Monitoring report form for CDM project activity
(Version 06.0)

MONITORING REPORT		
Title of the project activity	Landfill Gas Recovery and Flaring Project in the El Verde Landfill, León.	
UNFCCC reference number of the project activity	CDM Project 3378	
Version number of the PDD applicable to this monitoring report	Version 5	
Version number of this monitoring report	Version 1	
Completion date of this monitoring report	08/03/2019	
Monitoring period number	Sixth Monitoring Period	
Duration of this monitoring period	From 27/10/2017 to 31/12/2018 (both days included)	
Monitoring report number for this monitoring report	n/a	
Project participants	Promotora Ambiental S.A.B. de C.V First Climate (Switzerland) AG	
Host Party	Mexico (Host)	
Sectoral scopes	Sectoral scope 13: Waste handling and disposal	
Applied methodologies and standardized baselines	ACM0001 ver. 10 - Consolidated baseline and monitoring methodology for landfill gas project activities	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0 tCO_2e	47,629 tCO_2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	182,137[1] tCO_2e	

[1] The values in the ex-ante calculation of the updated CDM-PDD are 134,198 tCO2e for 2017 (365 days) and 157,871 tCO2e for 2018 (365 days). The daily average for 2017 and 2018 equate to 368 and 433 tCO2e/day, respectively. The ex-ante estimation is calculated by multiplying each of the daily average for 2017 and 2018 by the 431 days of the current monitored period (66 and 365, respectively).

SECTION A. Description of project activity

A.1. General description of project activity

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a) Purpose of the project activity and the measures taken for GHG emission reductions or net anthropogenic GHG removals by sinks;

The objective of El Verde Landfill Gas Project is to capture the landfill gas (LFG) and to flare and/or utilize it leading to GHG emissions reductions. The principal components of landfill gas are methane (CH_4) and carbon dioxide (CO_2), both of which are greenhouse gases (GHG) listed as such in the Kyoto Protocol.

b) Brief description of the installed technology and equipment;

A LFG Collection System and a LFG Flare System compose the installed equipment of the project activity. The LFG Collection System is composed by deep and shallow vertical wells installed in intermediate or closed areas of the El Verde Landfill site and interconnected by a piping network for serving the blower station with a specific diameter piping, suitable for the anticipated flow rates. A leachate pumping system and a condensate management system has also been installed. An enclosed ZTOF Biogas Flare composes the LFG Flare System, which is equipped with all the monitoring equipment as per the methodology requirements including continuous exhaust gas monitoring, ensuring a minimum destruction efficiency of 98%.

The LFG has been only flared during the monitoring period. Eventually, it is expected to install LFG Power Generation equipment. From then on, LFG would be used to generate electricity and only send the excess LFG to the flare. Thus, all LFG will be combusted in one of these two ways and methane contained in LFG would be destroyed.

c) Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.);

- 01/01/2010: Commissioning of the LFG Flare System of el Verde Landfill Gas Project;
- 27/02/2010: Commissioning of the LFG Collection System and the Leachate Evaporator System of el Verde Landfill Gas Project;
- 27/10/2010: Project registration date with Executive Board of United Nation Framework for Climate Change Convention (UNFCCC) and start of the 1st Crediting Period.
- 01/11/2011: Permanent cease of the use of the of the Leachate Evaporator System and start of the use of the and Phytoremediation System.
- 27/10/2017: Renewal of the project activity and start of the 2nd Crediting Period.

d) Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period.

The total emission reductions achieved during the sixth monitoring period from 27/10/2017 to 31/12/2018 (both days included) are 47,629 tCO_2e.

A.2. Location of project activity

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El Verde landfill is located in León de Los Aldamas (also called León), about 15 kilometres northwest of the centre of the city. The address is Carretera León, Lagos de Morenos km 18.5, León City, Guanajuato State, Mexico. The geographic coordinates are N 21°10'14"; W 101°46'30".

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Mexico (host)	Promotora Ambiental S.A.B. de C. V	No
Switzerland	First Climate (Switzerland) AG	No

A.4. Reference to applied methodologies and standardized baselines

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The approved baseline and monitoring methodology used for the project activity is ACM0001, "Flaring or use of landfill gas"(version 18.0)[2]. Moreover, the following tools have been applied to the project activity for the monitoring period:

- In order to determine the flare efficiency and/or to monitor the flare exhaust gases the "Project emissions from flaring" (version 02.0.0)[3] is applied.
- In order to determine emissions associated with electricity consumption in the project scenario, the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0)[4] is applied.
- The "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (version 03.0)[5] is applied in case any fossil fuels are used on site.

The registered CDM-PDD also used the following tools, which have not been used to calculate the emission reductions for the monitoring period:

- "Emissions from solid waste disposal sites" (version 08.0)[6]
- "Tool to calculate the emission factor for an electricity system" (version 7.0)[7]
- "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0)[8]
- "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" Version 03.0.1[9]

A.5. Crediting period type and duration

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The second crediting period corresponding to this monitoring period commence from the date of registration that is from 27/10/2017 and last till 26/10/2024 (Renewable).

[2]https://cdm.unfccc.int/UserManagement/FileStorage/0X2IE6B1PJDLKMWN89AZGTFUHR3VYS

[3] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v1.pdf/history_view

[4] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf

[5] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf

[6]https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v8.0.pdf

[7] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v1.1.pdf/history_view

[8] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v1.pdf/history_view

[9] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

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a) Description of the installed technology, technical processes and equipments;

The El Verde Landfill was designed for municipal waste treatment with a total area of 60 ha. The landfill is divided in two Macrocells, with a total area of approximately 51 ha planned for waste disposal. The remaining 9 ha include roads, buffer zone, and the administrative area. The proposed project activity covers the entire 60 ha, i.e. including future expansion as more waste is received. The landfill started to receive waste in June 2001 and since then is receiving an average of 442,000 tonnes per year. Before the project implementation, the most likely scenario was the atmospheric release of landfill gas generated at the landfill site with no landfill gas capture and destruction. The project activity was designed in two phases:

- Phase 1: The first phase includes the construction and operation of a landfill gas (LFG) collection and flare system. The purpose of LFG flaring is to safely dispose of the flammable constituents, particularly methane, and to control odour nuisance, health risks and adverse environmental impacts. This phase has involved the investment in a highly efficient landfill gas collection system and the required enclosed flaring equipment.
- Phase 2: Once the LFG flow is proven to be steady (in terms of volume and quality) for the electricity generation, a second project phase would be carried out and a reciprocating engine facility will be installed. This phase would imply the installation of generating equipment that would combust the methane of the LFG in order to produce electricity.

The El Verde Landfill Gas Project León is currently operating in its first phase. The installed equipment of El Verde Landfill Gas Project is composed by a LFG Collection System and a LFG Flare System. In order to maximize LFG recovery rates, and thus GHG emission reductions, an active LFG Collection System has been installed covering 60% of the area of Macrocell 1. The system consists of a series of vertical extraction wells interconnected by header piping. The LFG is extracted from the landfill by a set of blowers to be initially flared in the LFG Flare System. Once LFG gas recovery is considered to be stationary and proper dimensioning can be conducted, project proponent would install a LFG power generation equipment. During the current monitored period, LFG has been only flared. It is expected that in future monitoring periods LFG would be used mainly for power generation, with any excess of LFG being flared. The following diagram represents the technology applied in the El Verde Landfill Gas Project:

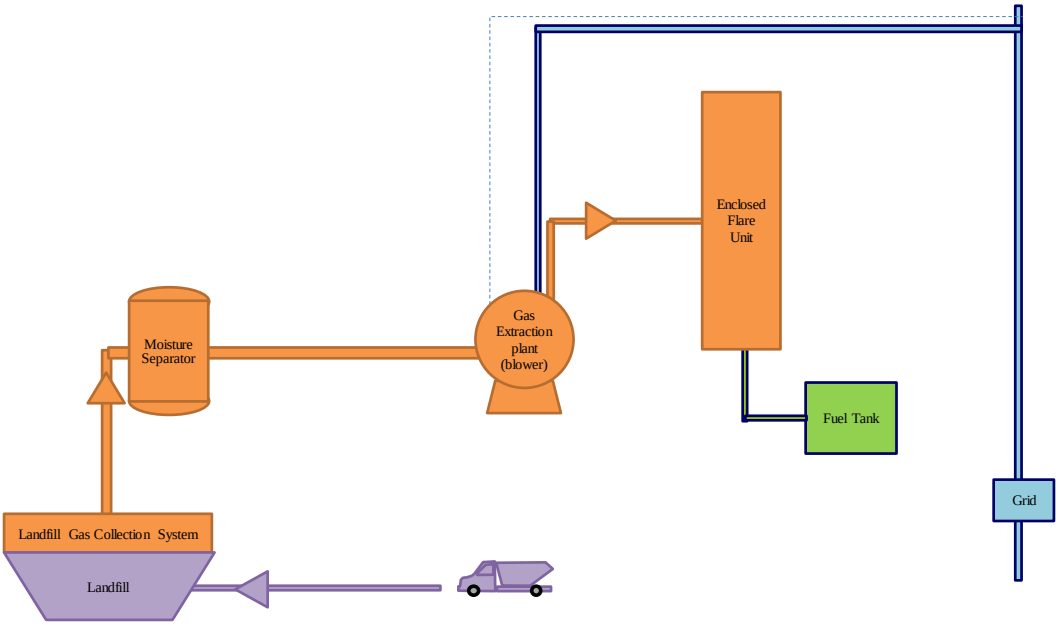

Figure 1. Diagram of the technology applied in the El Verde Landfill Gas Project.

The essential characteristics of the technology applied during the monitoring period for the LFG collection and flaring systems are:

1. **LFG Collection System:** The LFG collection system is composed by:
    - Deep and shallow vertical wells in intermediate or closed areas have been installed, trying not to interfere with landfill operation. Depending on future development plans, some horizontal wells might be installed to capture the gas in areas that continue to be filled;
    - A piping network has been installed to include connection to extraction wells for serving the blower station (two blowers with 75 HP each) with a specific diameter piping, suitable for the anticipated flow rates. Connection has been made to those extraction wells that have been constructed to final or intermediate grade, and to which the piping connection have a minimal impact on current filling operations.
    - A leachate pumping system and a condensate management system has also been installed. The LFG collection system has been designed to include self-draining condensate traps and condensate manholes with pumps where necessary.
2. **LFG Flare System:** The John Zink Biogas Flare System has been installed in the project activity and consists of:
    - An Enclosed ZTOF Biogas Flare which offers automated operation and is designed to destroy safely, with automatic temperature control, typical organic compounds generated by solid waste and other biogas processes. The flare system is controlled with a processor, or programmable logic controller (PLC), which receives and transmits signals with respect to operating conditions. If an unacceptable operating condition occurs, the control system discontinues flow of biogas or adjusts the operating parameters to correct the problem. Control of the Enclosed ZTOF Biogas Flare includes an initial purge cycle, automatic ignition sequence, and fail-safe controls. A self-checking flame scanner monitors the pilot flame and main flame and safety shutdown features prevent equipment damage. The Enclosed ZTOF Biogas Flare is equipped with all the monitoring equipment as per the methodology requirements including continuous exhaust gas monitoring.
    - A skid assembly containing a panel rack with flare control panel, a moisture separator, and a blower station. The blower station has been installed to provide the necessary suction pressure for the flare and leachate evaporator systems, considering future electricity generator flow demands.

b) Information on the implementation and actual operation of the project activity, including relevant dates (e.g. construction, commissioning, continued operation periods, etc.).

The LFG Flare System of El Verde Landfill Gas Project was commissioned on 11/01/2010 and has been operating since then. The construction works for the LFG Collection System and the Leachate Evaporator System were completed on 27/02/2010. The project was fully operational by the date of registration on 27/10/2010. Since its registration date it has been implemented and monitored as per the monitoring plan of the PDD, with continuous operation.

c) Description of events or situations that occurred during the monitoring period that may impact the applicability of the methodology and how the issues resulting from these events or situations are being addressed:

During the monitoring period, there were not major events or situations that affected the applicability of the methodology.

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies or standardized baselines

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Not applicable. The section is left blank intentionally.

B.2.2. Corrections

>>
Not applicable. The section is left blank intentionally.

B.2.3. Changes to the start date of the crediting period

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Not applicable. The section is left blank intentionally.

B.2.4. Inclusion of monitoring plan

>>
Not applicable. The section is left blank intentionally.

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools

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The monitoring system was found not in line with the description in the registered PDD. A revised PDD was prepared by the project participant during the 3rd CDM Verification and informed the contracted DOE about such changes. The revised PDD was approved by the EB on 02/12/2013 under reference PRC-3378-001. As per Table 5, “Operational Management Structure” for El Verde project Monitoring Plan of the registered PDD, the monitoring task described that daily data on temperature (T) and pressure (P) would be recorded in a spreadsheet file which would be filed. Daily data on pressure and temperature is not required for the ER calculations in the actual operation structure as the project activity is using flow meters that measures within the flow temperature and pressure, expressing LFG volumes in normalized cubic meters (Nm^3).

B.2.6. Changes to project design

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A revised PDD was prepared by the project participant during the 3rd CDM Verification and informed the contracted DOE about such changes. The revised PDD was approved by the EB on 02/12/2013 under reference PRC-3378-001. The following points provide a description of the changes as compared to the description in the registered PDD and description of the changes to the monitoring plan:

a) The project participant decided to permanently cease the use of the leachate evaporator on the EL Verde Landfill effectively from 1 November 2011 due to unexpected technical difficulties and failure to operate in a proper manner. Operation of the project is not compromised by the ceased of the leachate evaporator as the landfill gas not used for the leachate will be directly send to the flare and to the LFG fuelled power generator once it is installed.
b) According to the registered PDD, on section B.6.3 Ex-ante calculation emission reductions considers: “Blower electricity consumption: Based on manufacturer’s information, it is assumed that a blower will use 25 HP or about 18 kW to pump 1,869 m3/h of LFG (@ 50% methane). However, during the site visit two blowers were identified as 75 HP each. No

operational impact has been identified from this change. The installation of the two 75 HP blowers made possible the delivery of LFG to the flare.

c) For parameters $V_{LFG,total,y,db}$, $V_{LFG,sent\_flare,y,db}$, $V_{LFG,EL,y,db}$, as per registered PDD is stated in page 7 that according to the SCS Engineers study, a capacity of 2.4 MW power generators would be purchased in order to start operations in January 2012. Power generation equipment has not been installed during this monitoring period. Operation of the project is not compromised by the postponed installation of the power generator as the collected LFG is flared.

The contracted DOE was able to confirm that the discontinuation of the leachate evaporator, the installation of two 75 HP blowers and the postponed purchase of the LFG power generator would not impact the additionality of project activity negatively, would not change the scale of CDM project activity, and would not change the applicability of ACM0001 (version 10).

SECTION C. Description of monitoring system

The following section provides a description of the monitoring system including data collection procedures (information flow including data generation, aggregation, recording, calculation and reporting), organizational structure, roles and responsibilities of personnel, and emergency procedures for the monitoring system for the El Verde Landfill Project:

- **Line diagram showing all relevant monitoring points:** The following line diagram shows the monitoring points applied in the El Verde Landfill Gas Project during the monitoring period:

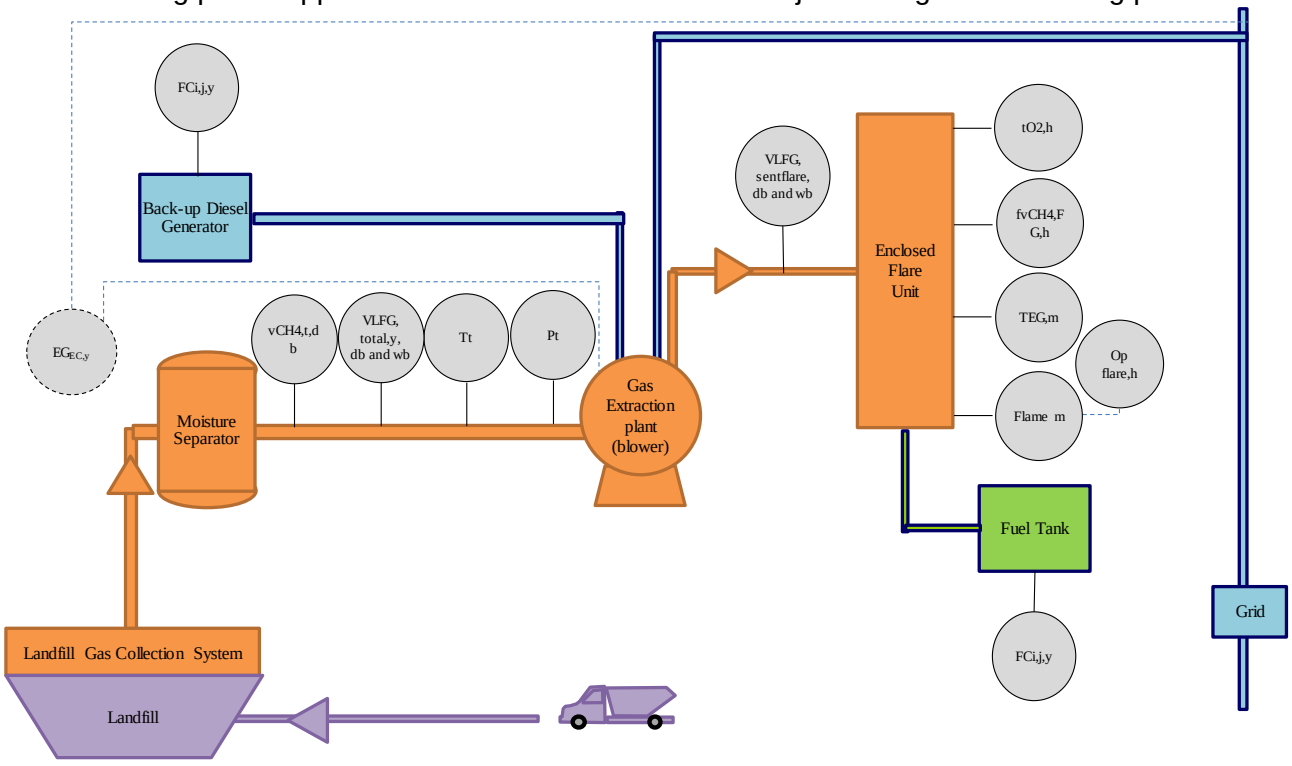

Figure 2. Line diagram showing all relevant monitoring points in the El Verde Landfill Gas Project.

- **Data collection procedures:** The following points provide a description of the data collection procedures followed by the El Verde Landfill Project during the monitoring period:

  a) Data generation: The data generation for the El Verde Landfill Gas Project is using both Automatic Continuous and Manual Periodic (Daily) Data Gathering System as follows:

  - Manual Periodic (Daily) Data Gathering System: The following parameters are gathered manually in daily log sheets:

Table 1. Parameters gathered manually in Leon LFS

Parameter	Data unit	Description of the parameter
ECPJ,j,y	MWh	Quantity of electricity consumed by the project activity during the year y (MWh)
FCi,j,y	m3	Quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr)

- Automatic Continuous Data Gathering System: In normal operating conditions, data has been recorded every two minutes electronically and it will be kept during the crediting period and two years after. The company LANDTEC is responsible to aggregate monthly the raw data and transmits these through Excel file to PASA. The following parameters are gathered automatically under such procedure:

Table 2. Parameters gathered automatically in Leon LFS.

Parameter	**Data unit**	**Description of the parameter**
$V_{LFG,sent\_flare,y,db}$	Nm3	Volumetric flow of landfill gas which is sent to flare in year y on a dry basis (m^3 dry gas)
$v_{CH4,t,db}$	m3 CH4 / m3 LFG	Average methane fraction of the landfill gas as measured and expressed as a fraction (m^3 CH4 / m^3 LFG)
$t_{O2,h}$	%	Volumetric fraction of O2 in the exhaust gas of the flare in the hour h.
$fv_{CH4,FG,h}$	mg/m3	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h
T_t	ºC	Temperature of the gaseous stream in time interval t
$Op_{flare,h}$	hours	Operation of the flare that consumes the LFG
$Flame_m$	hours	Flame detection of flare in the minute m
$T_{EG,m}$	°C	Temperature in the exhaust gas of the enclosed flare in minute m

b) Data aggregation: The data is aggregated monthly in a Monthly Report which is presented to the Board of Promotora Ambiental S.A.B. de C.V (PASA) as per internal procedures.

c) Data recording: The data which is gathered automatically is recorded in monthly spreadsheets while the data gathered manually is recorded both in paper forms and in spreadsheets. Promotora Ambiental S.A.B. de C.V (PASA) has an in-house back-up system to record the data during the crediting period. In parallel, LANDTEC provides support to back-up the automatic raw data.

d) ER calculation and reporting: The gathered data is used to calculate the Emission Reductions (ER) as per the applicable methodologies and the registered PDD and these are reported in the CDM-MR. Previous to this process, a QA/QC procedure is used with the aim of disregard any raw data in the same time interval which do not accomplish the following three operational conditions at the same time:

- Condition 1: The $V_{LFG,sent\_flare,y,db}$ should be between 450 and 5047 Nm^3/h
- Condition 2: The $v_{CH4,t,db}$ should be between 25 and 75% in CH_4
- Condition 3:The $T_{EG,m}$ should be between 500 and 1200ºC.

The following scheme simplifies the Data collection procedures followed in the El Verde Landfill Gas Project during the monitoring period:

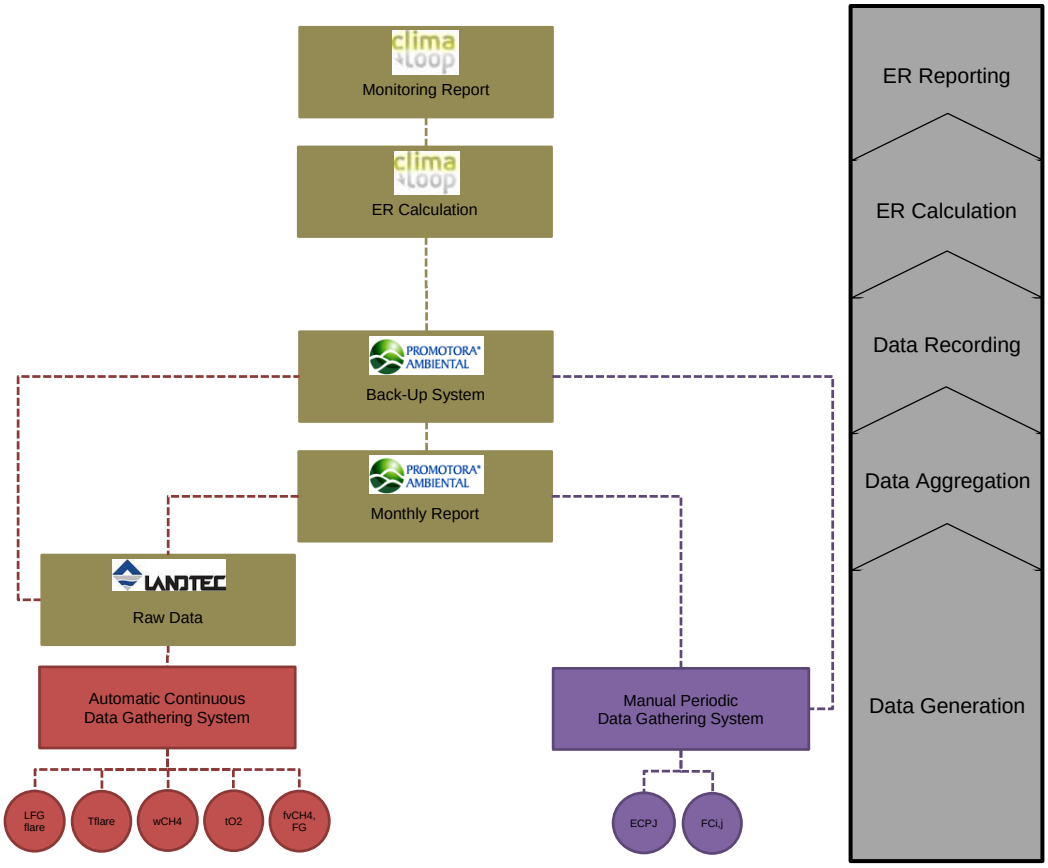

Figure 3. Scheme of the data collection procedures for El Verde Landfill Gas Project.

As shown in the scheme above, the Data collection procedures in the El Verde Landfill Gas Project are divided in an Automatic Continuous Data Gathering System (which gathers the parameters $V_{LFG,sent\_flare,y,db}$, $v_{CH4,t,db}$, $t_{O2,h}$, $fv_{CH4,FG,h}$ and $T_{EG,m}$) and a Manual Periodic Data Gathering System (which gathers the parameters EGEC,y and $FC_{i,j,y}$).

Once the data is collected, it is aggregated in a monthly basis to report the expected CER generation to PASA´s Board. Once data is archived in back-up system of the facility, all data is sent to the CDM Consultant to conduct the ER calculations and the preparation of the Monitoring Report (CDM-MR).

e) Organizational structure, roles and responsibilities: The following list simplifies the responsibilities allocated of each role during the monitoring period:

Table 3. Roles and responsibilities in the El Verde Landfill Gas Project.

Name	Role	Organization	Process Involvement
Gerardo Palato	Field Technician	PASA	Data Collection
Reynaldo Hernández	Monitoring and Biogas Manager	PASA	
Sergi Cuadrat	CDM Consultant	ClimaLoop	ER Calculation and Reporting

The following scheme simplifies the Organizational Structure followed by the El Verde Landfill Gas Project:

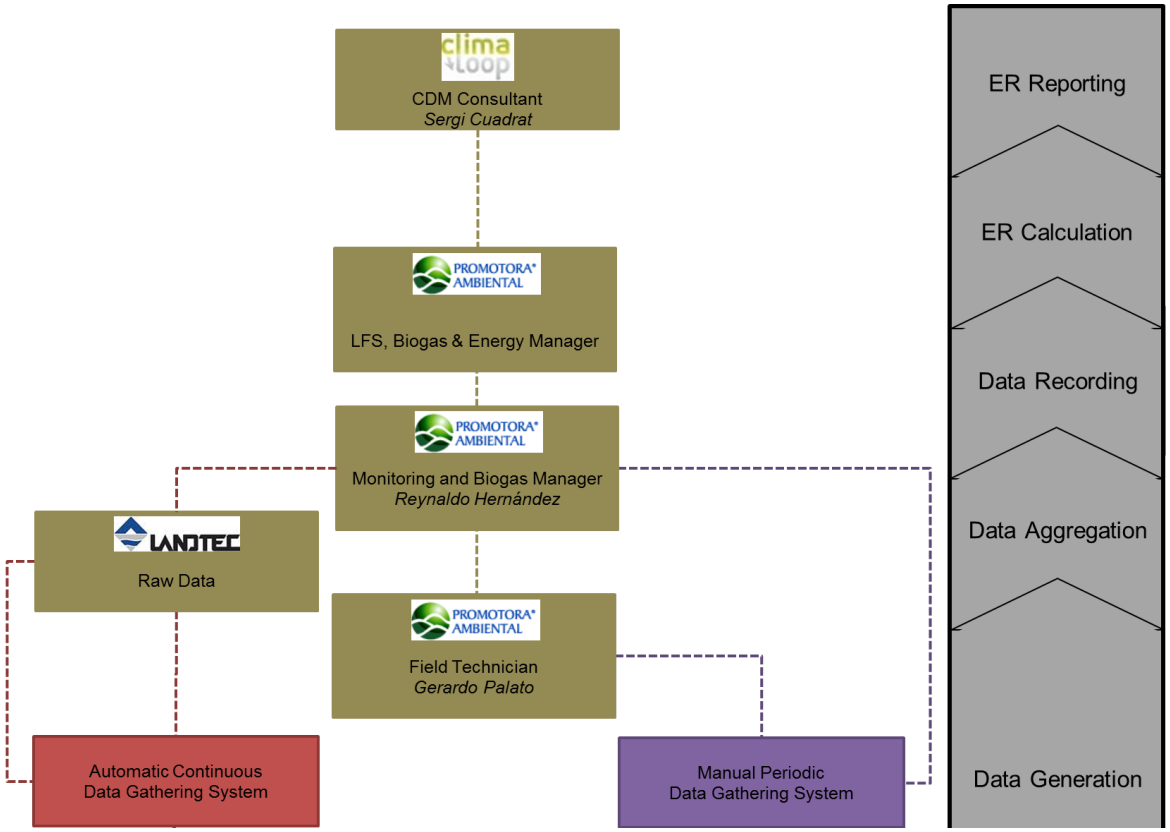

Figure 4. Organizational Structure followed in El Verde Landfill Gas Project.

The Field Technician is the responsible to conduct the day-to-day operation of equipment and collects data under the Manual Periodic Data Gathering System. The Monitoring and Biogas Manager supervises all CDM activities such as data collection, aggregation and recording and reports to the Landfill Sites, Biogas and Energy Manager who supervises the project activity. Finally, the CDM Consultant is responsible for the CERs calculations and elaborates the Monitoring Report.

f) The responsibilities and authorities for monitoring and reporting: The following list simplifies the responsibilities allocated of each role during the monitoring period:

- Field Technician
  - ✓ Checks day-to-day operation of equipment.
  - ✓ Conduct the required maintenance as per predefined schedule.
  - ✓ Executes the calibration of equipment with procedures and frequency established. Collects data under the Manual Periodic Data Gathering System (which gathers the parameters $EG_{EC,y}$ and $FC_{i,j,y}$) in paper registries and transfers to electronic registries.
- Automatic Continuous Data Gathering System provider (LANDTEC)
  - ✓ Aggregates the raw data gathered by the Automatic Continuous Data Gathering System.
  - ✓ Transmits raw data gathered in a monthly basis through Excel file to PASA.
  - ✓ Provides support to back-up the automatic raw data.
- Monitoring and Biogas Manager
  - ✓ Supervises the general operations.
  - ✓ Supervises all CDM activities such as data collection, aggregation and recording.
  - ✓ Supervision of Automatic Continuous Data Gathering System.
  - ✓ Ensures that data is collected as per the registered PDD.

- ✓ Manages the calibration of equipment with procedures and frequency established.
- ✓ Ensures proper Back-Up of the Raw Data and CDM Documentation.
- ✓ Sends Raw Data to CDM Consultant.

- Landfill Sites, Biogas and Energy Manager
  - ✓ Supervises the project activity.
  - ✓ Takes major decisions when required (equipment repair/replacement, improvements, etc).

- CDM Consultant (ClimaLoop)
  - ✓ Performs the CERs calculations;
  - ✓ Performs internal audits of the project;
  - ✓ Elaborates the Monitoring Report;
  - ✓ Supports the project during the verification site visits.

g) Emergency procedures for the monitoring system: The emergency procedures for the monitoring system in the El Verde Landfill Gas Project consist in daily checks of the project activity equipment and meters. If any problem occurs, the responsible personnel take the required action to solve the problem. If a malfunction on meters or equipment occurs, no CERs are claimed for the corresponding period.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	**$\rho_{CH4,n}$**
Unit	kg/m^3
Description	Density of methane gas at normal conditions
Source of data	"Project emissions from flaring" (version 02.0.0)
Value(s) applied	0.716
Choice of data or measurement methods and procedures	As per the "Project emissions from flaring" (version 02.0.0)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	The value of $\rho_{CH4,n}$ has been referred with three significant digits as 0.716 kg/m^3 as per the "Project emissions from flaring" (version 02.0.0)

Data/Parameter	**D_{CH4}**
Unit	tCH_4/m^3CH_4
Description	Methane density at normal temperature and pressure (0°C and 1.013 bar)
Source of data	As per the ACM0001 "Flaring or use of landfill gas"(version 18.0)
Value(s) applied	0.0007168
Choice of data or measurement methods and procedures	As per ACM0001 Version 18
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	The value of D_{CH4} has been referred with four significant digits as 0.0007168 tCH_4/m^3 CH_4 as per the ACM0001 "Flaring or use of landfill gas"(version 18.0)

Data/Parameter	**AM_C**
Unit	kg/kmol
Description	Atomic mass of carbon
Source of data	"Project emissions from flaring" (version 02.0.0)

Value(s) applied	12
Choice of data or measurement methods and procedures	As per “Project emissions from flaring” (version 02.0.0)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This section has been left blank intentionally

Data/Parameter	**AM_H**
Unit	kg/kmol
Description	Atomic mass of hydrogen
Source of data	“Project emissions from flaring” (version 02.0.0)
Value(s) applied	1.01
Choice of data or measurement methods and procedures	As per “Project emissions from flaring” (version 02.0.0)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This section has been left blank intentionally

Data/Parameter	**AM_O**
Unit	kg/kmol
Description	Atomic mass of oxygen
Source of data	“Project emissions from flaring” (version 02.0.0)
Value(s) applied	16
Choice of data or measurement methods and procedures	As per “Project emissions from flaring” (version 02.0.0)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This section has been left blank intentionally

Data/Parameter	**AM_N**
Unit	kg/kmol
Description	Atomic mass of nitrogen
Source of data	“Project emissions from flaring” (version 02.0.0)
Value(s) applied	14.01
Choice of data or measurement methods and procedures	As per “Project emissions from flaring” (version 02.0.0)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This section has been left blank intentionally

Data/Parameter	**$NA_{C,CH4}$**
Unit	Atoms
Description	Number of atoms of carbon in CH_4
Source of data	“Project emissions from flaring” (version 02.0.0)
Value(s) applied	1
Choice of data or measurement methods and procedures	As per “Project emissions from flaring” (version 02.0.0)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This section has been left blank intentionally

Data/Parameter	$NA_{N,N2}$
Unit	Atoms
Description	Number of atoms of nitrogen in N2
Source of data	“Project emissions from flaring” (version 02.0.0)
Value(s) applied	2
Choice of data or measurement methods and procedures	As per “Project emissions from flaring” (version 02.0.0)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This section has been left blank intentionally

Data/Parameter	MM_{CH4}
Unit	kg/kmol
Description	Molecular mass of methane
Source of data	“Project emissions from flaring” (version 02.0.0)
Value(s) applied	16.04
Choice of data or measurement methods and procedures	As per “Project emissions from flaring” (version 02.0.0)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This section has been left blank intentionally

Data/Parameter	MM_{N2}
Unit	kg/kmol
Description	Molecular mass of nitrogen
Source of data	“Project emissions from flaring” (version 02.0.0)
Value(s) applied	28.02
Choice of data or measurement methods and procedures	As per “Project emissions from flaring” (version 02.0.0)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This section has been left blank intentionally

Data/Parameter	MVn
Unit	m^3/Kmol
Description	Volume of one mole of any ideal gas at normal temperature and pressure
Source of data	“Project emissions from flaring” (version 02.0.0)
Value(s) applied	22.414
Choice of data or measurement methods and procedures	As per “Project emissions from flaring” (version 02.0.0)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This section has been left blank intentionally

Data/Parameter	MF_{O2}
Unit	m^3/Kmol
Description	O_2 volumetric fraction of air
Source of data	“Project emissions from flaring” (version 02.0.0)
Value(s) applied	0.21

Choice of data or measurement methods and procedures	As per “Project emissions from flaring” (version 02.0.0)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This section has been left blank intentionally

Data/Parameter	**P_n**
Unit	Pa
Description	Atmospheric pressure at normal conditions
Source of data	“Project emissions from flaring” (version 02.0.0)
Value(s) applied	101325
Choice of data or measurement methods and procedures	As per “Project emissions from flaring” (version 02.0.0)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This section has been left blank intentionally

Data/Parameter	**R_u**
Unit	Pa m^3/kmol K
Description	Universal ideal gas constant
Source of data	“Project emissions from flaring” (version 02.0.0)
Value(s) applied	8314.472
Choice of data or measurement methods and procedures	As per “Project emissions from flaring” (version 02.0.0)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This section has been left blank intentionally

Data/Parameter	**T_n**
Unit	K
Description	Temperature at normal conditions
Source of data	“Project emissions from flaring” (version 02.0.0)
Value(s) applied	273.15
Choice of data or measurement methods and procedures	As per “Project emissions from flaring” (version 02.0.0)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	This section has been left blank intentionally

Data/Parameter	**GWP_{CH4}**
Unit	tCO_2e/tCH_4
Description	Global Warming Potential of CH_4
Source of data	Table 2.14 of the Fourth Assessment Report of the IPCC.
Value(s) applied	25

Choice of data or measurement methods and procedures	As per COP Decision 4/CMP.7, "for the second commitment period of the Kyoto Protocol, the global warming potentials used by Parties to calculate the carbon dioxide equivalence of anthropogenic emissions by sources and removals by sinks of the greenhouse gases listed in Annex A to the Kyoto Protocol shall be those listed in the column entitled "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, taking into account the inherent and complicated uncertainties involved in global warming potential estimates". Therefore, GWP of methane has been considered as 25 (100-year time horizon) as per Table 2.14 of the Fourth Assessment Report of the IPCCC which can be found at: http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Shall be updated according to any future COP/MOP decisions.

Data/Parameter	**$EF_{EL,j,y} = EF_{grid, CM, y} = EF_{EL,k,y}$**
Unit	tCO2/MWh
Description	Emission factor
Source of data	Calculated as per the "Tool to calculate the emission factor for an electricity system" Version 7.0.
Value(s) applied	0.458
Choice of data or measurement methods and procedures	Value obtained as per SEMARNAT guidance (http://www.semarnat.gob.mx/sites/default/files/documentos/cicc/aviso_factor_de_emision_electrico_2015.pdf)
Purpose of data/parameter	Calculation of project emissions
Additional comments	A single, fixed value is used for each crediting period.

Data/Parameter	**Regulatory requirements relating to landfill gas projects**
Unit	Dimensionless
Description	Regulatory requirements relating to landfill gas projects
Source of data	Publicly available information of the host country's regulatory requirements relating to landfill gas.
Value(s) applied	0
Choice of data or measurement methods and procedures	Publicly available information of the host country's regulatory requirements relating to landfill gas.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	The information though recorded annually, is used for changes to the adjustment factor (AF) or directly $MD_{BL,y}$ at renewal of the credit period.

Data/Parameter	**TDL_y**
Unit	%
Description	Average technical transmission and distribution losses in the grid in year y.
Source of data	Default value of average technical transmission and distribution losses will be used.
Value(s) applied	20.0%
Choice of data or measurement methods and procedures	Not applicable

Purpose of data/parameter	Calculation of project emissions
Additional comments	Project electricity consumption is mainly due to the electricity consumption by the LFG blower.

D.2. Data and parameters monitored

Data/Parameter	**Management of SWDS**
Unit	-
Description	Management of SWDS
Measured/calculated/ default	Measured
Source of data	Use different sources of data: (a) Original design of the landfill; (b) Technical specifications for the management of the SWDS; (c) Local or national regulations
Value(s) of monitored parameter	No change in the management of the SWDS after the implementation of the project activity has occurred.
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	This section has been left in blank on purpose.
QA/QC procedures	Project participants should refer to the original design of the landfill to ensure that any practice to increase methane generation have been occurring prior to the implementation of the project activity. Any change in the management of the SWDS after the implementation of the project activity should be justified by referring to technical or regulatory specifications.
Purpose of data/parameter	Not required for calculations.
Additional comment	This section has been left in blank on purpose.

Data/Parameter	$\rho_{reg,y}$
Unit	Dimensionless
Description	Fraction of LFG that is required to be flared due to a requirement in year y
Measured/calculated/ default	Measured
Source of data	Information of the host country's regulatory requirements relating to LFG, contractual requirements, or requirements to address safety and odour concerns. For ex ante calculations, a default value of 0 has been chosen as per ACM0001 / Version 18.0, Step A2, Case 2 c), eq. 9.
Value(s) of monitored parameter	0
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	This section has been left in blank on purpose, since no calculation is necessary.

QA/QC procedures	Calculation of Baseline emissions.
Purpose of data/parameter	Applicable to Case 2 of section 5.4.1.3. Used to calculate $F_{CH4,BL,y}$, which is part of the calculation of $BE_{CH4,y}$
Additional comment	For the project activity, the Case 2 "Requirement to destroy methane exists and no existing LFG capture system" under situation c) "the requirement does not specify the amount or percentage of LFG that should be destroyed but requires the installation of a capture system, without requiring the captured LFG to be flared" is applicable because the legislation applicable at the submission for validation of the project activity does not specify the amount or percentage of LFG that should be destroyed but requires the installation of a capture system, without requiring the captured LFG and without existing LFG capture system. ACM0001 / Version 18.0, Step A2, Case 2 c), eq. 9 is applied.

Data/Parameter	**$V_{LFG,total,y,db}$**	
Unit	m³ dry gas/h	
Description.	Volumetric flow of total landfill gas which is sent to flare and used for electricity generation in year y on a dry basis	
Measured/calculated/ default	It will be measured by a mass flow meter when installed	
Source of data		Not installed
Value(s) of monitored parameter		Not installed
Monitoring equipment	Type	Not installed
	Accuracy class	Not installed
	Manufacturer	Not installed
	Model	Not installed
	Serial Number	Not installed
	Calibration Frequency	Not installed
	Date of last calibration	Not installed
	Validity of last calibration	Not installed
	Installation date	Not installed
	Validity of calibration runs from	Not installed
Measuring/reading/recording frequency	Volumetric flow measurement should always refer to the actual pressure and temperature. Instruments with recordable electronic signal (analogical or digital) are required. The measurement method will be based in the thermal principle of the thermal mass flowmeter. The readings will be gathered automatically by an automatic data collection system. The accuracy of the measurement equipment will be 1% full scale. The responsible person/entity for the measurement will be the project participant. The calibration will be carried out yearly or at the frequency required by the manufacturer following the recommended procedures.	
Calculation method (if applicable)	Not installed	
QA/QC procedures	Periodic calibration against a primary device will be conducted. Calibration and frequency of calibration is according to manufacturer's specifications.	
Purpose of data/parameter	Not used	
Additional comment	This parameter will be monitored as per Options A of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", version 2.0.0. No separate monitoring of temperature and pressure is necessary since flowmeters that automatically express LFG volumes in normalized cubic meters will be used.	

Data/Parameter	**$V_{LFG,sent\_flare,y,db}$**	
Unit	m^3 dry gas/h	
Description	Volumetric flow of landfill gas which is sent to flare in year y on a dry basis	
Measured/calculated/ default	Measured	
Source of data	Measured by a flow meter	
Value(s) of monitored parameter		6,484,599
Monitoring equipment	**Period 1**	
	Type	LFGflare_Flowmeter
	Accuracy class	± 1% Full Scale
	Manufacturer	Thermal Instruments
	Model	62-9/9500
	Serial Number	2011025
	Calibration Frequency	18 months
	Date of last calibration	08/04/2014
	Validity of last calibration	24/10/2017
	Installation date	25/04/2016
	Validity of calibration runs from	Installation date
	Period 2	
	Type	LFGflare_Flowmeter
	Accuracy class	± 1% Full Scale
	Manufacturer	Thermal Instruments
	Model	62-9/9500
	Serial Number	2008394
	Calibration Frequency	18 months
	Date of last calibration	01/02/2017
	Validity of last calibration	19/04/2019
	Installation date	20/10/2017
	Validity of calibration runs from	Installation date
Measuring/reading/recording frequency	Continuous mass flow meters will be used to measure flow rates combusted in the flare at normal temperature and pressure when installed. In normal operating conditions, data will be recorded every two minutes electronically and it will be kept during the crediting period and two years after. Data will also be aggregated monthly.	
Calculation method (if applicable)	The value of the monitored value shown in this table is the result of the accumulated flow in which raw data in the same time interval accomplish the following three operational conditions at the same time: • Condition 1: The $V_{LFG,sent\_flare,y,db}$ should be between 450 and 5047 Nm^3/h • Condition 2: The $v_{CH4,t,db}$ should be between 25 and 75% in CH_4 • Condition 3:The $T_{EG,m}$ should be between 500 and 1200ºC.	
QA/QC procedures	Flow meters have been subject to regular maintenance and testing regime to ensure accuracy. The same basis (dry or wet) as CH_4 concentration is considered for this measurement when the residual gas temperature exceeds 60ºC. QA/QC procedure is used with the aim of disregard any raw data in the same time interval which do not accomplish the following three operational conditions at the same time: • Condition 1: The $V_{LFG,sent\_flare,y,db}$ should be between 450 and 5047 Nm^3/h • Condition 2: The $v_{CH4,t,db}$ should be between 25 and 75% in CH_4 • Condition 3:The $T_{EG,m}$ should be between 500 and 1200ºC..	
Purpose of data/parameter	Baseline	

Additional comment	No separate monitoring of temperature and pressure have been necessary because the project activity is using flow meters that automatically compensate for temperature and pressure, expressing LFG volumes in normalized cubic meters (Nm^3). The parameter is measured by the LFGflare_Flowmeter, which is placed before the input to the flare.

Data/Parameter	$V_{LFG,EL,y,db}$	
Unit	m^3 dry gas/h	
Description	Volumetric flow of landfill gas which is used for electricity generation in year y on a dry basis	
Measured/calculated/ default	It will be measured by a mass flow meter when installed	
Source of data	Not installed	
Value(s) of monitored parameter		Not installed
Monitoring equipment	Type	Not installed
	Accuracy class	Not installed
	Manufacturer	Not installed
	Model	Not installed
	Serial Number	Not installed
	Calibration Frequency	Not installed
	Date of last calibration	Not installed
	Validity of last calibration	Not installed
	Installation date	Not installed
	Validity of calibration runs from	Not installed
Measuring/reading/recording frequency	Continuous mass flow meters will be used to measure flow rates combusted in power plant at normal temperature and pressure when installed. In normal operating conditions, data will be recorded every two minutes electronically and it will be kept during the crediting period and two years after. Data will also be aggregated monthly.	
Calculation method (if applicable)	Not installed	
QA/QC procedures	Flow meters will be subject to regular maintenance and testing regime to ensure accuracy. The same basis (dry or wet) as CH_4 concentration will be considered for this measurement when the residual gas temperature exceeds 60ºC.	
Purpose of data/parameter	Not used	
Additional comment	No separate monitoring of temperature and pressure will be necessary because the project activity will be using flow meters that automatically compensate for temperature and pressure, expressing LFG volumes in normalized cubic meters (Nm^3).	

Data/Parameter	$t_{O2,h}$
Unit	%
Description	Volumetric fraction of O_2 in the exhaust has of the flare in the hour h.
Measured/calculated/ default	Measured

Source of data	On-site measurements using a continuous gas analyser.	
Value(s) of monitored parameter		17.52%
	Period 1	
	Type	Flare Emissions Analyser (FEA)
	Accuracy class	O_2 = 0.1% + 1% of reading
	Manufacturer	Landtec
	Model	FEA
	Serial Number	4299
	Calibration Frequency	12 months
	Date of last calibration	28/02/2017
	Validity of last calibration	27/02/2018
	Installation date	13/01/2010
Measuring/reading/recording frequency	Oxygen concentration in the exhaust gas has been measured at least once per hour using a continuous gas analyser (under normal operating conditions, data has been recorded every two minutes), and data records will be kept during the crediting period and two years after. Data has also been aggregated monthly.	
Calculation method (if applicable)	The value of the monitored value shown in this table is the result of the weighted average in which raw data in the same time interval accomplish the following three operational conditions at the same time: • Condition 1: The $V_{LFG,sent\_flare,y,db}$ should be between 450 and 5047 Nm^3/h • Condition 2: The $v_{CH4,t,db}$ should be between 25 and 75% in CH_4 • Condition 3:The $T_{EG,m}$ should be between 500 and 1200ºC. The variable is monitored, as required by the "Project emissions from flaring" (version 02.0.0) to calculate the flare efficiency. In case of malfunction or delayed installation of the continuous gas analyser, 90% of flare efficiency is used.	
QA/QC procedures	Analyser has been periodically calibrated according to the manufacturer's recommendation. A zero check and typical value check by comparison with a standard certified gas has been conducted. The FEA is calibrated manually by the Field Technician at least one time per week. The characteristics of the standard certified gas are as follows: -Bottle 1: 400 ppm CH_4, 15% O_2 and balance ≈85% (N_2). -Bottle 2: 100% N_2.	
Purpose of data/parameter	Calculation of project emissions	
Additional comment	Extractive sampling analysers with water and particulates removal devices have been used. The point of measurement (sampling point) is in the upper section of the flare (80% of total flare height). Sampling is conducted with appropriate sampling probes adequate to high temperatures level (e.g. inconel probes).	

Data/Parameter	**$fv_{CH4,FG,h}$**	
Unit	mg/m^3	
Description	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h	
Measured/calculated/ default	On-site measurements using a continuous gas analyser.	
Source of data	Automatic Data Gathering System	
Value(s) of monitored parameter		45.48
	Period 1	
	Type	Flare Emissions Analyser (FEA)
	Accuracy class	CH_4 = 5ppm +1% of reading
	Manufacturer	Landtec

	Model	FEA
	Serial Number	4299
	Calibration Frequency	12 months
	Date of last calibration	28/02/2017
	Validity of last calibration	27/02/2018
	Installation date	13/01/2010
Measuring/reading/recording frequency	Methane concentration in the exhaust gas has been measured at least once per hour using a continuous gas analyser (under normal operating conditions, data has been recorded every two minutes electronically), and data records will be kept during the crediting period and two years after. Data has also been aggregated monthly.	
Calculation method (if applicable)	The value of the monitored value shown in this table is the result of the weighted average in which raw data in the same time interval accomplish the following three operational conditions at the same time: • Condition 1: The $V_{LFG,sent\_flare,y,db}$ should be between 450 and 5047 Nm^3/h • Condition 2: The $v_{CH4,t,db}$ should be between 25 and 75% in CH_4 • Condition 3:The $T_{EG,m}$ should be between 500 and 1200ºC. The variable is monitored, as required by the "Project emissions from flaring" (version 02.0.0) to calculate the flare efficiency. In case of malfunction or delayed installation of the continuous gas analyser, 90% of flare efficiency is used.	
QA/QC procedures	Analyser has been periodically calibrated according to the manufacturer's recommendation. A zero check and typical value check by comparison with a standard certified gas has been conducted. The FEA is calibrated manually by the Field Technician at least one time per week. The characteristics of the standard certified gas are as follows: -Bottle 1: 400 ppm CH_4, 15% O_2 and balance ≈85% (N_2). -Bottle 2: 100% N_2.	
Purpose of data/parameter	Project	
Additional comment	Extractive sampling analysers with water and particulates removal devices have been used. The point of measurement (sampling point) is in the upper section of the flare (80% of total flare height). Sampling is conducted with appropriate sampling probes adequate to high temperatures level (e.g. inconel probes). To convert from ppmv to mg/m^3, the monitored values have been multiplied by 0.716 as per the "Project emissions from flaring" (version 02.0.0).	

Data/Parameter	**$Maintenance_y$**
Unit	Calendar dates
Description	Maintenance events completed in year y
Measured/calculated/ default	Measured
Source of data	Record the date that maintenance events were completed in year y. Records of maintenance include all aspects of the maintenance including the details of the person(s) undertaking the work, parts replaced, or needing to be replaced, source of replacement parts, serial numbers and calibration certificates
Value(s) of monitored parameter	Records are kept in a maintenance log.
Measuring/reading/recording frequency	Annually

Calculation method (if applicable)	This section has been left in blank on purpose.
QA/QC procedures	Records will be kept in a maintenance log for two years beyond the life of the flare
Purpose of data/parameter	Not required for calculations.
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	**T_t**
Unit	^oC
Description	Temperature of the gaseous stream in time interval t
Measured/calculated/ default	Measured.
Source of data	Measured by thermal flowmeter continuously
Value(s) of monitored parameter	41.4
Monitoring equipment	See details of the thermal mass flowmeter used to measure the parameter $V_{LFG,sent\_flare,y,db}$
Measuring/reading/recording frequency	Data has been measured at least once per hour (under normal operating conditions, data has been recorded every two minutes) recorded electronically. Data has been aggregated monthly/yearly. Records will be kept during the crediting period and two years after.
Calculation method (if applicable)	The value of the monitored value shown in this table is the result of the weighted average. The flow meters automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters (Nm^3).
QA/QC procedures	Measuring instruments should be subject to a regular maintenance and testing regime to ensure accuracy.
Purpose of data/parameter	Not used.
Additional comment	No separate monitoring of temperature is necessary when using flow meters that automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters (Nm^3). As per the last version of the "Tool to determine the mass flow of a GHG in a gaseous stream" (Version 02.0.0), Option 2 (Simplified calculation without measurement of the moisture content) will be used to determine the absolute humidity by assuming the gaseous stream is dry or saturated depending on which is the conservative situation. The applicability condition related to the gaseous stream flow temperature being below 60^oC is adopted and therefore, this parameter must be monitored continuously to assure the applicability condition is met.

Data/Parameter	**P_t**
Unit	Pa
Description	Pressure of the gaseous stream in time interval t
Measured/calculated/ default	Measured
Source of data	Measured by a pressure meter

Value(s) of monitored parameter		174,115.7
Monitoring equipment	Type	Not installed
	Accuracy class	Not installed
	Manufacturer	Not installed
	Model	Not installed
	Serial Number	Not installed
	Calibration Frequency	Not installed
	Date of last calibration	Not installed
	Validity of last calibration	Not installed
	Date of previous calibration	Not installed
	Validity of previous calibration	Not installed
Measuring/reading/recording frequency	Not installed	
Calculation method (if applicable)	As per the last version of the "Tool to determine the mass flow of a GHG in a gaseous stream" (Version 02.0.0), Option 2 (Simplified calculation without measurement of the moisture content) will be used to determine the absolute humidity by assuming the gaseous stream is dry or saturated depending on which is the conservative situation. The applicability condition related to the gaseous stream flow temperature being below 60ºC is adopted and therefore, this parameter must be monitored continuously to calculate saturation absolute humidity ($m_{H2O,t,db,sat}$). However, no separate monitoring of temperature is necessary when using flow meters that automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters (Nm^3).	
QA/QC procedures	Not applicable	
Purpose of data/parameter	Not used. The flow meters automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters (Nm^3).	
Additional comment	Not applicable	

Data / Parameter:	$v_{CH4,t,db}$	
Data unit:	m^3 CH4/m^3 dry gas	
Description:	Volumetric fraction of CH4 in a time interval t on a dry basis	
Measured/calculated/ default	Measured	
Source of data:	Measured continuously by the project participant using certified gas analyser	
Value(s) of monitored parameter		47.39%
	Period 1	
	Type	Field Analyser Unit (FAU)
	Accuracy class	± 0.2% to ± 1% (0 to full scale)
	Manufacturer	Landtec
	Model	FAU
	Serial Number	GA08966/06
	Calibration Frequency	6 months
	Date of last calibration	20/02/2017
	Validity of last calibration	01/09/2017
	Installation date	02/03/2017
	Validity of calibration runs from	Installation date

Measuring/reading/recording frequency	Methane content has been measured using a continuous gas analyser. Data has been measured at least once per hour (In normal operating conditions, data has been recorded every two minutes) and recorded electronically. Data will be kept during the crediting period and two years after. Data has been aggregated monthly.
Calculation method (if applicable)	The value of the monitored value shown in this table is the result of the weighted average in which raw data in the same time interval accomplish the following three operational conditions at the same time: • Condition 1: The $V_{LFG,sent\_flare,y,db}$ should be between 450 and 5047 Nm^3/h • Condition 2: The $v_{CH4,t,db}$ should be between 25 and 75% in CH_4 • Condition 3:The $T_{EG,m}$ should be between 500 and 1200ºC..
QA/QC procedures	Gas analyzer has been subject to a regular calibration, maintenance and testing regime to ensure accuracy. As per equipment provider, the FAU conducts a span gas check every 8 hours, even though the provider recommends only one check per week. The characteristics of the standard certified gas are as follows: -Bottle 1: 45% CH_4, 40% CO_2 y balance 15% (N_2). -Bottle 2: 5% O_2 y balance 95% (N_2).
Purpose of data/parameter	Baseline
Additional comment	Paired values of the methane fraction of the landfill gas and LFG flow which are averaged for the same time interval have been used in the calculation of emission reductions. The parameter $v_{CH4,t,db}$ is measured by the Field Analyser Unit (FAU), which is placed after the booster.

Data/Parameter	**$EC_{BL,k,y}$**	
Unit	MWh	
Description	Net quantity of electricity generated using LFG	
Measured/calculated/ default	It will be calculated from the balance of electricity produced (EGy) substracting the electricity imported (EIy), both measured by electricity meter when installed	
Source of data	Not installed	
Value(s) of monitored parameter		Not installed
Monitoring equipment	Type	Not installed
	Accuracy class	Not installed
	Manufacturer	Not installed
	Model	Not installed
	Serial Number	Not installed
	Calibration Frequency	Not installed
	Date of last calibration	Not installed
	Validity of last calibration	Not installed
	Installation date	Not installed
	Validity of calibration runs from	Not installed
Measuring/reading/recording frequency	Electricity meter will be used to measure **$EC_{BL,k,y}$**. The measurement method will be based in the principle that the electricity reading is the power accumulated over a period divided by the duration of such period. The readings will be gathered automatically by an electricity meter and the project participant will be receiving the corresponding bills, which will be used as the monitoring data source. The accuracy of the measurement equipment will be 1% of maximum reading. The responsible person/entity for the measurement will be the project participant. The calibration will be carried out yearly or at the frequency required by the electricity company. The net quantity of electricity generated using LFG (**$EC_{BL,k,y}$**) will be calculated by the difference between the gross quantity of electricity generated using LFG	

	($EL_{LFG,y}$), which will be monitored and the mount of electricity consumed by the project activity (**$EG_{EC,y}$**)**.**.
Calculation method (if applicable)	Not installed
QA/QC procedures	Data will be measured continuously, recorded electronically, and data will be kept during the crediting period and two years after. Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy.
Purpose of data/parameter	Not used
Additional comment	Required to estimate the emission reductions from electricity generation from LFG.

Data/Parameter	**$EG_{EC,y}$**	
Unit	MWh	
Description	Amount of electricity consumed by the project activity in year y	
Measured/calculated/ default	Measured	
Source of data	Monthly invoices.	
Value(s) of monitored parameter		72
Monitoring equipment	**Period 1**	
	Type	Electricity Meter
	Accuracy class	±0.25%
	Manufacturer	Gridstream RF (Landys)
	Model	Industrial meter
	Serial Number	40B9C408
	Calibration Frequency	N/A
	Date of last calibration	N/A
	Validity of last calibration	N/A
	Date of previous calibration	01/10/2012
	Validity of previous calibration	N/A
	Installation date	19/11/2015
	Validity of calibration runs from	N/A
Measuring/reading/recording frequency	Measured continuously with electricity meter, aggregated monthly in invoices provided by the grid operator.	
Calculation method (if applicable)	Monthly invoices are aggregated and compared against accumulated electricity readings from electricity meter.	
QA/QC procedures	According to manufacturer's specifications, the electricity meter does not need to be calibrated. Monthly invoices are aggregated and cross-checked against accumulated electricity readings from electricity meter to ensure reliability of data.	
Purpose of data/parameter	Project	

Additional comment	Project electricity consumption is the sum of electricity consumption by the LFG blower, the monitoring equipment (incl. office). Each component has the same emissions factor for electricity generation and the same transmission and distribution losses. The meter has been installed in this first phase of the project activity outside the compound in order to be accessible by the electricity company (CFE).

Data/Parameter	**$Op_{engine,h}$**
Unit	-
Description	Operation of the engine that consumes the LFG
Measured/calculated/ default	Not installed
Source of data	Not installed
Value(s) of monitored parameter	Not installed
Monitoring equipment	Not installed
Measuring/reading/recording frequency	Not installed
Calculation method (if applicable)	For the engine using the LFG, the plant is operating in hour h by monitoring the product generated by the engine (i.e Net quantity of electricity generated using LFG). The method to determine the operation of the engine that consumes the LFG would be: • $Op_{engine,h}$=0 when no net quantity of electricity is generated using LFG in the hour h. • $Op_{engine,h}$=1 when net quantity of electricity is generated using LFG in the hour h.
QA/QC procedures	Data will be measured continuously, recorded electronically, and data will be kept during the crediting period and two years after. Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy.
Purpose of data/parameter	Not used
Additional comment	Required to estimate the emission reductions from electricity generation from LFG.

Data/Parameter	**$Op_{flare,h}$**
Unit	-
Description	Operation of the flare that consumes the LFG
Measured/calculated/ default	Measured
Source of data	Monitoring the flame detection system
Value(s) of monitored parameter	7,141 hours
Monitoring equipment	The flame detection system is used to ensure that the equipment is in operation since the control system of the equipment ensures that the enclosed flare will stop if no flame is detected. The method to determine the operation of the enclosed flare

	using the LFG would be: • $Op_{flare,h}$ =0 when flame is not detected continuously in hour h (instantaneous measurements are made at least every minute); • $Op_{flare,h}$=1 when flame is detected continuously in hour h (instantaneous measurements are made at least every minute).
Measuring/reading/recording frequency	Continuous
Calculation method (if applicable)	The flame detection system is used to ensure that the equipment is in operation since the control system of the equipment ensures that the enclosed flare will stop if no flame is detected. The method to determine the operation of the enclosed flare using the LFG would be: • $Op_{flare,h}$ =0 when flame is not detected continuously in hour h (instantaneous measurements are made at least every minute); • $Op_{flare,h}$=1 when flame is detected continuously in hour h (instantaneous measurements are made at least every minute).
QA/QC procedures	Data will be measured continuously, recorded electronically, and data will be kept during the crediting period and two years after. Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy.
Purpose of data/parameter	Baseline
Additional comment	Required to estimate the emission reductions from flaring the LFG.

Data/Parameter	$Flame_m$
Unit	Flame on or Flame off
Description	Flame detection of flare in the minute m
Measured/calculated/ default	Measured
Source of data	Monitoring the flame detection system
Value(s) of monitored parameter	7,141 hours
Monitoring equipment	Measured using IRIS Model S706-PF flame scanner UV detector, which do not require calibration. The flame detection system is used to ensure that the equipment is in operation since the control system of the equipment ensures that the enclosed flare will stop if no flame is detected. The method to determine whether the flame is on or off would be: • Flame off: when flame is not detected continuously in hour h (instantaneous measurements are made at least every minute); • Flame on: when flame is detected continuously in hour h (instantaneous measurements are made at least every minute).
Measuring/reading/recording frequency	Continuous
Calculation method (if applicable)	The flame detection system is used to ensure that the equipment is in operation since the control system of the equipment ensures that the enclosed flare will stop if no flame is detected. The method to determine the operation of the enclosed flare using the LFG would be: • Flame off: when flame is not detected continuously in hour h (instantaneous measurements are made at least every minute); • Flame on: when flame is detected continuously in hour h (instantaneous measurements are made at least every minute).

QA/QC procedures	Data will be measured continuously, recorded electronically, and data will be kept during the crediting period and two years after. Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy.
Purpose of data/parameter	Calculation of baseline emissions
Additional comment	Required to estimate the emission reductions from flaring the LFG.

Data/Parameter	**$PE_{EC,y}$**
Unit	tCO2
Description	Project emissions from electricity consumption by the project activity during the year *y*
Measured/calculated/ default	Calculated
Source of data	Calculated from monthly invoices of electricity consumption from the grid.
Value(s) of monitored parameter	34
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency	Continuous
Calculation method (if applicable)	Calculated as per the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0) using the electricity consumption from the grid
QA/QC procedures	As per the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 03.0)
Purpose of data/parameter	Calculation of project emissions
Additional comment	Project emissions from electricity consumption is the sum of project emissions from electricity consumption by the LFG blower, the monitoring equipment (incl. office). Each component has the same emissions factor for electricity generation and the same transmission and distribution losses. The meter has been installed in this first phase of the project activity outside the compound in order to be accessible by the electricity company (CFE).

Data/Parameter	**$FC_{i,j,y}$**	
Unit	m^3	
Description	Quantity of fuel type i combusted in process j during the year y	
Measured/calculated/ default	Measured	
Source of data	Onsite measurements of Liquid-Level Gauge percentage.	
Value(s) of monitored parameter	0.0500	
	Type	Liquid-Level Gauge
	Accuracy class	±5%
	Manufacturer	Ingusa
	Model	4_1693

	Serial Number	N/A
	Calibration Frequency	N/A
	Date of last calibration	N/A
	Validity of last calibration	N/A
	Date of previous calibration	N/A
	Validity of previous calibration	N/A
	Installation date	05/10/2016 (180 litres capacity)
	Validity of calibration runs from	N/A
Measuring/reading/recording frequency	Measured continuously with a volume meter. Since fuel (LPG) is supplied from small daily tanks, a ruler is used to determine the volume of the fuel consumed. The ruler gauge is part of the daily tank and the control for recording the measurements is done in daily log sheets.	
Calculation method (if applicable)	The consumed value in a daily basis is determined by the difference of two consecutive Liquid-Level Gauge readings (%) and multiplied by the storage tank capacity (180 litres capacity) .	
QA/QC procedures	The consistency of metered fuel consumption quantities has been crosschecked by an energy balance that is based on purchased quantities and stock changes. Since the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities have also been crosschecked with available purchase invoices from the financial records as per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion". As per manufacturer´s specification, the Liquid-Level Gauge does not require a calibration.	
Additional comment	The parameter $FC_{i,j,y}$ is measured by the Liquid Level Gauge. Since fuel (LPG) is supplied from small daily tanks, this measurement method have been used to determine the volume of the fuel consumed as per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" in its Version 2. The ruler gauge is part of the tank, installed inside the compound.	

Data/Parameter	**$T_{EG,m}$**	
Unit	°C	
Description	Temperature in the exhaust gas of the enclosed flare in minute m	
Measured/calculated/ default	Measured	
Source of data	On-site measurements using four measurements (sampling points), distributed along the flare stack.	
Value(s) of monitored parameter		710.2
	Period 1	
	Type	Thermocouple
	Accuracy class	± 2.2° C or 0.75% of reading, whichever is greater
	Manufacturer	Thermo Sensors Corporation
	Model	494-92716-8-K-I600
	Serial Number	139023-1,2,3 and 4
	Calibration Frequency	18 months
	Date of last calibration	24/02/2017
	Validity of last calibration	21/11/2018
	Installation date	22/05/2017
	Validity of calibration runs from	Installation date

Measuring/reading/recording frequency	Temperature in the exhaust gas has been measured at least once per hour (under normal operating conditions, data has been recorded every two minutes electronically) using four thermocouples distributed along the flare stack. Data records will be kept during the crediting period and two years after. Data has also been aggregated monthly.
Calculation method (if applicable)	The value of the monitored value shown in this table is the result of the weighted average in which raw data in the same time interval accomplish the following three operational conditions at the same time: • Condition 1: The $V_{LFG,sent\_flare,y,db}$ should be between 450 and 5047 Nm^3/h • Condition 2: The $v_{CH4,t,db}$ should be between 25 and 75% in CH_4 • Condition 3:The $T_{EG,m}$ should be between 500 and 1200ºC.
QA/QC procedures	Continuous measurement of the temperature of the exhaust gas stream in the flare by four thermocouples distributed along the flare stack. A temperature above 500 ºC indicates that a significant amount of gases are still being burnt and that the flare is operating.
Purpose of data/parameter	Not used directly in the calculations
Additional comment	An excessively high temperature at the sampling point (1200ºC) may be an indication that the flare is not being adequately operated or that its capacity is not adequate to the actual flow. The parameter $T_{EG,m}$ is measured with four measurements (sampling points), distributed along the flare stack.

D.3. Implementation of sampling plan

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Not applicable. The section is left blank intentionally.

SECTION E. Calculation of emission reductions or net anthropogenic removals

The raw data gathered is presented in Monthly ER Spreadsheets to calculate the Emission Reductions (ER_y) in a monthly basis as per the applicable methodologies and the registered PDD and these are aggregated and reported in the Summary ER Spreadsheet presented in conjunction with the CDM-MR.

E.1. Calculation of baseline emissions or baseline net removals

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The following table summarizes the actual values used to calculate the baseline emissions (BE_y) with the corresponding results applying the formulae as per the registered PDD:

Table 1 Results and parameters used to calculate the Baseline Emissions

Data / Parameter:	Description	Source		Unit
BEy	Baseline emissions (tCO2e)			
BEy = BECH4,y + BEEC,y		Eq. (1) page 18 PDD	**47,663**	tCO2e
BECH4,y	Baseline emissions of LFG from the SWDS (tCO2e/yr)			
BECH4 = ((1 − OXtop _layer) × FCH4,PJ,y − FCH4,BL,y) × GWPCH4		Eq. (2) page 19 PDD	**47,663**	tCO2e
OXtop _layer	Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline (dimensionless)	Default	**0.1**	-
FCH4,PJ,y = FCH4,flared,y + FCH4,EL,y	Amount of methane in the LFG which is flared and/or used in the project activity in year y (t CH4/yr)	Eq. (3) page 19 PDD	**2,118**	tCH4
FCH4flared, y = FCH4,sent_flare,y - (PEflare / GWPC	Amount of methane in the LFG which is destroyed by flaring in year y (t CH4/yr)	Eq (4) Page 20 PDD	**2,118**	tCH4
FCH4,sent_flare,y = VLFG,sent_flare,y,db * vCH4,t,(	Amount of methane in the LFG which is sent to the flare in year y (t CH4/yr)	Eq. (7) Page 23 PDD	**2,194**	tCH4
VLFG,sent_flare,y,db	Volumetric flow of landfill gas which is sent to flare in year y on a dry basis (m³ dry gas)	Measured	**6,484,599**	m3 LFG
vCH4,t,db	Average methane fraction of the landfill gas as measured and expressed as a fraction (m³ CH4 / m³ LFG)	Measured	**47.39%**	m³ CH4/m³ LFG
DCH4	Methane density at normal temperature and pressure (0°C and 1.013 bar) (tCH4/m3CH4)	Default	**0.0007168**	tCH4/m3CH4
PEflare = GWPCH4 * FCH4,RG * (1 - ηflare) / 1000	Project emissions from flaring of the residual gas stream in year y (t CO2e/yr)	Eq (15) Page 32 PDD	**1,895**	tCO2e
GWPCH4	Global warming potential of CH4 (t CO2e/t CH4)	Default	**25**	tCO2e/tCH4
FCH4,RG = FVRG * fv CH4, RG * ρ CH4,n	Mass flow rate of methane in the residual gas (kg)	Eq (5) Page 25 PDD	**2,191,745**	kgCH4
FVRG	Quantity of landfill gas fed to the flare (m3)	Measured	**6,484,599**	m3 LFG
fv CH4, RG	Volumetric fraction of methane in the residual gas on dry basis	Measured	**47.39%**	m³ CH4/m³ LFG
ρ CH4,n	Density of methane at normal conditions (kg/m3)	Default	**0.7160000**	kgCH4/m3CH4
ηflare	Flare combustion efficiency (%)	Measured	**96.54%**	%
GWPCH4	Global Warming Potential value of methane	Default	**25**	tCO2e/tCH4
FCH4,EL,y =VLFG,EL,y,db * vCH4,t,db * DCH4	Amount of methane in the LFG which is used for electricity generation in year y (t CH4/yr)	Page 20 PDD	**-**	tCH4
VLFG,EL,y,db	Volumetric flow of landfill gas which is used for electricity generation in year y on a dry basis (m³ dry gas)	Measured	**-**	m³ LFG
vCH4,t,db	Average methane fraction of the landfill gas as measured and expressed as a fraction (m³ CH4 / m³ LFG)	Measured	**47.39%**	m³ CH4/m³ LFG
DCH4	Methane density at normal temperature and pressure (0°C and 1.013 bar) (tCH4/m3CH4)	Default	**0.0007168**	tCH4/m3CH4
FCH4,BL,y	Amount of methane in the LFG that would be flared in the baseline in year y (t CH4/yr)	Default	**0**	tCH4
GWPCH4	Global Warming Potential value of methane	Default	**25**	tCO2e/tCH4
BEEC,y	Baseline emissions associated with electricity generation in year y (t CO2/yr)			
BEEC,y=ECBL,k,y * EFEL,k,y * (1-TDLk,y)		Page 37 PDD	**-**	tCO2e
ECBL,k,y	Quantity of electricity that would be consumed by the baseline electricity consumption source k in year y (MWh/yr)	Measured	**-**	MWh
EFEL,k,y	Emission factor for electricity generation for source k in year y (tCO2/MWh)	Default	**0.45338**	tCO2/MWh
TDLk,y	Average technical transmission and distribution losses in the grid	Default	**20%**	%

E.2. Calculation of project emissions or actual net removals

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The following table summarizes the actual values used to calculate the project emissions (PE_y) with the corresponding results applying the formulae as per the registered PDD:

Table 2 Results and parameters used to calculate the Project Emissions

Data / Parameter:	Description	Source		Unit
PEy	Project emissions in year y (tCO2e)			
PEy = PEEC,y + PEFC,j,y		Eq. (17) Page 38 PDD	**34**	tCO2
PEEC,y	Emissions from consumption of electricity in the project case.			
PEEC,y = ECPJ,j,y * EFEL,j,y * (1 + TDLj,y)	Project emissions from electricity consumption by the project activity during the year y (tCO2 / yr)	Eq. (1) Page 38 PDD	**34**	tCO2
ECPJ,j,y	Quantity of electricity consumed by the project activity during the year y (MWh)	Measured	**72**	MWh
EFEL,j,y	Emission factor for the grid in year y (tCO2/MWh)	Default	**0.45338**	tCO2/MWh
TDLj,y	Average technical transmission and distribution losses in the grid	Default	**3.0%**	%
PEFC,j,y	Project emissions from fossil fuel combustion in process j			
PEFC,j,y = FCi,j,y* COEFi,y	CO2 emissions from fossil fuel combustion in process j during the year y (tCO2/yr)	Eq. (1) Page 39 PDD	**0**	tCO2
FCi,j,y	Quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr)	Measured	**0**	m3
COEFi,y = NCVi,y *EF CO2,i,y	CO2 emission coefficient of fuel type i in year y (tCO2 / mass or volume unit)	Page 39 PDD	**2.027**	tCO2/TJ
NCVi,y	Weighted average net calorific value of the fuel type i in year y	Default	**30.90**	GJ/m3
EF CO2,i,y	Weighted average CO2 emission factor of fuel type i in year y	Default	**0.0656**	tCO2/GJ

E.3. Calculation of leakage emissions

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The calculation does not need to consider leakage emissions, so LE_y=0

E.4. Calculation of emission reductions or net anthropogenic removals

The following table summarizes the actual values used to calculate the emission reductions (ER_y) with the corresponding results applying the Equation 26 as per the page 18 of the registered PDD:

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	47,663	34	0	0	0	47,629

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

The following table shows a comparison of actual values of the emission reductions achieved during the monitoring period with the estimations in the registered CDM-PDD:

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante (t CO_2e)
47,629	182,137

The values in the ex-ante calculation of the updated CDM-PDD are 134,198 tCO2e for 2017 (365 days) and 157,871 tCO2e for 2018 (365 days). The daily average for 2017 and 2018 equate to 368 and 433 tCO2e/day, respectively. The ex-ante estimation is calculated by multiplying each of the daily average for 2017 and 2018 by the 431 days of the current monitored period (66 and 365, respectively).

Considering the same time basis and the same periods, the actual emission reductions achieved during the current monitoring period are lower than the emission reductions derived from the yearly values stated in the registered CDM-PDD as shown in the following table:

Item		Actual values achieved during this monitoring period	Values estimated in ex-ante calculation of registered PDD
Year 2017	*From*	27/10/2017	01/01/2017
	To	31/12/2017	31/12/2017
	Days	66	365
	Emission reductions or GHG removals by sinks (t CO_2e)	117	134,198
	tCO2e/day	**2**	**368**
Year 2018	*From*	01/01/2018	01/01/2018
	To	31/12/2018	31/12/2018
	Days	365	365
	Emission reductions or GHG removals by sinks (t CO_2e)	47,513	157,871
	tCO2e/day	**130**	**433**

E.6. Remarks on increase in achieved emission reductions

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The actual emission reductions achieved during the current monitoring period are lower than the emission reductions derived from the yearly values stated in the registered CDM-PDD. Therefore, there is no need to provide explanation of any increase.

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Document information

Version	*Date*	*Description*
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the "CDM project standard for project activities" (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
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 GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, 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).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

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