MONITORING REPORT FORM (F-CDM-MR)
Version 02.0

MONITORING REPORT

Title of the project activity	Caieiras landfill gas emission reduction
Reference number of the project activity	0171
Version number of the monitoring report	1
Completion date of the monitoring report	08/05/2012
Registration date of the project activity	09/03/2006
Monitoring period number and duration of this monitoring period	Monitoring period: #6 01/09/2011– 31/03/2012
Project participant(s)	Essencis Soluções Ambientais S.A. Electric Power Development Co., Ltd.
Host Party(ies)	Brazil
Sectoral scope(s) and applied methodology(ies)	CDM Sectoral Scope 13 – Waste handling and disposal. ACM0001 - Consolidated baseline methodology for landfill gas project activities (version 2)
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	313,402 tCO_2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	520,370 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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

(i) Capturing of LFG
(ii) Destruction of all captured LFG by combustion (in high temperature enclosed flares).

As indicated in the registered PDD, the project design also includes, as an alternative, share of collected LFG being supplied/exported as gaseous fuel to a local industry (in order to be combusted in boilers). Also as per the registered PDD, share of collected LFG could eventually be used as fuel for electricity generation (for meeting the electricity demand of the project activity as well as for meeting electricity demand for the CTR Caierias landfill. However, these LFG utilization alternatives are so far not implemented and not foreseen.

By the end of the monitoring period from 01/09/2011 to 31/03/2012, the implemented project's LFG collection system encompassed about 264 vertical LFG collection wells all interconnected through perforated concrete pipes surrounded by gravel. No horizontal LFG collection trenches have so far been utilized for collecting LFG.

During the considered monitoring period, LFG was collected from the landfill by the utilization of 5 blowers which are connected to the LFG collecting pipeline.

As part of the operation of the project activity, all collected LFG is conducted to a main pipe and sent to the enclosed high temperature flares for combustion. As required by ACM0001 (version 2) baseline and monitoring methodology, the amount and quality of collected LFG sent to the flares have been continuously measured, recorded and reported along the considered monitoring period (LFG flow, CH_4 content of collected LFG, temperature of LFG, pressure of LFG).

During the considered monitoring period, all collected LFG was directed to 3 enclosed flares for combustion at high temperature. The temperature of the exhaust gases of the flares have also been continuously measured recorded and reported in order to confirm whether flares were operating above 500^oC whenever related GHG emission destructions of methane destruction are claimed. Flare operating above 500^oC is a pre-requisite for accounting emission reductions achieved by the project activity.

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

During the monitoring period from 01/09/2011 to 31/03/2012 the project activity was implemented and has operated under the following configuration:

- 5 blowers with capacity to 4,000 Nm^3/h of LFG each.
- 3 enclosed high temperature flares.
- All required monitoring instruments/equipment for measuring LFG related parameters, temperature of the exhaust gas of the flares and grid electricity consumption.

- MSW disposal area covered by the LFG collection wells of the project activity of about 180,000 square meters (area with about 2,050,000 ton of accumulated disposed MSW (approximately 195 wells were connected to high density polyethylene (HDPE) LFG collection pipeline network with more than 70% of the existing LFG wells actually connected in the average[1].

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

The project's LFG collection and destruction system was completely implemented in February 2007. Essencis Soluções Ambientais S.A. has quality and control (QA/QC) and environmental management (EMS) system. The company's ISO 9001 and ISO 14001 certified QA/QC/EMS system were earlier implanted on 08/06/2006 and the scope of this QA/QC/EMS system currently also encompasses the operational tasks for the project activity in its scope.

A.2. Location of project activity

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

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

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

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	Essencis Soluções Ambientais S.A.	No
Japan	Electric Power Development Co., Ltd.	No

A.4. Reference of applied methodology

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

[1] As part of the normal operation of the CTR landfill and also as part of the normal operation of the project activity, some of the LFG extracting wells are often temporarily disconnected from the project's LFG collection pipeline in order to facilitated activities of MSW disposal and compacting (allowing transit of machinery (wheel loaders and excavators) and trucks) as part of the normal operations of the CTR landfill. Furthermore, sometimes, some of the LFG extracting wells are often temporarily disconnected from the LFG collection pipeline in order to allow repair and maintenance related services in the project's LFG pipeline and LFG wells network (welding services, repositioning of the LFG pipeline, maintenance in the head of the LFG wells, etc.).

For the considered monitoring period, the following tools are also adopted for the determination of project emissions due to the consumption of grid electricity and liquefied petroleum gas (LPG) by the project activity respectively:

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

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

A.5. Crediting period of project activity

From 31/03/2006 to 30/03/2013[2] (7-year renewable crediting period)

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

The total technical MSW disposal capacity for the CTR landfill is about 60,000,000 ton of MSW. By the end of the considered monitoring period, an accumulated quantity about 6,000,000 ton of MSW was disposed in the project site. Within the monitoring period, MSW has disposed with an average rate of about 1,000,000 ton of MSW per year[3]. The CTR 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 264 operational LFG collecting wells interconnected through a high density polyethylene pipeline network. The LFG collecting wells are used to extract LFG from inner section of the landfill. Captured LFG is transported to the project's LFG destruction facility (enclosed high temperature flares) through the high density polyethylene pipeline passing through condensation pots (where most of the humidity is removed by condensation).

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

[2] No post-registration changes in the starting date of the crediting period have occurred.

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

Fraction of CH_4 in the collected LFG and LFG flow (parameters $w_{CH4,y}$ and $LFG_{flare,y}$) are assumed as monitored on the same basis. This is a requirement of most recent version of ACM0001 methodology for the determination of amount of methane sent to the flares[4].

As per the construction and operational design of the CTR landfill, a geo-membrane of PVC or similar material is only expected to be implemented by the time of the closure of the cells of the landfill. While no cell of the CTR landfill has achieved it is final configuration, no geo-membrane has been installed in the project site so far.

During the whole monitoring period from 01/09/2011 to 31/03/2012, the project's LFG destruction facility operated under the following equipment/instrument configuration[5]:

- 3 Condensation trap to separate liquids in the collected LFG (leachate and condensate);
- 1 Blower manufactured by Anton Blaselbauer Artécnica Ltda. with nameplate power of 125 HP.
- 2 Blower manufactured by Anton Blaselbauer Artécnica Ltda. with nameplate power of 100 HP.
- 2 Blower manufactured by Anton Blaselbauer Artécnica Ltda. with nameplate power of 200 HP.
- LFG Monitoring equipment/instruments:
    - 1 LFG flow meter,
    - 1 LFG temperature sensor,
    - 1 LFG pressure sensor,
    - 1 $CH_4/O_2/CO_2$ content gas analyzer,
    - 1 thermocouple in each enclosed flare (to measure temperature in the exhaust gases of the flare).
- 3 high temperature enclosed flares manufactured by BTS Termodinâmica.
- 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 (to measure the consumption of electricity by the project activity related equipments).

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

The project activity was implemented and remains being operated without having any 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.

[4] E.g. The most recent version of ACM0001 (version 12) refers to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". As per this tool, it is assumed that moisture is not relevant when gas temperature is relative low (within the range of 60°C), Further UNFCCC's guidance as per the Requests of Clarification AM_CLA 0092 and AM_CLA116 are also taken into account in the context of project's monitoring and related emission reduction calculations. These Requests for Clarification for the application of ACM0001 were earlier raised in the context of verifications of other LFG collection and destruction/utilization CDM project activities:

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

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

[5] One additional high temperature enclosed flare was installed in 24 December 2011, but so far it is not connected to the LFG collection system, thus no collected LFG was sent to the fourth high temperature enclosed flare.

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

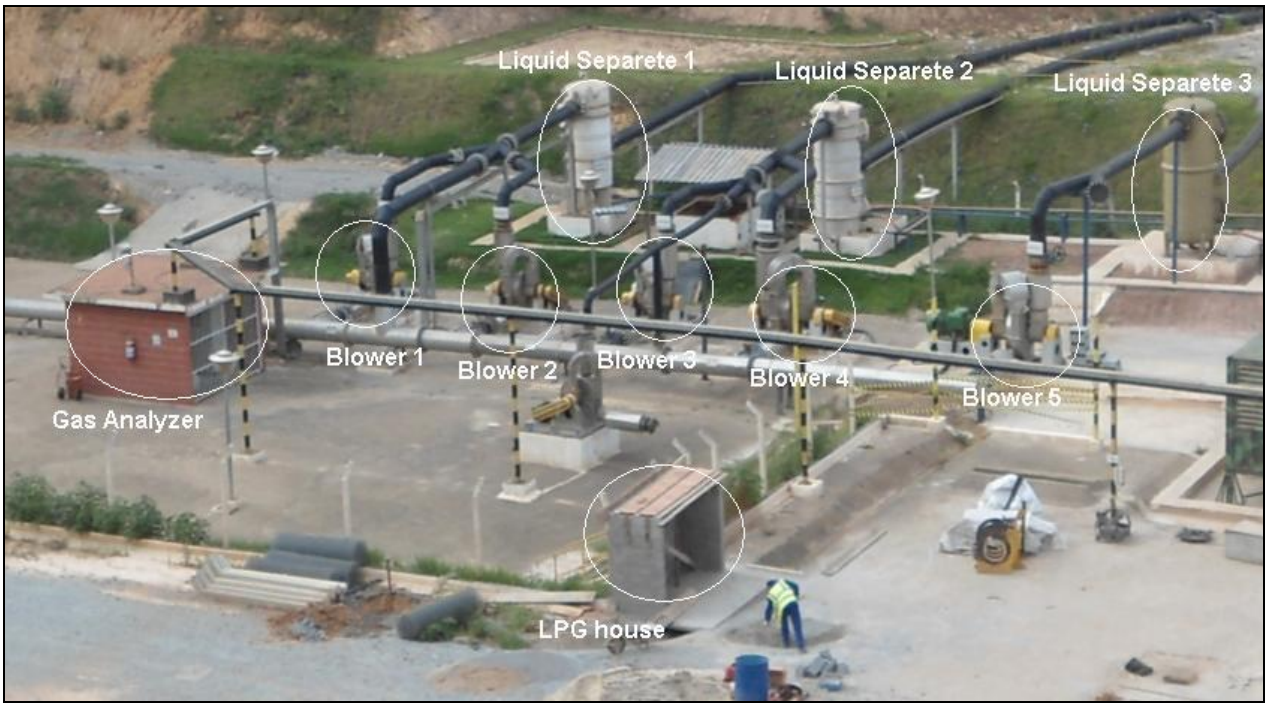

Figure 1 – Partial view of the LFG destruction station (LFG pipeline, blowers and condensation traps)

Figure 2 – Partial view of the LFG destruction plant (enclosed high temperature flares) (picture dated September 2011, before the installation of the fourth enclosed high temperature flare)

Figure 3 – Partial view of the LFG destruction plant (enclosed high temperature flares and location of the CH_4 content gas analyzer) (picture dated January 2012).

Figure 4 – LFG flow meter (view of the data converter/transmitter unit)

Figure 5 – LFG temperature sensor

Figure 6 – LFG pressure sensor

Figure 7 - Thermocouple (to measure temperature of the exhaust gases of the flare)

Figure 8 – Electricity meter 1 (for measuring electricity consumption of the project activity – except of blower No. 4)

Figure 9 - Electricity meter 2 (for measuring electricity consumption by blower No. 4)

In general, the project activity has been implemented and operated in accordance with the earlier conceived project design (as described in the registered PDD). The construction of the entire LFG capture and destruction system (by flaring) was initiated in March 2006 and was finished in December 2006. Related testing and commissioning phases occurred in January 2007. The official starting of monitoring data measurement and recording initiated on 1 February 2007.

B.2. Post registration changes

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

Not applicable.

B.2.2. Corrections

Not applicable.

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

Not applicable.

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

Not applicable.

B.2.5. Changes to start date of crediting period

Not applicable.

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

Not applicable.

SECTION C. Description of monitoring system

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

Every minute, continuous measurement of LFG flow, LFG pressure, LFG temperature, LFG CH_4 content, LFG O_2 content, LFG CO_2 content[6] and temperature of the exhaust gas of the each operational flare are processed by the project's PLC unit and are recorded by SQL format database (which is available at project's control room). The project's SQL based database was designed by Doxor Serviços de Instalações e Montagens Industriais Ltda.

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

- One MS-Excel spreadsheet file and a one PDF format file containing all LFG related monitoring records for the period are generated by the project's operational staff.

- While data in MS-Excel format is handled as a primary data input for the emission reduction calculations, the PDF format files (which also lists/reports all LFG related monitoring records in a table format with a frequency of every 1 minute are kept as proof of authenticity of MS-Excel based data which is actually used for emission reduction calculations. Authentic every minute LFG monitoring data are records in both pdf format and MS-Excel format files. The pdf format data is used as proof of authenticity of MS-Excel data used in the context of the emission reduction calculations[7].

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

The project's supervisory system (which is connected to the SQL database) includes in its user interface functionalities (controls) to generate a MS-Excel spreadsheet data file and a PDF data file every week upon request of the system user. This is outlined in Figures 10, 11 and 12 below.

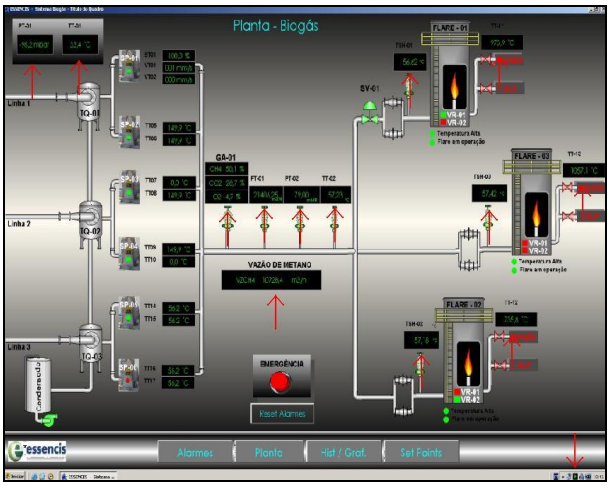

Figure 10 – The user interface (main screen) of supervisor system

Figure 11 – User interface of the supervisor system (highlighting function which is used to create the MS-Excel and PDF files with available every minute records of monitoring data in a monthly basis)

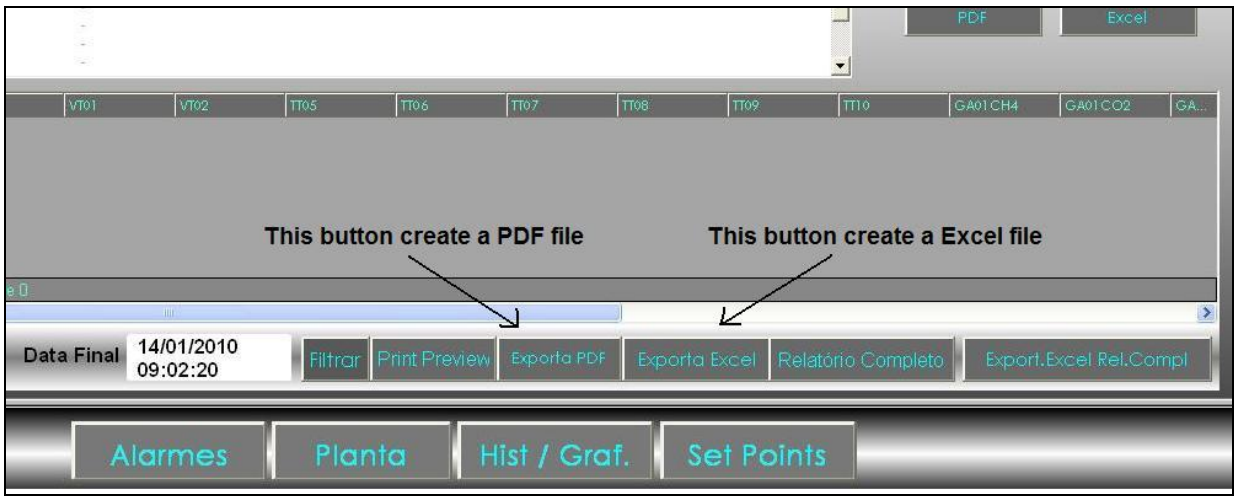

Figure 12 – Zoom of figure 10 showing the buttons (controls) in the user interface of the supervisory system which are used to generate MS-Excel and PDF files with every minute monitoring data in a monthly basis

As per the project's operational procedure for data monitoring and data reporting, the following steps are weekly performed by the project operational staff:

1) Every month it is generated a MS-Excel spreadsheet data file with LFG related monitoring records (raw data files).
2) The content of every monthly raw data file (in MS-Excel format) is copied and pasted into a customized monthly MS-Excel based emission reduction calculation spreadsheet template/model

(designed by Essencis Soluções Ambientais S.A). This MS-Excel template is internally denominated as "IMP 403 –Dados Registrador Isodoc". In this spreadsheet, all LFG related monitoring data records for every month of the monitoring period in question are reported as follows:

- It is calculated and reported every-minute and accumulated values for LFG volume (in Nm^3) by using every-minute monitoring records of LFG flow (in m^3/h), LFG Pressure (in mbar) and the LFG Temperature (in ^oC);
- It is calculated and reported every-minute and accumulated values for CH_4 volume (in Nm^3) by using every-minute records for LFG volume and every minute records for LFG CH_4 fraction (%);
- It is calculated and reported every-minute and accumulated values for CH_4 mass (in ton CH_4) by using every-minute records of CH_4 volume and ex-ante determined value for methane density (D_{CH4})
- By considering the ex-ante determined values of AF and GWP_{CH4} as well as determined values of FE, it is calculated and reported every-minute and accumulated values for MD_{flare} (which is equal to $MD_{project}$).

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

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

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

The diagram bellow shows the hierarchy for the project management.

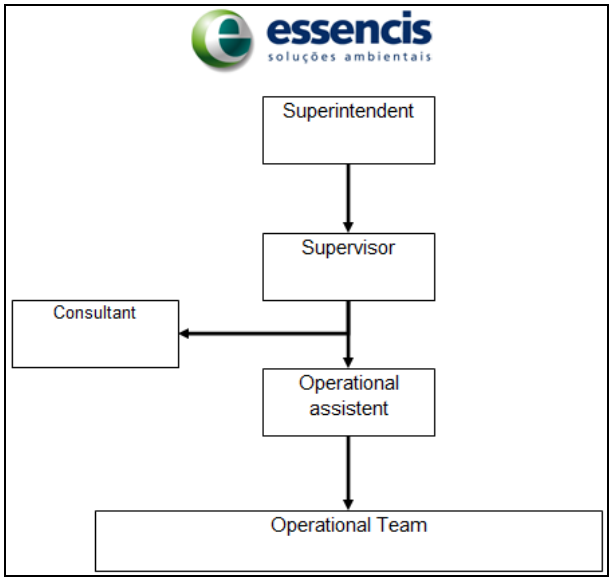

Figure 13 - Hierarchy for the project management

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

Data/Parameter	**D_{CH4}**
Unit	tCH_4/ m^3CH_4 (STP)
Description	Density of methane.
Source of data	Default value (as per consolidated baseline and monitoring methodology ACM0001 (version 2)).
Value(s) applied	0.0007168
Purpose of data	Data is used for the determination of baseline emissions.
Additional comment	-

Data/Parameter	**AF**
Unit	-
Description	Adjustment Factor
Source of data	Determined considering the assumed amount of methane that would be collected and destroyed in the absence of the project activity (baseline scenario).
Value(s) applied	20%
Purpose of data	Data is used for the determination of baseline emissions.
Additional comment	-

Data/Parameter	**GWP_{CH4}**
Unit	tCO_2e/ tCH_4
Description	Global Warming Potential (GWP) for methane
Source of data	IPCC Second Assessment Report (SAR), 1995
Value(s) applied	21
Purpose of data	Data is used for the determination of baseline emissions.
Additional comment	-

D.2. Data and parameters monitored

Data/Parameter	**LFG_{flare}** [8]
Unit	Nm^3
Description	Amount of landfill gas flared (parameter I.D 3.2 in the monitoring plan of the registered PDD)
Measured/Calculated /Default	Continuously measured by a LFG flow meter
Source of data	Measurements performed by a LFG flow meter located in the main LFG pipeline.
Value(s) of monitored parameter	Values of LFG flow are reported in every-minute basis in the monthly emission reduction calculation spreadsheets ("IMP 403" spreadsheet files which are enclosed to the Monitoring Report).
Monitoring equipment	Measurements are performed by a LFG flow meter with the following specifications: *Specifications and calibration details for the installed LFG flow meter:* The installed flow meter set includes 2 main components: • An annubar element (differential pressure measurement principle device (which is installed inside the LFG pipeline)) • A data converter/transmitter which is coupled to the annubar element. Manufacturer: • The data converter/transmitters are manufactured by Yokogawa Electric Corporation • The annubar element is manufactured by Digimat Montagem e Instrumentação Ltda. Model: • Data converer/transmitter: EJA110A • Annubar element: Sonda 6 Accuracy: • Data converter/transmitter: ±0.065% • Annubar element: ±2% (annubar element) Serial number (S/N): • Data converter/transmitter: 27EA26928 • Annubar element: There is no S/N for the installed annubar element.

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

	Calibration frequency and/or maintenance requirements[9]: • Data converter/transmitter: calibration is to be performed yearly (as established by the equipment manufacturer). • Annubar element: the instrument manufacturer recommends the performance of a calibration event or metrology analysis in the annubar element every 5 years. The metrology analysis, as an alternative to the calibration procedure, aims to confirm the dimensional integrity of the instrument (which is a required condition for its proper functioning). Calibration events valid for the monitoring period from 1 September 2011 to 31 March 2012: • Data converter/transmitter: FT01: calibration event was performed on 18/05/2011 by Elus Serviços de Instrmentação Ltda. Calibration certificate: Ellus E1192/11. • Annubar element: A calibration event was performed on 18/03/2011 by Elus Serviços de Instrumentação Ltda. (Certificate of Calibration No. E1194/11). The annubar element was supplied by its manufacturer/distributor already calibrated prior to be installed in the project site.
Measuring/Reading/ Recording frequency	Continuously measurements are recorded and reported every minute.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	As per the implemented maintenance/calibration procedure at Essencis Soluções Ambientais, the LFG flow meter's data converter/transmitter EJA110A and the annubar element are calibrated annually and every 5 years respectively. Related data collection, data recording and data reporting procedures are implemented as per company's ISO 9001 and 14001 certified quality and environmental management system.
Purpose of data	Data is used for the determination of baseline emissions.
Additional comment	-

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

Data/Parameter	FE
Unit	-
Description	Flare combustion/efficiency (parameter I.D 3.5 in the monitoring plan of the registered PDD)
Measured/Calculated /Default	FE is determined *inter-alia* on the basis of regular measurements of the amount of residual methane content in the exhaust gas of the flare (every 3 months), which are performed by a third party independent inspection service company. The operational status of the flare (which is also considered in the context of the determination of adopted FE values for every minute of the considered monitoring period) is also determined based on continuous monitoring of the temperature of exhaust gas of the flares (T_{flare}). Whenever flare temperature is lower than 500^{o}C, no emission reduction is claimed for the time instant in question.
Source of data	Related measurements and calculations applicable for the determination of periodical values for FE were performed by the third party independent inspection service company "Ecosampling Ambiental Ltda." The efficiency of the flares (FE) was determined on basis of: - measurements of residual concentration of methane in collected samples of the exhaust gas of the flares - out flow of exhaust gas in the flare being evaluated - inflow of methane in the flare being evaluated
Value(s) of monitored parameter	As a conservative approach, the selected values for the monitoring parameter FE are determined as the lower calculated value on each efficiency test. A maximum and a minimum value for FE were determined as part of each performed test. Results for the measurement/calculation events for the determination of FE valid for the considered monitoring period are presented below:

Test Number	Date	Applied value
1st FE periodic test	01/06/2011	99.9957%
2nd FE periodic test	05/09/2011	99.9946%
3rd FE periodic test	07/12/2011	99.9947%

	Each one of the selected values of FE are applied in the calculation of the parameter $MD_{project,y}$ during the period starting on the day when the related measurements for the determination of FE were performed and ending in the day prior to the day the related measurements in the context of the sequential next FE determination test event were performed.
Monitoring equipment	As per information made available in the test/evaluation technical reports issued by the third party independent inspection service company "Ecosampling Ambiental Ltda.", the measurements of residual methane in the flare were performed by using a gas analyzer manufactured by FID /

	California Analytical Instruments (CAI), model 300 HFID. The methodology applied in the analysis is described in Method 3 – "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air and Dry Molecular Weight", Method 4 - "Determination of Moisture in Stack Gases", Method 25A – "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer" all from EPA – Environmental Protection Agency. For determining the speed of exhaust gas in the flare (in order to calculate the flow of exhaust gas of the flare), a Pitot tube was used. Specifications of the thermocouple used for monitoring temperature of exhaust gas on Flare 1 (TT11): - Manufacturer: Naka Instrumentação Industrial Ltda. - Model: NKTC-3000, type K - Accuracy: ±0.5% - Serial Number: 51748 - Instrument internal identification number: TT 11 - Calibration frequency (as specified by the monitoring methodology/tool): periodically calibrated by an officially accredited entity - Calibration frequency (as per the application of the monitoring plan): yearly - Calibration Date: 02/05/2011 (Calibration Certificate: 7416-11) - Entity/company responsible for the calibrations: Contemp Laboratório de Metrologia - Specifications of the thermocouple used for monitoring temperature of exhaust gas on Flare 2 (TT12): - Manufacturer: Naka Instrumentação Industrial Ltda. - Model: NKTC-3000, type S - Accuracy: ±0.5% - Serial Number: 51856 - Instrument internal identification number: TT 12 - 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: 03/05/2011 (Calibration Certificate: 7495-11) - Entity/company responsible for the calibrations: Contemp Laboratório de Metrologia Specifications of the thermocouple used for monitoring temperature of exhaust gas on Flare 3 (TT13): - Manufacturer: Naka Instrumentação Industrial Ltda. - Model: NKTC-3000, type K - Accuracy: ±0.5% - Serial Number: 51747 - Instrument internal identification number: TT 13 - 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: 02/05/2011 (Calibration Certificate: 7417-11) - Entity/company responsible for the calibrations: Contemp Laboratório de Metrologia
Measuring/Reading/ Recording frequency	Measurement frequency: - FE is calculated every 3 months. - Temperature of exhaust gas of the flares (T_{flare}): continuously measurements are recorded/reported every minute.
Calculation method (if applicable)	See Section E.1.
QA/QC procedures	-
Purpose of data	Data is used for the determination of baseline emissions.
Additional comment	-

Data/Parameter	$w_{CH4,y}$
Unit	%
Description	Methane fraction in the landfill gas (parameter I.D 3.6 in the monitoring plan of the registered PDD)
Measured/Calculated /Default	Continuously measured with a CH_4 content gas analyzer.
Source of data	Monitored in the main LFG pipeline before the flares.
Value(s) of monitored parameter	Monitoring records (with every-minute frequency) are presented in the monthly emission reduction calculation spreadsheet.
Monitoring equipment	*Specifications and calibration details for the installed CH_4 content gas analyzer:* - Manufacturer: Yokogawa Instrument Corporation - Model: IR200 - Accuracy: ±2.0% - Serial Number: 6EG5195 - Instrument internal identification number: GA - Calibration frequency (as specified by the monitoring methodology/tool and/or in the PDD): no calibration frequency is specified. - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibrated every 15 days by a qualified operator - Dates for performed calibration events valid for the considered monitoring period: 23/08/2011; 06/09/2011; 16/09/2012; 26/09/2011, 06/10/2011; 17/10/2011; 25/10/2011; 16/11/2011; 25/11/2011; 12/12/2011; 26/12/2011; 03/01/2012; 13/01/2012; 30/01/2012; 07/02/2012; 21/02/2012; 27/02/2012; 12/03/2012; 22/03/2012; 02/04/2012; - Entity/company responsible for the calibrations: all calibrations were performed by trained responsible staff of Essencis Soluções Ambientais S.A. by following the applicable working procedure "PRO 405 Calibração Analisador de Gases". Calibration events were performed by using certified span gas cylinders with a known composition. Certified span gases utilized for the calibration events valid for the monitoring period: - Gas cylinders with 60% CH_4 span gas: cylinder n° 11916 Gas cylinders with 60% $_CH_4$ span gas: cylinder n° 13874F - Gas cylinders with 60% CH_4 span gas: cylinder n° 14028D All certified span gas cylinders were supplied by White Martins Gases Industriais Ltda.
Measuring/Reading/ Recording frequency	Continuously measurements are recorded/reported every minute.

Calculation method (if applicable)	Not applicable.
QA/QC procedures	Regular maintenance and testing regime to ensure accuracy. No valid calibration event was performed along the following periods: - 9 November 2011 to 16 November 2011; - 10 December 2011 to 12 December 2011; - 28 January 2012 to 30 January 2012. By taking into account UNFCCC's "Guidance for assessing compliance with the calibration frequency compliance", a correct conservative deduction factor was applied for the related periods. Two of the results of calibrations performed in the $CH_4/CO_2/O_2$ gas analyzer revealed positive deviations/error beyond the maximum permissible error of the measuring instrument (±2.0). A deduction factor was applied in order to correct this inconsistency on the following periods: - 06 September 2011 to 16 September 2011; - 13 January 2012 to 30 January 2012.
Purpose of data	Data is used for the determination of baseline emissions.
Additional comment	-

Data/Parameter	**T**
Unit	ºC
Description	Temperature of the landfill gas (parameter I.D 3.7 in the monitoring plan of the registered PDD) .
Measured/Calculated /Default	Continuously measured by a LFG temperature sensor
Source of data	Monitored in the main LFG pipeline before the flares.
Value(s) of monitored parameter	Monitoring records (with every-minute frequency) are presented in the monthly emission reduction calculation spreadsheet.
Monitoring equipment	*Specifications and calibration details for the LFG temperature sensor:* - Manufacturer: Pressgage Instrumentos de Medição e Controle - Model: STP 100 - Accuracy: ±1.0% - Serial Number (S/N): 32057 - Instrument internal identification number: TT 02 - 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 event valid for the considered monitoring period: 25/01/2011 (Calibration Certificate 1522-11 - Entity/company responsible for the calibrations: Contemp Laboratório de Metrologia Ltda.
Measuring/Reading/ Recording frequency	Continuously measurements are recorded/reported every minute.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	-
Purpose of data	Data is used for converting values of LFG flow to normalized cubic meters per hour (as required by ACM0001 version 2).
Additional comment	-

Data/Parameter	**P**
Unit	Pa
Description	Pressure of the landfill gas (parameter I.D 3.8 in the monitoring plan of the registered PDD)
Measured/Calculated /Default	Continuously measured by a LFG pressure sensor
Source of data	Monitored in the main LFG pipeline before the flares.
Value(s) of monitored parameter	Monitoring records (with every-minute frequency) are presented in the monthly emission reduction calculation spreadsheet.
Monitoring equipment	*Specifications and calibration details for the LFG pressure sensor:* - Manufacturer: Pressgage Instrumentos de Medição e Controle - Model: TPI-PRESS - Accuracy: ±1.5% - Serial Number: 43608 - Instrument internal identification number: PT 02 - Calibration frequency (as specified by the monitoring methodology/tool): Periodically calibrated by an officially accredited entity - Calibration frequency (as per the application of the monitoring plan): yearly - Equipment: Pressure Meter - Calibration Date: 25/01/2011 (Calibration Certificate: 1523-11) - Entity/company responsible for the calibrations: Contemp Laboratório de Metrologia
Measuring/Reading/ Recording frequency	Continuously measurements are recorded/reported every minute.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	-
Purpose of data	Data is used for converting values of LFG flow to normalized cubic meters per hour (as required by ACM0001 version 2).
Additional comment	-

Data/Parameter	HE
Unit	-
Description	Regulatory requirements relating to landfill gas projects
Measured/Calculated /Default	Not applicable
Source of data	Publicly available information of the Brazil's regulatory requirements relating to landfill gas.
Value(s) of monitored parameter	-
Monitoring equipment	Not applicable
Measuring/Reading/ Recording frequency	-
Calculation method (if applicable)	-
QA/QC procedures	Not applicable.
Purpose of data	Baseline. So far no new regulatory requirements relating to LFG projects went into force during the crediting period. Eventual changes in the current status for regulatory requirements relating to LFG managements in landfills will be used for changes to the adjustment factor (AF) at renewal of the credit period. The Brazilian Regulation of the National Policy on Waste Management, established by Decree No. 7,404/10 (the Decree), was published on 23 December 2010. In force since its publication, this decree regulates the National Policy on Waste Management (PNRS), established by Federal Law No. 12,305/10 (the LPNRS), and creates the Steering Committee for the Implementation of Reverse Logistics Systems (Steering Committee) and the PNRS Interministerial Committee. This new Brazilian Regulation of the National Policy on Waste Management does not establish any requirement, obligation or recommendation related to LFG management at landfills in Brazil. As outlined in paper issued by the law firm "Tauil & Chequer Advogados": *"The Regulation of the National Policy on Waste Management, established by Decree No. 7,404/10 (the Decree), was published on December 23, 2010. In force since its publication, the Decree regulates the National Policy on Waste Management (PNRS), established by Federal Law No. 12,305/10 (the LPNRS), and creates the Steering Committee for the Implementation of Reverse Logistics Systems (Steering Committee) and the PNRS Interministerial Committee.* *The main purpose of the PNRS Interministerial Committee is to support the PNRS structuring and implementation, in order to enable the accomplishment of the provisions and goals set forth by the LPNRS. The Steering Committee has the basic function of guiding the implementation of reverse logistics.* *Among the instruments regulated by the Decree are the Reverse Logistics Systems, the Waste Management Plans (PGRS) and the National Registry*

	for Hazardous Waste Operators. *The Decree lists three specific instruments for the implementation and operation of the reverse logistic systems: (i) sectorial agreements, executed between public authorities and the industry; (ii) regulations, issued by the executive branch; and (iii) commitment agreements—which are to be adopted in the absence of sectorial agreements and regulations and when specific circumstances require more restrictive obligations—to be approved by the competent environmental agency.* *Regarding the obligation to prepare a PGRS, which should be required within environmental permitting proceedings, the Decree mentions the possibility of jointly submitting the PGRS under specific conditions and in cases where activities are conducted in the same condominium, municipality, micro-region or metropolitan/urban areas. Additionally, the Decree establishes that small companies that generate household waste, as provided for by article 30 of the LPNRS, are not required to submit a PGRS.* *Regarding the National Registry for Hazardous Waste Operators, which must be integrated to the already existing Federal Technical Registry of IBAMA, the Decree establishes a registration obligation for companies that manipulate or operate hazardous waste. The Decree also describes those who are considered generators or operators of hazardous waste, establishing several requirements for their authorization or permitting. These include the preparation of hazardous waste management plan, the demonstration of technical and economic capacity and the obtaining of civil liability insurance for environmental damages."*
Additional comment	-

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

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

Monthly records of grid electricity consumption valid for the considered monitoring period:
<table>
<tr><td>Month</td><td>Amount of consumed grid electricity</td></tr>
<tr><td>Sep. 2011</td><td>249.00 MWh</td></tr>
<tr><td>Oct. 2011</td><td>254.00 MWh</td></tr>
<tr><td>Nov. 2011</td><td>210.00 MWh</td></tr>
<tr><td>Dec. 2011</td><td>253.00 MWh</td></tr>
<tr><td>Jan. 2012</td><td>261.00 MWh</td></tr>
<tr><td>Feb. 2012</td><td>260.00 MWh</td></tr>
<tr><td>Mar. 2012</td><td>269.00 MWh</td></tr>
</table>

Amount of consumed LPG (FC_{LPG}): As per the adopted monitoring procedure, the total amount of LPG consumed by the project activity during the considered verification is 540 kg (0.54 ton) of LPG.

In order to address the lack of calibration evidences for the measuring equipment (weight scale used by the LPG supplier to measure the amount of LPG delivered to the project site), it is assumed that the amount of LPG consumed was 100% higher as a conservative measure. Thus,
$FC_{LPG} = 1.08\ ton_{LPG}$

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

	project activity.
Monitoring equipment	Monitoring details for "*Amount of consumed grid electricity (EC_{grid})":* Electricity consumption by the project activity was measured by electricity meters. *Specifications and calibration details for the installed electricity meters for measurements of EC_{grid}:* Electricity meter 01: - Manufacturer: KRON Instrumentos Elétricos Ltda. - Model: MULT-K - Accuracy: ±0.2% - Serial Number: 234215 - Instrument internal identification number: ME Plant Electricity meter 02 (Blower 4) - Manufacturer: Manufacturer: KRON Instrumentos Elétricos Ltda. - Model: MULT-K - Accuracy: ±0.2 % - Serial Number: 465025 - Instrument internal identification number: ME Blower 4 Calibration requirements for Electricity meter 01 and 02: - Calibration frequency (as specified by the monitoring methodology/tool): The monitoring plan of the PDD and ACM0001 (version 2) do not specify any calibration frequency requirements for the electricity meters. As per the registered PDD, all monitoring equipment must be calibrated periodically. The "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" establishes the following regarding maintenance and calibration for electricity meters: "*(...) meters should be installed, maintained and calibrated according to equipment manufacturer instructions and be in line with national standards, or, if these are not available, international standards (e.g. IEC, ISO)*". - Calibration frequency (as per the recommendation of the meter manufacturer): it is important to note that the installed meters are approved/certified by INMETRO (The Brazilian national authority for metrology and standardization issues), and they are thus in conformance with INMETRO's requirements for maintenance and testing of electricity meters. According to the instrument manufacturer, the meters are to be calibrated every 5 years. A calibration frequency of 5 years was adopted. - Date of valid calibration events: Electricity meter 01: 02/03/2007 (Calibration Certificate: 518-07) Electricity meter 02: 03/10/2008 (Calibration Certificate: 2600-08)

	- Entity/company responsible for the performed calibration events: KRON Instrumentos Elétricos Ltda. *Monitoring details for "Amount of consumed LPG"* (FC_{LPG}): 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}:* - Manufacturer: Mettler-Toledo Inc. - Model: 2180 - Capacity: max. 250 kg - Accuracy: ± 50g - Serial Number: 10423008 - Calibration frequency (as specified by the monitoring methodology/tool): The monitoring plan of the PDD and ACM0001 (version 2) do not specify any calibration frequency requirements for the electricity meters. As per the registered 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). - No calibration records were made available by the local LPG supplier Cia Ultragaz S.A.

Measuring/Reading/ Recording frequency	Accumulated values for continuous measurements of electricity consumption are recorded once a month. Amount of LPG is measured upon the supply of cylinders of LPG with 45 kg capacity each.
Calculation method (if applicable)	Not applicable.
QA/QC procedures	The amount consumed LPG consumed is cross-checked with internal records of cost expenditures for fuel LPG as per the internal financial/accounting management system of Essencis Soluções Ambientais S.A. Data collection and reporting procedures for consumption of grid electricity and LPG by the project activity are implemented as per company's ISO 9001/ISO14001 certified QA/QC and environmental management system.
Purpose of data	Data is used for the determination of project emissions.
Additional comment	-

Data/Parameter	CO2emission
Unit	- tCO_2/MWh for emission factor for consumed electricity ($EF_{grid,CM}$) - tCO_2/ ton emission factor for consumed LPG ($COEF_{LPG}$)
Description	CO_2 emission intensity of the electricity and/or other energy carriers (parameter I.D 3.10 in the monitoring plan of the registered PDD) This parameter is associated with two sub-parameters: - Emission Factor for consumed grid electricity ($EF_{grid,CM}$) - Emission factor for consumed LPG ($COEF_{LPG}$) (in mass basis)
Measured/Calculated /Default	Both $COEF_{LPG}$ and EF_{LPG} are determined on the basis of default values.
Source of data	$EF_{grid,CM}$: The applicable conservative default value as established by the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" is selected.[10] $COEF_{LPG}$: Determined as the product between Net Calorific Value (NCV) for consumed LPG (NCV_{LPG}) and CO_2 emission factor for consumed LPG (in energy basis) (EF_{LPG}) where: - NCV_{LPG} = 0.0465 TJ/ton (source: Brazilian Energetic Balance 2011) - EF_{LPG} = 63.1 tCO_2/TJ (source: IPCCC 2006)
Value(s) of monitored parameter	$EF_{grid,CM:}$ 1.3 tCO_2e/MWh $COEF_{LPG}$: 2.93 tCO_2/ ton
Monitoring equipment	Not applicable
Measuring/Reading/ Recording frequency	Not applicable
Calculation method (if applicable)	$EF_{grid,CM}$: conservative default value as established by the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". $COEF_{LPG}$: Deternined as the product between NCV_{LPG} and EF_{LPG}. *The issue about the impossibility of reporting and validating the official calculation of the CO2 emission factor for the national electricity grid of Brazil:* It is important to observe that since year 2008 the Designated National Authority (DNA) of Brazil has published only results of the calculated value for the so called official combined margin CO_2 emission factor for the national electricity grid of Brazil. Due to confidentiality reasons detailed

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

	input data and related calculations (using the dispatch analysis calculation method as per the "Tool to calculate the emission factor for an electricity system") are not made publicly available. Moreover, the Brazilian entity Operador Nacional do Sistema (ONS) does not make any dispatch data publicly available either. ONS is the entity who coordinates the dispatch of electricity by the power generation sources (power plants) connected to the electricity grid of Brazil. Thus, while detailed input data and related calculations for the ex-post monitored parameter "Combined margin emission factor for consumed grid electricity" ($EF_{grid,CM}$) are not possible to be enclosed to this Monitoring Report (as explicitly required by CDM rules and by the "Tool to calculate the emission factor for an electricity system"), it is not possible to the DOE in charge of the verification assessment for the considered monitoring period to confirm whether the determination of the value for the grid emission factor for the National Electricity Grid of Brazil (as declared by the Brazilian DNA) is or is not in full compliance with the requirements of the "Tool to calculate the emission factor for an electricity system" either (as required by applicable CDM rules). It is crucial to note currently it is not possible for project participants of any grid-connected CDM project activity hosted in Brazil to make such calculation details enclosed to the Monitoring Report as established by "Tool to calculate the emission factor for an electricity system" (for cases where the CO_2 grid emission factor is monitored ex-post).During several relatively recents meetings of the CDM-EB, the issue of how DOEs are to validate ex-post determined emission factor of the electricity grids (for cases where calculations are based on confidential data such as the case of the electricity grid of Brazil) has been extensively discussed by the members of the CDM-EB. However, currently, there is still no clear procedural or methodological solution for this issue. In order to address this issue involving lack of data for monitoring $EF_{grid,CM,}$ as a conservative approach, project emissions due to the consumption of grid electricity by the project activity are thus determined by fully following the applicable guidance of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". In this context, the conservative default values of "CO_2 emission factor for grid electricity" and "Transmission and Distribution losses" are selected in order to address the lack of data which is outlined above. The adoption of such conservative approach results in a relative increment in project emissions due to consumption of grid electricity in more than 2,100 tCO_2 for the considered monitoring period. It is crucial to note that the registered PDD does not refer to the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption". For future monitoring periods, if issue of complete lack of publicly available data which is required for calculating $EF_{grid,CM}$ (and reporting related calculations) as per the "Tool to calculate the emission factor for an electricity system" be finally addressed, the applicable guidance of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" will not be used. Thus TDL will not be any longer considered in the context of the determination of related

	project emissions.
QA/QC procedures	Not applicable
Purpose of data	$EF_{grid,CM}$ and $COEF_{LPG}$ are used for determination of project emission due to the consumption of grid electricity and LPG respectively.
Additional comment	--

The following monitoring parameters (which are also included in the monitoring plan of the registered PDD) were not monitored since no collected LFG was utilized for electricity generation and/or in the context of the commercialization of LFG with an external company (industry).

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

D.3. Implementation of sampling plan

Not applicable.

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

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

As per the registered PDD, baseline emissions (BE) are determined (in tCO_2e) as follows:[11]

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

Where:

GWP_{CH4} Global Warming Potential value for methane. The approved value for the first commitment period of 21 tCO_2e/tCH_4 is selected.

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

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

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

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

Where:

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

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

$$MD_{project,y} = MD_{flared,y}^{13}$$

Where:

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

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

Where:

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

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

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

During the monitoring period from 01/09/2011 to 31/03/2012, no collected LFG was sold as gaseous fuel to a local industry ($MD_{industry,y} = 0$), thus $MD_{reg,y} = MD_{project,y} * AF$

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

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

Where:

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

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

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

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

Conversion of values of LFG_{flare} into Normal cubic meters (Nm/h^3)
The installed flow meter measures LFG flow in m^3/hour by considering fixed reference values for Pressure and Temperature. In order to convert the measured values in Nm/h^3 monitored values of LFG Temperature and LFG Pressure are considered as follows:
Qn = Q1 * (TN/T2 * P2/PN) * (T2/T1 * P1/P2)
Where:
Qn LFG Flow in Normal cubic meters (Nm^3)
Q1 LFG Flow in cubic meters (Nm^3) using the fixed reference values of temperature and pressure
T2 Temperature reference fixed value of the instrument (50 ^oC)
P2 Pressure reference fixed value of instrument (1.135 kgf/cm^2)
T1 LFG Temperature in ^oC.
P1 LFG Pressure transmitter in (mbar).

w_{CH4y}	Methane fraction of the LFG and expressed as a fraction ($\%CH_4$). Monitoring details for w_{CH4y} are outlined in Section D.2.
D_{CH4}	Density of methane. Is ex-ante determined as 0.0007168 tCH_4/ m^3CH_4 (STP)
FE	Flare combustion effieciency. No emission reduction is accounted for the time instants when the flare operated with exhaust temperature lower than 500^oC. (T_{flare} < 500^oC). For such cases the calculated value of $MD_{flared,y}$ is accounted as zero.[14]

Determination of Flare combustion/efficiency (FE):
Measurements of residual methane in the exhaust gas of the flares and measurements of speed of exhaust gas of the flares (for the determination of flow of exhaust gas of the flares) were periodically performed by the third part inspection service company Ecosampling Avaliações Ambientais Ltda. The performed

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

tests/evaluations aimed the determination of the combustion efficiency of the flares (in terms of destruction of methane during the combustion process). Ecosampling Avaliações Ambientais Ltda. is an inspection service company which is specialized in emission measurements and air pollution inspections.

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

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

There are four test/evaluations valid for the considered monitoring period: test evaluations were performed 01 June 2011, 05 September 2011 and 07 December 2011, respectively. The adopted testing frequency is in accordance with the requirements as per ACM0001 (version 2) and PDD which establishes that evaluation/test should be performed at least four times per year.

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

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

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

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

Where:

f	Flare number identification. Three enclosed flares were used during the considered monitoring period. f = 1: Flare 01 f = 2: Flare 02 f = 3: Flare 03
n	Number of evaluation. Four evaluations were performed which are valid for the considered monitoring period n = 1: evaluation dated 01 June 2011 n = 2: evaluation dated 05 September 2011 n = 3: evaluation dated 07 December 2011

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

Average-$CH4_{Flared,n,f}$	Average flow of methane sent to the flare f during the evaluation number n (in kg CH_4/h) The analysis period is the same time period of which measurements of $wCH4_{residual,n,f}$ were performed. As per the calculation method adopted by "Ecosampling Avaliações Ambientais Ltda.", records for $MD_{project,y}$ (methane destroyed by flaring) were also considered.
Min._$CH4_{residual,n,f}$	Minimum of residual flow of methane in the exhaust gas of the flare "f" in the context of evaluation "n" during the selected test/evaluation (in kg CH_4/h).
Max._$CH4_{residual,n,f}$	Maximum of residual flow of methane in the exhaust gas of the flare "f" in the context of evaluation "n" during the selected test/evaluation (in kg CH_4/h).

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

- Min._$CH4_{residual,,n,f}$ = $Flow\_Exhaust\_Gas\_flare_{n,f}$ * Min._$wCH4_{residual,n,f}$ * CF
- Max._$CH4_{residual,,n,f}$ = $Flow\_Exhaust\_Gas\_flare_{n,f}$ * Max._$wCH4_{residual,n,f}$ * CF

Where:

CF	Density of CH_4 (Conversion Factor). As indicated in the flare efficiency analysis reports issued by the inspection service company "Ecosampling Avaliações Ambientais Ltda., the assumed value for density of methane is 0.7168 kg / m^3. This value is equal to the value selected in the registered PDD for the ex-ante determined parameter Density of Methane (D_{CH4}): 0.0007168 tCH_4/ m^3CH_4STP.
$Flow\_Exhaust\_Gas\_flare_{n,f}$	Determined accumulated flow of exhaust gas of the flare "f" in the context of evaluation "n" (in Nm^3 exhaust gas/h).
Min._$wCH4_{residual,n,f}$	Minimum measurement of residual CH_4 concentration in the exhaust gas of the flare "f" in the context of evaluation "n" (in ppm CH_4)
Max._$wCH4_{residual,n,f}$	Maximum measurement of residual CH_4 concentration in the exhaust gas of the flare f in the context of evaluation n (in ppm CH_4)

Min._$wCH4_{residual,n,f}$ and Max._$wCH4_{residual,n,f}$ are determined based on performed measurements using a gas analyzer FID / California Analytical

Instruments (CAI), model HFID (in ppm CH_4). During the selected period a set of measurements of residual CH_4 concentration in the exhaust gas of the flare f was performed for each one of the four performed tests/evaluations.

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

1st periodic determination of the value of FE:
Min._$FE_{1,1}$ = 99.9957%
Max._$FE_{1,1}$ = 99.9984%

1st periodic determination of the value of FE:
Min._$FE_{1,2}$ = 99.9977%
Max._$FE_{1,2}$ = 99.9987%

Min._$FE_{2,1}$ = 99.9946%
Max._$FE_{2,1}$ = 99.9984%

2nd periodic determination of the value of FE:
Min._$FE_{2,2}$ = 99.9952%
Max._$FE_{2,2}$ = 99.9989%

Min._$FE_{2,3}$ = 99.9974%
Max._$FE_{2,3}$ = 99.9991%

3rd periodic determination of the value of FE:
Min._$FE_{3,1}$ = 99.9963%
Max._$FE_{3,1}$ = 99.9990%

Min._$FE_{3,2}$ = 99.9947%
Max._$FE_{3,2}$ = 99.9986%

Min._$FE_{3,3}$ = 99.9957%
Max._$FE_{3,3}$ = 99.9981%

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

[16] The same conservative calculation approach (FE is equal to the lowest of the four calculated values for Min._$FE_{n,f}$) was previously used in the context of the CER issuance request for the previous monitoring period (from 1 October 2010 to 31 August 2011).

Date of performance of measurements	Entity / company responsible for performing the measurements	Adopted value of FE
01/06/2011	Ecosampling Avaliações Ambientais Ltda.	0.999957
05/09/2011	Ecosampling Avaliações Ambientais Ltda.	0.999946
07/12/2011	Ecosampling Avaliações Ambientais Ltda.	0.999947

Result of the determination of the value for the calculation parameter $MD_{project,y}$ for the considered monitoring period:
The calculated value for accumulated quantity of CH_4 destroyed "$MD_{project,y}$" for the monitoring period from 1 September 2011 to 31 March 2012 (by accounting the application of the conservative deduction factors) is 27,241 tCH_4.

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

During the considered monitoring period, the operation of the project activity required consumption of grid electricity and LPG. Project emissions due to consumption of grid electricity 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 due to the consumption of grid electricity by the project activity:

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

$PE_{EC} = EC_{grid} * EF_{grid,CM} * (1 + TDL)$
Where:
EC_{grid} Amount of grid electricity consumed by the project activity.

Amount of consumed grid electricity (EC_{grid}). Monthly records of grid electricity consumption valid for the considered monitoring period:

Month	Amount of consumed grid electricity
Sep. 2011	249.00 MWh
Oct. 2011	254.00 MWh
Nov. 2011	210.00 MWh
Dec. 2011	253.00 MWh

Jan. 2012	261.00 MWh
Feb. 2012	260.00 MWh
Mar. 2012	269.00 MWh

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

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

Project emissions due to the consumption of grid electricity by the project activity (PE_{EC}) are calculated as 2,739.36 tCO_2.

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

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

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

Where:

FC_{LPG} Total consumption of LPG in period (ton). As per the adopted monitoring procedure, the total amount of LPG consumed by the project activity during the considered monitoring period is reported as 990 kg (0.99 ton) of LPG. In order to address the lack of calibration evidences for the measuring equipment (weight scale used by the LPG supplier to measure the amount of LPG delivered to the project site), it is assumed that the amount of LPG consumed was 100% higher as a conservative measure. Thus, FC_{LPG} = 1.98 $ton_{LPG.}$

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

$COEF_{LPG} = EF_{LPG} * NCV_{LPG}$

Where:

EF_{LPG} Emission factor for LPG (in energy basis). EF_{LPG} is determined as 63.1 tCO_2/TJ (source: Brazilian Energetic balance, 2008)

NCV_{LPG} Net calorific value for LPG. NCV_{LPG} is determined as 0.0465 TJ/ton (source: IPCC 2006)

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

Thus, $COEF_{LPG}$ = 63.1 tCO_2/TJ * 0.0465 TJ/ton = 2.93 tCO_2/ton

As a summary, PE_{LPG} is calculated as follows: PE_{LPG} = 1.98 (ton LPG) * 2.93 (tCO_2/ton LPG) = 5.80 tCO_2 Project emissions due to the consumption of LPG are thus determined as 5.80 tCO_2.

E.3. Calculation of leakage

Not applicable.

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

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

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

Emission reductions are determined as the difference between baseline emissions (BE) and project emissions (PE). During the monitoring period from 01 September 2011 to 31 March 2012, emission reductions are calculated and reported as 520,370 tCO_2e (rounded value). Further details are presented in the table below:

Time Period	Baseline emissions or baseline net GHG removals by sinks (tCO_2e)	Project emissions or actual net GHG removals by sinks (tCO_2)	Leakage (tCO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (tCO_2e)
Total	523,115	2,745	-	520,370

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 (tCO_2e)	313,402[18]	520,370

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

Period within year 2011:
For the share of the monitoring period including the 4-month period within year 2011 (from 1 September 2011 to 31 December 2011), the achieved emission reductions for the project activity are about ~ 79%

[18] The 313,402 tCO_2e value is calculated as the sum of the estimated share of emission reductions for the 4-month period within year 2011 (calculated as 497,433 tCO_2e * 4/12) and the estimated share of emission reductions for the 3-month period within year 2012 (calculated as 590,365 tCO_2e * 3/12).
497,433 tCO_2e and 590,365 tCO_2e are the ex-ante estimated emission reductions for years 2011 and 2012 respectively (as per the registered PDD).

higher than the comparable value for the *ex-ante* estimation of emission reductions as per the registered PDD which is assumed as applicable for such 3-month period.

Period within year 2012:
For the share of the monitoring period including the 3-month period within year 2012 (from 1 January 2012 to 31 March 2012), the achieved emission reductions for the project activity are about ~ 51 % higher than the comparable value for the *ex-ante* estimation of emission reductions as per the registered PDD which is assumed as applicable for such 8-month period.

The following aspects justify and explain the relative difference between the *ex-ante* estimation of emission reductions in the registered PDD and emission reductions actually achieved during the monitoring period from 1 September 2011 to 31 March 2012:

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

- *Significant increase in the amount of MSW actually disposed in the CTR landfill from the period from March 2007 onwards:*
  As per the ex-ante estimation of emission reductions in the PDD, the project would collect and flare LFG which would be generated from the decomposition of an average historical MSW disposal rate stream of 4,000 tons of waste per day. This MSW disposal rate stream estimation was actually not confirmed during the monitoring period due to the following reasons:

  - From March 2007 onwards, other public landfills (which at the time were also used for disposal MSW from the city of São Paulo) had some operational problems:
    - The Bandeirantes landfill (public landfill) was closed on March 2007. As a result of that, all MSW stream which were used to be disposed in this landfill started to be disposed to the CTR Caierias landfill, thus increasing its total MSW disposal rate to 7,500 ton of MSW per day.

    - Later in August 2007, other public landfill serving the city of São Paulo (São João Landfill) suffered with an unexpected severe accident event (slide accident). As a consequence of this severe accident, significant part of the MSW stream that used to be disposed in that site started to also being disposed in the CTR Caierias landfill, thus increasing its total MSW disposal rate to about 10,000 ton of MSW per day.
    -

  The occurred heavy increment in the amount of MSW actually disposed in the CTR landfill obviously resulted in a significant increase in the amount of LFG being generated at the CTR landfill and collected & destroyed by the CDM project activity "Caieiras landfill gas emission reduction" from the end of year 2007 onwards. With more LFG being collected and destroyed, baseline emissions and emission reductions achieved by the project activity also increased accordingly.

  It is important to note that in the absence of the CDM project activity (baseline scenario), the occurred significant increment of MSW disposal rate at CTR landfill would happen anyway. Thus, baseline emissions are not artificially inflated due to the occurred increment in the amount of MSW disposed at the CTR landfill.

- *No use of any share of collected LFG as fuel by a local industry:* As per the ex-ante estimation of emission reductions in the registered PDD, a total of 15,698 tCH_4 was earlier assumed as being annually sold to a local industry as gaseous fuel (to be combusted in boilers) without having associated

emission reductions (due to destruction of methane) being claimed as CERs (parameter $MD_{industry,y}$). In the context of the earlier determination of the ex-ante estimation of emission reduction in the PDD, as per the emission reduction calculation requirements also set in the PDD, the parameter $MD_{reg,y}$ was thus assumed as equal to $MD_{industry,y}$. During the considered monitoring period, $MD_{reg,y}$ is determined as $MD_{project,y}$ * 20% (where 20% is the ex-ante determined value for parameter AF in cases $MD_{industry,y}$ = zero). That represents a significant relative increase of reported emission reductions vis-à-vis related estimations in the registered PDD.

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

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

- *Accounting of project emissions:* While as per the ex-ante estimation of emission reductions in the PDD no project emissions due to grid electricity and LPG consumption is accounted, 2,442.52 tCO_2 (about 0.5% of total reported emission reductions) are accounted as project emissions valid for the considered monitoring period.

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History of the document

Version	Date	Nature of revision
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	EB 54, Annex 34 28 May 2010	Initial adoption.
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