Monitoring report form for CDM project activity
(Version 07.0)

MONITORING REPORT		
Title of the project activity	Proactiva Tijuquinhas Landfill Gas Capture and Flaring project	
UNFCCC reference number of the project activity	1506	
Version number of the PDD applicable to this monitoring report	8.0	
Version number of this monitoring report	1.0	
Completion date of this monitoring report	11/05/2020	
Monitoring period number	#8	
Duration of this monitoring period	01/05/2019 – 31/03/2020	
Monitoring report number for this monitoring period	Not applicable.	
Project participants	Proactiva Meio Ambiente – Brasil First Climate (Switzerland) AG	
Host Party	Brazil	
Applied methodologies and standardized baselines	ACM0001, version 18.0 - Flaring or use of landfill gas	
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
	-	139,930 tCO_2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	157,505 tCO_2e	

SECTION A. Description of project activity

A.1. General description of project activity

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The CDM project activity "Proactiva Tijuquinhas Landfill Gas Capture and Flaring project" is implemented at the Tijuquinhas municipal solid waste landfill, which is a landfill site located in Biguaçu, State of Santa Catarina in the Southern Region of Brazil. The project activity encompasses collection and destruction (through combustion in high temperature enclosed flares) of landfill gas (LFG) generated in the landfill site. During the considered monitoring period, the project activity promoted real, measurable and permanent abatement of greenhouse gas (GHG) emissions through collection and destruction of LFG.

The Tijuquinhas landfill is operated by the solid waste management company and host-country project participant Proactiva Meio Ambiente – Brasil. The Tijuquinhas landfill was started its operations involving permanent disposal of Municipal Solid Waste (MSW) in year 1991. The landfill currently serves as permanent disposal site for MSW generated by more than 750 thousand inhabitants within more than 22 municipalities including municipalities within the Metropolitan Region of Florianópolis (capital of Santa Catarina State). Although the Tijuquinhas landfill has always employed *state-of-the-art* waste landfilling technics and operation management, in the absence of the CDM project activity (that was commissioned in year 2006) no efficient management of LFG would occur on site.

LFG (which is rich in methane) is generated at the Tijuquinhas landfill as a result of anaerobic decomposition of municipal solid waste (MSW) historically disposed at the landfill. During the monitoring period from 01/05/2019 to 31/03/2020, the project activity encompassed the following components/infrastructure:

(i) Capturing of LFG through a set of LFG collecting wells that are interconnected through a LFG collection pipeline network. The project's LFG collection infrastructure covering the landfill area consists of a set of horizontal and vertical wells implemented within the waste mass at regular distance (every 10 meters in height for the horizontal drains, on a square mesh of 35 meters per 35 meters for the vertical wells). Horizontal and vertical drainage systems are interconnected to ensure high LFG collection efficiency and robustness over landfilling period. The LFG collection wells consists of perforated HDPE piping surrounded by gravel or other suitable drainage material. The LFG collection infrastructure operates under negative pressure through the use of centrifugal blowers. The horizontal and vertical LFG collection wells are connected to HDPE main carriers located over the surface which convey extracted LFG to the LFG destruction plant.

(ii) Destruction of all collected LFG (which is collected by the LFG collecting wells and transported through the LFG collection pipeline network) by controlled combustion (in two high temperature enclosed flares installed in a LFG destruction plant).

As indicated in the registered PDD valid for the 2nd 7-year renewable crediting period of the project activity (hereafter denominated as "PDD"), the project design does not encompass any utilization of LFG. The project activity was implemented and has operated without having any share of collected LFG being sold as gaseous fuel to a local industry (in order to be combusted in boilers) or being utilized as fuel to power a thermal desorption unit or an electricity generation facility or any other utilization type. During the considered monitoring period, no collected LFG was thus utilized as gaseous fuel for electricity generation, as gaseous fuel in boilers or for any purpose other than being destroyed under efficient conditions through combustion in the installed high temperature enclosed flares.

The amount and quality of collected LFG which is sent to the flare have been continuously measured, recorded and reported along the considered monitoring period. As also established in the project's monitoring procedure valid for the 2nd 7-year crediting period as per the PDD, the

status/conditions of the high temperature enclosed flare and its compliance with operational requirements (as established by the flare equipment manufacturer) are also monitored.

A.2. Location of project activity

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The Tijuquinhas landfill is located in the BR 101, km 177.6, in the Municipality of Biguaçu, State of Santa Catarina, in the South region of 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	27° 21' 39.50" S	48° 38' 15.50" W
Decimal	-27.3609	-48.6375

The following images show the location of the project activity.

Figure 1 - Project's location within Brazil
(as visible in May 2019 by using Google Earth PC application)

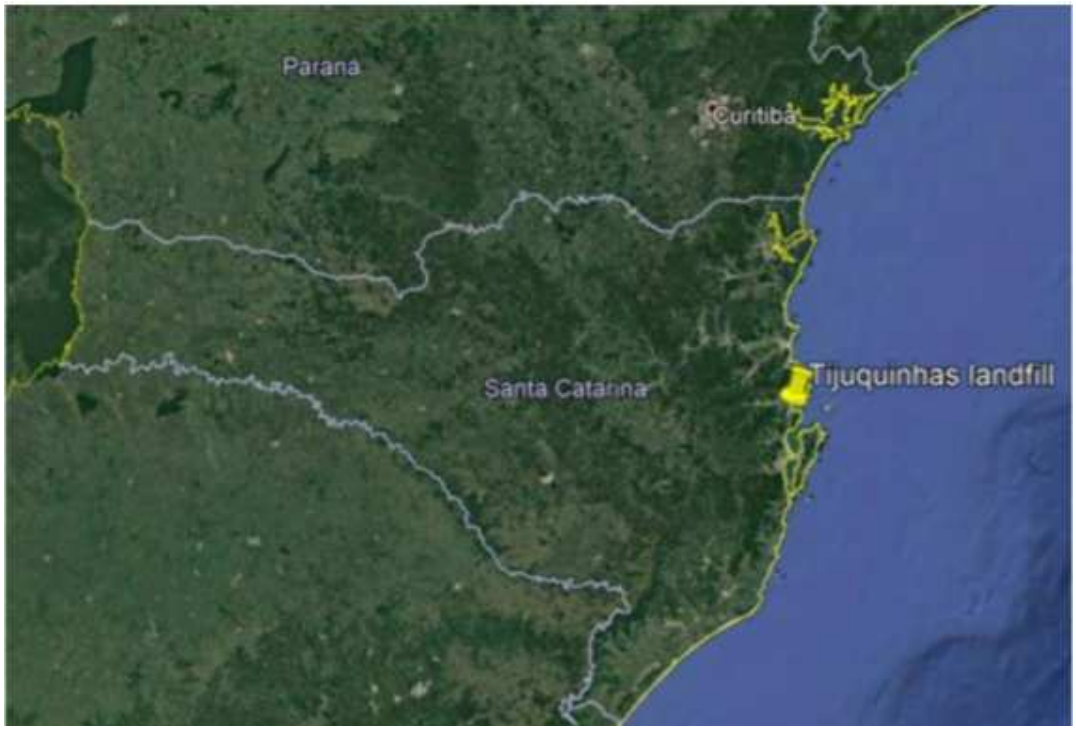

Figure 2 - Project's location within Santa Catarina State
(as visible in May 2019 by using Google Earth PC application)

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)	Proactiva Meio Ambiente – Brasil (Private Entity)	No
Switzerland	First Climate (Switzerland) AG	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 – "Flaring or use of landfill gas" (version 18.0) (https://cdm.unfccc.int/filestorage/0/X/2/0X2IE6B1PJDLKMWN89AZGTFUHR3VYS/EB94_repan04_ACM0001.pdf?t=TGx8b3J0NmdrfDAsr0FIlp4m3kJdaDUB-j3F)

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

- "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 02.0, EB 87)

[1] The registered PDD also refer to the methodological tool "Emissions from solid waste disposal sites" (version 08.0, EB94). However, it is crucial to note that, as outlined in the PDD, 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 the 2nd 7-year crediting period. This methodological tool is thus not applied for the ex-post determination of emission reductions achieved by the project activity.

(https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v2.0.pdf)

- "Project emissions from flaring" (version 02.0.0, EB 68) (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v2.0.pdf)
- "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 03.0, EB 87) (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-08-v3.0.pdf)
- "Tool to calculate the emission factor for an electricity system" (version 05.0, EB 87) (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf)
- "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 02, EB41) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf)

A.5. Crediting period type and duration

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2nd 7-year renewable crediting period from 29/10/2015 to 28/10/2022.

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

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

- LFG gas extraction system composed of 120 vertical extraction wells, of which approximately 76 were under regular operation, connected by HDPE pipes and aggregated in 2 manifolds,

- 3 centrifugal blower with a 3,000 Nm^3/h capacity of which only 2 were under continuous operation during the considered monitoring period,

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

- LFG monitoring equipment/instruments:
  - 2 LFG flow meters;
  - 1 LFG temperature sensors;
  - 1 LFG pressure sensors;
  - 1 CH_4 content gas analyser unit[2];
  - 2 thermocouples (to measure temperature in the exhaust gases of each flare))
  - 2 UV flame detectors (to monitor the operational and flame status of each installed flare)

- Two identical high temperature enclosed flare (designed and supplied by GRS VALTECH). The flares have a declared maximum LFG flow operational capacity of 2,500 Nm^3/h.

- One off-grid captive backup electricity generator (fuelled by diesel) composed by a MWM International diesel powered engine (model 6.10.TCA), and a Gramaco electricity generator. 1 off-grid captive backup electricity generator (fuelled by diesel) composed by a MWM International diesel powered engine (model 6.10.TCA), and a Gramaco electricity generator. It is important to note that within the considered monitoring period, the backup captive generator was often used for meeting the project's electricity demand during peak demand times for the

[2] Besides of continuous measurement of CH_4 fraction in collected LFG, the content of oxygen (O_2) and carbon dioxide (CO_2) in collected LFG is also continuously monitored.

electricity grid (to which the project is connected to) and/or whenever supply of grid-sourced electricity to the project activity was temporarily interrupted.

Figure 3 – Partial view of the project's LFG destruction plant

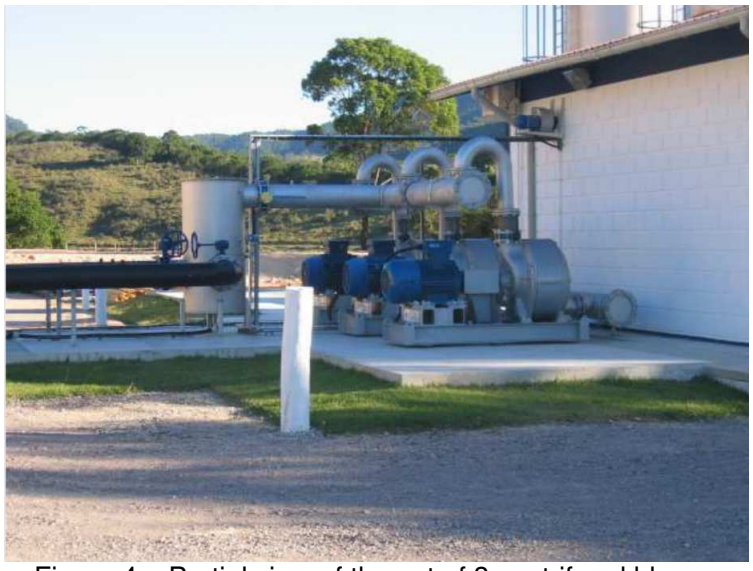

Figure 4 – Partial view of the set of 3 centrifugal blowers installed as part of the project activity

Further details about monitoring instruments/equipment under operation during the considered monitoring period are included in Section D.2.

In general, during the considered monitoring period, the project activity was implemented and has operated under full conformance with the previously conceived project design (as described in the PDD).

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

It is relevant to note that, during the considered monitoring period, due to occurred sporadic and intermittent failures in the project's data gathering and report infrastructure, non-recording and non-reporting of LFG and flaring related monitoring data during different 1-minute time instants within the considered monitoring period occurred (with no emission reduction being claimed for such periods with lack of reported monitoring data). The causes of such sporadic and intermittent failures in the project's data gathering and report infrastructure were finally identified and fixed in June/2019. The negative quantitative impact of such failures overachieved and claimed emission reductions is anyhow low due to the very low frequency and sporadic nature of the detected non-recording and non-reporting events.

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 monitoring period. There are no temporary deviation from the registered monitoring plan and/or applied methodology encompassed by the considered monitoring period that are to be submitted with or separately from this Monitoring Report as part of the request for issuance.

It is however relevant to note that Temporary deviations from the registered monitoring plan were previously approved (under PRC-1506-001 and I-DEV0404) as changes applicable/valid for monitoring period(s) prior to the considered monitoring period (thus not 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 "*Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents*"
PRC-1506-001	28/08/2012 (prior approval track)	- The exhaust temperature of the flares have not been monitored by project participant under full conformance with applicable requirements from the methodological tools "Tool to determine project emissions from flaring gases containing methane" during selected monitoring periods encompassed by currently expired 1st 7-year crediting period within the share of crediting period from 01/09/2010 to 01/01/2012. (Previous version of the PDD valid for the currently expired 1st 7-year crediting period of the project activity).
I-DEV0404	03/05/2011	- The monitoring parameter "Total amount of electricity imported to meet project requirement" has not been archived electronically monthly as stated in the MP of the registered PDD during the monitoring period from 29/10/2008 to 31/10/2010 (within the currently expired 1st 7-year crediting period of the project activity). Electricity imports have however continuously measured by an electricity meter and the equipment kept data of the accumulated electricity consumption. (Previous version of the PDD valid for the currently expired 1st 7-year crediting period of the project activity).

B.2.2. Corrections

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Not applicable for the considered monitoring period. 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).

It is however relevant to note that Corrections (in information that do not affect the project design) were previously approved under the not any longer valid CDM procedure commonly referred as "Notification of Changes from Registered PDD" as changes applicable/valid for monitoring period(s) prior to the considered monitoring period (thus not 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 "*Corrections (in information that do not affect the project design)*"
N/A	24/08/2011	- Value for claimed emission reductions being higher then ex-ante estimates of emission reductions as per the registered PDD and valid for the considered monitoring period due to both occurred increment in amount of disposed waste at the Tiuquinhas landfill and LFG collection efficiency also higher than previously forecasted in the registered PDD. (Previous version of the PDD valid for the currently expired 1st 7-year crediting period of the project activity).

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 any previously performed and approved post-registration changes for the project activity.

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.

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 monitoring period. 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 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 registered monitoring plan (revision of the monitoring plan) were previously approved under the not any longer valid CDM procedure commonly referred as "Notification of Changes from Registered PDD" as changes applicable/valid for monitoring period(s) prior to the considered monitoring period (thus not 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 registered monitoring plan, or permanent deviation of monitoring from the applied CDM baseline and monitoring methodology and/or applicable methodological tools"*
N/A	24/08/2011	- Appropriate approach for monitoring parameters associated with the determination of project emissions due to consumption of electricity sourced by a captive off-grid electricity generator (fuelled by diesel) installed as part of the project activity (with related calculation approach also being considered) (Previous version of the PDD valid for the currently expired 1st 7-year crediting period of the project activity).

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 the not any longer valid CDM procedure commonly referred as "Notification of Changes from Registered PDD" as changes applicable/valid for monitoring period(s) prior to the considered monitoring period (thus not 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"*
N/A	24/08/2011	- The project activity design was modified in order to considered the installation and use of a captive off-grid electricity generator (fuelled by diesel) for meeting electricity consumption demand of the project activity whenever supply of grid electricity to the project activity is temporarily interrupted. (Previous version of the PDD valid for the currently expired 7-year crediting period of the project activity)

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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C.1. INSTRUMENTATION

Figure shows a schematic instrumentation diagram of the project's monitoring system as per the configuration available and operational during the monitoring period.

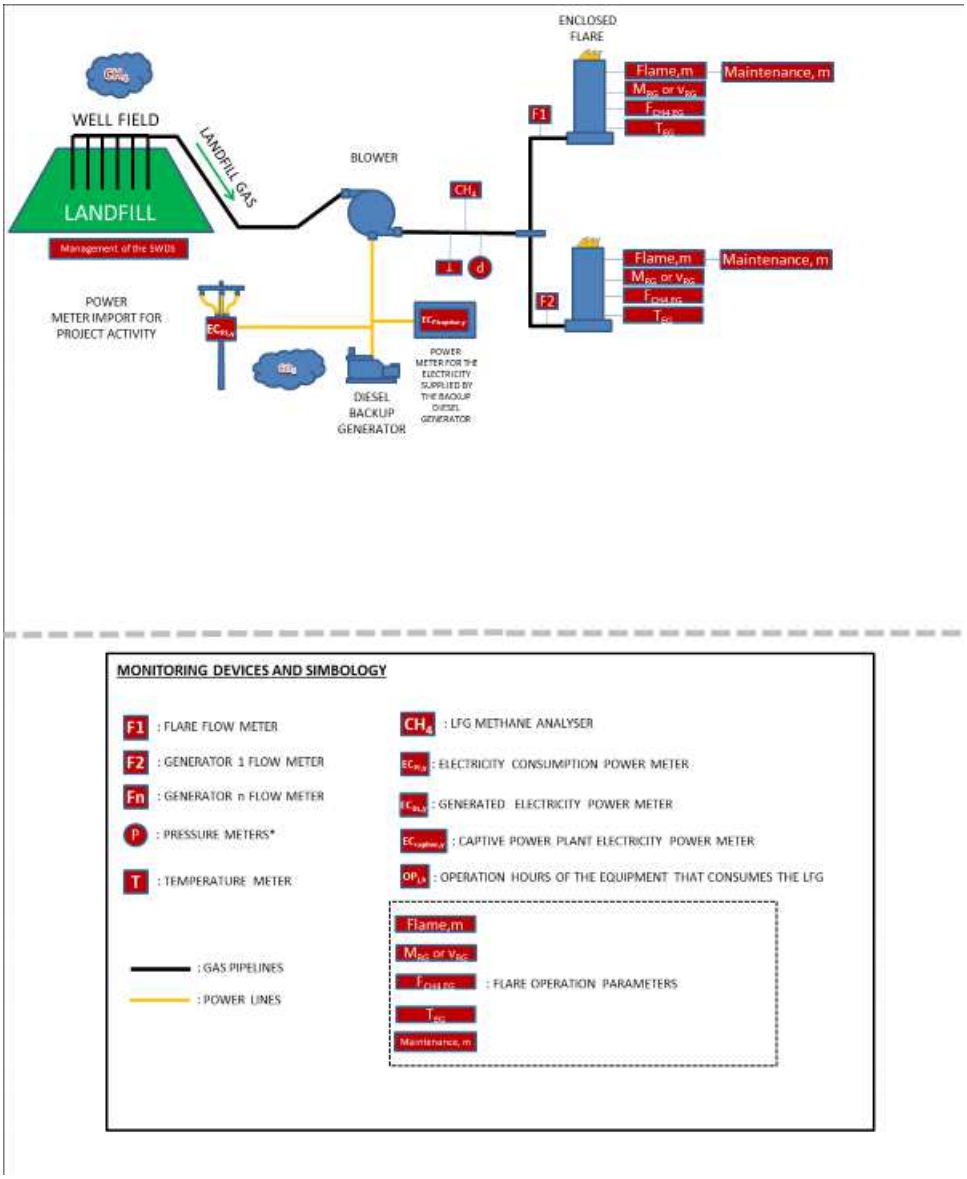


Figure 5: Schematic instrumentation diagram of the project's monitoring system valid for the considered monitoring period

As part of the project activity, the following monitoring instruments/equipment are installed along the main LFG distribution pipeline (in its final section) within the project's LFG destruction facility (between the installed centrifugal blowers and the enclosed flare):

- One LFG pressure sensor. This instrument measures LFG pressure in the section between the centrifugal blowers and the high temperature enclosed flare in the LFG collection pipeline.

- One LFG temperature sensor. This instrument measures the LFG temperature in the LFG collection pipeline in the section between the centrifugal blowers and the high temperature enclosed.

- One continuous CH_4 content gas analyzer unit. This equipment provides continuous measurement of methane fraction in collected LFG. While the project's LFG collection process ensures that most of the humidity of the collected LFG is removed by condensation (in available condensation removal traps) prior of having collected LFG passing through the installed LFG flow meters and the installed CH_4 content gas analyzer unit, flow of

collected LFG being sent to the flare and CH_4 fraction of collected LFG can thus be regarded as measured under the same basis/conditions in terms of moisture.

- Two thermocouples (one for each installed flare) that measures the temperature in the exhaust gas of each flare ($T_{EG,m}$). Such measurements are considered in order to assure the operation of flare as per the operation conditions defined by the flare manufacturer. The thermocouple is located in the upper section of the installed flare and is only used to monitor the flare temperature from an operational point of view and in order to ensure that high flare combustion efficiency is achieved.

- Two UV flame detectors (one for each installed flare). For every minute that flame is detected in the flare, its operational status is considered as "On" and emission reductions are thus accounted for such given minute.

- One electricity meter measuring grid-sourced electricity consumed by the project activity.

C.2. DATA ACQUISITION, STORAGE AND MANAGEMENT SYSTEM

As part of the monitoring process for the project activity, all continuous measurements of LFG related monitoring parameters (including measurements of temperature of exhaust gas of the flare and status of the flare) were recorded/reported every minute during the considered monitoring period in an installed data acquisition unit and archiving solution (database) designed and configured by GRS VALTECH.

As part of the operation of the project activity, monitoring data has been recorded by the utilized data acquisition and archiving infrastructure (database). Recorded LFG related monitoring data (+ measurement records for temperature of temperature of exhaust gas of the flare, status of the flare are regarded as "*raw data*" for processing emission reduction calculations valid for the considered monitoring period. As part of the implemented monitoring procedure for the project activity, such "*raw data*" is exported into MS-Excel spreadsheet format for generating the emission reduction calculation spreadsheet are enclosed to this Monitoring Report.

The project's operational staff for the LFG destruction facility are trained for all related operation, maintenance and safety procedures. Related training certificates for operational staff were issued and are kept achieved. All relevant operational events (emergency, failures, maintenance, etc.) for the LFG destruction facility are registered in operation workbooks. All performed maintenance and/or repair events applicable for the critical pieces of equipment for both project components (flare, centrifugal blowers, CH_4 content gas analyzer unit, control systems, etc.) are also registered in the project's operation workbooks.

Records and documented evidences for performed calibration events in monitoring instruments/equipment are also registered in workbooks. The calibration certificates and registries for all performed calibration events are also kept in files. Calibration procedures are performed in accordance with applicable recommendation and requirements as established by equipment manufacturers and are also under conformance with applicable CDM requirements. The project's maintenance manual also includes related calibration procedures, requirements and instructions.

C.3. MANAGERIAL RESPONSIBILITIES

Operation of the whole project activity under compliance with all applicable CDM requirements is the responsibility of the CDM Operational Manager of Proactiva Meio Ambiente - Brasil The CDM Project Manager of Proactiva Meio Ambiente - Brasil (who directly reports to the vice-president of the organization), is in charge of all validation and verification related activities (including development of PDD, Monitoring Reports and supporting documentation). The CDM Operational Manager is assisted/supported by hired technical consultants from the hired CDM technical

consultancy/advisory service company UniCarbo – Energia e Biogás Ltda. The CDM Project Manager is responsible for ensuring the correct application of the monitoring plan.

Under an operational perspective, the CDM operations manager and CDM supervisor are in charge of performing all field monitoring activities and ensuring appropriate monitoring data logging and recording (always with assistance/support from by hired technical consultants from UniCarbo – Energia e Biogás Ltda.). They are also responsible for the performance of related calibration events as well as all applicable planned or unplanned maintenance and repair events.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	**OX_{top_layer}**
Unit	Dimensionless
Description	Fraction of methane that would be oxidized in the top layer of the SWDS in the baseline
Source of data	Consistent with how oxidation is accounted for in the methodological tool "Emissions from solid waste disposal sites" (version 08.0)
Value(s) applied	0.1
Choice of data or measurement methods and procedures	Default value as per the applied CDM baseline and monitoring methodology ACM0001 - "Flaring or use of landfill gas" (version 18.0)
Purpose of data/parameter	Calculation of baseline emissions.
Additional comments	-

Data/Parameter	**$F_{CH4,BL,x-1}$**
Unit	tCH_4/yr
Description	Historical amount of methane in the LFG which is captured and destroyed in the year prior to the implementation of the project activity (2007).
Source of data	Measurements performed by Proactiva Meio Ambiente - Brasil (related to year 2007).
Value(s) applied	484.00
Choice of data or measurement methods and procedures	Selected value is as per historical measurements performed by Proactiva Meio Ambiente - Brasil
Purpose of data/parameter	Calculation of baseline emissions.
Additional comments	-

Data/Parameter	**GWP_{CH4}**
Unit	tCO_2e/tCH_4
Description	Global Warming Potential of CH_4
Source of data	"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. Available at: www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html#table-2-14 The applied value is also 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".
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	**R_u**
Unit	Pa.m^3/kmol.K
Description	Universal ideal gases constant
Source of data	Default value as per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0)
Value(s) applied	8,314
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Calculation of baseline emissions.
Additional comments	-

Data/Parameter	**MM_k**
Unit	kg/kmol
Description	Molecular mass of gas *k*
Source of data	Default values as per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0)
Value(s) applied	For considered gases *k* that are greenhouse gases (GHGs), the values below are applied for MMi. As per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream": *"The determination of the molecular mass of the gaseous stream ($MM_{t,db}$) requires measuring the volumetric fraction of all gases (k) in the considered gaseous stream. However as a simplification, only the volumetric fraction of gases k that are greenhouse gases and are considered in the emission reduction calculation in the underlying methodology must be monitored and the difference to 100% may be considered as pure nitrogen. The simplification is not acceptable if it is differently specified in the underlying methodology.* ACM0001 (version 18.0) does not include any restriction to such simplification. Thus, only the volumetric fraction of gases that are greenhouse gases and are considered in related calculations (CH_4 in the particular case of the project activity) and the difference to 100% is just considered as pure nitrogen. Compound: Nitrogen; Structure: N_2; Molecular mass (kg/kmol): 28.01
Choice of data or measurement methods and procedures	-

Purpose of data/parameter	Calculation of baseline emissions.
Additional comments	-

Data/Parameter	**MM_i**
Unit	kg/kmol
Description	Molecular mass of greenhouse gas *I*
Source of data	Default values as per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0)
Value(s) applied	The following values of molecular mass are applicable for CH_4 (the only GHG which is considered): Compound: Methane; Structure: CH_4; Molecular mass (kg/kmol): 16.04
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Calculation of baseline emissions.
Additional comments	-

Data/Parameter	**P_n**
Unit	Pa
Description	Total pressure at normal conditions
Source of data	Default value as per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (Version 02.0.0)
Value(s) applied	101,325
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Calculation of baseline emissions.
Additional comments	-

Data/Parameter	**T_n**
Unit	K

Description	Temperature at normal conditions
Source of data	Default value as per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0)
Value(s) applied	273.15
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Calculation of baseline emissions.
Additional comments	-

Data/Parameter	**MM_{H2O}**
Unit	kg/kmol
Description	Molecular mass of water
Source of data	Default value as per the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (version 02.0.0)
Value(s) applied	18.0152
Choice of data or measurement methods and procedures	-
Purpose of data/parameter	Calculation of baseline emissions.
Additional comments	-

Data/Parameter	**$TDL_{grid,y}$**
Unit	-
Description	Average technical transmission and distribution losses for providing electricity to the grid and for grid sourced electricity consumed by the project activity.
Source of data	Applicable default value as per the methodological tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation".
Value(s) applied	20%
Choice of data or measurement methods and procedures	-

Purpose of data/parameter	Calculation of project emissions (due to the consumption of grid-sourced electricity by the project activity).
Additional comments	-

Data/Parameter	w_{BM}
Unit	%
Description	Weighting of build margin emissions factor
Source of data	Applicable default value as per the "Tool to calculate the emission factor for an electricity system" (version 05.0)
Value(s) applied	0.75 (75%) during the 2nd 7-year crediting period
Choice of data or measurement methods and procedures	The applicable value valid for 2nd crediting period as per the "Tool to calculate the emission factor for an electricity system" (version 05.0) is selected.
Purpose of data/parameter	Calculation of project emissions (due to the consumption of grid-sourced electricity by the project activity).
Additional comments	-

Data/Parameter	w_{OM}
Unit	%
Description	Weighting of operating margin emissions factor
Source of data	Applicable default value as per the "Tool to calculate the emission factor for an electricity system" (version 05.0)
Value(s) applied	0.25 (25%) during the 2nd 7-year crediting period
Choice of data or measurement methods and procedures	The applicable value for the 2nd crediting period as per the "Tool to calculate the emission factor for an electricity system" (version 05.0) is selected.
Purpose of data/parameter	Calculation of project emissions (due to the consumption of grid-sourced electricity by the project activity).
Additional comments	-

Data/Parameter	**$EF_{grid,BM,y}$**
Unit	tCO_2/MWh
Description	Build margin CO_2 emission factor in year *y*
Source of data	Data is ex-ante determined as per applicable guidance of the "Tool to calculate the emission factor for an electricity system" (version 05.0) valid for 2nd crediting period. The selected value valid for all years encompassed by the 2nd 7-year crediting period is the value calculated by the DNA of Brazil and valid for year 2016 ($EF_{grid,BM,2016}$).
Value(s) applied	0.1581
Choice of data or measurement methods and procedures	Official value is determined/calculated by the DNA of Brazil. Values are made available online: http://www.mct.gov.br/index.php/content/view/74689.html
Purpose of data/parameter	Calculation of project emissions (due to the consumption of grid-sourced electricity by the project activity).
Additional comments	-

Data/Parameter	**$EF_{grid,OM-adj,y} = EF_{grid,OM,y}$**
Unit	tCO_2/MWh
Description	Operating margin CO_2 emission factor in year *y*
Source of data	Data is ex-ante determined as per applicable guidance of the "Tool to calculate the emission factor for an electricity system" (version 05.0) valid for 2nd crediting period. The selected value valid for all years encompassed by the 2nd 7-year crediting period is the 3-year generation-weighted average based on the most recent data public available (years of 2014, 2015 and 2016). Calculated annual official values are made available by the DNA of Brazil.
Value(s) applied	0.4979
Choice of data or measurement methods and procedures	Official value is determined/calculated by the DNA of Brazil. Values are made available online: http://www.mct.gov.br/index.php/content/view/363726.html
Purpose of data/parameter	Calculation of project emissions (due to the consumption of grid-sourced electricity by the project activity).
Additional comments	-

<table>
<tr><td>Data/Parameter</td><td>$SPEC_{flare}$</td></tr>
<tr><td>Unit</td><td>°C (for temperature values)
Nm^3/h (for LFG flow values)
Number of days (for maintenance schedule interval values)</td></tr>
<tr><td>Description</td><td>Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval.</td></tr>
<tr><td>Source of data</td><td>Flare manufacturer[3]</td></tr>
<tr><td>Value(s) applied</td><td>The specifications of the currently installed flares (Flare 1 and Flare 2) which are manufacturer by GRS VALTECH are listed below:
<table>
<tr><th>$SPEC_{flare}$ ($SPEC_{flare,flare-1}$ and $SPEC_{flare,flare-2}$)</th><th>Min.</th><th>Max.</th></tr>
<tr><td>Operational LFG flow (for continuous operation):</td><td>300 Nm^3/h</td><td>2,500 Nm^3/h</td></tr>
<tr><td>Required temperature of the exhaust gas of the flare (to ensure LFG destruction (combustion) under high CH_4 destruction efficiency):</td><td>500 ºC</td><td>1,200 ºC</td></tr>
<tr><td>Required minimum frequency for inspection and maintenance service (incl. inspection in the conditions of the flare isolation ceramics revetment material):</td><td colspan="2">Min. six months (min each 180 days)</td></tr>
<tr><td>Required/recommended minimum frequency for replacement of the flare isolation ceramics revetment material:</td><td colspan="2">After 10 years of regular and appropriate operation</td></tr>
</table></td></tr>
<tr><td>Choice of data
or measurement methods
and procedures</td><td>As established by the methodological tool "Project emissions from flaring", the flare specifications and operational + maintenance requirements (as set/recommended by the equipment manufacturer) are documented and considered for the ex-ante determination of applicable values for the parameter $SPEC_{flare}$. During the 2nd 7-year crediting period, ex-ante selected data will be compared against monitored data related to the operation of the flares, including:
a) Minimum and maximum monitoring records for data regarding inlet LFG flow rate, if necessary converted to flow rate at reference conditions or heat flux,
(b) Minimum and maximum monitoring records for data of temperature in the exhaust gas of each individual high temperature enclosed flare; and
(c) Duration in days of time periods between maintenance events for each individual high temperature enclosed flare.</td></tr>
</table>

[3] The manufacturer of both Flare 1 and Flare 2 is "GRS VALTECH", which is a subsidiary of SARP Industries (Veolia Group) and is specialized in biogas and leachate treatment and soil & groundwater remediation.

Purpose of data/parameter	Calculation of baseline emissions[4].
Additional comments	All flare specification and operation details/requirements are based on information provided by the equipment manufacturer.

Data/Parameter	**$PP_{CP,Diesel\text{-}generator}$**
Unit	MW
Description	Rated capacity of the installed captive backup electricity generators fuelled by diesel
Source of data	Name plate capacity of the captive generator, manufacturer's specifications or catalogue references
Value(s) applied	0.113
Choice of data or measurement methods and procedures	Not applicable
Purpose of data/parameter	Calculation of project emissions (due to the consumption of electricity sourced by captive off-grid electricity generator by the project activity).
Additional comments	The ex-ante determined default value for $PP_{CP,Diesel\text{-}generator}$ will only be used in case alternative approach 4 is used for the determination of Project emissions due to the consumption of electricity sourced by backup captive off-grid electricity generators (fuelled by Diesel) ($PE_{EC,captive,y}$).

Data/Parameter	**$TDL_{captive,y}$**
Unit	-
Description	Average technical transmission and distribution losses for electricity sourced by the captive electricity generator
Source of data	Applicable default as per the tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 01).
Value(s) applied	0
Choice of data or measurement methods and procedures	-

[4] As also highlighted in Section B.3, it is important to note that residual project emissions of CH_4 due to the combustion of LFG in the installed enclosed flare are considered in the context of the determination of baseline emissions (although ACM0001 (version 18.0) refers to the term "*project emissions from flaring*".

Purpose of data/parameter	Calculation of project emissions (due to the consumption of electricity sourced by captive off-grid electricity generator by the project activity).
Additional comments	The ex-ante determined default value for $TDL_{captive,y}$ will only be used in case alternative approach 1 or approach 2 is used for the determination of Project emissions due to the consumption of electricity sourced by backup captive off-grid electricity generators (fuelled by Diesel) ($PE_{EC,captive,y}$).

Data/Parameter	**$EF_{EL,captive,y}$**
Unit	tCO_2/MWh
Description	CO_2 emission factor for electricity sourced by the captive off-grid electricity generators
Source of data	Applicable default as per the tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 01) (in case the *Alternative approach 2* is selected (by following option B2 of the tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation").
Value(s) applied	1.3
Choice of data or measurement methods and procedures	Data is determined as per applicable guidance of the tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 01).
Purpose of data/parameter	Calculation of project emissions (due to the consumption of electricity sourced by captive off-grid electricity generator by the project activity).
Additional comments	The ex-ante determined default value for $EF_{EL,captive,y}$ will only be used in case alternative approach 2 is used for the determination of Project emissions due to the consumption of electricity sourced by backup captive off-grid electricity generators (fuelled by Diesel) ($PE_{EC,captive,y}$).

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:

- Efficiency of the LFG capture system that will be installed in the project activity (η_{PJ})
- Default value for model correction factor to account for model uncertainties ($\varphi_{default}$)
- Oxidation factor (reflecting the amount of methane from the considered SWDS that is oxidized in the soil (or other material covering the waste)) (OX)
- Fraction of methane in the SWDS gas (volume fraction) (F)
- Fraction of degradable organic carbon (DOC) in MSW that decomposes in the considered SWDS ($DOC_{f,default}$)
- Methane correction factor ($MCF_{default}$)
- Fraction of degradable organic carbon in the waste type j (weight fraction) (DOC_j)
- Decay rate for the waste type *j* (k_j)
- Weight fraction of the waste type *j* (W_j)

As also outlined in the PDD, data for the above-listed parameters are used only in the context of ex-ante estimation of annual accumulated values for the "Amount of methane in the LFG which is destroyed or utilized by the project activity" ($F_{CH4,PJ,y}$) (in the context of ex-ante estimation of emission reductions to be achieved by the project activity during the 2nd 7-year renewable crediting period). Due to that, details for the above-listed parameters are not included in this Section as they are not relevant in the context of determination of emission reductions achieved by the project activity during the considered monitoring period. Relevant details for such not reported parameters are included in Section B.6.2 of the PDD.

D.2. Data and parameters monitored

Data/Parameter	Management of SWDS
Unit	Dimensionless
Description	Management of the SWDS
Measured/calculated/ default	As per the adopted monitoring procedure for the project activity, the management of the Tijuquinhas landfill is yearly compared against the previously conceived original construction and operational design for the Tijuquinhas landfill in order to confirm that the overall management and operation for the landfill (including relevant aspects related to landfilling practice) were not deliberately modified with the unique aim to intentionally increase the generation of methane at the landfill. By performing the checking annually, it is monitored whether any practice aiming to increase methane generation in the landfill has occurred or promoted. As required by ACM0001 (version 18.0), any change in the management of the Tijuquinhas landfill after the implementation of the project activity should be justified by referring to applicable technical or regulatory specifications.
Source of data	Three technical evaluation assessments valid for the considered monitoring period were performed by the independent 3rd-party engineering service company "Ambconsult Estudos e Projetos Ambientais Ltda." on 06/06/2018, 23/05/2019 and 13/02/2020. The findings and summaries from the performed technical evaluation assessments are reported in a technical statement report issued by this engineering service company dated 13/02/2020. As part of the performed evaluations, the current configuration and operational conditions of the Tijuquinhas landfill were compared against the previously conceived design and operational conditions of the landfill (prior to the occurred implementation of the project activity) on the basis of different sources and assessments including inter alia: - The original design documents of the landfill (as described in the technical design description documentation required for all phases of the environmental licensing and operational permitting for the Tijuquinhas landfill); - Applicable local or national regulations. Since January 2017 "Ambconsult Estudos e Projetos Ambientais ltda." has performed regular technical inspections at the Tijuquinhas landfill (inter alia as part of the continuously performed monitoring/control of the geotechnical stability for the landfill's cells). Related monitoring/control (which is performed by "Ambconsult Estudos e Projetos Ambientais Ltda.") is part of the regular environmental monitoring for the landfill which is a prerequisite for keeping the validity of the environmental and safety permit/licensing for the whole Tijuquinhas landfill.

Value(s) of monitored parameter	As outlined in the issued technical statement report for the technical evaluation assessments valid for the considered monitoring period, the previously conceived original design of the Tijuquinhas landfill (dated prior to the implementation of the project activity) is confirmed as not to being deliberately modified since the project activity started to operate until 13/02/2020. Furthermore, no modification in the previously conceived original design of the Tijuquinhas landfill has occurred or was promoted during the period. The content of the issued technical report confirms that no practice to deliberately increase methane generation at the Tijuquinhas landfill have occurred or have been promoted (when compared to management and MSW landfilling practices prior to implementation of the project activity). Aspects, conditions and circumstances related to management of the landfill (e.g. waste disposal, waste covering, waste compacting, management of leachate, draining of rainwater, etc.) were not changed with an aim to increase methane generation on site. It is relevant to note that MSW management business (collection and disposal of MSW) in Brazil (and in most of the developing countries) has its own economics, dynamics, politics and related regulations. That makes MSW disposal activity for the Tijuquinhas landfill and other similar landfills in Brazil completely independent from the CDM mechanism and/or revenues of commercialization of CERs generated by project-based destruction of methane in landfills. In the particular case of the Tijuquinhas landfill, it is important to note that this landfill was designed and has operated inter alia as per terms and conditions for solid waste disposal contracts established with the different municipalities and private companies. The design and operation of the landfill is also under conformance with terms and conditions for the environmental licensing that were previously defined and are regularly monitored by the competent environmental authority from the State of Santa Catarina (Instituto do Meio Ambiente de Santa Catarina - IMA). Currently, there is still no regional or national climate change of waste management policy in Brazil which would provide an incentive or a mandate to have MSW being disposed in landfills with better/improved LFG collection/destruction systems (such as the project's LFG collection and destruction system currently implemented at the Tijuquinhas landfill as a CDM project activity).
Monitoring equipment	Not applicable. No measuring equipment is used for monitoring management of the Tijuquinhas landfill.
Measuring/reading/recording frequency	Annual checking is performed.
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.
Purpose of data/parameter	Calculation of baseline emissions

Additional comments	As required by ACM0001 (version 18.0), any change in the management of the landfill after the implementation of the project activity will be justified by referring to technical or regulatory specifications and impacts of such changes in the determination of baseline emissions should in this case be taken into account appropriately. Such monitoring requirement will be used for the determination/confirmation of baseline emissions and/or confirmation of the project's implementation as described in the PDD (in terms of operation and management conditions of the landfill from which LFG is combusted).

Data/Parameter	**$V_{t,wb}$**
Unit	m^3 wet gas/h
Description	Volumetric flow of LFG stream in time interval *t* on a wet basis.
Measured/calculated/ default	Continuously measured by LFG flow meter sets.
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (2 flow meter sets) (with recordable electronic signal).
Value(s) of monitored parameter	While measurements are performed by installed 2 LFG flow meter sets (one set for each individual installed flare), the monitoring parameter $V_{t,wb}$ is thus measured, recorded and reported on the basis of the following sub-parameters: - $V_{t,wb,flare-1}$: Volumetric flow of LFG to Flare 1 - $V_{t,wb,flare-2}$: Volumetric flow of LFG to Flare 2 The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) report all records of measurement data of LFG flow sent to the installed high temperature enclosed flares during the considered monitoring period. Measurement data is recorded and reported with an every-minute frequency.

Monitoring equipment	*Specifications and calibration details for the LFG flow meter sets used during the considered monitoring period for measuring the flow of LFG sent to the flares ($V_{t,wb,flare-1}$ and $V_{t,wb,flare-2}$):* Two identical LFG flow meter sets were used for measuring amount of LFG sent to each operational flare (Flare 1 and Flare 2). Each installed LFG flow meter set is a V-Cone type flow meter and encompasses the following main parts: - a LFG flow primary element (with V-shape cone in its inner section). - a differential pressure sensor + signal processing and transmitter unit (which is coupled/connected to available pressure measurement points at the V-Cone's taps in the primary element). The installed V-Cone type flow meter sets are differential pressure type flow measurement instruments. The "V" in the instrument type designation represents the V-shape of the existing cone in inner section of the primary element of flow meter (it does not stand for Venturi (Venturi-Cone)). Anyhow, like Venturi cones, each one of the installed V-Cone type flow meter sets operates based on the Bernoulli's principle for measurement (Bernoulli's theory of conservation of energy[5]). By having a cone placed in the inner section of the instrument's primary element, the cross sectional area inside the element is reduced, thus forcing velocity of the measured gas to increase. As gas velocity increases, pressure drops. Such pressure drop is continuously measured by the differential pressure sensor + signal processing and transmitter unit and such measurement which are coupled to the primary element. Measured pressure drop is used to determine the flow of LFG passing through the set. For the continuous determination of LFG flow passing through the flow meter set, measured pressure difference is incorporated into a derivation of the Bernoulli equation. The differential pressure sensor + signal processing and transmission unit measures and processes the differential pressure in the primary element. Once the signal is measured, the signal processing and transmission unit generates an electronic signal that is then interpreted by the process control system (programmable logic controller (PLC)) + monitoring infrastructure which were designed and configured for the project activity. As part of operation and monitoring procedures applicable for the monitoring parameter $V_{t,wb}$, related measurements, automatic data processing and data recording result on every-minute values for $V_{t,wb,flare-1}$ and $V_{t,wb,flare-2}$ being automatically reported in normalized cubic meters per hour (Nm^3/h). *Specifications and calibration details for the installed V-Cone type LFG flow meter set used for measuring $V_{t,wb,flare-1}$ (Flare 1):* Primary element: - Manufacturer: McCrometer, Inc. - Model/Series: V-CONE - Accuracy: ±0.5% - Serial Number: 07-1656 - Required Calibration frequency: No regular calibration is required in the primary element of the V-Cone type flow meter set. As per technical specification details for the installed LFG flow meter set, its primary element is rugged and has no moving parts. This characteristic allows

[5] The Bernoulli's principle states that for a constant flow, the pressure in a pipe is inversely proportional to the square of the velocity in the pipe. Simply, the pressure decreases as the velocity increases. For instance, as LFG approaches the primary element of the V-Cone type flow meter, it will have a pressure of P_1 in the initial section of the element. As the fluid velocity increases at the constricted area of the existing inner cone in the primary element, the pressure drops to P_2 in other section of the primary element. Both P_1 and P_2 are measured at the V-Cone's taps of the primary element by the differential pressure sensor + signal processing and transmission unit (which is coupled to the primary element). The Differential pressure created by the V-Cone of the primary element will increase and decrease exponentially with variation of the flow velocity. As the constriction of V-Cone takes up more of the pipe cross-sectional area, more differential pressure will be created at the same flow rates.

continuous measurements of differential pressure without wear or clogging concerns, with no need for maintenance. The primary element is set/calibrated during its manufacturing process and because its design is so robust, there is never a need for regular maintenance, visual checking and/or calibration event after its installation and starting of operations. No calibration requirements for the primary element are specified in the monitoring plan of the PDD or ACM0001 (version 18.0) either.

Differential pressure sensor + signal processing and transmission unit:
- Manufacturer: Fuji Electric
- Model: FKCM22V4AKDYYCA
- Accuracy: ±0.5%
- Serial Number: A7F9524F
- Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are to be performed every year.
- Date(s) and validity of performed calibration event(s) valid for the considered monitoring period:
  - Calibration event performed on 03/09/2018 by Tecnoiso Tecnologia e Soluções Industriais Ltda. (as indicated in the Calibration Certificate Number 1702180903). The performed calibration event is valid until 02/09/2019.
  - Calibration event performed on 20/05/2019 by Tecnoiso Tecnologia e Soluções Industriais Ltda. (as indicated in the Calibration Certificate Number 7610190520). The performed calibration event is valid until 19/05/2020.
  - Calibration event performed on 15/04/2020 by Tecnoiso Tecnologia e Soluções Industriais Ltda. (as indicated in the Calibration Certificate Number 1208200415). The performed calibration event is valid until 14/04/2021.

Specifications and calibration details for the installed V-Cone type LFG flow meter set used for measuring $V_{t,wb,flare-2}$ (Flare 2):

Primary element:
- Manufacturer: McCrometer, Inc.
- Model/Series: V-CONE
- Accuracy: ±0.5%
- Serial Number: 08-3033
- Required Calibration frequency: No regular calibration is required in the primary element of the V-Cone type flow meter set. As per technical specification details for the installed LFG flow meter set, its primary element is rugged and has no moving parts. This characteristic allows continuous measurements of differential pressure without wear or clogging concerns, with no need for maintenance. The primary element is set/calibrated during its manufacturing process and because its design is so robust, there is never a need for regular maintenance, visual checking and/or calibration event after its installation and starting of operations. No calibration requirements for the primary element are specified in the monitoring plan of the PDD or ACM0001 (version 18.0) either.

Differential pressure sensor + signal processing and transmission unit:
- Manufacturer: Fuji Electric
- Model: FKCM22V4AKDYYCA
- Accuracy: ±0.5%
- Serial Number: A7F9525F
- Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed every year.

	- Date(s) and validity of performed calibration event(s) valid for the considered monitoring period: • Calibration event performed on 20/08/2018 by Tecnoiso Tecnologia e Soluções Industriais Ltda. (as indicated in the Calibration Certificate Number 1702180820). The performed calibration event is valid until 19/08/2019. • Calibration event performed on 20/05/2019 by Tecnoiso Tecnologia e Soluções Industriais Ltda. (as indicated in the Calibration Certificate Number 7603190520). The performed calibration event is valid until 19/05/2020. • Calibration event performed on 15/04/2020 by Tecnoiso Tecnologia e Soluções Industriais Ltda. (as indicated in the Calibration Certificate Number 1206200415). The performed calibration event is valid until 14/04/2021.
Measuring/reading/recording frequency	Continuous measurements are recorded and reported with an every-minute frequency.
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 at Proactiva Meio Ambiente - Brasil in accordance with detailed working instructions.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	While the geometric profile of primary element of the installed V-Cone type flow meter sets (rugged construction with no moving parts) results on no periodic calibration being required in the element (since it does not suffer alterations over the operating conditions), as per the maintenance and monitoring procedure applied (as part of the application of the monitoring plan for the project activity), the primary element is anyway opened and cleaned once a year in order to verify and confirm no accidental eventual obstruction of the flow. Therefore, only the differential pressure sensor + signal processing and transmission unit shall be regularly calibrated. Related calibration events are carried out by independent 3rd party using appropriate pressure generator and a certified digital manometer. The values registered in the data logger are directly compared to the measurements of the reference instrument, so that the scope of the calibration covers the entire process of data recording and operational flow range of the installed LFG flow meter sets.

Data/Parameter	$v_{CH4,t,wb}$
Unit	m^3 CH_4/m^3 wet gas
Description	Volumetric fraction of CH_4 in the collected LFG in time interval *t* on a wet basis.
Measured/calculated/ default	Continuously measured by continuous CH_4 content gas analyzer.

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) include measurement data for $v_{CH4,t,wb}$ that are recorded and reported with an every-minute frequency.
Monitoring equipment	*Specifications and calibration details for the continuous CH_4 content gas analyzer unit used during the considered monitoring period for measuring the fraction of CH_4 in the collected LFG:* Two continuous CH_4 gas analyzer units of the same model were used alternately during the considered monitoring period. Their specifications are described below: - Manufacturer: ABB S.p.A. - Model: Uras26 - AO2000 Series - Accuracy: ±1% - Serial Number / period in use within the considered monitoring period: • 33457308 – installed during the period from 01/05/2019 to 22/05/2019 • 33457298 – installed during the period from 22/05/2019 to 31/03/2019 - 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: • Calibration event for the continuous CH_4 gas analyzer unit with S/N 33457308 performed on 14/11/2018 by ABB Ltda. (as indicated in the Calibration Certificate Number 01-11/18). The performed calibration event is valid until 13/11/2019. • Calibration event for the continuous CH_4 gas analyzer unit with S/N 33457298 performed on 20/05/2019 by Tecnoiso Tecnologia e Soluções Industriais Ltda. (as indicated in the Calibration Certificate Number 7620190520). The performed calibration event is valid until 19/05/2020. • Calibration event for the continuous CH_4 gas analyzer unit with S/N 33457298 performed on 15/04/2020 by Tecnoiso Tecnologia e Soluções Industriais Ltda. (as indicated in the Calibration Certificate Number 1201200415). The performed calibration event is valid until 13/04/2021. The calibration events were performed by using certified span gas cylinder with a known CH_4 composition (as outlined in the Calibration Certificate).
Measuring/reading/recording frequency	Continuous measurements are recorded and reported with an every-minute frequency.
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 at Proactiva Meio Ambiente - Brasil in accordance with detailed working instructions.

Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**T_t**
Unit	K
Description	Temperature of the LFG stream in time interval *t*
Measured/calculated/ default	Continuously measured by a temperature sensor installed along the LFG pipeline of the project activity within the flaring facility. Measurements are primarily recorded and reported in ^oC. Recorded/reported data is converted into Kelvin and data is also reported in this unit, thus meeting the related monitoring requirement as per the PDD.
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instrument (temperature sensor with recordable electronic signal).
Value(s) of monitored parameter	The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) include measurements data for T_t that are recorded and reported with an every-minute frequency.
Monitoring equipment	Measurements of temperature of LFG which is sent to the flares are performed by a temperature sensor that is installed in the main LFG pipeline within the flaring facility. Two temperature sensors of the same model were used alternately during the considering monitoring period. Their specifications are as follows; - Manufacturer: Consistec Controles e Sistemas de Automação Ltda. - Model: PR 5333 - Accuracy: ±1% - Serial Number / period in use within the considered monitoring period: • 181469439 – installed during the period from 01/05/2019 to 22/05/2019 • 185611 – installed during the period from 22/05/2019 to 31/03/2019 - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed every 1 year - Date(s) and validity of performed calibration event(s) valid for the considered monitoring period: • Calibration event for the temperature sensor with S/N 181469439, performed on 22/08/2018 by Consistec Controles e Sistemas de Automação Ltda. (as indicated in the Calibration Certificate Number CR-05503/18). The performed calibration event is valid until 21/08/2019 • Calibration event for the temperature sensor with S/N 185611, performed on 22/05/2019 by Alutal Laboratório de Metrologia (as indicated in the Calibration Certificate Number CA-2435/19 1-2). The performed calibration event is valid until 21/05/2020
Measuring/reading/recording frequency	Continuous measurements are recorded and reported with an every-minute frequency.

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 at Proactiva Meio Ambiente - Brasil in accordance with detailed working instructions.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**P_t**
Unit	Pa
Description	Pressure of the LFG stream in time interval *t*
Measured/calculated/ default	Continuously measured by a pressure sensor installed along the LFG pipeline of the project activity within the flaring facility. Measurements of pressure of LFG are primarily recorded and reported in mbar. Recorded/reported data is converted into Pascal and data is also reported in this unit, thus meeting the related monitoring requirement as per the PDD.
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instrument (2 pressure sensors with recordable electronic signal).
Value(s) of monitored parameter	The monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report) include measurement data for P_t that are recorded and reported with an every-minute frequency.
Monitoring equipment	Measurements of pressure of LFG which is sent to the flares are performed by a pressure sensor that is installed in the main LFG pipeline within the flaring facility. The specifications of the LFG pressure sensor utilized during the considered monitoring period are as follows: - Manufacturer: Fuji Electric France S.A. - Model: FKPW01V4AKAYY0E - Accuracy: ±0.2% - Serial Number: A8C8687F - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed every 1 year - Date(s) and validity of performed calibration event(s) valid for the considered monitoring period: • Calibration event performed on 30/05/2018 by Tecnoiso Tecnologia e Soluções Industriais Ltda. (as indicated in the Calibration Certificate Number 6720180530). The performed calibration event is valid until 29/05/2019 • Calibration event performed on 20/05/2019 by Tecnoiso Tecnologia e Soluções Industriais Ltda. (as indicated in the Calibration Certificate Number 7604190520). The performed calibration event is valid until 19/05/2020
Measuring/reading/recording frequency	Continuously 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 at Proactiva Meio Ambiente - Brasil in accordance with detailed working instructions.

Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**$EC_{PJ,grid,y}$**
Unit	MWh
Description	Amount of grid electricity consumed by the project activity during the year *y*
Measured/calculated/ default	Measured as part of the operation of the project activity by applying appropriate electricity meter.
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instrument (electricity meter).
Value(s) of monitored parameter	Available monthly records of grid-sourced electricity consumption valid for the considered monitoring period:
Monitoring equipment	*Specifications of the installed electricity meter* - Manufacturer: Sibratec - Model: DTS-353 - Accuracy: ±0.5% - Serial Number: N/A - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed every 5 years - Date(s) and validity of performed calibration event(s) valid for the considered monitoring period: • Calibration event performed on 20/06/2018 by Tecnoiso Tecnologia e Soluções Industriais Ltda. (as indicated in the Calibration Certificate Number 1206180620). The performed calibration event is valid until 19/06/2023.
Measuring/reading/recording frequency	Accumulated measurement values are recorded and reported every week. Monthly accumulated values are calculated and reported based on available weekly records.

Month	Total amount of consumed grid electricity (MWh)
May/2019	27.423
Jun./2019	31.719
Jul./2019	38.091
Aug./2019	34.066
Sep./2019	18.608
Oct./2019	17.000
Nov./2019	22.343
Dec./2019	37.120
Jan./2020	40.702
Feb./2020	33.241
Mar./2020	44.178

Calculation method (if applicable)	Not applicable.
QA/QC procedures	Periodic calibration events in the electricity meter will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations. Instrument will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice. Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Proactiva Meio Ambiente - Brasil in accordance with detailed working instructions.
Purpose of data/parameter	Calculation of project emissions (due to consumption of grid-sourced electricity by the project activity).
Additional comments	The project's major source for the consumption of grid-sourced electricity is the centrifugal blower (powered by electric motor) used for forced collection of LFG from the project's LFG collection wells. Electricity consumption also represents the major operational cost for the project activity. All monthly measurement records for $EC_{PJ,grid,y}$ and calculations for the determination of accumulated values applicable for the considered monitoring period are reported in the summarized emission reduction calculation spreadsheet that is enclosed to this Monitoring Report.

Data/Parameter	**$F_{CH4,EG,t}$**
Unit	kg
Description	Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period *t*
Measured/calculated/ default	Measurements performed by a third party accredited entity.
Source of data	Related measurements were performed by the independent third party inspection services companies "ES4I Environmental Services for Industries Ltda." and "JAPH Serviços Analíticos Ltda.". Biannual measurements of mass flow of methane in the exhaust gas are performed on the basis of measurements of CH_4 concentration in a collected gas sample + measurements of speed of exhaust gas in the upper section of the flare with one hour of duration each. Measurements are performed by following applicable guidance and requirements of the following standards/methods: US-EPA Method 18 – Measurement of Gaseous Organic Compound Emission by Gas Chromatography (available online: https://www.epa.gov/emc/method-18-volatile-organic-compounds-gas-chromatography); CETESB L9.221 - "Pipelines and chimneys in stationary emission sources-Sampling points determination procedure) (available online: http://www.esaat.com.br/docs/met_cetesb/CETESB-L9.221.pdf) CETESB L9.222 - "Pipelines and chimneys in stationary emission sources – Determination of speed and outflow of gases) (available online: http://www.esaat.com.br/docs/met_cetesb/CETESB-L9.222.pdf)

<table>
<tr><td></td><td>CETESB L9.223 - “Pipelines and chimneys in stationary emission sources – Determination of dry molecular mass and the excess of the air flow gas” (available online: http://www.esaat.com.br/docs/met_cetesb/CETESB-L9.223.pdf).

CETESB L9.224 - “Pipelines and chimneys in stationary emission sources – Determination of humidity of effluents” (available online: http://www.esaat.com.br/docs/met_cetesb/CETESB-L9.224.pdf).</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>For the considered monitoring period, 2 biannual related measurements were performed for Flare 1 and Flare 2.

The monitoring parameter $F_{CH4,EG,t}$ is measured, recorded and reported on the basis of the following sub-parameters:

- $F_{CH4,EG,t,flare-1}$: Mass flow of methane in the exhaust gas of Flare 1
- $F_{CH4,EG,t,flare-2}$: Mass flow of methane in the exhaust gas of Flare 2

For the determination of values of $F_{CH4,EG,t,flare-1}$ and $F_{CH4,EG,t,flare-2}$ average of the accumulated mass of methane (measured under conformance with related requirements of the methodological tool “Project emissions from flaring” (version 02.0.0)) is considered.

The table below summarizes the performed biannual determination of $F_{CH4,EG,t}$ for each one of the installed flares valid and available for the considered monitoring period:

Flare 1 ($F_{CH4,EG,t,flare-1}$):

<table><tr><th colspan="2">Flare 1 ($F_{CH4,EG,t,flare-1}$)</th></tr><tr><td>Measurements performed on 04/06/2019 by ES4I Environmental Services for Industries Ltda. (kg)</td><td>Measurements performed on 27/02/2020 by JAPH Serviços Analíticos Ltda. (kg)</td></tr><tr><td>0.0190</td><td>0.0078</td></tr></table>
Flare 2 ($F_{CH4,EG,t,flare-2}$):

<table><tr><th colspan="2">Flare 2 ($F_{CH4,EG,t,flare-2}$)</th></tr><tr><td>Measurements performed on 04/06/2019 by ES4I Environmental Services for Industries Ltda. (kg)</td><td>Measurements performed on 27/02/2020 by JAPH Serviços Analíticos Ltda. (kg)</td></tr><tr><td>0.0010</td><td>0.0018</td></tr></table></td></tr>
<tr><td>Monitoring equipment</td><td>Available measurements were performed by the independent 3rd party inspection service companies “ES4I Environmental Services for Industries Ltda.” and “JAPH Serviços Analíticos Ltda.”.</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Biannual</td></tr>
</table>

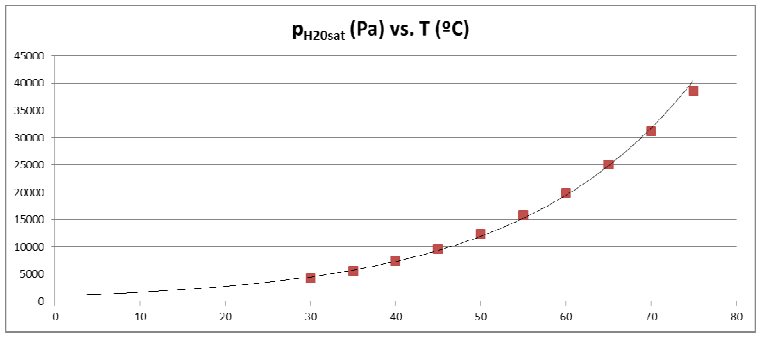
Calculation method (if applicable)	-
QA/QC procedures	Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Proactiva Meio Ambiente - Brasil in accordance with detailed working instructions. "ES4I Environmental Services for Industries Ltda." and "JAPH Serviços Analíticos Ltda." are independent third-party inspection services companies specialized in inspections and testing of air emissions from stationary sources.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Among the standards of which guidance and requirements were followed as part of performed biannual determination of $F_{CH4,EG,t}$ for the installed flare within the considered monitoring period, the US-EPA Method 18 – Measurement of Gaseous Organic Compound Emission by Gas Chromatography has been widely internationally recognized and/or accepted by different national and international organizations as a standard for performance of emission measurements from stationary emission sources in a wide range of industries (e.g. The California Air Resources Board (CARB), Scottish Environment Protection Agency (SEPA). Different agencies in the United States (USA) and in other countries require or recommend that determination of concentration of VOC portion in landfill gas is to be performed by applying US-EPA Method 18. The US-EPA Method 18 is also referred in the most popular and acknowledged pollution control handbooks and guides (i.e. Pollution Control Handbook for Oil and Gas Engineering, 2016, published by John Wiley & Sons, Inc. – USA, US-EPA Guidance for evaluating landfill gas emissions from closed or abandoned facilities, SEPA Guidance for monitoring landfill gas engine emissions, Pollution Prevention and Abatement Handbook 1998 – The World Bank Group, etc.). The technical test/evaluation reports for the performed biannual determination of $F_{CH4,EG,t}$ for the installed flares within the considered monitoring period (reports issued by the independent 3rd party inspection service companies "ES4I Environmental Services for Industries Ltda." and "JAPH Serviços Analíticos Ltda.") also refer to methods recommended by the environmental authority of São Paulo State in Brazil. Compliance with these methods has also been acknowledged as best practice for performance of air emission measurements by different environmental regulatory agencies in Brazil.

Data/Parameter	$p_{H20,t,Sat}$
Unit	Pa
Description	Saturation pressure of H_2O at temperature T_t in time interval *t*
Measured/calculated/ default	Default values as per selected literature.
Source of data	Data selected as per the literature "*Fundamentals of Classical Thermodynamics*". Authors: Gordon J. Van Wylen, Richard E. Sonntag and Borgnakke; 4th Edition. Published by John Wiley & Sons, Inc.
Value(s) of monitored parameter	$p_{H2O,t,Sat}$ is determined as a function of temperature of LFG (T_t by the equation: $p_{H2O,t,sat} = 1{,}031.3 * e^{(0.049 * Tt)}$, with a correlation coefficient of $R^2 = 0.998$. Further details are presented below in "Calculation Method".

Monitoring equipment	Not applicable.
Measuring/reading/recording frequency	Not applicable
Calculation method (if applicable)	The Absolute Vapor Pressure of Water was obtained from the mentioned literature and is presented in the following table within the rage of interest for the required calculations:

Temperature	**$p_{H2O,t,Sat}$**
ºC	Pa
30	4,246
35	5,628
40	7,384
45	9,593
50	12,349
55	15,758
60	19,940
65	25,030
70	31,190
75	38,580

The following graphic represents the above data and the regression calculated to adjust data:



As $p_{H2O,t,Sat}$ is a function of temperature and best represented by an exponential function, the exponential regression method is applied to the above data and the following equation is obtained:

$p_{H2O,t,sat} = 1{,}031.3 * e^{(0.049 * Tt)}$

This equation represents the above data with a correlation coefficient of $R^2 = 0.998$.

Thus, by applying the above equation, $p_{H2O,t,sat}$ is determined as a function of the temperature.

QA/QC procedures	Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Proactiva Meio Ambiente - Brasil in accordance with detailed working instructions.
Purpose of data/parameter	Calculation of baseline emissions.

Additional comments	It is important to note that $p_{H2O,t,Sat}$ is only used in the context of the determination of the methane mass flow in the residual gas (in a dry basis) for each minute *m* of the two time periods in year *y* during which the flare efficiency is measured (parameter $F_{CH4,RG,t}$). The calculations of every-minute values of $p_{H2O,t,Sat}$ for the 2 time periods during which the flare efficiency is measured is thus presented only in the flare efficiency calculation spreadsheet.

Data/Parameter	**$T_{EG,m}$**
Unit	ºC
Description	Temperature in the exhaust gas of the enclosed flares in minute *m*
Measured/calculated/ default	Continuously measured by a thermocouple installed in the upper section of the flare
Source of data	Measured as part of the operation of the project activity by applying appropriate monitoring instruments (thermocouple with recordable electronic signal).
Value(s) of monitored parameter	Values for each one of the installed 2 high temperature enclosed flares are reported in the monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report). Measurement data is recorded and reported with an every-minute frequency. While available measurements valid for the considered monitoring period were performed by 2 thermocouples (one thermocouple installed in each individual installed flare), the monitoring parameter $T_{EG,m}$ is measured, recorded and reported on the basis of the following sub-parameters: - $T_{EG,m,flare-1}$: Temperature in the exhaust gas of Flare 1 - $T_{EG,m,flare-2}$: Temperature in the exhaust gas of Flare 2

Monitoring equipment	*Specifications and calibration details for the installed/utilized thermocouples:* *Thermocouple used for measuring $T_{EG,m,flare-1}$ (Flare 1):* - Manufacturer: Consistec Controles e Sistemas de Automação Ltda. - Type: N - Serial Number: 185614 - Accuracy: ±0.75% - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed every year - Date(s) and validity of performed calibration event(s) valid for the considered monitoring period: • Calibration event performed on 21/06/2018 by Consistec Controles e Sistemas de Automação Ltda. (as indicated in the Calibration Certificate Number CR-04303/18). The calibration event is valid until 20/06/2019. • Calibration event performed on 22/05/2019 by Alutal Laboratório de Metrologia (as indicated in the Calibration Certificate Number CA-2438/19). The calibration event is valid until 21/05/2020. *Thermocouple used for measuring $T_{EG,m,flare-2}$ (Flare 2):* - Manufacturer: Consistec Controles e Sistemas de Automação Ltda. - Type: N - Serial Number: 185615 - Accuracy: ±0.75% - Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed every year - Date(s) and validity of performed calibration event(s) valid for the considered monitoring period: • Calibration event performed on 21/06/2018 by Consistec Controles e Sistemas de Automação Ltda. (as indicated in the Calibration Certificate Number CR-04304/18). The calibration event is valid until 20/06/2019. • Calibration event performed on 22/05/2019 by Alutal Laboratório de Metrologia (as indicated in the Calibration Certificate Number CA-2521/19). The calibration event is valid until 21/05/2020.
Measuring/reading/recording frequency	Continuous measurements are automatically recorded/reported every minute.
Calculation method (if applicable)	-
QA/QC procedures	Monitoring equipment/instruments are to be calibrated and maintained as per instrument specifications and/or recommendations of manufacturer. Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Proactiva Meio Ambiente - Brasil in accordance with detailed working instructions.
Purpose of data/parameter	Calculation of baseline emissions.
Additional comments	Measurements are required to determine if manufacturer's flare specifications for operating temperature are met.

Data/Parameter	**$Flame_m$**
Unit	Flame status "*on*" or flame status "*off*"
Description	Flame detection of flare in the minute *m*
Measured/calculated/ default	Continuously measured by Ultra violet (UV) flame detector
Source of data	Whenever flame is detected in the flare, flame status "*on*" or "1" value is attributed. Whenever no flame is detected in the flare, flame status "*off*" or "0" is attributed.
Value(s) of monitored parameter	Values for each one of the installed 2 high temperature enclosed flares are reported in the monthly emission reduction calculation spreadsheets (that are enclosed to this Monitoring Report). Measurement data is recorded and reported with an every-minute frequency. While available measurements valid for the considered monitoring period were performed by 2 UV flame detectors (one UV flame detector installed in each individual installed flare), the monitoring parameter $Flame_m$ is thus measured, recorded and reported on the basis of the following sub-parameters: - $Flame_{m,flare-1}$: Flame detection in Flare 1 - $Flame_{m,flare-2}$: Flame detection in Flare 2
Monitoring equipment	*Specifications and calibration details for the UV Flame detector installed on Flare 1:* - Manufacturer: Krom Schroder - Model: UVS 10D0G1 - Serial Number: 021452 - Calibration frequency: No regular calibration event is required as the equipment has a self-checking function. *Specifications and calibration details for the UV Flame detector installed on Flare 2:* - Manufacturer: Krom Schroder - Model: UVS 10D0G1 - Serial Number: 023512 - Calibration frequency: No regular calibration event is required as the equipment has a self-checking function.
Measuring/reading/recording frequency	Continuously 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 at Proactiva Meio Ambiente - Brasil in accordance with detailed working instructions.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**$Maintenance_y$**
Unit	Calendar dates
Description	Maintenance events completed in year *y* as monitored by the project participants.
Measured/calculated/ default	-
Source of data	Maintenance logs
Value(s) of monitored parameter	The following previously performed relevant maintenance events (inspection and maintenance services) are applicable for the flares during the considered monitoring period: - 08/02/2019: General inspection/maintenance service on Flare 1 and Flare 2 (incl. inspection of the condition of the flares' isolation ceramics revetment material, checking of condition/function of the air inlet dumpers, checking of the conditions of the thermocouples, checking of the condition of the UV flame detectors, checking of the condition of the flame arrester valves, checking of the conditions of the flares' LFG injectors). - 10/08/2018: General inspection/maintenance service on Flare 1 and Flare 2 (incl. inspection of the condition of the flares' isolation ceramics revetment material, checking of condition/function of the flares' air inlet dumpers, checking of the conditions of the thermocouples, checking of the condition of the UV flame detectors, checking of the condition of the flame arrester valves, checking of the conditions of the flares' LFG injectors). As per the applied maintenance practice for the project activity, general inspection/maintenance services on the flare are opportunely performed during planned or unplanned interruptions of operation of the both Flare 1 and Flare 2 within a time interval between 2 performed inspection/maintenance services events never higher than a year. The expected lifetime for the isolation ceramics revetment material for both Flare 1 and Flare 2 is of at least 10 years (as established under details valid for the ex-ante determined parameter "Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval" ($SPEC_{flare}$)). Flare 1 and Flare 2 are both under conformance with the required interval for replacement of their isolation ceramics revetment material (as defined under the details for the ex-ante parameter $SPEC_{flare}$) Performed regular maintenance services for both Flare 1 and Flare 2 are performed by specialized technical service team under full conformance with maintenance requirements for the flares (as established by equipment manufacturer) and as required/establsiehd under details for the ex-ante determined parameter $SPEC_{flare}$. Further details about related maintenance requirements established under details for the ex-ante determined parameter $SPEC_{flare}$ are included in Section D.1.
Monitoring equipment	Not applicable.
Measuring/reading/recording frequency	Not applicable.
Calculation method (if applicable)	Not applicable.

QA/QC procedures	Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Proactiva Meio Ambiente - Brasil in accordance with detailed working instructions.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Monitoring of this parameter is required for the case of enclosed flare and the project participant selects Option B to determine flare efficiency. These dates are required so that they can be compared to the maintenance schedule to check that maintenance events were completed within the minimum time between maintenance events specified by the manufacturer ($SPEC_{flare}$).

Data/Parameter	**Status of biogas destruction device**
Unit	-
Description	Operational status of biogas destruction devices
Measured/calculated/ default	Every-minute records of the status of the flare are reported based on the flame status of the flare (parameter $Flame_m$).
Source of data	Available every-minute records of the status of the both Flare 1 and Flare 2 are reported based on the flame status of both flares (monitoring parameter $Flame_m$)
Value(s) of monitored parameter	See details in the applicable monitoring details table for the parameter $Flame_m$..
Monitoring equipment	Specification details for the UV flame detectors used in Flare 1 and Flare 2 during the considered monitoring period are presented in the applicable monitoring details table for the parameter $Flame_m$ (with related measurements being recorded and reported on the basis of the sub-parameters $Flame_{m,flare-1}$ and $Flame_{m,flare-2}$)
Measuring/reading/recording frequency	Continuous measurements will be recorded and reported with an every minute frequency. See details in the applicable monitoring details table for the parameter $Flame_m$..
Calculation method (if applicable)	Not applicable
QA/QC procedures	See details in the applicable monitoring details table for the parameter $Flame_m$..
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**$EC_{PJ,captive,y}$**
Unit	MWh

<table>
<tr><td>Description</td><td>Quantity of electricity generated in captive diesel backup generator during the year y</td></tr>
<tr><td>Measured/calculated/ Default</td><td>Measured</td></tr>
<tr><td>Source of data</td><td>Measured by the project participants</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>Available monthly records of electricity sourced by the backup captive diesel generator valid for the considered monitoring period:

<table>
<tr><th>Month</th><th>Total amount of consumed grid electricity (MWh)</th></tr>
<tr><td>May/2019</td><td>2.777</td></tr>
<tr><td>Jun./2019</td><td>6.005</td></tr>
<tr><td>Jul./2019</td><td>5.430</td></tr>
<tr><td>Aug./2019</td><td>3.513</td></tr>
<tr><td>Sep./2019</td><td>19.437</td></tr>
<tr><td>Oct./2019</td><td>12.229</td></tr>
<tr><td>Nov./2019</td><td>2.431</td></tr>
<tr><td>Dec./2019</td><td>1.976</td></tr>
<tr><td>Jan./2020</td><td>2.545</td></tr>
<tr><td>Feb./2020</td><td>0.252</td></tr>
<tr><td>Mar./2020</td><td>0.007</td></tr>
</table></td></tr>
<tr><td>Monitoring equipment</td><td>Specifications of the installed electricity meter

- Manufacturer: Sibratec
- Model: DTS-353
- Accuracy: ±0.5%
- Serial Number: N/A
- Calibration frequency (as per the application of the monitoring plan and recommendations from the equipment manufacturer): Calibration events are performed every 5 years
- Date(s) and validity of performed calibration event(s) valid for the considered monitoring period:
• Calibration event performed on 20/06/2018 by Tecnoiso Tecnologia e Soluções Industriais Ltda. (as indicated in the Calibration Certificate Number 1205180620). The performed calibration event is valid until 19/06/2023.</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Accumulated measurement values are recorded and reported every week. Monthly accumulated values are calculated and reported based on available weekly records.</td></tr>
<tr><td>Calculation method (if applicable)</td><td>Not applicable.</td></tr>
<tr><td>QA/QC procedures</td><td>Periodic calibration events in the electricity meter will be performed in a frequency as per instrument specifications and/or instrument manufacturer’s recommendations. Instrument will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice.

Procedures related to collection/gathering, recording, storing and reporting of monitoring data for the project activity are performed at Proactiva Meio Ambiente - Brasil in accordance with detailed working instructions.</td></tr>
</table>

Purpose of data/parameter	Calculation of the project emissions.
Additional comments	It is important to note that within the considered monitoring period, the backup captive off-grid electricity generator (fueled by diesel) was often used for meeting the project's electricity demand during peak demand times for the electricity grid to which the project is connected to (normally between 06:00 PM and 09:00 PM during working days) and/or whenever supply of grid-sourced electricity to the project activity was temporarily interrupted. Due to identified malfunction and need of performance of related repair/overhauling work in the electricity generator, this equipment operated under reduced accumulated operation time during the months of February/2019 and March/2019 within the considered monitoring period.

The following monitoring parameters (which are also included in the monitoring plan of the PDD) were not monitored as the methodological options for which they are applicable were not selected as the monitoring or calculation approaches for the determination of baseline emissions and/or project emissions achieved by the project activity during the considered monitoring period:

- Volumetric flow of LFG stream in time interval t on a dry basis ($V_{t,db}$)
- Volumetric fraction of CH_4 in the collected LFG in time interval t on a dry basis ($v_{CH4,t,db}$)
- Mass flow of the LFG stream in time interval t on dry basis for ($M_{t,db}$)
- Quantity of fuel diesel combusted by the captive off-grid electricity generator ($FC_{Diesel,y}$)
- Net calorific value of the fuel diesel in year *y* ($NCV_{Diesel,y}$)
- CO_2 emission factor of fuel diesel in year y ($EF_{CO2,Diesel,y}$)

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

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

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

Where:

$BE_{CH4,y}$ Baseline emissions of methane from the SWDS[6]. As established by both ACM0001 (version 18.0) and the PDD, the determination of $BE_{CH4,y}$ is based on the amount of methane that is actually captured and combusted (through destruction of collected LFG in the flare) by the project activity. As established by both ACM0001 (version 18.0) and the PDD, the amount of methane that, in the absence of the project activity (baseline scenario), would be otherwise captured and destroyed in the landfill (by the pre-project previously existent conventional LFG destruction system) is also taken into account. In addition, the effect of methane oxidation (that, as per

[6] SWDS = Solid Waste Disposal Site. For the case of the project activity, the SWDS is the Tijuquinhas landfill.

ACM0001 (version 18.0) is assumed as existing in the baseline and not in the project scenario) is also taken into account. $BE_{CH4,y}$ is thus determined as follows:

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

Where:

OX_{top_layer} Fraction of methane in the LFG that would be oxidized in the top layer of the SWDS in the baseline scenario. OX_{top_layer} is ex-ante determined as 10%. Further details about the selection of the value for OX_{top_layer} is included in Section D.1 and in the PDD.

$GWP_{CH4,y}$ Global warming potential of CH_4. GWP_{CH4} is ex-ante determined as 25. Further details about the selection of the value for GWP_{CH4} is included in Section D.1 and in the PDD.

$F_{CH4,BL,y}$ Amount of methane in the LFG that would be flared in the baseline scenario (absence of project activity). As outlined in Section B.6.1 of the PDD, $F_{CH4,BL,y}$ is calculated as follows:

$F_{CH4,BL,y} = F_{CH4,hist,y} = F_{CH4,BL,x-1} / F_{CH4,x-1} * F_{CH4,PJ,y}$

Where:

$F_{CH4,x-1}$ Amount of methane in the LFG generated in the SWDS in the year prior to the implementation of the project activity. $F_{CH4,2007}$ is ex-ante determined as 5,753.13 tCH_4.

$F_{CH4,BL,x-1}$ Historical amount of methane in the LFG which is captured and destroyed in the year prior to the implementation of the project activity. $F_{CH4,BL,x-1}$ is ex-ante determined as 484 tCH_4. Further details about the selection of the value for $F_{CH4,BL,x-1}$ is included in Section D.1 and in the PDD.

$F_{CH4,PJ,y}$ Amount of methane in the LFG which is flared and/or used in the project activity. Details about the determination of every-minute values of the parameter $F_{CH4,PJ,y}$ are presented below.

For the considered monitoring period, $F_{CH4,BL,y}$ is thus determined as follows:

$F_{CH4,BL,y} = (484 / 5,753.13) * F_{CH4,PJ,y} = 0.0842 * F_{CH4,PJ,y}$

For the considered monitoring period, the accumulated value for $F_{CH4,BL,y}$ is calculated and reported as 585 tCH_4. All related calculation are presented in the monthly emission reduction calculation spreadsheets that are enclosed to the Monitoring Report.

$F_{CH4,PJ,y}$ Amount of methane in the LFG which is flared and/or used in the project activity. In the particular case of the project activity, $F_{CH4,PJ,y}$ is determined as follows:

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

Where:

$F_{CH4,flared,y}$ Amount of methane in the LFG which is destroyed by flaring (in tCH_4). In accordance with calculation guidance included in the PDD and by following applicable guidance of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", every-minute values for $F_{CH4,flared,y}$ are determined as the difference between the amount of methane supplied to the flare and residual methane emissions from combustion of LFG in the flare, as follows:

$$F_{CH4,flared,y} = F_{CH4,sent\_flare,y} - (PE_{flare,y} / GWP_{CH4})$$

Where:

$F_{CH4,sent\_flare,y}$ Amount of methane in the LFG which is sent to the flare. Details for the determination of every-minute values for $F_{CH4,sent\_flare,y}$ are presented below (under "*Determination of every-minute values for the calculation parameter $F_{CH4,sent\_flare,y}$*").

$PE_{flare,y}$ Project emissions from flaring of the residual gas stream. Details for the determination of every-minute values for $PE_{flare,y}$ for each individual flare are presented below (under "*Determination of $PE_{flare,y}$*").

Determination of every-minute values for the calculation parameter $F_{CH4,sent\_flare,y}$:
For the considered monitoring period, Option C of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" (where the gaseous stream the tool shall be applied to is the stream of collected LFG that is sent to each the flare)[7] is the selected option for determination of values of $F_{CH4,sent\_flare,y}$.

By following calculation option C (that is one of the applicable calculation methods the PDD refers to), the mass flow of greenhouse gas *i* for the installed flares ($F_{i,t}$, where $i = CH_4$) during the whole considered monitoring period (by taking into account the share of period for which related monitoring records are available) is determined as follows:

$$F_{CH4,sent\_flare,y,flare\text{-}n} = F_{CH4,t,flare\text{-}n} = V_{t,wb,n,flare\text{-}n} * v_{CH4,t,wb} * \rho_{CH4,n}$$

Where:

$V_{t,wb,n,flare\text{-}n}$ Volumetric flow of the gaseous stream (LFG) to the flare in time interval *t* on a wet basis at normal conditions. For the considered monitoring period, every-minute values of the calculation parameter $V_{t,wb,n,flare\text{-}n}$ for each flare (sub-parameters $V_{t,wb,n,flare\text{-}1}$ and $V_{t,wb,n,flare\text{-}2)}$ are directly measured and automatically reported (in Nm^3 wet gas/h) in the monthly emission reduction calculation spreadsheets valid for the

[7] It is relevant to note that the PDD states the following regarding the calculation approach for values of $F_{CH4,sent\_flare,y}$:

> "*Applicable guidance of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" will be applied to determine $F_{CH4,sent\_flare,y}$ by using one of the options A, B, C or D. The selection of the determination option will depend on project conditions and equipment to be installed.*"

considered monitoring period (and enclosed to this Monitoring Report). While in the particular case of the project activity, during the considered monitoring period, the determination of volumetric flow of the gaseous stream (LFG) is already processed and reported in Nm^3 of wet gas/h (normal conditions), the following assumption is thus valid:

- $V_{t,wb,n,flare-1}$ is equivalent to $V_{t,wb,flare-1}$
- $V_{t,wb,n,flare-2}$ is equivalent to $V_{t,wb,flare-2}$

Where:

$V_{t,wb,flare-1}$ Volumetric flow of the gaseous stream (LFG) sent to Flare 1 in time interval *t* on a wet basis (in actual conditions).

$V_{t,wb,flare-2}$ Volumetric flow of the gaseous stream (LFG) sent to Flare 2 in time interval *t* on a wet basis (in actual conditions).

Note: in accordance with the PDD, since measurements of LFG flow sent to each one of the flares are automatically processed and recorded in normalized cubic meters, monitoring of "Pressure of the LFG stream in time interval t" (P_t) and "Temperature of the LFG stream in time interval *t*" (T_t) are thus not required for the determination of $V_{t,wb,n,flare-1}$ and $V_{t,wb,n,flare-2}$. Further monitoring details about the monitoring parameter $V_{t,wb}$ are included in Section D.2.

$v_{CH4,t,wb}$ Volumetric fraction of CH_4 in the gaseous stream in time interval *t* on a wet basis. As per the applied monitoring procedure, every-minute values of the monitoring parameter $v_{CH4,t,wb}$ (in m^3 of CH_4 / m^3 of wet LFG) are reported in the monthly emission reduction calculation spreadsheets valid for the considered monitoring period (and enclosed to this Monitoring Report). Further monitoring details about the monitoring parameter $v_{CH4,t,wb}$ are included in Section D.2.

$\rho_{CH4,n}$ Density of CH_4 in the gaseous stream (LFG) at normal conditions. For the considered monitoring period, value of $\rho_{CH4,n}$ (in kg of CH_4 / m^3 of CH_4) is calculated and reported in the monthly emission reduction calculation spreadsheets valid for the considered monitoring period (and enclosed to this Monitoring Report) as follows:

$\rho_{CH4,n} = (P_n * MM_i) / (R_u * T_n)$

Where:

P_n Absolute pressure at normal conditions. P_n is ex-ante determined as 101,325 Pa. Further details about the ex-ante determined parameter P_n are included in Section D.1 and in the PDD.

T_n Temperature at normal conditions. T_n is ex-ante determined as 273.15 Kelvin. Further details about the ex-ante determined parameter T_n are included in Section D.1 and in the PDD.

MM_i Molecular mass of greenhouse gas *i* (*i* = CH_4). MM_i (*i* = CH_4) is ex-ante determined as 16.04 kg/mol. Further details about the ex-ante determined parameter MM_i (*i* = CH_4) are presented in Section D.1 and in the PDD.

R_u Universal ideal gases constant. R_u is ex-ante determined as 8,314 $Pa.m^3$ /kmol.K. Further details about the ex-ante determined parameter R_u are presented in Section D.1 and in the PDD.

$\rho_{CH4,n}$ is calculated as 0.7156650 $kgCH_4$ / m^3CH_4 as reported in the monthly emission reduction calculation spreadsheets valid for the considered monitoring period.

Determination of $PE_{flare,y}$:

$PE_{flare,y}$ is determined for both installed flares ($PE_{flare,y,flare-1}$ and $PE_{flare,y,flare-2}$) by following the applicable stepwise guidance of the methodological tool "Project emissions from flaring" (version 02.0.0). Every minute values for $PE_{flare,y,flare-1}$ and $PE_{flare,y,flare-2}$ are determined as a function of every-minute records of mass flow of methane sent to the flare in question as well as based on calculated values for flare efficiency ($\eta_{flare,m} = \eta_{flare,calc,y}$) for each one of the flares as follows:

$$PE_{flare,y} = GWP_{CH4} * \sum_{m=1}^{525,600} F_{CH4,RG,m} * (1 - \eta_{flare,m}) * 10^{-3}$$

Where:

$F_{CH4,RG,m}$ Mass flow of methane in the residual gas in the minute *m*. For each minute *m* of the considered monitoring period and for each individual flare (Flare 1 and Flare 2), values for $F_{CH4,RG,m}$ are equal to every-minute reported measurement records of the calculation parameter "Amount of methane in the LFG which is sent to the flare" ($F_{CH4,sent\_flare,y}$) that is valid to each individual flare (calculation sub-parameter $F_{CH4,sent\_flare,flare-1}$ and $F_{CH4,sent\_flare,flare-2}$).

$\eta_{flare,m}$ Flare efficiency in minute m. For the considered monitoring period and for each one of the flares, $\eta_{flare,m}$ is calculated as $\eta_{flare,m,flare-1}$ and $\eta_{flare,m,flare-2}$ based on performed measurements of methane in the exhaust gas of the flare in question by following applicable guidance as per Option B (Measured flare efficiency) of the methodological tool "Project emissions from flaring" from which the following related guidance of the PDD is applied:

> *"(…)*
> *Option B: Measured flare efficiency:*
> *For each one of the high temperature enclosed flare which are part of the project activity, the flare efficiency in the minute m is determined as a value which is calculated based on performed related measurements ($\eta_{flare,m} = \eta_{flare,calc,m}$) when the following two conditions are simultaneously met (in order to demonstrate that the flare is operating):*
> *(1) The temperature of the exhaust gas of the flare (monitoring parameter $T_{EG,m}$) and the flow rate LFG to the flare (monitoring parameter $F_{RG,m}$) is within the manufacturer's specification for the flare ($SPEC_{flare}$) in minute m*
> *(2) Flame is detected in the flare in minute m (monitoring parameter $Flame_m$).*
>
> *Otherwise $\eta_{flare,m}$ is set as 0%.*
> *(…)"*

In applying Option B for each one of the flares, the project participants chose to determine $\eta_{flare,calc,m}$ by applying the guidance of Option B.1 (with related measurements of emission of methane in the exhaust gas of the flare being performed by an accredited independent third party entity (e.g. an independent inspection/analysis service company) on a biannual basis). In order to calculate the flare efficiency value for each flare ($\eta_{flare,calc,m,flare-1}$ and $\eta_{flare,calc,m,flare-2}$) biannual values for the monitoring parameter "Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period t" ($F_{CH4,EG,t}$) are considered as per the following calculation formula for each one of the flares ($F_{CH4,EG,t,flare-1}$ and $F_{CH4,EG,t,flare-2}$).

Option B.1: Biannual measurement of the flare efficiency":

For each flare, the calculated flare efficiency values ($\eta_{flare,calc,y,flare-1}$ and $\eta_{flare,calc,y,flare-2}$) are determined as follows:

$$\eta_{flare,calc,y} = 1 - \frac{1}{2}\sum_{t=1}^{2}\left(\frac{F_{CH4,EG,t}}{F_{CH4,RG,t}}\right)$$

Where:

$F_{CH4,EG,t}$ Mass flow of methane in the exhaust gas of the flare on a dry basis at reference conditions in the time period *t*. As established by the PDD, for the considered monitoring period, $F_{CH4,EG,t}$ was measured for Flare 1 and Flare 2 as per appropriate national or international standard during 2 set of measurement events encompassed by the considered monitoring period under conformance with requirements established by the methodological tool "Project emissions from flaring" (version 02.0.0). Biannual measurements of residual methane in the exhaust gas of the flare and measurements of speed of exhaust gas of the flare (for the determination of flow of methane exhaust gas of the flare) were performed by the third party inspection service companies "ES4I Environmental Services for Industries Ltda." and "JAPH Serviços Analíticos Ltda.", inspection service companies which are specialized in emission measurements and air pollution inspections. Further monitoring details for $F_{CH4,EG,t}$ are presented in Section D.2.

t The two time periods in year y during which the flare efficiency is measured, each a minimum of one hour and separated by at least six months.

$F_{CH4,RG,t}$ Mass flow of methane in the residual gas on a dry basis at reference conditions in the time period *t.* Details for the determination of every-minute values for $F_{CH4,RG,t}$ are presented below.

Determination of $F_{CH4,RG,t}$:

As per the applicable guidance of the methodological tool "Project emissions from flaring" and also as per the PDD, for each flare, the methane mass flow in the residual gas (in a dry basis) for each minute *m* of the two time periods in year *y* during which the flare efficiency is measured shall be calculated by following the applicable guidance of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream". Values for the parameter $F_{CH4,RG,t}$ valid for for Flare 1 and Flare 2 (calculation sub-parameters $F_{CH4,RG,t,flare-1}$ and $F_{CH4,RG,t,flare-2}$) are thus calculated as follows:

$F_{CH4,RG,t,flare-n} = V_{t,db,n,flare-n} * v_{CH4,t,db} * \rho_{CH4,n}$

Where:

$\rho_{CH4,n}$ Density of greenhouse gas *i* (*i* = CH_4) in the gaseous stream (LFG) at normal conditions. Further details for the determination of $\rho_{CH4,n}$ are presented above under the sub-section "*Determination of every-minute values for the calculation parameter $F_{CH4,sent\_flare,y}$*".

$v_{CH4,t,db}$ Volumetric fraction of greenhouse gas *i* (*i* = CH_4) in the gaseous stream in a time interval *t* on a dry basis. The following is stated in footnote 3 of the methodological tool "Tool to determine the mass flow of a greenhouse gas in a gaseous stream":

> "*(…) Flow measurement on a dry basis is not feasible at reasonable costs for a wet gaseous stream, so there will be no difference in the readings for volumetric fraction in wet basis analyzers and dry basis analyzers (…).*"

Thus, every-minute values of $v_{CH4,t,db}$ are regarded as equal to every-minute values of the monitoring parameter $v_{CH4,t,wb}$ (for which further details are presented above under the sub-section "*Determination of every-minute values for the calculation parameter $F_{CH4,sent\_flare,y}$*").

$V_{t,db,n,flare-n}$ Volumetric flow of the gaseous stream (LFG) in time interval *t* on a dry basis which is sent to the flare n (n = 1 and 2). As per Option B of the applicable methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", the volumetric flow of the gaseous stream on a dry basis for Flare 1 and Flare 2 (calculation sub-parameters $V_{t,db,n,flare-1}$ and $V_{t,db,n,flare-2}$) is determined by converting the measured volumetric flow from wet basis to dry basis as follows:

$$V_{t,db,n,flare-n} = V_{t,wb,n,flare-n} / (1 + v_{H2O,t,db})$$

Where:

$V_{t,wb,n}$ Volumetric flow of the gaseous stream (LFG) in time interval *t* on a wet basis at normal conditions. Further details of $V_{t,wb,n,flare-n}$ are presented above under the sub-section "*Determination of every-minute values for the calculation parameter $F_{CH4,sent\_flare,y}$*"

$v_{H2O,t,db}$ Volumetric fraction of H_2O in the gaseous stream in time interval *t* on a dry basis. As per applicable guidance of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", $v_{H2O,t,db}$ is calculated as follows:

$$v_{H2O,t,db} = \frac{m_{H2O,t,db} * MM_{t,db}}{MM_{H2O}}$$

Where:

MM_{H2O} Molecular mass of H_2O. MM_{H2O} is ex-ante determined as 18.0152 kg/kmol.
Further details about the ex-ante determined parameter MM_{H2O} are included in Section D.1 and in the PDD.

$MM_{t,db}$ Molecular mass of the gaseous stream in time interval *t* on a dry basis.
As per applicable guidance of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", $MM_{t,db}$ is calculated as follows:

$$MM_{t,db} = \sum_{k} (v_{k,t,db} * MM_{k})$$

Where:

k All gases, except H_2O, contained in the gaseous stream (e.g. N_2, CO_2, O_2, CO, H_2, CH_4, N_2O, NO, NO_2, SO_2, SF_6 and PFCs). See simplification below.

$V_{k,t,db}$ Volumetric fraction of gas *k* in the gaseous stream in time interval *t* on a dry basis. Applicable guidance of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" states the following:

> "*(…) The determination of the molecular mass of the gaseous stream ($MM_{t,db}$) requires measuring the volumetric fraction of all gases (k) in the gaseous stream. However, as a simplification, the volumetric fraction of only the gases k that are greenhouse gases and are considered in the emission reduction calculation in the underlying methodology must be monitored and the difference to 100% may be considered as pure nitrogen."*

ACM0001 (version 18.0) does not include any restriction to such simplification. Thus, only the volumetric fraction of gases that are greenhouse gases and are considered in related calculations (CH_4 in the particular case of the project activity) should be measured and the difference to 100% is just considered as pure nitrogen. Further details for the determination of the volumetric fraction of CH_4 in the gaseous stream ($V_{k,t,db}$ = $v_{CH4,t,db}$) are

presented above under the calculation parameter $v_{CH4,t,db}$.

MM_k Molecular mass of gas *k* (*k* = CH_4 and N_2). The molecular mass of CH_4 and N_2 are ex-ante determined as 16.04 and 28.01, respectively. Further details about the ex-ante determined values for MM_k are included in Section D.1 and in the PDD.

$m_{H2O,t,db}$ Absolute humidity in the gaseous stream in time interval *t* n a dry basis. As per Option 2 of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", by conservatively assuming that the gaseous stream is saturated ($m_{H2O,t,db} = m_{H2O,t,db,Sat}$), $m_{H2O,t,db}$ is calculated as follows [8]:

$$m_{H2O,t,db,Sat} = \frac{p_{H2O,t,Sat} * MM_{H2O}}{(P_t - p_{H2O,t,Sat}) * MM_{t,db}}$$

Where:

MM_{H2O} Molecular mass of H_2O. MM_{H2O} is ex-ante determined as 18.0152. Further details about the ex-ante determined values for MM_{H2O} are included in Section D.1 and in the PDD.

[8] It is important to note that the simplified approach for the calculation of the absolute humidity of the gaseous stream ($m_{H2O,t,db}$) as presented in Option 2 of the methodological "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" shall be applied by assuming the gaseous stream is dry or saturated depending on which is the conservative situation. Footnote 4 of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" explicitly states the following:

> "*An assumption that the gaseous stream is saturated is conservative for the situation that the mass flow of greenhouse gas i is underestimated (applicable for calculating baseline emissions). Conversely, an assumption that the gas stream is dry is conservative for the situation that the greenhouse gas t is overestimated (applicable for calculating project emissions).*"

In this particular case, $m_{H2O,t,db}$ is calculated for the determination of the mass flow of methane in the residual gas on a dry basis during the time period t ($F_{CH4,RG,t}$). While $F_{CH4,RG,t}$ is used for the determination of the parameter $PE_{flare,y}$ (project emissions from flaring the residual gas), the assumption that the gaseous stream is dry (conservatively applicable for calculating project emissions) would not be conservative in this case as an overestimation of the amount of methane in the residual gas would actually increase the calculated efficiency of the flare, thus resulting in a reduction of $PE_{flare,y}$ and consequent increment of emission reductions during the considered monitoring period.

P_t	Absolute pressure of the gaseous stream in time interval *t*. Further monitoring details for P_t are included in Section D.2.
$MM_{t,db}$	Molecular mass of the gaseous stream in a time interval *t* on a dry basis. Further details for the determination of $MM_{t,db}$ are presented above.
$p_{H2O,t,Sat}$	Saturation pressure of H_2O at temperature T in time *t*. Further monitoring details about the monitoring parameter $p_{H2O,t,Sat}$ are included in Section D.2.

In summary, for the considered monitoring period, the following values of $\eta_{flare,m} = \eta_{flare,calc,y}$ were obtained:

- Flare 1 ($\eta_{flare,m,flare-1} = \eta_{flare,calc,y,flare-1}$): 0.9999820
- Flare 2 ($\eta_{flare,m,flare-2} = \eta_{flare,calc,y,flare-2}$): 0.9999976

Meeting of applicable flare operational criteria/requirements:
As per the applied monitoring procedure, for each flare, compliance with operational and maintenance requirements for the flare, as established by the *ex-ante* determined parameter "Manufacturer's flare specifications for temperature, flow rate and maintenance schedule interval" ($SPEC_{flare}$), is also considered for the determination and application of the values of $\eta_{flare,m} = \eta_{flare,calc,y}$ for the determination of $F_{CH4,PJ,y} = F_{CH4,flared,y}$ along the considered monitoring period.

This is reflected in the monthly emission reduction spreadsheets. For each flare, data records for the monitoring parameter "Flame detection of flare in the minute *m*" ($Flame_m$) are also considered for the determination and application of the values of $\eta_{flare,m}$ for the determination of values of $F_{CH4,PJ,y} = F_{CH4,flared,y}$ along the considered monitoring period. This is reflected in the monthly emission reduction spreadsheets.

The time each flare has operated is determined by monitoring the flame combustion status/condition by using an UV flame detector (of which status signal (flame status "*on*" or "*off*") is continuously recorded and reported). Moreover, the monitoring requirements related to operational requirements/conditions for the flare (as provided by the manufacturer's specifications for operating conditions as per the ex-ante determined parameter $SPEC_{flare}$ (min. and max. flow of LFG to the flare + min and max. temperature of exhaust gas of the flare + meeting of maintenance

requirements) are also considered in the context of the application of determined values for $\eta_{flare,m}$ along the considered monitoring period. As outlined in the monthly emission reduction spreadsheets, for each minute *m* within the considered monitoring period when the flare have combusted LFG by not operating in accordance with all the operational criteria/requirements as established by the ex-ante estimated parameter $SPEC_{flare}$ (in terms of LFG flow, temperature of exhaust gas or maintenance practice), no destruction of methane is accounted as part of the calculation values of $F_{CH4,PJ,y} = F_{CH4,flared,y}$ achieved by the project activity.

For each flare, the monthly emission reduction calculation spreadsheets enclosed to the Monitoring Report include the compliance/meeting of all the operational criteria/requirements as established by the ex-ante estimated parameter $SPEC_{flare}$ (in terms of LFG flow, temperature of exhaust gas or maintenance practice) during every single minute of the considered monitoring period.

For the considered monitoring period, the accumulated value for $F_{CH4,PJ,y} = F_{CH4,flared,y}$ is calculated as 6,877 tCH_4.

For the considered monitoring period, baseline emissions of methane from the SWDS ($BE_{CH4,y}$) are calculated as 140,108 tCO_2e.

The summarized emission reduction calculation spreadsheet (that is enclosed to this Monitoring Report) summarizes the determination of $BE_y = BE_{CH4,y}$ for the considered monitoring period. For the considered monitoring period, BE_y = 140,108 tCO_2e.

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

>>
As outlined in the registered PDD, the operation of the project activity requires consumption of grid-sourced electricity. As also established in the PDD, project emissions due to consumption of this energy carrier are determined by following the applicable guidance of the "Tool to calculated baseline, project and/or leakage emissions from electricity consumption".

Under conformance with provisions and calculation approaches of the registered PDD, project emissions (PE_y) for the considered monitoring period are determined (in tCO_2e) by taking into account the share of period for which related monitoring records are available as follows:

$$PE_y = PE_{EC,grid,y} + PE_{EC,captive,y}$$

Where:

$PE_{EC,grid,y}$ Project emissions due to the consumption of grid-sourced electricity by the project activity.

$PE_{EC,captive,y}$ Project emissions from consumption of electricity generated by a captive off-grid electricity generator fuelled by fossil fuel (diesel) in year *y* (in tCO_2/yr)

Project emissions due to the consumption of grid-sourced electricity by the project activity ($PE_{EC,grid,y}$):

Project emissions due to the consumption of grid-sourced electricity by the project activity ($PE_{EC,grid,y}$) are calculated as per the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (version 02) as follows:

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

Where:

$TDL_{grid,y}$ Average technical transmission and distribution losses for grid sourced electricity consumed by the project activity in year *y*. $TDL_{grid,y}$ is ex-ante selected as 20%. Further details about the ex-ante determined parameter $TDL_{grid,y}$ are included in Section D.1 and in the PDD.

$EC_{PJ,grid,y}$ Quantity of grid sourced electricity consumed by the project activity in year *y* (in MWh). As per the applied monitoring procedure, available monthly records of grid-sourced electricity consumption valid for the considered monitoring period are summarized below:

Month	Amount of grid-sourced electricity consumed by the project activity (MWh)
May/2019	27.423
Jun./2019	31.719
Jul./2019	38.091
Aug./2019	34.066
Sep./2019	18.608
Oct./2019	17.000
Nov./2019	22.343
Dec./2019	37.120
Jan./2020	40.702
Feb./2020	33.241
Mar./2020	44.178

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* (in tCO_2/MWh). $EF_{EL,grid,y}$ is determined as the combined margin emission factor ($EF_{grid,CM,y}$) that is calculated as the weighted average of the operating margin and build margin emission factors. To weight these two factors, the default values applicable to both for the 2nd crediting period are applied. The combined margin emission factor is thus obtained as follows:

$$EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y}$$

Where:

w_{OM} Weighting of operating margin emissions factor. w_{OM} is ex-ante selected as 0.25. Further details about the ex-ante selected parameter w_{OM} are included in Section D.1 and in the PDD.

w_{BM} Weighting of operating margin emissions factor. w_{BM} is ex-ante selected as 0.75. Further details about the ex-ante selected parameter w_{BM} are included in Section D.1 and in the PDD.

$EF_{grid,OM,y}$ Operating margin CO_2 emission factor in year *y* (in tCO_2/MWh). $EF_{grid,OM}$ is ex-ante determined as 0.4979 tCO_2/MWh. Further details about the ex-ante determined parameter $EF_{grid,BM}$ are included in Section D.1.

$EF_{grid,BM,y}$ Build margin CO_2 emission factor in year *y*. $EF_{grid,BM}$ is ex-ante determined as 0.1581 tCO_2/MWh. Further details about the ex-ante determined parameter $EF_{grid,BM}$ are included in Section D.1.

For the considered monitoring period, $EF_{EL,grid,y}$ is thus calculated as 0.2431 tCO_2/MWh

For the considered monitoring period, project emissions due to the consumption of grid-sourced electricity by the project activity ($PE_{EC,grid,y}$) are thus calculated as 104 tCO_2 (rounded value).

Project emissions from consumption of electricity generated by a captive off-grid electricity generator fuelled by fossil fuel (diesel) in year y (in tCO_2/yr):

Project emissions from consumption of electricity generated by a captive off-grid electricity generator fuelled by fossil fuel (diesel) in year *y* ($PE_{EC,captive,y}$) are calculated by following option B.2 of the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" as follows:

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

Where:

$EC_{PJ,captive,y}$ Amount of electricity sourced by the captive electricity generator (fuelled by diesel) and consumed by the project activity. As per the applied monitoring procedure, available monthly measurement records of electricity consumed by the project activity that is supplied by the installed backup off-grid captive electricity generator (fuelled by diesel) and valid for the considered monitoring period are summarized below:

Month	Amount of electricity generated by the backup diesel generator consumed by the project activity (MWh)
May/2019	2.777
Jun./2019	6.005
Jul./2019	5.430
Aug./2019	3.513
Sep./2019	19.437
Oct./2019	12.229
Nov./2019	2.431
Dec./2019	1.976
Jan./2020	2.545
Feb./2020	0.252
Mar./2020	0.007

$TDL_{captive,y}$ Average technical transmission and distribution losses for electricity sourced by the captive electricity generator. $TDL_{captive,y}$ is ex-ante determined as zero. Further

details about the ex-ante determined parameter $TDL_{captive,y}$ are included in Section D.1 and in the PDD.

$EF_{EL,captive,y}$ CO_2 emission factor for electricity sourced by the captive off-grid electricity generators $EF_{EL,captive,y}$ is ex-ante determined as 1.3 tCO_2/MWh. Further details about the ex-ante determined parameter $EF_{EL,captive,y}$ are included in Section D.1 and in the PDD.

For the considered monitoring period, project emissions due to the consumption of electricity sourced by the backup captive off-grid electricity generator ($PE_{EC,captive,y}$) are calculated as follows:

$PE_{EC,captive,y}$ = 56.595 MWh * 1.3 tCO_2/MWh * (1 + 0) = 74 tCO_2

Total project emissions (PE_y) for the considered monitoring period are calculated as 178 tCO_2 (rounded value).

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	Total amount
Total	140,108	178	-	-	139,930	139,930

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

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante for this monitoring period in the PDD (t CO_2e)
139,930	157,505

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

>>
The 157,505 tCO_2e value is calculated as the sum of (i) the estimated emission reductions for the 245-day length share of the considered monitoring period within year 2019 encompassing period

from 01/05/2019 to 31/12/2019 (calculated as 169,959 tCO_2e * 245 / 365 = 114,082) and (ii) the estimated emission reductions for the 91-day length share of the considered monitoring period within year 2020 encompassing period from 01/01/2020 to 31/03/2020 (calculated as 174,647 tCO_2e * 91 / 366 = 43,423).

E.6. Remarks on increase in achieved emission reductions

>>
Achieved emission reductions for the project activity represents about ~89% of the calculated value of ex-ante estimation of emission reductions as per the PDD that is valid for the whole considered monitoring period encompassing 336 days.

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

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Not applicable.

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Document information

Version	*Date*	*Description*
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.
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).

Version	*Date*	*Description*
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

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