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		
Title of the project activity	Doña Juana landfill gas-to-energy project	
UNFCCC reference number of the project activity	2554	
Version number of the PDD applicable to this monitoring report	9.2	
Version number of this monitoring report	3	
Completion date of this monitoring report	30/07/2018	
Monitoring period number	2nd Monitoring Period of the 2nd Crediting Period	
Duration of this monitoring period	From 01/04/2017 to 30/09/2017	
Monitoring report number for this monitoring report	2	
Project participants	Biogas Dona Juana S.A.S. ESP. (Colombia) Biogas Dona Juana S.A.S. ESP (Switzerland) Biogas Dona Juana S.A.S. ESP (Germany) Nordic Environment Finance Corporation (Norway)	
Host Party	Colombia	
Sectoral scopes	Sectorial Scope: 13 - Waste handling and disposal	
Applied methodologies and standardized baselines	Applied Methodology: ACM0001 ver. 17.0 Consolidated baseline and monitoring methodology for landfill gas project activities	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0 - tCO2e	177,266 tCO2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	484,687 tCO2e Calculated on a pro-rata basis of 183 days of monitoring in the year 2017 (between the 01 of April to 30 of September)	

SECTION A. Description of project activity

A.1. General description of project activity

>> Doña Juana Landfill Gas-to-Energy Project, Registration Number 2554[1] , involves landfill gas capture, flaring and use in reciprocating engines to produce electrical energy.

The Doña Juana Landfill, located in the District Capital of Bogotá – Colombia – is used for the disposal of the municipal solid waste generated by near of 8 million inhabitants of Bogotá, providing a solution to dispose of an average of 2.5 million tons of household waste per year. The Doña Juana Landfill is the biggest sanitary landfill in Colombia and one of the biggest in Latin America.

Purpose of the project activity and the measures taken to reduce greenhouse gas emissions:

The project objective is to maximize the capture of landfill gas (LFG) in actual operating zones and the future land filling zones within the perimeter of the Doña Juana landfill site; and to combust it in order to reduce fugitive emissions of methane generated by anaerobic waste degradation, a greenhouse gas which contributes to global warming and climate change. Before the commissioning of the LFG project, the landfill gas from these areas was vented to the atmosphere through passive gas wells.

The landfill gas will be used to produce electricity through dedicated reciprocating engines. Any excess of landfill gas will be flared. The project addresses the destruction of the methane contained in landfill gas via flaring and combustion in reciprocating engines (for electricity production).

Brief description of the installed technology and equipment:

The project can be divided in 2 main phases:

i. The landfill gas network and flares plant.
ii. The landfill gas engines.

The technology and equipment installed on site are:

- A gas collection pipe network and vertical gas wells
- A pumping system and high temperature enclosed flares
- A gas analyser room
- A supervisory control and data acquisition system
- A treatment and compression plant
- Reciprocating engines for electricity generation
- A electric delivery circuit in mid voltage level

This project is a “first of its kind” project in Colombia. Electricity generation and delivery to the national grid by LFG has never been developed before in Colombia.

Relevant dates for the project activity:

The relevant dates for the project activity are listed in the tables below:

[1] The presentation of values in this CDM Monitoring Report, including those used for emission reductions, is in international standard format, i.e. 1,000 representing one thousand and 1.000 representing one.

Table: Relevant Dates for the Landfill Gas Network Collection and Flaring Plant

Item	Phase	Start	End
1	Previous reports and landfill gas characterization	01/07/2008	28/11/2008
2	Design of the pumping and burning platform (2x25,000 kWth)	18/08/2008	19/03/2009
3	Design of the main collectors	08/09/2008	04/11/2008
4	Manufacturing of the pumping and burning platform	15/09/2008	11/02/2009
5	Civil works of the pumping and burning platform	04/12/2008	18/05/2009
6	Installation of the main collectors	15/12/2008	26/06/2009
7	Electrical works of the pumping and burning platform	20/01/2009	14/08/2009
8	Installation of the pumping and burning platform (2x25,000 kWth)	06/03/2009	08/06/2009
9	Testing of the pumping and burning platform	09/06/2009	06/07/2009
10	Commissioning of the pumping and burning platform	22/09/2009	22/09/2009
11	Installation of the third enclosed flare (additional 25,000 kWth)	10/09/2010	12/10/2010
12	Commissioning of the third enclosed flare	13/10/2010	13/10/2010
13	Installation and commissioning of a fourth blower for the pumping platform	18/02/2011	17/03/2011

Table: Relevant Dates for the Treatment Platform and Reciprocating Engine

Item	Phase	Start	End
1	Design of the treatment platform	10/08/2009	19/03/2010
2	Manufacturing of the treatment platform	02/12/2009	14/05/2010
3	Civil works of the treatment platform	24/02/2010	05/08/2010
4	Electrical works of the treatment platform	26/04/2010	26/07/2010
5	Installation of the treatment platform	02/08/2010	14/10/2010
6	Commissioning of the treatment platform	19/10/2010	22/11/2010
7	Commissioning of the 600KW reciprocating engine	19/10/2010	22/11/2010
8	1000KW reciprocating engine reception - unloading and positioning	26/07/2014	29/07/2014
9	Pre-commissioning of the 1000KW reciprocating engine	19/01/2015	28/01/2015
10	Works for Electrical grid connection	17/11/2015	08/04/2016
11	Commissioning of the 1000KW reciprocating engine	08/03/2016 23/04/2016	16/03/2016 28/04/2016
12	Commissioning of the energy measurement cabinet	28/04/2016	28/04/2016
13	Commercial operation and connection to the distribution network to delivery energy	29/04/2016	29/04/2016

Table: Relevant Dates for the Monitoring Periods of the first crediting period

Item	Phase	Start	End
1	First monitoring period	22/09/2009	15/12/2009
2	Second monitoring period	16/12/2009	25/05/2010
3	Third monitoring period	26/05/2010	30/09/2010
4	Fourth monitoring period	01/10/2010	30/06/2011
5	Fifth monitoring period	01/07/2011	31/12/2011

Item	Phase	Start	End
6	Sixth monitoring period	01/01/2012	30/06/2012
7	Seventh monitoring period	01/07/2012	30/06/2013
8	Eighth monitoring period	01/07/2013	30/06/2014
9	Ninth monitoring period	01/07/2014	31/12/2014
10	Tenth monitoring period	01/01/2015	30/06/2015
11	Eleventh monitoring period	01/07/2015	31/12/2015
10	Twelve monitoring period	01/01/2016	21/09/2016
12	End of the first crediting period	----------	21/09/2016 23:59:00

Table: Relevant Dates for the Monitoring Periods of the second crediting period

Item	Phase	Start	End
1	First Monitoring Period	22/09/2016	31/03/2017

Total Emissions Reduction achieved in this monitoring period:

The total Emissions Reduction of GHG from the Project Activity achieved in this monitoring period are 177,266.02tCO_2e.

Sustainable development criteria

The project has environmental, social, and financial impacts on the local communities. The project has created direct activity in the area during the construction of the first phase of the project with the involvement of local companies. During the construction of phase 1, up to 77 workers where working on-site. The operational structure is permanently evolving, incorporating new work-force as required. The project has already resulted in 17 direct employments.

Recovering and flaring landfill gas with an active system will not only contribute to the mitigation of climate change and benefit the environment, but will also enhance health and quality of life in the neighbouring area. In addition, the implementation of the project and its operation over 21 years will support local economic development and create direct and indirect jobs. Staff will be required to operate and maintain the landfill gas network and flare, and will be trained in advanced landfill operation techniques in order to optimise the landfill gas collection on a daily basis. Contractors and labourers will also be needed for the construction and external controls of the project.

A number of community projects will be enhanced/developed as a result of the CDM project implementation. UAESP will dedicate part of the CDM revenue to community projects. The projects in accordance with Colombian law will respond to local necessities

Additionally, the Project Activity has represented a supplementary source of income to the municipality, granting a percentage of its income from the CDM activity to implement the landfill's social program. So far, the project activity has transferred around 2.5 million USD to the municipality to support these activities.

The technology used for pumping and burning the landfill gas has been integrated and provided by GRS Valtech, a French company subsidiary of Veolia Environmental Services, the worldwide leader in waste management. The company provided training to new employees to build up the expertise locally.

The technology used for the landfill gas treatment and energy uses has been integrated and provided by Pro2 Anlagentechnik GmbH, a German company with more than 10 years of experience in waste treatment. Likewise, the company provided training to new employees to build up the expertise locally.

The LFG capture supports the stability of the landfill, and the LFG flaring mitigates odour emissions for the surrounding neighbourhoods of the landfill.

A.2. Location of project activity

>> The project activity is located in:

i. Host Party: Colombia.
ii. Region: Bogotá D.C., Cundinamarca.
iii. City: Bogotá Distrito Capital.

The project activity is developed in the Doña Juana Landfill, located at “Avenida Boyacá km. 5 Vía al Llano”, in the commune of Usme, Bogotá DC, in Colombia.

Map from: The International Bank for Reconstruction and Development (IBRD)

The G.P.S. (Global Positioning System) coordinates for the boundaries of the landfill are indicated below:

Limits	U.T.M.
North West	4º 31’ 31.33” N 74º 07’ 48.48” W
North East	4º 31’ 29.52” N 74º 07’ 34.71” W
South West	4º 29’ 27.39” N 74º 08’ 56.02” W
South East	4º 29’ 23.99” N 74º 07’ 40.97” 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)
Colombia (Host)	Biogas Dona Juana S.A.S. ESP.	No
Switzerland	Biogas Dona Juana S.A.S. ESP	No
Germany	Biogas Dona Juana S.A.S. ESP	No
Norway	Nordic Environment Finance Corporation	No
Spain	Withdrawn	No

A.4. Reference to applied methodologies and standardized baselines

(a) The applied methodology (ies)

The baseline methodology applied to the project activity is: Approved consolidated baseline methodology ACM0001: *"Flaring or use of landfill gas", Version 17.0*.

(b) Any tools and other methodologies to which the applied methodology(ies) refers

(a) "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1);
(b) "Emissions from solid waste disposal sites" (Version 07.0);
(c) "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 06.0);
(d) "Project emissions from flaring" (Version 02.0.0);
(e) "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity consumption" (Version 02.0);
(f) "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (Version 02);
(g) "Tool to determine the remaining lifetime of equipment" (Version 01);
(h) "Determining the baseline efficiency of thermal or electric energy generation systems" (Version 02);
(i) "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 03.0);
(j) "Project and leakage emissions from transportation of freight" (Version 01.1.0);
(k) Methodological tool (e) refers also to the "Tool to calculate the emission factor for an electricity system" (Version 05.0).

(c) The applied standardized baseline(s)

No applicable

>> Refer to the UNFCCC CDM website for the exact reference of the applied methodologies, tools and standardized baselines:

https://cdm.unfccc.int/methodologies/DB/Y88077XT5O83TZ2PYEZ36LFIAMAODR
https://cdm.unfccc.int/methodologies/index.html
https://cdm.unfccc.int/methodologies/PAmethodologies/approved

A.5. Crediting Period Type and duration

>> The starting date of the 2nd Crediting Period is the 22nd September 2016 (00:00:00, Colombian time, GMT -5). This starting date of the Crediting Period is associated to the renewal of the crediting period by the project participants. The length of the second crediting period is of 7 years and the type of period is renewable.

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

>> **Technical description of the project**

The project activity is implemented at the Doña Juana landfill site, which has been operating since November 1988. The Doña Juana Landfill consists of several zones and phases of waste disposal operation. Zone VII received around 5 million tons of waste between 1999 and 2001. Zone VIII and Zone 'Biosolidos' were completely filled in 2010 and 2011 respectively. Currently, Zone 'Optimización', between Zones VII and VIII, is being operated with waste disposal.

The area called Zone 'Biosolidos' is considered to be a part of Zone 'Optimización', and was used by the landfill operator as a contingency sector for solid waste disposal. Indeed, upon the completion of waste disposal in Zone VIII, the landfill operator had not finished the adaptation works required to start disposing waste in the originally designed zone for expanding the capacity of the landfill (Zone 'Optimización'). It was decided then to develop a complementary sector to the Zone 'Optimización' called Zone 'Biosolidos', using an old, closed nearby disposing zone. Taking into consideration that the waste disposal decisions are beyond the scope of action of Biogás Doña Juana S.A. ESP, and understanding that this contingency measure (Zone 'Biosolidos') is a part of the expansion of the Doña Juana landfill, it was Biogás Doña Juana´s right and duty to develop the infrastructure necessary for capturing the LFG generated by the newly disposed waste in this zone.

The technology applied in the project activity is the combustion of the landfill gas captured at the landfill gas network, using different processes like direct flaring, in burners or gas-to-energy reciprocating engines for electricity production.

The project development can be divided in 2 main phases:

i. The landfill gas network ("LFG Network"), blowers and flares plant ("LFG Plant").

ii. The landfill gas engines.

a. Power Plant BGDJ I 1.6 MW
b. Power Plant BGDJ II 10.09 MW
c. Power Plant BGDJ III 10.09 MW
d. Power Plant BGDJ IV 10.09 MW

For phases I and ii, the following equipment has been installed and commissioned:

1. A gas collection network consisting of vertical gas wells and a main collector, in Zone VIII, and Zone 'Optimización' (including Zone 'Biosolidos'). The LFG Plant has fifteen (15) main inlet pipes.

2. Four landfill gas blowers with an installed capacity of 5,000 Nm3/h each one.

3. Three high temperature (between 800°C – 1,200°C) enclosed flares of 5,000 Nm3/h capacity each one, or 25,000 kW_{th}.

4. Measuring equipment and control system: Detailed in section C.

5. A LFG treatment unit of 6,000 Nm3/h flow capacity, and a distribution capacity of 5,000 Nm3/h.

6. A reciprocating engine of an available onsite capacity of 600 KW

7. A reciprocating engine of an available onsite capacity of 1000 KW.

Phase i is fully operational.

Phase ii a) Power Plant BGDJ I 1.6 MW – Two (2) engines operating and delivering energy to the grid. Power increase to 5MW under designs b) Power Plant BGDJ II 10.09 MW – Designs complete, equipment purchase orders and contracts under review. c) Power Plant BGDJ III 10.09MW – Under Design projected for 2018 or later d) Power Plant BGDJ IV 10.09 MW – Under Design – projected for 2019 or later.

For phases i, and ii the following equipment and infrastructure have been installed:

Landfill gas network

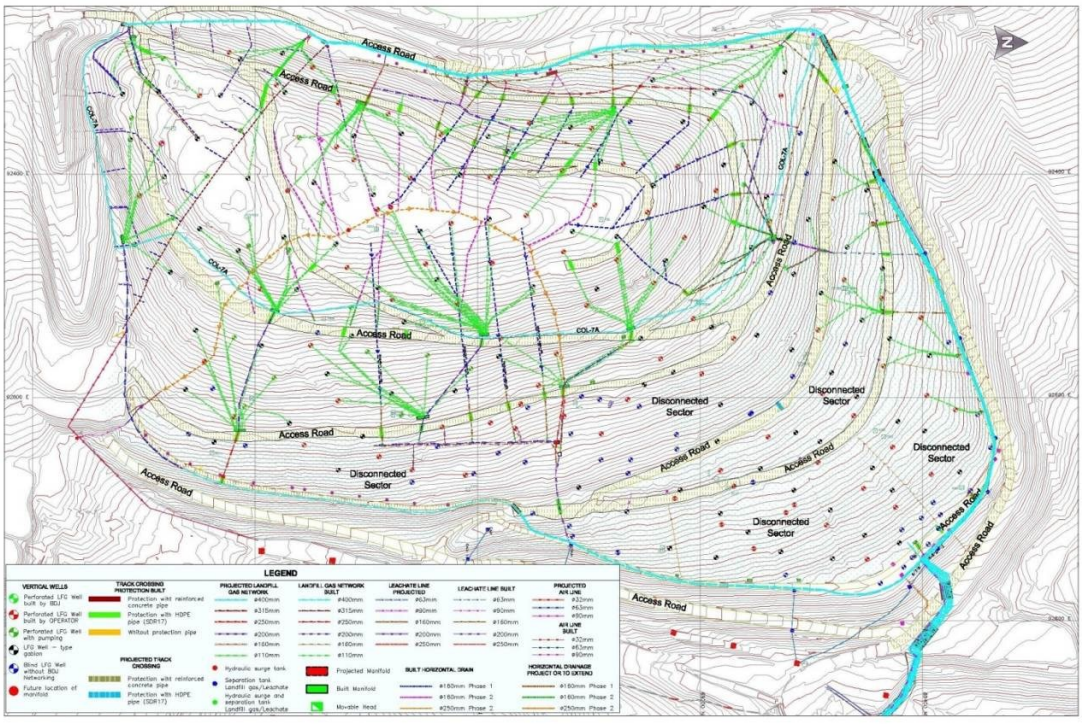
The landfill gas network has been implemented in the following Zones:

1. Zone VIII, which was operated, filled and fully completed at the end of 2010.
2. Zone 'Optimización', currently under operation.

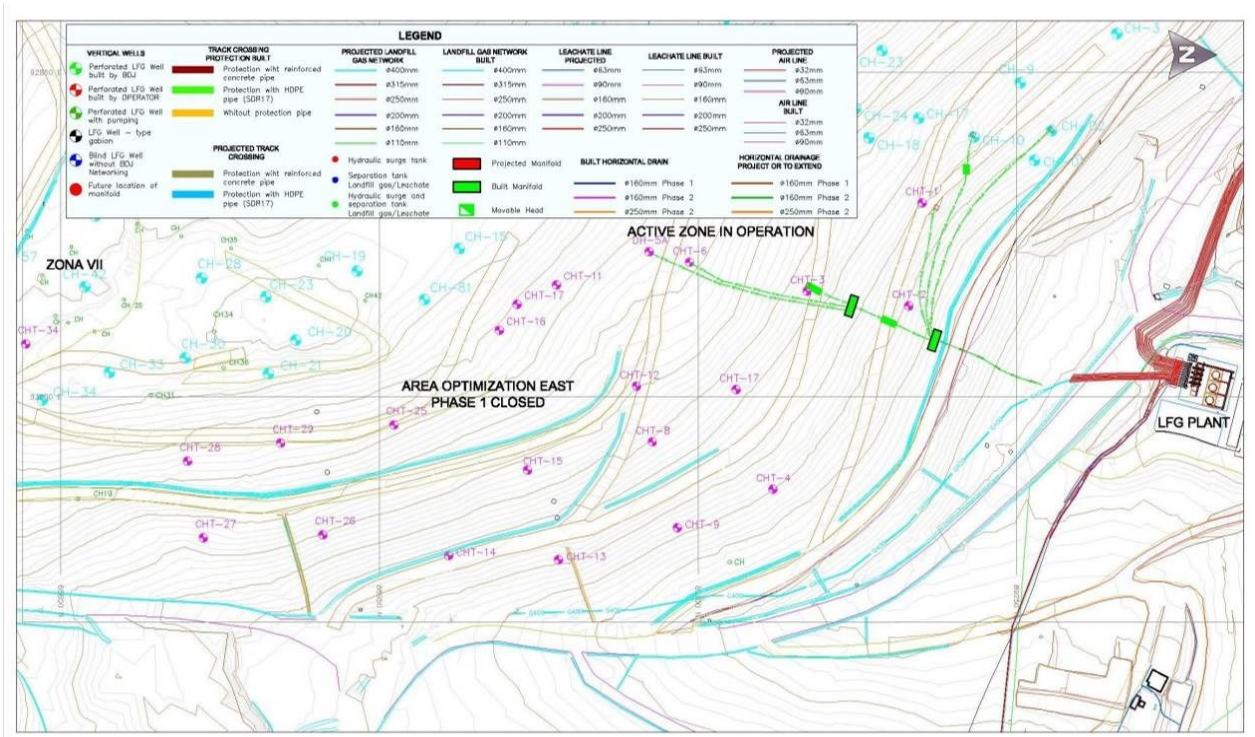
The gas network consists of vertical wells (over 220 wells have been connected so far), horizontal drains and adequate wellheads to connect to the main carrier. The overall landfill gas collection system (around 52 km of secondary and main collectors) is mainly buried under the ground in order to keep the HDPE pipes and the landfill gas at a low temperature and preventing further HDPE dilation problems. Only in special cases (e.g. when connections are temporary) pipes are left above the ground. The monthly average ambient temperature at Doña Juana landfill site is around 12°C, and since the LFG collection system is mainly buried, LFG humidity is significantly reduced due to the production and evacuation of LFG condensates.

The LFG network has been built on purpose in order to maintain a constant slope to transport by gravity the condensates from the LFG (i.e. LFG water humidity) to a well located before the entrance to the treatment plant.

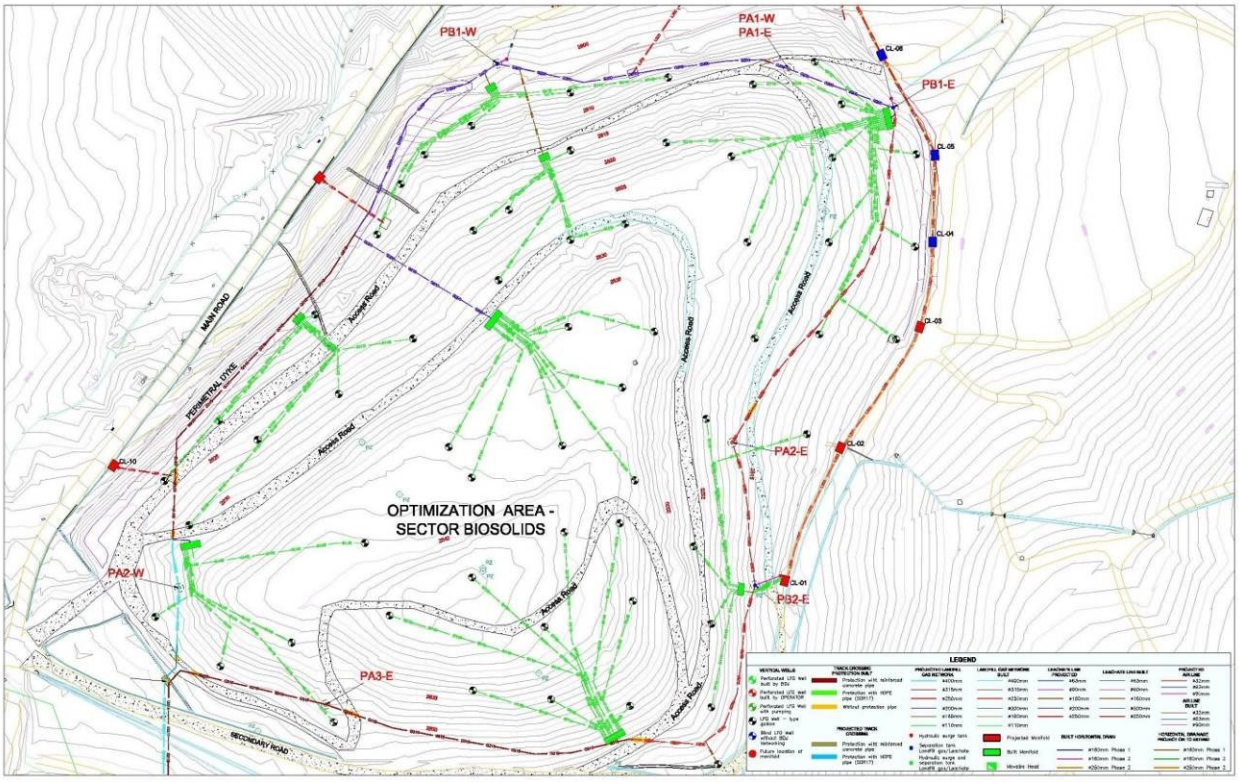
Zone VIII



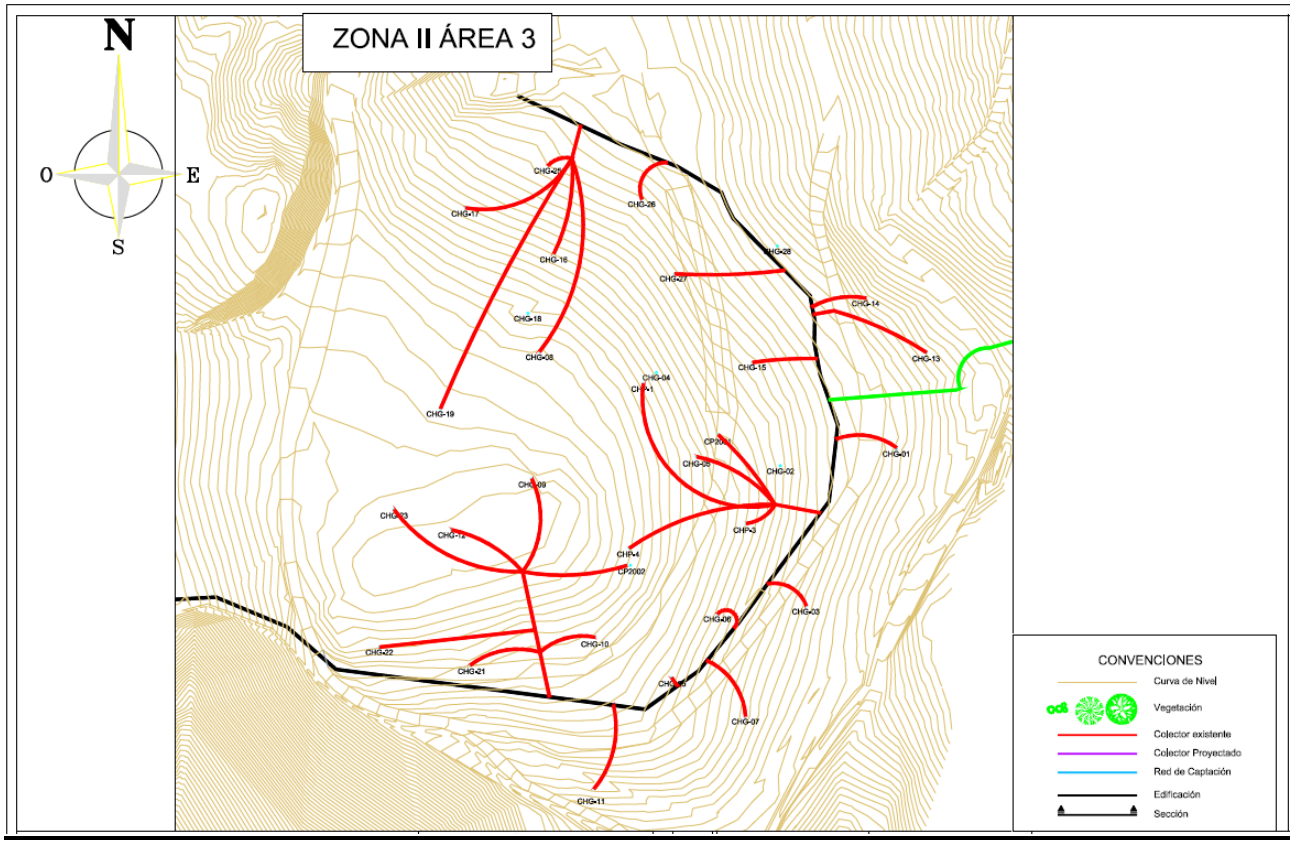
‘Optimización’ Zone



‘Optimización’ Zone – Sector ‘Biosolidos’



Zone II area 3



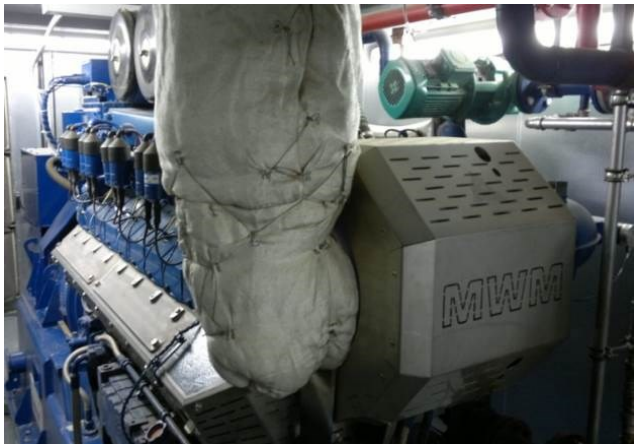
Blowers and enclosed high efficiency flares

The blowers are responsible for the extraction of the landfill gas from the wellheads to the LFG Plant. At the entrance of the LFG Plant, condensate filters were installed before each blower in order to separate any additional and substantial condensates from the LFG, reducing any remaining water humidity within the LFG, and preventing any problems in the blowers. Currently, the LFG Plant consists of three (3) enclosed flares of 25,000 kW each of thermal power capacity. The first two flares were fully commissioned on September 2009 and the third one in mid-October 2010. The different phases for the operation of the plant cover the supply, the installation, the commissioning and the start up.

According to the flare's manufacturer (GRS Valtech), the design temperature of combustion of the flares is between 800ºC to 1,200ºC, in order to guarantee very high rates of methane destruction. Additionally, the flares installed in the Project Activity continually measure the combustion temperature and the methane and oxygen concentration in the exhaust gas at sampling points located at a height of 80% of the total flare height (according to "Tool to determine project emissions from flaring gases containing methane"). This guarantees the proper functioning of the flares and very high rates of methane destruction.

Electricity Power Plant

The Landfill gas-fuelled reciprocating engines with a power rating, in continuous load, of approximately 1600 kWe on site are working to produce electricity and delivery to the local grid.



Controls & Instrumentation

A building for analysis purposes gathers all the instrumentation necessary for gas analysis:
- CH_4, CO_2, O_2 from the captured landfill gas
- CH_4 and O_2 from the exhaust gas of the flares

Besides for CDM monitoring, these instruments are very important for safety, process and operating purposes. The instrumentation installed throughout the facility is connected to a Profibus network which allows controlling the main parameters of the plant from the control room. All the currently installed phases are connected to the Profibus network, broadcasting the different signals in the control panel.

>> Regarding Phase i:

Preventive maintenance is made in accordance with the manufactures recommendations and planning. All the activities programmed under the Maintenance Plan were duly carried out, which resulted in scheduled shutdowns where Emission Reductions were not claimed. All the scheduled tasks were achieved during these shutdowns.

At the end of the Monitoring Period, the status of implementation, progress and starting date of operation for each phase is shown on the next table:

Phase	Status of implementation	Progress	Starting date of operation	Comments
Landfill gas network	Operation	100 % (for Phase i) over connected zones	22/09/2009	Landfill gas network is going to be implemented in all disposal zones
Blowers and flares plant	Operation	100 % (for Phase i)	22/09/2009	Flaring capacity of 10,000 Nm^3/h
			13/10/2010	Additional capacity of 5,000 Nm^3/h, to achieve a total current installed capacity of 15,000 Nm^3/h
Treatment and distribution plant	Operation	100 % (for Phase ii)	22/11/2010	Treatment capacity of 6,000 Nm^3/h
Power Plant BGDJ Ia	Operation	100% (for Phase ii)	22/11/2010	Generating capacity of 600 KW
Power Plant BGDJ Ib	Operation	100% (for Phase ii)	29/04/2016	Generating capacity of 1,000 KW
Power Plant BGDJ II	Start of construction	35% (for Phase ii)	Not started	Generating capacity of 10,090 KW
Power Plant BGDJ III	Design	15% (for Phase ii)	Not started	Generating capacity of 10,090 KW
Power Plant BGDJ IV	Future plans	0% (for Phase ii)	Not started	Generating capacity of 10,090 KW

Events registered

For this Monitoring Period, the following events were registered. In order to limit the extent of this document, only extraordinary events or the stops longer than 24 hours of duration are presented in the table below, events that were included in this table in order to expose the complete plant stops and are considerate extraordinary events:

Event #	Date	Description	From	To	How the event has been taking into account
001	01/04/17 – 03/04/17	There is physical disconnection of the data between the SCADA and the server. The data report for methane destroyed was interrupted until the connection is repaired	00:00 of the 01th	15:35 of the 03th	Emission reductions for methane destroyed are not claimed during this period of time for complete plant
002	01/04/17 – 22/06/17	LFG Engine 1 shutdown – Mechanical system of the engine fail, maintenance was performed, engine test.	00:00 of 01/04/17 16:05 of 22/06/17 17:21 of 22/06/17	16:02 of 22/06/17 16:50 of 22/06/17 14:22 of 23/06/17	Emission reductions are not claimed during this period of time for the LFG Engine 1

Event #	Date	Description	From	To	How the event has been taking into account
003	20/05/17 – 20/05/17	LFG Complete plant shutdown – according calibration plan the combustion Thermocouples must be changed	14:06 of the 20th	15:10 of the 20th	Emission reductions are not claimed during this period of time for complete plant
004	17/05/17 – 19/05/17	LFG Engine 2 shutdown – ignition system fault.	16:00 of the 17th	07:00 of the 19th	Emission reductions are not claimed during this period of time for the LFG Engine 2
005	23/06/17 – 09/08/17	LFG Engine 1 shutdown – Mechanical system of the engine fail, maintenance was performed engine test made.	16:18 of the 23 th	17:18 of the 09th	Emission reductions are not claimed during this period of time for the LFG Engine 1
006	28/07/16 – 29/07/16	LFG flare 2 shutdown – after plant restarting the pressure transmitter must be changed, the LFG Flare 1 calibrated transmitter was used.	16:59 of the 28 th	11:54 of the 29th	Emission reductions are not claimed during this period of time for the LFG Flare 2
007	11/08/17 – 16/08/17	LFG Engine 1 shutdown – Mechanical system of the engine fail, maintenance was performed, engine test.	16:13 of the 11th	14:39 of the 16th	Emission reductions are not claimed during this period of time for the LFG Engine 1
008	16/08/17 – 18/08/17	LFG Engine 1 shutdown – Stop for general engine failure.	23:46 of the 16th	13:20 of the 18th	Emission reductions are not claimed during this period of time for the LFG Engine 1
009	20/08/17 – 22/08/17	LFG Engine 1 shutdown – Cooling system failure.	18:46 of the 20th	16:46 of the 22th	Emission reductions are not claimed during this period of time for the LFG Engine 1
010	06/09/17 – 07/09/17	LFG Engine 2 shutdown. Oil system and pressure control fault	18:00 of the 06th	15:00 of the 07th	Emission reductions are not claimed during this period of time for the LFG Engine 2
011	07/09/17 – 18/09/17	LFG Engine 2 shutdown. Oil system and pressure control fault	17:00 of the 07th	14:00 of the 18th	Emission reductions are not claimed during this period of time for the LFG Engine 2
012	20/09/17 – 30/09/17	LFG Engine 2 shutdown. Oil system and pressure control fault	19:00 of the 20th	23:59 of the 30th	Emission reductions are not claimed during this period of time for the LFG Engine 2
013	26/09/17 – 30/09/17	LFG Engine 1 shutdown – starter pinion fault, spare part must be imported – Lube oil high temperature – maintenance required.	17:37 of the 26th	23:59 of the 30th	Emission reductions are not claimed during this period of time for the LFG Engine 1

Events that implied stops shorter than 24 hours also occurred in the LFG Plant within the monitoring period. As previously said, they are not shown in this section in order to limit the extent of this document. Nevertheless, they were duly registered and Emissions Reductions are not claimed during those stops and could be checked in the raw data values.

Biogas capture reduction

Doña Juana Landfill requires a new cell to disposal the waste between "Zona VIII" and "Zona Optimización" that will be constructed by the landfill operator CGR (Centro de Gerenciamiento de Residuos); however, the rainy season delayed the project schedule and other internal technical waste disposal activities like a slight land slide that occured in the available trucks disposal zone located in the south of "Zona Optimización" on 02/10/ 2015, this land slide caused the transfer of the disposal area so the operator of the landfill had still to use the old waste disposal zones; therefore, Biogás Doña Juana had to disconnect around 60 to 70 gas wells to permit the waste disposal operation, and this caused a reduction of landfill gas collection of about 4,500 Nm³/h on average in the last 6 months of 2017.

There were the need for disconnecting in advanced wells and a part of the collectors installed in Zone VIII and 'Optimización' Zone to allow the adequate waste disposal, the activities to control the land slide, the new cells works and the activities of a new wells connections. These additional unexpected events caused a delay in the connection works of other productive sectors and the LFG capture.

However, the district authorities are working with the landfill operator (CGR) in order to minimize the affectation of the LFG capture and treatment to avoid the GHG emissions and recover the normal gas flow.

Maintenance Works

Preventive maintenance is made in accordance with the manufacturers´ recommendations and planning. Daily verification of the plant status and operation is carried out by the site technician or plant auxiliary personnel in order to detect any malfunctions of the equipment.

The maintenance program, which is carefully followed by Biogás Doña Juana S.A.S, has daily, weekly, monthly and quarterly maintenance forms in conformity with the manufacturers' guidelines. Different works were performed as a part of the programmed tasks, e.g. grease changes for the blowers, oil change for the compressors or cleaning of the different transmitters, among others. All the activities were developed without incidents and followed the manufacturer's recommendations.

In order to minimize plant stops and enhance LFG destruction, some of the monthly maintenance activities were re-scheduled to coincide with other planned activities that also required the shutdown of the plant (e.g. instruments' verification and calibration). In all cases, the re-scheduling never exposed the integrity of the plant, the safety of the personnel, or the quality of the processes.

B.2. Post-registration changes

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

>> Besides the temporary deviation described herein, the registered Monitoring Plan has not been revised and has been strictly followed.

As temporary deviation from the registered monitoring plan, for the engine generator # 2 (Power Plant BGDJ Ib), the following parameters could not yet be monitored throughout the Monitoring Period:

- $Op_{j,h}$ Operation of the equipment that consumes the LFG

- $V_{tb,m}$ Volumetric flow of the LFG stream in time interval t on a dry basis in the hour *h* (m³ dry gas/h)

The reason for this deviation is that the company due to the decline in landfill gas capture and CER generation throughout 2015 and 2016 had not yet sufficient financial resources to invest in the respective monitoring equipment and the integration into its SCADA system. It is planned that the respective monitoring equipment will be installed during the first semester of the 2018.

For $Op_{j,h}$ (Operation of the equipment that consumes the LFG), a deviation is applied as follows:

There is clear evidence that Engine # 2 has been in operation and combusted methane in hour *h*, when the electric power sold to the grid ($EL_{sold,h}$) has been higher than the actual power generation of engine # 1 ($EL_{engine\ 1,h}$):

$Op_{engine\ 2,h}$ = yes, if $EL_{sold,\ h} > EL_{engine\ 1,h}$ Equation (A)
Where:

$Op_{engine\ 2,h}$	=	Operation of Engine # 2 that consumes the LFG in hour *h*
$EL_{engine\ 1,\ h}$	=	electric power generation by engine 1 in hour *h* (in kW)
$EL_{sold,\ h}$	=	electric power supplied/sold to the grid in hour *h* (in kW)

As a conservative way we decide to include the Operation of Engine # 2 only when the electric power supplied/sold to the grid in hour h (in kW) was higher than 100KW

For $V_{tb,m}$ Volumetric flow of the LFG stream in time interval t on a dry basis in the hour *h* (m³ dry gas/h) of engine 2, a deviation is applied as follows:

The following balance applies for the LFG flow as follows:

$LFG_{total,\ m} = LFG_{flare\ 1,\ m} + LFG_{flare\ 2,\ m} + LFG_{flare\ 3,\ m} + LFG_{engine\ 1,\ m} + LFG_{engine\ 2,\ m}$ Equation (B1)

Where:

$LFG_{total,\ m}$	=	total landfill gas flow in minute *m* (in m³)
$LFG_{flare\ 1,\ m}$	=	landfill gas flow combusted by flare 1 in minute *m* (in m³)
$LFG_{flare\ 2,\ m}$	=	landfill gas flow combusted by flare 2 in minute *m* (in m³)
$LFG_{flare\ 3,\ m}$	=	landfill gas flow combusted by flare 3 in minute *m* (in m³)
$LFG_{engine\ 1,\ m}$	=	landfill gas flow combusted by engine 1 in minute *m* (in m³)
$LFG_{engine\ 2,\ m}$	=	landfill gas flow combusted by engine 2 in minute *m* (in m³)

From Equation B1, Equation B2 can be derived:

$LFG_{engine\ 2,\ m} = LFG_{total,\ m} - LFG_{flare\ 1,\ m} - LFG_{flare\ 2,\ m} - LFG_{flare\ 3,\ m} - LFG_{engine\ 1,\ m}$ Equation (B2)

For $LFG_{total,\ m}$, the lower limit of the confidentiality tolerance is applied, while for $LFG_{flare\ 1,\ m}$, $LFG_{flare\ 2,\ m}$, $LFG_{flare\ 3,\ m}$ and $LFG_{engine\ 1,\ m}$ the upper limit of the confidentiality tolerance is applied. This approach is conservative, while $LFG_{engine\ 2,\ m}$ is rather underestimated.

All equipment used for the calculation of the volumetric flow of the LFG stream has its calibration certificate for the entire monitoring period.

B.2.2. Corrections

>> During this monitoring period no corrections to project information or parameters fixed at validation have been approved or submitted with this monitoring report.

B.2.3. Changes to start date of crediting period

>> No changes to start date of the second Crediting Period.

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

>> No inclusions of a monitoring plan occurred from the registered PDD.

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

>> There are Permanent Changes due the renovation of the crediting period. The registered monitoring plan and the applied methodology have been changed during this monitoring in the renewal of crediting period. The new methodology was updated from the version AMC0001 Ver 10 to AMC0001 Ver 17.0.

B.2.6. Changes to project design

>> A post-registration change including a grid-connected electricity generation capacity of up to 32 MW has been approved on 09/07/2015 (PDD v5). The renewal of the Crediting Period has been approved on 10/05/2017 (PDD v9.2), and includes now also the crediting of Emission Reductions associated with the replacement of fossil-fuel based electricity generation by the Project Activity. The New PDD uses the Project design document form for CDM project activities Version 08.0.

SECTION C. Description of monitoring system

>> **Monitoring Plan:**

The Monitoring Plan was developed based on *Version 17.0* of the Approved consolidated baseline methodology ACM0001: *"Flaring or use of landfill gas".* According to the recommendation made in this methodology, the following tools could be used:

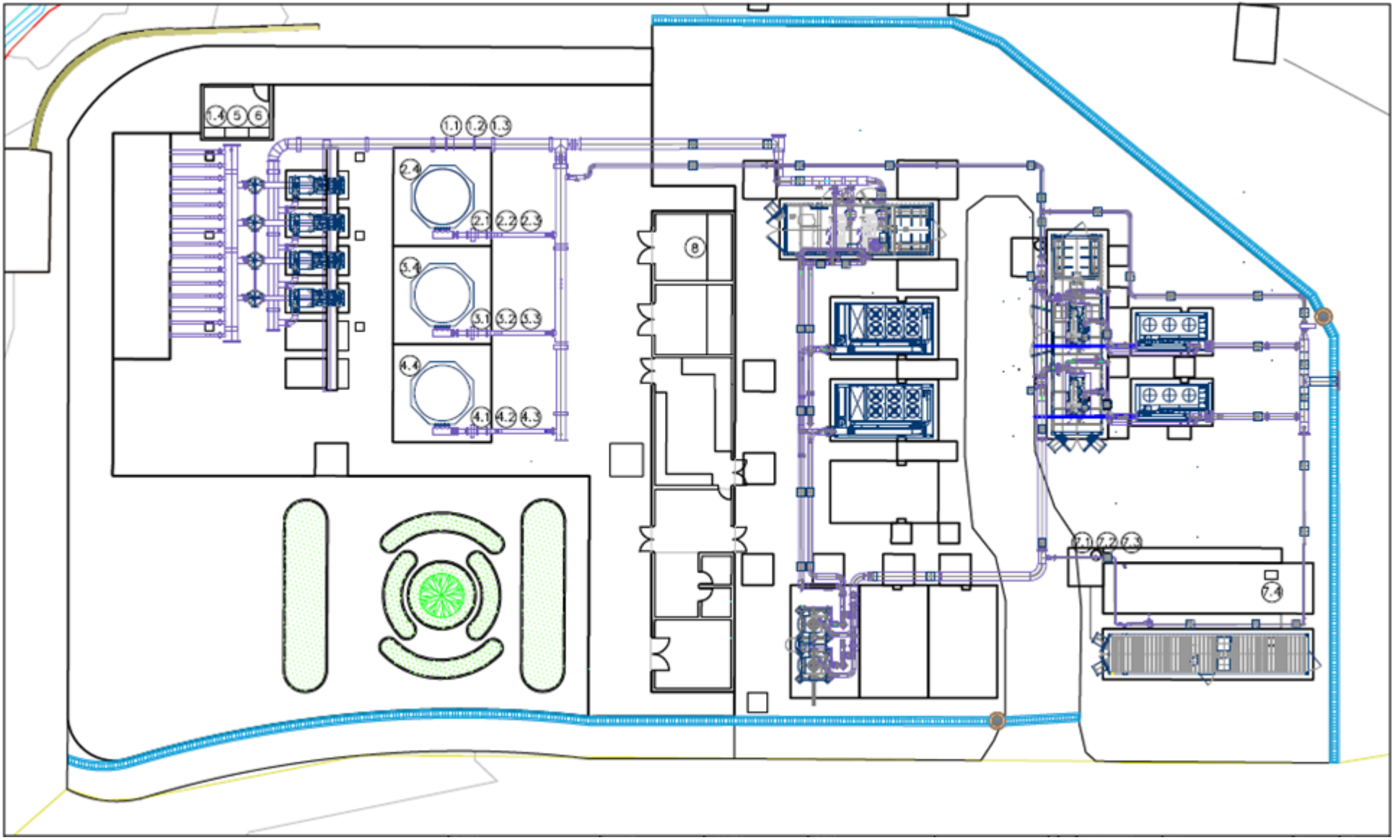
(a) "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1);
(b) "Emissions from solid waste disposal sites" (Version 07.0);
(c) "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 06.0);
(d) "Project emissions from flaring" (Version 02.0.0);
(e) "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity consumption" (Version 02.0);
(f) "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (Version 02);
(g) "Tool to determine the remaining lifetime of equipment" (Version 01);
(h) "Determining the baseline efficiency of thermal or electric energy generation systems" (Version 02);
(i) "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 03.0);
(j) "Project and leakage emissions from transportation of freight" (Version 01.1.0);

(k) Methodological tool (e) refers also to the “Tool to calculate the emission factor for an electricity system” (Version 05.0).

The applied Monitored Plan is the one presented within the registered PDD of the second crediting period for the project..

List of monitoring equipment

The following equipment’s are currently installed at the LFG Plant, as per the Monitoring Plan:


1.4
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7.2
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7.4

Methodology ID	Number	Equipment	Location	Manufacturer	Technology and Model	Serial Number	Range	Uncertainty
$LFG_{total, y}$	1.1	Flow meter	Admission pipe (DN600)	PFS / Endress + Hauser	Insert Venturi / Deltabar S	12157 / AB08FB0109D / C603020109D	1,765 … 17,650 Nm^3/h	Low
T_{total}	1.2	Temperature transmitter	Admission pipe (DN600)	Endress + Hauser	Digital sensor iTEMPT	AB00DA042B6	-20 ... 100 ºC	Low
P_{total}	1.3	Absolute pressure transmitter	Admission pipe (DN600)	Endress + Hauser	Ceramic and Metal, Cerabar M	AB02E301020	0 … 1 bar	Low
$W_{CH4, y}$	1.4	Landfill gas analyser	Analysis building and Admission pipe (DN600)	ABB	Infrared Analyzer / Uras 26	3.357394.8	0 ... 100 % vol	Low
$fv_{CO2, y}$								
$fv_{O2, y}$					Oxygen Sensor	3.357397.8	0 ... 25 % vol	Low
$LFG_{flare\ 1, y}$	2.1	Flow meter	Flare n°1 pipe (DN250)	PFS / Endress + Hauser	Insert Venturi / Deltabar S	12158-1 / AB08FC0109D / C603040109D	700 ... 7,000 Nm^3/h	Low
$T_{flare\ 1}$	2.2	Temperature transmitter	Flare n°1 pipe (DN250)	Endress + Hauser	Digital sensor iTEMPT	AB00DF042B6	-20 ... 100 ºC	Low
$P_{flare\ 1}$	2.3	Absolute pressure transmitter	Flare n°1 pipe (DN250)	Endress + Hauser	Ceramic and Metal, Cerabar M	D6017901020	0 ... 1 bar	Low
$T_{combustion\ flare\ 1}$	2.4	Flare thermocouple	Flare n°1	Pyrocapt	TC Type N Kanthal	1605122	0 ... 1,200 ºC	Low
$LFG_{flare\ 2, y}$	3.1	Flow meter	Flare n°2 pipe (DN250)	PFS / Endress + Hauser	Insert Venturi / Deltabar S	12158-2 / AB08FD0109D / C603030109D	700 ... 7,000 Nm^3/h	Low
$T_{flare\ 2}$	3.2	Temperature transmitter	Flare n°2 pipe (DN250)	Endress + Hauser	Digital sensor iTEMPT	AB00DC042B6	-20 ... 100 ºC	Low
$P_{flare\ 2}$	3.3	Absolute pressure transmitter	Flare n°2 pipe (DN250)	Endress + Hauser	Ceramic and Metal, Cerabar M	AB02E501020 / D6017901020	0 ... 1 bar	Low
$T_{combustion\ flare\ 2}$	3.4	Flare thermocouple	Flare n°2	Pyrocapt	TC Type N Kanthal	1605124	0 ... 1,200 ºC	Low
$LFG_{flare\ 3, y}$	4.1	Flow meter	Flare n°3 pipe (DN250)	PFS / Endress + Hauser	Insert Venturi / Deltabar S	13386 / D605060109D / D605070109D	700 ... 7,000 Nm^3/h	Low
$T_{flare\ 3}$	4.2	Temperature transmitter	Flare n°3 pipe (DN250)	Endress + Hauser	Digital sensor iTEMPT	D7004D042B6	-20 ... 100 ºC	Low
$P_{flare\ 3}$	4.3	Absolute pressure transmitter	Flare n°3 pipe (DN250)	Endress + Hauser	Ceramic and Metal, Cerabar M	J400EA15128	0 ... 1 bar	Low
$T_{combustion\ flare\ 3}$	4.4	Flare thermocouple	Flare n°3	Pyrocapt	TC Type N Kanthal	1605126	0 ... 1,200 ºC	Low

Methodology ID	Number	Equipment	Location	Manufacturer	Technology and Model	Serial Number	Range	Uncertainty
$Fv_{CH4\ i,\ y}$	5	Flare exhaust gas analyser	Analysis building	ABB	Infrared Analyzer / Uras 26	3.357396.8	0 … 3,000 ppmv	Low
$Fv_{O2\ i,\ y}$	6				Oxygen Sensor	3.357399.8	0 ... 25 % vol	Low
$LFG_{engine\ 1}$	7.1	Flow meter	Engine pipe (DN80)	Endress + Hauser	Orifice Plate Deltatop / Deltabar S	D100330111B / D2058B0109D	135 ... 673 Nm^3/h	Low
$T_{engine\ 1}$	7.2	Temperature transmitter	Engine pipe (DN80)	Endress + Hauser	Thermal-Resistance PT100	D20115142FE	-50 ... 250 ºC	Low
$P_{engine\ 1}$	7.3	Absolute pressure transmitter	Engine pipe (DN80)	Endress + Hauser	Ceramic and Metal, Cerabar M	D2002401128	0 ... 2 bar	Low
EL_{LFG}	7.4	Electricity generation power meter	Engine Board	DEIF A/S	Measuring Analyzer PPU / 2GS	2034500008 C	0…1,358 kW	Low
$EC_{PJ,\ y}$	8	Electricity import meter	Electrical Substation	Carlo Gavazzi	Power Quality Analyzer WM3-96	BJ1240052001P	0 ... 999 MWh	Low
$EG_{PJ,\ y}$	8.1	Electricity power meter	Grid connection	ITRON	Power Quality Analyzer SL7000	73048827 73049424	0 ... 999999 MWh	Low
$W_{CH4,\ y}$	9	Landfill gas analyser	Analysis building and Admission pipe (DN600)	ABB	Infrared Analyzer / Uras 26	3.357395.8	0 ... 100 % vol	Low
$fv_{CO2,\ y}$								
$fv_{O2,\ y}$					Oxygen Sensor	3.357398.8	0 ... 25 % vol	Low

Calibration

All monitoring equipment follow the manufacturer's recommendations. The details for this equipment are included in Appendix 2 in this monitoring report, which includes information on frequency, date of calibration and validity.

According to Appendix 2, the frequency of calibration should be annual. To comply with this, Biogás Doña Juana S.A.S ESP schedules external calibration campaigns before the completion of a year for all the equipment installed.

Data acquisition and storage system

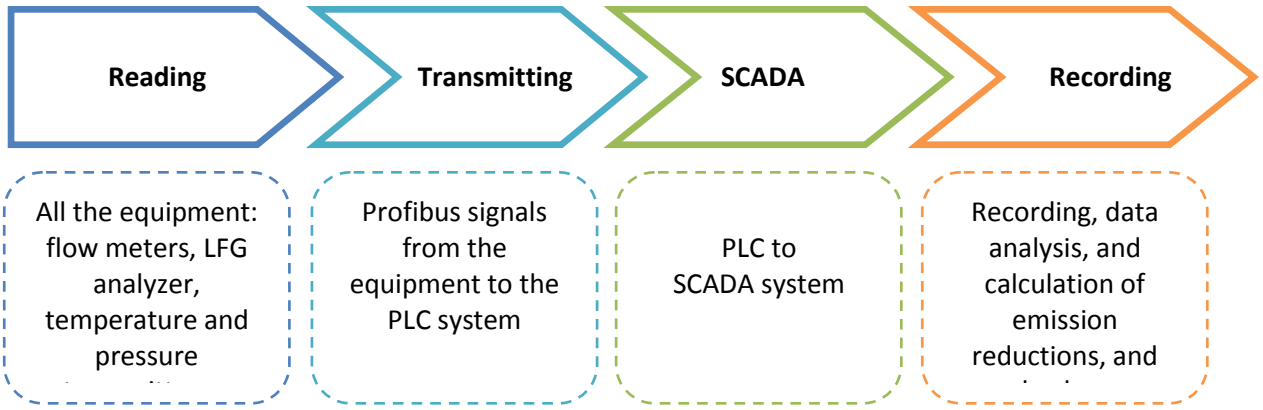
All monitoring equipment at the LFG Plant is continuously connected via a PLC (Programmable Logical Computer) to a SCADA (Supervisory Control and Data Acquisition)

The SCADA system:

i. Collects all the data within an internal binary format (*.arx) which cannot be manipulated according to the recommendations from the Food and Drugs Administration (FDA 21 Code of Federal Regulations CFR Part 11)
ii. Transfers continuously – automatically and electronically – all the *.arx data to a secured SQL Server Data Base which cannot be manipulated

All the monitoring equipment from the phases i, ii and partially iii are connected to a LAN (Local Area Network), broadcasting signals to the control panel.

For each parameter monitored, the PLC and the SCADA makes a routine of reading, transmitting, and recording on the SQL Server Data Base presented in the figure below:



The supervision system stores all data sets recorded with a frequency of 1 set of data each 1 minute. All the information is automatically transferred via an Ethernet connection to a computer located in the control room. It will create a secured file which cannot be altered by any means (SQL Server Data Base electronically connected to the *.arx files server). This computer serves as main data base computer for the analysis of the data, and the Emissions Reduction can be calculated by the SQL Server Data Base routine.

Calculation

The calculation of Emissions Reduction has been made following the approved methodology for each set of data recorded. One set of data is recorded every minute. The data are aggregated on a daily, monthly and then in a yearly basis. The algorithm is applied for each flare and engine, and then aggregated.

There is no consumption of fossil fuel as a part of the operation of the project activity. For any set of data for which the flare temperature falls below 500°C, no Emissions Reduction is claimed. No leakage effects need to be accounted for under this methodology.

Reporting

The Emissions Reduction calculations are an automatic and unforgeable operation, designed to prevent unconformities on the raw data and to allow transparency in the results.

For this purpose, the SQL Server Data Base:

i. Imports the data into a *.xls format
ii. Repeats the calculation into a presentation table

On a monthly basis the Biogás Doña Juana's CDM Manager prepares a landfill gas report, that includes all data and parameters previously described as well as a performance comparison for the last 6 months. This report is prepared on the basis of the Monthly ERs and landfill gas monitoring report Form and distributed to the Biogás Doña Juana's General Manager before the 15th of the following month.

The Biogás Doña Juana's General Manager will distribute the report to the Project Participants.

QA/QC measures: internal procedures

Biogás Doña Juana counts with an internal procedure whose objective is to control the quality of the monitoring procedures made inside the LFG Plant, such as gas flows, temperature, pressure, electricity consumption and methane concentration.

As presented above, all parameters monitored inside the LFG Plant have the same reading, transmitting, and recording routine and all routines are below the responsibility of the landfill gas plant supervisor.

Every week, the LFG Plant responsible makes a complete check of all the data in order to identify unconformities, such as unread recording or troubles with the PLC (mainly due to electricity black-outs). All unconformities raised are promptly compared with operational events, registered by the operators in the daily monitoring formats. The events are communicated to Biogás Doña Juana's CDM Manager, which is responsible for taking the preventive and/or corrective actions required.

In order to control the data transmission and recording process, the supervisor and technicians register all gas flow data manually in a proper format on a daily basis, which are verified and compared to the automatically recorded data by Biogás Doña Juana's CDM Manager weekly.

Additionally internal CDM audits are conducted in order to verify the compliance of CDM monitoring procedures.

QA/QC measures: organizational structure, responsibilities and competencies

Positions and roles for this CDM project activity are well defined, according with the chart below.

The technical project implementation and operation is under the direct supervision of Biogás Doña Juana's CDM Manager, who reports to Biogás Doña Juana's General Manager.

Biogás Doña Juana's landfill gas network and plant Supervisor is reporting to the CDM Manager and is in charge of the following activities:

- The daily monitoring of key parameters (forms of the Monitoring Plan) at the landfill site
- Monthly transmission of the data to the CDM Manager
- Perform preventive maintenance and necessary calibration

QA/QC measures: quality control

The values recorded by the monitoring equipment are verified at three different stages:

- Internal verification with the filling of the Monitoring Plan forms
- Internal verification of the values transferred from the Supervisory Control and Data Acquisition system to the SQL Server Data Base
- Final validation from the CDM Manager, including analysis of events, cross-check of data and eventual actions if it is necessary

QA/QC measures: trainings

All the Monitoring Personnel that took monitoring responsibility were trained on the following subjects:

- Technology of monitoring equipment
- Calibration and maintenance requirements
- Landfill gas collection system balancing
- Calibration of monitoring equipment
- Impact of the monitoring on the CDM activity

QA/QC measures: emergency procedures

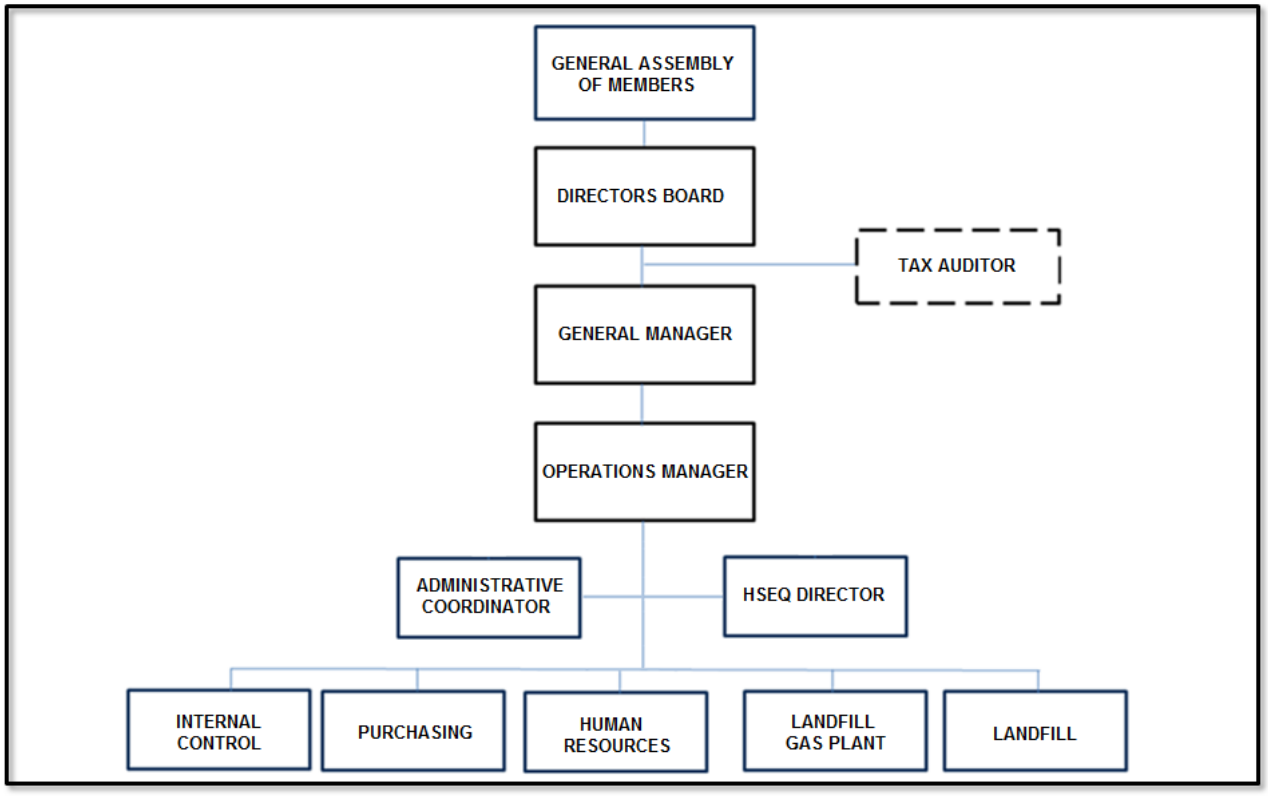
In order to ensure the integrity and the robustness of the data registered, Biogás Doña Juana developed the following actions:

- The PLC and the SCADA are not connected to the Internet, thus the risk of virus is minimized
- Only determined persons have access to the SCADA and the data base of the system
- Data backup: frequently a backup is stored in the SQL Server

In case of failure of the data logging equipment, the frequency of the manual readings shall be increased. The exact monitoring frequency will be determined and advised by Biogás Doña Juana's CDM Manager.

The aim of this monitoring is to provide evidence of the status of the flare and the quality and quantity of methane burnt through the system. However, the automatic data recording (data logger) is to be recovered as soon as possible

Biogás doñaJuana	ORGANIZATION CHART BIOGAS DOÑA JUANA S.A. E.S.P.	Código: Anexo G MA-SIG-001 Versión: 008 Fecha: 01- Nov -2015



SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data / Parameter	OX_{top_layer}
Unit	Dimensionless
Description	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline
Source of data	Consistent with how oxidation is accounted for in the methodological tool "Emissions from solid waste disposal sites"
Value(s) applied	0.1
Choice of data or Measurement methods and procedures	Parameter selected according to ACM0001, version 17.0
Purpose of data/ parameter	-
Additional comment	Applicable to *ex-post* determination of Baseline Emissions $BE_{CH4,y}$ according to Equation (2), and as OX to *ex-ante* calculation of Baseline Emissions $BE_{CH4,SWDS,y}$ according to Equation (1) of tool (b).

Data / Parameter	GWP_{CH4}
Unit	tCO_{2e}/tCH_4
Description	Global Warming Potential of methane
Source of data	IPCC
Value(s) applied	25 for the 2nd Commitment Period from 2013 onwards
Choice of data or Measurement methods and procedures	-
Purpose of data/ parameter	Baseline emissions and Project emissions
Additional comment	The value is updated according to EB69 Annex 3,COP/MOP Decision 4/CMP.7 and table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

Data / Parameter	NCV_{CH4}
Unit	TJ/t CH4
Description	Net calorific value of methane at reference conditions
Source of data	Technical literature; ACM0001 version 17.0
Value(s) applied	0.0504
Choice of data or Measurement methods and procedures	-
Purpose of data/ parameter	-
Additional comment	-

Data / Parameter	η_{PJ}
Unit	Dimensionless
Description	Efficiency of the LFG capture system that will be installed in the project activity
Source of data	ACM0001 version 17.0
Value(s) applied	50%
Choice of data or Measurement methods and procedures	Default value of ACM0001 version 17.0 applied throughout the Crediting Period
Purpose of data/ parameter	-
Additional comment	Applicable to *ex-ante* calculation of "Amount of methane in the LFG which is flared and/or used in the project activity" in year *y* according to Equation (5)

Data / Parameter	$\varphi_{default}$
Unit	-
Description	Default value for model correction factor to account for model uncertainties
Source of data	Methodological tool (b) "Emissions from solid waste disposal sites", version 07.0
Value(s) applied	0.890
Choice of data or Measurement methods and procedures	Option 2 of the procedure "Determining the model correction factor (φ_y)" selected, with the following parameters:
Purpose of data/ parameter	*Ex-ante* calculation of Baseline emissions
Additional comment	-

Factor	Par□meter	Selected value	Exp□anation
a	W	2%	Solid waste is weighed
b	DOCj	10□	Default value for DOC_j is used
c	DOCf	5□	More than 50% is o□gani□ material
□	F	0%	More than 50% is organic material
e	MCF	0%	Ma□aged SWDS
g	$e^{-kj(y-x)} \times (1-e^{-kj})$	5%	SWDS compartments where project is implemented are still open, or closed less than 3 years ago

Data / Parameter	***OX***
Unit	-
Description	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data	Methodological tool (b) "Emissions from solid waste disposal sites" (version 07.0) based on an extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.1
Choice of data or Measurement methods and procedures	-
Purpose of data/ parameter	Applicable to ex-ante calculation of Baseline Emissions $BE_{CH4,SWDS,y}$ according to Equation (1) of tool (b).
Additional comment	When methane passes through the top-layer, part of it is oxidized by methanotrophic bacteria to produce CO2. The oxidation factor represents the proportion of methane that is oxidized to CO2 This should be distinguished from the methane correction factor (MCF) which is to account for the situation that ambient air might intrude into the SWDS and prevent methane from being formed in the upper layer of SWDS

Data / Parameter	***F***
Unit	-
Description	Fraction of methane in the SWDS gas (volume fraction)
Source of data	Methodological tool (b) "Emissions from solid waste disposal sites" (version 07.0) based on IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	-
Purpose of data/ parameter	*Ex-ante* calculation of baseline emissions
Additional comment	Upon biodegradation, organic material is converted to a mixture of methane and carbon dioxide

Data / Parameter	DOC_f
Unit	Weight fraction
Description	Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	-
Purpose of data/ parameter	*Ex-ante* calculation of baseline emissions
Additional comment	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, in the SWDS. This default value is used for Application A.

Data / Parameter	$MCF_{default}$
Unit	-
Description	Methane correction factor
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	1.0

Choice of data or Measurement methods and procedures	(a) is the case for the SWDS for the options provided by the Methodological tool (b) "Emissions from solid waste disposal sites" (version 07.0): In case that the SWDS does not have a water table above the bottom of the SWDS and in case of application A, then select the applicable value from the following: (a) 1.0 for anaerobic managed solid waste disposal sites. These must have controlled placement of waste (i.e. waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) levelling of the waste;
Purpose of data/ parameter	*Ex-ante* calculation of baseline emissions
Additional comment	MCF accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS. In case of a water table above the bottom of the SWDS, a larger proportion of the SWDS is anaerobic and MCF shall be estimated according to equation (12).

Data / Parameter	***DOCj***
Unit	1/yr
Description	Fraction of degradable organic carbon in the waste type *j* (weight fraction)
Source of data	Methodological tool (b) "Emissions from solid waste disposal sites" (version 07.0) based on IPCC 2006 Guidelines for National Green-house Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5)
Value(s) applied	For MSW, the following values for the different waste types j should be applied : **Waste type *j*** | **DOC_j (% wet waste)** Wood and wood products | 43 Pulp, paper and cardboard (other than sludge) | 40 Food, food waste, beverages and tobacco (other than sludge) | 15 Textiles | 24 Garden, yard and park waste | 20 Glass, plastic, metal, other inert waste | 0
Choice of data or Measurement methods and procedures	-
Purpose of data/ parameter	*Ex-ante* calculation of baseline emissions
Additional comment	The procedure for the ignition loss test is described in BS EN 15169:2007 Characterization of waste. Determination of loss on ignition in waste, sludge and sediments. The percentages listed in table above are based on wet waste basis which are concentrations in the waste as it is delivered to the SWDS. The IPCC Guidelines also specify DOC values on a dry waste basis, which are the concentrations after complete removal of all moist from the waste, which is not believed practical for this situation.

Data / Parameter	k_i
Unit	1/yr
Description	Decay rate for the waste type *j*
Source of data	Methodological tool (b) "Emissions from solid waste disposal sites" (version 07.0) based on IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3)
Value(s) applied	**Waste type *j*** / **Default values for the decay rate (k*j*)** Pulp, paper, cardboard (other than sludge), textiles: 0.06 Wood, wood products and straw: 0.03 Other (non-food) organic putrescible garden and park waste: 0.10 Food, food waste, sewage sludge, beverages and tobacco: 0.185
Choice of data or Measurement methods and procedures	According to source, for the meteorological station "Bogota El Dorado Airport" (which is the station quoted in the atlas closest to the project site): - Mean annual temperature (MAT): 13.5 °C - Mean annual precipitation (MAP): 972 mm - Potential evapotranspiration (PET): 942 mm - Ratio MAP/PET = 1.03 > 1 => Therefore, column 2 "Boreal and Temperate", "Wet" of parameter table 7 of methodological tool (b) is applicable
Purpose of data/ parameter	*Ex-ante* calculation of baseline emissions
Additional comment	References for climatic data provided above.

Data / Parameter	$p_{j,x}$
Unit	%
Description	Average fraction of the waste type *j* in year *x* (weight fraction)
Source of data	UAESP: Complementary Environmental Impact Assessment for the Phase II Optimization of Zones VII and VIII; 2.1 Studies and Designs; version III; 30/11/2013
Value(s) applied	**Waste type j** / **Average fraction** Food: 74.49% *) Paper, Cardboard: 4.29% Wood: 2.08% Textile: 3.75% Garden waste: 0.00% Plastic, metal, glass, other inert: 15.39% Total: 100.00% *) Value adjusted from 74.50% in the source in order to have a total of 100.00%
Choice of data or Measurement methods and procedures	Waste composition analysis for the time from September 2011 until end 2012

Purpose of data/ parameter	Calculation of amount of annual waste type for e*x-ante* calculation of baseline emissions
Additional comment	Composition applied throughout entire time period for which waste composition is considered from 2000 to 2026

Data / Parameter	W_x
Unit	t
Description	Total amount of solid waste disposed in the SWDS in the year x (t)
Source of data	UAESP: Complementary Environmental Impact Assessment for the Phase II Optimization of Zones VII and VIII; 2.1 Studies and Designs; version III; 30/11/2013
Value(s) applied	

Year x	W_x [t]	Year x	W_x [t]
2000	876,468	2014	2,305,891
2001	1,746,779	2015	2,345,702
2002	1,884,015	2016	2,386,117
2003	1,837,188	2017	2,427,162
2004	1,930,752	2018	2,468,853
2005	1,974,971	2019	2,503,564
2006	2,132,326	2020	2,538,844
2007	2,091,331	2021	2,575,292
2008	2,161,587	2022	2,612,428
2009	2,096,396	2023	2,675,689
2010	2,152,544	2024	2,723,885
2011	2,190,018	2025	2,772,994
2012	2,228,060	2026	2,823,035
2013	2,266,681	2027 ff	0

Choice of data or Measurement methods and procedures	Until the year 2010 measured values; from the year 2011 onwards estimated values as average of several projections.
Purpose of data/ parameter	Calculation of amount of annual waste type for e*x-ante* calculation of baseline emissions
Additional comment	-

Data / Parameter	$SPEC_{flare}$
Unit	Temperature - °C Flow rate or heat flux - kg/h or m^3/h Maintenance schedule - number of days
Description	Manufacturer's flare specifications for temperature, flow rate and maintenance schedule
Source of data	Document by flare manufacturer (Manual de Descripción, Operación, Mantenimiento y Seguridad Versión: 0.1 – formación -2010- Chapter 11.3.4.7)
Value(s) applied	Temperature: >800 °C – 1,200 °C Flow rate: 1,000 - 5,000 Nm^3/h (functioning limits 20% - 100%) Maintenance schedule - annually

Choice of data or Measurement methods and procedures	Document in the CDM-PDD the flare specifications set by the manufacturer for the correct operation of the flare for the following parameters: (a) Minimum and maximum inlet flow rate, if necessary converted to flow rate at reference conditions or heat flux; (b) Minimum and maximum operating temperature; and (c) Maximum duration in days between maintenance events
Purpose of data/ parameter	*Ex post* determination of project emissions
Additional comment	Only applicable in case of enclosed flares which is the case. The flare specification and manuals do not specify a specific maintenance schedule in days; therefore, the requirement of the methodological tool (d) "Project emissions from flaring" (Version 02.0.0) of annual maintenance is applied (see also monitoring parameter "$Maintenance_y$")

Data / Parameter	$TDL_{k,y}$
Unit	%
Description	Average technical transmission and distribution losses for providing electricity to source *k* in year *y* (applied to project electricity generation)
Source of data	Methodological tool (e) "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity consumption"
Value(s) applied	20%
Choice of data or Measurement methods and procedures	Default value for scenario A according to methodological tool (e) "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity consumption", table 3
Purpose of data/ parameter	-
Additional comment	-

Data / Parameter	$TDL_{j,y}$
Unit	%
Description	Average technical transmission and distribution losses for providing electricity to source *j* in year *y*
Source of data	Methodological tool (e) "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity consumption"
Value(s) applied	20%
Choice of data or Measurement methods and procedures	Default value for scenario A according to methodological tool (e) "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity consumption", table 3
Purpose of data/ parameter	Calculation of project emissions
Additional comment	-

Data / Parameter	$EF_{grid,OM,ex\text{-}ante}$
Unit	t CO_2 / MWh
Description	Ex ante simple adjusted Operating Margin
Source of data	UPME, XM

Value(s) applied	Calendar year 2013: 0.6304 Calendar year 2014: 0.6349 Calendar year 2015: 0.5629 Average (3 years vintage): 0.6086
Choice of data or Measurement methods and procedures	Tool (k), sentence 39: For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages: (a) *Ex ante* option: if the *ex ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation. The option for *ex ante* simple adjusted OM is chosen by project participants.
Purpose of data/ parameter	Calculation of baseline and project emissions
Additional comment	For details see appendix 4 of the PDD

Data / Parameter	$EF_{grid,BM,ex\text{-}ante}$
Unit	t CO_2 / MWh
Description	Ex ante Build Margin
Source of data	UPME, XM
Value(s) applied	Calendar year 2015: 0.1631
Choice of data or Measurement methods and procedures	Tool (k), sentence 73: In terms of vintage of data, project participants can choose between one of the following two options: Option 1 For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE.
Purpose of data/ parameter	Calculation of baseline and project emissions
Additional comment	For details see appendix 4 of the PDD

Data / Parameter	w_{OM} and w_{BM}
Unit	%
Description	Default values for projects of intermittent output nature for weighting of operating margin and build margin emission factors
Source of data	based on Methodological tool (k) “Tool to calculate the emission factor for an electricity system”
Value(s) applied	w_{OM} = 0.25 w_{BM}= 0.75
Choice of data or Measurement methods and procedures	For details see appendix 4 of the PDD
Purpose of data/ parameter	Calculation of baseline and project emissions
Additional comment	For details see appendix 4 of the PDD

Data / Parameter	$EF_{grid,CM,ex-ante}$
Unit	t CO_2 / MWh
Description	Ex ante Combined Margin
Source of data	appendix 4 of the PDD
Value(s) applied	0.2745
Choice of data or Measurement methods and procedures	For details see appendix 4 of the PDD
Purpose of data/ parameter	Calculation of baseline and project emissions
Additional comment	For details see appendix 4 of the PDD

D.2. Data and parameters monitored

Data / Parameter	***Management of SWDS***
Unit	-
Description	Management of SWDS
Measured/calculated/ default	Default
Source of data	Use different sources of data: (a) Original design of the landfill; (b) Technical specifications for the management of the SWDS; (c) Local or national regulations
Value(s) of monitored parameter	-
Monitoring equipment	-
Measuring/reading/recording frequency	-
Calculation method (if applicable)	Not applicable
QA/QC procedures	-
Purpose of data / parameter	-
Additional comment	-

Data / Parameter	$Op_{j,h}$
Unit	-
Description	Operation of the equipment that consumes the LFG: • Flares • Electricity generation engines •
Measured/calculated/ default	Measured
Source of data	Project participants
Value(s) of monitored parameter	1
Monitoring equipment	-
Measuring/reading/recording frequency	Hourly

Calculation method (if applicable)	Not applicable
QA/QC procedures	A functional test of the flame detection system of each flare in operation is carried out once a week, and documented in a list. For QA/QS of electricity meters, please see EG_{PJ}.
Purpose of data	To monitor operation in order to calculate *ex post* baseline emissions
Additional comment	This parameter for the flares is equal to the parameter "$Flame_m$" to be monitored according to the methodological tool (d) "Project emissions from flaring" (Version 02.0.0)

Data / Parameter	$EG_{PJ,y}$
Unit	MWh
Description	Amount of electricity generated using LFG by the project activity in year *y*
Measured/calculated/ default	Measured
Source of data	Electricity meter
Value(s) of monitored parameter	Included in Excel spreadsheet "BDJ - CDM CALCULATION V2" sheet 1. Electricity Generation
Monitoring equipment	Included in Appendix 1. LIST OF MONITORING EQUIPMENT AND CALIBRATION PLAN MR 2 Rev 17 item No 7.4
Measuring/reading/recording frequency	Continuos
Calculation method (if applicable)	Not Applicable
QA/QC procedures	Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings will be double checked by the electricity distribution company
Purpose of data	This parameter is required for calculating baseline emissions associated with electricity generation ($BE_{EC,y}$) using the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"
Additional comment	-

Data / Parameter	$EG_{EC,y}$
Unit	MWh
Description	Amount of electricity consumed by the project activity in year *y*
Measured/calculated/ default	Measured
Source of data	Electricity meter
Value(s) of monitored parameter	Included in Excel spread sheet "BDJ - CDM CALCULATION V2" sheet 2. Electricity Consumption
Monitoring equipment	Included in Appendix 1. LIST OF MONITORING EQUIPMENT AND CALIBRATION PLAN MR 2 Rev 17 item No 8
Measuring/reading/recording frequency	Continuos
Calculation method (if applicable)	Not Applicable

QA/QC procedures	Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings will be double checked by the electricity distribution company
Purpose of data	This parameter is required for calculating project emissions from electricity consumption due to an alternative waste treatment process $t\,PE_{EC,y}$) using the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"
Additional comment	-

The following parameters are monitored during the crediting period according to the methodological tool (d) "Project emissions from flaring" (Version 02.0.0); parameters not required are not quoted:

Data / Parameter	$T_{EG,m}$
Unit	°C
Description	Temperature in the exhaust gas of the enclosed flare in minute m on the exhaust gas in the flare by a thermocouple type N
Measured/calculated/ Default	Measured
Source of data	Temperature sensor
Value(s) of monitored parameter	Included in Excel spreadsheet "BDJ - CDM Raw Data - YYYY MM V2" Sheet 2.CDM Raw Data
Monitoring equipment	Included in Appendix 1. LIST OF MONITORING EQUIPMENT AND CALIBRATION PLAN MR 2 Rev 17item No 2.4, 3.4, 4.4
Measuring/reading/recording frequency	Once per minute. Data will continuously be registered through a data logger.
Calculation method (if applicable)	Not Applicable
QA/QC procedures	Thermocouples will be replaced or calibrated as per the manufacturer recommendations every year.
Purpose of data	Project emissions from flaring
Additional comment	Unexpected changes such as a sudden increase/drop in temperature can occur for different reasons. These events should be noted in the site records along with any corrective action that was implemented to correct the issue. Monitoring of this parameter is applicable in case of enclosed flares. Measurements are required to determine if manufacturer's flare specifications for operating temperature are met.

Data / Parameter	$v_{i,RG,m}$
Unit	-
Description	Volumetric fraction of component *i* in the residual dry gas in minute *m,* where *i* = CH_4, CO_2, O_2
Measured/calculated/ Default	Measured
Source of data	Gas analyser
Value(s) of monitored parameter	Included in Excel spreadsheet "BDJ - CDM Raw Data - YYYY MM V2" Sheet 2.CDM Raw Data

Monitoring equipment	Included in Appendix 1. LIST OF MONITORING EQUIPMENT AND CALIBRATION PLAN MR 2 Rev 17item No 5, 6
Measuring/reading/recording frequency	continuously
Calculation method (if applicable)	Not Applicable
QA/QC procedures	Analysers will be calibrated according to the manufacturer's recommendation at least annually. A zero check and a typical value check will be performed annually by comparison with a standard certified gas.
Purpose of data	Baseline emissions and project emissions from flaring
Additional comment	As defined within the tool to determine project emissions from flaring gases containing methane, N_2 will be determined from the CH_4, CO_2 and O_2 concentrations. For CH_4, this parameter is equal to $v_{CH4.h,db}$ *(= F)* to be monitored hourly according to the methodological tool (i) "Tool to determine the mass flow of a greenhouse gas in a gaseous stream".

Data / Parameter	$V_{RG,tb,m}$
Unit	m³ dry gas
Description	Volumetric flow of the residual gas (LFG) on a dry basis in the minute *m* (m³ dry gas/m) for each flare
Measured/calculated/ Default	Calculated
Source of data	Measured by flow meters. Data to be aggregated monthly and yearly.
Value(s) of monitored parameter	Included in Excel spreadsheet "BDJ - CDM Raw Data - YYYY MM V2" Sheet 2.CDM Raw Data
Monitoring equipment	Included in Appendix 1. LIST OF MONITORING EQUIPMENT AND CALIBRATION PLAN MR 2 Rev 17 item No 1.1, 2.1, 3.1, 4.1,
Measuring/reading/recording frequency	continuously
Calculation method (if applicable)	A flowmeter will be used for each flare - Data will be checked each business day by the landfill gas manager. Flow will be monitored after a condensate trap which will remove most of the moisture. Moisture level will be monitored, or calculated and will be used to give the exact measurement on a dry basis. Volumetric flow measurement will consider the actual pressure and temperature. Calculated based on the wet basis flow measurement plus water concentration measurement.
QA/QC procedures	The flowmeter will be calibrated as per manufacturer recommendations. Frequency of calibration will be annually. Periodic calibration against a primary device provided by an independent accredited laboratory. Flow will be monitored after a condensate trap which will remove moisture. Data will be checked each business day by the landfill gas technician. Flow will be monitored after a condensate trap which will remove most moisture
Purpose of data	Baseline emissions and project emissions from flaring
Additional comment	-

Data / Parameter	$v_{o2,EG,m}$
Unit	-
Description	Volumetric fraction of O_2 in the exhaust gas on a dry basis at reference conditions in minute *m.* Extractive sampling analysers with water and particulates removal devices or in situ analyser for wet basis determination. The point of measurement (sampling point) shall be in the upper section of the flare (80% of total flare height). Sampling shall be conducted with sampling probes adequate for high temperature measurements.
Measured/calculated/ Default	Measured
Source of data	Gas analyser
Value(s) of monitored parameter	Included in Excel spreadsheet "BDJ - CDM Raw Data - YYYY MM V2" Sheet 2.CDM Raw Data
Monitoring equipment	Included in Appendix 1. LIST OF MONITORING EQUIPMENT AND CALIBRATION PLAN MR 2 Rev 17 item No 5, 6
Measuring/reading/recording frequency	continuously
Calculation method (if applicable)	Not applicable
QA/QC procedures	Analysers will be calibrated according to the manufacturer's recommendation at least annually. A zero check and a typical value check will be performed annually by comparison with a standard certified gas.
Purpose of data	Project emissions from flaring
Additional comment	Monitoring of this parameter is only applicable in case of enclosed flares and continuous monitoring of the flare efficiency.

Data / Parameter	$fc_{CH4,FG,h}$
Unit	mg/m^3
Description	Concentration of methane in the exhaust gas of the flare in dry basis at reference conditions in the minute *m.* Extractive sampling analysers with water and particulates removal devices or in situ analyser for wet basis determination. The point of measurement (sampling point) shall be in the upper section of the flare (80% of total flare height). Sampling shall be conducted with sampling probes adequate for high temperature measurements.
Measured/calculated/ Default	Measured
Source of data	Continuous gas analyser.
Value(s) of monitored parameter	Included in Excel spreadsheet "BDJ - CDM Raw Data - YYYY MM V2" Sheet 2.CDM Raw Data
Monitoring equipment	Included in Appendix 1. LIST OF MONITORING EQUIPMENT AND CALIBRATION PLAN MR 2 Rev 17 item No 5, 6
Measuring/reading/recording frequency	continuously
Calculation method (if applicable)	Not applicable

QA/QC procedures	Analysers will be calibrated according to manufacturer's recommendation or at least annually. A zero check and a typical value check will be performed annually by comparison with a standard gas.
Purpose of data	Project emissions from flaring
Additional comment	Monitoring of this parameter is only applicable in case of enclosed flares and continuous monitoring of the flare efficiency. Measurement instruments may read ppmv or % values. To convert from ppmv to mg/m^3, the value shall be multiplied by 0.716. 1% equals 10 000 ppmv. The gas analyser will monitor directly landfill gas methane concentration and give a direct measurement of methane content in the landfill gas

Data / Parameter	$Maintenance_y$
Unit	Calendar days
Description	Maintenance events completed in year *y*
Measured/calculated/ Default	Default
Source of data	CDM Manager Biogás Doña Juana S.A.S. E.S.P.
Value(s) of monitored parameter	- Maintenance Schedule
Monitoring equipment	-
Measuring/reading/recording frequency	-
Calculation method (if applicable)	-
QA/QC procedures	Records are kept in a maintenance log for two years beyond the life of the flare
Purpose of data	Ensure adequate functioning of flares
Additional comment	Monitoring of this parameter is required for the case of enclosed flares and the project participant selects Option B to determine flare efficiency. These dates are required so that they can be compared to the maintenance schedule to check that maintenance events were completed within the minimum time between maintenance events specified by the manufacturer ($SPEC_{,flare}$)

Data / Parameter	$V_{tb,m}$
Unit	m³ dry gas
Description	Volumetric flow of the LFG stream in time interval t on a dry basis in the hour *h* (m³ dry gas/h) for each power generator
Measured/calculated/ Default	Calculated
Source of data	Measured by flow meters. Data to be aggregated monthly and yearly.
Value(s) of monitored parameter	Included in Excel spreadsheet "BDJ - CDM Raw Data - YYYY MM V2" Sheet 2.CDM Raw Data
Monitoring equipment	Included in Appendix 1. LIST OF MONITORING EQUIPMENT AND CALIBRATION PLAN MR 2 Rev 17 item No 7.1

Measuring/reading/recording frequency	continuously
Calculation method (if applicable)	A flowmeter will be used for each power generator. Data will be checked each business day by the landfill gas manager. Flow will be monitored after a condensate trap which will remove most of the moisture. Moisture level will be monitored, or calculated and will be used to give the exact measurement on a dry basis.
QA/QC procedures	The flowmeter will be calibrated as per manufacturer recommendations. A flowmeter will be used. Flow will be monitored after a condensate trap which will remove moisture. Data will be checked each business day by the landfill gas technician. Flow will be monitored after a condensate trap which will remove most moisture
Purpose of data	Baseline emissions
Additional comment	-

Data / Parameter	T_f, T_{EG}, T_{HG}
Unit	°C
Description	Temperature of the landfill gas at the proximity of each flow meter, if volumetric flow meter are used: • at each flare (f), • at each engine (EG).
Measured/calculated/ Default	Measured
Source of data	Temperature sensor
Value(s) of monitored parameter	Included in Excel spreadsheet "BDJ - CDM Raw Data - YYYY MM V2" Sheet 2.CDM Raw Data
Monitoring equipment	Included in Appendix 1. LIST OF MONITORING EQUIPMENT AND CALIBRATION PLAN MR 2 Rev 17 item No 1.2, 2.2, 3.2, 4.2, 7,2
Measuring/reading/recording frequency	Once per minute. Data will continuously be registered through a data logger.
Calculation method (if applicable)	Not Applicable
QA/QC procedures	Periodic calibration against a primary device provided by an independent accredited laboratory. Calibration and frequency of calibration is according to manufacturer's specifications
Purpose of data	Baseline emissions. Input data in order to monitor LFG temperature, and to exclude claiming Emission Reductions for methane destruction in all minutes where the LFG temperature exceeds 60 °C for the respective LFG combustion equipment.
Additional comment	Monitored continuously to assure the applicability condition flow temperature being below 60ºC.

Data / Parameter	P_f, P_{EG}, P_{HG}

Unit	Pa
Description	Pressure of the landfill gas near each flow meter, if volumetric flow meter are used: • at each flare (f), • at each engine (EG).
Measured/calculated/ Default	Measured
Source of data	Pressure sensor
Value(s) of monitored parameter	Included in Excel spreadsheet "BDJ - CDM Raw Data - YYYY MM V2" Sheet 2.CDM Raw Data
Monitoring equipment	Included in Appendix 1. LIST OF MONITORING EQUIPMENT AND CALIBRATION PLAN MR 2 Rev 17item No 1.3, 2.3, 3.3, 4.3, 7,3
Measuring/reading/recording frequency	Once per minute. Data will continuously be registered through a data logger.
Calculation method (if applicable)	Not Applicable
QA/QC procedures	Periodic calibration against a primary device periodically and records of calibration procedures must be kept available as well as the primary device and its calibration certificate. Pressure transducers (either capacitive or resistive) calibrated monthly
Purpose of data	Baseline emissions
Additional comment	N/A

Data / Parameter	$\rho_{H20,t,Sat}$
Unit	Pa
Description	Saturation pressure of H2O at temperature Tt in time interval *t.* This parameter is solely a function of the gaseous stream temperature T_t and can be found at reference [1] for a total pressure equal to 101,325 Pa
Measured/calculated/ Default	Default
Source of data	-
Value(s) applied	-
Monitoring equipment	-
Measuring/reading/recording frequency	-
Calculation method (if applicable)	-
QA/QC procedures	-
Purpose of data	-
Additional comment	[1] Fundamentals of Classical Thermodynamics; Gordon J. Van Wylen, Richard E. Sonntag and Borgnakke; 4º Edition 1994, John Wiley & Sons, Inc.

D.3. Implementation of sampling plan

>> N/A

SECTION E. Calculation of emission reductions or net anthropogenic removals

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

Baseline emissions are determined according to equation (1) and comprise the following sources:

(a) Methane emissions from the SWDS in the absence of the project activity;

(b) Electricity generation using fossil fuels or supplied by the grid in the absence of the project activity.

Equation (1)

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

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)

Baseline emissions of methane from the SWDS are determined *ex-post* as follows:

Equation (2)

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

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)

$F_{CH4,PJ,y}$ = 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 CH_4 (t CO_2e/t CH_4)

During the crediting period, the $F_{CH4,PJ,y}$ will be determined as follows:

Equation (3)

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

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)

Baseline emissions associated with electricity generation are determined *ex-post* as follows:

Equation (2) of Tool (e)

$$BE_{EC,y} = \sum_k EG_{PJ,y} \times EF_{EL,k,y} \times (1 + TDL_{k,y})$$

Sample Calculations:

The spreadsheet "BDJ - CDM Raw Data - YYYY MM V2" Sheet 2.CDM Raw Data - includes all the raw values and formulas to calculate the $MD_{project}$ according the last formula referred to PDD and the methodology, the steps to calculate are similar to the following:

$Flare_x$ $TCO2_e$ = (((1-Ox)*DF7*(DM7-(0.1*DL7)))*GWPCH4/1000*Time_Record/60,6)
Where DF7 is the spreadsheet column DF row 7: mass flow rate of methane (Kg/h) and DM7 is the spreadsheet column DM row 7: calculated efficiency according the Tool to determine project emissions from flaring gases containing methane (the additional values to calculate according the tool were presented on the electronic file)

$TCO2_{e\ Flare2\ minute\ n}$ = 0.328711

The spreadsheet "BDJ - CDM CALCULATION V2" tab 1. Electricity Generation includes all values and formulas to calculate the Emissions reductions for electricity generated. The steps to calculate are similar to the following:

Month: April
Period: 01/04/2017 to 30/04/2017
Electricity Generated to the grid [kWh]: 368,569.92
Emissions reduction from electricity generated [tCO2e] = EG [MWh] * (1+TDL) * EFgrid
Emissions reduction from electricity generated [tCO2e] = (368,569.92 /1000) (1+0.2) · 0.2745
Emissions reduction from electricity generated [tCO2e] = 121.41

Monitoring Period					
Year	Month	Period		Electricity Generated [kWh]	Baseline emissions from electricity Generated [tCO2e]
				EG	BE=EG[MWh]*EF[tCO2e/MWh]*(1+TDL)
2017	April	01/04/2017	30/04/2017	368,569.92	121.41
	May	01/05/2017	31/05/2017	323,016.48	106.40
	Jun	01/06/2017	30/06/2017	372,125.52	122.58
	July	01/07/2017	31/07/2017	407,710.68	134.30
	August	01/08/2017	31/08/2017	414,100.68	136.40
	September	01/09/2017	30/09/2017	115,938.48	38.19

Emissions reductions from electricity generated **[tCO2e]**	**659.28**

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

Project emissions are calculated as follows:

Equation (1)

$$PE_y = PE_{EC,y}$$

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)

Emissions from consumption of fossil fuels due to the project activity, for purpose other than electricity generation, and emissions from the distribution of compressed/liquefied LFG using trucks have been eliminated from the equation because they are not applicable to the project activity.

Sample Calculations:

The spreadsheet "BDJ - CDM CALCULATION V2" tab 2. Electricity Consumption includes all values and formulas to calculate the Project Emissions the steps to calculate are similar to the following:

Month: April
Period: 01/04/2017 to 30/04/2017
Electricity imported from the grid [kWh]: 3,951.0
Project emissions from electricity imported [tCO2e] = ECpj [MWh] * (1+TDL) * EFgrid
Project emissions from electricity imported [tCO2e] = (3,951.0 /1000) (1+0.2) · 0.2745
Project emissions from electricity imported [tCO2e] = 1.30

Monitoring Period					
Year	**Month**	**Period**		**Electricity imported from the grid [kWh]**	**Project emissions from electricity imported** [tCO2e]
				EC	PE=EC[MWh]*EF[tCO2e/MWh]*(1+TDL)
2017	**April**	01/04/2017	30/04/2017	3,951.0	1.30
	May	01/05/2017	31/05/2017	8,087.0	2.66
	Jun	01/06/2017	30/06/2017	7,640.0	2.52
	July	01/07/2017	31/07/2017	7,108.0	2.34
	August	01/08/2017	31/08/2017	10,101.0	3.33
	September	01/09/2017	30/09/2017	14,246.0	4.69
Project emissions from electricity imported **[tCO2e]**					**16.84**

Project emissions from electricity consumption by the project activity during the monitoring period are: **16.84 tCO2**.

E.3. Calculation of leakage emissions

>> There are no leakages associated with this project

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

Item	Baseline GHG emissions or baseline net GHG removals (t CO2e)	Baseline GHG emissions or baseline net GHG for electricity generation (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO2e)		
					Before 01/01/2013	From 01/01/2013	Total amount
Total	177,266.02	659.28	16.84	0	0	177,266.02	177,266.02

The direct subtraction between the baseline emissions, the baseline emissions by electricity generation and the project emissions using the decimal fractions is: 177,266.02 as a conservative way in the calculation and CER's request we decide to round down to **177,266**

Emission reduction calculation

According to methodology ACM0001 / Version 17 the greenhouse gas Emissions Reduction achieved by the project activity during the monitoring period (*ER*) shall be estimated as follows:

Equation (1)

$$ER_y = BE_y - PE_y$$

Where:

ER_y = Emission reductions in year *y* (t CO_2e/yr)

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

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

Data monitored

See Excel spreadsheet named "BDJ - CDM Raw Data - YYYY MM V2"which presents the data monitored and calculated every minute during the monitoring period. This information is also available on the Excel file in which the calculation algorithm used can be seen.

List of constants involved in the emission reduction calculation

Parameter	SI Unit	Description	Value
MM_{CH4}	kg/kmol	Molecular mass of methane	16.04
MM_{CO}	kg/kmol	Molecular mass of carbon monoxide	28.01
MM_{CO2}	kg/kmol	Molecular mass of carbon dioxide	44.01
MM_{O2}	kg/kmol	Molecular mass of oxygen	32.00
MM_{H2}	kg/kmol	Molecular mass of hydrogen	2.02
MM_{N2}	kg/kmol	Molecular mass of nitrogen	28.02

Parameter	SI Unit	Description	Value
AM_C	kg/kmol (g/mol)	Atomic mass of carbon	12.00
AM_H	kg/kmol (g/mol)	Atomic mass of hydrogen	1.01
AM_O	kg/kmol (g/mol)	Atomic mass of oxygen	16.00
AM_N	kg/kmol (g/mol)	Atomic mass of nitrogen	14.01
P_{ref}	Pa	Atmospheric pressure at reference conditions	101 325
R_u	Pa.m³/kmol.K	Universal ideal gas constant	0.008314472
T_{ref}	K	Temperature at reference conditions	273.15
$v_{O2,air}$	Dimensionless	O_2 volumetric fraction of air	0.21
GWP_{CH4}	t_{CO2}/t_{CH4}	Global warming potential of methane valid for the commitment period	see table above
MV_n	m³/Kmol	Volume of one mole of any ideal gas at reference conditions	22.414
$\rho_{CH4, n}$	kg/m³	Density of methane gas at reference conditions	0.716
$NA_{i,j}$	Dimensionless	Number of atoms of element j in component i, depending on molecular structure	
VMref	m³/kmol	Volume of one mole of any ideal gas at reference temperature and pressure	22.4

Data error checks procedure

The coherence of the data is continuously checked. If abnormal values are found or one device is faulty, the following procedures will be applied in accordance with the methodology ACM0001 and the conservativeness procedures of the CDM. The table below describes how the algorithm is treating an error within the measurement chains.

Error checks [values outside of range and/or equipment error]	Calculation rules
Landfill gas analyser	The flares efficiency and the total Emissions Reduction during the period of time is set to 0
Exhaust gas analysis from flare i	- If the temperature of the exhaust gas of flare i > 800°C and the other parameters are within the flare manufacturer's specifications, then the flare i efficiency will be set to the efficiency measurement during the period of time and calculate according the project emissions from flaring and be adjusted, as a conservative approach, by subtracting 0.1 from the efficiency as determined in the minute m. - - If the temperature of the exhaust gas of flare i <800°C then the flare i efficiency will be set to 0% during the period of time
Temperature combustion sensor of the exhaust gas in flare i	The flare i efficiency and the Emissions Reduction from flare i during the period of time is set to 0
Temperature sensor of the residual gas at the flare i	The flare i efficiency and the Emissions Reduction from flare i during the period of time is set to 0

Error checks [values outside of range and/or equipment error]	Calculation rules
Absolute pressure sensor of the residual gas at the flare i	The flare i efficiency and the Emissions Reduction from flare i during the period of time is set to 0
UV cell of the flare i	The flare i efficiency and the Emissions Reduction from flare i during the period of time is set to 0
Temperature sensor of the residual gas at the engine	The Emissions Reduction from the engine during the period of time is set to 0
Absolute pressure sensor of the residual gas at the engine	The Emissions Reduction from the engine during the period of time is set to 0
Engine power generated	If the power rating of the engine < 50 kWe then the Emissions Reduction from engine during the period of time is set to 0

Procedure in the case of failure

If the equipment (flow meter, gas analyser, gauge, etc.) fails, the equipment supplier will be immediately notified. If possible, repairs will be carried out. If the damaged equipment cannot be repaired, it will be replaced by the same or an equivalent unit as soon as possible.

The flare will be equipped with a telemetry system allowing notifying the landfill gas technician in case the flare is stopped. If the flare is stopped, no landfill gas will be burned and no credits will be claimed during this period. The running hours of the flare will be monitored as part of the monitoring procedures.

Emissions Reduction table

The table with the total Emissions Reduction of GHG from the project activity during the monitoring period is shown below:

Monitoring Period										
				A	B	C	D	E	F	G
Year	Month	Date, Hour		Baseline emissions methane destroyed FLARES [tCO_2e]	Baseline emissions methane destroyed GE1 [tCO_2e]	Baseline emissions methane destroyed GE2 [tCO_2e]	Baseline emissions from electricity Generated [tCO2e] BE = EG [MWh] · EF · (1+TDL)	Project emissions from electricity imported [tCO2e] PE = EC [MWh] · EF · (1+TDL)	Leakages [tCO2e]	Emissions Reductions [tCO_2e]
2017	April	01/04/2017 0:00	30/04/2017 23:59	21,911.19	0.00	2,528.98	121.41	1.30	0	24,560.28
	May	01/05/2017 0:00	31/05/2017 23:59	24,577.82	0.00	2,532.89	106.40	2.66	0	27,214.45
	June	01/06/2017 0:00	30/06/2017 23:59	23,469.85	1.93	2,845.22	122.58	2.52	0	26,437.06
	July	01/07/2017 0:00	31/07/2017 23:59	29,711.07	0.00	3,198.66	134.30	2.34	0	33,041.69
	August	01/08/2017 0:00	31/08/2017 23:59	32,216.84	384.99	1,617.48	136.40	3.33	0	34,352.37
	September	01/09/2017 0:00	30/09/2017 23:59	30,632.85	896.74	97.08	38.19	4.69	0	31,660.17
			TOTAL	162,519.62	1,283.65	12,820.31	659.28	16.84	0	177,266.02

Total Baseline emissions methane destroyed **[tCO2e] (A+B+C)**	**176,623.59**
Total Baseline emissions from electricity Generated **[tCO2e] (D)**	**659.28**
Total Project emissions from electricity imported **[tCO2e] (E)**	**16.84**
Leakage emissions **[tCO2e] (F)**	**0.00**
Total emissions reduction from the Project Activity **[tCO2e]**	**177,266.02**

The direct subtraction between the baseline emissions, the emissions reduction from electricity generated and the project emissions using the decimal fractions is: 177,266.02 as a conservative way in the calculation and CER's request we decide to round down to 177,266

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

Amount achieved during this monitoring period (t CO2e)	Amount estimated ex ante (t CO2e)
484,687 *	**177,266**
[*:Calculated on a pro-rata basis of 183 days of monitoring in the year 2017 (between the 01 of April to 30 of September)]	

E.6. Remarks on increase in achieved emission reductions

>> During this Monitoring period no increase in achieved emission reductions, the Emissions Reduction for this monitoring period are 307,421 tons of $CO_{2,}$ eq lower than the estimated value in the PDD.

The difference is explained by the following circumstances:

- Doña Juana Landfill requires a new cell to disposal the waste between "Zona VIII" and "Zona Optimización" that will be constructed by the operator of the landfill CGR (Centro de Gerenciamiento de Residuos); however, the rainy season delayed the project schedule and other internal technical waste disposal activities like a slight land slide that occurs in the available trucks disposal zone located in the south of "Zona Optimización" on October 2 of 2015, this land slide causes the transfer of the disposal area so the operator of the landfill had still to use the old waste disposal zones; therefore, Biogás Doña Juana had to disconnect around 60 gas wells to permit the operation and the works on waste disposal areas which caused a reduction of landfill gas collection of about 4,000 Nm³/h on average in the last 12 months.

- There was the need for disconnecting in advance wells and a part of the collectors installed in Zone VIII and 'Optimización' Zone to allow the adequate waste disposal, the activities to control the land slide, the new cells works and the activities of a new wells connections. These additional unexpected events caused a delay in the connection works of other productive sectors and the LFG capture.

- Damages in the LFG network caused by the landfill operator, which were not informed on-time and caused a flow reduction during the period between the events happening and the repairs of the pipelines carried out.

Appendix 1. LIST OF MONITORING EQUIPMENT AND CALIBRATION PLAN MR 2 Rev 17

Biogás doñaJuana	LISTA DE EQUIPOS DE MONITOREO Y PLAN DE CALIBRACIÓN LIST OF MONITORING EQUIPMENT AND CALIBRATION PLAN	**Revisión N°** / Review N°	17
		Fecha Revisión / Revision Date	Oct - 2017
		Aprobado - Revisado por / Approved - Review by	
		Operations Manager/ Gerente de Operaciones	

EQUIPOS FIJOS / FIXED EQUIPMENTS

No. No.	**Mediciones / Equipo** Measurement / Equipment	**Ubicación** Location	Equipment Reference Number	**Marca** Brand	**Tecnología** / Technology	**Modelo** Model	**Rango del Equipo** Equipment's range	**Rango de Uso** Process Range	**Exactitud** / Accuracy	**No. Serie** Serial No.	**Fecha de instalación** Date of Installation	**Código del Certificado** Certificate's Code	**Fecha de Ejecución de la Calibración** Date of the Calibration Performance	**Próxima fecha calibración** Next Due Calibration	**Frecuencia de Calibración** / Frequency of Calibration
1.1	**Caudalímetro** Flow Meter	**Colector de entrada DN600** DN600 Admission Pipe	1.1.1	PFS	Insert Venturi	24" HVT-PI	1765..17650 Nm3/h	1765..17650 Nm3/h	+/- 0,50% of actual reading (2 Sigma)	12157	08/04/2009	N.A.	Calibration is not necesary, only replacement if the Venturi is damaged		**To be replaced only in case of damaged** / Cambio por daño
			1.1.2	Endress + Hauser	Differential pressure transmitter	Deltabar S PMD70-70A7B1BAAA	-25..25 mbar	0..25 mbar	+/- 0.075% of the set span	AB08FB0109D	30/04/2009	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL 1:** CA09288 **CAL 2:** LP032-11 **CAL 3:** IM-OF9683-LP472-11 **CAL 4:** IM-OF11111-LP-549-12 **CAL 5:** IM-OF12399-LP-723-13 **CAL 6:** IM-OF14174-LP-882-14 **CAL 7**: IM-OF16405-LP-2258-15 **CAL 8:** IM-OF19243-LP-3767-16	01/07/2009 11/12/2009 20/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 10/12/2010 19/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
			1.1.3	Endress + Hauser	Differential pressure transmitter	Deltabar S PMD70-70A7D1BAAA	-100..100 mbar	0..100 mbar	+/- 0.075% of the set span	C603020109D	21/07/2009	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL 1:** CA09284 **CAL 2:** LP031-11 **CAL 3:** IM-OF9683-LP471-11 **CAL 4:** IM-OF11111-LP-550-12 **CAL 5:** IM-OF-12399-LP-722-13 **CAL 6:** IM-OF14174-LP-884-14 **CAL 7:** IM-OF16405-LP-2259-15 **CAL 8:** IM-OF 19243-LP-3768-16	21/07/2009 11/12/2009 20/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 10/12/2010 19/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
1.2	**Transmisor de Temperatura** Temperature Transmitter	**Tubería de Admisión DN600** DN600 Admission Pipe	1.2	Endress + Hauser	Digital Sensor	iTEMP PA TMT84-B5A2A	-20..100 °C	20..70 °C	+/- 0.1°C	AB00DA042B6	12/05/2009	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL 1:** CA09280 **CAL 2:** LT048-11 **CAL 3:** IM-OF9683-LT1142-11 **CAL 4:** IM-OF1111-LT-1565-12 **CAL 5:** IM-OF12399-LT-2117-13 **CAL 6:** IM-OF14174-LT-2763-14 **CAL7:** IM-OF16405-LT-6712-15 **CAL 8:** IM-OF19243-LT-4983-16	01/07/2009 11/12/2009 23/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 10/12/2010 19/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
1.3	**Transmisor de Presión Absoluta** Absolute pressure transmitter	**Tubería de Admisión DN600** DN600 Admission Pipe	1.3	Endress + Hauser	Ceramic and Metal Sensor	Cerabar M PMC41-NE22H1P11A1	0..1 bar	0,7..0,9 bar	+/- 0.2% of TD	AB02E301020	17/06/2009	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL1:** CA09279 **CAL 2:** LP030-11 **CAL 3:** IM-OF9683-LP470-11 **CAL 4:** IM-OF1111-LP-551-12 **CAL 5:** IM-OF12399-LP-724-13 **CAL 6:** IM-OF14174-LP-883-14 **CAL7:** IM-OF16405-LP-2260-15 **CAL8:** IM-OF19243-LP-3769-16	01/07/2009 11/12/2009 20/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 10/12/2010 19/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
1.4	**Analizador de gas de vertedero** Landfill gas CDM analyzer	**Tubería de Admisión DN600** DN600 Admission Pipe	1.4	ABB	Infrared Analyzer	AO 2000 Series Uras 26	0..100 %vol CH4	0..60 %vol CH4	≤ 0.2% of the span	3.357394.8	19/05/2009	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL1:** IS-09-2377 **CAL2:** LFQ016-10 **CAL 3:** IM-OF9683-CV091-11 **CAL 4:** IM-OF11111-LFQ046-12 **CAL 5:** IM-OF-12399-LFQ188-13 **CAL 6:** IM-OF-14174-LFQ050-14 **CAL7:** IM-OF16405-LFQ081-15 **CAL8:** IM-OF19243-LFQ100-16	01/07/2009 07/12/2009 20/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 06/12/2010 19/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
							0..100 %vol CO2	0..45 %vol CO2		3.357394.8					
					Oxygen Sensor	AO 2000 Series O2 Sensor	0..25 %vol O2	0..5 %vol O2	≤ 0.5% of the span	3.357397.8					
2.1	**Caudalímetro** Flow meter	**Tubería de Antorcha BG1 DN250** DN250 Flare BG1 pipe	2.1.1	PFS	Insert Venturi	10" HVT-PI	700..7000 Nm3/h	700..5000 Nm3/h	+/- 0,50% of actual reading (2 Sigma)	12158-1	08/04/2009	N.A.	Calibration is not necesary, only replacement if the Venturi is damaged		**To be replaced only in case of damaged** / Cambio por daño
			2.1.2	Endress + Hauser	Differential pressure transmitter	Deltabar S PMD70-70A7B1BAAA	-25..25 mbar	0..25 mbar	+/- 0.075% of the set span	AB08FC0109D	30/04/2009	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL 1:** CA09287 **CAL 2:** LP023-11 **CAL 3**: IM-OF9683-LP459-11 **CAL 4**: IM-OF1111-LP-540-12 **CAL 5:** IM-OF12399-LP-714-13 **CAL 6:** IM-OF14174-LP-879-14 **CAL7:** IM-OF16405-LP-2261-15 **CAL8:** IM-OF19243-LP-3770-16	01/07/2009 11/12/2009 20/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 10/12/2010 19/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
			2.1.3	Endress + Hauser	Differential pressure transmitter	Deltabar S PMD70-70A7D1BAAA	-100..100 mbar	0..100 mbar	+/- 0.075% of the set span	C603040109D	21/07/2009	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL 1:** CA09283 **CAL 2:** LP022-11 **CAL 3** : IM-OF9683-LP458-11 **CAL 4:** IM-OF11111-LP-541-12 **CAL 5:** IM-OF12399-LP-713-13 **CAL 6:** IM-OF14174-LP-881-14 **CAL7:** IM-OF16405-LP-2262-15 **CAL8:** IM-OF19243-LP-3771-16	21/07/2009 11/12/2009 20/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 10/12/2010 19/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
2.2	**Transmisor de Temperatura** Temperature transmitter	**Tubería de Antorcha BG1 DN250** DN250 Flare BG1 pipe	2.2	Endress + Hauser	Digital Sensor	iTEMP PA TMT84-B5A2A	-20..100 °C	20..70 °C	+/- 0.1°C	AB00DF042B6	12/05/2009	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL 1:** CA09281 **CAL 2:** LT049-11 **CAL 3:** IM-OF9683-LT1141-11 **CAL 4:** IM-OF11111-LT-1562-12 **CAL 5:** IM-OF12399-LT-2120-13 **CAL 6:** IM-OF14174-LT-2762-14 **CAL7:** IM-OF16405-LT-6713-15 **CAL8:** IM-OF19243-LT-4984-16	01/07/2009 11/12/2009 20/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 10/12/2010 19/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual

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LISTA DE EQUIPOS DE MONITOREO Y PLAN DE CALIBRACIÓN
LIST OF MONITORING EQUIPMENT AND CALIBRATION PLAN

Revisión N° / Review N°	17
Fecha Revisión / Revision Date	Oct - 2017
Aprobado - Revisado por / Approved - Review by	
Operations Manager/ Gerente de Operaciones	

EQUIPOS FIJOS / FIXED EQUIPMENTS

No. No.	**Mediciones / Equipo** Measurement / Equipment	**Ubicación** Location	Equipment Reference Number	**Marca** Brand	**Tecnologia** / Technology	**Modelo** Model	**Rango del Equipo** Equipment's range	**Rango de Uso** Process Range	**Exactitud** / Accuracy	**No. Serie** Serial No.	**Fecha de instalación** Date of Installation	**Código del Certificado** Certificate's Code	**Fecha de Ejecución de la Calibración** Date of the Calibration Performance	**Próxima fecha calibración** Next Due Calibration	**Frecuencia de Calibración** / Frequency of Calibration
2.3	**Transmisor de Presión Absoluta** Absolute pressure transmitter	**Tubería de Antorcha BG1 DN250** DN250 Flare BG1 pipe	2.3	Endress + Hauser	Ceramic and Metal Sensor	Cerabar M PMC41-NE22H1P11A1	0..1 bar	0,7..0,9 bar	+/- 0.2% of TD	AB02E401020 ---------- CA00EA01020 ---------- D6017901020	17/06/2009 ---------- 22/03/2013 ---------- 26/12/2013	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL 1:** CA09278 **CAL 2:** LP024-11 **CAL 3:** IM-OF9683-LP460-11 **CAL 4:** IM-OF11111-LP-542-12 ---------- **CAL 1:** IM-OF11693-LP-064-13 **CAL 2:** IM-OF12399-LP-715-13 ---------- **CAL 1:** IM-OF12399-LP-721-13 **CAL 2:** IM-OF14174-LP-880-14 **CAL3:** IM-OF16405-LP-2263-15 **CAL4:** IM-OF19243-LP-3772-16	01/07/2009 11/12/2009 20/12/2010 05/12/2011 30/11/2012 ---------- 22/03/2013 29/11/2013 ---------- 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 10/12/2010 19/12/2011 04/12/2012 29/11/2013 ---------- 21/03/2014 28/11/2014 ---------- 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
2.4	**Termopar** Flare thermocouple	**Antorcha BG1** Flare BG1	2.4	Pyrocapt	Kanthal	TGM Type N	0..1280 °C	0..1100 °C	+/- 0.075 |t|	CDV0903107-02 RZ 1025 /1 RZ 1127 / 01 CDV1008032 BI-COL 01 BI-COL-04 BI-COL-07 BI-COL-10 1605122	12/05/2009 01/06/2010 21/03/2011 09/02/2012 23/11/2012 21/10/2013 30/09/2014 26/08/2015 17/08/2016	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL 1:** 1006030 RZ 1025 /1 **CAL 2:** 1102056 RZ 1127 / 01 **CAL 3:** IM-OF9683-LT800-11 **CAL 4:** MESTRA 1210110 **CAL 5:** IM-OF12400-LT-1731-13 **CAL 6:** MESTRA 1408126 **CAL.7:** IM-OF15843-LT-5100-15 **CAL 8:** MESTRA 1605122	01/07/2009 01/06/2010 10/02/2011 26/11/2011 22/10/2012 18/10/2013 28/08/2014 20/08/2015 20/05/2016	NA 31/05/2011 09/02/2012 25/11/2012 21/10/2013 17/10/2014 27/08/2015 19/08/2016 20/05/2017	**Anual** / Annual
3.1	**Caudalímetro** Flow Meter	**Tubería de Antorcha BG2 DN250** DN250 Flare BG2 pipe	3.1.1	PFS	Insert Venturi	10" HVT-PI	700..7000 Nm3/h	700..5000 Nm3/h	+/- 0,50% of actual reading (2 Sigma)	12158-2	08/04/2009	N.A.	Calibration is not necesary, only replacement if the Venturi is damaged		**To be replaced only in case of damaged** / Cambio por daño
			3.1.2	Endress + Hauser	Differential pressure transmitter	Deltabar S PMD70-70A7B1BAAA	-25..25 mbar	0..25 mbar	+/- 0.075% of the set span	AB08FD0109D	30/04/2009	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL 1:** CA09286 **CAL 2:** LP027-11 **CAL 3:** IM-OF9683-LP461-11 **CAL 4:** IM-OF1111-LP-543-12 **CAL 5:** IM-OF12399-LP-718-13 **CAL 6:** IM-OF14174-LP-876-14 **CAL.7:** IM-OF16405-LP-2264-15 **CAL 8:** IM-OF19243-LP-3773-16	01/07/2009 11/12/2009 20/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 10/12/2010 19/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
			3.1.3	Endress + Hauser	Differential pressure transmitter	Deltabar S PMD70-70A7D1BAAA	-100..100 mbar	0..100 mbar	+/- 0.075% of the set span	C60303010 9D	21/07/2009	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL 1:** CA09285 **CAL 2:** LP026-11 **CAL 3:** IM-OF9683-LP457-11 **CAL 4:** IM-OF11111-LP-544-12 **CAL 5:** IM-OF12399-LP-717-13 **CAL 6:** IM-OF14174-LP-877-14 **CAL.7:** IM-OF16405-LP-2265-15 **CAL 8:** IM-OF19243-LP-3774-16	21/07/2009 11/12/2009 20/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 10/12/2010 19/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
3.2	**Transmisor de Temperatura** Temperature transmitter	**Tubería de Antorcha BG2 DN250** DN250 Flare BG2 pipe	3.2	Endress + Hauser	Digital Sensor	iTEMP PA TMT84-B5A2A	-20..100 °C	20..70 °C	+/- 0.1°C	AB00DC042B6	12/05/2009	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL 1:** CA09282 **CAL 2:** LT050-11 **CAL 3:** IM-OF9683-LT1140-11 **CAL 4:** IM-OF11111-LT-1563-12 **CAL 5:** IM-OF12399-LT-2119-13 **CAL 6:** IM-OF14174-LT-2761-14 **CAL.7:** IM-OF16405-LT-6714-15 **CAL 8:** IM-OF19243-LT-4985-16	01/07/2009 11/12/2009 20/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 10/12/2010 19/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
3.3	**Transmisor de Presión Absoluta** Absolute pressure transmitter	**Tubería de Antorcha BG2 DN250** DN250 Flare BG2 pipe	3.3	Endress + Hauser	Ceramic and Metal Sensor	Cerabar M PMC41-NE22H1P11A1	0..1 bar	0,7..0,9 bar	+/- 0.2% of TD	AB02E601020 ---------- AB02E501020 ---------- D6017901020	17/06/2009 ---------- 05/08/2013 ---------- 29/07/2017	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL1:** CA09277 **CAL 2:** LP025-11 **CAL 3:** IM-OF9683-LP462-11 **CAL 4:** IM-OF11111-LP-545-12 ---------- **CAL 1:** IM-OF12140-LP-367-13 **CAL 2:** IM-OF12399-LP-716-13 **CAL 3:** IM-OF14174-LP-878-14 **CAL.4:** IM-OF16405-LP-2266-15 **CAL.5:** IM-OF19243-LP-3775-16 ---------- **CAL**: IM-OF19243-LP-3772-16	01/07/2009 11/12/2009 20/12/2010 05/12/2011 30/11/2012 ---------- 05/08/2013 29/11/2013 28/11/2014 26/11/2015 24/11/2016 ---------- 24/11/2016	NA 10/12/2010 19/12/2011 04/12/2012 29/11/2013 ---------- 04/08/2014 28/11/2014 27/11/2015 25/11/2016 23/11/2017 ---------- 23/11/2017	**Anual** / Annual
3.4	**Termopar** Flare thermocouple	**Antorcha BG2** Flare BG2	3.4	Pyrocapt	Kanthal	TGM Type N	0..1280 °C	0..1100 °C	+/- 0.075 |t|	CDV0903107-04 RZ 1025 / 02 RZ 1127 / 02 CDV1008031 BI-COL 02 BI-COL-05 BI-COL-08 BI-COL-11 1605124 1605122	12/05/2009 01/06/2010 21/03/2011 09/02/2012 23/11/2012 21/10/2013 30/09/2014 26/08/2015 17/08/2016 20/05/2017	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL 1:** 1006031 RZ 1025 / 02 **CAL 2:** 1102057 RZ 1127 / 02 **CAL.3:** IM-OF9683-LT798-11 **CAL 4:** MESTRA 1210111 **CAL 5:** IM-OF12400-LT-1730-13 **CAL6:** MESTRA 1408127 **CAL.7:** IM-OF15843-LT-5147-15 **CAL8:** MESTRA 1605124 **CAL9:** IM-OF22030-LT-3011-17	01/07/2009 01/06/2010 10/02/2011 26/11/2011 22/10/2012 18/10/2013 28/08/2014 22/08/2015 20/05/2016 19/05/2017	NA 31/05/2011 09/02/2012 25/11/2012 21/10/2013 17/10/2014 27/08/2015 21/08/2016 20/05/2017 18/05/2018	**Anual** / Annual

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No. No.	Mediciones / Equipo Measurement / Equipment	Ubicación Location	Equipment Reference Number	Marca Brand	Tecnologia / Technology	Modelo Model	Rango del Equipo Equipment's range	Rango de Uso Process Range	Exactitud / Accuracy	No. Serie Serial No.	Fecha de instalación Date of Installation	Código del Certificado Certificate's Code	Fecha de Ejecución de la Calibración Date of the Calibration Performance	Próxima fecha calibración Next Due Calibration	Frecuencia de Calibración / Frequency of Calibration
4.1	**Caudalimetro** Flow Meter	**Tubería de Antorcha BG3 DN250** DN250 Flare BG3 pipe	4.1.1	PFS	Insert Venturi	10" HVT-PI	700..7000 Nm3/h	700..5000 Nm3/h	+/- 0,50% of actual reading (2 Sigma)	13386	13/10/2010	N.A.	Calibration is not necesary, only replacement if the Venturi is damaged		**To be replaced only in case of damaged** / Cambio por daño
			4.1.2	Endress + Hauser	Differential pressure transmitter	Deltabar S PMD70-70A7B1BAAA	-25..25 mbar	0..25 mbar	+/- 0.075% of the set span	D605060109D	13/10/2010	FINAL INSPECTION REPORT No: 48851379/0040 **CAL 1:** LP029-11 **CAL 2:** IM-OF9683-LP468-11 **CAL 3:** IM-OF11111-LP-546-12 **CAL 4:** IM-OF12399-LP-719-13 **CAL 5:** IM-OF14174-LP-873-14 **CAL6:** IM-OF16405-LP-2267-15 **CAL7:** IM-OF19243-LP-3776-16	22/06/2010 20/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 19/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
			4.1.3	Endress + Hauser	Differential pressure transmitter	Deltabar S PMD70-70A7D1BAAA	-100..100 mbar	0..100 mbar	+/- 0.075% of the set span	D605070109D	13/10/2010	FINAL INSPECTION REPORT No: 48851379/0010 **CAL 1:** LP028-11 **CAL 2:** IM-OF9683-LP463-11 **CAL 3:** IM-OF11111-LP-547-12 **CAL 4:** IM-OF12399-LP-720-13 **CAL 5:** IM-OF14174-LP-875-14 **CAL6:** IM-OF16405-LP-2268-15 **CAL8:** IM-OF19243-LP-3777-16	22/06/2010 20/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 19/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
4.2	**Transmisor de Temperatura** Temperature transmitter	**Tubería de Antorcha BG3 DN250** DN250 Flare BG3 pipe	4.2	Endress + Hauser	Digital Sensor	iTEMP PA TMT84-B5A2A	-20..100 °C	0..70 °C	+/- 0.1°C	AB00DD042B6 ---------- D7004D042B6	13/10/2010 ---------- 05/12/2011	CONFORMITY CERTIFICATE No: GRS-01-11-2010 **CAL 1:** IM-OF9119-LT056-11 **CAL 2:** IM-OF9683-LT1161-11 ---------- **CAL 1:** IM-OF9683-LT1139-11 **CAL 2:** IM-OF11111-LT1564-12 **CAL 3:** IM-OF12399-LT-2118-13 **CAL 4:** IM-OF14174-LT-2760-14 **CAL.7:** IM-OF16405-LT-6715-15 **CAL8:** IM-OF19243-LT-4986-16	13/10/2010 20/12/2010 05/12/2011 ---------- 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 19/12/2011 ---------- 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
4.3	**Transmisor de Presión Absoluta** Absolute pressure transmitter	**Tubería de Antorcha BG3 DN250** DN250 Flare BG3 pipe	4.3	Endress + Hauser	Ceramic and Metal Sensor	Cerabar M PMC41-NE22H1P11A1	0..1 bar	0,7..0,9 bar	+/- 0.2% of TD	D6017901020 ---------- J400EA15128	13/10/2010 ---------- 26/05/2014	FINAL INSPECTION REPORT No: 48851379/0020 **CAL 1:** LP014-11 **CAL 2:** IM-OF9683-LP469-11 **CAL 3:** IM-OF11111-LP-548-12 **CAL 4:** IM-OF12399-LP-721-13 ---------- FINAL INSPECTION REPORT No: 3800074780/0010 **CAL 1:** IM-OF14174-LP-874-14 **CAL2:** IM-OF16405-LP-2269-15 **CAL3:** IM-OF19243-LP-3778-16	17/06/2010 13/12/2010 05/12/2011 30/11/2012 29/11/2013 ---------- 24/04/2014 28/11/2014 26/11/2015 24/11/2016	NA 12/12/2011 04/12/2012 29/11/2013 28/11/2014 ---------- NA 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
4.4	**Termopar** Flare thermocouple	**Antorcha BG3** Flare BG3	4.4	Pyrocapt	Kanthal	TGM Type N	0..1280 °C	0..1100 °C	+/- 0.075 |t|	RZ 1056 /01 RZ 1127 / 03 CDV0903106 BI-COL 03 BI-COL 06 BI-COL-09 BI-COL-12 1605126 1605123	13/10/2010 21/03/2011 09/02/2012 23/11/2012 21/10/2013 30/09/2014 26/08/2015 17/08/2016 20/05/2017	**CAL 1:** 1008030 RZ 1056 /01 **CAL 2:** 1102058 RZ 1127 / 03 **CAL3:** IM-OF9683-LT796-11 **CAL 4:** MESTRA 1210112 **CAL 5:** IM-OF12400-LT-1729-13 **CAL 6:** MESTRA 1408128 **CAL.7:** IM-OF15843-LT-5134-15 **CAL 8:** MESTRA 1605126 **CAL 9:** IM-OF22030-LT-3010-17	03/08/2010 10/02/2011 25/11/2011 22/10/2012 18/10/2013 28/08/2014 21/08/2015 20/05/2016 19/05/2017	02/08/2011 09/02/2012 24/11/2012 21/10/2013 17/10/2014 27/08/2015 20/08/2016 20/05/2017 18/05/2018	**Anual** / Annual
5	**Analizador de gases de humos de escape** Flare exhaust gas analyzer	**Antorcha BG1** Flare BG1 **Antorcha BG2** Flare BG2 **Antorcha BG3** Flare BG3	5	ABB	Infrared Analyzer	AO 2000 Series Uras 26	0..3000 ppm CH4	0..500 ppm CH4	≤ 0.2% of the span	3.357396.8	19/05/2009	CONFORMITY CERTIFICATE No: GRS-2009-09-01 **CAL 1:** IS-09-2377 **CAL 2:** IM-09119-LFQ015-10 **CAL 3:** IM-OF9683-CV092-11 **CAL 4:** IM-OF11111-LFQ048-12 **CAL 5:** IM-OF12399-LFQ190-13 **CAL 6:** IM-OF14174-LFQ051-14 **CAL7:** IM-OF16405-LFQ082-15 **CAL8:** IM-OF19243-LFQ101-16	01/07/2009 07/12/2009 20/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 06/12/2010 19/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	Anual / Annual
6		**Antorcha BG1** Flare BG1 **Antorcha BG2** Flare BG2 **Antorcha BG3** Flare BG3	6		Oxygen Sensor	AO 2000 Series O2 Sensor	0..25 %vol O2	0..22 %vol O2	≤ 0.5% of the span	3.357399.8	19/05/2009				

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7.1	**Caudalímetro** Flow Meter	**Tubería de Admisión Generador DN80** DN80 Engine Pipe	7.1	Endress + Hauser	Orifice Plate	Deltatop DO63C	135..673 Nm3/h	135..673 Nm3/h	+/- 0,50%	D100330111B	13/10/2010	N.A.	Calibration is not necesary, only replacement if the Deltatop is damaged		**To be replaced only in case of damaged** / Cambio por daño
			7.1.2	Endress + Hauser	Differential pressure transmitter	Deltabar S PMD70-70A7B1BAAA	-100..100 mbar	0..60 mbar	+/- 0.075% of the set span	D2058B0109D	13/10/2010	FINAL INSPECTION REPORT No: 61547467/0160 **CAL 1:** IM-OF9119-LP039-11 **CAL 2:** IM-OF9683-LP473-11 **CAL 3:** IM-OF11111-LP-538-12 **CAL 4:** IM-OF12399-LP-711-13 **CAL 5:** IM-OF14174-LP-885-14 **CAL.7:** IM-OF16405-LP-2270-15 **CAL.8:** IM-OF19243-LP-3779-16	25/02/2010 17/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 16/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
7.2	**Transmisor de Temperatura** Temperature transmitter	**Tubería de Admisión Generador DN80** DN80 Engine Pipe	7.2	Endress + Hauser	Thermal-Resistence	PT100 / TR12	-50…250 °C	0..40 °C	0.15 ± 0.002 · |t|	D20115142FE	13/10/2010	FACTORY CALIBRATION CERTIFICATE No: D2047B14318 **CAL 1:** IM-OF9119-LT051-11 **CAL 2:** IM-OF9683-LT1143-11 **CAL 3:** IM-OF11111-LT-1561-12 **CAL 4:** IM-OF12399-LT-2116-13 **CAL 5:** IM-OF14174-LT-2764-14 **CAL6:** IM-OF16405-LT-6716-15 **CAL7:** IM-OF19243-LT-4987-16	19/02/2010 17/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 16/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
7.3	**Transmisor de Presión Absoluta** Absolute pressure transmitter	**Tubería de Admisión Generador DN80** DN80 Engine Pipe	7.3	Endress + Hauser	Ceramic and Metal Sensor	Cerabar M PMC51-1PD0/115	0…2000 mbars	700..950 mbar	+/- 0.2% of TD	D2002401128	13/10/2010	FINAL INSPECTION REPORT No: 61547467/0180 **CAL 1:** IM-OF9119-LP019-11 **CAL 2:** IM-OF9683-LP474-11 **CAL 3:** IM-OF11111-LP-539-12 **CAL 4:** IM-OF12399-LP-712-13 **CAL 5:** IM-OF14174-LP-886-14 **CAL6:** IM-OF16405-LP-2271-15 **CAL7:** IM-OF19243-LP-3780-16	22/02/2010 17/12/2010 05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	NA 16/12/2011 04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
7.4	**Medidor Eléctrico** Electrical meter	**Armario del Cuarto del Generador** Engine Board	7.4	DEIF A/S	Measuring Analyzer	PPU / 2GS	0…1358 kW	0..800 kW	Class 1.0 according to IEC 688	2034500008 C	13/10/2010	78/781/550877	**Following the manufacturer's recommendations (DEIF A/S), calibration is not necessary, only replacement if damaged** / Según las recomendaciones del fabricante (DEIF A/S), no es necesario calibrar el equipo, sólo reemplazarlo en caso de daño.		
8	**Multimedidor Eléctrico** Electricity import meter	**Subestación Eléctrica** Electrical Substation	8	Carlo Gavazzi	Power Quality Analyzer	W M396AV53LA1S1	0..999 MW h	0..999 MW h	±0.2% f.s.; (@ 25°C ±5°C)	BJ1240052001P	01/09/2009	**CAL 1:** 100312 **CAL 2:** 112228 **CAL 3:** 123973 **CAL 3:** 132963 **CAL 4:** 146936 **CAL 5:** 150442 **CAL 6:** 160819-47748 **CAL 7:** 170824	09/08/2010 16/08/2011 01/08/2012 30/07/2013 29/07/2014 27/07/2015 19/08/2016 16/08/2017	08/08/2011 15/08/2012 31/07/2013 29/07/2014 28/07/2015 26/07/2016 18/08/2017 15/08/2018	**Anual** / Annual
8.1	**Multimedidor Eléctrico** Electricity meter	**Punto de conexión a la red** Grid Connection	8.1	ITRON	Power Quality Analyzer	SL7000	0 - .999999 MW h	0-999999 MW h	±0.2S	73048827 73049424	28/04/2017	**CAL 1:** 160211-44165 **CAL 1:** 160211-44166	11/02/2016	11/02/2019	**According to the national regulation of the grid**
9	**Analizador de gas de vertedero** Landfill gas Regulation analyzer	**Tubería de Admisión DN600** DN600 Admission Pipe	9.1	ABB	Infrared Analyzer	AO 2000 Series Uras 26	0..100 %vol CH4	0..60 %vol CH4	≤ 0.2% of the span	3.357395.8	26/11/2012	**CAL1:** IM-OF9683-CV093-11 **CAL2:** IM-OF11111-LFQ047-12 **CAL 3:** IM-OF12399-LFQ189-13 **CAL 4:** IM-OF14174-LFQ052-14 **CAL5:** IM-OF16405-LP-2264-15 **CAL6:** IM-OF19243-LFQ102-16	05/12/2011 30/11/2012 29/11/2013 28/11/2014 26/11/2015 24/11/2016	04/12/2012 29/11/2013 28/11/2014 27/11/2015 25/11/2016 23/11/2017	**Anual** / Annual
							0..100 %vol CO2	0..45 %vol CO2		3.357395.8					
					Oxygen Sensor	AO 2000 Series O2 Sensor	0..25 %vol O2	0..5 %vol O2	≤ 0.5% of the span	3.357398.8					