MONITORING REPORT FORM (CDM-MR)
Version 01- in effect as of: 28/09/2010

CONTENTS

MONITORING REPORT
Version 01 – 07/02/2012

SÃO JOÃO LANDFILL GAS TO ENERGY PROJECT (SJ)
0373
17th Monitoring Period - From 01/10/2011 to 31/01/2012

SECTION A. General description of the project activity

A.1. Brief description of the project activity:

São João Landfill Gas to Energy is a project designed to explore the landfill gas produced in São João landfill, one of the biggest landfills in Brazil. This landfill is located in the metropolitan region of São Paulo, Brazil's biggest city and financial center of the country. With an estimated population of around 10 million citizens in 2000, São Paulo generates nearly 15,000 tons of waste daily. São João Landfill Gas to Energy's goal is to explore the gas produced in São João landfill, using it to generate electricity and flaring.

São João landfill was designed according to the best practices at the time of its conception, applying modern engineering and environmental sound technology in order to avoid environmental hazards, such as underground water contamination. Regarding landfill gas emissions, the project contemplated only passive venting, intending to solely let the gas escape. Eventually, the gas was flared in the past at the top of well's heads, in a very inefficient combustion mechanism. It is estimated that only around 20% of the gas was flared through such system.

With the implementation of São João Landfill Gas to Energy Project, the above situation has been terminated. Sealing properly the well's heads, the project has ensured that methane previously released to the atmosphere is extracted either to the flares or to the powerhouse, where the gas will be ultimately used to generate energy. São João Landfill Gas to Energy Project's implementation will therefore reduce greenhouse gas emissions.

São João Landfill Gas to Energy Project also avoids greenhouse gas emissions through grid electricity displacement. The methane extracted from the landfill is combusted to generate electricity which is going to feed the Brazilian grid. With that, emission reductions occur due to fossil-fueled energy generation displacement at the margin of the electric system.

The installation of the SJ Project was executed in the period 2007/2008. Firstly, the LFG collecting system was implemented independently to start up flaring LFG as soon as possible. The CH_4 flaring would be enough to avoid GHG emission as prescribed by the UNFCCC. As a result, the Biogas Plant operation was started on June 1st, 2007. From that date up to March 2008, the SJ Project activity was limited exclusively to the LFG flaring, as properly verified by the monitoring and verification reports issued for that period particularly.

The second implementation phase of the São João LFGE Project was the startup of the power plant in the beginning of 2008. The power plant began to work with 14 engines, model CAT3520. Finally, on October 23rd, 2008, once the Power Plant was already operational, the PP invested in the acquisition of two additional engines, the same model than the others already installed, completing so the current existent power capacity of 24.64 MW which is given by the installation of 16 engines model CAT3520. The CERs due to electricity generation have been claimed only from April 01st, 2008. The final configuration became effective only by the end of October 2008 and since then the output of the São João LFGE project is the following:

- Model CAT3520 Capacity at SJ site conditions: 1.54 MWe
- Number of Engine Units: 16
- Installed Capacity: 16 X 1.54 MWe: 24.64 MWe
- Final Energy Output delivered to the grid: 21.89 – 0.99 = 20.90 MWe[1]

The LFG degassing system includes more than 30 Km of high density polyethylene pipes connected to the about 160 landfill wells; 4 blowers to provide suction for extracting the gas from the landfill; facilities for gas treatment, such as heat exchangers, chillers; and 3 flares with capacity to destroy up to 15,000 Nm3 per hour of LFG that is not used to generate electricity.

This Monitoring Report refers to the 17th Monitoring Period that contemplates the period from October 1st, 2011 until January 31st, 2012. The total emission reductions achieved in this Monitoring Period is given on the table below:

Total tCO_2e from methane destroyed	78,859
Total tCO_2e from electricity dispatched	5,711
Total tCO2e from electricity consumed	13
TOTAL tCO_2e	**84,557**

A.2. Project Participants:

- Public entity: Prefeitura Municipal de São Paulo – Municipality of São Paulo - Brazil
- Private entity: Biogás Energia Ambiental S.A. - Brazil
- KfW Bankegruppe - Germany
- Mercuria Energy Trading SA – Switzerland

A.3. Location of the project activity:

The São João project is located at Av. Sapopemba, km 33, Bairro Jardim Rodolfo Pirane, São Paulo - Brazil. GPS coordinates from the location of the power house are the followings: Latitude -23.6362°, Longitude -46.4141°.

A.4. Technical description of the project

The SJ includes high density polyethylene pipes connected to the landfill wells; blowers to extract the gas from the landfill; facilities for gas treatment, such as heat exchangers, chillers; flares and generators, which destroys the methane previously released to the atmosphere. The project had in the monitoring period under consideration a total installed capacity of 24.64 MW[2].

The degassing station is responsible for extracting the landfill gas from the landfill and transports it to the flares and to the gas engines in the power plant. During the transportation, the gas goes through a

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[1] The Caterpillar dealer (SOTREQ) assumes 88% of the installed capacity of 24.64 MW or 21.70 MW as the average energy output of the Power Plant before discounting the losses in the transmission system. However, assuming the 93% of the Expected Plant Operation Efficiency as mentioned in the revised PDD, the Maximum Power Plant Capacity Available for Export is 21.89MW and the final energy output delivered to the grid (i.e. after discounting transmission losses) is 20.90 MWe. For sake of conservatism the value 21.70MW was adopted in the investment analysis as described in PDD - Section B.3- step 2.

[2] The efficiency of the engines is 93%, according to Caterpillar's representative in Brazil - Sotreq. This makes that the real capacity installed is 22.91 MW. If we discount the internal consumption of the plant, somewhere around 1.02 MW, the actual power capacity to be exported is 21.89 MW. From this value we have to discount the power loss in the transmission up to connection point of 4.5%. So we can consider that the Final Energy Delivered to the grid is 20.90 MW. After 46 months of operation, since the Power Plant start-up in April 2008 up to January 2012, São João LFGE Project has not yet performed to the point of Delivering more than 20 MWh / h in 24 hour daily average into the Brazilian Electric Grid Operating System.

treatment to allow its use as fuel for energy generation. Other functions of the degassing station are: drying landfill gas by gas coolers; and measuring and analyzing the quantity and quality of the landfill gas for safety, process and operating purposes.

The landfill gas is cooled down when transported from the landfill, resulting in a condensate. This is be drained to condensate shafts, to be placed nearby the gas pipes. Once in the degassing station, the gas is measured and sent to a flaring and generation system. Biogás has chillers installed in order to remove moisture. This is a very important step in the gas treatment process, since the condensate, which contains silicium components, could block the gas pipes and also damage the gas engines, due to the silicium. After this step, the gas is heated again through a second heat exchanger, or economizer, to a temperature of around 25ºC, far enough from the dew point of 4ºC to avoid further condensation.

Blowers are used for transportation of the landfill gas from the landfill to the flares and power house. These blowers are equipped with all the necessary safety equipment, including a noise reducing housing.

The figure below presents the installation of all collecting equipment from SJ, the location of the degassing station and the location of the power house.

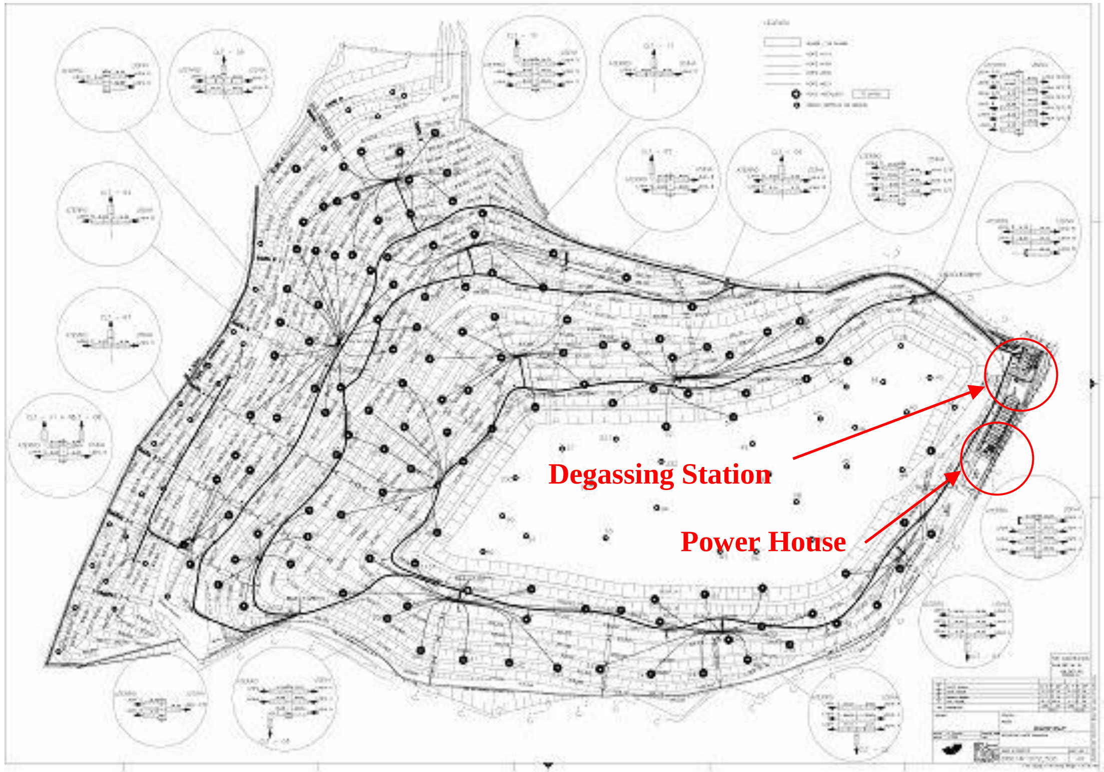

Figure -1: SJ Layout

Figure -2: Degassing Station (1) and Power House (2)

The pictures below illustrate the collecting system of the SJ project.

Figure -3: Wellhead

Figure -4: Wellhead and Collection Pipeline

Figure -5: Transmission Pipeline

Figure -6: Gas entrance in the Degassing Station

On the pressure side of the degassing station, all kinds of gas analyzing and gas measuring instruments are present. These instruments are very important for safety, process and operating purposes. SJ counts, actually, with three turbine flow-meters: one measures the total gas collected (tag FIR600) and the other two measures the gas sent to the flaring system and to the power house (tags: FIR500 and FIR800, respectively).

While the power house was not installed, SJ generated electricity through a diesel engine installed in the degassing station. The electricity produced was registered continuously by the PLC and the diesel consumed was registered via the contract between Biogás and the diesel supplier. This equipment was in stand-by in the time of the Monitoring Period, as the electricity consumed by the Degassing Station was supplied by the Power House; however, during electricity black-outs the generator is turned on in order to supply electricity to the Station (this source of project emissions was considered in the calculation of ERs).

The pictures below present the above mentioned installed equipment and the layout of the degassing station and power house, location of the measuring equipment.

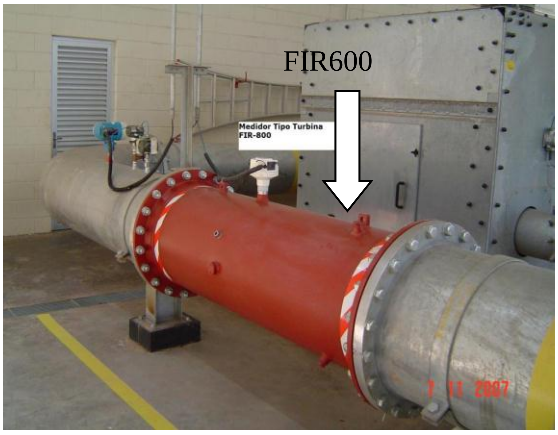

Figure -7: FIR600

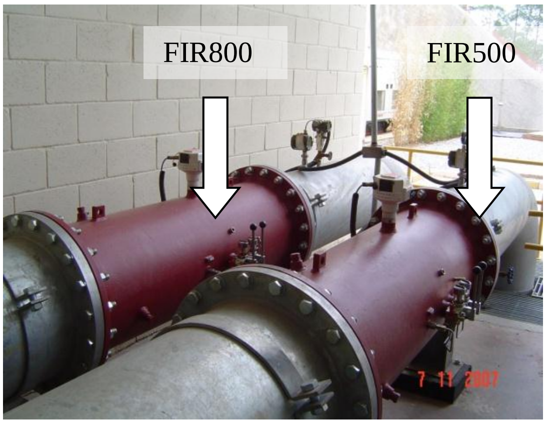

Figure -8: FIR500 and FIR800

Figure -9: Flares F520, F540 and F560

Figure -10: Blower

Figure -11: Detail of the blower

Figure -12: Chiller

Figure -13: Methane Analyzer A400

The Power House’s construction was finished in January 2008. 14 gas engines were installed in February and March 2008 with a nominal capacity of 1.54 MW each, achieving a total installed capacity of 21.56 MW – 1.54 MW (or 1 engine) in stand-by. On October 23rd, 2008, 2 new engines were installed and total capacity installed was up graded to 24.64 MW – 1.54 MW (or 1 engine) in standby, what was equivalent to the implementation status during the whole given monitoring period. The electricity produced is sent to the substation located next to the power house and transported via two transmissions lines – 14 and 16 km[3], respectively - until the connection to the Brazilian Electric Grid. Two electricity-meters are installed to measure the net quantity of electricity exported to the grid, one for each bar, and there is another measuring point at the substation connected to the grid – this substation measures the electricity which is indeed exported, discounting the transmission losses. The monitoring system of net electricity export data is fully operational.

The pictures below presents the gas engines installed in the Power House, the substation, the electricity-meter and the transmission line from São João Landfill to the connection to the Brazilian Electric Grid.

[3] The 1st transmission line (14 km) is fully operational and the 2nd line with 16 km is scheduled to be operational in April, 2012.

Figure -14: Transmission Line 1 (14 km) which is fully operational (green colored) and Transmission Line 2 (16 km) which will be able to operate in April, 2012 (yellow colored).

Figure -15: Electricity-meter

A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

The project's name is "São João Landfill Gas to Energy Project" (SJ).

The methodology applied to SJ is **ACM0001 – version 02**, called "Consolidated baseline methodology for landfill gas project activities". The applicability conditions for ACM0001 have already been considered under the baseline section of the PDD. In fact, SJ is a project activity undertaken with the purpose of capturing and flaring methane from landfill operations, and also using this methane as fuel for a power plant, generating electricity that will avoid fossil fuelled plants at the margin of the Brazilian electricity system, therefore causing a reduction in GHG emissions. ACM0001 is therefore fully applicable to São João Landfill Gas to Energy Project.

The Monitoring Plan was developed based on **ACM0001 - version 02** of the **"Consolidated monitoring methodology for landfill gas project activities"**.

A.6. Registration date of the project activity:

The date of registration of the project is 02/07/2006.

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

SJ is in the first crediting period that had started on 22/05/2007. This period will finish on 21/05/2013, because the project proponent has chosen a renewable crediting period of 7 years. The crediting period was changed from 30/06/2006-29/06/2013.

A.8. Name of responsible person(s)/entity (ies):

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SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

1) The starting date of operation of the project activity: the degassing station had started on 01/06/2007 and the power plant had started on 01/04/2008.

2) There were four special events registered during this monitoring period, described below:

Event	Description	How the event was considered
1	On October 14th, the PP could generate less electricity than the normal because AES had problems in their system.	AES Eletropaulo had some problems in their system and the power plant couldn't export the generated electricity (TRIP Eletropaulo). There was an impact on FIR800; however a big part of the gas was flared. AES Eletropaulo realized a corrective maintenance in their system.
2	On October 17th, the PP could generate a small quantity of electricity because AES had problems in their system.	AES Eletropaulo had some problems in their system and the power plant couldn't export the generated electricity (TRIP Eletropaulo). It wasn't observed any impact related to the total gas flow during the maintenance period, because the gas was burned on the flares; however a small impact occurred in the electricity production. AES Eletropaulo realized a corrective maintenance in their system.
3	On December 23rd and 24th, the PP could generate a small quantity of electricity because AES had problems in their system.	AES Eletropaulo had some problems in their system and the power plant couldn't export the generated electricity (TRIP Eletropaulo). It wasn't observed any impact related to the total gas flow during the maintenance period, because the gas was burned on the flares; however a considerable impact occurred in the electricity production in both days 23 and 24/12. AES Eletropaulo realized a corrective maintenance in their system.
4	On January 07th, the PP could generate a small quantity of electricity because AES had problems in their system.	AES Eletropaulo had some problems in their system and the power plant couldn't export the generated electricity (TRIP Eletropaulo). It was observed a small impact related to the engine gas flow (FIR800) and in the electricity generation. AES Eletropaulo realized a corrective maintenance in their system.

3) During this monitoring period, 01/10/2011 to 31/01/2012, an average of 6 Caterpillar engines worked in the power plant. This happens because the gas production in the landfill is lower than the estimated in the PDD. The 3 flares installed in the degassing plant were in operation during the monitoring period however usually did not operate at the same time or were on standby when all gas was combusted in the generators.

No other events or rule/policy changes have taken place that could have affected the normal operation of the project and the applicability of the methodology.

B.2. Revision of the monitoring plan

The application of a new monitoring plan, as approved by the EB in 18/02/2008, including, among others:

- The use of a diesel generator to supply the project's electric needs from the beginning of the project's operation until January/2008, when the power house entered into operation. This source of project emission was considered in the calculation of emission reduction. However, this project emission source is in stand-by now as the electricity generated in the power house is used to supply the project's internal needs – the diesel generator is only turned on during black-outs of electricity generation. The diesel generator CO_2 emission factor was adopted based on a conservative value (1.3 tCO_2/MWh), according with the "Tool to calculate project emissions from electricity consumption (version 1)"

- Differently from Annex 4 – Monitoring Plan, 3 (three) flow-meters were installed instead of the 2 (two) mentioned: the first to measure the total flow, the second to measure the gas sent to the flares and the third to measure the methane sent to the power house, according with the revised Monitoring Plan approved by the EB;

- "The net quantity of electricity displaced" will be measured by an electricity meter. São João Landfill Gas to Energy Project will measure the total electricity fed into the grid (via an electricity-meter).

A new revision of the Monitoring Plan was requested by UNFCCC on February 15th, 2011, in order to include the recording frequency for the parameter "Regulatory requirements relating to landfill gas projects". The recording frequency adopted by the PP is monthly, which is more conservative that the annually frequency mentioned in the methodology applied in the São João Landfill Gas to Energy Project. On February 24th, 2011, PP/DOE uploaded through the UNFCCC CDM interface a request for revision of the monitoring plan for the CDM project activity "São João Landfill Gas to Energy Project (SJ)". The new revision of the monitoring plan was approved by EB in 09/04/2011.

B.3. Request for deviation applied to this monitoring period

During this monitoring period, no request for deviation has taken place.

B.4. Notification or request of approval of changes

A.2., A.4.3. and E.4. of the registered PDD mentioned an installed capacity of 20 MW for renewable electricity generation. As during the 5th and 6th verification period (period from 01/04/2008 to 30/06/2008 and 01/07/2008 to 30/09/2008, respectively) the installed capacity was of 21.56 MW (14 engines of each 1.54 MW) and later on (from the 7th verification period (01/10/2008 to 30/11/2008) on), the installed capacity increased to 24.64 MW (16 engines of each 1.54 MW), what is equivalent to the nominal installed capacity today, the DOE together with the PPs submitted on January 28, 2010 a "Request for approval of changes from project activity as described in the registered PDD" to UNFCCC.

From the registered PDD, the following main changes were presented:

- The application of a revised monitoring plan, as approved by the EB in 18/02/2008, as mentioned above, in B.2.

- The SJ Project was implemented, according to PDD revised, in three phases: Degassing Stations, Power Plant (with 14 engines) and acquisition of 2 new engines (the same model and capacity);

- The project was implemented with a total installed capacity of 24.64MW for electricity generation (16 engines of 1.54 MW each). This was equivalent to the total installed capacity for the Monitoring Period under consideration and two transmissions lines of around 14 and 16 km length respectively, however the latter one is not operational yet.

São João Project had its PDD revised according to the EB48, Annex 66/67. The changes do neither affect the additionality nor scale of the project nor applicability of neither the methodology nor its contribution to the Brazilian sustainable development as described further on in the revised PDD. The SJ PDD version 03, dated on December, 29th, 2009, was approved on 28/05/2010.

SECTION C. Description of the monitoring system

Monitoring Instruments:

The following instruments were installed in the Degassing Station, as per the revised Monitoring Plan:

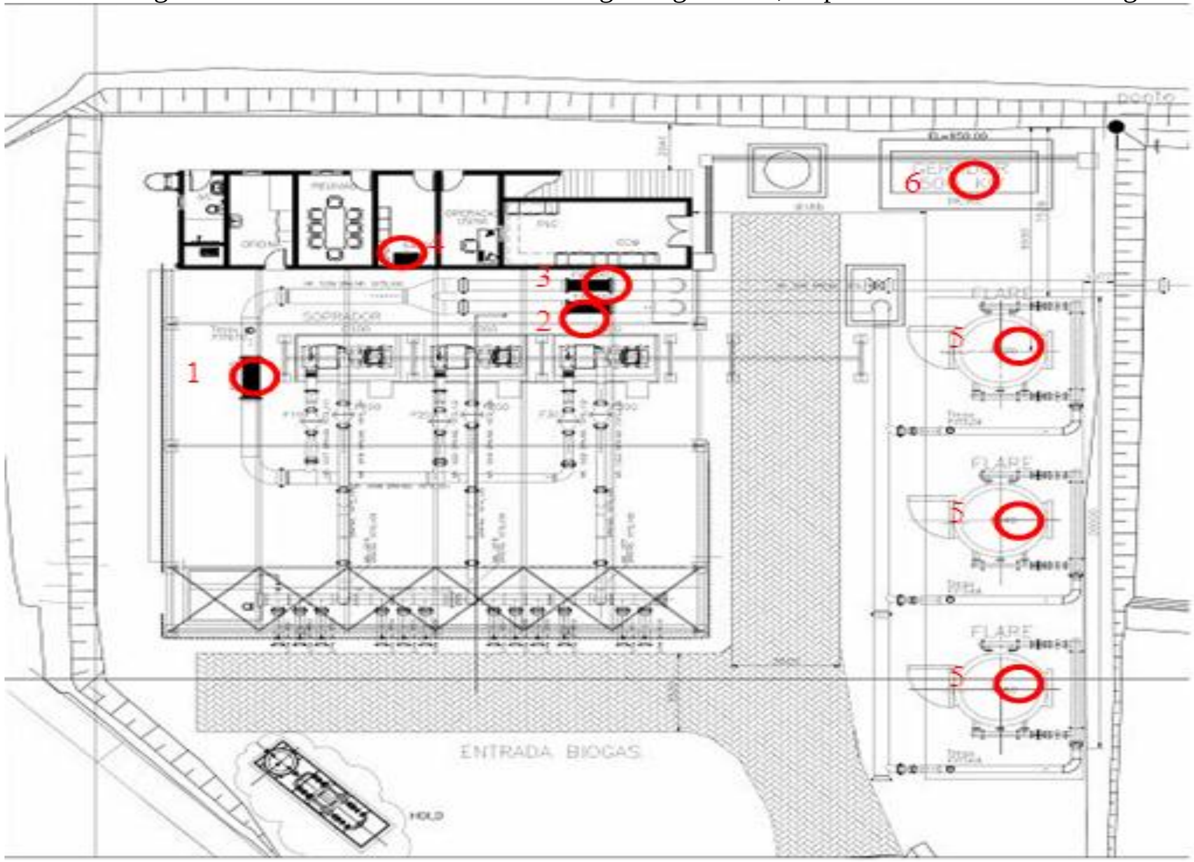

Figure -16.Lay-out of the Degassing Station

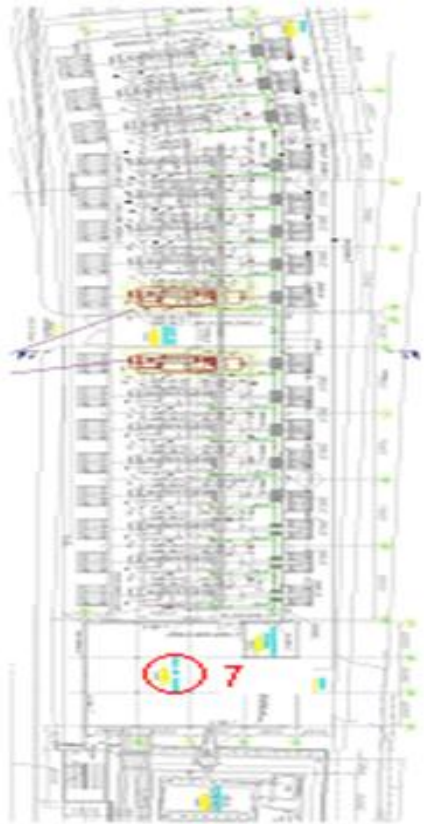

Figure -17.Lay-out of the Power Plant

1 – FIR600: Flow meter - Register the total amount of landfill gas captured;
2 – FIR500: Flow meter - Register the total amount of landfill gas flared;
3 – FIR800: Flow meter - Registered the total amount of landfill gas combusted in the Power plant
4 – Gas Analyzer: Measure the Methane fraction in the landfill;
5 – Temperature meters of the exhaust gas - Flares: F520, F540 and F560, respectively
6 – Electricity meter - Diesel generator
7 - Electricity meter - Substation

Methodology ID	Equipment Number	Equipment	Location	TAG	Manufacturer	Model	Range	Serial Number	Error (%)
$LFG_{Total, y}$	1	Turbine Flow-meter [4]	Main Line	FIR600	Instromet	SM-RI-X-K	1,300–25,000 m^3/h	10508423	0.4800
$LFG_{Flare, y}$	2	Turbine Flow-meters[4]	Line to Flares	FIR500	Instromet	SM-RI-X-K	800–16,000 m^3/h	10508421	0.9800
$LFG_{Electricity, y}$	3	Turbine Flow-meter [4]	Line to the Power House	FIR800	Instromet	SM-RI-X-K	800–16,000 m^3/h	10508422	1.2800
FE	5	(1) Temperature transmitters (thermocouples) (2) Chromatographer – analysis made by a Third Party	Flares F520, F540 and F560	(1) TAC520, TAC540 and TAC560 (2) N/A	(1) Jumo (all thermocouples) (2) N/A	(1) type "S" L750 (all thermocouples) (2) N/A	(1) 0-1500°C (all thermocouples) (2) N/A	N/A	N/A
$w_{CH4, y}$	4	Methane Analyzer	Analysis Room	A100	NUK-Emerson-	Binos 100	0-100%	120171639018	1.0000

[4] The Turbine flow-meters installed are connected to a pressure and temperature transmitters, which allows the device to use those variables to make the conversion automatically to Nm^3. Thus, readings from pressure and temperature were not monitored; however the errors from the transmitters were discounted from the final calculation (refer to E.1).

Methodology ID	Equipment Number	Equipment	Location	TAG	Manufacturer	Model	Range	Serial Number	Error (%)
					Rosemount				
EG_y [5]	7	Electricity Meters	Substation	N/A	Merlin Gerin	Power Logic - CM 4000	240V/300V - 96mA MAX.	32004234 32004233	1.0000
EC_y	6	Electricity Meter	Diesel Generator	N/A	Siemens	MMG 144	0-100 MWh	00400243415	0.5000

Depending on the parameter the, the frequency of the PLC's routine may vary, as presented in the table below:

Methodology ID	Equipment TAG	Reading Frequency	Transmition Frequency	Registration Frequency	Comments
$LFG_{Total, y}$	FIR600	Continuously	Continuously	Every 5 minutes (instant gas-flow) Every 1 hour (accumulated gas-flow)	– Data of instant gas-flow is registered every 5 minutes in the Supervisory System's hard disk, in Nm^3/h, using the readings from the pressure and temperature transmitters; – Data accumulated every 1 hour is registered in the Supervisory System's hard disk, in Nm^3, using the readings from the pressure and temperature transmitters; – Every 00:00, the PLC's counter is reseted; – The flow-computer installed in the flow-meter keeps registering the accumulated flow; – Every 3 hours, the accumulated flow (in Nm^3) is manually registered by the operators; – Every 1 hour, the operators perform a "Print-Screen" of the PLC Controlling System Panel, which presents the operational variables. – Responsibilities of the routine: PLC (continuously) and plant supervisor (monthly)
$LFG_{Flare, y}$	FIR500	Continuously	Continuously	Every 5 minutes (instant gas-flow) Every 1 hour (accumulated gas-flow)	
$LFG_{Electricity, y}$	FIR800	Continuously	Continuously	Every 5 minutes (instant gas-flow) Every 1 hour (accumulated gas-flow)	

[5] There are two electricity-meters installed at SJ – one in each bar. The electricity-meters are from the same manufacturer and are the same model.

Methodology ID	Equipment TAG	Reading Frequency	Transmition Frequency	Registration Frequency	Comments
FE	(1) TAC520, TAC540 and TAC560 (2) N/A	(1) Continuously (2) Every 3 months, by a specialized company on gas analysis	(1) Continuously (2) Every 3 months, by a specialized company on gas analysis	(1) Every 5 minutes (2) Every 3 months, by a specialized company on gas analysis	– Temperatures below 900°C indicates that the flare is running out of the specified combustion temperature range; – A sudden decrease of temperature indicates that the main valve of the flare is closed and no gas is being sent to the flare (please, refer to item 3.1.1) – The flare efficiency analysis is made according with internal procedures from the hired company
$w_{CH4, y}$	A100	Continuously	Continuously	Every 5 minutes	– By the end of the day, an average of CH_4 concentration (registered every 5 minutes) is calculated. – Responsibilities of the routine: PLC (continuously) and plant supervisor (monthly)
Regulatory requirements relating to landfill gas projects	Green Solutions Database	Monthly	N/A	N/A	– Biogás has a data base named "Green Solutions" which contains all the National Environmental Legislation applicable to the Project. The Green Solutions was developed and updated by a consultancy specialized in Environmental Legislation.
EG_y	EM100	Continuously	Continuously	Every 1 hour	– Data accumulated every 1 hour in the Power House's Supervisory System's hard disk, in MWh; – Every 00:00, the PLC's counter is reseted; – Responsibilities of the routine: PLC (continuously) and power plant supervisor (monthly)
EC_y	N/A	Continuously	Continuously	Every 1 hour (accumulated electricity consumption)	– The electricity-meter keeps accumulating the electricity consumed; – When the meter reaches 100 MWh, the count is reseted. – Responsibilities of the routine: PLC (continuously) and plant supervisor (monthly)

Involvement of Third Parties

SJ has three third parties involved (directly and indirectly):

- Specialized company on gas analysis, to perform the analysis of methane concentration in the exhaust gas. For this monitoring period, Biogás hired CORPLAB, a national certified laboratory.

- NEXT Automation, the company responsible for the automation of the system;

- ARCADIS Tetraplan is the company responsible to develop the Monitoring Report and is part of the quality assurance/quality control procedures.

Quality assurance and quality control measures

Internal Procedures

Biogás counts with the internal procedure PO-005 which objective is to specify the monitoring procedures made inside the Degassing Station, as gas flows, temperature, pressure, electricity generation and methane concentration.

As presented above all parameters monitored inside the Degassing Station has the same reading / transmitting / registration routine and all routines have one person responsible: the plant supervisor.

Every week, the plant supervisor downloads all data registered from the PLC and makes a complete check to identify unconformities, such as unread registrations or troubles with the PLC (this unconformities happens mainly due to electricity black-outs). All unconformities raised are promptly compared with operational events, registered by the operators in the Operation Diary. The event is informed to the Production Manager of Biogás, which is responsible for taking the necessary actions to avoid it to happen again.

In order to avoid data loss, the operators are oriented to register all gas flow data manually in proper sheets every 3 hours, which are verified by the production manager weekly for legibility. Manual records are transferred to an Excel sheet (which is double-checked with a sheet developed by ARCADIS Tetraplan). Additionally, the operators are oriented to perform a “Print-Screen” of the PLC Controlling System Panel every hour. The picture printed presents all monitoring parameters and is saved in the computer’s hard disk.

Also, the SJ count with a third-party, non-responsible for the project’s monitoring: ARCADIS Tetraplan, which is the responsible for the development of the Monitoring Report. ARCADIS Tetraplan’ role in the Project is to assure the quality of the registered data, through a double-check process, and to assure the quality of the calculation of ERs and is in constant contact with the Production Manager of Biogás.

Biogás has, until now, no intention to implement EMS such as ISO 14001 in SJ.

Other procedures developed at SJ are:

PO-001: Procedure about re-starting the plant after an electricity breakdown

PO-002: Calibration of methane analyzer

PO-003: Calibration of valve (flare)

PO-004: Service orders and maintenance
PO-005: Procedure of monitoring parameters (including calibration plan)
PO-006: Procedure about internal monitoring of São João
PO-007: Procedure about workers control
PO-008: Procedure for the elaboration of the monthly operational report
PO-009: Procedure in emergency situations
PO-010: Procedure for data back-up of the supervisory system
PO-011: Procedure for manual data collection
PO-012: Instruction for Refueling the Diesel Device
PO-013: Identification of legal and other requirements
PO-014: Administrative Procedure

Organizational Structure, responsibilities and competencies

Positions and roles for this CDM project activity are well defined. From the point of view of the plant operation, positions and roles are defined. Duties, personnel replacement in the case of non-availability of the supervisor of monitoring and/or the electrical supervisor and hiring requirements for job positions are determined in documented procedures, as presented in the figures below:

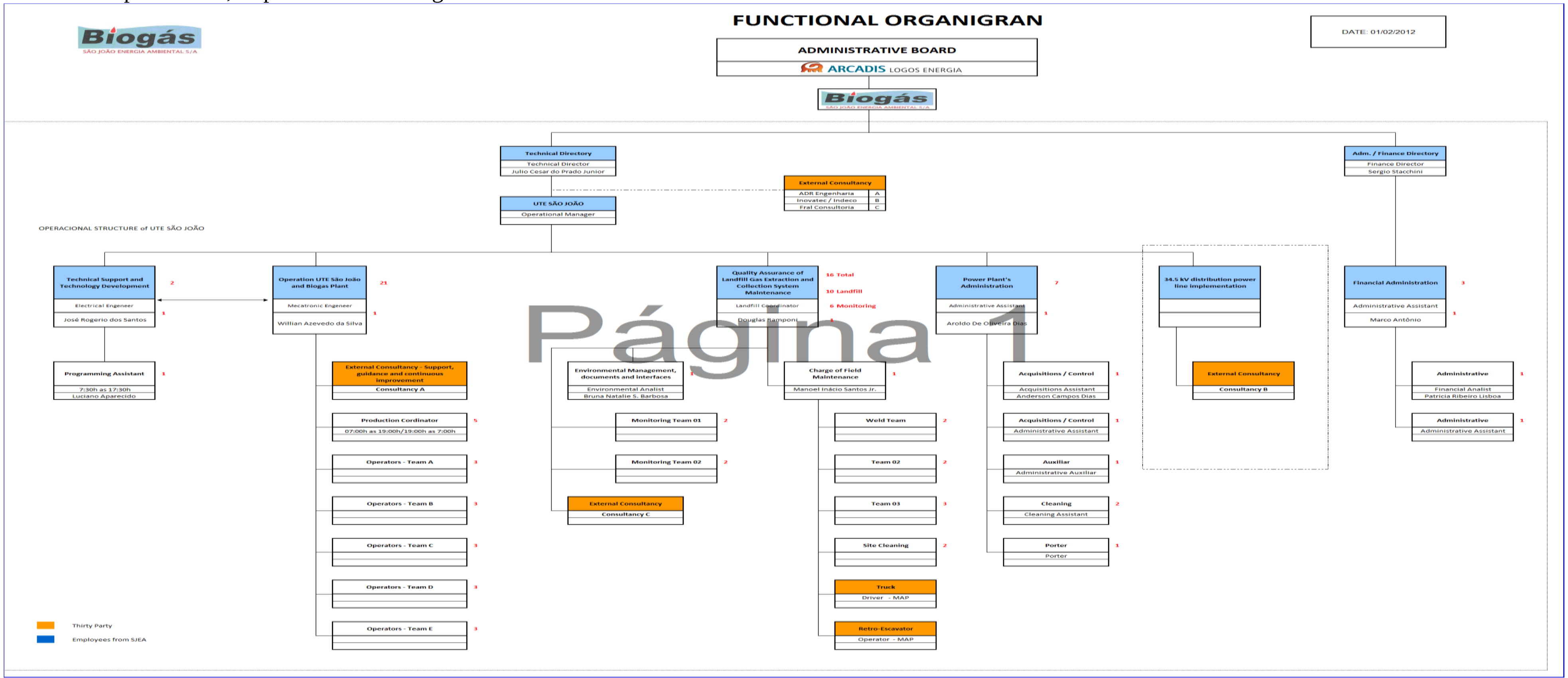

Figure -18. General Organogram of SJ

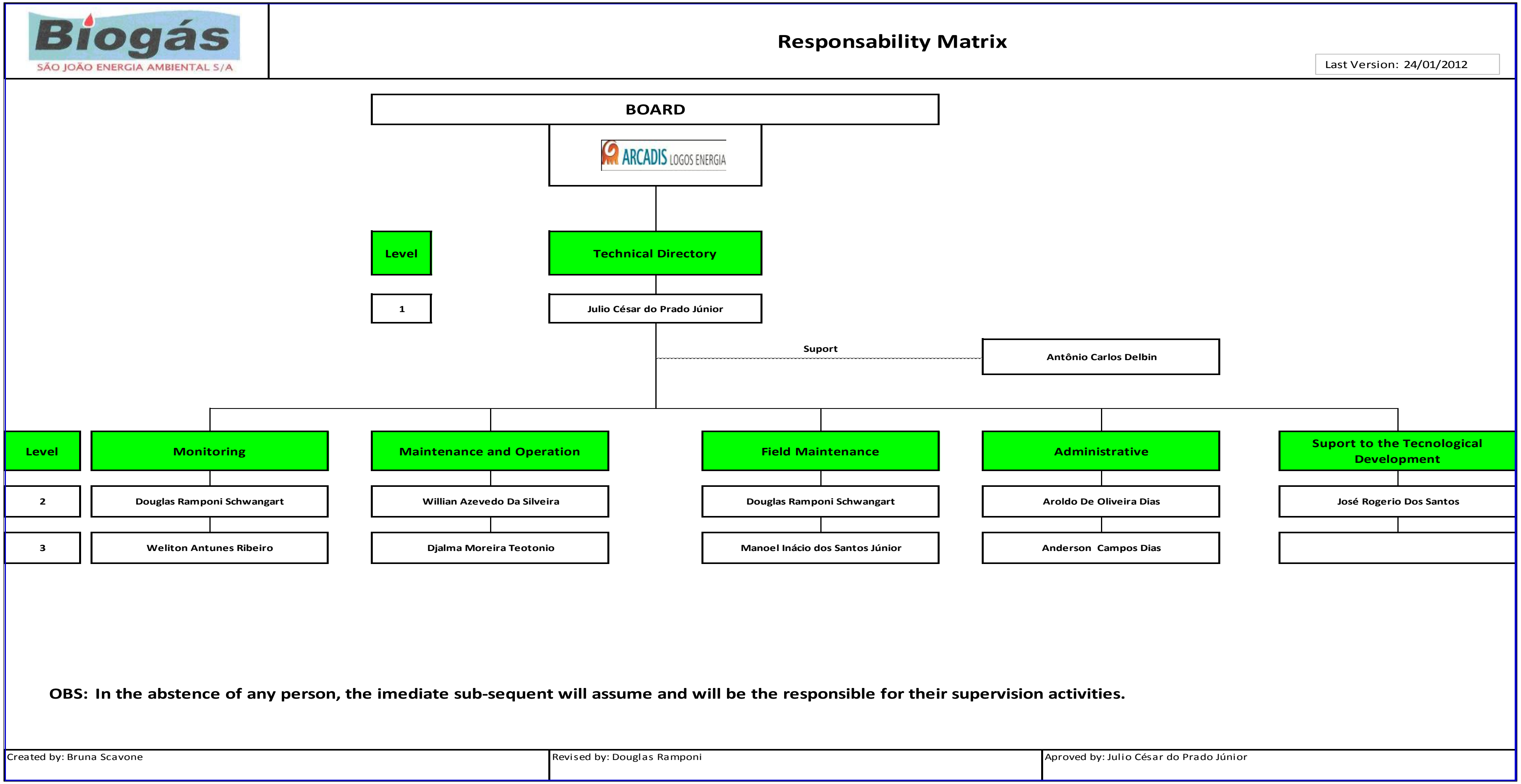

Figure -19. Responsibility Matrix of SJ

Trainings

All training was supplied to operators and technical assistants before the project's implementation. The training certificates were presented to the Verification Team.

For this monitoring period no new employee was hired:

The new operators before starts the job, realized the training, composed by:

- How to operate and start the plant;
- Reading instruments and recording of reports;
- Verification and calibration of gas analyzer;
- Maintenance of equipment.
- Data Protection Measures.

As all data registered in the Supervisory System's hard disk is subjected to sabotage and technical failure, Biogás developed the following actions to protect the monitoring system:

- The PLC is not connected to the Internet, thus the risk of virus is minimized;
- Only defined persons have access to the data base of the system;
- Antivirus programs are installed at the system;
- Data backup:
  - A weekly CD backup of the Supervisory System's hard disk;
  - A weekly backup of the Supervisory System's hard disk is made by the server of Arcadis LOGOS (Biogás shareholders);
  - ARCADIS Tetraplan downloads regularly the primary data for the elaboration of the monitoring report.

SECTION D. Data and parameters

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2e/tCH_4
Description:	Global Warming Potential value for methane
Source of data used:	1996 IPCC Guideline for National Greenhouse Gas Inventory
Value(s) :	21
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline calculation
Additional comment:	N/A

Data / Parameter:	**$\rho_{CH4,n,h}$**
Data unit:	tCH_4/m^3CH_4
Description:	Density of methane gas at standard temperature and pressure

Source of data used:	1996 IPCC Guideline for National Greenhouse Gas Inventory
Value(s) :	0.0007168
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline calculation
Additional comment:	N/A

Data / Parameter:	**(ID - 10) EF_y**
Data unit:	**tCO2e/MWh**
Description:	Emission Factor of Diesel Engines
Source of data used:	Project participant
Value(s) :	1.3 tCO_2e/MWh
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline calculation
Additional comment:	N/A

Data / Parameter:	**(ID – 8) CEF_y**
Data unit:	**tCO2e/MWh**
Description:	CO_2 emission intensity of the electricity
Source of data used:	Brazilian Grid
Value(s) :	0.2677 tCO_2e/MWh
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline calculation
Additional comment:	N/A

Data / Parameter:	**AF**
Data unit:	**%**
Description:	Adjustment Factor
Source of data used:	PDD registered
Value(s) :	20%
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline calculation
Additional comment:	N/A

D.2. Data and parameters monitored

Data / Parameter:	**(ID – 1) $LFG_{Total, y}$**
Data unit:	Nm^3
Description:	Total amount of landfill gas captured from the landfill site in normal cubic meters at standard temperature and pressure
Measured /Calculated	Measured

/Default:	
Source of data:	PLC data records
Value(s) of monitored parameter:	These values are indicated in table E.1.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	The data flow generated from FIR600 is actually used to realize the cross-checking of the other flow meters. These values of the total gas flow are not used to calculate the amount of CERs.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<table><tr><th>Equipment</th><th>TAG</th><th>Manufacturer</th><th>Model</th><th>Serial Number</th><th>Error (%)</th><th>Date of the last calibration</th><th>Date of the next calibration</th></tr><tr><td>Turbine Flow-meters</td><td>FIR600</td><td>Instromet</td><td>SM-RI-X-K</td><td>10508423</td><td>0.480</td><td>23/05/2007</td><td>23/05/2012</td></tr><tr><td>Pressure Transmitter</td><td>FIR.600</td><td>Yokogawa</td><td>91G216023 – 2007</td><td>91G216023</td><td>0.030</td><td>15/05/2007</td><td>15/05/2012</td></tr><tr><td>Temperature Transmitter</td><td>FIR600</td><td>Yokogawa</td><td>C2F622018 – 2007</td><td>C2F6018</td><td>0.020</td><td>15/05/2007</td><td>15/05/2012</td></tr></table>
Measuring/ Reading/ Recording frequency:	Data is continuously measured by a flow meter. Measurements of the flow are recorded electronically by PLC at least each five minutes and the hourly value is accumulated. The data is archived electronically. The reading frequency is continuously and registered by the PLC.
Calculation method (if applicable):	N/A
QA/QC procedures applied:	The procedure PO – 005: Procedure of monitoring parameters (including calibration plan) explains how the maintenance and testing are realized and also explains that the operator must check the operational conditions for all the equipment/instruments, at least once a day. In the flow meters case if the operator identifies some problem, the instrument must be replaced or calibrated. If the operator doesn’t find any abnormality, the instrument will be calibrated or replaced by another one already calibrated every five years.

Data / Parameter:	**(ID – 2) $LFG_{Flare,y}$**
Data unit:	Nm³
Description:	Amount of landfill gas to flares from the landfill site in normal cubic meters at standard temperature and pressure
Measured /Calculated /Default:	Measured
Source of data:	PLC data records
Value(s) of monitored parameter:	These values are indicated in table E.1.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	<table><tr><th>Equipment</th><th>TAG</th><th>Manufacturer</th><th>Model</th><th>Serial Number</th><th>Error (%)</th><th>Date of the last calibration</th><th>Date of the next calibration</th></tr><tr><td>Turbine Flow-meters</td><td>FIR500</td><td>Instromet</td><td>SM-RI-X-K</td><td>10508421</td><td>0.980</td><td>23/05/2007</td><td>23/05/2012</td></tr></table>

<table>
<tr><td></td><td>
<table>
<tr><td>Pressure Transmitter</td><td>FIR500</td><td>Yokogawa</td><td>EJA - 510A</td><td>91G216021 - 2007</td><td>0.010</td><td>15/05/2007</td><td>15/05/2012</td></tr>
<tr><td>Temperature Transmitter</td><td>FIR500</td><td>Yokogawa</td><td>YTA-110</td><td>C2G311000-2007</td><td>0.030</td><td>15/05/2007</td><td>15/05/2012</td></tr>
</table>
</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>Data is continuously measured by a flow meter. Measurements of the flow are recorded electronically by PLC at least each five minutes and the hourly value is accumulated. The data is archived electronically. The reading frequency is continuously and registered by the PLC.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>N/A</td></tr>
<tr><td>QA/QC procedures applied:</td><td>The procedure PO – 005: Procedure of monitoring parameters (including calibration plan). This procedure explains how the maintenance and testing are realized and also explains that the operator must check the operational conditions for all the equipment/instruments, at least once a day. In the flow meters case if the operator identifies some problem, the instrument must be replaced or calibrated. If the operator doesn’t find any abnormality, the instrument will be calibrated or replaced by another one already calibrated every five years.</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>(ID – 3) $LFG_{Electricity, y}$</td></tr>
<tr><td>Data unit:</td><td>Nm^3</td></tr>
<tr><td>Description:</td><td>Amount of landfill gas to power house from the landfill site in normal cubic meters at standard temperature and pressure</td></tr>
<tr><td>Measured /Calculated /Default:</td><td>Measured</td></tr>
<tr><td>Source of data:</td><td>PLC data records</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td>These values are indicated in table E.1.</td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Baseline emission calculation</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td>
<table>
<tr><th>Equipment</th><th>TAG</th><th>Manufacturer</th><th>Model</th><th>Serial Number</th><th>Error (%)</th><th>Date of the last calibration</th><th>Date of the next calibration</th></tr>
<tr><td>Turbine Flow-meters</td><td>FIR800</td><td>Instromet</td><td>SM-RI-X-K</td><td>10508422</td><td>1.280</td><td>23/05/2007</td><td>23/05/2012</td></tr>
<tr><td>Pressure Transmitter</td><td>FIR800</td><td>Yokogawa</td><td>EJA - 510A</td><td>91G216022 - 2007</td><td>0.010</td><td>15/05/2007</td><td>15/05/2012</td></tr>
<tr><td>Temperature Transmitter</td><td>FIR800</td><td>Yokogawa</td><td>YTA-110</td><td>C2G311001 – 2007</td><td>0.100</td><td>15/05/2007</td><td>15/05/2012</td></tr>
</table>
</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>Data is continuously measured by a flow meter. Measurements of the flow are recorded electronically by PLC at least each five minutes and the hourly value is accumulated. The data is archived electronically. The reading frequency is continuously and registered by the PLC.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>N/A</td></tr>
<tr><td>QA/QC procedures applied:</td><td>The procedure PO – 005: Procedure of monitoring parameters (including calibration plan). This procedure explains how the</td></tr>
</table>

<table>
<tr><td></td><td>maintenance and testing are realized and also explains that the operator must check the operational conditions for all the equipment/instruments, at least once a day. In the flow meters case if the operator identifies some problem, the instrument must be replaced or calibrated. If the operator doesn’t find any abnormality, the instrument will be calibrated or replaced by another one already calibrated every five years.</td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>(ID – 4) $FE_{F520/F540/F560}$</td></tr>
<tr><td>Data unit:</td><td>(1) °C
(2) mg/Nm^3</td></tr>
<tr><td>Description:</td><td>(1) Temperature of the exhaust gas in the flares F520/F540/F560
(2) Methane content of flare exhausts gas.</td></tr>
<tr><td>Measured /Calculated /Default:</td><td>(1) Measured
(2) Measured and Calculated</td></tr>
<tr><td>Source of data:</td><td>(1) PLC data records
(2) Analyses made by a third party.</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td>These values are indicated in table E.1.</td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Baseline emission calculation</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td>
<table>
<tr><th>Equipment</th><th>TAG</th><th>Manufacturer</th><th>Model</th><th>Serial Number</th><th>Error (%)</th><th>Date of the last calibration</th><th>Date of the next calibration</th></tr>
<tr><td>(1) Thermocouple</td><td>(1) TAC520 TAC540 TAC560</td><td>(1) Jumo</td><td>(1) type "S" L750</td><td rowspan="2">(1)1534-00 (1)3562-00 (1)4404-00</td><td rowspan="2">N/A</td><td rowspan="2">N/A</td><td rowspan="2">N/A</td></tr>
<tr><td>(2) Chromatographer – analysis made by a Third Party</td><td>(2)N/A</td><td>(2) N/A</td><td>(2) N/A</td></tr>
</table>
</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>(1) Data is measured by thermocouples installed in the flares and the reading frequency is continuously. Measurements of the temperature of the exhaust gas are recorded electronically by PLC at least each five minutes and once per hour. The data is archived electronically.
(2) The data is measured with a chromatographer each three months by a specialized lab – CORPLAB, as explained on item E.1.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>(1) N/A
(2) Flare Efficiency Spreadsheet.</td></tr>
<tr><td>QA/QC procedures applied:</td><td>Regular maintenance will ensure optimal operation of flares. Flare efficiency should be checked quarterly, with monthly checks if the efficiency shows significant deviations from previous values. This is mentioned in the procedure PO – 005: Procedure of monitoring parameters (including calibration plan) that explains how the maintenance and testing are realized and also explains that the operator must check the operational conditions for all the equipment/instruments, at least once a day. The calibration is not applicable; however the thermocouple respects the</td></tr>
</table>

	demands from Standard EN 60584.

Data / Parameter:	**(ID – 5) $W_{CH4,y}$**
Data unit:	**m^3CH4/m^3LFG**
Description:	Methane fraction in the landfill gas.
Measured /Calculated /Default:	Measured
Source of data:	PLC data records.
Value(s) of monitored parameter:	These values are indicated in table E.1.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Manufacturer: Rosemount - NUK Type: Binos 100 TAG: A400 Accuracy class: 1.0000% (error) Serial number: 120171639018 Calibration frequency: weekly calibration throughout the monitoring period with a standard gas Date of last calibration which affected this Monitoring Period: 24/01/2012. Validity: Each calibration is valid for one week.
Measuring/ Reading/ Recording frequency:	The data is continuously measured by the gas analyzer and recorded electronically by PLC at least each five minutes and once per hour, instantaneously. The reading frequency is continuously and registered by the PLC.
Calculation method (if applicable):	N/A
QA/QC procedures applied:	The gas analyser will be subject to a regular maintenance and testing regime to ensure accuracy. This is mentioned in the procedure PO – 005: Procedure of monitoring parameters (including calibration plan) that explains how the maintenance and testing are realized and also explains that the operator must check the operational conditions for all the equipment/instruments, at least once a day. The operation team performs a daily check list of the instrument to detect leaks and other defects. The filter replacement is performed when the team deems necessary. The calibration is also performed to detect possible flaws in the gas analyser.

Data / Parameter:	**(ID - 6) Regulatory requirements**
Data unit:	Test
Description:	Regulatory requirements relating to landfill gas projects
Measured /Calculated /Default:	N/A
Source of data:	National environmental legislation and data base “Green Solution”
Value(s) of monitored parameter:	Required for any changes to the adjustment factor (AF) or directly MDreg,y
Indicate what the data are used for (Baseline/ Project/	Baseline emission calculation

Leakage emission calculations)	
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	N/A
Measuring/ Reading/ Recording frequency:	The recording frequency is yearly.[6]
Calculation method (if applicable):	N/A
QA/QC procedures applied:	Required for any changes to the adjustment factor (AF) or directly $MD_{reg,y}$

Data / Parameter:	**(ID – 7) EG_y**
Data unit:	**MWh**
Description:	Net quantity of electricity delivered to the grid which is produced by using LFG under the project activity.
Measured /Calculated /Default:	Measured
Source of data:	PLC data records
Value(s) of monitored parameter:	See section E.1.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Manufacturer: Merlin Gerin Type: Power Logic – CM4000 TAG: Not applicable Accuracy class: 1.0000% Serial number: 32004234 / 32004233 Calibration frequency: 2 years Date of last calibration: 03/08/2010 Validity: 03/08/2012
Measuring/ Reading/ Recording frequency:	The data is measured by electricity meter installed at the project site and the connected substation. The reading frequency from the electricity meter is continuously and the recording frequency is hourly. AES Eletropaulo sends the registered data for Biogás. Double-check by electricity generated is realized and the lower values between SJ PLC data records and AES Eletropaulo sales receipt data are used for the CER calculation.
Calculation method (if applicable):	N/A
QA/QC procedures applied:	If Biogas operator identifies some problem, the instrument must be replaced or calibrated. If the operator doesn't find any abnormality, the

[6] Even though the revised monitoring plan/methodology mention as "Recording Frequency" yearly period, actually the database named Green Solutions is updated monthly by a consultancy specialized in Environmental Legislation.

	instrument will be calibrated or replaced by another one already calibrated each 2 years. According to Biogas is very easy to identify if the instrument is not working because it can be checked by the daily registered data and the monthly production sheet.

Data / Parameter:	**(ID – 9) EC_y**
Data unit:	**MWh**
Description:	Electricity consumed from the diesel generator
Measured /Calculated /Default:	Measured
Source of data:	PLC data records
Value(s) of monitored parameter:	See section E.1.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project emission calculation
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Manufacturer: Siemens Type: MMGE 144 TAG: Not applicable Accuracy class: 0.5000% Serial number: 220000226101 Calibration frequency: 5 years Date of last calibration: 23/05/2007 Validity: 23/05/2012
Measuring/ Reading/ Recording frequency:	Directly measured by electricity meter installed at the project site and the connected to the PLC. The data is registered every minute in the PLC's database. The data is monitored and archived electronically. The reading frequency from the electricity meter is continuously and the recording frequency is hourly.
Calculation method (if applicable):	N/A
QA/QC procedures applied:	If Biogas operator identifies some problem, the instrument must be replaced or calibrated. If the operator doesn't find any abnormality, the instrument will be calibrated or replaced by another one already calibrated each five years. According to Biogas is very easy to identify if the instrument is not working because it can be checked by the daily registered data and the monthly production sheet.

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

According with baseline methodology ACM0001 – version 02, Emission Reductions are calculated as follows:

$$ER_y = \left(MD_{project,y} - MD_{reg,y}\right) \times GWP_{CH4} + EG_y \times CEF + ET_y \times CEF_{thermal,y} \quad (1)$$

Where:

ER_y = Emission reduction achieved by the project activity during a given year y (tCO_2e);
$MD_{project,y}$ = Amount of methane actually destroyed/combusted during the year y (tCH_4);

$MD_{reg,y}$ = Amount of methane that would have been destroyed/combusted during the year *y* in the absence of the project activity (tCH_4);
GWP_{CH4} = Global Warming Potential value for methane (tCO_2e/tCH_4);
EG_y = Net quantity of electricity displaced during the year *y* (MWh)
$CEF_{electricity,y}$ = CO_2 emissions intensity of the electricity displaced (tCO_2e/MWh)
ET_y = Quantity of thermal energy displaced during the year *y* (TJ)
$CEF_{thermal,y}$ = CO_2 emissions intensity of the thermal energy displaced (tCO_2e/TJ).

$MD_{project,y}$ is calculated as the sum of methane flow destroyed in the flares, in the power house and in the heat generation, as follows:

$$MD_{project,\ y} = MD_{flared,\ y} + MD_{electricity,\ y} + MD_{thermal,\ y} \quad (2)$$

Where:

$MD_{flared,y}$ = quantity of methane destroyed in the flares in year *y* (tCH_4)
$MD_{electricity,y}$ = quantity of methane destroyed by the generation of electricity *y* (tCH_4);
$MD_{thermal,y}$ = quantity of methane destroyed for the generation of thermal energy in year *y* (tCH_4)

As São João Landfill Gas to Energy Project does not use the methane to generate thermal energy, $MD_{thermal,y} = 0$.

$MD_{flared,y}$ is calculated as follows:

$$MD_{flared,\ y} = LFG_{flared,y} \times w_{CH4} \times D_{CH4} \times FE \quad (3)$$

Where:

$MD_{flared,y}$ = Quantity of methane destroyed by flaring (tCH_4);
$LFG_{flare,y}$ = Quantity of landfill gas flared during the year measured in cubic meters (Nm^3);
$w_{CH4,y}$ = Average methane fraction of the landfill gas as measured during the year and expressed as a fraction (m^3_{CH4}/m^3LFG)
FE = Flare efficiency (%);
D_{CH4} = Methane density expressed in tones of methane per cubic meter of methane (tCH_4/m^3_{CH4});

$MD_{electricity,y}$ is calculated as follows:

$$MD_{electricity,\ y} = LFG_{electricity,y} \times w_{CH4} \times D_{CH4} \quad (4)$$

Where:

$MD_{electricity,y}$ = Quantity of methane destroyed by generation of electricity (tCH_4);
$LFG_{electricity,y}$ = quantity of landfill gas fed into electricity generator (Nm^3);
$w_{CH4,y}$ = Average methane fraction of the landfill gas as measured during the year and expressed as a fraction (m^3_{CH4}/m^3LFG)
D_{CH4} = Methane density expressed in tones of methane per cubic meter of methane (tCH_4/m^3_{CH4});

Thus, $MD_{project,y}$ is equal to:

$$MD_{project,\ y} = \left(LFG_{flared,y} \times w_{CH4} \times D_{CH4} \times FE\right) + \left(LFG_{electricity,y} \times w_{CH4} \times D_{CH4}\right) \quad (5.1)$$

$$MD_{project,\ y} = w_{CH4} \times D_{CH4} \times \left(LFG_{flared,y} \times FE + LFG_{electricity,y}\right) \quad (5.2)$$

The amount of methane that would have been destroyed/combusted during the year *y* in the absence of the project activity ($MD_{reg,\,y}$) is calculated adopting an “Adjustment Factor” (AF), as no regulatory or contractual requirements specifying a quantity of methane destruction exists. As will be presented below, the *AF* adopted for the 1st Crediting Period is equal to 20% of total gas collected. Thus, equation (1) is updated to:

$$ER_y = \left(MD_{project,y} - 0.2 \times MD_{project,y}\right) \times GWP_{CH4} + EG_y \times CEF + ET_y \times CEF_{thermal,\,y} \qquad (6.1)$$

As São João Landfill Gas to Energy Project does not displace thermal energy, $ET_y = 0$ and equation 6.1 is updated to:

$$ER_y = \left(0.8 \times MD_{project,y}\right) \times GWP_{CH4} + EG_y \times CEF \qquad (6.2)$$

Additionally, electricity consumption from the diesel generator times a conservative diesel CO_2 emission factor was subtracted from equation 6.2, resulting in:

$$ER_y = \left(0.8 \times MD_{project,y}\right) \times GWP_{CH4} + EG_y \times CEF - EC_y \times EF \qquad (6.3)$$

Where:

EC_y = Electricity consumed from the diesel generator (MWh);
EF = Diesel CO_2 emission factor, based on a conservative value (tCO_2/MWh);

A description and consideration of measurement uncertainties and error propagation will be presented and detailed along this item.

Calculation of FE – Flare Efficiency

To calculate the Flare Efficiency, the following formulae were applied, based on the mass-balance (an Excel spreadsheet was evidenced to the Verification Team):

Calculate the volume of CH_4 sent to flares F_i ($Flow_{methane}$), measured by FIR500:

$$Flow_{methane} = Flow_{FIR500} \times \frac{\%_{methane}}{100}$$, where:

- Flowmethane = methane flow sent to the flare Fi (Nm3/h);
- FlowFIRi = total flow measured by the flow-meter FIR500 sent to the flare Fi (Nm3/h);
- % methane = methane measured by the gas analyzer (%);

Calculate the volume of other gases (residual gases) sent to flares ($Flow_{remaining}$):

$$Flow_{remaining} = Flow_{FIR500} - Flow_{methane}$$, where:

- Flow remaining = flow of residual gases sent to the flare Fi (Nm3/h);

Calculate the total flow entering the flare F_i ($Flow_{Total}$):

$$Flow_{Total} = Flow_{methane} + (Flow_{methane} \times air_{ratio}) + Flow_{remaining},$$

Where:

- Flowtotal = total gas sent to the flare Fi (Nm3/h);
- air_{ratio} = theoretical air ratio[7];

Calculate the mass of methane in the exhaust gas ($M_{methane}$):

$$M_{methane} = Flow_{Total} \times \frac{CH_{4,eg}}{1000}$$, where:

- $M_{methane}$ = amount of methane remaining in the exhaust gas (g), calculated using the result of the analysis;
- $CH_{4,\ eg}$ = methane concentration in the exhaust gas (mg/Nm^3) – data acquired from the analysis form the specialized company;

Calculate the Flare Efficiency (FE):

$$FE = \frac{(Flow_{methane} \times 0.7168) - \frac{M_{methane}}{1000}}{(Flow_{methane} \times 0.7168)} \times 100$$, where:

- FE = Flare Efficiency (%);
- 0.7168 = density of methane, at STP (kg/Nm^3).

During this monitoring period, CORPLAB/ESAAT[8] performed three analyses of the methane content in the exhaust gas of the flares F520, F540 and F560 in the following days: 01/07/2011, 03/10/2011 and 03/01/2012. The table below presents the methane concentration results.

Flare	July/2011 (Report 210111/2011.3)	October/2011 (Report 210111/2011.4)	January/2012 (Report MC 1112.16)
F520	3.37 mg/Nm^3	1.36 mg/Nm^3	0.43 mg/Nm^3
F540	2.17 mg/Nm^3	1.14mg/Nm^3	1.36 mg/Nm^3
F560	2.11 mg/Nm^3	1.50 mg/Nm^3	0.71 mg/Nm^3

Other parameters used to calculate the flare efficiency were:

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[7] Air_{ratio} is equal to 5, as recommended by Hoffstetter, the flare manufacturer.

[8] Since January/2011 Corplab has a new name: Corplab/ESAAT.

Measurement	$Flow_{FIR500}$			$\%_{methane}$		
	F520	F540	F560	F520	F540	F560
July/2011	4,507.8462 Nm^3/h	4,107.5077 Nm^3/h	4,087.0769 Nm^3/h	44.4708%	44.3046%	44.0677%
October/2011	1,364.7384 Nm^3/h	1,1786.2923 Nm^3/h	1,1563.3538 Nm^3/h	44.2446%	42.4307%	41.2846%
January/2012	3,142.9385 Nm^3/h	2,679.7077 Nm^3/h	2,712.0769 Nm^3/h	45.5738%	45.2815%	43.9077%

The results were:

Measurement	Flare Efficiency Calculated		
	F520	F540	F560
July/2011	99.9966%	99.9978%	99.9979%
October/2011	99.9986%	99.9988%	99.9984%
January/2012	99.9996%	99.9986%	99.9993%

In order to adopt a conservative approach, the lowest efficiency calculated through the methane content among the three flares was adopted. The table below resumes the period and the flare efficiency considered.

Period		Flare Efficiency Adopted
From	To	
01/10/2011	02/10/2011	99.9966%
03/10/2011	02/01/2012	99.9984%
03/01/2012	31/01/2012	99.9986%

The flare efficiency assumed from 01/10/2011 to 02/10/2011 was 99.9966%; the flare efficiency from 03/10/2011 to 02/01/2012 was 99.9984% and the the flare efficiency from 03/01/2012 to 31/01/2012 was 99.9986% (the lowest efficiencies calculated).

Monitoring of the operation time of the flares is made continuously by the PLC and every 5 minutes the instantaneously flare temperature is registered by the supervisory system. In order to guarantee the real destruction of the gas, the flares are equipped with an automatic system which can detect the existence of flame. The following operational procedure is applied:

- a signal of gas being collected is sent to the PLC, which sends a signal to a solenoid valve;
- the valve is opened and a small amount of gas is delivered to an ignition burner;
- the ignition burner ignites the gas;
- an UV-sond (part of the ignition burner) verifies the existence of an stable flame – if not, the flare is stopped;
- if the stable flame detection is successful, the UV-sond sends a signal to the PLC, which then opens the main valve, located in the entrance of the flare;
- the main burner is ignited and gas begins to be destroyed;
- after a few seconds, the ignition burner is switched off and UV-sond begins to monitor the existence of flame in the flare – if no flame is detected, the flare will be automatically stopped by a signal sent from the UV-sond to the PLC;

According with the manufacturer, if the temperature of the flare is higher than 1,350°C, the flare will be stopped automatically and if the temperature is below 900°C an alarm indicates to the operator that the flare is running out of the specified combustion temperature range.

If temperature decreases significantly from one registration to another (5 minutes interval), it means that the main valve is closed – the flare is stopped and no gas is being burned. It can be confirmed that no gas is being burned by the instant reading of gas flow from the flow-meter FIR500, installed right before the flares entrances.

However, in some readings it was detected that the flare accepted gas, but with a combustion chamber temperature below 900°C. It happened because between a 5 minutes interval the flare might have stopped and turned on again (e.g. the flare was stopped at 10:01 and turned on 10:04, not remaining enough time to register a temperature above 900°C). To discount the values below 900°C, the following procedure was applied:

- An hourly average of flares temperature was calculated, considering the temperature registers when the instant gas-flow was above 0 Nm^3/h (flares are accepting gas);
- Gas flow (FIR 500) is considered for the CER calculation only in the case when:
  a) all three flares´ temperature is above 900°C; or
  b) one flare´s temperature is above 900°C and the other two flares indicate temperature of 0°C;

Proper Excel sheets applying the above mentioned procedure were presented to the Verification Team.

Moreover, the flares are equipped with an hour-meter, which measures the accumulated operating hours of the flares. Despite of not being registered by SJ's computer supervisory system, Van der Wiel, one of Biogás shareholders, makes the registration of these accumulated operating hours of the flares every 00:01 via CARS, a system which allows Van der Wiel to have total access to the PLC of SJ.

PP has monthly worksheets to calculate the hourly average of the flares temperature (as detailed above) and for this monitoring period the worksheets were named "São João – PLC_2011.10", "São João – PLC_2011.11" "São João – PLC_2011.12" and "São João - PLC_2012.01". These monthly worksheets files are very large because contains data registered by PLC every 5 minutes.

For this reason and in order to maintain transparency and to comply with the reporting requirements, PP decided to include in the CER calculation spreadsheet only the values related to the hourly data of flow and the temperature of the flares. It was created one new worksheet for each month verified; named DATA_OCT_2011, DATA_NOV_2011, DATA_DEC_2011 and DATA_JAN_2012 which were included into the CER excel calculation spreadsheet (tool). In order to clarify the process these data were pasted as a link from the monthly worksheets to the CER Calculation spreadsheet.

For the whole monitoring period, the following table presents all measured data and the calculation of methane destroyed.

DATE	COLLECTING SYSTEM				FLARING SYSTEM			ELECTRICITY GENERATION			
	LFG measured FIR600 (Nm^3)	Methane (%)	*Methane measured FIR600 (Nm³)*	Flares Efficiency (%)	LFG measured FIR500 (Nm³)	*Methane measured FIR500 (Nm³)*	*Methne Destroyed in Flares (Nm³)*	LFG measured FIR800 (Nm³)	*Methane measured FIR800 (Nm³)*	Eletricity Exported SJ (MWh)	Eletricity Consumed (MWh)
	A	B	*C = A . B*	D	E	*F = E . B*	*G = F . D*	H	*I = H . B*	J	L
01/10/2011	120,133	45.2737	*54,388.6540*	99.9966%	0	*0.0000*	0.0000	119,771	*54,224.7632*	193.84	0.0000
02/10/2011	127,848	42.9339	*54,890.1324*	99.9966%	0	*0.0000*	0.0000	127,435	*54,712.8154*	190.55	0.0000
03/10/2011	128,464	42.9052	*55,117.7361*	99.9984%	9,207	*3,950.2817*	3,950.2184	117,352	*50,350.1103*	173.05	0.0000
04/10/2011	127,319	44.4561	*56,601.0619*	99.9984%	0	*0.0000*	0.0000	126,987	*56,453.4677*	187.36	0.0000
05/10/2011	124,555	44.6494	*55,613.0601*	99.9984%	0	*0.0000*	0.0000	124,152	*55,433.1230*	185.12	0.0000
06/10/2011	119,745	45.0336	*53,925.4843*	99.9984%	0	*0.0000*	0.0000	119,293	*53,721.9324*	181.13	0.0000
07/10/2011	115,570	44.7761	*51,747.7387*	99.9984%	3,160	*1,414.9247*	1,414.9020	111,886	*50,098.1872*	172.16	0.1937
08/10/2011	126,737	43.4990	*55,129.3276*	99.9984%	0	*0.0000*	0.0000	126,261	*54,922.2723*	193.41	0.0000
09/10/2011	125,245	43.3993	*54,355.4532*	99.9984%	0	*0.0000*	0.0000	124,861	*54,188.7999*	189.30	0.0000
10/10/2011	121,601	43.2847	*52,634.6280*	99.9984%	0	*0.0000*	0.0000	121,280	*52,495.6841*	180.37	0.0000
11/10/2011	121,585	43.2483	*52,583.4455*	99.9984%	0	*0.0000*	0.0000	121,338	*52,476.6222*	178.66	0.0000
12/10/2011	121,645	43.3654	*52,751.8408*	99.9984%	0	*0.0000*	0.0000	121,415	*52,652.1004*	177.95	0.0000
13/10/2011	119,979	43.6070	*52,319.2425*	99.9984%	0	*0.0000*	0.0000	119,714	*52,203.6839*	177.51	0.0000
14/10/2011	122,251	44.4060	*54,286.7790*	99.9984%	49,789	*22,109.3033*	22,108.9495	64,305	*28,555.2783*	97.24	1.3592
15/10/2011	127,957	44.5034	*56,945.2155*	99.9984%	0	*0.0000*	0.0000	127,563	*56,769.8721*	195.83	0.0000
16/10/2011	120,267	46.0242	*55,351.9246*	99.9984%	0	*0.0000*	0.0000	119,886	*55,176.5724*	196.70	0.0000
17/10/2011	121,752	46.6165	*56,756.5210*	99.9984%	4,122	*1,921.5321*	1,921.5013	115,574	*53,876.5537*	173.68	0.1445
18/10/2011	124,456	45.1620	*56,206.8187*	99.9984%	61,253	*27,663.0798*	27,662.6371	62,087	*28,039.7309*	102.75	1.4097
19/10/2011	125,090	44.1882	*55,275.0193*	99.9984%	0	*0.0000*	0.0000	124,529	*55,027.1235*	190.29	0.0000
20/10/2011	128,785	43.8693	*56,497.0780*	99.9984%	0	*0.0000*	0.0000	128,049	*56,174.1999*	193.88	0.0000

DATE	COLLECTING SYSTEM				FLARING SYSTEM			ELECTRICITY GENERATION			
	LFG measured FIR600 (Nm³)	Methane (%)	*Methane measured FIR600 (Nm³)*	Flares Efficiency (%)	LFG measured FIR500 (Nm³)	*Methane measured FIR500 (Nm³)*	*Methne Destroyed in Flares (Nm³)*	LFG measured FIR800 (Nm³)	*Methane measured FIR800 (Nm³)*	Eletricity Exported SJ (MWh)	Eletricity Consumed (MWh)
	A	B	*C = A . B*	D	E	*F = E . B*	*G = F . D*	H	*I = H . B*	J	L
21/10/2011	126,868	44.4220	*56,357.3029*	99.9984%	0	*0.0000*	0.0000	126,117	*56,023.6937*	192.14	0.0000
22/10/2011	126,650	44.3186	*56,129.5069*	99.9984%	33,326	*14,769.6166*	14,769.3802	92,420	*40,959.2501*	142.67	0.6629
23/10/2011	126,410	44.3768	*56,096.7128*	99.9984%	0	*0.0000*	0.0000	125,655	*55,761.6680*	194.14	0.0000
24/10/2011	119,304	46.0470	*54,935.9128*	99.9984%	0	*0.0000*	0.0000	118,497	*54,564.3135*	190.58	0.0000
25/10/2011	123,291	45.3973	*55,970.7851*	99.9984%	0	*0.0000*	0.0000	122,354	*55,545.4124*	195.98	0.0000
26/10/2011	124,699	44.7514	*55,804.5482*	99.9984%	0	*0.0000*	0.0000	123,725	*55,368.6696*	193.38	0.0000
27/10/2011	123,392	45.4541	*56,086.7230*	99.9984%	0	*0.0000*	0.0000	122,333	*55,605.3641*	190.75	0.0000
28/10/2011	126,074	44.6427	*56,282.8375*	99.9984%	0	*0.0000*	0.0000	125,178	*55,882.8390*	193.81	0.0000
29/10/2011	125,468	45.0427	*56,514.1748*	99.9984%	0	*0.0000*	0.0000	124,670	*56,154.7340*	191.27	0.0000
30/10/2011	125,165	44.0152	*55,091.6250*	99.9984%	7,791	*3,429.2242*	3,429.1693	114,222	*50,275.0417*	171.87	0.4368
31/10/2011	130,053	42.9552	*55,864.5262*	99.9984%	0	*0.0000*	0.0000	129,233	*55,512.2936*	181.50	0.0000
01/11/2011	135,054	42.7204	*57,695.6090*	99.9984%	0	*0.0000*	0.0000	134,074	*57,276.9490*	188.31	0.0000
02/11/2011	134,105	42.5826	*57,105.3957*	99.9984%	0	*0.0000*	0.0000	133,122	*56,686.8087*	184.44	0.0000
03/11/2011	123,704	44.5888	*55,158.1291*	99.9984%	0	*0.0000*	0.0000	122,746	*54,730.9684*	177.50	0.0000
04/11/2011	117,616	45.6753	*53,721.4608*	99.9984%	0	*0.0000*	0.0000	116,703	*53,304.4453*	175.92	0.0000
05/11/2011	116,797	46.3996	*54,193.3408*	99.9984%	0	*0.0000*	0.0000	115,892	*53,773.4244*	177.34	0.0000
06/11/2011	117,678	46.0625	*54,205.4287*	99.9984%	0	*0.0000*	0.0000	116,747	*53,776.5868*	178.38	0.0000
07/11/2011	113,834	46.5555	*52,995.9878*	99.9984%	0	*0.0000*	0.0000	112,973	*52,595.1450*	175.16	0.0000
08/11/2011	114,207	45.0419	*51,441.0027*	99.9984%	0	*0.0000*	0.0000	113,372	*51,064.9028*	175.68	0.0000
09/11/2011	117,370	44.4103	*52,124.3691*	99.9984%	0	*0.0000*	0.0000	116,473	*51,726.0087*	177.30	0.0000
10/11/2011	114,900	45.2055	*51,941.1195*	99.9984%	0	*0.0000*	0.0000	114,034	*51,549.6398*	177.62	0.0000

DATE	COLLECTING SYSTEM				FLARING SYSTEM			ELECTRICITY GENERATION			
	LFG measured FIR600 (Nm^3)	Methane (%)	*Methane measured FIR600 (Nm^3)*	Flares Efficiency (%)	LFG measured FIR500 (Nm^3)	*Methane measured FIR500 (Nm^3)*	*Methne Destroyed in Flares (Nm^3)*	LFG measured FIR800 (Nm^3)	*Methane measured FIR800 (Nm^3)*	Eletricity Exported SJ (MWh)	Eletricity Consumed (MWh)
	A	B	*C = A . B*	D	E	*F = E . B*	*G = F . D*	H	*I = H . B*	J	L
11/11/2011	117,233	44.5758	*52,257.5476*	99.9984%	8,404	*3,746.1502*	3,746.0902	106,569	*47,503.9843*	164.87	0.3719
12/11/2011	122,538	42.9413	*52,619.4101*	99.9984%	0	*0.0000*	0.0000	121,649	*52,237.6620*	177.72	0.0000
13/11/2011	117,517	43.7932	*51,464.4548*	99.9984%	7,805	*3,418.0592*	3,418.0045	107,922	*47,262.4973*	161.38	0.4008
14/11/2011	120,267	44.0929	*53,029.2080*	99.9984%	0	*0.0000*	0.0000	119,223	*52,568.8781*	182.46	0.0000
15/11/2011	116,970	47.1622	*55,165.6253*	99.9984%	0	*0.0000*	0.0000	116,205	*54,804.8345*	189.61	0.0000
16/11/2011	120,075	46.0478	*55,291.8958*	99.9984%	0	*0.0000*	0.0000	119,230	*54,902.7919*	187.00	0.0000
17/11/2011	118,055	45.7460	*54,005.4403*	99.9984%	0	*0.0000*	0.0000	117,184	*53,606.9926*	184.24	0.0000
18/11/2011	119,427	45.2423	*54,031.5216*	99.9984%	0	*0.0000*	0.0000	118,552	*53,635.6514*	184.33	0.0000
19/11/2011	121,948	44.2043	*53,906.2597*	99.9984%	0	*0.0000*	0.0000	121,021	*53,496.4859*	186.01	0.0000
20/11/2011	119,118	45.1219	*53,748.3048*	99.9984%	0	*0.0000*	0.0000	118,193	*53,330.9272*	184.22	0.0000
21/11/2011	119,451	45.2397	*54,039.2740*	99.9984%	0	*0.0000*	0.0000	118,502	*53,609.9492*	185.75	0.0000
22/11/2011	121,899	45.5145	*55,481.7203*	99.9984%	0	*0.0000*	0.0000	120,927	*55,039.3194*	190.88	0.0000
23/11/2011	122,838	45.0162	*55,296.9997*	99.9984%	0	*0.0000*	0.0000	122,022	*54,929.6675*	190.46	0.0000
24/11/2011	117,695	46.1125	*54,272.1068*	99.9984%	0	*0.0000*	0.0000	116,806	*53,862.1667*	186.01	0.0000
25/11/2011	118,662	46.2090	*54,832.5235*	99.9984%	0	*0.0000*	0.0000	117,958	*54,507.2122*	187.98	0.0000
26/11/2011	121,413	45.3215	*55,026.1927*	99.9984%	0	*0.0000*	0.0000	120,736	*54,719.3662*	189.51	0.0000
27/11/2011	118,290	46.0273	*54,445.6931*	99.9984%	0	*0.0000*	0.0000	117,517	*54,089.9021*	185.64	0.0000
28/11/2011	120,943	45.7840	*55,372.5431*	99.9984%	0	*0.0000*	0.0000	120,044	*54,960.9449*	189.05	0.0000
29/11/2011	121,218	45.2800	*54,887.5104*	99.9984%	0	*0.0000*	0.0000	120,398	*54,516.2144*	188.00	0.0000
30/11/2011	125,509	44.8720	*56,318.3984*	99.9984%	0	*0.0000*	0.0000	124,765	*55,984.5508*	193.22	0.0000
01/12/2011	126,479	44.3872	*56,140.4866*	99.9984%	0	*0.0000*	0.0000	125,662	*55,777.8432*	188.46	0.0000

DATE	COLLECTING SYSTEM				FLARING SYSTEM			ELECTRICITY GENERATION			
	LFG measured FIR600 (Nm^3)	Methane (%)	*Methane measured FIR600 (Nm^3)*	Flares Efficiency (%)	LFG measured FIR500 (Nm^3)	*Methane measured FIR500 (Nm^3)*	*Methne Destroyed in Flares (Nm^3)*	LFG measured FIR800 (Nm^3)	*Methane measured FIR800 (Nm^3)*	Eletricity Exported SJ (MWh)	Eletricity Consumed (MWh)
	A	B	*C = A . B*	D	E	*F = E . B*	*G = F . D*	H	*I = H . B*	J	L
02/12/2011	129,047	43.1982	*55,745.9811*	99.9984%	0	*0.0000*	0.0000	128,179	*55,371.0207*	187.92	0.0000
03/12/2011	129,128	43.7068	*56,437.7167*	99.9984%	0	*0.0000*	0.0000	128,336	*56,091.5588*	190.78	0.0000
04/12/2011	129,780	44.1035	*57,237.5223*	99.9984%	0	*0.0000*	0.0000	129,125	*56,948.6443*	192.58	0.0000
05/12/2011	129,013	43.8875	*56,620.5803*	99.9984%	0	*0.0000*	0.0000	128,316	*56,314.6845*	192.16	0.0000
06/12/2011	125,285	44.8576	*56,199.8441*	99.9984%	0	*0.0000*	0.0000	123,803	*55,535.0545*	189.33	0.0000
07/12/2011	123,394	44.7139	*55,174.2697*	99.9984%	0	*0.0000*	0.0000	122,683	*54,856.3539*	189.16	0.0000
08/12/2011	123,864	44.8231	*55,519.6845*	99.9984%	0	*0.0000*	0.0000	123,157	*55,202.7852*	191.91	0.0000
09/12/2011	123,521	45.8498	*56,634.1314*	99.9984%	0	*0.0000*	0.0000	122,808	*56,307.2223*	198.38	0.0000
10/12/2011	125,901	45.5600	*57,360.4956*	99.9984%	0	*0.0000*	0.0000	125,212	*57,046.5872*	200.02	0.0000
11/12/2011	122,274	45.8434	*56,054.5589*	99.9984%	0	*0.0000*	0.0000	121,669	*55,777.2063*	193.86	0.0000
12/12/2011	121,562	45.4238	*55,218.0797*	99.9984%	0	*0.0000*	0.0000	120,979	*54,953.2590*	190.92	0.0000
13/12/2011	122,337	45.7088	*55,918.7746*	99.9984%	0	*0.0000*	0.0000	121,752	*55,651.3781*	193.40	0.0000
14/12/2011	124,760	45.2671	*56,475.2339*	99.9984%	0	*0.0000*	0.0000	124,180	*56,212.6847*	196.48	0.0000
15/12/2011	121,330	46.8753	*56,873.8014*	99.9984%	0	*0.0000*	0.0000	120,701	*56,578.9558*	194.28	0.0000
16/12/2011	123,416	46.8594	*57,831.9971*	99.9984%	0	*0.0000*	0.0000	122,694	*57,493.6722*	190.84	0.0000
17/12/2011	124,448	46.5302	*57,905.9032*	99.9984%	0	*0.0000*	0.0000	123,725	*57,569.4899*	189.04	0.0000
18/12/2011	125,597	46.3312	*58,190.5972*	99.9984%	0	*0.0000*	0.0000	124,887	*57,861.6457*	192.99	0.0000
19/12/2011	126,420	45.6206	*57,673.5625*	99.9984%	0	*0.0000*	0.0000	125,684	*57,337.7949*	190.60	0.0000
20/12/2011	122,797	46.1272	*56,642.8177*	99.9984%	0	*0.0000*	0.0000	122,154	*56,346.2198*	183.78	0.0000
21/12/2011	125,480	45.8093	*57,481.5096*	99.9984%	0	*0.0000*	0.0000	124,848	*57,191.9948*	188.64	0.0000
22/12/2011	126,256	44.2832	*55,910.1969*	99.9984%	0	*0.0000*	0.0000	125,649	*55,641.3979*	188.20	0.0000

DATE	COLLECTING SYSTEM				FLARING SYSTEM			ELECTRICITY GENERATION			
	LFG measured FIR600 (Nm^3)	Methane (%)	*Methane measured FIR600 (Nm³)*	Flares Efficiency (%)	LFG measured FIR500 (Nm³)	*Methane measured FIR500 (Nm³)*	*Methne Destroyed in Flares (Nm³)*	LFG measured FIR800 (Nm³)	*Methane measured FIR800 (Nm³)*	Eletricity Exported SJ (MWh)	Eletricity Consumed (MWh)
	A	B	*C = A . B*	D	E	*F = E . B*	*G = F . D*	H	*I = H . B*	J	L
23/12/2011	126,634	43.5116	*55,100.4795*	99.9984%	43,111	*18,758.2858*	18,757.9856	81,185	*35,324.8924*	130.96	0.9560
24/12/2011	127,612	43.3417	*55,309.2102*	99.9984%	109,290	*47,368.1439*	47,367.3860	12,543	*5,436.3494*	29.81	2.2557
25/12/2011	127,274	43.6467	*55,550.9009*	99.9984%	0	*0.0000*	0.0000	126,821	*55,353.1814*	188.74	0.0000
26/12/2011	128,674	43.7456	*56,289.2133*	99.9984%	0	*0.0000*	0.0000	128,292	*56,122.1051*	188.77	0.0000
27/12/2011	127,266	44.2945	*56,371.8383*	99.9984%	0	*0.0000*	0.0000	126,850	*56,187.5732*	192.50	0.0000
28/12/2011	129,214	43.1068	*55,700.0205*	99.9984%	0	*0.0000*	0.0000	128,707	*55,481.4690*	194.84	0.0000
29/12/2011	127,158	43.0954	*54,799.2487*	99.9984%	13,251	*5,710.5714*	5,710.4800	113,473	*48,901.6432*	169.86	0.3313
30/12/2011	126,717	43.4677	*55,080.9654*	99.9984%	0	*0.0000*	0.0000	126,251	*54,878.4059*	189.05	0.0000
31/12/2011	119,352	45.7688	*54,625.9781*	99.9984%	0	*0.0000*	*0.0000*	118,691	*54,323.4464*	185.29	0.0000
01/01/2012	119,504	47.4711	*56,729.8633*	99.9984%	0	*0.0000*	*0.0000*	118,730	*56,362.4370*	187.81	0.0000
02/01/2012	121,205	46.5514	*56,422.6243*	99.9984%	0	*0.0000*	*0.0000*	120,315	*56,008.3169*	186.36	0.0000
03/01/2012	116,136	45.4434	*52,776.1470*	99.9986%	18,302	*8,317.0510*	*8,316.9345*	94,795	*43,078.0710*	148.79	0.0000
04/01/2012	120,086	44.5477	*53,495.5510*	99.9986%	0	*0.0000*	*0.0000*	119,232	*53,115.1136*	186.18	0.0000
05/01/2012	122,361	43.9422	*53,768.1153*	99.9986%	0	*0.0000*	*0.0000*	121,611	*53,438.5488*	188.46	0.0000
06/01/2012	120,816	44.2193	*53,423.9894*	99.9986%	0	*0.0000*	*0.0000*	120,143	*53,126.3935*	186.90	0.0000
07/01/2012	116,169	44.5373	*51,738.5360*	99.9986%	70,493	*31,395.6788*	*31,395.2392*	41,339	*18,411.2744*	63.78	1.2704
08/01/2012	123,476	44.2777	*54,672.3328*	99.9986%	0	*0.0000*	*0.0000*	122,698	*54,327.8523*	190.86	0.0000
09/01/2012	118,961	44.4277	*52,851.6361*	99.9986%	0	*0.0000*	*0.0000*	118,045	*52,444.6784*	182.46	0.0000
10/01/2012	124,601	43.6425	*54,378.9914*	99.9986%	0	*0.0000*	*0.0000*	123,499	*53,898.0510*	189.26	0.0000
11/01/2012	123,723	44.4580	*55,004.7713*	99.9986%	0	*0.0000*	*0.0000*	122,613	*54,511.2875*	190.46	0.0000
12/01/2012	122,729	44.6917	*54,849.6764*	99.9986%	0	*0.0000*	*0.0000*	121,628	*54,357.6208*	187.99	0.0000

DATE	COLLECTING SYSTEM				FLARING SYSTEM			ELECTRICITY GENERATION			
	LFG measured FIR600 (Nm³)	Methane (%)	*Methane measured FIR600 (Nm³)*	Flares Efficiency (%)	LFG measured FIR500 (Nm³)	*Methane measured FIR500 (Nm³)*	*Methne Destroyed in Flares (Nm³)*	LFG measured FIR800 (Nm³)	*Methane measured FIR800 (Nm³)*	Eletricity Exported SJ (MWh)	Eletricity Consumed (MWh)
	A	B	*C = A . B*	D	E	*F = E . B*	*G = F . D*	H	*I = H . B*	J	L
13/01/2012	118,600	44.8986	*53,249.7396*	99.9986%	0	*0.0000*	*0.0000*	117,608	*52,804.3454*	181.74	0.0000
14/01/2012	118,745	43.6752	*51,862.1162*	99.9986%	0	*0.0000*	*0.0000*	117,766	*51,434.5360*	176.33	0.0000
15/01/2012	117,345	44.0320	*51,669.3504*	99.9986%	0	*0.0000*	*0.0000*	116,409	*51,257.2108*	176.05	0.0000
16/01/2012	115,382	46.6527	*53,828.8183*	99.9986%	0	*0.0000*	*0.0000*	114,503	*53,418.7410*	183.66	0.0000
17/01/2012	116,240	46.4177	*53,955.9344*	99.9986%	0	*0.0000*	*0.0000*	115,419	*53,574.8451*	186.66	0.0000
18/01/2012	115,122	46.5018	*53,533.8021*	99.9986%	0	*0.0000*	*0.0000*	114,304	*53,153.4174*	185.77	0.0000
19/01/2012	115,123	46.5545	*53,594.9370*	99.9986%	0	*0.0000*	*0.0000*	114,327	*53,224.3632*	186.30	0.0000
20/01/2012	114,172	46.4850	*53,072.8542*	99.9986%	0	*0.0000*	*0.0000*	113,430	*52,727.9355*	182.98	0.0000
21/01/2012	116,108	45.6552	*53,009.3396*	99.9986%	0	*0.0000*	*0.0000*	115,405	*52,688.3835*	185.66	0.0000
22/01/2012	112,105	46.0538	*51,628.6124*	99.9986%	0	*0.0000*	*0.0000*	111,191	*51,207.6807*	183.79	0.0000
23/01/2012	108,909	46.5506	*50,697.7929*	99.9986%	0	*0.0000*	*0.0000*	107,929	*50,241.5970*	184.40	0.0000
24/01/2012	109,390	45.8747	*50,182.3343*	99.9986%	0	*0.0000*	*0.0000*	108,860	*49,939.1984*	183.54	0.0000
25/01/2012	109,198	45.8254	*50,040.4202*	99.9986%	0	*0.0000*	*0.0000*	108,218	*49,591.3313*	181.66	0.0000
26/01/2012	108,909	44.9000	*48,900.1410*	99.9986%	0	*0.0000*	*0.0000*	107,929	*48,460.1210*	181.99	0.0000
27/01/2012	109,370	45.0272	*49,246.2486*	99.9986%	0	*0.0000*	*0.0000*	108,391	*48,805.4323*	180.43	0.0000
28/01/2012	109,300	46.7615	*51,110.3195*	99.9986%	0	*0.0000*	*0.0000*	108,321	*50,652.5244*	177.41	0.0000
29/01/2012	108,915	46.7981	*50,970.1506*	99.9986%	0	*0.0000*	*0.0000*	107,936	*50,511.9972*	176.16	0.0000
30/01/2012	111,988	45.9070	*51,410.3311*	99.9986%	0	*0.0000*	*0.0000*	110,680	*50,809.8675*	176.96	0.0000
31/01/2012	109,571	46.2961	*50,727.0997*	99.9986%	0	*0.0000*	*0.0000*	108,254	*50,117.3800*	170.38	0.0000

Obs.: the calculation of *methane measured* and *methane destroyed* was conservatively made, using Excel tool “ROUND DOWN” with four decimal rounds.

A consolidation of methane destroyed and electricity consumed/exported is presented in the table below:

Total Methane Destroyed in Flares (Nm^3), measured by FIR500	**193,968.8778**
Total Methane destroyed in the Power House (Nm^3), measured by FIR800	**6,463,038.1226**
Total electricity consumed from the diesel generator (MWh)	**9.7929**
Total Electricity Exported, measured at São João Landfill's substation (MWh)	**22,259.5650**

ERs from the electricity indeed exported are measured at Eletropaulo's substation (based on monthly electricity transaction notes), located around 14 km from São João Landfill. The values measured are lower than the one in the landfill's substation due to losses in the transmission line. The table below presents the electricity measured during the Monitoring Period and the comparison between the one measured in the landfill:

MONTH	Electricity Measured at São João Landfill (MWh)	Electricity Measured at Eletropaulo's Substation (MWh)[9]
October/2011	5,387.3690	5.392,8150
November/2011	5,657.5000	5.309,0384
December/2011	5,683.5300	5.488,3240
January/2012	5,531.1660	5,359.3086
TOTAL	**22,259.5650**	**21,549.4860**

As mentioned above, follows the description and consideration of measurement uncertainties and error propagation of the equipment. The readings from all equipment are subjected to internal errors from a standard value. These errors are measured and described in the Calibration Certificates, in terms of ± % from the standard adopted.

All calibrations usually have an expiration date, however the manufacturers of the flow-meters and pressure-temperature transmitters are Europeans and there are no rule in Europe specifying the calibration periodicity. Biogás decided to adopt a 2 years calibration frequency for the electricity meter of the grid, 5 years calibration frequency for the electricity meter of the diesel generator and 5 years for the others instruments. Regarding electricity meter, the manufacturer does not mention a specific calibration frequency of the meter. Besides, does not exist any standard or norm in Brazil indicating a specific calibration frequency.

The errors for each instrument will be presented in the formulae below.

Adopting a conservative approach on Emission Reduction calculation, the equivalent error calculated was discounted from the amount of methane calculated for each flow-meter, according to the equations below:

$$\varepsilon_{FIR500} = \sqrt{\left(\varepsilon_{\text{Gas Flow}_{FIR500}}\right)^2 + \left(\varepsilon_{\text{Temperature}_{FIR500}}\right)^2 + \left(\varepsilon_{\text{Pressure}_{FIR500}}\right)^2 + \left(\varepsilon_{\text{Methane Analysis}}\right)^2}$$

$$\varepsilon_{FIR600} = \sqrt{\left(\varepsilon_{\text{Gas Flow}_{FIR600}}\right)^2 + \left(\varepsilon_{\text{Temperature}_{FIR600}}\right)^2 + \left(\varepsilon_{\text{Pressure}_{FIR600}}\right)^2 + \left(\varepsilon_{\text{Methane Analysis}}\right)^2}$$

[9] Electricity measured based on monthly transaction notes.

$$\varepsilon_{FIR800} = \sqrt{\left(\varepsilon_{Gas\,Flow_{FIR800}}\right)^2 + \left(\varepsilon_{Temperature_{FIR800}}\right)^2 + \left(\varepsilon_{Pressure_{FIR800}}\right)^2 + \left(\varepsilon_{Methane\,Analysis}\right)^2}$$

Calculation of $LFG_{flared,\,y}$

The calculation of $LFG_{flared,\,y}$ is the measurement from FIR500 made during the monitoring period, minus the uncertainties of the flow-meters, as follows:

$$LFG_{flared,\,y,\,corrected} = FIR_{500} \times \left(1 - \frac{\varepsilon_{FIR500}}{100}\right)$$

Applying the errors from the table below in the equations previously presented:

$$\varepsilon_{FIR500} = \sqrt{0.980^2 + 0.030^2 + 0.010^2 + 1.000^2} = 1.4005\%$$

Calculation of $LFG_{electricity,\,y}$

The calculation of $LFG_{electricity,\,y}$ is measurement from FIR800 made during the monitoring period, minus the uncertainties of the flow-meter, as follows:

$$LFG_{electricity,\,y,\,corrected} = FIR_{800} \times \left(1 - \frac{\varepsilon_{FIR800}}{100}\right)$$

Applying the errors from the table below in the equations previously presented:

$$\varepsilon_{FIR800} = \sqrt{1.280^2 + 0.100^2 + 0.010^2 + 1.000^2} = 1.6275\%$$

Calculation of $EG_{y,\,corrected}$

The calculation of EG_y is the sum of all measurements from the electricity-meter made during the monitoring period, minus the uncertainties of the electricity-meter due to conservativeness, as follows:

$$EG_{y,\,corrected} = \sum EG_y \times \left(1 - \frac{\varepsilon_{EG}}{100}\right)$$

$$\varepsilon_{EG} = 1.0000\%$$

Calculation of $EC_{y,\,corrected}$

The calculation of EC_y is the sum of all measurements from the electricity-meter made during the monitoring period, plus the uncertainties of the electricity-meter due to conservativeness, as follows:

$$EC_{y,corrected} = \sum EC_y \times \left(1 + \frac{\varepsilon_{EC}}{100}\right)$$

$$\varepsilon_{EC} = 0.5000\%$$

Table providing the formulae used

	Variable	Description
Flaring System	A_{FIR500} (see the table of consolidated methane destroyed and electricity consumed/exported – last table from item 4.1)	Total methane destroyed in flares, measured by FIR500 (Nm^3)
	B_{FIR500}	Total error from FIR500 (%) – see item 4.4
	$C_{FIR500} = A_{FIR500} . (1-B_{FIR500}/100)$	**Total methane corrected destroyed at the flare (Nm^3)**
Power House	A_{FIR800} (see the table of consolidated methane destroyed and electricity consumed/exported – last table from item 4.1)	Methane flow to the power house measured by FIR800 (Nm^3)
	B_{FIR800}	Total measuring error from FIR800 (%) – see item 4.5
	$C_{FIR800} = A_{FIR800} . (1 - B_{FIR800}/100)$	**Total methane corrected destroyed at the power house (Nm^3)**
CO_2e Methane	$A = C_{FIR500} + C_{FIR800}$	Total methane destroyed in the period (Nm^3)
	B = 0.0007168	Density of Methane at the STPC (tCH_4/Nm^3)
	C = A . B	Total weight of methane destroyed (tCH_4)
	D = 21	CO_2 equivalency (tCO_2e/tCH_4)
	E = C . D	Total equivalent carbon (tCO_2e)
	F = 20%	Adjustment Factor (%)
	G = E . (1-F)	**Total equivalent carbon after consideration of Adjustment Factor (tCO_2e)**
CO_2e Electricity Exported	H (see the table of consolidated methane destroyed and electricity consumed/exported – last table from item 4.1)	Total electricity exported (MWh)
	I	Electricity-meter error (%)
	J = H . (1 – I/100)	Total electricity corrected (MWh)
	K = 0.2677	Emission Factor (tCO_2e/MWh)
	L = J . K	**Total CO_2e from the electricity exported (tCO_2e)**
CO_2e Electricity Consumed	M (see the table of consolidated methane destroyed and electricity consumed/exported – last	Total Electricity Consumed from the Diesel Generator (MWh)

	Variable	Description
	table from item 4.1)	
	N	Electricity-meter error (%)
	O = M . (1 + N/100)	Total electricity corrected (MWh)
	P = 1.3	Conservative Diesel CO_2 Emission Factor (tCO_2e/MWh)
	Q = O . P	**Total CO_2e from the electricity consumed (tCO_2e)**
TOTAL	**R = G + L – Q**	**TOTAL CREDITS DURING THE PERIOD (tCO_2e)**

E.2. Project emissions calculation

SJ have project emissions from the consumption of electricity from an emergency diesel generator during energy supply black-outs, as per stated in the revised monitoring plan. This source of emission will only be accounted during emergency situations and the electricity consumed by SJ will be from the Power Plant. Project emissions due to electricity consumption from the diesel generator are discounted of the total CERs generated.

E.3. Leakage calculation

No leakages under **ACM0001 – version 02**.

E.4. Emission reductions calculation / table

In accordance with the ACM0001 (version 2) and the registered PDD, emission reductions (ERy, expressed in tCO2) are calculated according to the following formula:

$ER_y = BE_y - PE_y - L_y$

Where:
ER_y = Emission reductions in year $_y$
BE_y = Baseline emissions in year $_y$
PE_y = Project emissions in year $_y$
L_y = Leakage in year $_y$

In SJ Project, there is no leakage calculation. For this reason we considered that:

$ER_y = BE_y - PE_y$

According to the above calculation of baseline emissions and project emissions, the project emission reductions are calculated as shown in the table below. The project totally generated 84,557 tCO2e during this monitoring period.

Period	Baseline Emissions	Project Emissions	Leakage	Emission Reductions
	tCO_2e	tCO_2e	tCO_2e	tCO_2e
01/10/2011 to 31/01/2012	84,570	13	-	84,557

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

The actual emission reductions during the monitoring period are: 84,557 tCO_2.

According to the registered PDD, the estimated value of emission reduction is averagely 720,002 tCO_2e/year for 2011, that is 60,000 tCO_2e per month on average in 2011, while the project activity actually generates totally 63,969 tCO2e emission reductions during three months of this monitoring period – from 01/10/2011 to 31/12/2011 – with 92 days when the plants are in operation. That is about 21,323 tCO2e per month; which is about 64.46% lower than the estimated average value per month in 2011.

Furthermore according to the registered PDD, the estimated value of emission reduction is averagely 653,121 tCO_2e/year for 2012, that is 54,426 tCO_2e per month on average in 2012, while the project activity actually generates totally 20,570 tCO2e emission reductions during the fourth month of this monitoring period – from 01/01/2012 to 31/01/2012 – with 31 days when the plants are in operation. That is about 20,570 tCO2e per month; which is 62.20% lower than the estimated average value per month in 2012.

The average predicted ERs for 2011 and 2012 is 686,561 tCO2e that is 57,213 tCO_2e per month on average for these two years. Considering that current monitoring period consists of days and that the total ERs of this period is 84,557 tCO2e, that represents an equivalent average of 24,139 tCO2e emission reductions during this monitoring period, which is about 63.05% lower than the estimated average value per month in this monitoring period.

Therefore, the emission reductions in this monitoring period are not higher than the estimation in the PDD even when bearing in mind the monitoring period does not cover a full calendar year. The difference between the PDD estimate and the gas flow monitored is mainly due for the landfill´s poor final layer cover, which increases the gas leakage through the landfill´s surface.

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO_2e)	**234,797 (value in this monitoring period)** **720,002 (value in year 2011)** **653,121 (value in year 2012)**	**84,557**

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

Not applicable to this monitoring period.