Monitoring report form for CDM project activity
(Version 09.0)

MONITORING REPORT			
Title of the project activity	Exploitation of the biogas from controlled landfill in solid waste management central – CTRS / BR.040		
UNFCCC reference number of the project activity	3464		
Version number of the PDD applicable to this monitoring report	3		
Version number of this monitoring report	1.0		
Completion date of this monitoring report	01/11/2021		
Monitoring period number	#4		
Duration of this monitoring period	01/12/2019 – 31/12/2020		
Monitoring report number for this monitoring period	Not applicable.		
Project participants	Consórcio Horizonte Asja Asja Brasil Serviços para o Meio Ambiente Ltda. First Climate (Switzerland) AG		
Host Party	Brazil		
Applied methodologies and standardized baselines	ACM0001, version 11 – Consolidated baseline and monitoring methodology for landfill gas project activities		
Sectoral scopes	13 - Waste handling and disposal		
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 until 31 December 2020	Amount achieved from 1 January 2021
	0 tCO_2e	27,690 tCO_2e	0 tCO_2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	72,074 tCO_2e		

SECTION A. Description of project activity

A.1. General description of project activity

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The CDM project activity "Exploitation of the biogas from controlled landfill in solid waste management central – CTRS / BR.040" is implemented at the Central de Tratamento de Resíduos Sólidos (CTRS) BR-040 municipal solid waste landfill of Belo Horizonte (CTRS BR-040 landfill), which is a landfill site located in the city of Belo Horizonte, in the Minas Gerais State. The project activity encompasses collection of landfill gas (LFG) at the CTRS BR-040 landfill and its destruction through combustion in high temperature enclosed flares and/or its utilization as gaseous fuel for electricity generation in an electricity generation facility.

LFG is generated at the CTRS BR-040 landfill as a result of anaerobic decomposition of municipal solid waste (MSW) historically disposed at this landfill. LFG is rich in methane (CH_4), a powerful greenhouse gas (GHG). By combusting LFG, the operation of the project activity thus mitigates CH_4 that would otherwise be directly emitted into the atmosphere in the absence of the project activity (baseline scenario). By exporting net-generated electricity through the National Electricity Grid of Brazil, the project activity has also promoted carbon dioxide (CO_2) emission reductions (due to displacement of electricity (under amount equivalent to the amount of net-electricity generated by the project electricity generation facility) which would otherwise be generated by existing grid-connected power plants, including fossil-fuel fired power plants (and addition of new power generation units) within the National Electricity Grid of Brazil).

The CTRS BR-040 landfill is operated by the solid waste management company and host-country project participant Asja Brasil Serviços para o Meio Ambiente Ltda. The landfill started its operations involving permanent disposal of Municipal Solid Waste (MSW) in year 1975. By the end 2006, more than 17,400,000 m^3 of MSW had been disposed at the landfill.

The lifetime of the landfill was 32 years, ending on December 2007 (when the landfill ceased its MSW disposal activities). The Project's infrastructure construction started in December 2008 and the first LFG collection wells were drilled in the beginning of 2009. The LFG flaring station was installed in 12/09/2009 and it is operational since 29/10/2009 and it was initially composed of 2 enclosed flares of 2,500 Nm^3/h of capacity each one.

The electricity generation facility was commissioned in November 2010 and started operating on 29/11/2010, with 4.278 MW of total nameplate installed capacity. On 04/06/2011, one of the installed enclosed flares was definitively turned off, because it had been idle since the electricity generation facility started operating. On 21/09/2011, an additional engine of 1.426 MW was installed, so the installed nameplate capacity of the power plant increased to 5.704 MW. On 21/09/2012, one engine was permanently removed from the project site and the installed nameplate capacity of the power plant was reduced to 4.278 MW. On 15/05/2013 the remaining enclosed flare was temporarily turned off as the largest share of collected LFG was being utilized for electricity generation, but it is still installed and operational, so it can be promptly restarted in case the landfill gas flow surpasses the capacity of the engines.

The project activity was registered under the CDM on 04/06/2011 with the reference number 3464.

The CTRS BR-040 landfill currently serves as permanent disposal site for MSW generated by the nearby municipalities in the region of the Municipality of Belo Horizonte. Although the CTRS BR-040 landfill has always employed *state-of-the-art* waste landfilling technics and operation management, in the absence of the CDM project activity no efficient management of LFG would occur at this landfill site.

A.2. Location of project activity

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The CTRS BR-040 landfill is located at the highway BR.040, section Belo Horizonte – Sete Lagoas, near km 531, Jardim Filadélfia neighbourhood in Belo Horizonte city, Minas Gerais state, Brazil.

The exact geographic coordinates of the project site (in decimal and in Degree, Minute, Second (DMS) formats) are as follows:

Format	Latitude	Longitude
DMS	19º 54' 57" S	44º 1' 5" W
Decimal	-19.9159	- 44.0181

The following images show the location of the project activity.

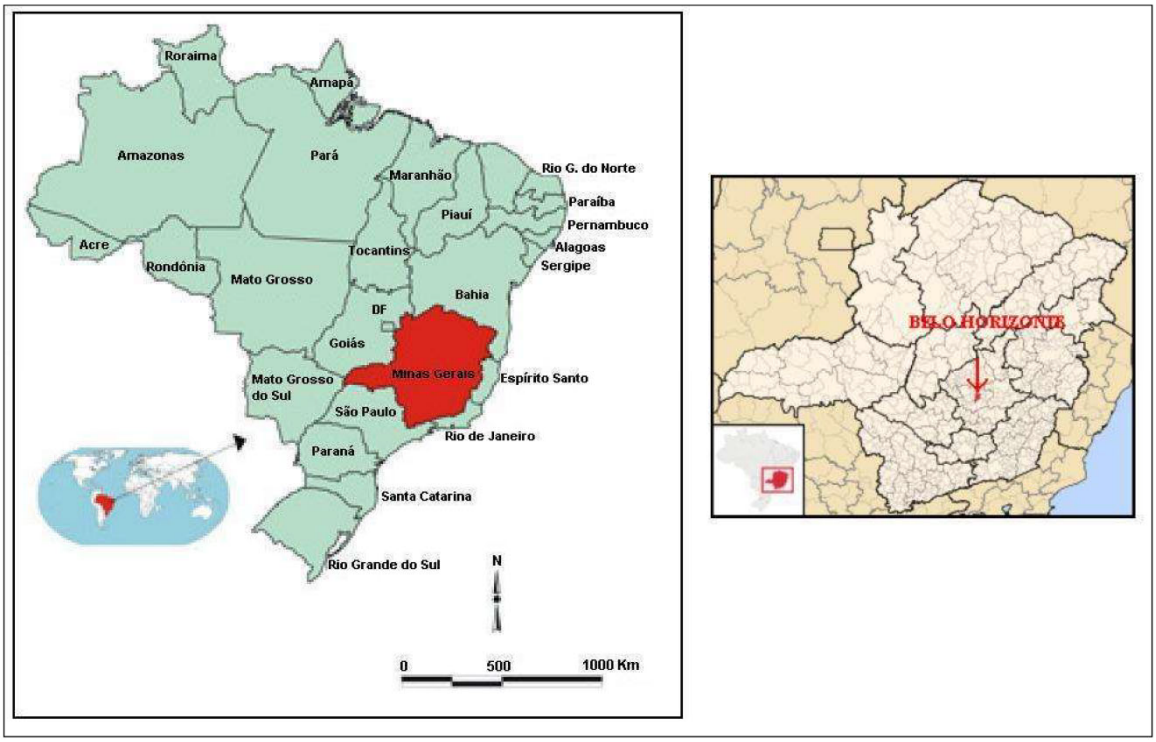

Figure 1 – CTRS BR-040 landfill location within Brazil

Figure 2 – Aerial view of the CTRS BR-040 landfill
(Source: Google Earth Web Application, accessed on 14/06/2021)

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	Consórcio Horizonte Asja (Private entity) Asja Brasil Serviços para o Meio Ambiente Ltda. (Private entity)	No
Switzerland	Consórcio Horizonte Asja (Private entity)	No.

A.4. References to applied methodologies and standardized baselines

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The project activity applies the following large-scale CDM baseline and monitoring methodology:

- ACM0001 – "Consolidated baseline and monitoring methodology for landfill gas project activities" (version 11)
(https://cdm.unfccc.int/methodologies/DB/JPYB4DYQUXQPZLBDVPHA87479EMY9M)

For the considered monitoring period, as also established in the PDD, the following methodological tools are also applied[1]:

- Tool to calculate baseline, project and/or leakage emissions from electricity consumption (version 1) (http://cdm.unfccc.int/Reference/tools/ls/meth_tool05_v01.pdf);

- Tool to determine project emissions from flaring gases containing methane (version 01) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v1.pdf);

- Tool to calculate the emission factor for an electricity system (version 02) (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v1.1.pdf/history_view).

- Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02) (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf/history_view)

A.5. Crediting period type and duration

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Fixed 10-year crediting period from 04/06/2011 to 03/06/2021.

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

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The Project's infrastructure construction started in December 2008 and the first LFG collection wells were drilled in the beginning of 2009. The project's flaring station, composed by 2 enclosed flares of capacity of 500 Nm^3/h each, was completed on 12/09/2009 and it is operational since 29/10/2009. The electricity generation facility started operating with 4.278 MW of installed capacity on 29/11/2010. From this date onwards, the largest share of collected LFG has been used for electricity generation (with minor share of collected LFG being combusted in the flares); for this reason, one of the enclosed flares (Flare 2) was turned off in 04/06/2011. On 21/09/2011 an additional engine of 1.426 MW was installed but it was uninstalled on 21/09/2012, thus the electricity generation facility remained with its initial 4.278 MW nameplate installed capacity.

During the considered monitoring period, the project activity encompassed the operation of the following equipment:

- LFG gas extraction system composed of 350 vertical extraction wells, of which 199 were under operation, connected by HDPE pipes.

- 2 centrifugal blowers powered by electric motor (with nameplate power of 30 kW).

- Two LFG condensation traps (for separating undesirable liquids in the collected LFG (leachate and condensate))

[1] The registered PDD also refer to the methodological tool "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" (version 4). However, it is crucial to note that applicable guidance of this methodological tools is only applied in the context of ex-ante estimation of emission reductions to be achieved by the project activity during its crediting period. This methodological tool is thus not applied for the ex-post determination of emission reductions achieved by the project activity.

- Infrastructure for additional removal of moisture and removal of siloxanes in collected LFG using activated carbon and its continuous regeneration.

- One operational high temperature enclosed flare (designed and supplied by Ecogas SRL.) The flare has a declared maximum LFG flow operational capacity of 2,500 Nm^3/h.

- Electricity generation infrastructure using collected LFG as gaseous fuel comprising 3 engine-generators modular package sets (container-based assembly) manufactured by GE Jenbacher of type 4 and G-420 model with individual nameplate installed capacity of 1.426 MW each. The project's electricity generation infrastructure also encompasses the installation and operation of a LFG cooling/treatment unit (electrical LFG chilling and activated-carbon LFG purification/filtering equipment).

Details about monitoring instruments/equipment utilized within the considered monitoring period are described in Section C.

During the whole monitoring period covered by this Monitoring Report, the project activity has operated under full conformance with the technical project description as per the PDD. From an operational perspective, there were no post-registration changes on the project activity during the considered monitoring period.

During the considered monitoring period, the project activity faced events it became temporarily out of operation due to different reasons (incl. temporarily interruption in the supply of grid-sourced electricity, planned and unplanned equipment maintenance/repair, performance of regular calibration events, drainage of condensate from the project's LFG pipeline, unexpected problems in the PLC panel, data communication problems, etc.).

As further described in Section B.2.1., in October 2014 the supervisory software suffered an outage causing the lack of registration of the main data until November 2019 (when the supervisory system of the project activity was finally replaced). Nevertheless, it caused no constraint to the operation of the project activity, so LFG collection/destruction and electricity generation systems operated normally, which can be clearly demonstrated by records of electricity generated by the project activity and exported to the grid.

B.2. Post-registration changes

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

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Not applicable for the considered. There are no temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents encompassed by the considered monitoring period that are to be submitted with this Monitoring Report as part of the request for issuance (post-registration change – issuance track).

It is however relevant to note that temporary deviations from the registered monitoring plan were previously addressed in the context of the previous 2nd and 3rd monitoring periods (thus not in the context of the verification assessment for the considered monitoring period).

An initial temporary deviation from the monitoring plan of the registered PDD was requested for the periods from 01/01/2014 to 31/01/2014 and from 01/10/2014 to 04/09/2016 (PRC-3463-002, for which assessment is included in the related Validation report for post-registration changes (which was submitted by the DOE responsible for performing the previous 2nd verification for the project activity and approved by the UNFCCC on 04/04/2017)).

Nonetheless, as further explained in the Monitoring Report for the previous 3rd monitoring period, while the supervisory system of the project activity was supposedly fixed in September/2016, it was

later acknowledged by the project participants that data recorded by such supervisory system was not reliable enough to be used in the calculations of emission reductions achieved by the project activity (due to failures in the system which caused repeated values to be reported during specific periods and other inconsistencies to measurement data). Thus, a new temporary deviation from the registered monitoring plan (encompassing the period from 04/09/2016 to 30/11/2019) is requested in the context of the previous 3rd monitoring period.

B.2.2. Corrections

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Not applicable for the considered and/or previous monitoring periods. There are no Corrections (in information that do not affect the project design) encompassed by the considered monitoring period that are to be submitted with this Monitoring Report as part of the request for issuance (post-registration change – issuance track).

In fact, no Corrections (in information that do not affect the project design) were ever addressed in the context of previously performed and approved post-registration changes for the project activity (PRC-3464-001 and PRC-3464-002).

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

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Not applicable for the considered and/or previous monitoring periods. There are no changes to start date of the crediting period encompassed by the considered monitoring period and/or previously approved by the CDM-EB.

In fact, no change to start date of the crediting period was ever addressed in the context of previously performed and approved post-registration changes for the project activity (PRC-3464-001 and PRC-3464-002).

B.2.4. Inclusion of monitoring plan

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Not applicable for the considered and/or previous monitoring periods. There is no inclusion of monitoring plan (and/or applicable methodological tools) encompassed by the considered monitoring period and/or previously approved by the CDM-EB as being applicable for the considered monitoring period.

In fact, no inclusion of monitoring plan was ever addressed in the context of previously performed and approved post-registration changes for the project activity (PRC-3464-001 and PRC-3464-002).

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

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Not applicable for the considered and/or previous monitoring periods. There are no permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied CDM baseline and monitoring methodology and/or applicable methodological tools encompassed by the considered monitoring period and/or previously approved by the CDM-EB as being applicable for the considered monitoring period.

In fact, no permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied CDM baseline and monitoring methodology and/or applicable

methodological tools were ever addressed in the context of previously performed and approved post-registration changes for the project activity (PRC-3464-001 and PRC-3464-002).

B.2.6. Changes to project design

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Not applicable for the considered monitoring period. There are no permanent changes to the design of the project activity encompassed by the considered monitoring period that are to be submitted with this Monitoring Report as part of the request for issuance (post-registration change – issuance track).

It is however relevant to note that permanent changes to the design of the project activity were previously approved under PRC-3464-001 (not in the context of the verification assessment for the considered monitoring period) as follows:

Ref of PRC processes so far encompassed by the project activity	Approval date	Description of the post-registration change(s) under the category *"Permanent changes to the design of the project activity"*
PRC-3464-001	15/03/2013 (issuance track)	- *In the registered PDD dated 25 November 2009, the output power of the project activity is stated to be 4.5 MW, planned to be invested in 2009. The designed capacity was an indicative energy generation with an installed capacity to be implemented through a first phase of 0.5 MW and a second phase of 4.0 MW. However, the project has been implemented using the following equipment and according to the following schedule:* • *On November 2010, three generators of 1.426 MW each were installed, totalling 4.278 MW of capacity, and thus within the installed capacity of 4.5 MW described in the registered PDD;* • *On September 2011 one more generator set of 1.426 MW of installed capacity was implementing, resulting in a total installed capacity of 5.704 MW.*

B.2.7. Changes specific to afforestation or reforestation project activity

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Not applicable.

SECTION C. Description of monitoring system

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In accordance with ACM0001 – *"Consolidated baseline and monitoring methodology for landfill gas project activities"* (version 11), continuous monitoring of LFG related parameters is conducted on collected LFG which is destroyed by flaring and/or used for electricity generation.

An operative manual of the project activity is available. This document is the guideline for the application of the monitoring plan (description of the project and responsibilities, operative procedures for measurements and handlings of data and details about internal audits, etc.).

1. Parameters monitored

The following parameters are monitored and logged in accordance to the Monitoring Plan:

- Amount of LFG collected;
- Amount of LFG sent to the flares;
- Amount of LFG fed to the engines;
- Methane content in collected LFG;
- Temperature of the exhaust gas of the flare;
- Methane and oxygen contents in the exhaust gas of the flare;
- Electricity imported from the grid;
- Electricity exported to the grid;
- Power plant working hours;
- Emissions from flaring;
- Local and national regulatory framework;
- CO_2 emission factor from the grid;
- Average technical transmission and distribution losses for providing electricity to the Project in the year y.

All monitoring instruments are connected through a Programmable Logic Control (PLC) that allows the operator to quickly check the main working parameters through a user-friendly interface. The process parameters are continuously sampled and stored in the data logger of the plant. Then information registered is automatically aggregated per hour in a standard form used for reporting purposes.

All monitoring instruments are subject to regular checks and calibrations for which procedures are described in detail in the Managing Manual of the project. All procedures comply with manufacturer's instructions or specifications of the methodology applied.

The Project Manager is responsible for the general management of the plant, including controlling equipment subjected to regular checks and calibration, in order not to surpass the frequencies established for each QA/QC procedure, and for checking the equipment's proper working order, as well as checking and storing up the calibration certificates and records.

Calibrations performed internally, by the plant's operators themselves, are registered in specific forms for each activity and calibrations performed by external companies receive calibration certificates. Both forms and certificates are stored at the project site.

2. Monitoring equipment and installation

All measuring equipment are maintained and managed on general technical standards. The Management Manual determines the quality control regime for each equipment that includes regular maintenance and calibration. The figure below presents a schematic diagram of the monitoring instruments installed during the considered monitoring period:

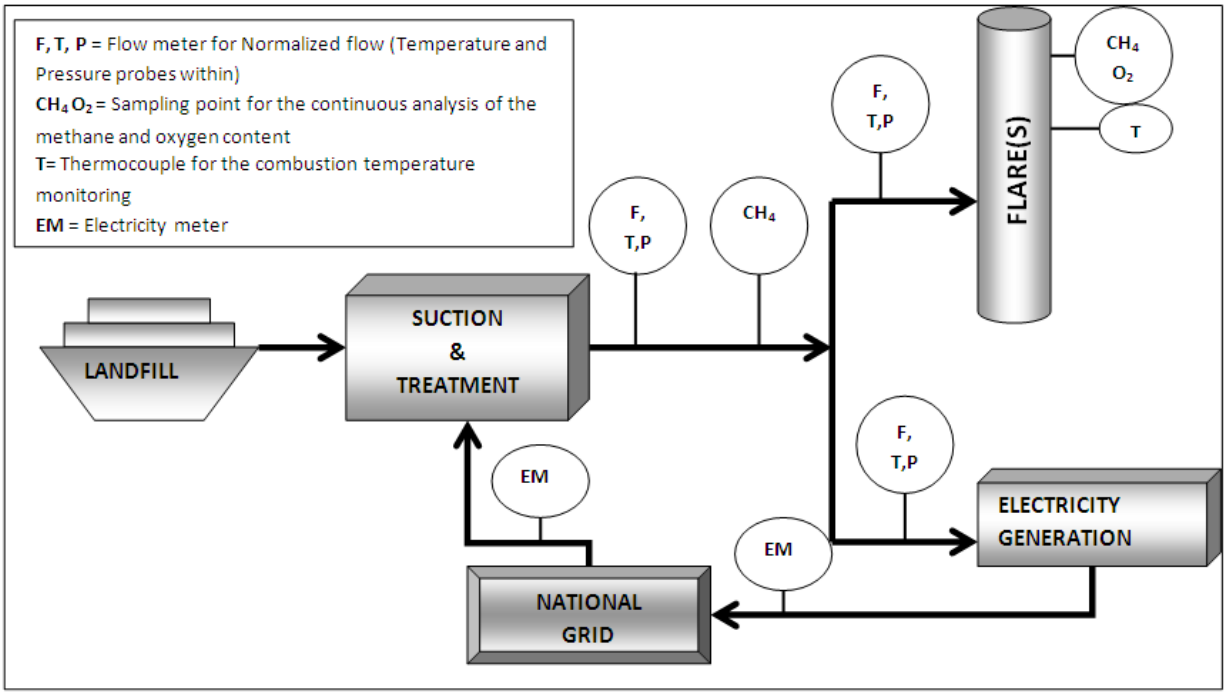

Figure 4: Monitoring points

To assure a correct monitoring, the personnel are trained on the following subjects:

- General knowledge about the equipment used in the landfill;
- Reading and recording data;
- Calibration methodology; and
- Emergency situation.

During the considered monitoring period, the CDM Project Manager was assisted/supported by hired technical consultants from the hired CDM technical consultancy/advisory service company UniCarbo – Energia and Biogás Ltda. The CDM Project Manager is responsible for ensuring the correct application of the monitoring plan.

The personnel staff involved in the operation of the project activity received proper training before the project started its operation. The figure below shows the organizational chart for the project activity:

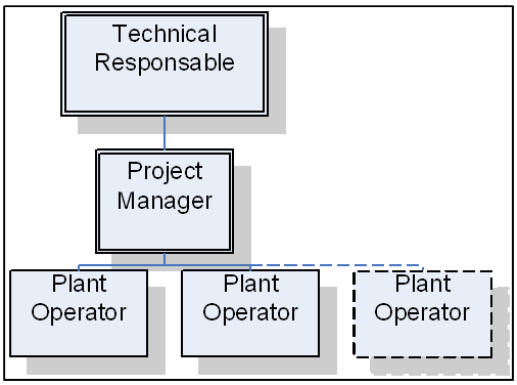

Figure 5: Organization chart

The PLC continuously receives values of the parameters monitored on-site and automatically generates spreadsheets that are archived. The quality control system ensures that all the necessary

documents (such as operational manual, drawings, maintenance and calibration instructions, etc.) are available and stored in a proper manner. Monitored data and Monitoring Sheets are daily copied to local extra HD and to Project Proponent's digital server every 6 months.

All data, including calibration records and Monitoring Reports, will be kept until 2 years after the end of the crediting period.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	**Regulatory requirements relating to landfill gas**
Unit	-
Description	Regulatory requirements relating to landfill gas
Source of data	Publicly available information of the Brazilian's regulatory requirements relating to landfill gas. The Designated National Authority (DNA) has been contacted to provide information.
Value(s) applied	Brazilian government does not mandate to flare or collect the Landfill Gas (LFG) emitted from landfills (communication *Ofício nº058/2008/CIMGC*).
Choice of data or measurement methods and procedures	The information though recorded annually is not used to change the adjustment factor (AF) or the amount of methane that would have been destroyed/combusted during the year y in the absence of the project ($MD_{BL,y}$) at renewal of the credit period because for this Project it has been chosen a fixed Crediting Period.
Purpose of data/parameter	Calculation of baseline emissions or baseline net GHG removals by sinks.
Additional comments	-

Data/Parameter	η_{PV}
Unit	%
Description	Capture efficiency of the baseline passive venting system
Source of data	*2006 IPCC Guidelines for National Greenhouse Gas Inventories*
Value(s) applied	37%
Choice of data or measurement methods and procedures	As per measurements made in 11 Dutch landfills, in the closed unlined period, Oonk and Boom (1995) measures efficiencies in between 10 and 80%, the average being 37%.

Purpose of data/parameter	Calculation of baseline emissions or baseline net GHG removals by sinks.
Additional comments	Used to calculate Adjustment Factor.

Data/Parameter	η_{LFGF}
Unit	%
Description	Landfill Gas (LFG) Flaring efficiency of the passive venting system's connected wells
Source of data	*Version 01 of the "Tool to determine project emissions from flaring gases containing methane"*
Value(s) applied	50%
Choice of data or measurement methods and procedures	It can be considered that lighted wells can burn methane less efficiently than an open flare. In the *"Tool to determine project emissions from flaring gases containing methane"* open flares are defined as devices where the residual gas is burned in an open air tip with or without any auxiliary fluid assistance, therefore it is conservative to adopt for these wells the open flare efficiency value which is equal to 50%.
Purpose of data/parameter	Calculation of baseline emissions or baseline net GHG removals by sinks.
Additional comments	Used to calculate Adjustment Factor.

Data/Parameter	**GWP_{CH4}**
Unit	tCO_2e/tCH_4
Description	Global Warming Potential of methane
Source of data	The applied value is in accordance with the "Standard for application of the global warming potential to clean development mechanism project activities and programmes of activities for the second commitment period of the Kyoto Protocol" and also with the "Global Warming Potential for Given Time Horizon" in table 2.14 of the errata to the contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, based on the effects of greenhouse gases over a 100-year time horizon. Information is available online: http://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14
Value(s) applied	25
Choice of data or measurement methods and procedures	-

Purpose of data/parameter	Calculation of baseline emissions.
Additional comments	The applied value shall be updated according to any future COP/MOP decisions and/or decision by the CDM-EB.

Data/Parameter	**N_{fw}**
Unit	-
Description	Number of wells lighted on in the baseline
Source of data	Survey data, see Annex 3 of *CDM Project Design Document* (CDM PDD) *"Baseline information"* for the Survey Report
Value(s) applied	25
Choice of data or measurement methods and procedures	It has been measured that the average number of wells lighted on in the CTRS / BR.040 landfill in the survey period was 23; in the calculation it has been assumed a value of 25 to be more conservative. Moreover, the ignited wells were conservatively considered to remain lighted all day long, for the whole year, not taking into account seasonal rains, windy days and the frequent quenching attested from the survey in order to act in the most conservative way. No other data source was available.
Purpose of data/parameter	Calculation of baseline emissions or baseline net GHG removals by sinks.
Additional comments	Used to calculate Adjustment Factor.

Data/Parameter	**N_{vw}**
Unit	-
Description	Total number of wells present on site that can be ignited
Source of data	Survey data, see Annex 3 of *CDM Project Design Document* (CDM PDD) *"Baseline information"* for the Survey Report
Value(s) applied	123
Choice of data or measurement methods and procedures	Attested from the Survey, see Report attached to CDM PDD with picture and drawings, no other data source were available.
Purpose of data/parameter	Calculation of baseline emissions or baseline net GHG removals by sinks.
Additional comments	Used to calculate Adjustment Factor.

Data/Parameter	D_{CH4}
Unit	tCH_4/m^3CH_4
Description	Methane Density
Source of data	-
Value(s) applied	0.0007168
Choice of data or measurement methods and procedures	At standard temperature and pressure (0 degree Celsius and 1.013 bar) the density of methane is 0.0007168 tCH_4/m^3CH_4.
Purpose of data/parameter	Calculation of baseline emissions or baseline net GHG removals by sinks.
Additional comments	-

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	2006 IPCC Guidelines for National Greenhouse Gas Inventories for the CTRS / BR.040 Landfill cover
Value(s) applied	0
Choice of data or measurement methods and procedures	The CTRS / BR.040 landfill is covered with a compacted clay layer. As this kind of cover is not considered an oxidising material, OX used for calculations is equal to 0
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Ex-ante determined parameters not used in the context of ex-post determination and calculation of emission reductions achieved by the project activity:

The following ex-ante determined parameters (that are also included in the PDD) are not used for the purpose of ex-post determination of baseline emissions and project emissions achieved by the project activity during the considered monitoring period:

- Collection efficiency of the degassing system (CE)
- Fraction of methane in the SWDS gas (volume fraction) (F)
- Methane generation from the landfill in the absence of the project activity at year y (tCO_2e) ($BE_{CH4,SWDS,y}$)
- Fraction of degradable organic carbon (DOC) that can decompose (DOC_f)
- Methane Correction Factor (MCF)
- Fraction of degradable organic carbon (in weight) in the waste type j (DOC_j)
- Decay rate for the waste type *j* (k_j)
- Fraction of methane captured at SWDS and flared, combusted or used in another manner (f)
- Model correction factor to account for model uncertainties (φ)
- Total amount of organic waste prevented from disposal in year x (W_x)
- Weight fraction of the waste type j ($p_{n,j,x}$)
- Number of samples collected during the year x (z)

D.2. Data and parameters monitored

Data/Parameter	**$LFG_{total,y}$**
Unit	m^3 wet gas/h
Description	Total amount of landfill gas captured at normal Temperature and Pressure
Measured/calculated/ Default	Continuously measured by LFG flow meter
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (a flow meter) (with recordable electronic signal).
Value(s) of monitored parameter	The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) report all every-minute records of total amount of collected LFG during the considered monitoring period.

Monitoring equipment

Information details about the instruments installed and utilized during the considered monitoring period are listed below:

Flow meter Manufacturer & Type: Rosemount Annubar 285 Accuracy: +/- 0.25% Serial number: 78147	Differential pressure sensor Manufacturer & Type: ABB 264 DS Accuracy: +/- 0.075% Manufacturer & Type: Smar LD301D Accuracy: +/- 0.075% Details on the serial number are listed below. Periods each of the instruments were installed are shown below.
Relative pressure probe Manufacturer & Type: ABB 264 HS Accuracy: +/- 0.075% Manufacturer & Type: Smar LD301M Accuracy: +/- 0.075% Details on the serial number are listed below. Periods each of the instruments were installed are shown below.	Temperature probe Manufacturer & Type: Ecil Pt-100 Accuracy: 0.15 ºC + 0.002*T Details on the serial number are listed below. Periods each of the instruments were installed are shown below.

Calibration details:

Differential pressure sensor

External calibration is applied to this equipment annually, in accordance with manufacturer specifications.

Manufacturer and Serial nº of equipment	Calibration date	Utilization period
ABB 6409016455	22/02/2019 – 03/12/2019	01/12/2019 – 31/12/2020

Relative pressure probe

External calibration is applied to this equipment annually, in accordance with manufacturer specifications.

Manufacturer and Serial nº of equipment	Calibration date	Utilization period
ABB 6409016561	13/12/2018 and 03/12/2019	01/12/2019 – 24/06/2020
ABB 3K646619023208	04/12/2019 and 30/11/2020	24/06/2020 – 31/12/2020

Temperature probe

External calibration is applied to this equipment annually, in accordance with manufacturer specifications.

Manufacturer and Serial nº of equipment	Calibration date	Utilization period
Ecil 1028.137493	12/12/2018 and 24/11/2020	01/12/2019 – 31/12/2020

Measuring/reading/recording frequency	Continuous measurements are recorded/reported every minute.
Calculation method (if applicable)	Not applicable.

QA/QC procedures	Monitoring equipment/instruments are to be calibrated and maintained as per instrument specifications and/or recommendations of their manufacturer. Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed in accordance with detailed working instructions.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**$LFG_{flare,y}$**
Unit	m^3 wet gas/h
Description	Amount of landfill gas flared
Measured/calculated/ Default	Continuously measured by LFG flow meter
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (a flow meter) (with recordable electronic signal).
Value(s) of monitored parameter	The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) report all every-minute records of total amount of flared LFG during the considered monitoring period.

Monitoring equipment

Information details about the instruments installed and utilized during the considered monitoring period are listed below:

Flow meter Manufacturer & Type: Rosemount Annubar 285 Accuracy: +/- 0.25% Serial number: 78147	Differential pressure sensor Manufacturer & Type: ABB 264 DS Accuracy: +/- 0.075% Manufacturer & Type: Smar LD301D Accuracy: +/- 0.075% Details on the serial number are listed below. Periods each of the instruments were installed are shown below.
Relative pressure probe Manufacturer & Type: ABB 264 HS Accuracy: +/- 0.075% Manufacturer & Type: Smar LD301M Accuracy: +/- 0.075% Details on the serial number are listed below. Periods each of the instruments were installed are shown below.	Temperature probe Manufacturer & Type: Ecil Pt-100 Accuracy: 0.15 ºC + 0.002*T Details on the serial number are listed below. Periods each of the instruments were installed are shown below.

Calibration details:

Differential pressure sensor

External calibration is applied to this equipment annually, in accordance with manufacturer specifications.

Manufacturer and Serial nº of equipment	Calibration date	Utilization period
ABB 6409016455	22/02/2019 – 03/12/2019	01/12/2019 – 31/12/2020

Relative pressure probe

External calibration is applied to this equipment annually, in accordance with manufacturer specifications.

Manufacturer and Serial nº of equipment	Calibration date	Utilization period
ABB 6409016561	13/12/2018 and 03/12/2019	01/12/2019 – 24/06/2020
ABB 3K646619023208	04/12/2019 and 30/11/2020	24/06/2020 – 31/12/2020

Temperature probe

External calibration is applied to this equipment annually, in accordance with manufacturer specifications.

Manufacturer and Serial nº of equipment	Calibration date	Utilization period
Ecil 1028.137493	12/12/2018 and 24/11/2020	01/12/2019 – 31/12/2020

Measuring/reading/recording frequency	Continuous measurements are recorded/reported every minute.
Calculation method (if applicable)	Not applicable.

QA/QC procedures	Monitoring equipment/instruments are to be calibrated and maintained as per instrument specifications and/or recommendations of their manufacturer. Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed in accordance with detailed working instructions.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**$LFG_{electricity,y}$**
Unit	m^3 wet gas/h
Description	Amount of landfill gas combusted in power plant
Measured/calculated/ Default	Continuously measured by LFG flow meter
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (a flow meter) (with recordable electronic signal).
Value(s) of monitored parameter	The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) report all every-minute records of total amount of combusted LFG during the considered monitoring period.

Monitoring equipment

Information details about the instruments installed and utilized during the considered monitoring period are listed below:

Flow meter Manufacturer & Type: Rosemount Annubar 285 Accuracy: +/- 0.25% Serial number: 78147	Differential pressure sensor Manufacturer & Type: ABB 264 DS Accuracy: +/- 0.075% Manufacturer & Type: Smar LD301D Accuracy: +/- 0.075% Details on the serial number are listed below. Periods each of the instruments were installed are shown below.
Relative pressure probe Manufacturer & Type: ABB 264 HS Accuracy: +/- 0.075% Manufacturer & Type: Smar LD301M Accuracy: +/- 0.075% Details on the serial number are listed below. Periods each of the instruments were installed are shown below.	Temperature probe Manufacturer & Type: Ecil Pt-100 Accuracy: 0.15 ºC + 0.002*T Details on the serial number are listed below. Periods each of the instruments were installed are shown below.

Calibration details:

Differential pressure sensor

External calibration is applied to this equipment annually, in accordance with manufacturer specifications.

Manufacturer and Serial nº of equipment	Calibration date	Utilization period
ABB 6409016455	22/02/2019 – 03/12/2019	01/12/2019 – 31/12/2020

Relative pressure probe

External calibration is applied to this equipment annually, in accordance with manufacturer specifications.

Manufacturer and Serial nº of equipment	Calibration date	Utilization period
ABB 6409016561	13/12/2018 and 03/12/2019	01/12/2019 – 24/06/2020
ABB 3K646619023208	04/12/2019 and 30/11/2020	24/06/2020 – 31/12/2020

Temperature probe

External calibration is applied to this equipment annually, in accordance with manufacturer specifications.

Manufacturer and Serial nº of equipment	Calibration date	Utilization period
Ecil 1028.137493	12/12/2018 and 24/11/2020	01/12/2019 – 31/12/2020

Measuring/reading/recording frequency	Continuous measurements are recorded/reported every minute.
Calculation method (if applicable)	Not applicable.

QA/QC procedures	Monitoring equipment/instruments are to be calibrated and maintained as per instrument specifications and/or recommendations of their manufacturer. Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed in accordance with detailed working instructions.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	$w_{CH4,y}$
Unit	m^3CH_4 / m^3LFG
Description	Methane fraction in the landfill gas
Measured/calculated/ Default	Continuously measured by a gas analyzer unit
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (CH_4 content gas analyser) (with continuous measurements being electronically recorded).
Value(s) of monitored parameter	The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) report all every-minute records of fraction of CH_4 in the collected LFG during the considered monitoring period.
Monitoring equipment	*Specifications and calibration details for the continuous gas analyzer unit used for measuring fraction of CH_4 in collected LFG during the considered monitoring period:* The specifications of the installed continuous gas analyzer are described below: - Manufacturer: Siemens - Model: Ultramat 23 - Accuracy: ±0.5% - Serial Number: N1-X6-991 - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are to be performed every year - Dates and validity of performed calibration event(s) valid for the considered monitoring period:
Measuring/reading/recording frequency	Continuous measurements are recorded/reported every minute.
Calculation method (if applicable)	Not applicable.

Calibration date	**Calibration certificate No.**	**Calibration validity**
05/12/2018	F0_CAL/002	04/12/2019
19/06/2019	208.0/2019	18/06/2020
11/05/2020	1978-2/20	10/05/2021

The calibration events were performed by using certified span gas cylinder with a known CH_4 composition (as outlined in the Calibration Certificate).

QA/QC procedures	Monitoring equipment/instruments are to be calibrated and maintained as per instrument specifications and/or recommendations of their manufacturer.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**Operation of the energy plant**
Unit	Hours
Description	Operation of the energy plant
Measured/calculated/ Default	Measured
Source of data	Engine's working hour counter meters
Value(s) of monitored parameter	The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) report the operational status of each engine every minute.
Monitoring equipment	Engine's working minute meter.
Measuring/reading/recording frequency	Monitoring frequency: continuously measured by the engine's minute counter meters
Calculation method (if applicable)	Not applicable.
QA/QC procedures	Not applicable.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**EL_{LFG}**
Unit	MWh
Description	Net amount of electricity generated using landfill gas
Measured/calculated/ default	Measured.
Source of data	Measured as part of the operation of the project activity by applying appropriate electricity meter.

<table>
<tr><td>Value(s) of monitored parameter</td><td>Monthly records of electricity generated by the project activity during the considered monitoring period:

<table><tr><th>Month</th><th>Electricity generated by the project (kWh)</th></tr><tr><td>December/2019</td><td>604,306.39</td></tr><tr><td>January/2020</td><td>609,832.34</td></tr><tr><td>February/2020</td><td>530,433.60</td></tr><tr><td>March/2020</td><td>590,714.55</td></tr><tr><td>April/2020</td><td>637,946.39</td></tr><tr><td>May/2020</td><td>624,940.56</td></tr><tr><td>June/2020</td><td>580,381.29</td></tr><tr><td>July/2020</td><td>572,083.47</td></tr><tr><td>August/2020</td><td>249,621.89</td></tr><tr><td>September/2020</td><td>-</td></tr><tr><td>October/2020</td><td>99,152.76</td></tr><tr><td>November/2020</td><td>539,348.71</td></tr><tr><td>December/2020</td><td>553,464.18</td></tr></table></td></tr>
<tr><td>Monitoring equipment</td><td>Two identical electricity meters were used for measuring EL_{LFG} during the considered monitoring period. Their specifications are as follows:

Main Electricity Meter
- Manufacturer: Schneider
- Model: ION 8600C
- Accuracy: ±0.2%
- Serial number: PT-0912A354-01
- Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): no calibration is needed as per the manufacturer of the instrument
- Latest calibration event performed: 27/01/2010, calibration certificate nº: 852/2010 issued by CAM Endesa.

Standby Electricity Meter
- Manufacturer: Schneider
- Model: ION 8600C
- Accuracy: ±0.2%
- Serial number: PT-0912A361-01
- Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): no calibration is needed as per the manufacturer of the instrument
- Latest calibration event performed: 26/01/2010, calibration certificate nº: 734/2010 issued by CAM Endesa.</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Continuous measurements are to be aggregated manually or automatically. Accumulated measurement records are reported with an every-month frequency.</td></tr>
<tr><td>Calculation method (if applicable)</td><td>Not applicable</td></tr>
<tr><td>QA/QC procedures</td><td>Electricity meter is subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. Double check by receipt of sales.</td></tr>
<tr><td>Purpose of data/parameter</td><td>Calculation of project emissions</td></tr>
<tr><td>Additional comments</td><td></td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>EL_{PR}</td></tr>
<tr><td>Unit</td><td>MWh</td></tr>
<tr><td>Description</td><td>Total amount of electricity imported to meet the requirements of the Project</td></tr>
<tr><td>Measured/calculated/ default</td><td>Measured.</td></tr>
<tr><td>Source of data</td><td>Measured as part of the operation of the project activity by applying appropriate electricity meter.</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>Monthly records of grid-sourced electricity consumption valid for the considered monitoring period:
<table>
<tr><th>Month</th><th>Electricity consumed by the project (kWh)</th></tr>
<tr><td>December/2019</td><td>346.83</td></tr>
<tr><td>January/2020</td><td>377.43</td></tr>
<tr><td>February/2020</td><td>1,219.12</td></tr>
<tr><td>March/2020</td><td>909.09</td></tr>
<tr><td>April/2020</td><td>585.43</td></tr>
<tr><td>May/2020</td><td>351.22</td></tr>
<tr><td>June/2020</td><td>226.52</td></tr>
<tr><td>July/2020</td><td>255.60</td></tr>
<tr><td>August/2020</td><td>5,715.66</td></tr>
<tr><td>September/2020</td><td>12,826.01</td></tr>
<tr><td>October/2020</td><td>10,223.00</td></tr>
<tr><td>November/2020</td><td>708.57</td></tr>
<tr><td>December/2020</td><td>700.77</td></tr>
</table></td></tr>
</table>

Monitoring equipment	*Two identical electricity meters were used for measuring EL_{PR}. Specifications and calibration details for the electricity meters used for measuring net amount of electricity generated using landfill gas are described below:* The specifications of the electricity meter utilized during the considered monitoring period in which the project activity operated are as follows: Main Electricity Meter - Manufacturer: Schneider - Model: ION 8600C - Accuracy: ±0.2% - Serial number: PT-0912A354-01 - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): no calibration is needed as per the manufacturer of the instrument - Latest calibration event performed: 27/01/2010, calibration certificate nº: 852/2010 issued by CAM Endesa. Standby Electricity Meter - Manufacturer: Schneider - Model: ION 8600C - Accuracy: ±0.2% - Serial number: PT-0912A361-01 - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): no calibration is needed as per the manufacturer of the instrument - Latest calibration event performed: 26/01/2010, calibration certificate nº: 734/2010 issued by CAM Endesa.
Measuring/reading/recording frequency	Continuous measurements are to be aggregated manually or automatically. Accumulated measurement records are reported with an every-month frequency.
Calculation method (if applicable)	Not applicable
QA/QC procedures	Electricity meter is subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. Double check by receipt of sales.
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

Data/Parameter	**$CEF_{elec,BL,y}$**
Unit	tCO_2/MWh
Description	Carbon emission factor for electricity
Measured/calculated/ default	Calculated as per the “Tool to calculate the emission factor for an electricity system”, using the latest figures available, provided by the Host Country DNA.
Source of data	Calculated as per the “Tool to calculate the emission factor for an electricity system”, using the latest figures available, provided by the Host Country DNA.

Value(s) of monitored parameter	2019: 0.3101 tCO_2/MWh 2020: 0.4539 tCO_2/MWh
Monitoring equipment	n/a
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	Value is determined as per guidance and procedures established by the methodological tool “Tool to calculate the emission factor for an electricity system”.
QA/QC procedures	-
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

Data/Parameter	**$PE_{EC,y}$**
Unit	tCO_2
Description	Project emissions from electricity consumption by the project activity during the year y.
Measured/calculated/ default	Calculated
Source of data	Calculated as per the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”.
Value(s) of monitored parameter	Total $PE_{EC,y}$ in the considered monitoring period is 13 tCO_2.
Monitoring equipment	Not applicable
Measuring/reading/recording frequency	Calculated for the monitoring period as it depends on the $CEF_{elecy,BL,y}$ to be applied (the most recent available).
Calculation method (if applicable)	Value is determined as per guidance and procedures established by the methodological tool “Tool to calculate the emission factor for an electricity system”.
QA/QC procedures	-
Purpose of data/parameter	Calculation of project emissions
Additional comments	

Data/Parameter	**$TDL_{j,y}$**
Unit	%
Description	Average technical transmission and distribution losses for providing electricity to source j in year y

Measured/calculated/ default	Default
Source of data	According to the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”, scenario A applies to the project as the source of electricity consumption and, since no recent, accurate and reliable data were available, the option to choose a default value of 20% was chosen.
Value(s) of monitored parameter	20%
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	Not applicable.
QA/QC procedures	-
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

Data/Parameter	**$EF_{CM,y}$**
Unit	tCO_2/MWh
Description	Combined margin emissions factor required to evaluate CO_2 emissions due to the power consumption of the project activity imported from the National Grid.
Measured/calculated/ default	Calculated as per the “Tool to calculate the emission factor for an electricity system”
Source of data	Not applicable.
Value(s) of monitored parameter	2019: 0.3101 tCO_2/MWh 2020: 0.2759 tCO_2/MWh
Monitoring equipment	n/a
Measuring/reading/recording frequency	Annually
Calculation method (if applicable)	Value is determined as per guidance and procedures established by the methodological tool “Tool to calculate the emission factor for an electricity system”.
QA/QC procedures	-
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

<table>
<tr><td>Data/Parameter</td><td>$fv_{i,h}$</td></tr>
<tr><td>Unit</td><td>-</td></tr>
<tr><td>Description</td><td>Volumetric fraction of component i in the residual gas in the hour h where i = CH_4, CO, CO_2, O_2, H_2, N_2</td></tr>
<tr><td>Measured/calculated/ default</td><td>Continuously measured by a gas analyzer unit</td></tr>
<tr><td>Source of data</td><td>Measured as part of the operation of the project activity by applying appropriate monitoring instruments (content gas analyser) (with continuous measurements being electronically recorded).</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) report all every-minute records of volumetric fraction of CH_4 in the residual gas during the considered monitoring period.</td></tr>
<tr><td>Monitoring equipment</td><td><u>Specifications and calibration details for the continuous gas analyzer unit used for measuring fraction of CH_4 in in the residual gas LFG during the considered monitoring period:</u>

The specifications of the installed continuous gas analyzer are described below:

- Manufacturer: Siemens
- Model: Ultramat 23
- Accuracy: ±0.5%
- Serial Number: N1-X6-991
- Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are to be performed every year
- Dates and validity of performed calibration event(s) valid for the considered monitoring period:
<table><tr><th>Calibration date</th><th>Calibration certificate No.</th><th>Calibration validity</th></tr><tr><td>05/12/2018</td><td>F0_CAL/002</td><td>04/12/2019</td></tr><tr><td>19/06/2019</td><td>208.0/2019</td><td>18/06/2020</td></tr><tr><td>11/05/2020</td><td>1978-2/20</td><td>10/05/2021</td></tr></table>
The calibration events were performed by using certified span gas cylinder with a known CH_4 composition (as outlined in the Calibration Certificate).</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Continuous measurements are recorded/reported every minute.</td></tr>
<tr><td>Calculation method (if applicable)</td><td>Not applicable.</td></tr>
<tr><td>QA/QC procedures</td><td>Monitoring equipment/instruments are to be calibrated and maintained as per instrument specifications and/or recommendations of their manufacturer.</td></tr>
<tr><td>Purpose of data/parameter</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comments</td><td>-</td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>$t_{O2,h}$</td></tr>
<tr><td>Unit</td><td>-</td></tr>
<tr><td>Description</td><td>Volumetric fraction of O_2 in the exhaust gas of the flare in the hour h</td></tr>
<tr><td>Measured/calculated/ default</td><td>Measured as part of the operation of the project activity by applying appropriate monitoring instruments (content gas analyser) (with continuous measurements being electronically recorded).</td></tr>
<tr><td>Source of data</td><td>The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) report all every-minute records of volumetric fraction of O_2 in the exhaust gas of the flare during the considered monitoring period.</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) report all measurement data for $t_{O2,h}$ during the considered monitoring period.</td></tr>
<tr><td>Monitoring equipment</td><td>The specifications of the installed continuous gas analyzer are described below:

- Manufacturer: Siemens
- Model: Ultramat 23
- Accuracy: ±0.5%
- Serial Number: N1-X6-992
- Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are to be performed every year
- Dates and validity of performed calibration event(s) valid for the considered monitoring period:
<table>
<tr><th>Calibration date</th><th>Calibration certificate No.</th><th>Calibration validity</th></tr>
<tr><td>28/01/2019</td><td>Internal calibration F0_CAL/003</td><td>27/01/2020</td></tr>
<tr><td>30/12/2019</td><td>Internal calibration F0_CAL/003</td><td>29/12/2020</td></tr>
<tr><td>11/05/2020</td><td>1978-1/20</td><td>10/05/2021</td></tr>
</table>
The calibration events were performed by using certified span gas cylinder with a known CH_4 composition (as outlined in the Calibration Certificate).</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Continuous measurements are recorded/reported every minute.</td></tr>
<tr><td>Calculation method (if applicable)</td><td>Not applicable.</td></tr>
<tr><td>QA/QC procedures</td><td>Monitoring equipment/instruments are to be calibrated and maintained as per instrument specifications and/or recommendations of their manufacturer.</td></tr>
<tr><td>Purpose of data/parameter</td><td>Calculation of project emissions</td></tr>
<tr><td>Additional comments</td><td>-</td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>$fv_{CH4,FG,h}$</td></tr>
<tr><td>Unit</td><td>mg/m^3</td></tr>
<tr><td>Description</td><td>Concentration of methane in the exhaust gas of the flares in dry basis at normal conditions in the hour h</td></tr>
<tr><td>Measured/calculated/ default</td><td>Measured as part of the operation of the project activity by applying appropriate monitoring instruments (content gas analyser) (with continuous measurements being electronically recorded).</td></tr>
<tr><td>Source of data</td><td>Measured as part of the operation of the project activity by applying appropriate monitoring instruments (content gas analyser) (with continuous measurements being electronically recorded).</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) report all every-minute records of concentration of methane in the exhaust gas of the flare during the considered monitoring period.</td></tr>
<tr><td>Monitoring equipment</td><td>The specifications of the installed continuous gas analyzer are described below:

- Manufacturer: Siemens
- Model: Ultramat 23
- Accuracy: ±0.5%
- Serial Number: N1-X6-992
- Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are to be performed every year
- Dates and validity of performed calibration event(s) valid for the considered monitoring period:

<table>
<tr><th>Calibration date</th><th>Calibration certificate No.</th><th>Calibration validity</th></tr>
<tr><td>28/01/2019</td><td>Internal calibration F0_CAL/003</td><td>27/01/2020</td></tr>
<tr><td>30/12/2019</td><td>Internal calibration F0_CAL/003</td><td>29/12/2020</td></tr>
<tr><td>11/05/2020</td><td>1978-1/20</td><td>10/05/2021</td></tr>
</table>

The calibration events were performed by using certified span gas cylinder with a known CH_4 composition (as outlined in the Calibration Certificate).</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Continuous measurements are recorded/reported every minute.</td></tr>
<tr><td>Calculation method (if applicable)</td><td>Not applicable.</td></tr>
<tr><td>QA/QC procedures</td><td>Monitoring equipment/instruments are to be calibrated and maintained as per instrument specifications and/or recommendations of their manufacturer.</td></tr>
<tr><td>Purpose of data/parameter</td><td>Calculation of project emissions</td></tr>
<tr><td>Additional comments</td><td>-</td></tr>
</table>

Data/Parameter	T_{flare}
Unit	°C
Description	Temperature in the exhaust gas of the enclosed flare
Measured/calculated/ default	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (thermocouple).
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (thermocouple).
Value(s) of monitored parameter	The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) report all every-minute records of temperature in the exhaust gas of the enclosed flare during the considered monitoring period.
Monitoring equipment	The specifications of the installed thermocouples and their period in use are described below: - Manufacturer: Ecil - Model: Type S - Accuracy: ±1.5 °C or 0.25% of the temperature (the one which is greater) - Serial Number: 1121-513793 - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are to be performed every year - Dates and validity of performed calibration event(s) valid for the considered monitoring period:
Measuring/reading/recording frequency	Continuous measurements are recorded/reported every minute.
Calculation method (if applicable)	Value is determined as per guidance and procedures established by the methodological tool “Tool to calculate the emission factor for an electricity system”.
QA/QC procedures	-
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

Equipment	Calibration date	Period installed
Ecil 0950.064353	25/04/2016	01/12/2019 – 31/12/2020

Data/Parameter	$PE_{flare,y}$
Unit	tCO_2e
Description	Project emissions from flaring of the residual gas stream in year y
Measured/calculated/ default	Calculated as per the “Tool to determine project emissions from flaring gases containing methane”.

Source of data	Calculated as per the “Tool to determine project emissions from flaring gases containing methane”.
Value(s) of monitored parameter	The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) report all every-minute calculated vallues of project emissions from flaring of the residual gas stream during the considered monitoring period.
Monitoring equipment	n/a
Measuring/reading/recording frequency	Calculated for each hour using hourly aggregated data. Aggregated also daily and monthly for reporting purposes.
Calculation method (if applicable)	See Section E.1.
QA/QC procedures	-
Purpose of data/parameter	Calculation of project emissions
Additional comments	-

Data/Parameter	**$FV_{RG,h}$**
Unit	m^3/h
Description	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour h
Measured/calculated/ default	Continuously measured by LFG flow meter
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (a flow meter) (with recordable electronic signal).
Value(s) of monitored parameter	The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) report all every-minute records of volumetric flow rate of the residual gas LFG during the considered monitoring period.

Monitoring equipment

Information details about the instruments installed and utilized during the considered monitoring period are listed below:

Flow meter Manufacturer & Type: Rosemount Annubar 285 Accuracy: +/- 0.25% Serial number: 78147	Differential pressure sensor Manufacturer & Type: ABB 264 DS Accuracy: +/- 0.075% Manufacturer & Type: Smar LD301D Accuracy: +/- 0.075% Details on the serial number are listed below. Periods each of the instruments were installed are shown below.
Relative pressure probe Manufacturer & Type: ABB 264 HS Accuracy: +/- 0.075% Manufacturer & Type: Smar LD301M Accuracy: +/- 0.075% Details on the serial number are listed below. Periods each of the instruments were installed are shown below.	Temperature probe Manufacturer & Type: Ecil Pt-100 Accuracy: 0.15 ºC + 0.002*T Details on the serial number are listed below. Periods each of the instruments were installed are shown below.

Calibration details:

Differential pressure sensor

External calibration is applied to this equipment annually, in accordance with manufacturer specifications.

Manufacturer and Serial nº of equipment	Calibration date	Utilization period
ABB 6409016455	22/02/2019 – 03/12/2019	01/12/2019 – 31/12/2020

Relative pressure probe

External calibration is applied to this equipment annually, in accordance with manufacturer specifications.

Manufacturer and Serial nº of equipment	Calibration date	Utilization period
ABB 6409016561	13/12/2018 and 03/12/2019	01/12/2019 – 24/06/2020
ABB 3K646619023208	04/12/2019 and 30/11/2020	24/06/2020 – 31/12/2020

Temperature probe

External calibration is applied to this equipment annually, in accordance with manufacturer specifications.

Manufacturer and Serial nº of equipment	Calibration date	Utilization period
Ecil 1028.137493	12/12/2018 and 24/11/2020	01/12/2019 – 31/12/2020

Measuring/reading/recording frequency	Continuous measurements are recorded/reported every minute.
Calculation method (if applicable)	Not applicable.

QA/QC procedures	Monitoring equipment/instruments are to be calibrated and maintained as per instrument specifications and/or recommendations of their manufacturer. Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed in accordance with detailed working instructions.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

D.3. Implementation of sampling plan

>>

Not applicable.

SECTION E. Calculation of emission reductions or net anthropogenic removals

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

>>

Under conformance with provisions and calculation approaches of the registered PDD and by taking into account the configuration of the so far implemented component of the project activity, baseline emissions (BE_y) for the considered monitoring period are determined (in tCO_2e) as follows:

$$BE_y = (MD_{project,y} – MD_{BL,y}) * GWP_{CH4} + EL_{LFG,y} * CEF_{elec,BL,y}$$

Where:

BE_y Baseline emissions in year y (tCO_2e)

$MD_{project,y}$ Amount of methane destroyed by the project activity during the year (in tCH_4). Further details for the determination of $MD_{project,y}$ for the considered monitoring period are presented below under "*Determination of values of $MD_{project,y}$*".

$MD_{BL,y}$ Amount of methane that would have been destroyed/combusted during the year in the absence of the project due to regulatory and/or contractual requirement (in tCH_4). $MD_{BL,y}$ is calculated as follows:

$$MD_{BL,y} = MD_{project,y} * AF_y$$

Where:

AF_y Adjustment factor for year y. As per the registered PDD, AF_y is determined as follows:

$$AF_y = \frac{\varepsilon_{BL}}{\varepsilon_{PRy}}$$

Where:

ε_{BL} Destruction efficiency of the baseline system (fraction). ε_{BL} is calculated in the registered PDD as 3.8%.

ε_{PR} Destruction efficiency of the system used in the project activity for year y (fraction). ε_{PR} is determined as follows:

$$\varepsilon_{PR,y} = \frac{MD_{project,y}}{MG_{PR,y}}$$

Where:

$MD_{project,y}$ Amount of methane destroyed by the project activity during the year y (tCH_4). Further details for the determination of $MD_{project,y}$ for the considered monitoring period are presented below under "*Determination of values of $MD_{project,y}$*".

$MG_{PR,y}$ Amount of methane generated during year y of the project activity. The following values of $MG_{PR,y}$ valid for the years encompassed by the considered monitoring period were calculated in the registered PDD:

Year	$MG_{PR,y}$
2019	4,218
2020	3,839

Calculated monthly values of $MD_{BL,y}$ are presented in the emission reductions calculation spreadsheet which is enclosed to this Monitoring Report. The accumulated value of $MD_{BL,y}$ for the considered monitoring period is calculated as 56 tCH_4.

GWP_{CH4} Global Warming Potential value for methane for the second commitment period is 25 tCO_2e/tCH_4.

$CEF_{elecy,BL,y}$ CO_2 emission factor for electricity generated by the project activity (in tCO_2e/MWh). As per the registered PDD, $CEF_{elecy,BL,y}$ is calculated as the combined margin emission factor ($EF_{grid,CM,y}$) as follows:

$$EF_{grid,CM,y} = (EF_{grid,OM,y} \times w_{OM}) + (EF_{grid,BM,y} \times w_{BM})$$

Where:

$EF_{grid,CM,y}$ Emission factor for the Brazilian electric grid in year y (tCO_2/MWh).

$EF_{grid,OM,y}$ Operating margin CO_2 emission factor in year y (tCO_2/MWh).

$EF_{grid,BM,y}$ Build margin CO_2 emission factor in year y (tCO_2/MWh).

w_{OM} Weighting of operating margin emissions factor (%). w_{OM} is ex-ante determined in the PDD as 0.5.

w_{BM} Weighting of build margin emissions factor (%). W_{BM} is ex-ante determined in the PDD as 0.5.

In accordance with the "Tool to calculate the emission factor for an electricity system", data used to calculate the grid emission factor was taken from publicly available information available in the Brazilian DNA's website[2] for the years 2019 and 2020, as demonstrated in the table below.

$EF_{CM} = (EF_{OM} \times W_{OM}) + (EF_{BM} \times W_{BM})$			
Year	**EF_{OM}**	**EF_{BM}**	**EF_{CM}**
2019	0.5181	0.1020	0.3101
2020	0.4539	0.0979	0.2759

$EL_{LFG,y}$ Net quantity of electricity produced using LFG, which in the absence of the project activity would have been produced by power plants connected to the grid or by an onsite/off-site fossil fuel based captive power generation, during year y (in MWh). Monthly values of $EL_{LFG,y}$ valid for the considered monitoring period calculated in the emission reductions calculation spreadsheet are also presented in Section D.2.

Determination of values of $MD_{project,y}$:

$$MD_{project,\,y} = MD_{flare,\,y} + MD_{electricit\,y,y} + MD_{thermal,\,y} + MD_{PL,\,y}$$

Where:

$MD_{flared,y}$ Quantity of methane destroyed by flaring (tCH_4)

$MD_{electricity,y}$ Quantity of methane destroyed by generation of electricity (tCH_4).

$MD_{thermal,y}$ Quantity of methane destroyed for the generation of thermal energy (tCH_4), for the proposed Project this is equal to 0

$MD_{PL,y}$ Quantity of methane sent to the pipeline for feeding to the natural gas distribution network (tCH_4), for the proposed Project this is equal to 0

Quantity of methane destroyed by flaring ($MD_{flared,y}$):

$$MD_{flared,\,y} = LFG_{flared,\,y} \times W_{CH4,\,y} \times D_{CH4} - \left(\frac{PE_{flare,\,y}}{GWP_{CH4}} \right)$$

Where:

$LFG_{flare,y}$ Quantity of landfill gas fed to the flare(s) during the year measured in cubic meters (m^3)

$W_{CH4,y}$ Average methane fraction of the landfill gas as measured during the year and expressed as a fraction (in m^3 CH_4 / m^3 LFG)

[2] https://antigo.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_despacho.html

D_{CH4} Methane density expressed in tonnes of methane per cubic meter of methane (tCH_4/m^3CH_4)

$PE_{flare,y}$ Project emissions from flaring of the residual gas stream in year y (tCO_2e)

Application of "Tool to determine project emissions from flaring gases containing methane"

For the Project enclosed flares are installed and continuous monitoring of the flare efficiency is made.

This tool involves the following seven steps:

STEP 1: Determination of the mass flow rate of the residual gas that is flared

STEP 2: Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas

STEP 3: Determination of the volumetric flow rate of the exhaust gas on a dry basis

STEP 4: Determination of methane mass flow rate of the exhaust gas on a dry basis

STEP 5: Determination of methane mass flow rate of the residual gas on a dry basis

STEP 6: Determination of the hourly flare efficiency

STEP 7: Calculation of annual project emissions from flaring based on measured hourly values or based on default flare efficiencies

STEP 1

This step calculates the residual gas mass flow rate in each hour h, based on the volumetric flow rate and the density of the residual gas. The density of the residual gas is determined based on the volumetric fraction of all components in the gas.

$$FM_{RG,h} = \rho_{RG,n,h} \bullet FV_{RD,h}$$

Where:

Variable	SI Unit	Description
$FM_{RG,h}$	kg/h	Mass flow rate of the residual gas in hour h
$\rho_{RG,n,h}$	Kg/m^3	Density of the residual gas at normal conditions in hour h
$FV_{RG,h}$	m^3/h	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour h

Where:

$$\rho_{RG,n,h} = \frac{P_n}{\frac{R_u}{MM_{RG,h}} \bullet T_n}$$

Where:

Variable	SI Unit	Description
$\rho_{RG,n,h}$	Kg/m^3	Density of the residual gas at normal conditions in hour h
P_n	Pa	Atmospheric pressure at normal conditions (101,325)
R_u	$Pa.m^3/kmol.K$	Universal ideal gas constant (8,314)
$MM_{RG,h}$	Kg/kmol	Molecular mass of the residual gas in hour h
T_n	K	Temperature at normal conditions (273.15)

And:

$$MM_{RG,h} = \sum_i (fv_{i,h} \bullet MM_i)$$

Where:

Variable	SI Unit	Description
$MM_{RG,h}$	Kg/kmol	Molecular mass of the residual gas in hour h
$f_{vi,h}$	-	Volumetric fraction of component i in the residual gas in the hour h
MM_i	Kg/kmol	Molecular mass of residual gas component i
i		The components CH_4, CO, CO_2, O_2, H_2, N_2

For this Project it has been chosen, as a simplified approach, to measure only the volumetric fraction of methane and consider the difference to 100% as being nitrogen (N_2).

STEP 2

Determine the mass fractions of carbon, hydrogen, oxygen and nitrogen in the residual gas, calculated from the volumetric fraction of each component i in the residual gas, as follows:

$$fm_{j,h} = \frac{\sum_i fv_{i,h} \bullet AM_j \bullet NA_{j,i}}{MM_{RG,h}}$$

Where:

Variable	SI Unit	Description
$fm_{j,h}$	-	Mass fraction of element j in the residual gas in hour h
$fv_{i,h}$	-	Volumetric fraction of component i in the residual gas in the hour h
AM_j	Kg/kmol	Atomic mass of element j
$NA_{j,y}$	-	Number of atoms of element j in component i
$MM_{RG,h}$	Kg/kmol	Molecular mass of the residual gas in hour h
j	-	The elements carbon, hydrogen, oxygen and nitrogen
I	-	The components CH_4, CO, CO_2, O_2, H_2, N_2

STEP 3

This step was applied in the Project since the methane combustion efficiency of the flare(s) has been continuously monitored.

Determine the average volumetric flow rate of the exhaust gas in each hour h based on a stoichiometric calculation of the combustion process, which depends on the chemical composition of the residual gas, the amount of air supplied to combust it and the composition of the exhaust gas, as follows:

$$TV_{n,FG,h} = V_{n,FG,h} \bullet FM_{RG,h}$$

Where:

Variable	SI Unit	Description
$TV_{n,FG,h}$	M^3/h	Volumetric flow rate of the exhaust gas in dry basis at normal conditions in hour h
$V_{n,FG,h}$	M^3/kg residual gas	Volume of the exhaust gas of the flare in dry basis at normal conditions per kg of residual gas in hour h
$FM_{RG,h}$	Kg residual gas/h	Mass flow rate of the residual gas in the hour h

$$V_{n,FG,h} = V_{n,CO2,h} + V_{n,O2,h} + V_{n,N2,h}$$

Where:

Variable	SI Unit	Description
$V_{n,FG,h}$	M^3/ kg residual gas	Volume of the exhaust gas of the flare in dry basis at normal conditions per kg of residual gas in the hour h
$V_{n,CO2,h}$	M^3/ kg residual gas	Quantity of CO_2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour h
$V_{n,N2,h}$	M^3/ kg residual gas	Quantity of N_2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour h
$V_{n,O2,h}$	M^3/ kg residual gas	Quantity of O_2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour h

$$V_{n,O2,h} = n_{O2,h} \bullet MV_n$$

Where:

Variable	SI Unit	Description
$V_{n,O2,h}$	M^3/ kg residual gas	Quantity of O_2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour h
$n_{O2,h}$	Kmol/kg residual gas	Quantity of moles O_2 in the exhaust gas of the flare per kg residual gas flared in hour h h
MV_n	M^3/kmol	Volume of one mole of any ideal gas at normal temperature and pressure (22.4 L/mol)

$$V_{n,N2,h} = MV_n \bullet \left\{ \frac{fm_{N,h}}{200AM_N} + \left(\frac{1 - MF_{O2}}{MF_{O2}} \right) \bullet \left[F_h + n_{O2,h} \right] \right\}$$

Where:

Variable	SI Unit	Description
$V_{n,N2,h}$	M^3/ kg residual gas	Quantity of N_2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour h

MV_n	M^3/kmol	Volume of one mole of any ideal gas at normal temperature and pressure (22.4 m3/kmol)
$fm_{N,h}$	-	Mass fraction of nitrogen in the residual gas in the hour h
AM_n	Kg/kmol	Atomic mass of nitrogen
MF_{O2}	-	O_2 volumetric fraction of air
F_h	Kmol/kg residual gas	Stoichiometric quantity of moles of O_2 required for a complete oxidation of one kg residual gas in hour h
$n_{O2,h}$	Kmol/kg residual gas	Quantity of moles O_2 in the exhaust gas of the flare per kg residual gas flared in hour h

$$V_{n,CO2,h} = \frac{fm_{C,h}}{AM_C} \bullet MV_n$$

Where:

Variable	SI Unit	Description
$V_{n,CO2,h}$	M^3/ kg residual gas	Quantity of CO_2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour h
$F_{mc,h}$	-	Mass fraction of carbon in the residual gas in the hour h
AM_c	Kg/kmol	Atomic mass of carbon
MV_n	M^3/kmol	Volume of one mole of any ideal gas at normal temperature and pressure (22.4 m3/Kmol)

$$n_{O2,h} = \frac{t_{O2,h}}{[1-(t_{O2,h}/MF_{O2})]} \bullet \left[\frac{fm_{C,h}}{AM_C} + \frac{fm_{N,h}}{2AM_N} + \left(\frac{1-MF_{O2}}{MF_{O2}}\right) \bullet F_h\right]$$

Where:

Variable	SI Unit	Description
$n_{O2,h}$	Kmol/kg residual gas	Quantity of moles O_2 in the exhaust gas of the flare per kg residual gas flared in hour h
$t_{CO2,h}$		Volumetric fraction of O_2 in the exhaust gas in the hour h
MF_{O2}		Volumetric fraction of O_2 in the air (0.21)
F_h	Kmol/kg residual gas	Stoichiometric quantity of moles of O_2 required for a complete oxidation of one kg residual gas in hour h
$F_{mj,h}$		Mass fraction of element j in the residual gas in hour h (from equation 7.4)
AM_j	Kg/kmol	Atomic mass of element j
j		The elements carbon (index C) and nitrogen (index N)

$$F_h = \frac{fm_{C,h}}{AM_C} + \frac{fm_{H,h}}{4AM_H} - \frac{fm_{O,h}}{2AM_O}$$

Where:

Variable	SI Unit	Description

F_h	Kmol O_2/kg residual gas	Stoichiometric quantity of moles of O_2 required for a complete oxidation of one kg residual gas in hour h
$F_{mj,h}$	-	Mass fraction of element j in the residual gas in hour h (from equation 7.4)
AM_j	Kg/kmol	Atomic mass of element j
j		The elements carbon (index C), hydrogen (index H) and oxygen (index O)

STEP 4

This step was applied in the Project since the methane combustion efficiency of the flare(s) has been continuously monitored.

The mass flow of methane in the exhaust gas is based on the volumetric flow of the exhaust gas and the measured concentration of methane in the exhaust gas, as follows:

$$TM_{FG,h} = \frac{TV_{n,FG,h} \bullet fv_{CH4,FG,h}}{1000000}$$

Where:

Variable	SI Unit	Description
$TM_{FG,h}$	Kg/h	Mass flow rate of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h
$TV_{n,FG,h}$	M^3/h exhaust gas	Volumetric flow rate of the exhaust gas in dry basis at normal conditions in hour h
$fv_{CH4,FG,h}$	Mg/m^3	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in hour h

STEP 5

The quantity of methane in the residual gas flowing into the flare is the product of the volumetric flow rate of the residual gas ($FV_{RG,h}$), the volumetric fraction of methane in the residual gas ($fv_{CH4,RG,h}$) and the density of methane ($\rho_{CH4,n,h}$) in the same reference conditions (normal conditions and dry or wet basis).

The residual gas moisture is not significant in the Project because several treatment units were foreseen in order to reduce significantly the landfill gas moisture content; therefore the measured flow rate of the residual gas do not need to be corrected to dry basis to be comparable with the measurement of methane that is undertaken on a dry basis.

$$TM_{RG,h} = FV_{RG,h} \bullet fv_{CH4,RG,h} \bullet \rho_{CH4,n}$$

Where:

Variable	SI Unit	Description
$TM_{RG,h}$	Kg/h	Mass flow rate of methane in the residual gas in the hour h
$FV_{RG,h}$	M^3/h	Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h
$fv_{CH4,RG,h}$	-	Volumetric fraction of methane in the residual gas on dry basis in hour h (NB: this corresponds to $fv_{i,RG,h}$ where i refers to methane).
$\rho_{CH4,n}$	Kg/m^3	Density of methane at normal conditions (0.716)

STEP 6

Since this Project installed enclosed flares and does a continuous monitoring, the flare efficiency in the hour h ($\eta_{flare,h}$) is:

- 0% if the temperature of the exhaust gas of the flare (T_{flare}) is below 500°C during more than 20 minutes during the hour h.
- determined as follows in cases where the temperature of the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h :

$$\eta_{flare,h} = 1 - \frac{TM_{FG,h}}{TM_{RG,h}}$$

Where:

Variable	SI Unit	Description
$\eta_{flare,h}$		Flare efficiency in the hour h
$TM_{FG,h}$	Kg/h	Methane mass flow rate in exhaust gas averaged in a period of time t (hour, two months or year)
$TM_{RG,h}$	Kg/h	Mass flow rate of methane in the residual gas in the hour h

STEP 7
Project emissions from flaring are calculated as the sum of emissions from each hour h, based on the methane flow rate in the residual gas ($TM_{RG,h}$) and the flare efficiency during each hour h ($\eta_{flare,h}$), as follows:

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \bullet (1-\eta_{flare,h}) \bullet \frac{GWP_{CH4}}{1000}$$

Where:

Where:

$PE_{flare,y}$ Project emissions from flaring of the residual gas stream (tCO_2e/y)

$TM_{RG,h}$ Mass flow rate of methane in the residual gas in the hour h (kg/h)

$\eta flare,h$ Flare efficiency in hour h

GWP_{CH4} Global Warming Potential of methane valid for the commitment period (tCO_2e/tCH_4)

Quantity of methane destroyed by generation of electricity

$$MD_{electricity,y} = LFG_{electricity} \bullet W_{CH4,y} \bullet D_{CH4}$$

Where:

$MD_{electricity,y}$ Quantity of methane destroyed by generation of electricity

$LFG_{electricity,y}$

Calculated monthly values of $MD_{project,y}$ are presented in the emission reductions calculation spreadsheet which is enclosed to this Monitoring Report. The accumulated value of $MD_{project,y}$ for the considered monitoring period is calculated as 1,095 tCH_4.

Total baseline emissions (BE_y) for the considered monitoring period are calculated as 27,690 tCO_2e (rounded value).

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

>>

Under conformance with provisions and calculation approaches of the PDD, project emissions (PE_y) for the considered monitoring period are determined (in tCO_2e) as follows:

$PE_y = PE_{EC,y}$

Where:

$PE_{EC,y}$ Emissions from consumption of electricity by the project activity. While grid-sourced electricity represents the only external sources of electricity consumed by the project activity[3], $PE_{EC,y}$ is calculated by following the applicable guidance of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" as follows:

$$PE_{EC,grid,y} = EC_{PJ,grid,y} * EF_{EL,grid,y} * (1 + TDL_{grid,y})$$

Where:

$PE_{EC,grid,y}$ Project emissions from electricity consumption in year y (tCO_2)

$EC_{PJ,grid,y}$ Quantity of grid-sourced electricity consumed by the project electricity in year y (MWh). Additional monitoring details about the monitoring parameter $EC_{PJ,grid,y}$ are included in Section D.2.

$EF_{EL,grid,y}$ Emission factor for grid-sourced electricity in year y (tCO_2/MWh). As per the adopted monitoring procedure and in accordance with the PDD, $EF_{EL,grid,y}$ is equal to the parameter $EF_{grid,CM,y}$. Further details for the determination of values of $EF_{grid,CM,y}$ are presented in Section E.1.

$TDL_{grid,y}$ Average technical transmission and distribution losses for grid-sourced electricity in year y. For the considered monitoring period, the 20% default value is adopted.

Total project emissions from grid-sourced electricity consumption for the considered monitoring period are calculated as 13 tCO_2 (rounded value).

[3] It is relevant to note that, whenever the electricity generation facility of the project activity is operational, the electricity demand of the project activity is met by electricity generated by such facility.

E.3. Calculation of leakage emissions

>>
Not applicable.

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

Emission reductions achieved by the project activity during the considered monitoring period are determined as the difference between baseline emissions (BE_y) and project emissions (PE_y) determined for such period. Calculations of baseline emissions (BE_y) are presented in Section E.1. Calculations of project emissions (PE_y) are presented in Section E.2. Achieved emission reductions for the considered monitoring period are summarized in the table below:

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)			
				Before 01/01/ 2013	From 01/01/ 2013 until 31/12/ 2020	From 01/01/ 2021	Total amount
Total	27,703	13	-	-	27,690	-	27,690

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

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante for this monitoring period in the PDD (t CO_2e)
27,690	72,074

E.5.1. Explanation of calculation of "amount estimated ex ante for this monitoring period in the PDD"

>>
The 72,074 tCO_2e value is calculated as the sum of previously determined annual values for ex-ante estimates of emission reductions valid for the 31-day period within 2019 (72,483/366*31 tCO_2e), and 2020 (65,935 tCO_2e) as reported in the PDD.

E.6. Remarks on increase in achieved emission reductions

>>
Not applicable

E.7. Remarks on scale of small-scale project activity

>>
Not applicable.

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Document information

Version	*Date*	*Description*
09.0	8 October 2021	Revision to: • Ensure consistency with version 03.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN).
08.0	6 April 2021	Revision to: • Reflect the “Clarification: Regulatory requirements under temporary measures for post-2020 cases” (CDM-EB109-A01-CLAR).
07.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.

Version	*Date*	*Description*
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

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