Monitoring report form

(Version 05.1)

Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.

MONITORING REPORT		
Title of the project activity	Ciudad Juarez Landfill Gas to Energy Project	
UNFCCC reference number of the project activity	1123	
Version number of the monitoring report	1.0	
Completion date of the monitoring report	02/12/2016	
Monitoring period number and duration of this monitoring period	**Monitoring period number:** 1st MP (first monitoring period) 2nd CP (second crediting period) **Duration of this monitoring period:** From 30/11/2014 – 31/12/2015 (both days included).	
Project participant(s)	Biogas de Juárez S.A de C.V.	
Host Party	Mexico	
Sectoral scope(s)	The landfill gas capture component falls into: Scope number: 13 Sectoral scope: Waste handling and disposal The power plant component falls into: Scope number:1 Sectoral scope: Energy industries (renewable / non renewable sources)	
Selected methodology(ies)	ACM0001 version 15.0: "Large-scale Consolidated Methodology Flaring or use of landfill gas" ACM0002 version 16.0: "Large-scale Consolidated Methodology: Grid-connected electricity generation from renewable sources."	
Selected standardized baseline(s)	N/A	
Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD	166,160 tCO_{2e}	
Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	N/A	152,209 tCO_{2e}

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>>

The Ciudad Juarez Landfill Gas to Energy Project (the Project) developed by Biogas de Juarez, S.A. de C.V. (the Project Developer) is a landfill gas (LFG) collection and utilization project in the Ciudad Juarez landfill in the state of Chihuahua, Mexico (the Host Country). The project was registered as a CDM project activity on 30 November 2007. The second 7-year renewable crediting period started on 30/11/2014 and ends on 29/11/2021. The present Monitoring Report corresponds to the 1st verification of the second crediting period.

The Project's purpose is to reduce greenhouse gas (GHG) emissions by capturing and utilizing the methane (CH_4) in the LFG released by the Ciudad Juarez landfill, and avoiding future GHG emissions from the decomposition of municipal solid waste residues. The captured methane is combusted to generate electricity that is fed to the national power grid and used as an alternative source of cheap, indigenous, stable and renewable energy that will reduce dependence on grid power. Thus, in addition to directly eliminating a significant portion of the methane, which is a potent GHG with 25 times the global warming potential of CO_2, the Project also displace fossil fuel-based electricity generation that would have emitted additional CO_2. All landfill gas collected during periods when electricity is not produced is being flared, however, due to the marginal quantity of time-stamps, no emission reductions are claimed from flaring the gas in the current report.

For proper gas extraction, conduction and destruction, the following components have been installed:

- 17 horizontal and vertical extraction wells.
- Modulators of LFG collection wells field systems.
- High density polyethylene pipe (HDPE) to connect the extraction wells to the flare station and power plant.
- Condensate management system.
- 1 blower station.
- 1 enclosed flare.
- 1 control room.
- 4 generator engines 1.6 MW each, totalizing an installed capacity of 6.4 MW

Relevant dates for the project activity are provided below in Table 1:

Table 1. Relevant dates for project activity

Date	Event
12/03/2007	Construction starting date
23/11/2007	Project commissioning
11/06/2009	Legal permits for electricity generation "Permission to generate electricity for self-consumption"- Comisión Reguladora de Energía (CRE)
11/06/2009	Right of way contract – authorization to build interconnection line inside the municipal landfill – Juarez Municipality
26/05/2010	Construction of interconnection line concluded
15/06/2010	Interconnection contract with Comisión Federal de Electricidad (CFE)
25/06/2010	Right of way contract – authorization to operate interconnection line inside the municipal landfill – Juarez Municipality
29/07/2010	Modification of the Permission to generate electricity for self-consumption" – construction end dates extension – Comisión Reguladora de Energía (CRE)
22/03/2011	Installation of the bidirectional power meter device
01/04/2011- 14/06/2011	Electricity generation PERIOD OF TESTS
15/06/2011	Power plant OFFICIAL STARTING DATE (flare is turned off)

The first monitoring period comprises from 30/11/2014 to 31/12/2015 (both days included). The total emission reductions obtained during this period are 152,209 tCO_2e.

A.2. Location of project activity

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The Project is located at the Ciudad Juárez Landfill, in the municipality of Ciudad Juárez, state of Chihuahua, Mexico. It is located at kilometer 27.5 of Federal Highway number 45.

The project site is located within the coordinates of 31º 33' 35.62'' N - 106º 29' 40.94'' W; 31º 33' 36.80'' N - 106º 29' 18.90'' W; 31º 33' 15.44'' N - 106º 29' 21.62'' W; and 31º 33' 15.29'' N - 106º 29' 39.64'' W. And specifically Phase I of the project is located within the coordinates of 31º 33' 36.42'' N - 106º 29' 32.06'' W; 31º 33' 36.80'' N - 106º 29' 18.90'' W; 31º 33' 25.85'' N - 106º 29' 19.75'' W; and 31º 33' 27.03'' N - 106º 29' 30.86'' W.

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 whether the Party involved wishes to be considered as project participant (yes/no)
Mexico (host)	Biogas de Juarez S.A. de C.V.	No

A.4. Reference of applied methodology and standardized baseline

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Two approved baseline methodologies are used:

- ACM0001: "Large-scale Consolidated Methodology Flaring or use of landfill gas", version 15.0[1]

- ACM0002: "Large-scale Consolidated Methodology: Grid-connected electricity generation from renewable sources", version 16[2]

The methodologies also refer to the following methodological tools, which have been applied:

- "Tool Project emissions from flaring", version 2.0.0[3]
- "Tool Emissions from solid waste disposal sites", version 6.0.1[4]
- "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", version 2.0.0[5]
- "Tool to calculate the emission factor for an electricity system", version 4.0[6]
- "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", version 1[7]
- "Tool Assessment of the validity of the original/current baseline and update of the baseline at renewal of the crediting period", version 03.0.1[8]

[1] https://cdm.unfccc.int/methodologies/DB/QOU487ZYKBIAU17YHORZXENWDTEPAC

[2] https://cdm.unfccc.int/methodologies/DB/8W400U6E7LFHHYH2C4JR1RJWWO4PVN

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

[4] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v4.pdf/history_view

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

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

[7] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf/history_view

[8] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v1.pdf/history_view

A.5. Crediting period of project activity

>>
Second 7-year renewable crediting period started on 30/11/2014 and ends on 29/11/2021

A.6. Contact information of responsible persons/entities

>>
Responsible entity: Biogas de Juarez S.A. de C.V.

Contact information:

- **Mr. Hector Francisco Rangel Legarreta**
  Email: hector.rangel@biogasdejuarez.com
  Telephone: +52 614 4300001

- **Ms. Nancy Herrada Garibaldi**
  Email: nancy.herrada@biogasdejuarez.com
  Telephone: +52 614 4300001

Biogás de Juarez is a project participant to Appendix 1

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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In order to maximize LFG recovery rates, and thus GHG emission reductions, an active LFG collection system has been installed. The system consists of a series of horizontal extraction wells interconnected by header piping, including modulators systems. High density polyethylene pipelines (HDPE) to connect the extraction wells with the flare station and the power plant have been installed. The LFG is extracted from the landfill by a blower and then conducted to the enclosed flare station. Additionally, infrastructure for electricity generation with a capacity of 6.4MW was designed. The main components of this system are:

Table 2. Description of the installed technology

Landfill gas extraction and capture system					
Implemented technology	**Quantity**	**Manufacturer Brand/Model**	**Serial number**	**Installed capacity**	**Operating during this MP (YES/NO)**
Horizontal / vertical wells	17	Iohisa	N/A	N/A	YES
Separator	19	SmartSoil Canada	According to every separator nameplate	300 l	YES
Chiller	1	York	035-16283-000	32°C or less	YES
Blowers	2	Gardner Denver, 9CDL23	450740 361221	Max. 2,700 m^3/h	YES
Electricity generation system					
Implemented technology	**Quantity**	**Manufacturer Brand/Model**	**Serial number**	**Installed capacity**	**Operating during this MP (YES/NO)**
Generation engines	4	CAT 3520C	GZJ00278 GZJ00280	1.6 MW each 60Hz	YES

			GZJ00281 GZJ00663	1200 rpm 480 V	
Switch gear system	1	N/A	N/A	N/A	YES
Transformer	5	Continental	4005-22088 4005-22089 4005-22090 4005-22672 4005-22691	2000KVA 2000KVA 2000KVA 500KVA 2000KVA	YES
Landfill gas flaring system					
Implemented technology	**Quantity**	**Manufacturer Brand/Model**	**Serial number**	**Installed capacity**	**Operating during this MP (YES/NO)**
Enclosed flare	1	Mactronic Enerflex	0821	16" x 18" Flare Stack	NO

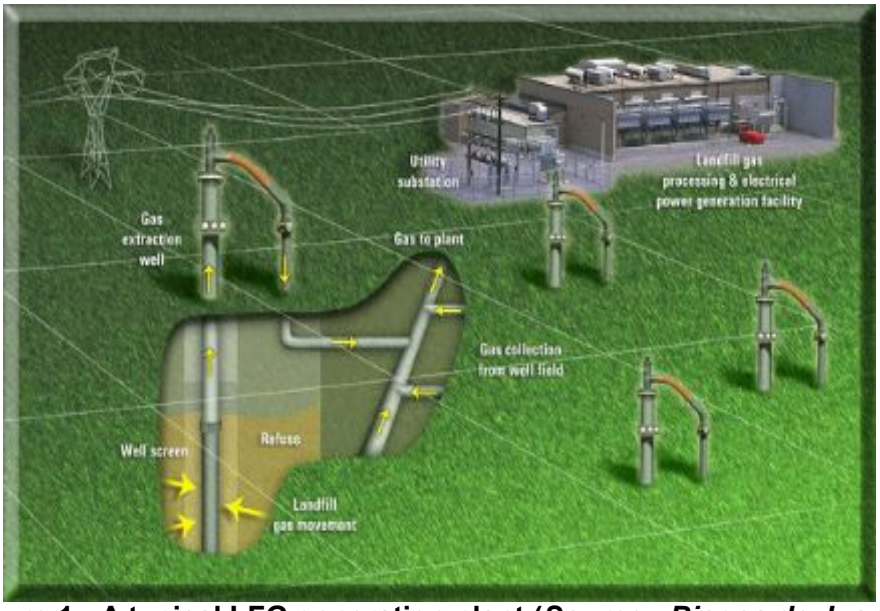


Figure 1: A typical LFG generation plant (*Source: Biogas de Juarez)*

Information on the implementation and actual operation of the project activity:

The Ciudad Juarez landfill started operating in 1994. The landfill is separated into three main areas consisting of three differentiated cells: A, B, C. The first step of the Project, captures and use the biogas produced in a fraction area of cell A, which was closed in April 2008. This partially closed area extends over an area of approximately 128,000 square meters (m^2), accumulated a total of 2.628 million tons of waste. On April 2013, this area was extended over an area of approximately 196,000 m^2 and contains 5.633 million tons of waste. Final closure of cell A took place in December 2014 and has accumulated a total of 8.261 million tons of waste to-date. The Project has an electricity component that was designed in two phases. In Phase I, the infrastructure for electricity generation with a capacity of 6.4MW was initially designed, and was planned to start operations in 2008. During the second phase, the installed capacity was expected to increase to a total of 20.8MW in 2011. However the project has experienced delays in the implementation of the electricity generation component due to delays in obtain relevant permits from local and national authorities and for the low biogas captured flow from the landfill which is below than the initial ex-ante estimation. Therefore, phase I only began partially operation on June 15th, 2011 with an installed capacity of 4.8MW (1.6MW X 3 units) after that on September 2013 an extra unit of 1.6MW was installed; therefore the installed capacity is 6.4MW. This is still the actual installed capacity.

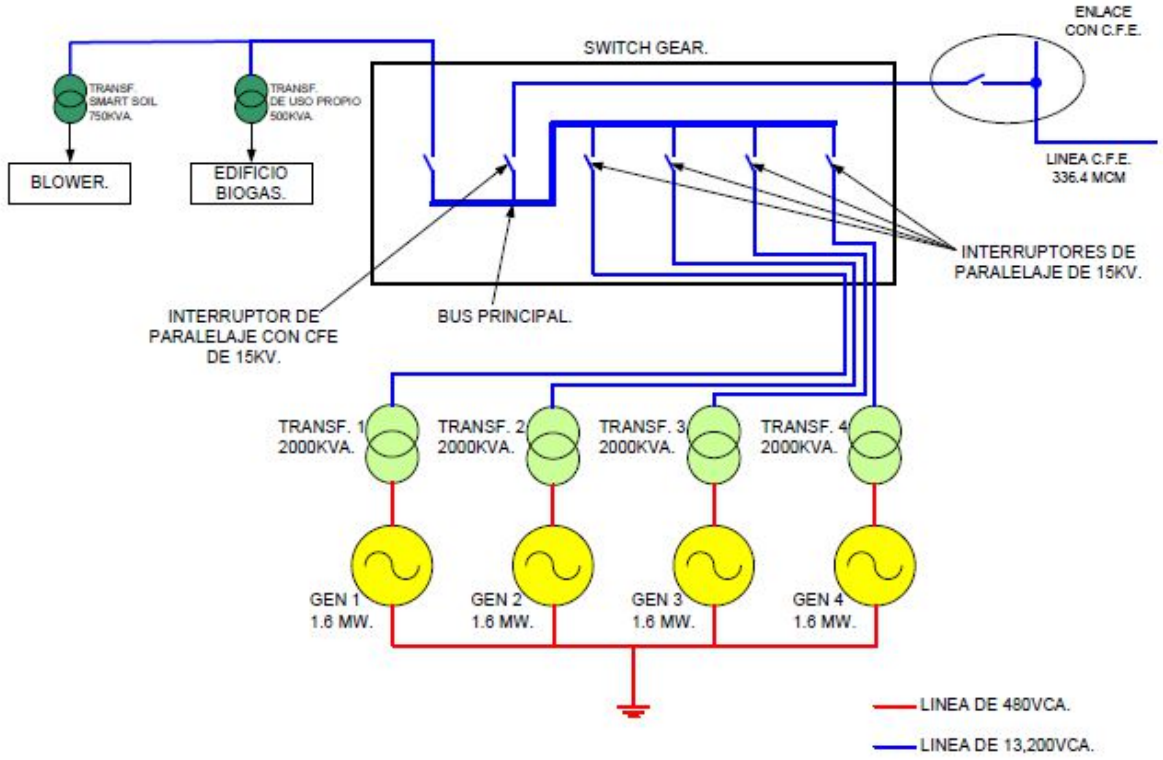
The actual captured biogas flow is not enough to justify the addition of more generation units to reach the initial designed power capacity. In the case collected biogas flow rates increase, additional power units will be added to the project. Currently, the biogas collection system encompasses a total of 17 horizontal / vertical wells (eight wells installed during phase I plus another 9 installed during phase II).

Interconnection to CFE

The Federal Electricity Commission (CFE) is a company created and owned by the Mexican government. It generates, distributes and markets electric power for almost 35.3 million customers. As a federal authority, the CFE is in charge of monitoring electricity from renewable and fossil sources that is being exported to the national grid. All projects related to electricity generation in Mexico must celebrate a contract (named interconnection contract) with CFE, which indicates the regulations and normative to be followed during the life of the project.

For Ciudad Juarez Landfill Gas to Energy Project the link with CFE is established through a synchronization system and an automatic switchgear controlled directly by a master system designed by IsoPower-LINK. The system is linked with the CFE at 13,800 Volts; therefore, a transformer is used as a link between the generation units and the synchronization system. The transformer has a power capacity of 2,000 KVA for the transformation of 13,800 Volts to 480 Volts. The following figure shows the line diagram of connection from the generator to the point of interconnection to CFE:

Diagram 1. Interconnection to CFE



During this monitoring period there were events that affected the generation of emission reductions. The following table summarizes the main events and the total hours where no emission reductions have being claimed:

Table 3. Events during the Monitoring Period

Event	Number of time stamps recorded during the Monitoring Period (hours)		
	30 November – 31 December 2014	2015	TOTAL
Power shutdown	-	150	150
Maintenance / Reparation	8	147	155
Software / Program issues	-	10	10
Low LFG extraction volume	16	36	52
TOTAL	**24**	**343**	**367**

- **Power shutdown:** These events occur, for example, during unexpected blackouts on the federal grid; as per the security normative, power plant must be isolated through the automatic opening of the interconnection switches when power shutdowns occur.

- **Maintenance / Reparation:** In these cases, all power plant systems are turned off in order to provide service to operational equipment. The service is scheduled according to equipment specifications and requirements.

- **Software / Program issues:** unexpected failure in computing software leads to misreading of measurements; the emission reductions estimated during a software problem are disregarded from final claiming.

- **Low LFG extraction volume:** Partial or full closing of LFG extraction valves due to adverse meteorological conditions and/or detection of low levels of methane.

All of the above events are part of the normal operation of the project and may not impact the applicability of the applied methodologies, however, as mentioned before, no emission reductions are claimed during the total of mentioned hours in table 3.

B.2. Post-registration changes

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

>>
Not applicable. There were no temporary deviations from registered monitoring plan or applied methodology during the current monitoring period.

B.2.2. Corrections

>>
Not applicable. No corrections were introduced in the registered PDD or application of methodologies during the current monitoring period.

B.2.3. Changes to start date of crediting period

>>
Not applicable. There were no changes to the start date of the crediting period. As described in the project webpage: the second 7-year renewable crediting period comprises from 30/11/2014 to 29/11/2021

B.2.4. Inclusion of a monitoring plan to the registered PDD that was not included at registration

>>

Not applicable. Any inclusion to the registered monitoring plan was conducted during this monitoring period.

B.2.5. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

>>

Not applicable. Any change to the registered monitoring plan or applied methodology was conducted during this monitoring period.

B.2.6. Changes to project design of registered project activity

>>

Not applicable. Any change to the registered PDD was conducted during this monitoring period.

B.2.7. Types of changes specific to afforestation or reforestation project activity

>>

This section is not applicable to the landfill project activities.

SECTION C. Description of monitoring system

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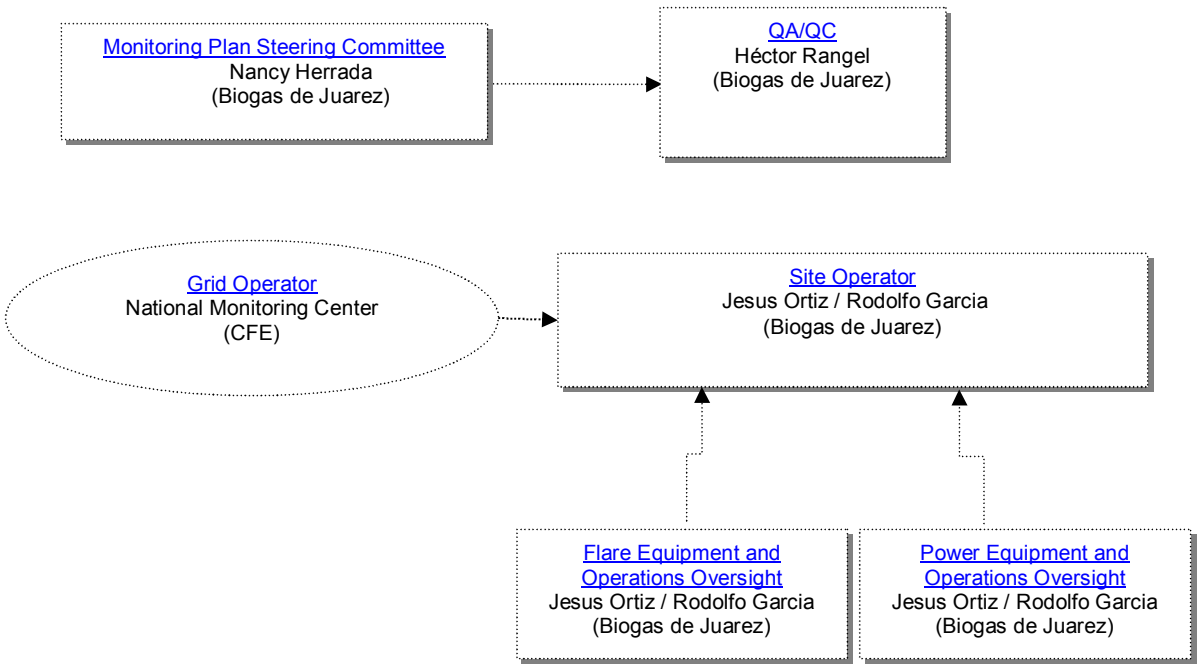
Organizational structure – roles and responsibilities:

The monitoring organizational structure presented in the following diagram summarizes the key roles in the performance of monitoring activities.

Diagram 2. Monitoring organizational structure



Monitoring Plan Steering Committee (MP Committee):

- Coordinates with the QA/QC Committee, reporting to the DOE at verification, including providing all necessary monitoring information to facilitate the verification work and cooperating with the DOE in a timely manner on all data requests and questions.

- Responds to requests by the CDM Executive Board and conducts preparatory work for the verification.
- Training of the monitoring staff and Site Operator on the requirements of the monitoring plan the PDD.
- Secures written proof of the Project's monthly energy consumption/production from the Grid Operator.
- Keeps data for at least two years following the end of the crediting period.
- Implements file management procedures to ensure integrity of data and calculations as per Monitoring Protocol.
- Receives reports on the training of monitoring staff and Site Operator.
- Submits all reports related to the monitoring process: 1) data to estimate ERs from the ERCP Manager and Site Operator; 2) report of the total ERs; 3) training of monitoring staff and Site Operator; and, 4) updates related to the monitoring process as instructed by the QA/QC Committee.
- Receives and keeps calibration and maintenance reports (hard and soft copies).
- Receives and keeps weekly operational reports (hard and soft copies)

QA/QC Committee:

- QA/QC information on a monthly basis from previous month.
- Oversees the work undertaken by the MP Committee.
- Tracks changes in national regulatory requirements relating to LFG projects.

Site Operator

- Secures measurements of data variables identified in the PDD and indicated in the Monitoring Checklists.
- Reports to the MP Committee on the daily operations at the site.

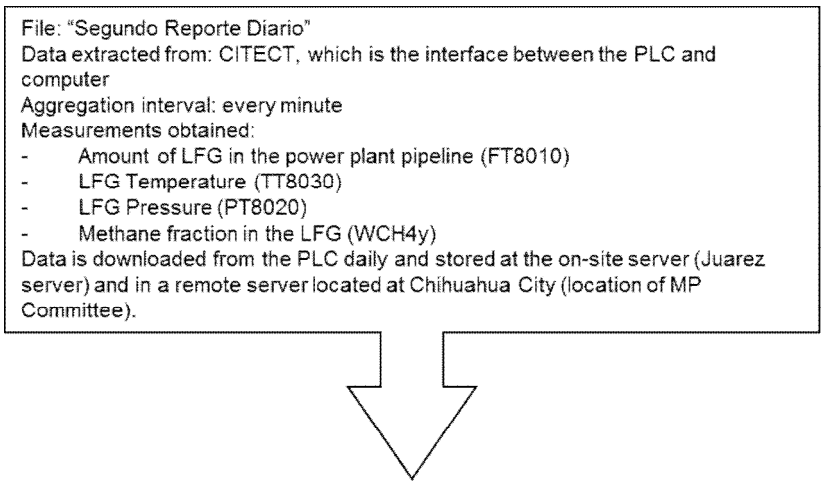
Flare/Power Equipment and Operations Oversight:

- Supervises equipment operation and maintenance program, ensuring that the equipment meets the monitoring requirements set forth in PDD, Monitoring Plan and manufacturer's specifications.
- Trains appropriate personnel on operational matters.

Data Management: Collection, transfer, processing and storage

The following diagrams show the information flow that conforms the ER calculation, file: "Total ER – XX Verification" (XX is for the MP number).

Diagram 3: Collection of parameters to calculate the Baseline emissions of methane from SWDS "BE_{CH4}"



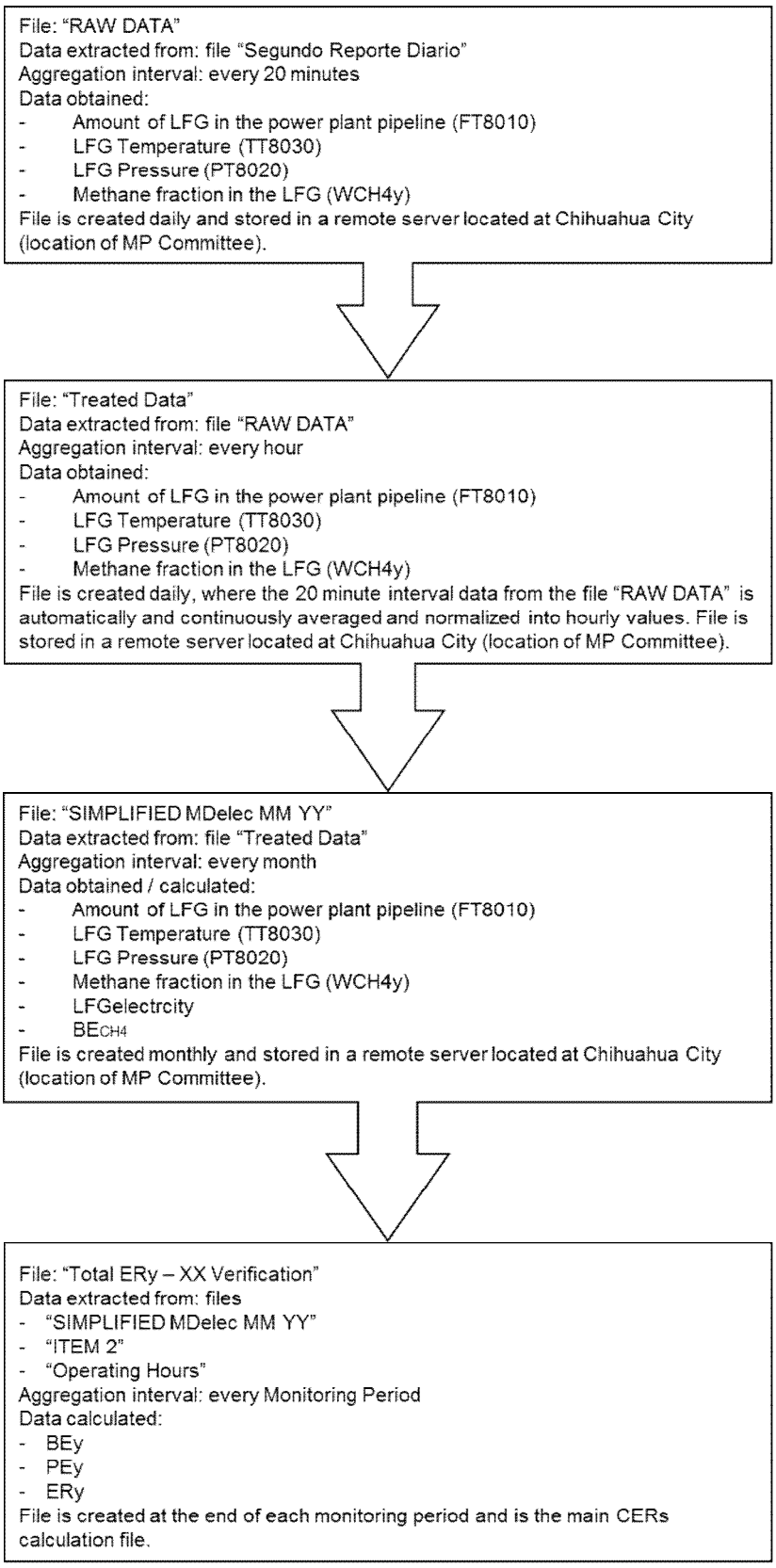

File: "RAW DATA"
Data extracted from: file "Segundo Reporte Diario"
Aggregation interval: every 20 minutes
Data obtained:
- Amount of LFG in the power plant pipeline (FT8010)
- LFG Temperature (TT8030)
- LFG Pressure (PT8020)
- Methane fraction in the LFG (WCH4y)
File is created daily and stored in a remote server located at Chihuahua City (location of MP Committee).
File: "Treated Data"
Data extracted from: file "RAW DATA"
Aggregation interval: every hour
Data obtained:
- Amount of LFG in the power plant pipeline (FT8010)
- LFG Temperature (TT8030)
- LFG Pressure (PT8020)
- Methane fraction in the LFG (WCH4y)
File is created daily, where the 20 minute interval data from the file "RAW DATA" is automatically and continuously averaged and normalized into hourly values. File is stored in a remote server located at Chihuahua City (location of MP Committee).
File: "SIMPLIFIED MDelec MM YY"
Data extracted from: file "Treated Data"
Aggregation interval: every month
Data obtained / calculated:
- Amount of LFG in the power plant pipeline (FT8010)
- LFG Temperature (TT8030)
- LFG Pressure (PT8020)
- Methane fraction in the LFG (WCH4y)
- LFGelectrcity
- BECH4
File is created monthly and stored in a remote server located at Chihuahua City (location of MP Committee).
File: "Total ERy – XX Verification"
Data extracted from: files
- "SIMPLIFIED MDelec MM YY"
- "ITEM 2"
- "Operating Hours"
Aggregation interval: every Monitoring Period
Data calculated:
- BEy
- PEy
- ERy
File is created at the end of each monitoring period and is the main CERs calculation file.

Diagram 4: Collection of parameters to calculate the Baseline emission associated with electricity generation "BE_{EC}" and Project emissions from consumption of electricity due to the project activity "PE_{EC}"

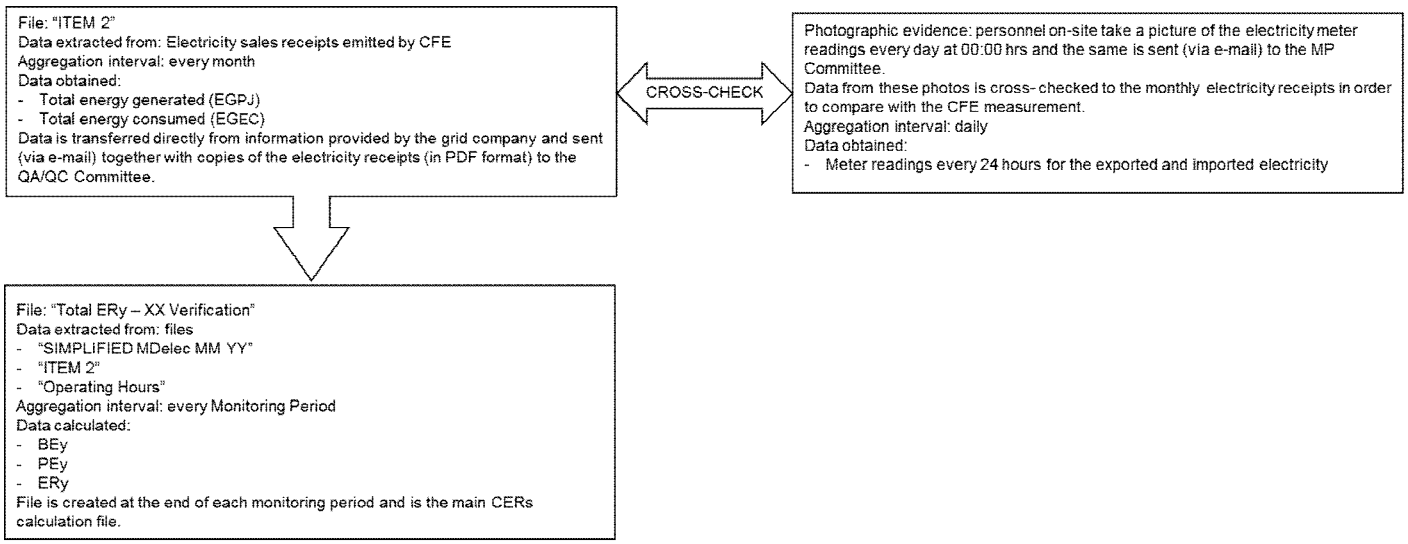
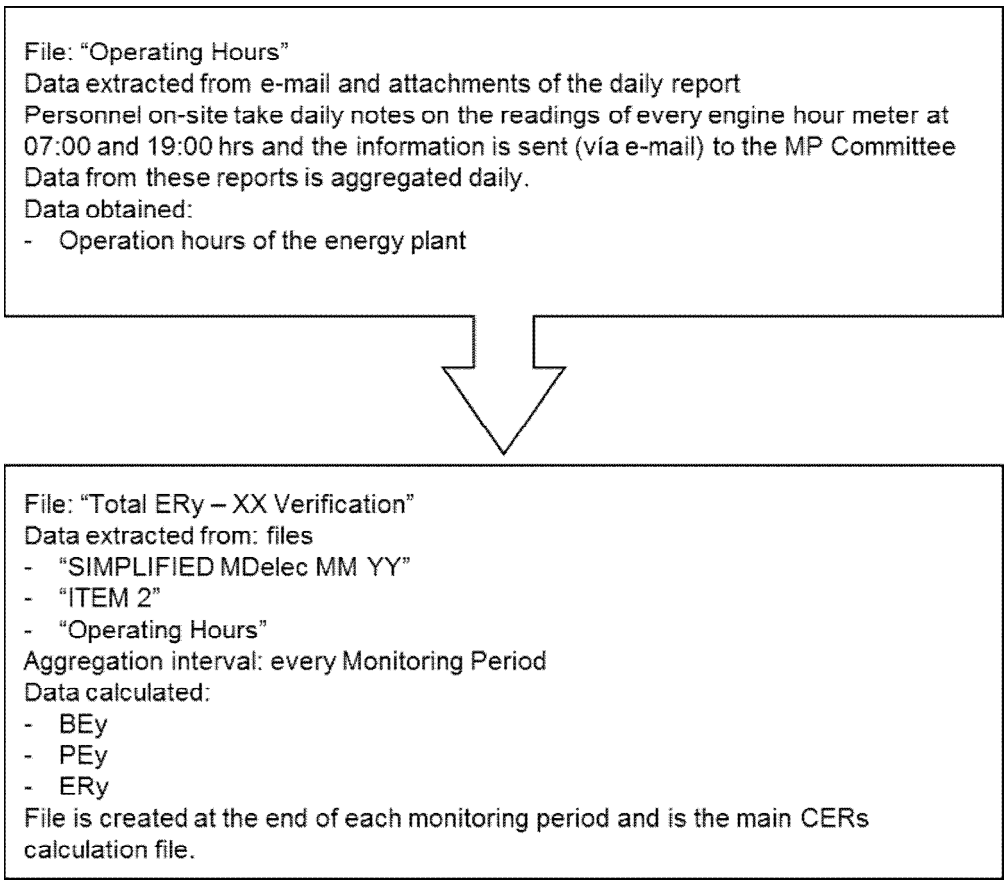


Diagram 5: Collection of parameter Operation hours of the energy plant "OP_j"



Regarding the parameter $\mathbf{MD_{reg}}$ or $\mathbf{F_{CH4,BL}}$, changes related to methane to be destroyed due to regulatory or other requirements are monitored by the MP Committee by means of communication with the relevant authority. Communication is received, confirmed and signed by the authority and the same is archived at Chihuahua City. For the current monitoring period the file called:

"Constancia de monitoreo annual a los requerimientos relacionados con los proyectos Landfill Gas-to-Energy" is dated on 13 March 2015. The information though recorded annually is used for changes to the parameter $MD_{reg,y}$ at renewal of the credit period.

Archiving:

- Measurements from on-site monitoring equipment and ER calculations are saved on external media (e.g., USB or Hard Disk) and filed along with all project-related information. These data are saved on external media every month.

- In addition, all monitoring-related data on long term back up are saved to external media (e.g., external hard drive disk) and stored in a secure location onsite and offsite.

- All documents shall be kept for at least 2 years beyond the end of the crediting period.

Treatment of missing or invalid data / Emergency procedures:

On the unplanned occasions where the data is missing or invalid no emission reduction is claimed. These incidents could be attributed to interruption of the data stream (computer, software issues) or equipment status (shutdowns, maintenance).

Presentation of monitoring results:

All the project data for this monitoring period is presented in Excel workbook: "Total ERy- 1st Verification". In the following tables information contained in the file, by sheet, is explained.

Table 4. "Simplified MDelec Month"

Column	Description	Unit
FT8010	Amount of LFG fed to the power plant	m^3/h
TT8030 (T)	Temperature of the LFG fed to the power plant	°C
PT8020 (P)	Pressure of the LFG fed to the power plant	Pa
W_{CH4}	Methane fraction in the Landfill Gas	%
$LFG_{electricity}$	Amount of LFG combusted in power plant (normalized)	Nm^3/h
ρ _CH4.n	Methane density at standard conditions	tCH_4/m^3CH_4
$F_{CH4,EL,y}$	Amount of methane in the LFG which is used for electricity generation	tCH_4
GWP_{CH4}	Global Warming Potential	tCO_{2e}/tCH_4
BE_{CH4}	Baseline emissions of methane from the SWDS	tCO_{2e}

Table 5. "ITEM 2"

Column	Description	Unit
EG_{PJ}	Amount of electricity generated using LFG	kWh
EF_{CM}	Combined Margin emission factor for Mexican grid	tCO_2/kWh
TDL_k	Average technical transmission and distribution losses for providing electricity to the grid	%
BE_{EC}	Baseline emissions associated with electricity generation	tCO_{2e}
EG_{EC}	Amount of electricity consumed by the project activity	kWh
TDL_j	Average technical transmission and distributions losses for the electricity consumption from the grid	%
PE_{EC}	Project emissions from consumption of electricity due to the project activity	tCO_{2e}

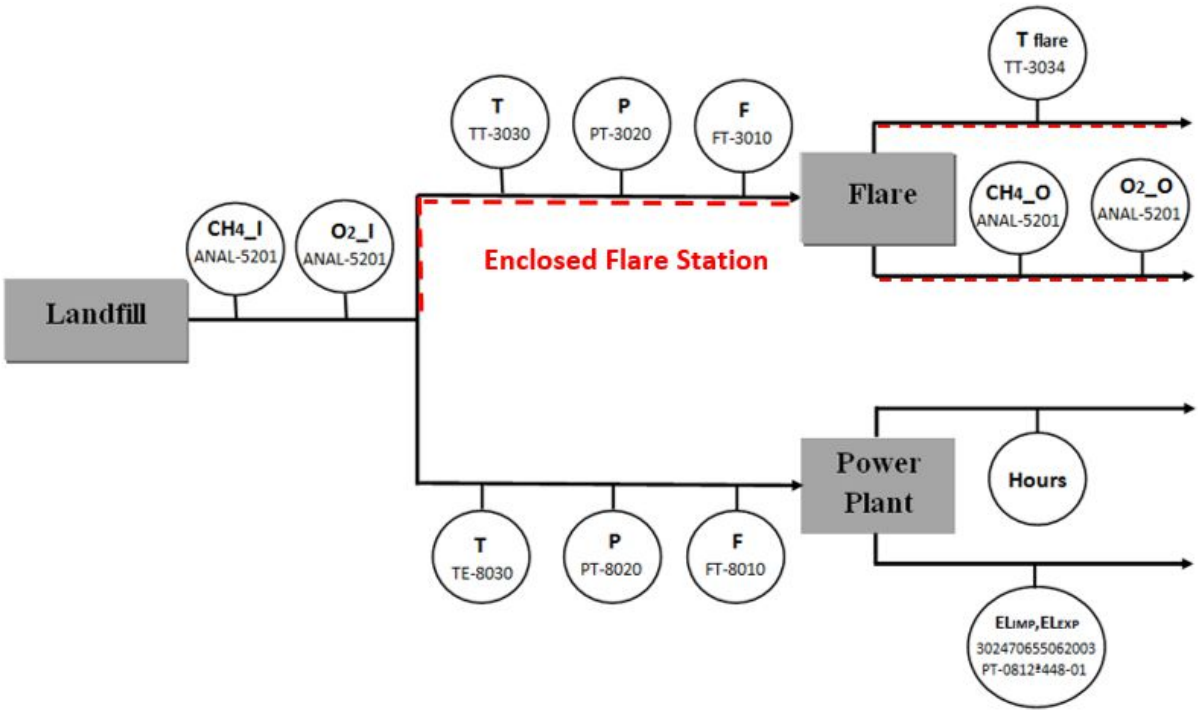
Table 6. "Total ERy"

Column	Description	Unit
BE_{CH4}	Baseline emissions of methane from the SWDS	tCO_{2e}
BE_{EC}	Baseline emissions associated with electricity generation	tCO_{2e}
BE_y	Total Baseline Emissions	tCO_{2e}
$PE_y = PE_{EC}$	Total Project Emissions = Project emissions from consumption of electricity due to the project activity	tCO_{2e}
ER_y	Total Emission Reductions	tCO_{2e}

Monitoring points and calibration

The following diagram presents a simplified scheme identifying relevant monitoring equipment and parameters used to calculate ER. Please notice that since the flare system is off, for the present monitoring period the relevant monitoring equipment was not used, however the calibration of all the monitoring equipment is being carried out properly (calibration dates are not included since this information is not relevant for this monitoring period).

Diagram 6. Monitoring points



The following table shows calibrations carried out valid during this monitoring period.

Table 7. Calibration of monitoring equipment

Instrument	Serial number	Date	Validity	Date	Validity	Date	Validity
Flow meter	10231961	25/08/14	6 months	25/02/15	6 months	25/08/15	6 months
Gas analyzer	N1-V3-0218	01/11/14	3 months	01/12/14	3 months	01/01/15	3 months
		01/02/15		01/03/15		01/04/15	
		01/05/15		01/06/15		01/07/15	
		01/08/15		01/09/15		01/10/15	
		01/11/15		01/12/15		---	---
Temperature transmitter	D5002B 23365	25/08/14	6 months	25/02/15	6 months	25/08/15	6 months
Absolute Pressure Transmitter	14262838	25/08/14	6 months	25/02/15	6 months	25/08/15	6 months
Electricity meter	PT-0812A448-01	27/03/14	1 year	24/03/15	1 year	---	---

SECTION D. Data and parameters

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

Data / Parameter:	**GWP_{CH4}**
Unit:	tCO_2e/tCH_4
Description:	Global Warming Potential of methane
Source of data:	IPCC Fourth Assessment Report: Climate Change 2007 http://www.ipcc.ch/publications_and_data/ar4/wg1/en/erratataserrata-errata.html#table214
Value(s) applied):	25
Choice of data or measurement methods and procedures:	According to EB 69, annex 3, all emission reductions achieved in the second commitment period shall be calculated using the GWP as applied by decision 4/CMP. 7
Purpose of data:	Calculation of baseline emissions
Additional comments:	Value from registered PDD was updated accordingly.

Data / Parameter:	**$\rho_{CH4} = D_{CH4}$**
Unit:	tCH_4/m^3CH_4
Description:	Density of methane gas at standard temperature and pressure
Source of data:	https://cdm.unfccc.int/methodologies/DB/203B03KT6N8QCC0R1C56DFOF9OYO2T
Value(s) applied):	0.0007168
Choice of data or measurement methods and procedures:	As per applied methodology
Purpose of data:	Calculation of baseline emissions
Additional comments:	NA

Data / Parameter:	EF_{CM}
Unit:	tCO_{2e}/MWh
Description:	Combined Margin emission factor for Mexican grid
Source of data:	Based on official statistics published by the Department of Energy
Value(s) applied):	0.3989
Choice of data or measurement methods and procedures	As per registered PDD
Purpose of data:	Calculation of baseline emissions Calculation of project emissions
Additional comments:	Fixed value for the first crediting period

Data / Parameter:	TDL_k
Unit:	%
Description:	Average technical transmission and distribution losses for providing electricity to the grid
Source of data:	"Tool to calculate baseline, project and/or leakage emissions from electricity consumption", version 1
Value(s) applied):	3%
Choice of data or measurement methods and procedures:	Default value provided by the applied tool.
Purpose of data:	Calculation of baseline emissions
Additional comments:	NA

Data / Parameter:	TDL_j
Unit:	%
Description:	Average technical transmission and distribution losses for the electricity consumption from the grid
Source of data:	"Tool to calculate baseline, project and/or leakage emissions from electricity consumption", version 1
Value(s) applied):	20%
Choice of data or measurement methods and procedures:	Default value provided by the applied tool.
Purpose of data:	Calculation of project emissions
Additional comments:	NA

D.2. Data and parameters monitored[9]

Data / Parameter:	$LFG_{total} = LFG_{electricity}$
Unit:	Nm^3
Description:	Amount of LFG combusted in power plant (normalized)
Measured/ Calculated / Default:	Measured
Source of data:	Flow meter, data extracted from PLC records
Value(s) of monitored parameter:	Values presented in a separate spreadsheet: "Total ERy – 1st Verification"
Monitoring equipment:	**Type**: FOXBORO flow meter **Accuracy Class**: Accuracy for gases and steam is + 1% of reading for flow rates with Reynolds number of 20,000 or greater **Serial No.**: Serial: 10231961 Model: 83F-T08S1SSTJA **Calibration Frequency**: Calibration is not required by the manufacturer; however, for QA/QC procedures, verification of the instrument is performed every 6 months. **Date of last calibration**: Refer to table 7 above **Validity**: During the monitoring period
Measuring/ Reading/ Recording frequency:	Data are continuously measured by a flow meter, aggregated every minute and averaged hourly for the calculation means.
Calculation method (if applicable):	Value presented at normal conditions (temperature and pressure)
QA/QC procedures:	Flow meter is subject to a regular maintenance and testing regime to ensure accuracy.
Purpose of data:	Calculation of baseline emissions
Additional comments:	Since during this monitoring period, the LFG was used to generate electricity, one flow meter can be used and therefore $LFG_{total} = LFG_{electricity}$

Data / Parameter:	T
Unit:	°C
Description:	Temperature of LFG
Measured/ Calculated / Default:	Measured
Source of data:	Temperature transmitter, data extracted from PLC records
Value(s) of monitored parameter:	Values presented in a separate spreadsheet: "Total ERy – 1st Verification"

[9] Please notice that since the flaring system is off, the parameters corresponding to the flare are not included in the MR

Monitoring equipment:	<table><tr><td>**Type**</td><td>Endress+Hauser Temperature transmitter</td></tr><tr><td>**Accuracy Class**</td><td>The maximum tolerance for an RTD class B system is + 0.3+0.005 C (absolute).</td></tr><tr><td>**Serial No.**</td><td>Serial: D5002B 23365 Model: T13-G3A12A3AACKA</td></tr><tr><td>**Calibration Frequency**</td><td>Manufacturer states 1 calibration per year; however, for QA/QC procedures, calibration is performed every 6 months.</td></tr><tr><td>**Date of last calibration**</td><td>Refer to Table 7 above</td></tr><tr><td>**Validity**</td><td>During the monitoring period</td></tr></table>
Measuring/ Reading/ Recording frequency:	Data are continuously measured by a temperature transmitter, aggregated every minute and averaged hourly for the calculation means.
Calculation method (if applicable):	Value is converted to °K for calculation means.
QA/QC procedures:	Temperature transmitter is subject to a regular maintenance and testing regime to ensure accuracy. Standard Operating Procedure for Calibration and Maintenance SOP-A-en-002.
Purpose of data:	Calculation of baseline emissions
Additional comments:	NA

Data / Parameter:	**P**
Unit:	Pa
Description:	Pressure of LFG
Measured/ Calculated / Default:	Measured
Source of data:	Absolute pressure transmitter, data extracted from PLC records
Value(s) of monitored parameter:	Values presented in a separate spreadsheet: "Total ERy – 1st Verification"
Monitoring equipment:	<table><tr><td>**Type**</td><td>FOXBORO Absolute pressure transmitter</td></tr><tr><td>**Accuracy Class**</td><td>Maximum analogue error is 0.02% at 50% of span.</td></tr><tr><td>**Serial No.**</td><td>Serial: 14262838 Model: IAP10-A22C1F</td></tr><tr><td>**Calibration Frequency**</td><td>Calibration is not required by the manufacturer; however, for QA/QC procedures, verification of the instrument is performed every 6 months.</td></tr><tr><td>**Date of last calibration**</td><td>Refer to table 7 above</td></tr><tr><td>**Validity**</td><td>During the monitoring period</td></tr></table>
Measuring/ Reading/ Recording frequency:	Data are continuously measured by an absolute pressure transmitter, aggregated every minute and averaged hourly for the calculation means.
Calculation method (if applicable):	NA
QA/QC procedures:	Absolute pressure transmitter is subject to a regular maintenance and testing regime to ensure accuracy.
Purpose of data:	Calculation of baseline emissions
Additional comments:	NA

Data / Parameter:	**w_{CH4}**
Unit:	% (m^3CH_4/m^3LFG)
Description:	Methane fraction in the LFG
Measured/ Calculated / Default:	Measured
Source of data:	Gas analyzer, data extracted from PLC records
Value(s) of monitored parameter:	Values presented in a separate spreadsheet: "Total ERy – 1st Verification"
Monitoring equipment:	**Type**: Gas analyzer **Accuracy Class**: <1% of full-scale value. **Serial No.**: Serial: N1-V3-0218 Model: ULTRAMAT 23 **Calibration Frequency**: Quarterly basis as per manufacturer specifications, however, a stricter practice which is to perform a manual calibration at least once a month has been implemented. Automatic Zero on CH_4 and a span on O_2 are performed every day. **Date of last calibration**: Refer to Table 7 above **Validity**: During the monitoring period
Measuring/ Reading/ Recording frequency:	Data are continuously measured by a gas analyzer, aggregated every minute and averaged hourly for the calculation means.
Calculation method (if applicable):	NA
QA/QC procedures:	The gas analyzer is subject to a regular maintenance and testing regime to ensure accuracy.
Purpose of data:	Calculation of baseline emissions
Additional comments:	NA

Data / Parameter:	**MD_{reg} or $F_{CH4,BL,y}$**
Unit:	% or tones
Description:	Methane destroyed due to regulatory or other requirements
Measured/ Calculated / Default:	Regulatory requirements relating to landfill gas projects (NOM-083-SEMARNAT-2003) have been followed in order to comply with it.
Source of data:	National environmental legislation – annual phone calls to environmental authorities. Communication is received, confirmed and signed by the authority and the same is archived at Chihuahua City.
Value(s) of monitored parameter:	Remain the same (zero)
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	For the current monitoring period the file called: "Constancia de monitoreo annual a los requerimientos relacionados con los proyectos Landfill Gas-to-Energy" is dated on 13 March 2015.
Calculation method (if applicable):	N/A
QA/QC procedures:	N/A

Purpose of data:	The information though recorded annually, is used for the amount of methane destroyed in the baseline scenario $F_{CH4,BL,y}$ or directly MD_{reg} at renewal of the crediting period.
Additional comments:	NA

Data / Parameter:	**$EG_{PJ,y}$**
Unit:	MWh
Description:	Amount of electricity generated using LFG
Measured/ Calculated / Default:	Measured
Source of data:	Bidirectional power meter Monthly electricity sale receipts emitted by CFE
Value(s) of monitored parameter:	25,598 MWh Values per month are presented in a separated spreadsheet: Total ERy – 1st Verification
Monitoring equipment:	**Type**: Bidirectional electricity meter – Schneider Electric **Accuracy Class**: +0.2% **Serial No.**: Serial: PT-0812A448-01 Model: PowerLogic ION8600 **Calibration Frequency**: Annually **Date of last calibration**: Refer to table 7 above **Validity**: During the monitoring period
Measuring/ Reading/ Recording frequency:	Continuously measured, aggregated every month by the grid administrator (CFE). Photographic evidence on the meter readings every 24 hours is also archived.
Calculation method (if applicable):	N/A
QA/QC procedures:	The meter is calibrated annually by the grid administrator (CFE)
Purpose of data:	Calculation of baseline emissions
Additional comments:	Data from the photos is cross-checked to the monthly electricity sale receipts.

Data / Parameter:	**$EG_{EC,y}$**
Unit:	MWh
Description:	Amount of electricity consumed by the project activity
Measured/ Calculated / Default:	Measured
Source of data:	Bidirectional power meter Monthly electricity sale receipts emitted by CFE
Value(s) of monitored parameter:	16 MWh Values per month are presented in a separated spreadsheet: Total ERy – 1st Verification

Monitoring equipment:	<table><tr><td>**Type**</td><td>Bidirectional electricity meter – Schneider Electric</td></tr><tr><td>**Accuracy Class**</td><td>+0.2%</td></tr><tr><td>**Serial No.**</td><td>Serial: PT-0812A448-01 Model: PowerLogic ION8600</td></tr><tr><td>**Calibration Frequency**</td><td>Annually</td></tr><tr><td>**Date of last calibration**</td><td>Refer to table 7 above</td></tr><tr><td>**Validity**</td><td>During the monitoring period</td></tr></table>
Measuring/ Reading/ Recording frequency:	Continuously measured, aggregated every month by the grid administrator (CFE). Photographic evidence on the meter readings every 24 hours is also archived.
Calculation method (if applicable):	N/A
QA/QC procedures:	The meter is calibrated annually by the grid administrator (CFE)
Purpose of data:	Calculation of project emissions
Additional comments:	Data from the photos is cross-checked to the monthly electricity sale receipts.

Data / Parameter:	**$OP_{j,h}$**
Unit:	Hours
Description:	Operating hours of the energy plant
Measured/ Calculated / Default:	Measured
Source of data:	Hour meter located in every generation engine
Value(s) of monitored parameter:	19,965 hours Values in detail are presented in a separate spreadsheet: Total ERy – 1st Verification
Monitoring equipment:	Hour meter
Measuring/ Reading/ Recording frequency:	Continuously measured. Personnel on-site take daily notes on the readings of every engine hour meter at 7:00 and 19:00 hrs. Data is aggregated daily.
Calculation method (if applicable):	Operation hours registered for every engine are summed to obtain the total.
QA/QC procedures:	N/A
Purpose of data:	This parameter is monitored to ensure methane destruction is claimed for methane used in electricity plant when it is operational.
Additional comments:	N/A

Data / Parameter:	**Management of SWDS**
Unit:	
Description:	Management of SWDS
Measured/ Calculated / Default:	National environmental legislation – annual phone calls to environmental authorities. Communication is received, confirmed and signed by the authority and the same is archived at Chihuahua City.
Source of data:	Regulatory requirements relating to landfill gas projects (NOM-083-SEMARNAT-2003) have been followed in order to comply with it. Also, Biogas de Juarez has not changed the original design of the landfill nor the technical specifications of the site management.

Value(s) of monitored parameter:	N/A
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	For the current monitoring period the file called: "Constancia de monitoreo annual a los requerimientos relacionados con los proyectos Landfill Gas-to-Energy" is dated on 13 March 2015.
Calculation method (if applicable):	N/A
QA/QC procedures:	N/A
Purpose of data:	To ensure that any practice to increase methane generation have been occurring prior to the implementation of the project activity.
Additional comments:	NA

D.3. Implementation of sampling plan

>>

This section is 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

>>

The baseline emissions were calculated according to the following formulas:

From the used methodology ACM0001, version 15.0

$$BE_y = BE_{CH4,y} + BE_{EC,y} + BE_{HG,y} + BE_{NG,y} \quad \text{(1BE)}$$

Where:

BE_y = Baseline emissions in year y (t CO_2e/yr)

$BE_{CH4,y}$ = Baseline emissions of methane from the SWDS in year y (t CO_2e/yr)

$BE_{EC,y}$ = Baseline emissions associated with electricity generation in year y (t CO_2/yr)

$BE_{HG,y}$ = Baseline emissions associated with heat generation in year y (t CO_2/yr)

$BE_{NG,y}$ = Baseline emissions associated with natural gas use in year y (t CO_2/yr)

During the monitoring period the captured LFG was only destroyed through generation of electricity, thus $BE_{HG,y}$= 0 and $BE_{NG,y}$ = 0.

Therefore:

$$BE_y = BE_{CH4,y} + BE_{EC,y} \quad \text{(2BE)}$$

From which:

$$BE_{CH4} = (1 - OX_{top\_layer}) * (F_{CH4,PJ,y} - F_{CH4,BL,y}) * GWP_{CH4} \quad \text{(3BE)}$$

Where:

$BE_{CH4,y}$ = Baseline emissions of methane from the SWDS in year y (t CO_2e/yr)

OX_{top_layer} = Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline (dimensionless)[10]

$F_{CH4,PJ,y}$ = Amount of methane in the LFG which is flared and/or used in the project activity in year y (t CH_4/yr)

$F_{CH4,BL,y}$ =Amount of methane in the LFG that would be flared in the baseline in year y (t CH_4/yr)

GWP_{CH4} = Global warming potential of CH4 (t CO_2e/t CH_4)

From the above formula, $OX_{top\text{-}layer}$ = 0 and $F_{CH4,BL,y}$ = 0, as per registered PDD.

Therefore:

$$BE_{CH4} = F_{CH4,PJ,y} * GWP_{CH4} \quad (4BE)$$

From which:

$$F_{CH4,PJ,y} = F_{CH4,flared,y} + F_{CH4,EL,y} + F_{CH4,HG,y} + F_{CH4,NG,y} \quad (5BE)$$

Where:

$F_{CH4,PJ,y}$ = Amount of methane in the LFG which is flared and/or used in the project activity in year y (t CH_4/yr)

$F_{CH4,flared,y}$ = Amount of methane in the LFG which is destroyed by flaring in year y (t CH_4/yr)

$F_{CH4,EL,y}$ = Amount of methane in the LFG which is used for electricity generation in year y (t CH_4/yr)

$F_{CH4,HG,y}$ = Amount of methane in the LFG which is used for heat generation in year y (t CH_4/yr)

$F_{CH4,NG,y}$ = Amount of methane in the LFG which is sent to the natural gas distribution network in year y (t CH_4/yr)

The captured gas is only used for electricity generation, no flaring, or heating, or natural gas replacement took place, then:

$$F_{CH4,PJ,y} = F_{CH4,EL,y} \quad (6BE)$$

As per used methodology ACM0001, version 15.0, parameter $F_{CH4,EL,y}$ is determined using the *"Tool to determine the mass flow of a greenhouse gas in gaseous stream", version 2.0.0.* Option A will be used[11]. The mass flow of greenhouse gas *i* ($F_{i,t}$) is determined as follows:

[10] *OXtop-layer* is the fraction of the methane in the LFG that would oxidize in the top layer of the SWDS in the absence of the project activity. Under the project activity, this effect is reduced as a part of the LFG is captured and does not pass through the top layer of the SWDS. This oxidation effect is also accounted for in the methodological tool "Emissions from solid waste disposal sites". In addition to this effect, the installation of a LFG capture system under the project activity may result in the suction of additional air into the SWDS. In some cases, such as with a high suction pressure, the air may decrease the amount of methane that is generated under the project activity. However, in most circumstances where the LFG is captured and used this effect was considered to be very small, as the operators of the SWDS have in most cases an incentive to main a high methane concentration in the LFG. For this reason, this effect is neglected as a conservative assumption.

[11] It is demonstrated that the temperature in the gaseous stream is less than 60°C, please refer to the hourly recorded data in the file: "Total ERy 1st. verification"

$$F_{i,t} = V_{t,db} * v_{i,t,db} * \rho_{i,t} \quad (5)$$

With

$$\rho_{i,t} = \frac{P_t * MM_i}{R_u * T_t} \quad (6)$$

Where:

$F_{i,t}$ = Mass flow of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas/h)
$V_{t,db}$ = Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m³ dry gas/h)
$v_{i,t,db}$ = Volumetric fraction of greenhouse gas *i* in the gaseous stream in a time interval *t* on a dry basis (m³ gas *i*/m³ dry gas)
$\rho_{i,t}$ = Density of greenhouse gas *i* in the gaseous stream in time interval *t* (kg gas *i*/m³ gas *i*)
P_t = Absolute pressure of the gaseous stream in time interval *t* (Pa)
MM_i = Molecular mass of greenhouse gas *i* (kg/kmol)
R_u = Universal ideal gases constant (Pa.m³/kmol.K)
T_t = Temperature of the gaseous stream in time interval *t* (K)

In terms of the project activity and the parameters described in section C and D above:

$$F_{CH4,EL,y} = \left(LFG_{electricity,y}\right) * \left(W_{CH4}\right) * \left(\rho_{CH4}\right) \quad (7BE)$$

$$\rho_{CH4} = \frac{P * MM_{CH4}}{\left(T + 273.15\right) * Ru} \quad (8BE)$$

From the above equations parameters $LFG_{electricity}$, W_{CH4}, *P*, *T* are monitored according to sections C and D.2 above.

For the following parameters the values are stated in the mentioned tool:

MM_{CH4} = 16.04 kg/kmol
R_u = 8,314 Pa m³/kmol °K

Back to the formula (2BE), the baseline emissions associated with electricity generation in year y ($BE_{EC,y}$) are calculated using the *"Tool to calculate baseline, project and/or leakage emissions from electricity consumption", version 1.* When applying the tool:

(a) The electricity sources *k* in the tool correspond to the sources of electricity generated identified in the selection of the most plausible baseline scenario; and
(b) $EC_{BL,k,y}$ in the tool is equivalent to the net amount of electricity generated using LFG in year y ($EG_{PJ,y}$)

Scenario A described in the Tool applies for the calculation in the following equation:

$$BE_{EC,y} = \sum_k EC_{BL,k} * EF_{EL,k,y} * (1 + TDL_{k,y}) \quad (9BE)$$

Where:

$BE_{EC,y}$ = Baseline emissions from electricity consumption in year y (tCO2/yr)
$EC_{BL,k}$ = Quantity of electricity that would be consumed by the baseline electricity consumption source k in year y (MWh/yr)

$EF_{EL,k,y}$ = Emission factor for electricity generation for source k in year y (tCO2/MWh)

$TDL_{k,y}$ = Average technical transmission and distribution losses for providing electricity to source k in year y

For the means of the project activity and according to the used parameters and values, the above formula will lead to:

$$BE_{EC,y} = \sum_{k} EG_{PJ,y} * EF_{CM} * (1 + 0.03) \quad \text{(10BE)}$$

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

>>

According to methodology ACM0001, version 15.0, project emissions are calculated as follows:

$$PE_y = PE_{EC,y} + PE_{FC,y} \quad \text{(1PE)}$$

Where:

PE_y = Project emissions in year y (t CO_2/yr)

$PE_{EC,y}$ = Emissions from consumption of electricity due to the project activity in year y (t CO_2/yr)consumption source *k* in year *y* (MWh/yr)

$PE_{FC,y}$ = Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, in year y (t CO_2/yr)

During the monitoring period there was any use of fossil fuels on Ciudad Juarez landfill due to the implementation of the project activity ($PE_{FC,y}$=0); hence, the project emissions are equivalent to emissions from electricity consumption and will be calculated as follows:

$$PE_y = PE_{EC,y} \quad \text{(2PE)}$$

The project emissions from consumption of electricity by the project activity ($PE_{EC,y}$) shall be calculated using the *"Tool to calculate baseline, project and/or leakage emissions from electricity consumption", version 1:*

$$PE_{EC,y} = \sum_{k} EC_{PJ,j,y} * EF_{EL,j,y} * (1 + TDL_{j,y}) \quad \text{(3PE)}$$

Where:

$PE_{EC,y}$ = Are the project emissions from electricity consumption by the project activity in the year y (tCO_2 / yr)

$EC_{PJ,j,y}$ = Quantity of electricity consumed by the project electricity consumption source j in year y (MWh/yr)

$EF_{EL,j,y}$ = Emission factor for electricity generation for source *j* in year *y* (tCO2/MWh)

$TDL_{j,y}$ = Average technical transmission and distribution losses for providing electricity to source *j* in year *y* (%)

For the means of the project activity and according to the used parameters and values, the above formula will lead to:

$$PE_{EC,y} = \sum_{k} EG_{EC,y} * EF_{CM} * (1 + 0.20) \quad \text{(4PE)}$$

E.3. Calculation of leakage

>>
No leakage effects need to be accounted under the approved consolidated methodology ACM0001, version 15

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

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	GHG emission reductions or net GHG removals by sinks (t CO_2e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
Total	152,223	14	0	0	152,209	152,209

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

Item	Values estimated in ex ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO_2e)	166,160	152,209

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

>>
The actual values achieved during this monitoring period do not overpass the estimation in the registered PDD.

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

Project participant and/or responsible person/ entity	☒ Project participant ☒ Person/entity responsible for completing the CDM-MR-FORM
Organization name	Biogas de Juárez S.A de C.V.
Street/P.O. Box	Periferico Ortiz Mena # 3403
Building	Plaza Quintas L-16
City	Chihuahua
State/region	Chihuahua
Postcode	31214
Country	Mexico
Telephone	+52 614 430 0001
Fax	--
E-mail	nancy.herrada@biogasdejuarez.com
Website	http://www.biogasdejuarez.com/
Contact person	Nancy Herrada Garibaldi
Title	Engineer
Salutation	Ms.
Last name	Herrada
Middle name	--
First name	Nancy
Department	Operations Manager
Mobile	+52 614 132 0020
Direct fax	--
Direct tel.	+52 614 430 0001
Personal e-mail	nancy.herrada@biogasdejuarez.com

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Document information

Version	*Date*	*Description*
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 (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

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