively) are assumed as monitored on the same basis[7].

[6] It is relevant to note that from year 2007, a significant increase in daily MSW disposal at the CTR Caieiras landfill occurred. Such occurred increase and its impact over baseline emissions for the project activity are explained in Section A.3 of the PDD valid for the 2nd 7-year renewable crediting period.

[7] As per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", it is assumed that moisture is not relevant when gas temperature is relative low (within the range of 60°C). Moreover, existent 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 previous versions of ACM0001 were previously raised in the context of verifications of other similar 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

As per the construction and operational design of the CTR Caieiras landfill, a geo-membrane of PVC or similar material is expected to 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 so far achieved its final configuration, no geo-membrane has been installed to cover disposed MSW so far[8].

During the whole monitoring period from 13/06/2014 to 31/12/2014, 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 (93.2 kW).
- 2 centrifugal blower manufactured by Anton Blaselbauer Artécnica Ltda. powered by electric motors with nameplate power of 100 HP (74.5 kW).
- 2 centrifugal blower manufactured by Anton Blaselbauer Artécnica Ltda. powered by electric motors with nameplate power of 200 HP (149.1 kW).
- LFG monitoring equipment/instruments:
    - LFG mass flow meter
    - LFG temperature sensor,
    - LFG pressure sensor,
    - $CH_4/O_2/CO_2$ content gas analyzer,
    - Thermocouples (1 thermocouple for each enclosed flare (to measure temperature in the exhaust gases of the flare))
    - UV flame detectors (1 flame detector in each enclosed flare (to monitor the operational and flame status of each one of the installed flares))
- 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.

During the 2nd semester of year 2013 the project's monitoring system and procedures were upgraded in order to meet all additional monitoring requirements established by the CDM baseline and monitoring methodology ACM0001 (version 13.0.0) + applicable methodological tools (as described and predicted in the PDD). As forecasted in the PDD, Essencis Soluções Ambientais S.A. worked on the required changes in terms of monitoring equipment/instruments and related monitoring procedures (e.g. procurement for new equipment/instruments (e.g. additional LFG flow meters, flame detectors in the flares, etc.), review of monitoring and working procedures, etc.) in order to have the project activity meeting applicable monitoring requirements of ACM0001 (version 13.0.0) + applicable methodological tools.

The following pictures provide overview of the project activity.

- 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.*"

[8] 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.

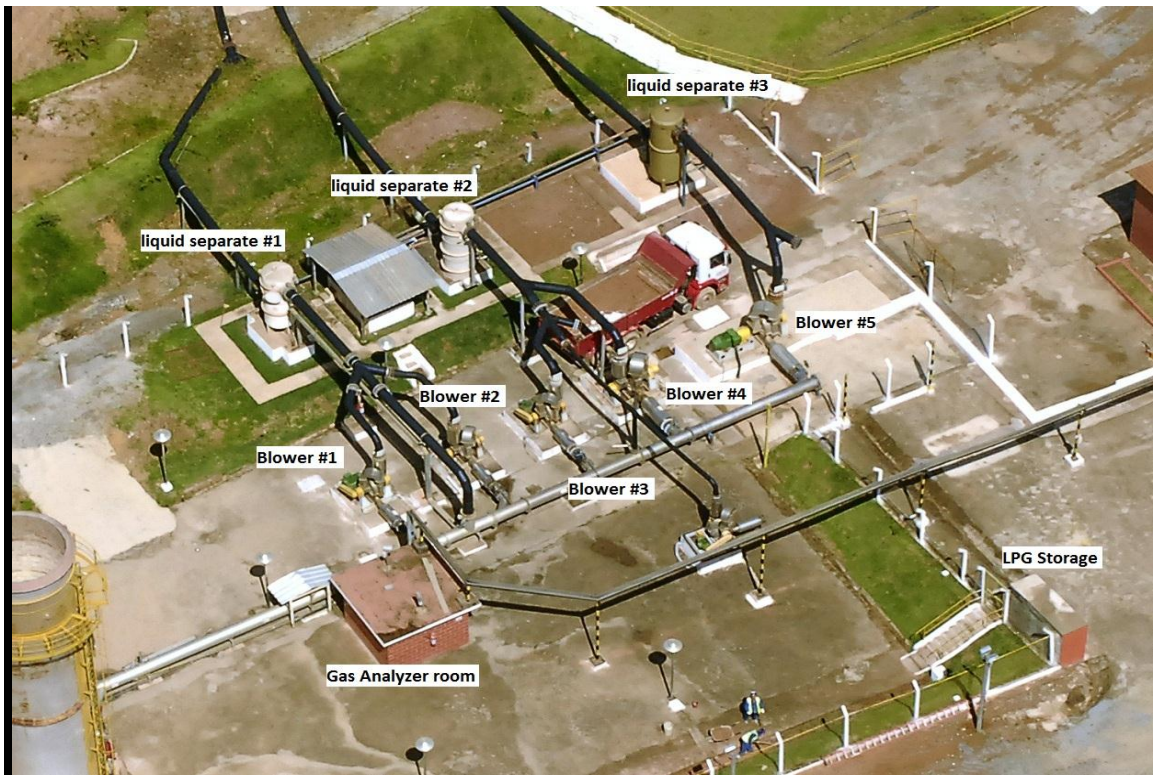

Figure 1 – Partial view of the LFG destruction station (LFG pipeline, blowers and condensation traps)

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

In general, the project activity was implemented and has operated under full conformance with the previously conceived project design.

During the considered monitoring period, the project activity faced events it became temporarily out of operation due to different reasons (incl. temporarily interruption in the supply of grid-sourced electricity, planned and unplanned equipment maintenance/repair, performance of regular calibration events, drainage of condensate from the project's LFG pipeline, unexpected problems in the PLC panel, data communication problems, etc.).

The CTR Caieiras landfill is regarded as a very well-designed and well-managed landfill. It applies the best practice in Brazil in terms of landfill design and operation. As established by the valid environmental and operational permits, disposed MSW is constantly covered and levelled with the use of heavy equipment (excavators, compacting equipment, etc.). Furthermore, safety requirements are defined and addressed as part of the operation of the landfill by using a preventative approach. No practice to increase the amount of methane generated at the CTR Caieiras landfill has ever been applied. While the project activity represents real improvement in terms of LFG management at the landfill when compared to the situation prior to the implementation of the project activity (baseline scenario), no change in terms of MSW disposal practice at the CTR Caieiras landfill was ever promoted or influenced by the project activity. Further details are included in Section D.2 (under details for the monitoring parameter "Management of SWDS").

Since the project's operation start in February 2007, no backup captive off-grid electricity generator has ever been used to meet the project's electricity demand during eventual interruptions of the supply of grid-sourced electricity to the project activity. While the local electricity grid is reliable (without regular interruptions in the supply of grid-sourced electricity), in the occasions there is interruption in supply of grid-sourced electricity, the operation of the project activity is temporarily interrupted. Currently it is not planned the installation of any backup captive off-grid electricity generator during the 2nd 7-year crediting period.

B.2. Post registration changes

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

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Not applicable.

B.2.2. Corrections

>>
Not applicable.

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

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Not applicable.

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

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Not applicable.

B.2.5. Changes to start date of crediting period

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Not applicable.

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

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Not applicable.

SECTION C. Description of monitoring system

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As part of the application of the designed monitoring plan valid for the 2nd 7-year crediting period, as reported in the PDD, LFG and flaring related monitoring data is automatically measured, processed and recorded with the use of related monitoring instruments/equipment, a Programmable Logic Controller (PLC) unit, a SQL based database (with customized design and configuration) that are all integrated to a data supervisory system (SCADA) of which design and configuration customized to the project activity. The data supervisor system is sourced by Elipse Software Ltda. (model: e3). In the second half of 2013, both the project's data supervisor system and the SQL based database were upgraded in order to have the project's monitoring system under full compliance with ACM0001 (version 13.0.0) + applicable methodological tools[9].

[9] During the whole 1st 7-year crediting period for the project activity, both the project's data supervisor system and the SQL based database were configured in order to have the project's monitoring system under compliance with the applied previous version of ACM0001 (version 2).

During the considered monitoring period, continuous measurements of LFG flow to each individual flare, LFG pressure, LFG temperature, LFG CH_4 content, LFG O_2 content, LFG CO_2 content[10], temperature of the exhaust gas (for each installed flare) and status of the flame detector (for each installed flare) were processed by the project's PLC unit and recorded within an every-minute frequency by the project's SQL format database.

As part of the implemented data reporting and emission reduction calculation procedures applicable for the 2nd 7-year crediting period of the project activity, two sets of data files (with set of LFG and flaring related monitoring records) are generated for each month of considered monitoring period as follows:

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

Both data files contain LFG and flaring related monitoring records for every 1-month period encompassed by the considered monitoring period. While data in MS-Excel format is handled as a primary data input for the performance of emission reduction calculations (data is used as input data for the compilation of monthly emission reduction calculation spreadsheets that are enclosed to this Monitoring Report), the PDF format files (which also lists/reports all LFG and flaring related monitoring records in table format within an every-minute frequency for each month of the considered monitoring period) are kept in storage and are considered as proof of authenticity of data retrieved from the SQL database and exported to MS-Excel format data.

The project's data supervisory system (which is linked to the SQL database) includes in its user interface functionalities for regularly generating both MS-Excel format data as well as PDF format data files upon request of the system user (functions "*Ëxporta Excel*" and "*Exporta PDF*" respectively).

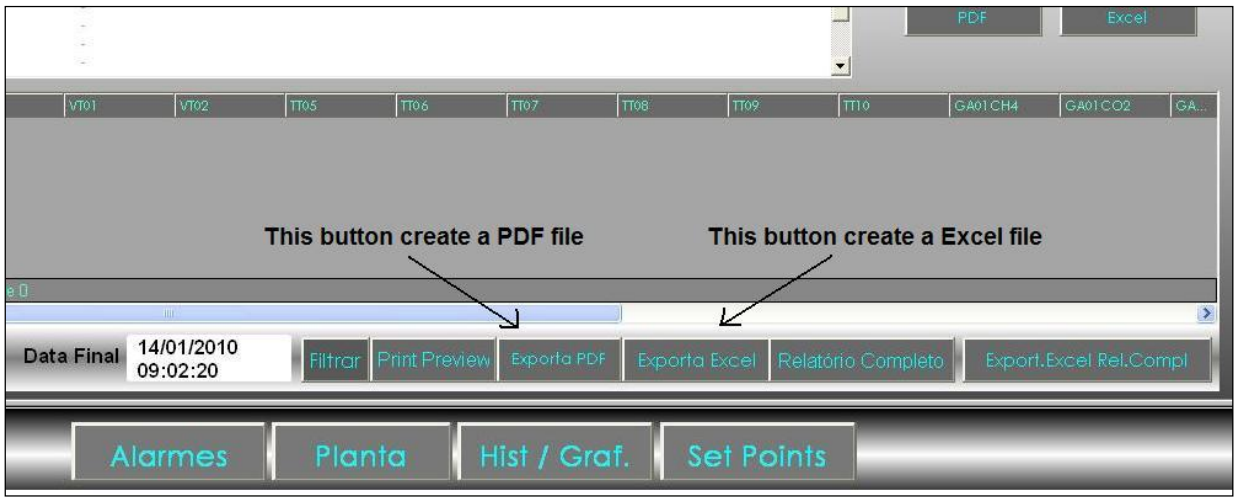


Figure 4 – Zoom view of the buttons (controls) in the user interface of the project's supervisory system that are used to generate MS-Excel format and PDF format files with every minute monitoring data

As per the project's operational procedure valid for the 2nd 7-year crediting period, the following routine (steps) is monthly performed by the project operational staff in order to appropriately report LFG and flaring (temperature of exhaust gas of the flares and flare status) related monitoring records:

1) Every month, a MS-Excel format spreadsheet data file with LFG and flaring related monitoring records (raw data files) is generated by using the functionality "*Exporta Excel*" of the project's supervisory system. Each generated file includes monitoring data reported for a

[10] Continuous monitoring of LFG O_2 and CO_2 contents is not required as per ACM0001 (version 13.0.0) + applicable methodological tool. Moreover, the monitoring plan of the registered PDD does not refer to monitoring of LFG O_2 and CO_2 contents either. However, LFG O_2 and CO_2 contents are measured due to safety and operational requirements.

full month. A PDF format data file with the same LFG and flaring related monitoring records is also generated for the month in question by using the functionality "*Exporta PDF*" of the project's supervisory system.

2) The content of every monthly raw data file (in MS-Excel format) is used as input data in customized and pre-formatted monthly MS-Excel format emission reduction calculation spreadsheet template/model (designed by the project participant Essencis Soluções Ambientais S.A.). This MS-Excel based template is internally denominated as "*MMYYYY*", where "*MM*" is the number of the month and "*YYYY*" is the year of the input data.

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). Both the CDM Project Superintendent and the CDM Project supervisor are fully supported by CDM specialists (consultants) from the CDM consultancy company UniCarbo Energia e Biogás Ltda. 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 specialists (consultants) also support the project team in operational and monitoring related issues.

The diagram bellow shows the hierarchy for the project management.

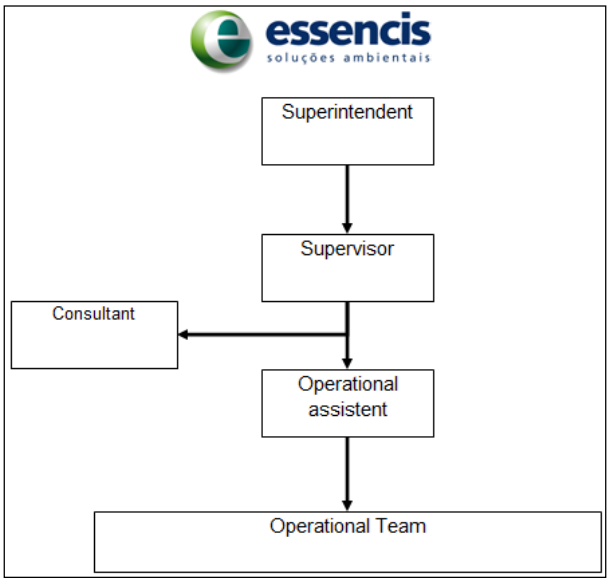


Figure 5 - Hierarchy for the project management of the project activity

The project's operational and management structure relies on trained staff with responsibilities clearly defined. All collaborators and employees involved with operation of project and/or monitoring are trained internally and/or externally. Training efforts includes *inter alia*:

a) General competence development about LFG generation and collection;
b) Review of equipment operational principles and captors;
c) Maintenance and calibration requirements for project's related equipment;
d) Procedures for monitoring data gathering and handling[11];

[11] While the PDD valid for the 2nd 7-year crediting period (that applies ACM0001 (version 13.0.0) + applicable methodological tools) includes somehow differentiated monitoring requirements (when compared to the PDD valid

e) Emergency and safety procedures.

SECTION D. Data and parameters

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

Data / Parameter:	**OX_{top_layer}**
Unit:	Dimensionless
Description:	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline.
Source of data:	The PDD refers to the default value as per the CDM baseline and monitoring methodology ACM0001 (version 13.0.0). The value is consistent with how oxidation is accounted for in the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1).
Value(s) applied):	0.1
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	**GWP_{CH4}**
Unit:	tCO_2/tCH_4
Description:	Global Warming Potential of CH_4
Source of data:	The PDD refers to the "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 value is 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):	25

for the 1st 7-year crediting period (that applies ACM0001 (version 2), of which monitoring requirements were followed by the project's operational staff during the 1st crediting period from year 2007 to 2013); additional training were thus provided to the project's operational and monitoring staff in order to have such differentiated monitoring requirements being met. The project activity monitoring infrastructure was also upgraded in order to fulfil such additional monitoring requirements.

Purpose of data:	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	**R_u**
Unit:	$Pa.m^3/kmol.K$
Description:	Universal ideal gases constant
Source of data:	The PDD refers to the default value as per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0).
Value(s) applied):	8,314
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	**MM_k**
Unit:	kg/kmol
Description:	Molecular mass of gas *k*
Source of data:	The PDD refers to the default value as per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0).
Value(s) applied):	As outlined in the PDD, for considered gases *k* that are greenhouse gases (GHGs), the values in the table below are applied for MM_i. As per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream": "*The determination of the molecular mass of the gaseous stream ($MM_{t,db}$) requires measuring the volumetric fraction of all gases (k) in the considered gaseous stream. However as a simplification, only the volumetric fraction of gases k that are greenhouse gases and are considered in the emission reduction calculation in the underlying methodology must be monitored and the difference to 100% may be considered as pure nitrogen. The simplification is not acceptable if it is differently specified in the underlying methodology.*" ACM0001 (version 13.0.0) does not include any restriction to such simplification. Thus, only the volumetric fraction of gases that are greenhouse gases and are considered in related calculations (CH_4 in the particular case of the project activity) should be considered and the difference to 100% is just considered as pure nitrogen.
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

Compound	Structure	Molecular mass (kg/mol)
Nitrogen	N_2	28.01

Data / Parameter:	**MM_i**
Unit:	kg/kmol
Description:	Molecular mass of greenhouse gas *i*
Source of data:	The PDD refers to the default value as per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0).
Value(s) applied):	As outlined in the PDD, the following value of molecular mass is applicable for CH_4 (the only GHG which is considered): Compound: Methane; Structure: CH_4; Molecular mass (kg/mol): 16.04
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	**P_n**
Unit:	Pa
Description:	Total pressure at normal conditions
Source of data:	The PDD refers to the default value as per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0).
Value(s) applied):	101,325
Purpose of data:	Calculation of baseline emissions
Additional comment:	In accordance with the PDD, since measurements of LFG flow are automatically converted and recorded in normalized cubic meters (by considering standard temperature and pressure (STP) conditions), the ex-ante determined parameters Temperature at normal conditions (T_n) and Total pressure at normal conditions (P_n) are not considered.

Data / Parameter:	MM_{H2O}
Unit:	kg/kmol
Description:	Molecular mass of water
Source of data:	The PDD refers to the default value as per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0).
Value(s) applied):	18.0152
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	T_n
Unit:	K
Description:	Temperature at normal conditions
Source of data:	The PDD refers to the default value as per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0).
Value(s) applied):	273.15
Purpose of data:	Calculation of baseline emissions
Additional comment:	In accordance with the PDD, since measurements of LFG flow are automatically converted and recorded in normalized cubic meters (by considering standard temperature and pressure (STP) conditions), the ex-ante determined parameters Temperature at normal conditions (T_n) and Total pressure at normal conditions (P_n) are not considered.

Data / Parameter:	$TDL_{grid,y}$
Unit:	Dimensionless
Description:	Average technical transmission and distribution losses for grid sourced electricity consumed by the project activity.
Source of data:	The PDD refers to the applicable default as per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 01).
Value(s) applied):	20%

Purpose of data:	Calculation of project emissions (due to consumption of grid-sourced electricity by the project activity).
Additional comment:	-

Data / Parameter:	**w_{BM}**
Unit:	%
Description:	Weighting of build margin emissions factor
Source of data:	The PDD refers to the applicable default value as per the "Tool to calculate the emission factor for an electricity system" (version 03.0.0). The selected value is valid for the whole 2nd 7-year renewable crediting period.
Value(s) applied):	0.75 (75%)
Purpose of data:	Calculation of project emissions (due to consumption of grid-sourced electricity by the project activity).
Additional comment:	-

Data / Parameter:	**w_{OM}**
Unit:	%
Description:	Weighting of operating margin emissions factor
Source of data:	The PDD refers to the applicable default value as per the "Tool to calculate the emission factor for an electricity system" (version 03.0.0). The selected value is valid for the whole 2nd 7-year renewable crediting period.
Value(s) applied):	0.25 (25%)
Purpose of data:	Calculation of project emissions (due to consumption of grid-sourced electricity by the project activity).
Additional comment:	-

Data / Parameter:	**$SPEC_{flare}$**
Unit:	°C (for temperature values) Nm^3/h (for LFG flow values) Number of days (for maintenance schedule interval values)

Description:	Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval.
Source of data:	The PDD refers to data as per the flare manufacturer. Data is used as a reference for later ex-post determination of values of flare efficiency ($\eta_{flare,m}$) for each individual high temperature enclosed flare in the context of determination of baseline emissions.
Value(s) applied):	Flare 1, Flare 2, Flare 3 and Flare 4:

$SPEC_{flare, Flare\ 1}$ $SPEC_{flare, Flare\ 2}$ $SPEC_{flare, Flare\ 3}$ $SPEC_{flare, Flare\ 4}$	Min.	Max.
Operational LFG flow for each flare (for continuous operation):	650 Nm^3/h	6,500 Nm^3/h
Required temperature of the exhaust gas of the flare (to ensure LFG destruction (combustion) under high CH_4 destruction efficiency):	500 ^oC	1,200 ^oC
Required minimum frequency for inspection and maintenance service in each flare (incl. inspection in the conditions of the flare isolation ceramics revetment material):	Min. every 6 months	
Required/recommended minimum frequency for replacement of the flare isolation ceramics revetment material in each flare:	after 10 years of regular and appropriate operation	

Purpose of data:	Calculation of baseline emissions
Additional comment:	All flare specification and operation details/requirements are based on information provided by the equipment manufacturer.

Data / Parameter:	**$EF_{grid,BM,y}$**
Unit:	tCO_2/MWh
Description:	Build margin CO2 emission factor in year *y*
Source of data:	As outlined in the PDD, data is ex-ante determined as per applicable guidance of the "Tool to calculate the emission factor for an electricity system" and value is valid for the whole 2nd 7-year crediting period. The selected value is the value calculated by the DNA of Brazil and valid for year 2012 ($EF_{grid,BM,2012}$).
Value(s) applied):	0.2010

Purpose of data:	Calculation of project emissions (due to consumption of grid-sourced electricity by the project activity).
Additional comment:	-

Ex-ante determined parameters not used in the context of ex-post determination and calculation of emission reductions achieved by the project activity:

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

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

As also outlined in the PDD, data for the above-listed parameters are used only in the context of ex-ante estimation of annual accumulated values for the "Amount of methane in the LFG which is destroyed or utilized by the project activity" ($F_{CH4,PJ,y}$) (in the context of ex-ante estimation of emission reductions to be achieved by the project activity during the 2nd 7-year renewable crediting period). Due to that, details for the above-listed parameters are not included in this Section as they are not relevant in the context of determination of emission reductions achieved by the project activity during the considered monitoring period. Relevant details for such not reported parameters are included in Section B.6.2 of the PDD.

D.2. Data and parameters monitored

Data / Parameter:	Management of SWDS
Unit:	Dimensionless
Description:	Management of the SWDS
Measured/ Calculated / Default:	As per the adopted monitoring procedure for the project activity, the management of the CTR Caieiras landfill is yearly compared against the previously conceived original construction and operational design of the landfill in order to confirm that the overall management and operation for CTR Caieiras landfill (including relevant aspects related to landfilling practice) were not modified with the unique aim to increase generation of methane on site. By performing the checking annually, it is monitored whether no practice aiming to increase methane generation in the landfill has occurred. As required by ACM0001 (version 13.0.0), any change in the management of the landfill after the implementation of the project activity should be justified by referring to technical or regulatory specifications.
Source of data:	A technical evaluation was performed by the independent 3rd party engineering company "Cepollina Engenheiros Consultores Ltda.". The findings for the performed evaluations are reported in a declaration document issued by such company that is dated 02/12/2014. As part of the performed technical evaluation, the current configuration and operational conditions of the CTR Caieiras landfill were compared against the previously conceived design and operational conditions of the landfill prior to the implementation of the project activity on the basis of different sources, including inter alia: - Original design documents of the landfill (as described in the documentation required for all phases of the environmental licensing for the CTR Caieiras landfill); - Applicable local or national regulations - Expertise and experience of "Cepollina Engenheiros Consultores Ltda." with the CTR Caieiras landfill. Since January 2007 "Cepollina Engenheiros Consultores Ltda." has performed regular technical inspections at the CTR Caieiras landfill as part of the continuously performed assessment of geotechnical stability monitoring for the landfill cells. Such regular assessments are required by the competent environmental authority from São Paulo State (Companhia de Tecnologia de Saneamento Ambiental - CETESB) for the validity of the environmental and safety permit/licensing for the CTR Caieiras landfill.
Value(s) of monitored parameter:	As outlined in the issued internal technical evaluation/declaration document dated 02/12/2014, the previously conceived original design of the landfill (dated prior to the implementation of the project activity) is confirmed not to being modified during the period from 01/02/2007 (date when the project activity started to operate) to 31/12/2014. No practice to increase methane generation at the CTR Caieiras landfill have occurred (when compared to management and MSW landfilling practices prior to implementation of the project activity). Aspects, conditions and circumstances related to management of the landfill (e.g. waste disposal, waste covering, waste compacting, management of leachate, draining of rainwater, etc.) were not changed with an aim to increase methane generation on site. MSW management business (collection and disposal of MSW) in Brazil (and in most of the developing countries) has its own economics, dynamics, politics and related regulations. That makes MSW disposal activity for the CTR Caieiras landfill and other similar landfills in Brazil completely independent from the CDM mechanism

	and/or revenues of commercialization of CERs generated by project based destruction of methane in landfills. In the particular case of the CTR Caieiras landfill, it is important to note that this landfill was designed and it has operated inter alia as per terms and conditions of the public service concession contracts established with the Administration of the Municipality of São Paulo. The design and operation of the landfill is also under conformance with terms and conditions for the environmental licensing that were previously defined and are regularly monitored by the competent environmental authority from São Paulo State (CETESB). While the occurrence of changes in the quantitative condition related to MSW disposal in this landfill (such as the occurred increment in the amount of disposed MSW in the landfill as explained in the PDD) are completely independent from the CDM project activity, the project activity per se does not represent any incentive for promoting a change in the management of the landfill in order to increase the amount of methane generated in the site. The registered CDM project activity does not encompass any MSW management related measures. Currently, there is still no climate change of waste management policy in Brazil which would provide an incentive or a mandate to have MSW being disposed in landfills with better/improved LFG collection / destruction systems (such as the project's LFG collection and destruction system currently implemented at the CTR Caieiras landfill). In this context, it is crucial to note that, regarding the amount of methane that is generated at the CTR Caieiras landfill and collected by the project activity, as outlined in the PDD (under Footnote 63 (Section B.6.1) and Footnote 79 (Section B.6.2)), significant amount of methane generated by the project activity has unfortunately not been collected and destroyed due to the lack of LFG collection infrastructure covering all regions of the very large CTR Caieiras landfill.
Monitoring equipment:	Not applicable. No measuring equipment is used for monitoring management of the CTR Caieiras landfill.
Measuring/ Reading/ Recording frequency:	Annual checking is performed.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation of baseline emissions
Additional comment:	As required by ACM0001 (version 13.0,0), any change in the management of the landfill after the implementation of the project activity will be justified by referring to technical or regulatory specifications and impacts of such changes in the determination of baseline emissions should in this case be taken into account appropriately. Such monitoring requirement will be used for the determination/confirmation of baseline emissions and/or confirmation of the project's implementation as described in the PDD (in terms of operation and management conditions of the landfill from which LFG is combusted).

Data / Parameter:	**$V_{t,wb}$**
Unit:	m^3 wet gas/h
Description:	Volumetric flow of LFG stream in time interval *t* on a wet basis
Measured/ Calculated / Default:	Continuously measured by LFG flow meters (one flow meter for each installed high temperature enclosed flare)
Source of data:	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (flow meters) (with recordable electronic signal).
Value(s) of monitored parameter:	The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) include measurement data valid for each installed high temperature enclosed flare. Measurement data is recorded and reported with an every-minute frequency. While measurements are performed by installed 4 LFG flow meters (one flow meter for each individual installed flare), the monitoring parameter $V_{t,wb}$ is thus measured, recorded and reported on the basis of the following sub-parameters: - $V_{t,wb,flare-1}$: Volumetric flow of LFG to Flare 1 - $V_{t,wb,flare-2}$: Volumetric flow of LFG to Flare 2 - $V_{t,wb,flare-3}$: Volumetric flow of LFG to Flare 3 - $V_{t,wb,flare-4}$: Volumetric flow of LFG to Flare 4

Monitoring equipment:	Measurements are performed by 4 LFG flow meters that are installed in independent sections of the LFG pipeline located between the centrifugal blowers and each one of the installed 4 high temperature enclosed flares. *Specifications and calibration details for the installed LFG flow meters:* *Flow meter used for measuring $V_{t,wb,flare-1}$ (Flare 1):* - Manufacturer: Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda - Model: FT-2 - Accuracy: +/-1% - Serial Number: 1412000235 - Instrument internal identification number: FT-01 - Calibration frequency (as specified by the monitoring methodology/tool and/or in the PDD): The registered PDD establishes that "*Periodic calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations".* - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed every 2 years - Dates for performed calibration events valid for the considered monitoring period:04/06/2014 - Entity/company responsible for performing the calibration events: all calibration events were performed by Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. *Flow meter used for measuring $V_{t,wb,flare-2}$ (Flare 2):* - Manufacturer:Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda - Model: FT-2 - Accuracy: +/-1% - Serial Number: 1412000236 - Instrument internal identification number: FT-02 - Calibration frequency (as specified by the monitoring methodology/tool and/or in the PDD): The registered PDD establishes that "*Periodic calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations".* - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed every 2 years - Dates for performed calibration events valid for the considered monitoring period:04/06/2014 - Entity/company responsible for performing the calibration events: all calibration events were performed by Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. *Flow meter used for measuring $V_{t,wb,flare-3}$ (Flare 3):* - Manufacturer:Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda - Model: FT-2 - Accuracy: +/-1% - Serial Number: 1412000237 - Instrument internal identification number: FT-03 - Calibration frequency (as specified by the monitoring methodology/tool and/or in the PDD): The registered PDD establishes that "*Periodic calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations".* - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed every 2 years - Dates for performed calibration events valid for the considered monitoring period:04/06/2014

	- Entity/company responsible for performing the calibration events: all calibration events were performed by Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda. *Flow meter used for measuring $V_{t,wb,flare-4}$ (Flare 4):* - Manufacturer:Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda - Model: FT-2 - Accuracy: +/-1% - Serial Number: 1412000238 - Instrument internal identification number: FT-04 - Calibration frequency (as specified by the monitoring methodology/tool and/or in the PDD): The registered PDD establishes that "*Periodic calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations".* - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed every 2 years - Dates for performed calibration events valid for the considered monitoring period:04/06/2014 - Entity/company responsible for performing the calibration events: all calibration events were performed by Contech Indústria e Comércio de Equipamentos Eletrônicos Ltda.
Measuring/ Reading/ Recording frequency:	Continuous measurements are recorded and reported with an every-minute frequency.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Monitoring equipment/instruments are calibrated and maintained as per instrument specifications and/or recommendations of manufacturer. Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation of baseline emissions
Additional comment:	The design of the LFG flow meters ensures that measurement data is automatically converted and recorded in normal cubic meters per hour (Nm^3/h). Due to that, measurements of LFG pressure and LFG temperature are not required for GHG calculations. Reported values of $V_{t,wb}$ are used for the determination of the amount of methane in the LFG flared by the project activity ($F_{CH4,flared,y}$) as per Option C of the applicable methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (measurements of volume flow in a wet basis).

Data / Parameter:	$v_{CH4,t,wb}$
Unit:	m^3 CH_4/m^3 wet gas
Description:	Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a wet basis
Measured/ Calculated / Default:	Continuously measured by continuous CH_4 content gas analyzer.
Source of data:	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (CH_4 content gas analyser) (with recordable electronic signal).
Value(s) of monitored parameter:	The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) include measurement data for $v_{CH4,t,wb}$ that are recorded and reported with an every-minute frequency.

Monitoring equipment:	Measurements are performed by installed continuous CH_4 content gas analyser for which the LFG sample collecting point is located in the main LFG pipeline in a section between the centrifugal blowers and the high temperature enclosed flares. *Specifications and calibration details for the installed continuous CH_4 content gas analyzer:* - Manufacturer: BGM Instrumentação Controle e Automação Ltda. - Model: CENTRUM AG 4000 - Accuracy: ±2.0% - Serial Number: NS 53159 - Instrument internal identification number: GA01 - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed with a maximum interval of 3 months. - Dates for performed calibration events valid for the considered monitoring period: - 11/06/2014 - 18/06/2014 - 25/06/2014 - 02/07/2014 - 10/07/2014 - 17/07/2014 - 23/07/2014 - 31/07/2014 - 07/08/2014 - 14/08/2014 - 21/08/2014 - 28/08/2014 - 04/09/2014 - 11/09/2014 - 18/09/2014 - 25/09/2014 - 02/10/2014 - 10/10/2014 - 17/10/2014 - 10/11/2014 - 19/11/2014 - 26/11/2014 - 04/12/2014 - 12/12/2014 - 19/12/2014 - 26/12/2014 - 05/01/2015 - Entity/company responsible for performing the calibration events: all calibration events were performed by trained responsible staff of the project participant Essencis Soluções Ambientais S.A. by following the applicable internal working procedure titled "*CA.BG.01.05 – Rev 09 Calibração analisador de gases"* (*CA.BG.01.05 – Rev 09* – Calibration of gas analyser). Calibration events valid for the considered monitoring period were performed by using certified span gas cylinders with a known CH_4 composition. Certified span gases utilized for performing the calibration events valid for the considered monitoring period: - 2 Gas cylinders with N_2 with a minimum purity of 99,999%: cylinder S/N 395939 and 395749, certificate number IBG04220814 and IBG00760114 supplied by IBG – Indústria Brasileira de Gases Ltda. - Gas cylinders with a calibration mixture of 5,01 cmol/mol of O_2: cylinder n° S/N 3933516, certificate number IBG00590114 supplied by IBG – Indústria Brasileira de Gases Ltda.

	- Gas cylinders with a calibration mixture of 59,95 cmol/mol of CO_2: cylinder n° S/N 4849733, certificate number IBG04170814 supplied by IBG – Indústria Brasileira de Gases Ltda. - Gas cylinders with a calibration mixture of 59,96 cmol/mol of CH_4: cylinder n° S/N 1118, certificate number IBG00580114 supplied by IBG – Indústria Brasileira de Gases Ltda. - Gas cylinders with a calibration mixture of 60,00 cmol/mol of CO_2: cylinder n° S/N 877597, certificate number IBG00570114 supplied by IBG – Indústria Brasileira de Gases Ltda.
Measuring/ Reading/ Recording frequency:	Continuously measurements are recorded/reported every minute.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Monitoring equipment/instruments are calibrated and maintained as per instrument specifications and/or recommendations of manufacturer. Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	**T_t**
Unit:	K
Description:	Temperature of the LFG stream in time interval *t*
Measured/ Calculated / Default:	Continuously measured by LFG temperature sensor. Measurements are primarily recorded and reported in ^oC. Recorded/reported data is converted into Kelvin and data is also reported in this unit, thus meeting the related monitoring requirement as per the PDD.
Source of data:	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (temperature sensor) (with recordable electronic signal).
Value(s) of monitored parameter:	The monthly emission reduction calculation spreadsheet (that is enclosed to this Monitoring Report) includes measurement data for T_t that are recorded and reported with an every-minute frequency.

Monitoring equipment:	Measurements are performed by installed LFG temperature sensor that is installed in the main LFG pipeline in a section between the centrifugal blowers and the high temperature enclosed flares. *Specifications and calibration details for the LFG temperature sensor:* - Manufacturer: Pressgage instrumentos de Medição e Controle Ltda. - Model: STP-100 - Accuracy: ±1.0% - Serial Number (S/N): 45519 - 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: 11/03/2014 (Calibration Certificate T-202/14) - Entity/company responsible for the performance of calibration events: Naka Comércio e Indústria de Instrumentação Industrial Ltda.
Measuring/ Reading/ Recording frequency:	Continuously measurements are recorded/reported every minute.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Monitoring equipment/instruments are calibrated and maintained as per instrument specifications and/or recommendations of manufacturer. Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation of baseline emissions
Additional comment:	In accordance with the PDD, since measurements of LFG flow are automatically converted and recorded in normalized cubic meters (by considering standard temperature and pressure (STP) conditions), monitoring of "Pressure of the gaseous stream in time interval t" (P_t) and Temperature of the gaseous stream in time interval *t* (T_t) are not required.

Data / Parameter:	**P_t**
Unit:	Pa
Description:	Pressure of the LFG stream in time interval *t*
Measured/ Calculated / Default:	Continuously measured by LFG pressure sensor. Measurements are primarily recorded and reported in mbar. Recorded/reported data is converted into Pascal and data is also reported in this unit, thus meeting the related monitoring requirement as per the PDD.
Source of data:	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (pressure sensor) (with recordable electronic signal).

Value(s) of monitored parameter:	The monthly emission reduction calculation spreadsheet (that is enclosed to this Monitoring Report) includes measurement data for P_t that are recorded and reported with an every-minute frequency.
Monitoring equipment:	Measurements are performed by installed LFG pressure sensor that is installed in the main LFG pipeline in a section between the centrifugal blowers and the high temperature enclosed flares. *Specifications and calibration details for the LFG pressure sensor:* - Manufacturer: Pressgage instrumentos de Medição e Controle Ltda. - Model: TPI-PRESS - Accuracy: ±1.5% - Serial Number: 43608 - Instrument internal identification number: PT002 - 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: 10/03/2014 (Calibration Certificate: R-0154/14) - Entity/company responsible for the performance of calibration events: Naka Comércio e Indústria de Instrumentação Industrial Ltda. (both calibration events)
Measuring/ Reading/ Recording frequency:	Continuously measurements are recorded/reported every minute.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Monitoring equipment/instruments are calibrated and maintained as per instrument specifications and/or recommendations of manufacturer. Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation of baseline emissions
Additional comment:	In accordance with the PDD, since measurements of LFG flow are automatically converted and recorded in normalized cubic meters (by considering standard temperature and pressure (STP) conditions), monitoring of "Pressure of the gaseous stream in time interval t" (P_t) and Temperature of the gaseous stream in time interval *t* (T_t) are not required.

Data / Parameter:	**$EC_{PJ,y}$**
Unit:	MWh
Description:	Amount of grid electricity consumed by the project activity during the year *y*
Measured/ Calculated / Default:	Continuously measured by electricity meter.

<table>
<tr><td>Source of data:</td><td>Monitored values are based on measurements performed by Elektro Eletricidade e Serviços S.A. (local electricity distribution company serving the region where the project activity is located) by applying appropriated monitoring instruments (electricity meters).</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td>Monthly records of grid-sourced electricity consumption valid for the considered monitoring period:

<table>
<tr><th>Month</th><th>Amount of consumed grid electricity (MWh)</th></tr>
<tr><td>Jun. 2014
(13 Jun 2014 to 30 Jun 2014)</td><td>65.0</td></tr>
<tr><td>Jul. 2014</td><td>98.6</td></tr>
<tr><td>Aug. 2014</td><td>92.7</td></tr>
<tr><td>Sep. 2014</td><td>76.6</td></tr>
<tr><td>Oct. 2014</td><td>60.5</td></tr>
<tr><td>Nov. 2014</td><td>79.3</td></tr>
<tr><td>Dec. 2014</td><td>78.0</td></tr>
</table>
</td></tr>
</table>

Monitoring equipment:	Measurements are performed by installed electricity meters. *Specifications and calibration details for the installed electricity meters:* Electricity meter 01 (Blowers 1, 2, 3, 5 and landfill instalations): - 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): 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: 19/03/2012 (Calibration Certificate: R-0701/12, issued by Naka Comércio e Indústria de Instrumentação Industrial Ltda., respectively) Electricity meter 02: 19/03/2012 (Calibration Certificate:R-0702/12, issued by Naka Comércio e Indústria de Instrumentação Industrial Ltda., respectively)
Measuring/ Reading/ Recording frequency:	Accumulated values for continuous measurements of grid-sourced electricity consumption are recorded once a month.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Monitoring equipment/instruments are calibrated and maintained as per instrument specifications and/or recommendations of manufacturer. Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).

Purpose of data:	Calculation of project emissions (due to consumption of grid-sourced electricity by the project activity).
Additional comment:	The amount of grid electricity consumed by the project activity consists in the sum of the values measured by both electricity meters.

Data / Parameter:	**$EF_{grid,OM,y} = EF_{grid,OM-DD,y}$**
Unit:	tCO_2/MWh
Description:	Operation margin CO_2 emission factor in year *y* = Dispatch data analysis operating margin CO_2 emission factor in year *y*
Measured/ Calculated / Default:	Calculated (based on official monthly values as calculated and published by the DNA of Brazil).
Source of data:	Value for year 2014 is selected. Selected value is the average of monthly official values as calculated and currently made available (published) by the DNA of Brazil. Monthly official values are made available online: http://www.mct.gov.br/index.php/content/view/354731.html#ancora
Value(s) of monitored parameter:	0.5822 tCO_2/MWh
Monitoring equipment:	Not applicable
Measuring/ Reading/ Recording frequency:	Values are calculated annually.
Calculation method (if applicable):	Value applicable for year 2014 is calculated by the DNA of Brazil as per applicable guidance of the calculation method "dispatch data analysis operating margin CO_2 emission factor" of the "Tool to calculate the emission factor for an electricity system".
QA/QC procedures:	Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation of project emissions (due to consumption of grid-sourced electricity by the project activity)
Additional comment:	-

Data / Parameter:	**$F_{CH4,EG,t}$**
Unit:	kg
Description:	Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period *t*

<table>
<tr><td>Measured/ Calculated / Default:</td><td>Measurements are performed by a third party accredited entity.</td></tr>
<tr><td>Source of data:</td><td>Related measurements and calculations were performed by the independent third party inspection services company “Ecosampling Ambiental Ltda.”

Biannual measurements of mass flow of methane in the exhaust gas are performed on the basis of measurements of CH_4 concentration in a collected gas sample + measurements of speed of exhaust gas in the upper section of the flares with one hour of duration each. Measurements are performed as per applicable guidance of the following standards:

US-EPA Method 25A – Determination Of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer (available online: http://www.epa.gov/ttnemc01/promgate/m-25a.pdf);

CETESB L9.221 - Dutos e chaminés de fontes estacionárias - determinação dos pontos de amostragem: procedimento (translated into English language as “Stacks and chimneys in stationary emission sources- Sampling points determination procedure) (available online: http://www.cetesb.sp.gov.br/userfiles/file/servicos/normas/vigentes/L9.221_Dutos%20e%20chamin%C3%A9s%20de%20fontes%20estacion%C3%A1rias%20-%20determina%C3%A7%C3%A3o%20dos.pdf)

CETESB L9.222 - Dutos e chaminés de fontes estacionárias - determinação da velocidade e vazão dos gases: método de ensaio (translated into English language as “Stacks and chimneys in stationary emission sources – Determination of speed and outflow of gases) (available online: http://www.cetesb.sp.gov.br/userfiles/file/servicos/normas/vigentes/L9.222_Dutos%20e%20chamin%C3%A9s%20de%20fontes%20estacion%C3%A1rias%20-%20determina%C3%A7%C3%A3o%20da.pdf)</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td>While biannual related measurements were performed for each one of the installed 4 flares, the monitoring parameter $F_{CH4,EG,t}$ is thus measured, recorded and reported on the basis of the following sub-parameters:
- $F_{CH4,EG,t,flare-1}$: Mass flow of methane in the exhaust gas of Flare 1
- $F_{CH4,EG,t,flare-2}$: Mass flow of methane in the exhaust gas of Flare 2
- $F_{CH4,EG,t,flare-3}$: Mass flow of methane in the exhaust gas of Flare 3
- $F_{CH4,EG,t,flare-4}$: Mass flow of methane in the exhaust gas of Flare 4

For the determination of values of $F_{CH4,EG,t}$, average the accumulated mass of methane measured during one hour of continuous measurements are considered (average of every-minute measurements).

The table below summarizes the performed biannual determination of $F_{CH4,EG,t}$ for each one of the installed flares valid for the considered monitoring period:

<table>
<tr><th>Flare</th><th>Measurements performed on: 13/06/2014</th><th>Measurements performed on: 16/06/2014</th><th>Measurements performed on: 19/12/2014</th></tr>
<tr><td>Flare 1 ($F_{CH4,EG,t,flare-1}$)</td><td></td><td>0.0569</td><td>0.0519</td></tr>
<tr><td>Flare 2 ($F_{CH4,EG,t,flare-2}$)</td><td></td><td>0.0577</td><td>0.0566</td></tr>
<tr><td>Flare 3 ($F_{CH4,EG,t,flare-3}$)</td><td>0.0347</td><td>-</td><td>0.0571</td></tr>
<tr><td>Flare 4 ($F_{CH4,EG,t,flare-4}$)</td><td>0.0569</td><td>-</td><td>0.0546</td></tr>
</table>
</td></tr>
</table>

Monitoring equipment:	Measurements were performed by the independent 3rd party inspection service company "Ecosampling Ambiental Ltda." using an appropriated chromatographer and a pitot tube
Measuring/ Reading/ Recording frequency:	Biannual
Calculation method (if applicable):	-
QA/QC procedures:	Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Essencis Soluções Ambientais S.A. in accordan ce with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS). Ecosampling Ambiental Ltda. is a licensed independent third party inspections services company with specialized in inspections and testing of air emissions from stationary sources. In Brazil, operation of inspection entities and labs are regulated by the Instituto Nacional de Metrologia, Qualidade e Tecnologia (INMETRO) (the Brazilian national authority for metrology and certification affairs).
Purpose of data:	Calculation of baseline emissions
Additional comment:	-

Data / Parameter:	**$T_{EG,m}$**
Unit:	^{o}C
Description:	Temperature in the exhaust gas of the enclosed flare in minute *m*
Measured/ Calculated / Default:	Continuously measured by thermocouples installed in the upper section of the flares.
Source of data:	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (thermocouples) (with recordable electronic signal).
Value(s) of monitored parameter:	Values for each one of the installed 4 high temperature enclosed flares are reported in the monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report). Measurement data is recorded and reported with an every-minute frequency. While measurements are performed by 4 thermocouples (one thermocouple installed in the upper section of each individual installed flare), the monitoring parameter $T_{EG,m}$ is measured, recorded and reported on the basis of the following sub-parameters: - $T_{EG,m,flare-1}$: Temperature in the exhaust gas of Flare 1 - $T_{EG,m,flare-2}$: Temperature in the exhaust gas of Flare 2 - $T_{EG,m,flare-3}$: Temperature in the exhaust gas of Flare 3 - $T_{EG,m,flare-4}$: Temperature in the exhaust gas of Flare 4

Monitoring equipment:	*Specifications and calibration details for the installed/utilized thermocouples:* *Thermocouple used for measuring $T_{EG,m,flare-1}$ (Flare 1):* - 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: 11/03/2014 (Calibration Certificate: T-0198-14) - Entity/company responsible for the performance of calibration events: Naka Comércio e Indústria de Instrumentação Industrial Ltda. *Thermocouple used for measuring $T_{EG,m,flare-2}$ (Flare 2):* - 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: 11/03/2014 (Calibration Certificate: T-0196-14) - Entity/company responsible for the performance of calibration events: Naka Comércio e Indústria de Instrumentação Industrial Ltda. *Thermocouple used for measuring $T_{EG,m,flare-3}$ (Flare 3):* - 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: 11/03/2014 (Calibration Certificate: T-0201-14) - Entity/company responsible for the performance of calibration events: Naka Comércio e Indústria de Instrumentação Industrial Ltda. *Thermocouple used for measuring $T_{EG,m,flare-4}$ (Flare 4):* - 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: 11/03/2014 (Calibration Certificate: T-0200-14 - Entity/company responsible for the performance of calibration events: Naka Comércio e Indústria de Instrumentação Industrial Ltda.
Measuring/ Reading/ Recording frequency:	Continuously measurements are recorded/reported every minute.
Calculation method (if applicable):	-
QA/QC procedures:	Monitoring equipment/instruments are calibrated and maintained as per instrument specifications and/or recommendations of manufacturer. Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation of baseline emissions
Additional comment:	Measurements outside the operational temperature specified/recommended by the manufacturer may indicate that the flare is not functioning correctly and may require maintenance. Unexpected changes such as a sudden increase/drop in temperature can occur for different reasons. As part of the monitoring procedure, these events are noted in the site records along with any corrective action that was implemented to correct the issue. Measurements are required to determine if manufacturer's flare specifications for operating temperature are met.

Data / Parameter:	**$Flame_m$**
Unit:	Flame status "*on*" or flame status "*off*"
Description:	Flame detection of flare in the minute *m*
Measured/ Calculated / Default:	Continuously measured by Ultra violet (UV) flame detectors installed in each one of the flares.
Source of data:	Whenever flame is detected in the flare, flame status "*on*" or "1" value is attributed. Whenever no flame is detected in the flare, flame status "*off*" or "0" is attributed.

Value(s) of monitored parameter:	Values for each one of the installed 4 high temperature enclosed flares are reported in the monthly emission reduction calculation spreadsheets (that is enclosed to this Monitoring Report). Measurement data is recorded and reported with an every-minute frequency. While measurements are performed by 4 UV flame detectors (one UV flame detector installed in each individual installed flare), the monitoring parameter $Flame_m$ is thus measured, recorded and reported on the basis of the following sub-parameters: - $Flame_{m,flare-1}$: Flame detection in Flare 1 - $Flame_{m,flare-2}$: Flame detection in Flare 2 - $Flame_{m,flare-3}$: Flame detection in Flare 3 - $Flame_{m,flare-4}$: Flame detection in Flare 4

Monitoring equipment:	*Specifications and calibration details for the installed/utilized UV Flame detectors:* *UV Flame detector for measuring* $Flame_{m,flare-1}$ *(Flare 1):* - Manufacturer: SELCON Sistemas Eletrônicos de Controle Ltda. - Model: SEL-SV-UL-K4 - Serial Number: 323730808 - Instrument internal identification number: UV01 - Calibration frequency: No calibration is required as the equipment has a self-checking function. - Working hours (lifetime): 50,000 h *UV Flame detector for measuring* $Flame_{m,flare-2}$ *(Flare 2):* - Manufacturer: SELCON Sistemas Eletrônicos de Controle Ltda. - Model: SEL-SV-UL-K4 - Serial Number: 55600905 - Instrument internal identification number: UV02 - Calibration frequency: No calibration is required as the equipment has a self-checking function. - Working hours (lifetime): 50,000 h *UV Flame detector for measuring* $Flame_{m,flare-3}$ *(Flare 3):* - Manufacturer: Honeywell Analytics Ltd. - Model: C7061 - Serial Number: R7861 - Instrument internal identification number: UV03 - Calibration frequency: No calibration is required as the equipment has a self-checking function. - Working hours (lifetime): 40,000 h *UV Flame detector for measuring* $Flame_{m,flare-4}$ *(Flare 4):* - Manufacturer: SELCON Sistemas Eletrônicos de Controle Ltda. - Model: SEL-SV-210230-K6 - Serial Number: 565400312 - Instrument internal identification number: UV04 - Calibration frequency: No calibration is required as the equipment has a self-checking function. - Working hours (lifetime): 50,000 h
Calculation method (if applicable):	Not applicable
QA/QC procedures:	Monitoring equipment/instruments are calibrated and maintained as per instrument specifications and/or recommendations of manufacturer. Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation of baseline emissions
Additional comment:	

Data / Parameter:	**Maintenance$_y$**
Unit:	Calendar dates
Description:	Maintenance events completed in year *y* as monitored by the project participants.
Measured/ Calculated / Default:	-
Source of data:	maintenance logs
Value(s) of monitored parameter:	The following maintenance events (inspection and maintenance services) were performed in the flares during the considered monitoring period: - 14/06/2014: General inspection/maintenance service on Flare 1 (incl. inspection of the condition of the flare isolation ceramics revetment material, checking of conditions of the LPG supply valve for pilot flame, checking of condition/function of the air inlet dumpers, checking of the conditions of the thermocouples, checking of the condition of the UV flame detector, checking of the condition of the flame arrester valve, checking of the conditions of the LFG injectors, checking of painting conditions). - 01/07/2014: General inspection/maintenance service on Flare 3 (incl. inspection of the condition of the flare isolation ceramics revetment material, checking of conditions of the LPG supply valve for pilot flame, checking of condition/function of the air inlet dumpers, checking of the conditions of the thermocouples, checking of the condition of the UV flame detector, checking of the condition of the flame arrester valve, checking of the conditions of the LFG injectors, checking of painting conditions). - 22/09/2014: General inspection/maintenance service on Flare 4 (incl. inspection of the condition of the flare isolation ceramics revetment material, checking of conditions of the LPG supply valve for pilot flame, checking of condition/function of the air inlet dumpers, checking of the conditions of the thermocouples, checking of the condition of the UV flame detector, checking of the condition of the flame arrester valve, checking of the conditions of the LFG injectors, checking of painting conditions). l - 26/09/2014: General inspection/maintenance service on Flare 2 (incl. inspection of the condition of the flare isolation ceramics revetment material, checking of conditions of the LPG supply valve for pilot flame, checking of condition/function of the air inlet dumpers, checking of the conditions of the thermocouples, checking of the condition of the UV flame detector, checking of the condition of the flame arrester valve, checking of the conditions of the LFG injectors, checking of painting conditions). - 01/10/2014: General inspection/maintenance service on Flare 1 (incl. inspection of the condition of the flare isolation ceramics revetment material, checking of conditions of the LPG supply valve for pilot flame, checking of condition/function of the air inlet dumpers, checking of the conditions of the thermocouples, checking of the condition of the UV flame detector, checking of the condition of the flame arrester valve, checking of the conditions of the LFG injectors, checking of painting conditions).

	- 01/11/2014: General inspection/maintenance service on Flare 3 (incl. inspection of the condition of the flare isolation ceramics revetment material, checking of conditions of the LPG supply valve for pilot flame, checking of condition/function of the air inlet dumpers, checking of the conditions of the thermocouples, checking of the condition of the UV flame detector, checking of the condition of the flame arrester valve, checking of the conditions of the LFG injectors, checking of painting conditions). As per the applied maintenance practice for the project activity, general inspection/maintenance services on the flares are opportunely performed during planned or unplanned interruptions of operation of the flares. After the project's commissioning, the isolation ceramics revetment material of the Flare 1 and Flare 2 were replaced once in February 2009 and February 2012 respectively. For Flares 3 and Flare 4 (which were installed in July 2011 and February 2012 respectively), the isolation ceramics revetment material was not yet replaced. The expected lifetime for the isolation ceramics revetment material for the flares is of at least 10 years (as established in details for the ex-ante determined parameter "Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval" ($SPEC_{flare}$)). Performed maintenance and overhauling services in the flare are regularly performed under conformance with maintenance requirements for the flares (as established by equipment manufacturer) and required by the ex-ante determined parameter $SPEC_{flare}$. Further details about the parameter $SPEC_{flare}$ are included in Section D.1.
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	Not applicable.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	The maintenance event logs and documentation for the whole project activity are recorded as per requirement of the company's ISO 9001 and ISO 14001 certified quality and control (QA/QC) and environmental management (EMS) system that is implemented for activities undertaken at the CTR Caieiras landfill.
Purpose of data:	Calculation of baseline emissions
Additional comment:	Monitoring of this parameter is required for the case of enclosed flares and the project participant selects Option B to determine flare efficiency. These dates are required so that they can be compared to the maintenance schedule to check that maintenance events were completed within the minimum time between maintenance events specified by the manufacturer ($SPEC_{flare}$).

Data / Parameter:	**$FC_{LPG,y}$**
Unit:	Ton
Description:	Quantity of LPG consumed by the project activity in year *y*

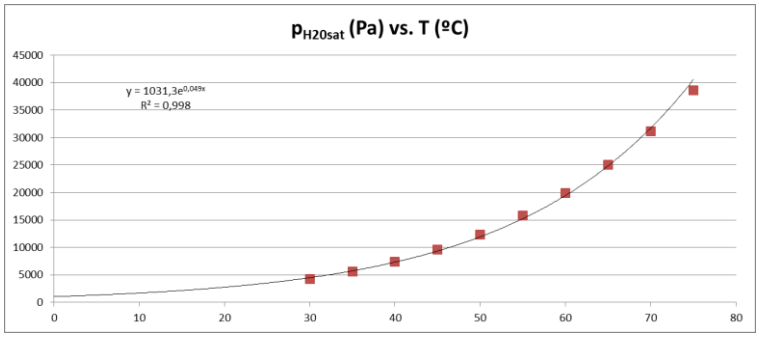
Measured/ Calculated / Default:	Measured.
Source of data:	Monitored values of $FC_{LPG,y}$ are based on measurements performed by the local LPG distribution company Cia Ultragas S.A. as part of LPG delivery events.
Value(s) of monitored parameter:	As per the adopted monitoring procedure, the total amount of LPG consumed by the project activity during the considered monitoring period is 405 kg (0.405 ton) of LPG. Thus, $FC_{LPG,y} = 0.405\ ton_{LPG}$ LPG was consumed for lighting/igniting the flares (flare pilot). The reported value corresponds to all the LPG acquired during or before the considered monitoring period (in the present case 5 cylinders of 45 kg of LPG where acquired by the project participant on 13/11/2013 and 4 more cylinders of 45 kg on 03/10/2014), conservatively assuming that all the LPG was used during the monitoring period. .
Monitoring equipment:	*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 13.0.0) 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", 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 calibration: 14/06/2012 (Calibration Certificate MA124/2012, respectively). - Entity/company responsible for the performed calibration events: and Instituto de Pesos e Medidas do Estado de São Paulo IPEM-SP (calibration event of 14/06/2012).
Measuring/ Reading/ Recording frequency:	Amount of LPG is measured upon the supply of cylinders of LPG with 45 kg capacity each.
Calculation method (if 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. Monitoring equipment/instruments are calibrated and maintained as per instrument specifications and/or recommendations of manufacturer.

	Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation of project emissions (due to consumption of LPG by the project activity)
Additional comment:	-

Data / Parameter:	**$NCV_{LPG,y}$**
Unit:	GJ/ton LPG
Description:	Net calorific value of the fuel LPG
Measured/ Calculated / Default:	Default value is selected.
Source of data:	National default value as per the Brazilian National Energetic Balance Report for year 2014 (Balanço Energético Nacional (BEN) – 2014) / Table VIII.9 – Specific Mass and Heating Values (Higher Heating Value). This annual report is the latest issued version and it is based on data valid for year 2013. This official document was published by the public entity Empresas de Pesquisas Energéticas (EPE). While EPE was created and established in accordance with the Federal Law 10.847 of 15/03/2004, the EPE is a governmental entity that undertakes energy planning related investigation and research services. The BEN-2014 report is available online: https://ben.epe.gov.br/downloads/Relatorio_Final_BEN_2014.pdf Reported value in kcal/kg is converted into GJ/ton.
Value(s) of monitored parameter:	46.5
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	In accordance with the PDD, as national default value is considered, an every year monitoring frequency is thus applied.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation of project emissions (due to consumption of LPG by the project activity)
Additional comment:	-

Data / Parameter:	**$EF_{CO2,LPG,y}$**
Unit:	tCO_2/GJ LPG
Description:	CO_2 emission factor of fuel LPG in year *y*
Measured/ Calculated / Default:	Default value is selected.
Source of data:	Value is selected as per 2006 IPCC Guidelines on National GHG Inventories (applicable value at upper limit of uncertainty at 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy)).
Value(s) of monitored parameter:	0.0656
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	In accordance with the PDD, as IPCC default value is considered, an every year monitoring frequency is thus applied.
Calculation method (if applicable):	Not applicable.
QA/QC procedures:	Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Essencis Soluções Ambientais S.A. in accordance with detailed working instructions that are included in the company's ISO 9001 and 14001 certified quality management and control (QA/QC) and environmental management system (EMS).
Purpose of data:	Calculation of project emissions (due to consumption of LPG by the project activity)
Additional comment:	-

Data / Parameter:	$p_{H2O,t,Sat}$
Unit:	Pa
Description:	Saturation pressure of H_2O at temperature T_t in time interval *t*
Measured/ Calculated / Default:	Default values as per selected literature.
Source of data:	Data selected as per the literature "*Fundamentals of Classical Thermodynamics*". Authors: Gordon J. Van Wylen, Richard E. Sonntag and Borgnakke; 3rd Edition 1986. Published by John Wiley & Sons, Inc.
Value(s) of monitored parameter:	$p_{H2O,t,Sat}$ is determined as a function of temperature of LFG (T_t by the equation: $p_{H2O,t,sat}$ = 1031,3 * e ^ (0,049 * T_t), with a correlation coefficient of R^2 = 0,998. Further details are presented below in "Calculation Method".
Monitoring equipment:	Not applicable.
Measuring/ Reading/ Recording frequency:	Not applicable
Calculation method (if applicable):	The Absolute Vapor Pressure of Water was obtained from the mentioned literature and is presented in the following table within the rage of interest for the required calculations:

	<table><tr><td>Temperature</td><td>$p_{H2O,t,Sat}$</td></tr><tr><td>ºC</td><td>Pa</td></tr><tr><td>30</td><td>4,246</td></tr><tr><td>35</td><td>5,628</td></tr><tr><td>40</td><td>7,384</td></tr><tr><td>45</td><td>9,593</td></tr><tr><td>50</td><td>12,349</td></tr><tr><td>55</td><td>15,758</td></tr><tr><td>60</td><td>19,940</td></tr><tr><td>65</td><td>25,030</td></tr><tr><td>70</td><td>31,190</td></tr><tr><td>75</td><td>38,580</td></tr></table> The following graphic represents the above data and the regression calculated to adjust data:  As $p_{H2O,t,Sat}$ is a function of temperature and best represented by an exponential function the exponential regression method was applied to the above data the following equation is obtained: $p_{H2O,t,sat} = 1031,3 * e^{(0,049 * Tt)}$ This equation represents the above data with a correlation coefficient of R^2 = 0,998. Thus, by applying the above equation we can obtain the $p_{H2O,t,sat}$ as a function of the temperature.
QA/QC procedures:	Not applicable.
Purpose of data:	Calculation of baseline emissions.
Additional comment:	It is important to note that $p_{H2O,t,Sat}$ is only used in the context of the determination of the methane mass flow in the residual gas (in a dry basis) for each minute *m* of the two time periods in year *y* during which the flare efficiency is measured (parameter $F_{CH4,RG,t}$). The calculations of every-minute values of $p_{H2O,t,Sat}$ for the 2 time periods during which the flare efficiency is measured is thus presented only in the flare efficiency calculation spreadsheet. “MR 10 - Caieiras - V.2 - 04.03.2015 – FE”.

The following monitoring parameters (which are also included in the monitoring plan of the registered PDD) were not monitored as the methodological options for which they are applicable were not

selected as the monitoring or calculation approaches for the determination of baseline emissions achieved by the project activity during the considered monitoring period:

- Volumetric flow of LFG stream in time interval *t* on a dry basis ($V_{t,db}$)
- Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a dry basis ($v_{CH4,t,db}$)
- Mass flow of the LFG stream in time interval *t* on dry basis ($M_{t,db}$) [12]

D.3. Implementation of sampling plan

>>
Not applicable.

[12] It is important to note the following methodological aspects (as further discussed in Section E.1):

- The application of the tool "Project emissions from flaring" under Step 1 requires the values of mass flow of methane entering each flare (for each minute *m* of the two time periods in year *y* during which the flare efficiency is measured, under Option B.2) to be measured on a **dry basis**.
- Every-minute values of the amount of methane in the LFG which is sent to the flares (calculation parameter $F_{CH4,sent,flare,y}$) are determined on a **wet basis** (as per Option C of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream").

In order to have the above summarized requirement from the methodological tool "Project emissions from flaring" being met, mass flow of methane entering each flare is thus determined by converting calculated values of $F_{CH4,sent,flare,y}$ from wet basis to dry basis uniquely for each minute *m* of the two time periods in year *y* during which the flare efficiency is measured. In this particular context, as further explained in Section E.1, every-minute values of $V_{t,db}$, $v_{CH4,t,db}$ and $M_{t,db}$ for such particular time instants (hours) are calculated by applying data records from the following parameters (ex-ante determined parameters, calculation parameters and ex-post monitored parameters):

- $\rho_{CH4,n}$
- $v_{CH4,t,wb}$
- $V_{t,wb}$
- $v_{H2O,t,db}$
- MM_{H2O}
- $MM_{t,db}$
- MM_K (k = CH_4 and N_2)
- $m_{H2O,t,db}$
- P_t
- $p_{H2O,t,Sat}$

In summary, by taking into account that, for the considered monitoring period, values of $F_{CH4,sent,flare,y}$ are determined by applying Option C the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (wet basis), the parameters $V_{t,db}$, $v_{CH4,t,db}$ and $M_{t,db}$ are thus not regarded as valid monitoring parameters (since, as outlined in the PDD, they are valid monitoring parameters only in case Option A or Option D of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (dry basis) is selected for the determination of $F_{CH4,sent,flare,y}$). Moreover, as explained above, $V_{t,db}$, $v_{CH4,t,db}$ and $M_{t,db}$ are calculated as function of other parameters.

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

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

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Baseline emissions (BE_y) for the considered monitoring period are determined (in tCO_2e) as follows:

$$BE_y = BE_{CH4,y}$$

Where:

$BE_{CH4,y}$ Baseline emissions of methane from the SWDS[13]. As established by ACM0001 (version 13.0.0), the determination of $BE_{CH4,y}$ is based on the amount of methane that is actually captured and combusted (destroyed) by the project activity and also by taking into account the amount of methane that, in the absence of the project activity (baseline scenario), would be otherwise captured and destroyed in the landfill by the pre-project conventional LFG destruction system. In addition, the effect of methane oxidation (that, as per ACM0001 (version 13.0.0), is assumed as existing in the baseline and not in the project scenario) is also taken into account. $BE_{CH4,y}$ is thus determined as follows:

$$BE_{CH4,y} = (1 - OX_{top\_layer}) * (F_{CH4,PJ,y} - F_{CH4,BL,y}) * GWP_{CH4}$$

Where:

OX_{top_layer} Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline scenario. OX_{top_layer} is ex-ante determined as 10%. Further details about the selection of the value for OX_{top_layer} is included in Section D.1 and in the PDD.

$GWP_{CH4,y}$ Global warming potential of CH_4. GWP_{CH4} is ex-ante determined as 25. Further details about the selection of the value for GWP_{CH4} is included in Section D.1 and in the PDD.

$F_{CH4,BL,y}$ Amount of methane in the LFG that would be flared in the baseline scenario (absence of project activity). As outlined in Section B.6.1 of the PDD, $F_{CH4,BL,y}$ is calculated as follows:

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

Where:

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

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

Where:

[13] SWDS = Solid Waste Disposal Site. For the case of the project activity, the SWDS is the CTR Caieiras landfill.

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

For the considered monitoring period, the accumulated value for $F_{CH4,BL,y}$ is calculated as 4,454 tCH_4.

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

In the particular case of the project activity, $F_{CH4,PJ,y}$ is determined as follows:

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

$F_{CH4,flared,y}$ Amount of methane in the LFG flared by the project activity (in tCH_4). In accordance with calculation guidance included in the PDD and by following applicable guidance of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", for each individual flare every-minute values for $F_{CH4,flared,y}$ are determined as the difference between the amount of methane supplied to the flares and residual methane emissions from combustion of LFG in the flares, as follows:

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

Where:

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

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

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

For the considered monitoring period, Option C of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (where the gaseous stream the tool shall be applied to is the stream of collected LFG that is sent to the flares)[14] is the selected option for determination of values of $F_{CH4,sent\_flare,y}$ valid for each installed flare (calculation sub-parameters $F_{CH4,sent\_flare,y,flare-1}$, $F_{CH4,sent\_flare,y,flare-2}$, $F_{CH4,sent\_flare,y,flare-3}$ and $F_{CH4,sent\_flare,y,flare-4}$). By following calculation option C (that is one of the applicable calculation methods the PDD refers to), the mass flow of greenhouse gas *i* ($F_{i,t}$) (*i* = CH_4) for each installed flare is determined as follows:

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

Where:

Sulfix "*Flare-n*": (flare in question: Flare 1, Flare 2, Flare 3 and Flare 4)

For each one of the flares:

$V_{t,wb,n,flare-n}$ Volumetric flow of the gaseous stream (LFG) in time interval *t* on a wet basis at normal conditions. For the considered monitoring period, every-minute values of the calculation parameter $V_{t,wb,n,flare-n}$ valid for each flare (calculation sub-parameters $V_{t,wb,n,flare-1}$, $V_{t,wb,n,flare-2}$, $V_{t,wb,n,flare-3}$ and $V_{t,wb,n,flare-4}$) are measured and reported (in Nm^3 wet gas/h) in the monthly emission reduction calculation spreadsheets valid for the considered monitoring period (and enclosed to this Monitoring Report). While in the particular case of the project activity, during the considered monitoring period, volumetric flow of the gaseous stream (LFG) valid for each flare is already measured in Nm^3 wet gas/h (normal conditions), the following assumption is valid:

$V_{t,wb,n,flare-n}$ is equivalente to $V_{t,wb,flare-n}$

Where:

$V_{t,wb,flare-n}$ Volumetric flow of the gaseous stream (LFG) in time interval *t* on a wet basis for flare *n* (n = 1, 2, 3 and 4).

Note: in accordance with the PDD, since measurements of LFG flow are automatically converted and recorded in normalized cubic meters (by considering standard temperature and pressure (STP) conditions), monitoring of "Pressure of the LFG stream in time interval t" (P_t) and "Temperature of the LFG stream in time interval *t*" (T_t) are not required for the determination of $V_{t,wb,n,flare-n}$. Moreover, the ex-ante determined parameters Temperature at normal

[14] It is relevant to note that the PDD states the following regarding the calculation approach for values of $F_{CH4,sent\_flare,y}$: "*Applicable guidance of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" will be applied to determine $F_{CH4,sent\_flare,y}$ by using Option 2: Simplified calculation without measurement of the moisture content, and one of the options A, C or D. The selection of the determination option will depend on project conditions and equipment to be installed."*

conditions (T_n) and Total pressure at normal conditions (P_n) are not considered either.

$v_{CH4,t,wb}$ Volumetric fraction of CH_4 in the gaseous stream in time interval *t* on a wet basis. As per the applied monitoring procedure, every-minute values of the monitoring parameter $v_{CH4,t,wb}$ (in m^3 of CH_4 / m^3 of wet LFG) are reported in the monthly emission reduction calculation spreadsheet valid for the considered monitoring period (and enclosed to this Monitoring Report). Further monitoring details about the monitoring parameter $v_{CH4,t,wb}$ are included in Section D.2.

$\rho_{CH4,n}$ Density of CH_4 in the gaseous stream (LFG) at normal conditions. For the considered monitoring period, value of $\rho_{CH4,n}$ (in kg of CH_4 / m^3 of CH_4) is calculated and reported in the monthly emission reduction calculation spreadsheet valid for the considered monitoring period (and enclosed to this Monitoring Report) as follows:

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

Where:

P_n Absolute pressure at normal conditions. P_n is ex-ante determined as 101,325 Pa. Further details about the ex-ante determined parameter P_n are included in Section D.1 and in the registered PDD valid for the 2nd 7-year renewable crediting period for the project activity.

T_n Temperature at normal conditions. T_n is ex-ante determined as 273.15 Kelvin. Further details about the ex-ante determined parameter T_n are included in Section D.1 and in the registered PDD valid for the 2nd 7-year renewable crediting period for the project activity.

MM_i Molecular mass of greenhouse gas *i* (*i* = CH_4). MM_i (*i* = CH_4) is ex-ante determined as 16.04 kg/mol. Further details about the ex-ante determined parameter MM_i (*i* = CH_4) are presented in Section D.1 and in the registered PDD valid for the 2nd 7-year renewable crediting period for the project activity.

R_u Universal ideal gases constant. R_u is ex-ante determined as 8,314 $Pa.m^3$ /kmol.K. Further details about the ex-ante determined parameter R_u are presented in Section D.1 and in the registered PDD valid for the 2nd 7-year renewable crediting period for the project activity.

$\rho_{CH4,n}$ is calculated as 0.7156650 $kgCH_4$ / m^3CH_4 as reported in the monthly emission reduction calculation spreadsheet valid for the considered monitoring period.

While for each installed flare, the calculated every-minute values of $F_{i,t,flare-n}$ are equivalent to every-minute values for $F_{CH4,sent\_flare,y,flare-n}$, (where *n* = 1, 2, 3 and 4) the monthly emission reduction calculation spreadsheets valid for the considered monitoring period include the determination of every minute values of $F_{CH4,sent\_flare,y,flare-n}$ that is applicable for each one of the installed 4 high temperature enclosed flares for which collected LFG is sent for combustion.

Determination of $PE_{flare,y}$:

$PE_{flare,y}$ is determined for each one of the installed flares ($PE_{flare,y,flare-1}$, $PE_{flare,y,flare-3}$ and $PE_{flare,y,flare-4}$) by following the applicable stepwise guidance of the methodological tool "Project emissions from flaring" (version 2). Every minute values for $PE_{flare,y,flare-1}$, $PE_{flare,y,flare-2}$, $PE_{flare,y,flare-3}$ and $PE_{flare,y,flare-4}$ are determined as a function of every-minute records of mass flow of methane sent to the flare in question (for each flare *n*, $F_{CH4,RG,m,flare-n} = F_{CH4,sent\_flare,y,flare-n}$, where *n* = 1, 2, 3 and 4) as well as based on calculated values for flare efficiency ($\eta_{flare,m} = \eta_{flare,calc,y}$) for each one of the flares as follows:

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

Where:

$F_{CH4,RG,m}$ — Methane mass flow in the residual gas for the considered flare. For each minute *m* of the considered monitoring period and for each individual flare *n*, values for $F_{CH4,RG,m}$ are equal to every-minute reported measurement records of the calculation sub-parameter "Amount of methane in the LFG which is sent to the flares" ($F_{CH4,sent\_flare,y}$) that is valid for each individual flare (calculation sub-parameters $F_{CH4,sent\_flare,y,flare-1}$, $F_{CH4,sent\_flare,y,flare-2}$, $F_{CH4,sent\_flare,y,flare-3}$ and $F_{CH4,sent\_flare,y,flare-4}$)).

$\eta_{flare,m}$ — Flare efficiency in minute m. For the considered monitoring period, $\eta_{flare,m}$ is calculated based on performed measurements of methane in exhaust gas of the flare by following applicable guidance as per Option B (Measured flare efficiency) of the methodological tool "Project emissions from flaring" from which the following related guidance of the PDD is applied:

> *"(…)*
> *<u>Option B: Measured flare efficiency:</u>*
> *For each one of the high temperature enclosed flares which are part of the project activity, the flare efficiency in the minute m is determined as a value which is calculated based on performed related measurements ($\eta_{flare,m} = \eta_{flare,calc,m}$) when the following two conditions are simultaneously met (in order to demonstrate that the flare is operating):*
> *(1) The temperature of the exhaust gas of the flare (monitoring parameter $T_{EG.m}$) and the flow rate LFG to the flare (monitoring parameter $F_{CH4,RG,m}$) is within the manufacturer's specification for the flare ($SPEC_{flare}$) in minute m*
> *(2) Flame is detected in the flare in minute m (monitoring parameter $Flame_m$).*
>
> *Otherwise $\eta_{flare,m}$ is set as 0%.*
> *(…)"*

In applying Option B, the project participants chose to determine $\eta_{flare,calc,m}$ for each individual flare by applying guidance of Option B.1 (with related measurements of emission of methane in the exhaust gas of the flare being performed by an accredited independent third party entity (e.g. an independent inspection/analysis service company) on a biannual basis).
In order to calculate the flare efficiency value for each flare ($\eta_{flare,calc,m}$) biannual values for the monitoring parameter "Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period t" ($F_{CH4,EG,t}$)) are considered as per the following calculation formula:

Option B.1: Biannual measurement of the flare efficiency":
For each individual flare, the calculated flare efficiency $\eta_{flare,calc,y}$ is determined as follows:

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

Where:

$F_{CH4,EG,t}$ — Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period *t*. As established by the PDD, for the considered monitoring period, $F_{CH4,EG,t}$ was measured for each individual flare as per appropriate national or international standard during 2 set of measurement events within the year encompassed by the considered monitoring period (year 2014). For each flare, 1-hour length biannual measurements of residual methane in the exhaust gas of the flare and measurements of speed of exhaust gas of the flare (for the determination of flow of methane exhaust gas of the flares) were performed by the third party inspection service company Ecosampling Avaliações Ambientais Ltda. Ecosampling Avaliações Ambientais Ltda. is an inspection service company which is specialized in emission measurements and air pollution inspections.

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

$F_{CH4,RG,t}$ — Mass flow of methane in the residual gas on a dry basis at reference conditions in the time period *t.* Details for the determination of every-minute values for $F_{CH4,RG,t}$ for each individual flare are presented below.

Determination of $F_{CH4,RG,t}$:

As per the applicable guidance of the methodological tool "Project emissions from flaring" and also as per the PDD, the methane mass flow in the residual gas (in a dry basis) for each minute *m* of the two time periods in year *y* during which the flare efficiency is measured shall be calculated by following the applicable guidance of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". Values for the parameter $F_{CH4,RG,t}$ valid for each flare (calculation sub-parameters $F_{CH4,RG,t,flare-1}$, $F_{CH4,RG,t,flare-2}$, $F_{CH4,RG,t,flare-3}$ and $F_{CH4,RG,t,flare-4}$) are thus calculated as follows:

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

Where:

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

$v_{CH4,t,db}$ Volumetric fraction of greenhouse gas *i* (*i* = CH_4) in the gaseous stream in a time interval *t* on a dry basis. The following is stated in footnote 3 of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream":

> "*(…) Flow measurement on a dry basis is not feasible at reasonable costs for a wet gaseous stream, so there will be no difference in the readings for volumetric fraction in wet basis analyzers and dry basis analyzers (…)*."

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

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

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

Where:

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

$v_{H2O,t,db}$ Volumetric fraction of H_2O in the gaseous stream in time interval *t* on a dry basis. As per applicable guidance of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", $v_{H2O,t,db}$ is calculated as follows:

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

Where:

MM_{H2O} Molecular mass of H_2O. MM_{H2O} is ex-ante determined as 18.0152 kg/kmol. Further details about the ex-ante determined parameter MM_{H2O} are included in Section D.1 and in the registered PDD.

$MM_{t,db}$ Molecular mass of the gaseous stream in time interval *t* on a dry basis. As per applicable guidance of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", $MM_{t,db}$ is calculated as follows:

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

Where:

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

$V_{k,t,db}$ Volumetric fraction of gas *k* in the gaseous stream in time interval *t* on a dry basis. As per applicable guidance of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", "*(…) The determination of the molecular mass of the gaseous stream ($MM_{t,db}$) requires measuring the volumetric fraction of all gases (k) in the gaseous stream. However, as a simplification, the volumetric fraction of only the gases k that are greenhouse gases and are considered in the emission reduction calculation in the underlying methodology must be monitored and*

	the difference to 100% may be considered as pure nitrogen." ACM0001 (version 13.0.0) does not include any restriction to such simplification. Thus, only the volumetric fraction of gases that are greenhouse gases and are considered in related calculations (CH_4 in the particular case of the project activity) should be measured and the difference to 100% is just considered as pure nitrogen. Further details for the determination of the volumetric fraction of CH_4 in the gaseous stream ($V_{k,t,db} = v_{CH4,t,db}$) are presented above under the calculation parameter $v_{CH4,t,db}$.
MM_k	Molecular mass of gas *k* (*k* = CH_4 and N_2). The molecular mass of CH_4 and N_2 are ex-ante determined as 16.04 and 28.01, respectively. Further details about the ex-ante determined values for MM_k are included in Section D.1 and in the registered PDD.
$m_{H2O,t,db}$	Absolute humidity in the gaseous stream in time interval *t* n a dry basis. As per Option 2 of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", by conservatively assuming that the gaseous stream is saturated ($m_{H2O,t,db}$ =

$m_{H2O,t,db,Sat}$), $m_{H2O,t,db}$ is calculated as follows [15]:

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

Where:

MM_{H2O} Molecular mass of H_2O. MM_{H2O} is ex-ante determined as 18.0152. Further details about the ex-ante determined values for MM_{H2O} are included in Section D.1 and in the registered PDD.

P_t Absolute pressure of the gaseous stream in time interval *t*. Further monitoring details for P_t are included in Section D.2.

$MM_{t,db}$ Molecular mass of the gaseous stream in a time interval *t* on a dry basis. Further details for the determination of $MM_{t,db}$ are presented above.

$p_{H2O,t,Sat}$ Saturation pressure of H_2O at temperature T in time *t*, Further monitoring details about the monitoring parameter $p_{H2O,t,Sat}$ are included in Section D.2.

In summary, for the considered monitoring period, the following values of $\eta_{flare,m} = \eta_{flare,calc,y}$ were obtained:

	Flare 1	Flare 2	Flare 3	Flare 4

[15] It is important to note that the simplified calculation for the absolute humidity of the gaseous stream ($m_{H2O,t,db}$) presented in Option 2 of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" shall be applied by assuming the gaseous stream is dry or saturated depending on which is the conservative situation. Footnote 4 of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" states the following: "*An assumption that the gaseous stream is saturated is conservative for the situation that the mass flow of greenhouse gas I is underestimated (applicable for calculating baseline emissions). Conversely, an assumption that the gas stream is dry is conservative for the situation that the greenhouse gas t is overestimated (applicable for calculating project emissions).*". In this particular case, $m_{H2O,t,db}$ is calculated for the determination of the mass flow of methane in the residual gas on a dry basis during the time period t ($F_{CH4,RG,t}$). While $F_{CH4,RG,t}$ is used for the determination of the parameter $PE_{flare,y}$ (project emissions from flaring the residual gas), the assumption that the gaseous stream is dry (conservatively applicable for calculating project emissions) would not be conservative in this case as an overestimation of the amount of methane in the residual gas would actually increase the calculated efficiency of the flares, thus resulting in a reduction of $PE_{flare,y}$ and consequent increment of emission reductions.

Determined (calculated) values for $\eta_{flare,m} = \eta_{flare,calc,y}$ for the considered monitoring period	($\eta_{flare,calc,y,flare-1}$)	($\eta_{flare,calc,y,flare-2}$)	($\eta_{flare,calc,y,flare-3}$)	($\eta_{flare,calc,y,flare-4}$)
	0.9999593	0.9999521	0.9999532	0.9999578

As per the applied monitoring procedure, compliance with operational and maintenance requirements for the flares, as established by the *ex-ante* determined parameter "Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval" ($SPEC_{flare}$), is also considered for the determination and application of the values of $\eta_{flare,m} = \eta_{flare,calc,y}$ for the determination of $F_{CH4,PJ,y} = F_{CH4,flared,y}$ along the considered monitoring period. This is reflected in the monthly emission reduction spreadsheets. Data records for the monitoring parameter "Flame detection of flare in the minute *m*" ($Flame_m$) are also considered for the determination and application of the values of $\eta_{flare,m}$ for the determination of values of $F_{CH4,PJ,y} = F_{CH4,flared,y}$ along the considered monitoring period. This is reflected in the monthly emission reduction spreadsheet

For each installed flare, the time the flare has operated is determined by monitoring the flame combustion status/condition by using an UV flame detector (of which status signal (flame status "*on*" or "*off*") is continuously recorded and reported). Moreover, the monitoring requirements related to operational requirements/conditions for the flare (as provided by the manufacturer's specifications for operating conditions as per the ex-ante determined parameter $SPEC_{flare}$ (min. and max. flow of LFG to the flares + temperature of exhaust gas of the flares + meeting of maintenance requirements) are also considered in the context of the application of determined values for $\eta_{flare,m}$ along the considered monitoring period. As outlined in the monthly emission reduction spreadsheets, for each minute *m* within the considered monitoring period when the flare have combusted LFG by not operating in accordance with the operational criteria as established by the ex-ante estimated parameter $SPEC_{flare}$ (in terms of LFG flow, temperature of exhaust gas or maintenance practice), no destruction of methane is accounted for the flare as part of the calculation values of $F_{CH4,PJ,y} = F_{CH4,flared,y}$ achieved by the project activity.

For the considered monitoring period, the accumulated value for $F_{CH4,PJ,y} = F_{CH4,flared,y}$ is calculated as 20,499 tCH_4.

For the considered monitoring period, baseline emissions of methane from the SWDS ($BE_y = BE_{CH4,y}$) are calculated as 361,013 tCO_2e. The summarized emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) summarizes the determination of $BE_y = BE_{CH4,y}$ for the considered monitoring period.

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

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As outlined in the PDD, the operation of the project activity requires consumption of both grid-sourced electricity and Liquefied Petroleum Gas (LPG). As also established in the PDD, project emissions due to consumption of these energy carriers are determined by following the applicable

guidance of the "Tool to calculated baseline, project and/or leakage emissions from electricity consumption" and "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion", respectively.

Project emissions (PE_y) for the considered monitoring period are determined (in tCO_2e) as follows:

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

Where:

$PE_{EC,grid,y}$ Project emissions due to the consumption of grid-sourced electricity by the project activity

$PE_{LPG,y}$ Project emissions due to the consumption of LPG by the project activity

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

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

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

Where:

$TDL_{grid,y}$ Average technical transmission and distribution losses for grid-sourced electricity consumed by the project activity in year *y*. $TDL_{grid,y}$ is ex-ante selected as 20%. Further details about the ex-ante determined parameter $TDL_{grid,y}$ are included in Section D.1 and in the registered PDD valid for the 2nd 7-year renewable crediting period for the project activity.

$EC_{PJ,grid,y}$ Quantity of grid sourced electricity consumed by the project activity in year *y*. As per the applied monitoring procedure, monthly records of grid-sourced electricity consumption valid for the considered monitoring period are summarized below:

Month	Amount of consumed grid electricity (MWh)
Jun. 2014 (13 Jun 2014 to 30 Jun 2014)	65.0
Jul. 2014	98.6
Aug. 2014	92.7
Sep. 2014	76.6
Oct. 2014	60.5
Nov. 2014	79.3
Dec. 2014	78.0

Additional monitoring details about the monitoring parameter $EC_{PJ,grid,y}$ are included in Section D.2.

$EF_{EL,grid}$ Emission factor for grid sourced electricity in year *y*. $EF_{EL,grid}$ is determined as the combined margin emission factor ($EF_{grid,CM,y}$) that is calculated as the weighted average of the operating margin and build margin emission factors. To weight these

two factors, the default values applicable to both for the 2nd crediting period are applied. The combined margin emission factor is thus obtained as follows:

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

Where:

w_{OM} Weighting of operating margin emissions factor. w_{OM} is ex-ante selected as 0.25%. Further details about the ex-ante selected parameter w_{OM} are included in Section D.1 and in the registered PDD valid for the 2nd 7-year renewable crediting period for the project activity.

w_{BM} Weighting of operating margin emissions factor. w_{BM} is ex-ante selected as 0.75%. Further details about the ex-ante selected parameter w_{BM} are included in Section D.1 and in the registered PDD valid for the 2nd 7-year renewable crediting period for the project activity.

$EF_{grid,OM}$ Operating margin CO_2 emission factor in year *y*. As per the applied monitoring procedure, the selected value for the monitoring parameter $EF_{grid,OM,y} = EF_{grid,OM-DD,y}$ (0.5822 tCO_2/MWh) represents to the official average value for year (vintage) 2014 as calculated and made public available by the DNA of Brazil. Further details about the monitoring parameter $EF_{grid,OM}$ are included in Section D.2.

$EF_{grid,BM}$ Build margin CO_2 emission factor in year *y*. $EF_{grid,BM}$ is ex-ante determined as 0.2010 tCO_2/MWh. Further details about the ex-ante determined parameter $EF_{grid,BM}$ are included in Section D.1.

For the considered monitoring period, project emissions due to the consumption of grid-sourced electricity by the project activity ($PE_{EC,grid,y}$) are calculated as follows:

$PE_{EC,grid,y}$ = 550.63 MWh * (0.25 * 0.5822 tCO_2/MWh + 0.75 * 0.2010 tCO_2/MWh) = 196 tCO_2 (rounded value)

The summarized emission reduction calculation spreadsheet (that is enclosed to this Monitoring Report) includes all calculations related to the determination of $PE_{EC,grid,y}$ for the considered monitoring period.

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

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

Where:

$FC_{LPG,y}$ Quantity of LPG consumed by the project activity in year *y*. As per the adopted monitoring procedure, during the considered monitoring $FC_{LPG,y}$ is determined as 405 kg (0.405 ton) of LPG. Additional monitoring details for the monitoring parameter $FC_{LPG,y}$ are included in Section D.2.

$COEF_{LPG,y}$ CO_2 emission coefficient for LPG. As established in the PDD valid for the 2nd 7-year crediting period of the project activity, $COEF_{LPG,y}$ is determined by following applicable guidance as per Option B of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" as follows:

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

Where:

$EF_{CO2,LPG,y}$	CO_2 emission factor of fuel LPG (in energy basis). As per the applied monitoring procedure, $EF_{CO2,LPG,y}$ is determined as 0.0656 tCO_2/GJ. Further details about the monitoring parameter $EF_{CO2,LPG,y}$ are included in Section D.2.
$NCV_{LPG,y}$	Net calorific value of the fuel LPG. As per the applied monitoring procedure, $NCV_{LPG,y}$ is determined as 49.2 GJ/ton for the considered monitoring period. Further details about the monitoring parameter $NCV_{LPG,y}$ are included in Section D.2

Thus, $COEF_{LPG,y}$ = 0.0656 tCO_2/GJ * 46.5 GJ/ton = 3.05 tCO_2/ton

In summary, $PE_{LPG,y}$ is calculated as follows:

$PE_{LPG,y}$ = 0.405 ton LPG * 3.05 tCO_2/ton LPG = 1.24 tCO_2

Project emissions due to the consumption of LPG are thus determined as 2 tCO_2 (rounded value). The summarized emission reduction calculation spreadsheet (that is enclosed to this Monitoring Report) includes all calculations related to the determination of $PE_{LPG,y}$ for the considered monitoring period.

Total project emissions (PE_y) are calculated as 198 tCO_2 (rounded value).

E.3. Calculation of leakage

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Not applicable.

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

Emission reductions achieved by the project activity during the considered monitoring period are determined as the difference between baseline emissions (BE_y) and project emissions (PE_y) determined for such period. Calculations of baseline emissions (BE_y) are presented in Section E.1. Calculations of project emissions (PE_y) are presented in Section E.2. As summarized in the table below, during the monitoring period from 13/06/2014 to 31/12/2014, achieved emission reductions are calculated and reported as 360,815 tCO_2e (rounded value):

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	361,013	198	-	360,815

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)	566,817[16]	360,815

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

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Achieved emission reductions for the project activity are about ~64% lower than the calculated value of ex-ante estimation of emission reductions as per the PDD that is comparable/proportional for the considered 202-day monitoring period. The following aspects justify and explain the relative difference between such value for ex-ante estimation of emission reductions as per the PDD (calculated as equivalent for the considered monitoring period) and emission reductions actually achieved by the project activity during the considered monitoring period:

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:

1) *Uncertainties associated with the application of First Order Decay (FOD) multi-phased model for estimating the emission reductions in the PDD:*

[16] The 566,817 tCO_2e value is calculated as the share of estimated emission reductions for year 2014 to be achieved during the 202 day length considered monitoring period. Such estimates are calculated as 1,024,199 tCO_2e * 202/365.

As outlined in the PDD, like other similar CDM project activities encompassing LFG collection and destruction/utilization, the amount of methane to be generated by decomposition of MSW disposed at the CTR Caieiras landfill and collected by the project activity was derived by applying the First Order Decay (FOD) model as per the methodological tool "Emission from Solid Waste Disposal Sites" (version 06.0.1) in the context of the determination of ex-ante estimated emission reductions to be achieved during the 2nd 7-year renewable crediting period. By taking in account all potential uncertainties associated with the application of such multi-phased decay model, it is reasonable to assume that, in the particular case of the project activity during the considered monitoring period, the application of this model somehow overestimated the amount of LFG to be actually generated and collected by the project activity. In this particular context, it is crucial to note that, while the PDD assumes a LFG collection efficiency of 92.80% (ex-ante determined parameter "Efficiency of the LFG capture system that will be installed in the project activity" (η_{PJ})) in the context of the ex-ante estimates of emission reductions, as outlined in Section A.1 and B.2, during the considered monitoring period there were relevant number of LFG collection wells and conventional LFG venting/combustion drains that were not connected to project activity, thus negatively affecting the collection efficiency of LFG generated in the site during the considered period. Besides of minor uncertainty aspects, this particular aspect represents a relevant negative impact over emission reductions achieved during the period (when compared to estimates in the PDD).

2) *Lack of LFG collection infrastructure covering all area of the very large CTR Caieiras landfill:* As outlined in the PDD (under Footnote 63 (Section B.6.1) and Footnote 79 (Section B.6.2)), significant amount of methane generated by the project activity has unfortunately not been collected and destroyed due to the lack of LFG collection infrastructure covering all area of the very large CTR Caieiras landfill.

3) *Time periods with flares not operating as per manufacturer's specifications (operational requirements) for temperature and/or flow rate:*
During the considered monitoring period, the project activity operated with one or more flare(s) not operating as per manufacturer's specifications (operational requirements) for temperature and/or flow rate during limited time periods. As established by applicable guidance of the methodological tool "Project emissions from flaring", during such time periods, where non-compliance with operational requirements for the installed flares occurred, the efficiency for combustion of methane in the flare(s) in question was considered as null (zero), negatively affecting emission reductions achieved by the project activity during 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)	-	360,815 tCO_2e

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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.
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Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for completing the CDM-MR-FORM
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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.

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