



**Monitoring report form for CDM project activity  
(Version 06.0)**

*Complete this form in accordance with the instructions attached at the end of this form.*

**MONITORING REPORT**

<b>Title of the project activity</b>	Ciudad Juarez Landfill Gas to Energy Project	
<b>UNFCCC reference number of the project activity</b>	1123	
<b>Version number of the PDD applicable to this monitoring report</b>	5.0	
<b>Version number of this monitoring report</b>	4.0	
<b>Completion date of this monitoring report</b>	18/08/2018	
<b>Monitoring period number</b>	3 <sup>rd</sup> MP (third monitoring period) 2 <sup>nd</sup> CP (second crediting period)	
<b>Duration of this monitoring period</b>	From 13/05/2016 – 31/05/2017 (both days included).	
<b>Monitoring report number for this monitoring report</b>	1/1 (unique MR for this MP)	
<b>Project participants</b>	Biogas de Juarez S.A. de C.V. BELEKTRON d.o.o	
<b>Host Party</b>	Mexico	
<b>Sectoral scopes</b>	Scope number linked to applied methodology: 13 Sectoral scope: Waste handling and disposal  Scope number conditioned to the power plant component : 1 Sectoral scope: Energy industries (renewable - / non-renewable)	
<b>Applied methodologies and standardized baselines</b>	ACM0001 Version 15: "Large-scale Consolidated Methodology: Flaring or use of landfill gas."	
<b>Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period</b>	<b>Amount achieved before 1 January 2013</b>	<b>Amount achieved from 1 January 2013</b>
	0 tCO <sub>2e</sub>	169,930 tCO <sub>2e</sub>
<b>Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD</b>	179,698 tCO <sub>2e</sub>	

## SECTION A. Description of project activity

### A.1. 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 3<sup>rd</sup> verification of the second crediting period.

The Project's purpose is to reduce greenhouse gas (GHG) emissions by capturing and utilizing the methane (CH<sub>4</sub>) 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<sub>2</sub>, the Project also displaces fossil fuel-based electricity generation that would have emitted additional CO<sub>2</sub>. 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

The third monitoring period comprises from 13/05/2016 to 31/05/2017 (both days included). The total emission reductions obtained during this period are 169,930 tCO<sub>2</sub>e.

### A.2. Location of project activity

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 31° 33' 35.62" N - 106° 29' 40.94" W; 31° 33' 36.80" N - 106° 29' 18.90" W; 31° 33' 15.44" N - 106° 29' 21.62" W; and 31° 33' 15.29" N - 106° 29' 39.64" W.

**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 Party)	Biogas de Juarez S.A. de C.V.	No
Switzerland	BELEKTRON d.o.o.	No

**A.4. Reference to applied methodologies and standardized baselines**

Two approved baseline methodologies are used:

- ACM0001: "Large-scale Consolidated Methodology Flaring or use of landfill gas", version 15.0<sup>1</sup>

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

- "Tool Project emissions from flaring", version 2.0.0<sup>2</sup>
- "Tool Emissions from solid waste disposal sites", version 6.0.1<sup>3</sup>
- "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", version 2.0.0<sup>4</sup>
- "Tool to calculate the emission factor for an electricity system", version 4.0<sup>5</sup>
- "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", version 1<sup>6</sup>
- "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<sup>7</sup>

**A.5. Crediting period type and duration**

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

**SECTION B. Implementation of project activity****B.1. Description of implemented project activity**

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 power plant or the enclosed flare station. Additionally, infrastructure for electricity generation with a capacity of 6.4MW was designed. The main components of this system are:

<sup>1</sup> <https://cdm.unfccc.int/methodologies/DB/QOU487ZYKBIAU17YHORZXENWDTEPAC>

<sup>2</sup> [https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v1.pdf/history\\_view](https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v1.pdf/history_view)

<sup>3</sup> [https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v4.pdf/history\\_view](https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v4.pdf/history_view)

<sup>4</sup> [https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v1.pdf/history\\_view](https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v1.pdf/history_view)

<sup>5</sup> [https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v1.1.pdf/history\\_view](https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v1.1.pdf/history_view)

<sup>6</sup> [https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf/history\\_view](https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf/history_view)

<sup>7</sup> [http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v1.pdf/history\\_view](http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v1.pdf/history_view)

Table 1. 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 <sup>3</sup> /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 GZJ00281 GZJ00663	1.6 MW each 60Hz 1200 rpm 480 V	YES
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	Macronic Enerflex	0821	16" x 18" Flare Stack	NO

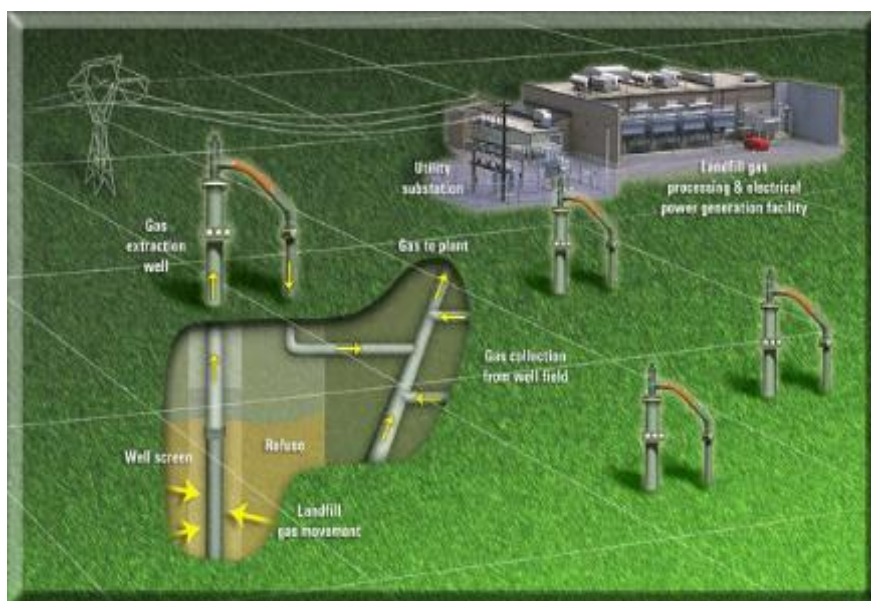


Figure 1: A typical LFG generation plant (Source: Biogas de Juarez)

**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<sup>2</sup>), 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<sup>2</sup> 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 15<sup>th</sup>, 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.

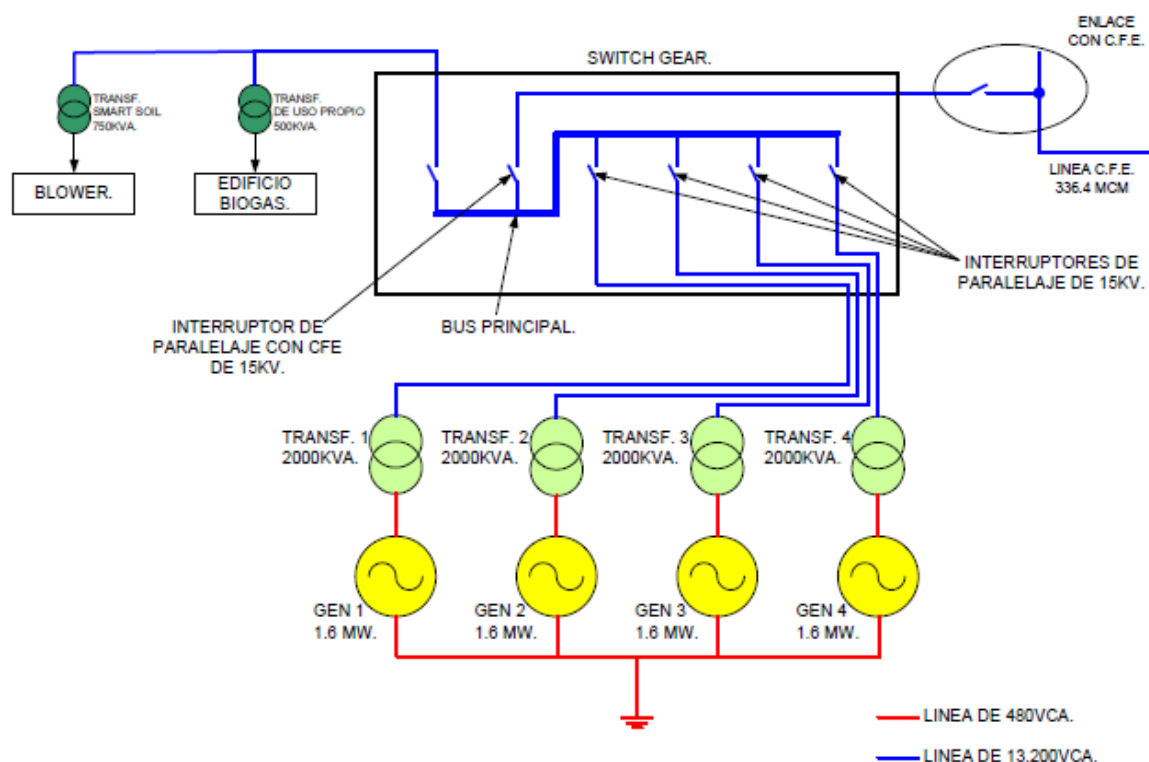
The actual captured biogas flow only justifies the implementation of the currently installed 17 horizontal / vertical wells (eight wells installed during phase I plus another 9 installed during phase II) and 1.6MW X 4 generation units. In the case the collected biogas flow rates increase, additional wells and power units will be added to reach the initial design as per PDD.

**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



Relevant dates for the project activity are provided below in Table 2:

Table 2. 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 – Juárez 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 – Juárez 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)

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)		
	13 May – 31 December 2016	01 January – 31 May 2017	TOTAL
Power shutdown	75	55	130
Maintenance / Reparation	127	85	212
Software / Program issues	15	8	23
Low LFG extraction volume	0	0	0
<b>TOTAL</b>	<b>217</b>	<b>148</b>	<b>365</b>

- **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 the registered monitoring plan, applied methodologies or standardized baselines

Not applicable. No temporary deviations were applied during this monitoring period.

### B.2.2. Corrections

The following corrections have been made since the registration of the project activity:

#### (a) Corrections that have been approved by the Board as applicable from the period prior to this monitoring period.

A post registration change (PRC ref No. PRC-1123-001) was submitted and accepted by the Chair of the EB on September 06 2013<sup>8</sup>, which included the following correction:

During the transcription of the PDD form version 03 to PDD form version 04.1, was found an inconsistency related to the annual average emissions reduction estimated over the crediting

<sup>8</sup> <http://cdm.unfccc.int/PRCContainer/DB/prcp686787438/view>

period (tonnes of CO<sub>2</sub>e). In the registered PDD on November 30<sup>th</sup>, 2007, section A.4.4., table 1, stated the annual average emission reductions over the crediting period as 170,499 (tonnes of CO<sub>2</sub>e) while on section B.6.4, the same data is reported as 166,912 tCO<sub>2</sub>e.

According to the spreadsheet “appendix 4 baseline calculation phase II.xls” public available on <http://cdm.unfccc.int/Projects/DB/TUEV-SUED1179241731.11/view>, the correct value is 160,361 tCO<sub>2</sub>e.

Furthermore, emissions reduction estimation over the second and third crediting period was corrected in section B.6.4 according to the values presented on the registered PDD page 2.

Contact information of project participant was updated as per the updated version of MoC format.

A post registration change (PRC ref No. PRC-1123-002) was submitted and approved by the Chair of the EB on February 12 2018<sup>9</sup>, which included the following corrections:

- To include the recently added PP, BELEKTRON d.o.o. in all relevant sections.
- To delete all the references to the methodology ACM0002, since it is no longer used and applicable to the project activity. As per used ACM0001, version 15, for the second crediting period for the calculation of the emission factor of the grid the methodology ACM0002 has to be changed to the “Tool to calculate emission factor for an electricity system”. All deleted references to ACM0002 came from the initially registered PDD for the first crediting period and could be just deleted since for the second crediting period the mentioned tool completely substitutes this methodology.
- The PP updated the value of GWP of methane, from 21 to 25. 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. The increase in the ex-ante ER calculation is due exclusively to this change, specifically in the parameters: “Baseline emissions of methane from the SWDS”, table 9; and “Project emissions”, table on section B.6.4. Both parameters were recalculated and consequently, ex-ante ER calculations changed all over the document.
- To include further information on how to determine the parameter  $F_{CH_4,EL,y}$  ex-post. The aim of this inclusion is to add clarity to calculations made in the Monitoring Reports.
- To include parameters  $p_{CH_4} = D_{CH_4}$ ,  $TDL_k$  and  $TDL_j$  in section B.6.2. These parameters are used in the ex-post calculations and are important within the Monitoring Reports; however, they were accidentally not included in this section before.
- To delete the parameter  $EL_y$ , which came from the initially registered PDD for the first crediting period, and for this second crediting period is substituted by the parameters:  $EG_{PJ,y}$  and  $EG_{EC,y}$
- To include monitoring parameters  $T$ , and  $P$  in section B.7.1. These parameters are used in the ex-post calculations and are important within the Monitoring Reports; however, they were accidentally not included in this section before.
- In the previous version of the PDD, there were references to files and spreadsheets for the data management, however actually they are no longer in use. The real and actual collection, transfer and processing of data and information is now placed in the PDD. This change is to add accuracy to the actual monitoring process.
- Since the PDD template needs to be updated from version 05.0 to 10.1, the PP included new information requested by the latest PDD template.
- All over the document, changes in the wording and inclusion of further references in order to add clarity to some statements.
- Typo mistakes

<sup>9</sup> <http://cdm.unfccc.int/PRCContainer/DB/prcp608476019/view>

**(b) Corrections that have been approved by the Board as applicable from this monitoring period.**

Not applicable. Mentioned corrections submitted under PRC-1123-002 are applicable from the last monitoring period (2<sup>nd</sup> MP, 2<sup>nd</sup> CP).

**(c) Corrections that are being submitted with this monitoring report as part of the request for issuance (post-registration change – issuance track) as applicable from this monitoring period.**

Not applicable, no corrections are to be submitted with this monitoring report.

**B.2.3. Changes to the start date of the 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 monitoring plan**

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

**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**

The following corrections have been made since the registration of the project activity:

**(a) Changes that have been approved by the Board as applicable from the period prior to this monitoring period.**

A post registration change (PRC ref No. PRC-1123-001) was submitted and accepted by the Chair of the EB on September 06 2013<sup>10</sup>, which included the following permanent changes from registered monitoring plan:

The Monitoring Plan was updated to include the following parameters:

- Operation hours of the energy plant

A post registration change (PRC ref No. PRC-1123-002) was submitted and approved by the Chair of the EB on February 12 2018<sup>11</sup>, which included the following permanent deviation of the monitoring from the applied methodology:

The project applies the methodology ACM0001, version 15, which is tied to clarification AM\_CLA\_0252, in which it is requested to have one single flow meter for each one of the energy generators placed in the site. In the case of the project design there is only one flow meter for all the energy generators, i.e. one flow meter measures the total of biogas introduced into the four

<sup>10</sup> <http://cdm.unfccc.int/PRCContainer/DB/prcp686787438/view>

<sup>11</sup> <http://cdm.unfccc.int/PRCContainer/DB/prcp608476019/view>

engines. Therefore, in order to alleviate the lack of flow meters, the PP proposes a permanent deviation from the applied methodology, which consists on the deduction of the accuracy level (1%) of the installed monitoring equipment to the actual measured biogas flow.

**(b) Changes that have been approved by the Board as applicable from this monitoring period.**

Not applicable. Mentioned permanent deviation of the monitoring from the applied methodology submitted under PRC-1123-002 is applicable from the last monitoring period (2<sup>nd</sup> MP, 2<sup>nd</sup> CP).

**(c) Changes that are being submitted with this monitoring report as part of the request for issuance (post-registration change - issuance track) as applicable from this monitoring period.**

Not applicable, no permanent changes or deviations are to be submitted with this monitoring report.

**B.2.6. Changes to project design**

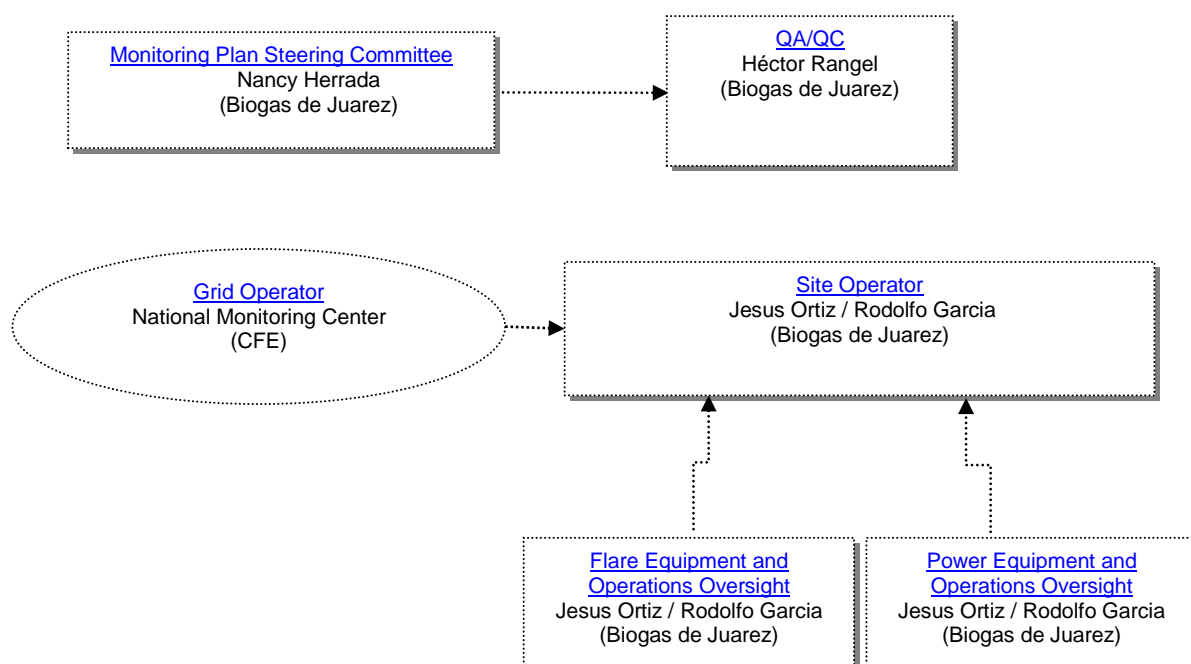
Not applicable. Any change to the registered PDD was conducted during this monitoring period.

**SECTION C. Description of monitoring system**

**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.

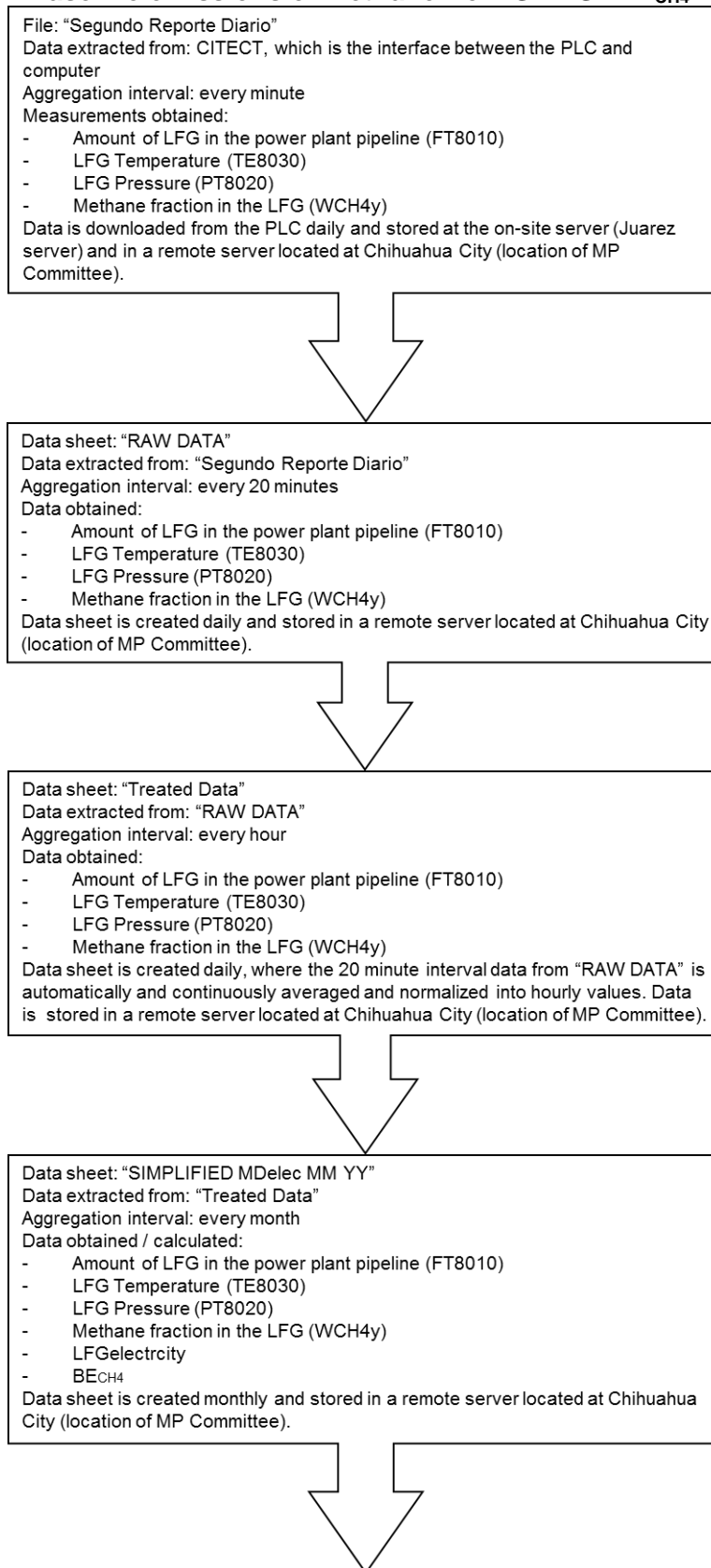
**Flare/Power Equipment and Operations Oversight:**

- 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<sub>CH4</sub>”



File: "Total ERy – XX Verification"  
 Data extracted from:  
 - "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<sub>EC</sub>" and Project emissions from consumption of electricity due to the project activity "PE<sub>EC</sub>"**

File: "ITEM 2"  
 Data extracted from: Electricity sales receipts emitted by CFE  
 Aggregation interval: every month  
 Data obtained:  
 - Total energy generated (EGPJ)  
 - Total energy consumed (EGEC)  
 Data is transferred directly from information provided by the grid company and sent (via e-mail) together with copies of the electricity receipts (in PDF format) to the QA/QC Committee.

CROSS-CHECK

Photographic evidence: personnel on-site take a picture of the electricity meter readings every day at 00:00 hrs and the same is sent (via e-mail) to the MP Committee.  
 Data from these photos is cross-checked to the monthly electricity receipts in order to compare with the CFE measurement.  
 Aggregation interval: daily  
 Data obtained:  
 - Meter readings every 24 hours for the exported and imported electricity

File: "Total ERy – XX Verification"  
 Data extracted from:  
 - "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 5: Collection of parameter Operation hours of the energy plant "OP<sub>j</sub>"**

File: "Operating Hours"  
 Data extracted from e-mail and attachments of the daily report  
 Personnel on-site take daily notes on the readings of every engine hour meter at 07:00 and 19:00 hrs and the information is sent (via e-mail) to the MP Committee  
 Data from these reports is aggregated daily.  
 Data obtained:  
 - Operation hours of the energy plant

File: "Total ERy – XX Verification"  
 Data extracted from:  
 - "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.

Regarding the parameter  $MD_{reg}$  or  $F_{CH_4, BL}$ , 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 files called: "Constancia de monitoreo anual a los requerimientos relacionados con los proyectos Landfill Gas-to-Energy" are dated on 11 March 2016 and 10 March 2017, for each year. 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- 3<sup>rd</sup> 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 <sup>3</sup> dry gas/h
FT8010 -1% adjusted	Adjusted amount of LFG fed to the power plant due to permanent deviation	m <sup>3</sup> dry gas/h
TE8030 (°C)	Temperature of the LFG fed to the power plant readings from the temperature meter in °C	°C
TE8030 (°K)	Temperature of the LFG fed to the power plant converted to °K	°K
PT8020 (P)	Pressure of the LFG fed to the power plant readings from the absolute pressure meter	Pa
$W_{CH_4}$	Methane fraction in the Landfill Gas	%
$LFG_{electricity}$	Amount of LFG combusted in power plant	m <sup>3</sup> dry gas/h
$\rho_{CH_4}$	Hourly methane density in the gaseous stream	tCH <sub>4</sub> /m <sup>3</sup> gas
$F_{CH_4, EL, y}$	Amount of methane in the LFG which is used for electricity generation	tCH <sub>4</sub>
$GWP_{CH_4}$	Global Warming Potential	tCO <sub>2e</sub> /tCH <sub>4</sub>
$BE_{CH_4}$	Baseline emissions of methane from the SWDS	tCO <sub>2e</sub>

**Table 5. "ITEM 2"**

Column	Description	Unit
EG <sub>PJ</sub>	Amount of electricity generated using LFG	kWh
EF <sub>CM</sub>	Combined Margin emission factor for Mexican grid	tCO <sub>2</sub> /kWh
TDL <sub>k</sub>	Average technical transmission and distribution losses for providing electricity to the grid	%
BE <sub>EC</sub>	Baseline emissions associated with electricity generation	tCO <sub>2e</sub>
EG <sub>EC</sub>	Amount of electricity consumed by the project activity	kWh
TDL <sub>j</sub>	Average technical transmission and distributions losses for the electricity consumption from the grid	%
PE <sub>EC</sub>	Project emissions from consumption of electricity due	tCO <sub>2e</sub>

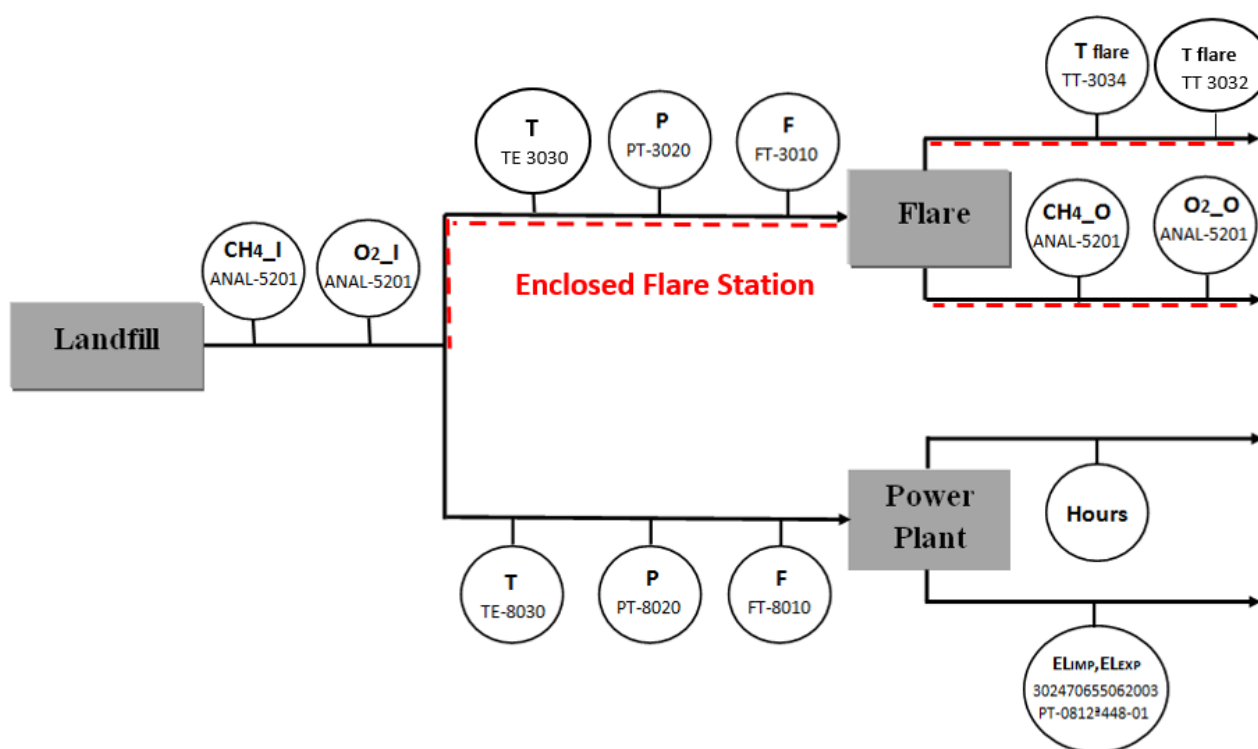
to the project activity

**Table 6. “Total ERY”**

Column	Description	Unit
$BE_{CH_4}$	Baseline emissions of methane from the SWDS	tCO <sub>2e</sub>
$BE_{EC}$	Baseline emissions associated with electricity generation	tCO <sub>2e</sub>
$BE_y$	Total Baseline Emissions	tCO <sub>2e</sub>
$PE_y = PE_{EC}$	Total Project Emissions = Project emissions from consumption of electricity due to the project activity	tCO <sub>2e</sub>
$ER_y$	Total Emission Reductions	tCO <sub>2e</sub>

**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 (red line), however the calibration of all the monitoring equipment was properly carried out.

**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 FT-8010	10231961 (removed)	26/02/16	6 months	26/08/16	6 months	---	---
	10512227 (installed on 02/01/2017)	06/01/17	6 months	17/02/17	6 months	---	---
Gas analyzer ANAL-5201	N1-V3-0218	01/05/16	3 months	01/06/16	3 months	01/07/16	3 months
		01/08/16		01/09/16		01/10/16	
		01/11/16		01/12/16		01/01/17	
		01/02/17		01/03/17		01/04/17	
		01/05/17		---		---	
Temperature transmitter TE-8030	D5002B 23365	26/02/16	6 months	26/08/16	6 months	17/02/17	6 months
Absolute Pressure Transmitter PT-8020	14262838	26/02/16	6 months	26/08/16	6 months	17/02/17	6 months
Electricity meter	PT-0812A448-01	28/03/16	1 year	27/03/17	1 year	---	---
Flow meter FT-3010	07210815	26/02/16	6 months	26/08/16	6 months	17/02/17	6 months
Temperature transmitter TE-3030	950090 23365	26/02/16	6 months	26/08/16	6 months	17/02/17	6 months
Absolute Pressure Transmitter PT-3020	07213133	26/02/16	6 months	26/08/16	6 months	17/02/17	6 months
Temperature transmitter TT-3032	D50BC7231C1	26/02/16	6 months	26/08/16	6 months	17/02/17	6 months
Temperature transmitter TT-3034	D50BC8231C1	26/02/16	6 months	26/08/16	6 months	17/02/17	6 months

During the present MR there is a gap on calibration of the equipment: flow meter FT-8010, from its installation on January 02, 2017 to its calibration on January 06, 2017, thus a penalty equals to the accuracy level of the instrument ( $\pm 1$ ) was applied to the readings of the instrument during the lack of calibration.

## SECTION D. Data and parameters

### D.1. Data and parameters fixed ex ante

Data / Parameter:	GWP <sub>CH4</sub>
Unit:	tCO <sub>2</sub> e/tCH <sub>4</sub>
Description:	Global Warming Potential of methane
Source of data:	IPCC Fourth Assessment Report: Climate Change 2007 <a href="http://www.ipcc.ch/publications_and_data/ar4/wg1/en/errataserrata-errata.html#table214">http://www.ipcc.ch/publications_and_data/ar4/wg1/en/errataserrata-errata.html#table214</a>
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:	NA

<b>Data / Parameter:</b>	$\rho_{CH_4} = D_{CH_4}$
Unit:	tCH <sub>4</sub> /m <sup>3</sup> CH <sub>4</sub>
Description:	Density of methane gas at standard temperature and pressure
Source of data:	<a href="http://www.engineeringtoolbox.com/gas-density-d_158.html">http://www.engineeringtoolbox.com/gas-density-d_158.html</a>
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

<b>Data / Parameter:</b>	<b>Operating Margin Emission Factor (EF<sub>OM,y</sub>)</b>
Unit:	tCO <sub>2e</sub> /MWh
Description:	CO <sub>2</sub> emissions intensity factor of the electricity displaced
Source of data:	Based on official statistics published by the Department of Energy
Value(s) applied:	0.6484
Choice of data or measurement methods and procedures:	As per registered PDD
Purpose of data:	Calculation of baseline and project emissions
Additional comments:	Fixed value for the second crediting period

<b>Data / Parameter:</b>	<b>Build Margin Emission Factor (EF<sub>BM,y</sub>)</b>
Unit:	tCO <sub>2e</sub> /MWh
Description:	CO <sub>2</sub> emissions intensity factor of the electricity displaced
Source of data:	Based on official statistics published by the Department of Energy
Value(s) applied:	0.3157
Choice of data or measurement methods and procedures:	As per registered PDD
Purpose of data:	Calculation of baseline and project emissions
Additional comments:	Fixed value for the second crediting period

<b>Data / Parameter:</b>	<b>Carbon Emission Intensity Factor (CEF<sub>electricity,y</sub>)</b>
Unit:	tCO <sub>2e</sub> /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 second crediting period

<b>Data / Parameter:</b>	<b>TDL<sub>k</sub></b>
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

<b>Data / Parameter:</b>	<b>TDL<sub>j</sub></b>
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

<b>Data / Parameter:</b>	<b>Regulatory requirements relating to landfill gas projects</b>
Unit:	Review
Description:	The regulatory requirements will be checked once a year and in case of changes, necessary adjustments will be made.
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) applied:	No changes in the regulatory requirements.
Choice of data or measurement methods and procedures:	For the current monitoring period the file called: "Constancia de monitoreo anual a los requerimientos relacionados con los proyectos Landfill Gas-to-Energy" are dated on 11 March 2016 and 10 March 2017, for each year.
Purpose of data:	Calculation of Baseline emissions
Additional comments:	N/A

<b>Data / Parameter:</b>	<ul style="list-style-type: none"> <li>- Fuel Quantity (<math>F_{i,y}</math>)</li> <li>- Emission Factor Coefficient (<math>COEF_i</math>)</li> <li>- Electricity Quantity (<math>GEN_{i,y}</math>)</li> <li>- <math>\Phi_{\text{default}}</math></li> <li>- OX</li> <li>- <math>MCF_{\text{default}}</math></li> <li>- <math>K_j</math></li> <li>- F</li> <li>- <math>\eta_{pj}</math> = Efficiency of the LFG capture system that will be installed in the project activity</li> <li>- Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS (<math>DOC_{f,\text{default}}</math>)</li> </ul>
Unit:	Various
Description:	Various
Source of data:	Various
Value(s) applied:	Various
Choice of data or measurement methods and procedures	Various
Purpose of data:	Calculation of baseline and project emissions
Additional comments:	These parameters are part of the PDD, section B.6.2, and used tools; however they were not used and are not relevant for the ER calculation during the present monitoring period, thus they are included in the same table for simplicity.

## D.2. Data and parameters monitored

<b>Data / Parameter:</b>	<b><math>LFG_{\text{total}} = LFG_{\text{electricity}}</math></b>
Unit:	<b><math>m^3\text{dry gas/h}</math></b>
Description:	Amount of LFG combusted in power plant
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: "2018_08_18_Total ERY 3rd verification"

Monitoring equipment:	<b>Type</b>	FOXBORO flow meter
	<b>Accuracy Class</b>	Accuracy for gases and steam is + 1% of reading for flow rates with Reynolds number of 20,000 or greater
	<b>Serial No.</b>	Serial: 10231961 (removed) Model: 83F-T08S1SSTJA
	<b>Calibration Frequency</b>	Calibration is not required by the manufacturer; however, for QA/QC procedures, verification of the instrument is performed every 6 months.
	<b>Date of last calibration</b>	Refer to table 7 above
	<b>Validity</b>	During the monitoring period
	<b>Type</b>	FOXBORO flow meter
	<b>Accuracy Class</b>	Accuracy for gases and steam is + 1% of reading for flow rates with Reynolds number of 20,000 or greater
	<b>Serial No.</b>	Serial: 10512227 (installed 02/01/2017) Model: 83F-T08S1SSTJA
	<b>Calibration Frequency</b>	Calibration is not required by the manufacturer; however, for QA/QC procedures, verification of the instrument is performed every 6 months.
	<b>Date of last calibration</b>	Refer to table 7 above
	<b>Validity</b>	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):	As per applied “ <b>Tool to determine the mass flow of a greenhouse gas in a gaseous stream</b> ” (Version 02.0.0), value is presented at actual 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:	<p>Since during this monitoring period, the LFG was used to generate electricity, one flow meter can be used and therefore <math>LFG_{total} = LFG_{electricity}</math></p> <p>Due to a permanent deviation (explained in section B.2.5) the raw data measured by this instrument applies a deduction according to the accuracy class above, i.e. 1%.</p>	

<b>Data / Parameter:</b>	<b>T</b>
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: “2018_08_18_Total ERY 3rd verification”

Monitoring equipment:	<b>Type</b>	Endress+Hauser Temperature transmitter
	<b>Accuracy Class</b>	The maximum tolerance for an RTD class B system is + 0.3+0.005 C (absolute).
	<b>Serial No.</b>	Serial: D5002B 23365 Model: T13-G3A12A3AACKA
	<b>Calibration Frequency</b>	Manufacturer states 1 calibration per year; however, for QA/QC procedures, calibration is performed every 6 months.
	<b>Date of last calibration</b>	Refer to Table 7 above
	<b>Validity</b>	During the monitoring period
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: “2018_08_18_Total ERY 3rd verification”	
Monitoring equipment:	Type	FOXBORO Absolute pressure transmitter
	Accuracy Class	Maximum analogue error is 0.02% at 50% of span.
	Serial No.	Serial: 14262838 Model: IAP10-A22C1F
	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 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	

<b>Data / Parameter:</b>	<b>W<sub>CH4</sub></b>												
Unit:	% (m <sup>3</sup> CH <sub>4</sub> /m <sup>3</sup> LFG)												
Description:	Methane fraction in the LFG												
Measured/ Calculated / Default:	Measured												
Source of data:	Gas analyser, data extracted from PLC records												
Value(s) of monitored parameter:	Values presented in a separate spreadsheet: "2018_08_18_Total ERY 3rd verification"												
Monitoring equipment:	<table border="1"> <tr> <td><b>Type</b></td><td>Gas analyser</td></tr> <tr> <td><b>Accuracy Class</b></td><td>&lt;1% of full-scale value.</td></tr> <tr> <td><b>Serial No.</b></td><td>Serial: N1-V3-0218 Model: ULTRAMAT 23</td></tr> <tr> <td><b>Calibration Frequency</b></td><td>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<sub>4</sub> and a span on O<sub>2</sub> are performed every day.</td></tr> <tr> <td><b>Date of last calibration</b></td><td>Refer to Table 7 above</td></tr> <tr> <td><b>Validity</b></td><td>During the monitoring period</td></tr> </table>	<b>Type</b>	Gas analyser	<b>Accuracy Class</b>	<1% of full-scale value.	<b>Serial No.</b>	Serial: N1-V3-0218 Model: ULTRAMAT 23	<b>Calibration Frequency</b>	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 <sub>4</sub> and a span on O <sub>2</sub> are performed every day.	<b>Date of last calibration</b>	Refer to Table 7 above	<b>Validity</b>	During the monitoring period
<b>Type</b>	Gas analyser												
<b>Accuracy Class</b>	<1% of full-scale value.												
<b>Serial No.</b>	Serial: N1-V3-0218 Model: ULTRAMAT 23												
<b>Calibration Frequency</b>	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 <sub>4</sub> and a span on O <sub>2</sub> are performed every day.												
<b>Date of last calibration</b>	Refer to Table 7 above												
<b>Validity</b>	During the monitoring period												
Measuring/ Reading/ Recording frequency:	Data are continuously measured by a gas analyser, aggregated every minute and averaged hourly for the calculation means.												
Calculation method (if applicable):	NA												
QA/QC procedures:	The gas analyser is subject to a regular maintenance and testing regime to ensure accuracy.												
Purpose of data:	Calculation of baseline emissions												
Additional comments:	NA												

<b>Data / Parameter:</b>	<b>MD<sub>reg</sub> or F<sub>CH4,BL,y</sub></b>
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 anual a los requerimientos relacionados con los proyectos Landfill Gas-to-Energy" are dated on 11 March 2016 and 10 March 2017
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 $F_{CH_4,BL,y}$ or directly $MD_{reg}$ at renewal of the crediting period.
Additional comments:	NA

Data / Parameter:	EG <sub>PJ,y</sub>													
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:	30,083.61 MWh Values per month are presented in a separated spreadsheet: 2018_08_18_Total ERY 3rd 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>		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
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.													

<b>Data / Parameter:</b>	<b>EG<sub>EC,y</sub></b>	
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:	19.151 MWh Values per month are presented in a separated spreadsheet: 2018_08_18_Total ERY 3rd verification	

Monitoring equipment:	<b>Type</b>	Bidirectional electricity meter – Schneider Electric
	<b>Accuracy Class</b>	+0.2%
	<b>Serial No.</b>	Serial: PT-0812A448-01 Model: PowerLogic ION8600
	<b>Calibration Frequency</b>	Annually
	<b>Date of last calibration</b>	Refer to table 7 above
	<b>Validity</b>	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 project emissions	
Additional comments:	Data from the photos is cross-checked to the monthly electricity sale receipts.	

<b>Data / Parameter:</b>	<b>OP<sub>j,h</sub></b>
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:	25,666 hours Values in detail are presented in a separate spreadsheet: 2018_08_18_Total ERY 3rd 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

<b>Data / Parameter:</b>	<b>Management of SWDS</b>
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 anual a los requerimientos relacionados con los proyectos Landfill Gas-to-Energy" are dated on 11 March 2016 and 10 March 2017
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

<b>Data / Parameter:</b>	<b>LFG<sub>flared</sub></b>												
Unit:	<b>Nm<sup>3</sup></b>												
Description:	Total amount of LFG flared												
Measured/ Calculated / Default:	Measured												
Source of data:	Flow meter												
Value(s) of monitored parameter:	Zero, any LFG flared was taken into account during the present monitoring period.												
Monitoring equipment:	<table border="1"> <tr> <td><b>Type</b></td><td>FOXBORO flow meter</td></tr> <tr> <td><b>Accuracy Class</b></td><td>Accuracy for gases and steam is + 1% of reading for flow rates with Reynolds number of 20,000 or greater</td></tr> <tr> <td><b>Serial No.</b></td><td>Serial: 07210815 Model: 83F-T08S1SSTJA</td></tr> <tr> <td><b>Calibration Frequency</b></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><b>Date of last calibration</b></td><td>Refer to table 7 above</td></tr> <tr> <td><b>Validity</b></td><td>During the monitoring period</td></tr> </table>	<b>Type</b>	FOXBORO flow meter	<b>Accuracy Class</b>	Accuracy for gases and steam is + 1% of reading for flow rates with Reynolds number of 20,000 or greater	<b>Serial No.</b>	Serial: 07210815 Model: 83F-T08S1SSTJA	<b>Calibration Frequency</b>	Calibration is not required by the manufacturer; however, for QA/QC procedures, verification of the instrument is performed every 6 months.	<b>Date of last calibration</b>	Refer to table 7 above	<b>Validity</b>	During the monitoring period
<b>Type</b>	FOXBORO flow meter												
<b>Accuracy Class</b>	Accuracy for gases and steam is + 1% of reading for flow rates with Reynolds number of 20,000 or greater												
<b>Serial No.</b>	Serial: 07210815 Model: 83F-T08S1SSTJA												
<b>Calibration Frequency</b>	Calibration is not required by the manufacturer; however, for QA/QC procedures, verification of the instrument is performed every 6 months.												
<b>Date of last calibration</b>	Refer to table 7 above												
<b>Validity</b>	During the monitoring period												
Measuring/ Reading/ Recording frequency:	Data are continuously measured by a flow meter.												
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:	No purpose during this monitoring period.												
Additional comments:	Although the parameter is part of the registered PDD and used methodologies and tools, the same was not used for calculations since the flare system is off.												

<b>Data / Parameter:</b>	<b>FE</b>
Unit:	Number
Description:	Flare/combustion efficiency, determined by the operation hours (1) and the methane content in the exhaust gas (2)

Measured/ Calculated / Default:	Calculated
Source of data:	N/A
Value(s) of monitored parameter:	N/A, any LFG flared was taken into account during the present monitoring period.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	N/A
Calculation method (if applicable):	Tool to determine project emissions from flaring gases containing methane.
QA/QC procedures:	N/A
Purpose of data:	No purpose during this monitoring period
Additional comments:	Although the parameter is part of the registered PDD and used methodologies and tools, the same was not used for calculations since the flare system is off.

<b>Data / Parameter:</b>	<b>PE<sub>flare,y</sub></b>
Unit:	tCO <sub>2</sub> e
Description:	Project emissions from flaring of the residual gas stream in year <i>y</i>
Measured/ Calculated / Default:	Calculated
Source of data:	N/A
Value(s) of monitored parameter:	N/A, any LFG flared was taken into account during the present monitoring period.
Monitoring equipment:	N/A
Measuring/ Reading/ Recording frequency:	N/A
Calculation method (if applicable):	Tool to determine project emissions from flaring gases containing methane.
QA/QC procedures:	N/A
Purpose of data:	No purpose during this monitoring period
Additional comments:	Although the parameter is part of the registered PDD and used methodologies and tools, the same was not used for calculations since the flare system is off.

<b>Data / Parameter:</b>	<b>V<sub>i, RG, m</sub></b>
Unit:	%
Description:	Volumetric fraction of component <i>i</i> in the residual gas in the minute <i>m</i> where <i>i</i> = CH <sub>4</sub> , N <sub>2</sub>
Measured/ Calculated / Default:	Measured
Source of data:	Gas analyzer
Value(s) of monitored parameter:	Zero, any LFG flared was taken into account during the present monitoring period.

Monitoring equipment:	<b>Type</b>	Gas analyzer
	<b>Accuracy Class</b>	<1% of full-scale value.
	<b>Serial No.</b>	Serial: N1-V3-0218 Model: ULTRAMAT 23
	<b>Calibration Frequency</b>	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 <sub>4</sub> and a span on O <sub>2</sub> are performed every day.
	<b>Date of last calibration</b>	Refer to Table 7 above
	<b>Validity</b>	During the monitoring period
Measuring/ Reading/ Recording frequency:	Data are continuously measured by a gas analyzer.	
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:	No purpose during this monitoring period	
Additional comments:	Although the parameter is part of the registered PDD and used methodologies and tools, the same was not used for calculations since the flare system is off.	

<b>Data / Parameter:</b>	$V_{RG,m}$	
Unit:	<b>m<sup>3</sup>/h</b>	
Description:	Volumetric flow rate of the residual gas in dry basis at normal conditions in the minute <i>m</i>	
Measured/ Calculated / Default:	Measured	
Source of data:	Flow meter	
Value(s) of monitored parameter:	Zero, any LFG flared was taken into account during the present monitoring period.	
Monitoring equipment:	<b>Type</b>	FOXBORO flow meter
	<b>Accuracy Class</b>	Accuracy for gases and steam is + 1% of reading for flow rates with Reynolds number of 20,000 or greater
	<b>Serial No.</b>	Serial: 07210815 Model: 83F-T08S1SSTJA
	<b>Calibration Frequency</b>	Calibration is not required by the manufacturer; however, for QA/QC procedures, verification of the instrument is performed every 6 months.
	<b>Date of last calibration</b>	Refer to table 7 above
	<b>Validity</b>	During the monitoring period
Measuring/ Reading/ Recording frequency:	Data are continuously measured by a flow meter.	
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:	No purpose during this monitoring period.
Additional comments:	Although the parameter is part of the registered PDD and used methodologies and tools, the same was not used for calculations since the flare system is off.

<b>Data / Parameter:</b>	<b>V<sub>O<sub>2</sub>,EG,m</sub></b>												
Unit:	%												
Description:	Volumetric fraction of O <sub>2</sub> in the exhaust gas on a dry basis at reference conditions in the minute <i>m</i>												
Measured/ Calculated / Default:	Measured												
Source of data:	Gas analyser												
Value(s) of monitored parameter:	Zero, any LFG flared was taken into account during the present monitoring period.												
Monitoring equipment:	<table border="1"> <tr> <td><b>Type</b></td><td>Gas analyzer</td></tr> <tr> <td><b>Accuracy Class</b></td><td>&lt;1% of full-scale value.</td></tr> <tr> <td><b>Serial No.</b></td><td>Serial: N1-V3-0218 Model: ULTRAMAT 23</td></tr> <tr> <td><b>Calibration Frequency</b></td><td>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<sub>4</sub> and a span on O<sub>2</sub> are performed every day.</td></tr> <tr> <td><b>Date of last calibration</b></td><td>Refer to Table 7 above</td></tr> <tr> <td><b>Validity</b></td><td>During the monitoring period</td></tr> </table>	<b>Type</b>	Gas analyzer	<b>Accuracy Class</b>	<1% of full-scale value.	<b>Serial No.</b>	Serial: N1-V3-0218 Model: ULTRAMAT 23	<b>Calibration Frequency</b>	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 <sub>4</sub> and a span on O <sub>2</sub> are performed every day.	<b>Date of last calibration</b>	Refer to Table 7 above	<b>Validity</b>	During the monitoring period
<b>Type</b>	Gas analyzer												
<b>Accuracy Class</b>	<1% of full-scale value.												
<b>Serial No.</b>	Serial: N1-V3-0218 Model: ULTRAMAT 23												
<b>Calibration Frequency</b>	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 <sub>4</sub> and a span on O <sub>2</sub> are performed every day.												
<b>Date of last calibration</b>	Refer to Table 7 above												
<b>Validity</b>	During the monitoring period												
Measuring/ Reading/ Recording frequency:	Data are continuously measured by a gas analyzer.												
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:	No purpose during this monitoring period												
Additional comments:	Although the parameter is part of the registered PDD and used methodologies and tools, the same was not used for calculations since the flare system is off.												

<b>Data / Parameter:</b>	<b>f<sub>CH<sub>4</sub>,EG,m</sub></b>
Unit:	%
Description:	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the minute <i>m</i>
Measured/ Calculated / Default:	Measured
Source of data:	Gas analyzer
Value(s) of monitored parameter:	Zero, any LFG flared was taken into account during the present monitoring period.

Monitoring equipment:	<b>Type</b>	Gas analyzer
	<b>Accuracy Class</b>	<1% of full-scale value.
	<b>Serial No.</b>	Serial: N1-V3-0218 Model: ULTRAMAT 23
	<b>Calibration Frequency</b>	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 <sub>4</sub> and a span on O <sub>2</sub> are performed every day.
	<b>Date of last calibration</b>	Refer to Table 7 above
	<b>Validity</b>	During the monitoring period
Measuring/ Reading/ Recording frequency:	Data are continuously measured by a gas analyzer.	
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:	No purpose during this monitoring period	
Additional comments:	Although the parameter is part of the registered PDD and used methodologies and tools, the same was not used for calculations since the flare system is off.	

<b>Data / Parameter:</b>	<b>T<sub>EG,m</sub></b>
Unit:	°C
Description:	Temperature in the exhaust gas of the enclosed flare in minute <i>m</i>
Measured/ Calculated / Default:	Measured
Source of data:	2 Temperature transmitters
Value(s) of monitored parameter:	N/A, any LFG flared was taken into account during the present monitoring period.

Monitoring equipment:	<b>Type</b>	Endress+Hauser Temperature transmitter
	<b>Accuracy Class</b>	The maximum tolerance for an RTD class B system is + 0.3+0.005 C (absolute).
	<b>Serial No.</b>	Serial: D50BC7231C1 Model: TMT122-D31BA
	<b>Calibration Frequency</b>	Manufacturer states 1 calibration per year; however, for QA/QC procedures, calibration is performed every 6 months.
	<b>Date of last calibration</b>	Refer to Table 7 above
	<b>Validity</b>	During the monitoring period
	<b>Type</b>	Endress+Hauser Temperature transmitter
	<b>Accuracy Class</b>	The maximum tolerance for an RTD class B system is + 0.3+0.005 C (absolute).
	<b>Serial No.</b>	Serial: D50BC8231C1 Model: TMT122-D31BA
	<b>Calibration Frequency</b>	Manufacturer states 1 calibration per year; however, for QA/QC procedures, calibration is performed every 6 months.
	<b>Date of last calibration</b>	Refer to Table 7 above
	<b>Validity</b>	During the monitoring period
Measuring/ Reading/ Recording frequency:	Data are continuously measured by a temperature transmitter.	
Calculation method (if applicable):	N/A	
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:	No purpose during this monitoring period	
Additional comments:	Although the parameter is part of the registered PDD and used methodologies and tools, the same was not used for calculations since the flare system is off.	

### D.3. Implementation of sampling plan

This section is not applicable

## SECTION E. Calculation of emission reductions or net anthropogenic removals

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

The baseline emissions were calculated according to the following formulas:

From the used methodology ACM0001, version 15.0

$$BE_y = BE_{CH_4,y} + BE_{EC,y} + BE_{HG,y} + BE_{NG,y} \quad (1BE)$$

Where:

- $BE_y$  = Baseline emissions in year y (t CO<sub>2</sub>e/yr)  
 $BE_{CH_4,y}$  = Baseline emissions of methane from the SWDS in year y (t CO<sub>2</sub>e/yr)  
 $BE_{EC,y}$  = Baseline emissions associated with electricity generation in year y (t CO<sub>2</sub>/yr)  
 $BE_{HG,y}$  = Baseline emissions associated with heat generation in year y (t CO<sub>2</sub>/yr)  
 $BE_{NG,y}$  = Baseline emissions associated with natural gas use in year y (t CO<sub>2</sub>/yr)

The sample calculation for this formula, randomly chosen, is the accumulated of the month of July 2016, we chose the accumulated since the electricity generation data is based on the monthly invoices and the accumulated could easily provide traceability with the spreadsheet. For all the sample calculations showed in section E, please take into account that the figures show limited decimals, complete numbers can be examined in the spreadsheet attached.

$BE_y$	$BE_{CH_4,y}$	$BE_{EC,y}$	$BE_{HG,y}$	$BE_{NG,y}$
12,211 tCO <sub>2e</sub>	11,343 tCO <sub>2e</sub>	868 tCO <sub>2e</sub>	0 tCO <sub>2e</sub>	0 tCO <sub>2e</sub>

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:

$$BE_y = BE_{CH_4,y} + BE_{EC,y} \quad (2BE)$$

$BE_y$	$BE_{CH_4,y}$	$BE_{EC,y}$
12,211 tCO <sub>2e</sub>	11,343 tCO <sub>2e</sub>	868 tCO <sub>2e</sub>

From which:

$$BE_{CH_4} = (1 - OX_{top\_layer}) * (F_{CH_4,PJ,y} - F_{CH_4,BL,y}) * GWP_{CH_4} \quad (3BE)$$

Where:

- $BE_{CH_4,y}$  = Baseline emissions of methane from the SWDS in year y (t CO<sub>2</sub>e/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)<sup>12</sup>  
 $F_{CH_4,PJ,y}$  = Amount of methane in the LFG which is flared and/or used in the project activity in year y (t CH<sub>4</sub>/yr)  
 $F_{CH_4,BL,y}$  = Amount of methane in the LFG that would be flared in the baseline in year y (t CH<sub>4</sub>/yr)  
 $GWP_{CH_4}$  = Global warming potential of CH<sub>4</sub> (t CO<sub>2</sub>e/t CH<sub>4</sub>)

<sup>12</sup>  $OX_{top\_layer}$  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 maintain a high methane concentration in the LFG. For this reason, this effect is neglected as a conservative assumption.

From the above formula,  $OX_{top-layer} = 0$  and  $F_{CH_4,BL,y} = 0$ , as per registered PDD.

Sample calculation from the random date: 13 July 2016, 04:00 AM.

$BE_{CH_4,y}$	$OX_{top-layer}$	$F_{CH_4,PJ,y}$	$F_{CH_4,BL,y}$	$GWP_{CH_4}$
17* tCO <sub>2e</sub>	0	0.69 tCH <sub>4</sub>	0 tCH <sub>4</sub>	25 tCO <sub>2e</sub> /tCH <sub>4</sub>

\* Value is rounded; however, complete calculation and numbers are shown in the spreadsheet

Therefore:

$$BE_{CH_4} = F_{CH_4,PJ,y} * GWP_{CH_4} \quad (4BE)$$

$BE_{CH_4,y}$	$F_{CH_4,PJ,y}$	$GWP_{CH_4}$
17* tCO <sub>2e</sub>	0.69 tCH <sub>4</sub>	25 tCO <sub>2e</sub> /tCH <sub>4</sub>

\* Value is rounded; however, complete calculation and numbers are shown in the spreadsheet

From which:

$$F_{CH_4,PJ,y} = F_{CH_4,flared,y} + F_{CH_4,EL,y} + F_{CH_4,HG,y} + F_{CH_4,NG,y} \quad (5BE)$$

Where:

- $F_{CH_4,PJ,y}$  = Amount of methane in the LFG which is flared and/or used in the project activity in year y (t CH<sub>4</sub>/yr)
- $F_{CH_4,flared,y}$  = Amount of methane in the LFG which is destroyed by flaring in year y (t CH<sub>4</sub>/yr)
- $F_{CH_4,EL,y}$  = Amount of methane in the LFG which is used for electricity generation in year y (t CH<sub>4</sub>/yr)
- $F_{CH_4,HG,y}$  = Amount of methane in the LFG which is used for heat generation in year y (t CH<sub>4</sub>/yr)
- $F_{CH_4,NG,y}$  = Amount of methane in the LFG which is sent to the natural gas distribution network in year y (t CH<sub>4</sub>/yr)

Following with the above sample, the calculation of 13 July 2016 at 04:00 AM is showed:

$F_{CH_4,PJ,y}$	$F_{CH_4,flared,y}$	$F_{CH_4,EL,y}$	$F_{CH_4,HG,y}$	$F_{CH_4,NG,y}$
0.69 tCH <sub>4</sub>	0 tCH <sub>4</sub>	0.69 tCH <sub>4</sub>	0 tCH <sub>4</sub>	0 tCH <sub>4</sub>

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

$$F_{CH_4,PJ,y} = F_{CH_4,EL,y} \quad (6BE)$$

$F_{CH_4,PJ,y}$	$F_{CH_4,EL,y}$
0.69 tCH <sub>4</sub>	0.69 tCH <sub>4</sub>

As per used methodology ACM0001, version 15.0, parameter  $F_{CH_4,EL,y}$  is determined using the "Tool to determine the mass flow of a greenhouse gas in gaseous stream", version 2.0.0.

Option A in page 5 is being used, since it is demonstrated that the temperature in the gaseous stream is less than 60°C at the flow measurement point, as required in way (b) of the tool. Please refer to the complete hourly-recorded data in the file: "2018\_08\_18\_Total ERY 3rd verification"; column E shows readings from the temperature meter TE8030.

There are only five readings in which the temperature meter was above 60°C and it is due to an erroneous reading. The same was noticed during the on-site visit and addressed accordingly in CAR 2.

For the mentioned readings there is any claim of emission reductions, i.e. for these 5 readings parameter  $BE_{CH_4}=0$

The mass flow of greenhouse gas  $i$  ( $F_{i,t}$ ),  $F_{CH_4,EL,y}$  in the project case, is determined as follows:

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

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 (m <sup>3</sup> 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 (m <sup>3</sup> gas $i$ /m <sup>3</sup> dry gas)
$\rho_{i,t}$	= Density of greenhouse gas $i$ in the gaseous stream in time interval $t$ (kg gas $i$ /m <sup>3</sup> 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.m <sup>3</sup> /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:

$$F_{CH_4,EL,y} = (LFG_{electricity,y}) * (W_{CH_4}) * (\rho_{CH_4}) \quad (7BE)$$

Following with the above sample calculation, for 13 July 2016 at 4:00 AM:

$F_{CH_4,EL,y}$	$LFG_{electricity,y}$	$W_{CH_4}$	$\rho_{CH_4}$
0.69* tCH <sub>4</sub>	1,761.46 m <sup>3</sup> /h	0.53 (53%)	0.000744 tCH <sub>4</sub> /m <sup>3</sup> CH <sub>4</sub>

\* Value is rounded; however, complete calculation and numbers are shown in the spreadsheet

$$\rho_{CH_4} = \frac{P * MM_{CH_4}}{(T + 273.15) * R_u} \quad (8BE)$$

From the above equations (7BE) and (8BE) parameters  $LFG_{electricity}$ ,  $W_{CH_4}$ ,  $P$ ,  $T$  are monitored according to sections C and D.2 above.

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

$$MM_{CH_4} = 16.04 \text{ kg/kmol}$$

$$R_u = 8,314 \text{ Pa m}^3/\text{kmol } ^\circ\text{K}$$

Then, the calculation for the chosen date, 13 July 2016 at 4:00 AM leads to:

$\rho_{CH_4}^*$	$P$	$MM_{CH_4}$	$T$	$Ru$
0.000744 tCH <sub>4</sub> /m <sup>3</sup> CH <sub>4</sub>	119.01 Pa	16.04 kg/kmol	35.51 °C	8,314 Pa m <sup>3</sup> /kmol°K

\* Value is rounded; however, complete calculation and numbers are shown in the spreadsheet

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:

- 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
- $EC_{BL,k,y}$  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 $y$ (tCO <sub>2</sub> /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 $y$ (tCO <sub>2</sub> /MWh)
$TDL_{k,y}$	= Average technical transmission and distribution losses for providing electricity to source $k$ in year $y$

Sample calculation for this formula is the electricity generated during July 2016 in order to show consistency with formulas (1BE) and (2BE) above.

$BE_{EC,y}$	$EC_{BL,k}$	$EF_{EL,k,y}$	$TDL_{k,y}$
868.34 tCO <sub>2e</sub>	2,113,438.74 kWh	0.0003989 tCO <sub>2</sub> /kWh	0.03 (3%)

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

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

$BE_{EC,y}$	$EG_{PJ,y}$	$EF_{CM}$	$TDL_{k,y}$
868.34 tCO <sub>2e</sub>	2,113,438.74 kWh	0.0003989 tCO <sub>2</sub> /kWh	0.03 (3%)

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

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

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

Where:

$PE_y$  = Project emissions in year  $y$  (t CO<sub>2</sub>/yr)

$PE_{EC,y}$  = Emissions from consumption of electricity due to the project activity in year  $y$  (t CO<sub>2</sub>/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<sub>2</sub>/yr)

For the sample calculation the random month of January 2017 is chosen:

$PE_y$	$PE_{EC,y}$	$PE_{FC,y}$
1 tCO <sub>2</sub>	1 tCO <sub>2</sub>	0 tCO <sub>2</sub>

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:

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

$PE_y$	$PE_{EC,y}$
1 tCO <sub>2</sub>	1 tCO <sub>2</sub>

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:

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

Where:

$PE_{EC,y}$  = Are the project emissions from electricity consumption by the project activity in the year  $y$  (tCO<sub>2</sub> / 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  $y$  (tCO<sub>2</sub>/MWh)

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

Sample calculation for this formula is the electricity consumed during January 2017 in order to show consistency with formulas (1PE) and (2PE) above. Please notice that although the result is less than 1 tCO<sub>2e</sub>, the value was rounded up for conservativeness principle (the same applies for all the  $PE_{EC,y}$  monthly values).

$PE_{EC,y}$	$EC_{PJ,j,y}$	$EF_{EL,k,y}$	$TDL_{j,y}$
0.685 tCO <sub>2e</sub>	1,431.76 kWh	0.0003989 tCO <sub>2</sub> /kWh	0.20 (20%)

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

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

$PE_{EC,y}$	$EG_{EC}$	$EF_{CM}$	$TDL_{j,y}$
0.685 tCO <sub>2e</sub>	1,431.76 kWh	0.0003989 tCO <sub>2</sub> /kWh	0.20 (20%)

**Summary:**

According to the general formula:  $ER_y = BE_y - PE_y - LE_y$ ; (ER)

and to the formulas:

$$BE_y = BE_{CH_4,y} + BE_{EC,y} \quad (2BE)$$

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

$$LE_y = 0 \quad (1LE)$$

**Table 8. ER values per month**

					PE <sub>y</sub>	
		BE <sub>CH<sub>4</sub></sub> (tCO <sub>2</sub> e)	BE <sub>EC</sub> (tCO <sub>2</sub> e)	BE <sub>y</sub> (tCO <sub>2</sub> e)	PE <sub>EC</sub> (tCO <sub>2</sub> e)	ER <sub>y</sub> (tCO <sub>2</sub> e)
2016	13 - 31 May	7,805	590	8,394	1	8,393
	June	11,309	871	12,180	1	12,179
	July	11,343	868	12,211	2	12,209
	August	11,467	931	12,397	2	12,395
	September	13,068	1,034	14,102	1	14,101
	October	13,185	1,052	14,237	1	14,236
	November	12,623	982	13,605	1	13,604
	December	12,503	1,011	13,513	2	13,511
2017	January	12,542	1,031	13,572	1	13,571
	February	11,323	902	12,224	2	12,222
	March	13,802	1,057	14,858	1	14,857
	April	12,933	992	13,924	1	13,923
	May	13,691	1,040	14,730	1	14,729
				<b>169,947</b>	<b>17</b>	<b>169,930</b>

Columns BE<sub>CH<sub>4</sub></sub> and BE<sub>EC</sub> are calculated with the raw data from the PLC and invoices. In order to be conservative, columns BE<sub>y</sub> and PE<sub>y</sub> are rounded down and rounded up, respectively.

The rest of the values mentioned in the above formulae are completely shown in the excel file: "2018\_08\_18\_Total ER<sub>y</sub> 3rd verification"

**E.3. Calculation of leakage emissions**

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

$$LE_y = 0 \quad (1LE)$$

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

	Baseline GHG emissions or baseline net GHG removals (t CO <sub>2</sub> e)	Project GHG emissions or actual net GHG removals (t CO <sub>2</sub> e)	Leakage GHG emissions (t CO <sub>2</sub> e)	GHG emission reductions or net anthropogenic GHG removals (t CO <sub>2</sub> e)		
				Before 01/01/2013	From 01/01/2013	Total amount
<b>Total</b>	169,947	17	0	0	169,930	169,930

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

Amount achieved during this monitoring period (t CO <sub>2</sub> e)	Amount estimated ex ante (t CO <sub>2</sub> e)
169,930	179,698

**E.6. Remarks on increase in achieved emission reductions**

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

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**Document information**

<i>Version</i>	<i>Date</i>	<i>Description</i>
06.0	7 June 2017	Revision to: <ul style="list-style-type: none"> <li>• Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN);</li> <li>• Make editorial improvements.</li> </ul>
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: <ul style="list-style-type: none"> <li>• Include provisions related to delayed submission of a monitoring plan;</li> <li>• Provisions related to the Host Party;</li> <li>• Remove reference to programme of activities;</li> <li>• Overall editorial improvement.</li> </ul>
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> <li>• Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0));</li> <li>• Include provisions related to standardized baselines;</li> <li>• Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1;</li> <li>• Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>;</li> <li>• Editorial improvement.</li> </ul>
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.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report		